Neurosurgery Review

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Neurosurgery Review

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To
My Spiritual Teacher
and
My Parents

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PREFACE

Neurosurgery Review is a book written for a rapid revision of usually forgotten concepts of Neurosurgery. This book can guide the post-graduates busy in preparing for entrance examinations of Neurosurgery.

It was realized that different institutions have different pattern of questions for MCh entrance examinations. We have tried to evolve a method by which all kinds of variations in questions framed by different institutions can be addressed by the current book. Simultaneously, it has been tried that every question and all options of each question should remain informative. The explanations wherever required have also been included at the end of the question(s) in order to offer a reasoning behind the particular answer and reasoning for other options included in that question as well.

We have also given tips, not in the form of questions, but in the form of statements, which would greatly help in answering the questions not covered in this book.

This book will help the following groups of neurosurgical colleagues:

- Aspirants preparing for examinations of MCh
- Academicians for quick revision
- Clinicians for revision of concepts

This book would offer great help to those who are beginners in Neurosurgery, as it does not contain the detailed text of a particular disease, but covers the concepts of entire Neurosurgery.

Raj Kumar
Udit Singhal
AK Mahapatra

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MCQs in Neurosurgery Review

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1. **Impairment of optokinetic nystagmus is seen in lesion of the**
   - **A.** Frontal lobe
   - **B.** Parietal lobe
   - **C.** Occipital lobe
   - **D.** Temporal lobe

Ans. B. Parietal lobe: It is a normal, physiologic phenomenon, sometimes affected by disease. OKN tape is used for examination. A patient with a hemianopsia and normal OKN response is more likely to have occipital lobe lesion, with vascular pathology being common with asymmetric OKN, the lesion is more likely to be nonvascular that is tumor. (Cogan's rule)

2. **Causes of hyperintensity on MRI TIWI are**
   - **A.** Very high protein content
   - **B.** Melanin
   - **C.** Hypercellularity with low cytoplasm as seen in medulloblastoma or pinealoblastoma
   - **D.** Fat
   - **E.** Edema

Ans. A to D. E is false

- Causes of hyperintensity on TI are paramagnetic effect of hemorrhage (subacute or chronic), paramagnetic material melanin ion, very high protein content, fat (teratoma, dermoid lipoma) and in flow related enhancement in tumor vessels.

3. **In fundoscopy, how many vessels course over the disc margin?**
   - **A.** 8 to 12
   - **B.** 12 to 14
   - **C.** 15 to 20
   - **D.** 20 to 25

Ans. A. i.e. 8 to 12 vessels course over the disc margin and the darker arterioles are approx 2/3rd the size of the light colored venules

4. **Paratonia/Gagenhalten is due to lesion in**
   - **A.** Frontal lobe
   - **B.** Parietal lobe
   - **C.** UMN lesion
   - **D.** Extrapyramidal lesion

Ans. A. Paratonia/Gagenhalten (fluctuating changes in resistance to repetitive passive movements) with frontal lobe or thalamic disorder

5. Xanthochromic CSF not due to blood product but due to protein is when level is

A. > 150 – 200 mg/dl
B. > 200 – 250 mg/dl
C. > 250 – 300 mg/dl
D. > 350 – 400 mg/dl

Ans. A. i.e. [>1.5 to 2 g/L] (150–200 mg/dl)

6. Posterior iliac crest corresponds to

A. L2 – L3 interspace
B. L3 – L4 interspace
C. L4 – L5 interspace
D. L5 – S1 interspace

Ans. B

7. Headaches occurring after lumbar puncture occur in about

A. 5 – 10%
B. 10 – 20%
C. 20 – 30%
D. 30 – 40%

Ans. A. i.e. 5 – 10%. Such headaches typically begin 12 to 48 hrs after the procedure and may last from several days to 2 weeks. These headaches are positional in character

8. Radiation level in CT per examination is

A. 3 – 5 cGy
B. 5 – 10 cGy
C. 10 – 15 cGy
D. 15 – 20 cGy

Ans. A. i.e. 3 – 5 cGy. CT is safe and reliable. Radiation levels are between 3 and 5cGy per examination. Most frequent complications are associated with use of contrast. Ionic and non-ionic are in use. A rise in serum creatinine of at least 1 mg/dl within 48 hr of administration is a definition of contrast nephropathy

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9. Regarding MRI

A. The T1 relaxation rate is the time for 63% of the protons to return to their normal equilibrium state
B. The T2 relaxation rate is the time for 63% of the protons to become dephased owing to interaction among other protons
C. Approx 5% of the population experience claustrophobea in the MR environment
D. Unlike CT patient cooperation is important
E. T2W images are more sensitive than T1W images to edema or myelin destruction

Ans. All are correct.

- The rate of return to equilibrium of perturbed proton is called the relaxation rate. Rate is different for different, normal and pathologic tissues. T1W images produced by keeping TE and TR are relatively short. T2W image has long TR and TE. Fat and subacute hemorrhage has short T1, therefore having high intensity on T1WI.

10. About intravenous MR contrast agent

A. Gadolinium forms the basis of all current intravenous MR contrast agent
B. Gadolinium is paramagnetic
C. Reduces T1 and T2 relaxation time resulting in high signal on T1W image
D. Approx 0.2 ml/kg body weight is administered IV (10 – 15 ml for the average sized adult)
E. Hypersensitivity reactions are common

Ans. A to D are correct

- **E** is false. It reduces the T1 and T2 relaxation time of nearby water protons resulting in high signal on T1W. Metal is chelated to an agent DTPA which allow renal excretion without toxicity. It does not cross a normal blood brain barrier. Allergic reactions extremely rare. Recently Gadolinium has been linked to the development of the nephrogenic systemic fibrosis (NSF) or nephrogenic fibrosing dermopathy(NFD). Occurred in patients with moderate to end stage renal disease

11. MRI is considered safe for patients at magnetic field level up to

A. 2 T
B. 3 T
C. 4 T
D. 5 T

Ans. B. MRI is considered safe for patients at magnetic field upto 3 T. Serious injuries have been caused by the high magnetic field used

12. The radiation exposure during conventional myelography

A. 04 to 8 cGy
B. 08 to 12 cGy
C. 12 to 16 cGy
D. 16 to 20 cGy

Ans. A. Conventional myelography involves high concentration and volume of contrast material. Radiation exposure is 4 to 8 cGy- (one of the more radiation intense procedure). Gonads should be shielded if possible. CT myelography has replaced conventional myelography

13. For cerebral angiography, the contrast is injected into

A. Femoral artery
B. Radial artery
C. Common carotid
D. Internal carotid

Ans. A. Femoral artery: The femoral route is used most commonly. Most feared complication is stroke. 4 percent risk for TIA and stroke 1 percent permanent deficit and very low < 0.1 percent for death

14. In astrocytic tumor, DNA is commonly lost on chromosomes

A. 17P, 13Q and 9Q
B. 18P, 14Q and 9P
C. 18Q, 15Q and 9Q
D. 17P, 13Q and 9P

Ans. D

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15. Important predictors of a tumor's potential for rapid growth and aggressive invasion of normal surrounding tissue is

A. Hypercellularity and mitotic activity
B. Hypercellularity and nuclear atypia
C. Endothelial proliferation and necrosis
D. Nuclear and cytoplasmic atypia

Ans. C.

16. Drug of choice in tic doulourex is

A. Phenytoin
B. Gabapentin
C. Baclofen
D. Carbamazepine

Ans. D. Carbamazepine is the drug of choice and is effective initially in 75% of patients. It should be started gradually as a daily dose of 100 mg and increased to 200 mg qid

17. "Parosmia" is for those

A. Who recognize and name the odours quickly
B. Who recognize, but cannot name them
C. Who can detect a smell and earily distinguish differences but can neither recognize nor name them
D. Those for whom each odour smells the same but is distorted and unpleasant
E. Those who can small nothing in one or both nostril

Ans. D. Parosmia is not uncommon in incomplete olfactory recovery following head injuries. It may also occur in depressive or schizophrenic states. Option 'E' is anosmia

18. Causes of Anosmia are

A. Parkinson's disease
B. Syphilis
C. Sarcoidosis
D. Head injuries
E. Heavy smoking

Ans. All of the above

- Local acute or chronic inflammatory nasal disease and head injury are by far the most common causes. Head injury and atrophy of the olfactory bulbs may be accompanied by CSF rhinorrhea

19. About testing of visual acuity

A. Snellen's type charts are used for testing distant vision
B. Jaegar type cards for near vision
C. 6/5 – 6/6 are within the average normal range
D. Jaegar type card must be held 30 cm from the patient's eye
E. Average acuity lies between J-2 and J-4

Ans. All of the above are true

20. Phenomenon of visual inattention is common in

A. Frontal lobe disorder
B. Parietal lobe disorder
C. Temporal lobe disorder
D. Occipital lobe disorder

Ans. B

- Anton's syndrome (denial of visual deficit) and Redlichs phenomenon are seen in occipital lobe disorder

21. About visual examination

A. Bjerrum's screen enlarges the central area (out to 30) and make it easier to detect scotomata and blind spot
B. Distance of the patient eye from the fixation point is usually 330 mm for the perimeter and 2000 mm for the Bjerrum's screen
C. Field for red is greater than that for white object.
D. By using red object, early defect may sometime be detected

Ans. A. B. D. are correct

- Field for red is smaller than that for white object

22. Match the following appearance of disc

A. Primary optic atrophy – Whole disc is quite white
B. Consecutive optic atrophy – Whole disc is pale
C. Temporal pallor – Lesion of the papillomacular bundle
D. Myopic disc – Very pale, appears greatly enlarged and a crescent of pallor around it
E. Hypermetropic disc – Pink, edge appear blurred, small disc vessel and fields are normal

Ans. All are true

23. About the optic disc

A. The temporal side of the disc is usually paler than the nasal side
B. Normally the nasal edge of the disc is usually blurred.
C. In papilledema, despite the degree of swelling, vision is well preserved; visual fields showing only enlargement of the blind spot
D. In papillitis, the degree of swelling is slight, usually unilateral, veins not engorged, humping slight, disc area not greatly enlarged
E. In papillitis, the vision is grossly disturbed due to large central or centro-caecal scotoma

Ans. All are true

24. Foster Kennedy syndrome is due to tumor in

A. Superior frontal region
B. Inferior frontal region
C. Inferior temporal region
D. Inferior occipital region

Ans. B. It consists of a triad of
i. Ipsilateral anosmia
ii. Ipsilateral optic atrophy
iii. Contralateral papilledema

Foster Kennedy syndrome is found in olfactory groove meningioma and medial one third sphenoid meningioma

25. Causes of pseudopapilledema are

A. Obliquity of the optic nerves
B. Drusen bodies
C. Juxta-papillary choroiditis
D. Haziness of the vitreous
E. Pseudotumor cerebri

Ans. A to D

- **E.** is false, i.e. pseudotumor cereberi. There is true papilledema but not due to intracranial tumor. Pseudopapilledema swelling is mild but without vessel engorgement and symptomic throughtout the patient's life

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26. Spidery black "bone corpuscles" pigmentation spreading toward center is seen in

A. Toxoplasmosis
B. Retinitis pigmentosa
C. Cerebromacular degeneration
D. Choroidoretinitis

Ans. B

27. Cotton-wool patches are seen in

A. Papilledema
B. Renal failure
C. Polyarteritis nodosa
D. SLE
E. Retinal embolism and severe anemias

Ans. All are true.

- Cotton wool spot is essentially a focal ischemic reaction (microinfarct) of injured axons

28. About fluorescein and fundus photography

A. Sterilized solution of 10% fluorescein is used
B. In retinal artery, occlusion failure of filling is seen
C. Gross exudation is seen in central venous occlusion and true papilledema
D. Gross exudation is absent in pseudopapilledema
E. In true optic atrophy, the disc remains dark throughout serial photographs

Ans. All are true

29. Horner's syndrome consists of all EXCEPT

A. Miosis
B. Mydriasis
C. Enophthalmos
D. Anhydrosis

Ans. B.

- Horner's Syndrome consists of miosis, ptosis, enophthalmos, dryness and warmth of that half of the face

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30. The commonest cause of dilated pupil is

A. Vascular accident in midbrain
B. Tentorial herniation
C. Carotid artery aneurysm
D. Mydriatic

Ans. D.

- **A. B. C.** all cause mydriasis but **D.** is the commonest cause

31. Holms Adie syndromes consist of all EXCEPT

A. Pupillary reflex to light is absent
B. Pupillary reflex to accommodation is present
C. Response to 1% pilocarpine
D. Present in young males
E. In full syndrome, ankle and knee jerks are absent and occasionally there is complete areflexia

Ans. D.

32. About the action of ocular muscles

A. Superior rectus elevates the eye when it is turned outwards
B. Inferior oblique elevates the eye when it is turned inwards
C. Inferior rectus depress the eye when it is turned inward
D. Superior oblique depress the eye when it is turned inwards
E. Medial rectus moves the eye horizontally inwards

Ans. A, B, D and E. are correct

33. Superior oblique results in

A. Extorsion, Depression, Adduction
B. Intorsion, Depression, Adduction
C. Intorsion, Depression, Abduction
D. Extorsion, Depression, Abduction

Ans. C

34. Deviation of the head and eyes to the right occur in all EXCEPT

A. Lesion of right frontal lobe
B. Lesion of left frontal lobe
C. Lesion of left side of pons
D. Irritative lesion of left frontal lobe
E. Irritative lesion of right side of pons

Ans. B.

- Lesion of left frontal lobe will result in deviation to left side

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35. Ataxic nystagmus is seen in

A. Arnold-Chiari malformation
B. Syringobulia
C. Labyrinthine disease
D. Internuclear ophthalmoplegia

Ans. D.

36. The commonest cause of vertical nystagmus is

A. Drugs
B. Arnold-Chiari
C. Syringobulbia
D. Basilar invagination

Ans. A.

37. About vertical nystagmus

A. Nystagmus on looking upwards
B. Oscillation in up and down direction
C. Never labyrinthine in origin
D. Quick phase is most often upward
E. Essentially due to intrinsic disturbance in brainstem

Ans. B to E. are correct

A. is false

38. Match the following nystagmus

A. Downbeat nystagmus – Pineal tumor
B. Convergence retraction nystagmus – Arnold-Chiari malformation
C. See-saw nystagmus – Internuclear ophthalmoplegia
D. Ocular bobbing – lesion in pontine tegmentum
E. Ataxic nystagmus – Suprasellar tumor

Ans. D.

- Downbeat nystagmus is seen in Arnold-Chiari malformation
- Convergence retraction nystagmus is seen in Pineal tumor (Perinaud's syndrome)
- See-saw nystagmus is seen in Suprasellar lesion anterior to third ventricle
- Ataxic nystagmus – Internuclear opthalmoplegia

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39. Peduncular nystagmus is seen in

A. Macular abnormalities
B. Chorioidoretinitis
C. Albinism
D. High infantile myopia
E. Opacities of the media

Ans. All are true

40. About horizontal nystagmus

A. In more peripheral lesion, the quick phase is away from the lesion
B. Amplitude is greater in the direction of quick phase
C. In cerebellar lesion, the quick phase and the greatest amplitude is toward the side of the lesion
D. In cerebello pontine angle tumor, both central and peripheral effect, but the amplitude is greater toward the side of the lesion
E. Nystagmus due to central lesion tend to be more chronic

Ans. All are true

41. About optokinetic nystagmus

A. Is a normal phenomenon
B. Quick phase is back towards the primary position, this is the reverse of all other forms
C. Absent in deep parietal lobe lesion
D. Particular value in patient with a homonymous hemianopia
E. Optokinetic response is absent when the drum is rotated away from the lesion

Ans. A to D are correct

42. About jaw jerk

A. Absent jaw jerk is rarely helpful
B. In many normal people, no response is obtained
C. Afferent and efferent is by V nerve
D. Exaggerated jaw jerk point UMN lesion below pons
E. Exaggerated jaw jerk is seen in pseudobulbar palsy, motor neuron disease and quite often in multiple sclerosis

Ans. A, B, C and E. D is false

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43. Loss of corneal reflex is seen in

A. Cerebello pontine angle tumor
B. Carotid aneurysm
C. Superior orbital fissure tumor
D. Rostral 2/3 of spinal trigeminal tract lesion
E. Caudal 1/3 of spinal trigeminal tract lesion

Ans. A to D are correct. E is false.

- The afferent corneal reflex is as follows:
- First order neurons of the ophthalmic nerve (CN V-1) are found in the trigeminal ganglion. Their axons enter the pons and descend in the spinal trigeminal tract. They enter the spinal trigeminal nucleus in its rostral portion and synapse on second order neurons which project to the ipsilateral and contralateral facial nuclei. Axons from third order neurons in the faciar nuclei innervate the orbicularis oculi muscles bilaterally (directly and consensually). Trigeminal tractotomy at caudal levels produces facial anesthesia without interruption of the corneal reflex.

44. "Emotional Facial Weakness" occurs in

A. UMN lesion
B. LMN lesion
C. Ipsilateral thalamic lesion
D. Contralateral thalamic lesion

Ans. D.

- A deviation of the mouth on smiling, which disappear on voluntary movement, constitute the so called 'Emotional Facial Weakness'. This occurs in deep seated lesions of the opposite thalamus, or its connection with frontal lobe

45. Schirmer's test is abnormal in lesion of the following EXCEPT

A. Lesser petrosal nerve
B. Greater petrosal nerve
C. Sphenopalatine ganglion
D. Lacrimal nerve

Ans. A

46. Most common cyanotic heart disease associated with brain abscess in children is

A. Tetralogy of Fallot
B. VSD
C. Patent foramen ovale
D. Transposition of great vessels

Ans. A

47. Regarding brain abscess

A. 85 to 95% of cerebellar abscesses are associated with ear or mastoid infections
B. Four stages of brain abscess formation is best described by following infection with beta-hemolytic streptococci
C. Encapsulation is frequently more complete on cortical side than on the ventricular side
D. Capsule is extensive in abscesses resulting from hematogenous spread than in those arising from a contiguous focus of infection
E. Propensity of abscess rupture is greater laterally than medially

Ans. A to C are correct

- **D** and **E.** are false. Abscess from hematogenous spread has thin capsule. Abscess from contiguous spread has thick capsule

48. Subdural empyema complicating meningitis is due to

A. *S. pneumoniae*
B. *H. influenzae*
C. Both
D. None

Ans. C. Due to *S. pnuemoniae* and *H. influenzae* but most commonly due to *H. influenzae*

49. Most important associated pathogen in patient with cavernous sinus thrombosis is

A. *S. aureus*
B. *Streptococci pneumoniae*
C. *Bacteroides*
D. *H. influenzae*

Ans. A.

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50. Pseudomembranes in case of chronic SDH is derived from

A. Dura
B. Arachnoid
C. Both
D. None

Ans. A

51. Normal ICP is between

A. 02 – 12 mmHg
B. 04 – 16 mmHg
C. 06 – 18 mmHg
D. 10 – 20 mmHg

Ans. A

52. Most common cause of death in a patient of head injury is

A. Raised ICP
B. Hemorrhage
C. Coma
D. Respiratory complication

Ans. A. At least 50% of patients who die as a result of head injury do so because of uncontrolled increase in ICP

53. First operation for a glioma was done by

A. Bailey and Cushing (1926)
B. Virchow (1863)
C. Bennett and Godlee (1884)
D. Harvey Cushing

Ans. C.

- Gliomas initially classified by Bailey and Cushing (1926)

54. About tumor marker

A. PLAP (Placental alkaline phosphatase)– positivity indicates germ-cell differentiation
B. Alpha-fetoprotein indicates the presence of yolk sac elements
C. hCG positivity indicates the presence of syncytiotrophoblastic elements
D. Vimentin is being called the "default" intermediate filament protein in CNS tumors
E. Menigiomas typically exhibit EMA-positivity, a feature that helps in differential diagnosis with hemangiopericytoma

Ans. All of the above are true

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55. Most widely used "Pan-endocrine" marker

A. Synaptophysin
B. NSE
C. Chromogranin
D. None of the above

Ans. C.

56. All of the following are Intermediate Filament Protein EXCEPT

A. Nestin
B. Vimentin
C. S-100
D. Cytokeratin
E. EMA

Ans. E

57. The p53 protein is coded by a tumor suppressor gene on chromosome

A. 17p 13.1
B. 18p 13.1
C. 17q 13.1
D. 18q 13.1

Ans. A

58. Which gene amplification constitutes a hallmark of primary glioblastomas?

A. EGFR
B. Myc
C. Both
D. None

Ans. A.

- EGFR gene amplification constitutes a hallmark of primary glioblastomas, more than 60% of which show EGFR expression. All glioblastomas with EGFR amplification also show simultaneous loss of [chromosome 10]. Myc is the most common oncogene amplified in medulloblastomas

59. About contribution to neurosurgery

A. Moorey and Hinshaw in 1979 introduced the first MRI
B. Yasargil used operating microscope in 1957

C. CUSA (Cavitron ultrasonic aspirator) by Epstein in 1983
D. Laser by Tew in 1983
E. Introduction of intra operative endoscopy to brain surgery by Oppel in 1987

Ans. All of the above are true

- James M Drake et al 1991 (First computer and robot assisted resection of thalamic astrocytoma)

60. Match the following:

A. Tuberous sclerosis – Subependymal giant cell astrocytoma
B. NF-2 – Bilateral acoustic schwannoma
C. NF-1 – Optic Glioma
D. VHL syndrome – Hemangioblastoma
E. Gardner syndrome – Medulloblastoma

Ans. A to D are correct

61. NE (norepinephrine) containing cell bodies are located in

A. Locus ceruleus and ventral tegmental nuclei
B. Locus ceruleus and lateral tegmental nuclei
C. Ventral and lateral tegmental nuclei
D. Lateral and dorsal tegmental nuclei

Ans. B.

62. Baclofen acts as

A. Agonist on GABAa receptor
B. Antagonist on GABAa receptor
C. Agonist on GABAb receptor
D. Antagonist on GABAb receptor

Ans. C. It is an antispasticity agent

63. Which of the following is a positive abnormality?

A. Spasticity
B. Hemiparesis
C. Loss of momory
D. Impaired sensation

Ans. A.

- Negative abnormality means loss of function
- Positive abnormality indicates inappropriate excitation (seizure, spasiticity)

64. Wallenberg's syndrome is due to occlusion of

A. AICA
B. SCA
C. PCA
D. PICA

Ans. D.

- Posterior Inferior Cerebellar Artery

65. About Central Nervous System

A. Brain weighs about 2% of the body weight
B. Spinal cord is 42 to 45 cm in length
C. Spinal cord is about 2% of the weight of the brain
D. About 20% of extra cellular fluid is present of total brain volume
E. Conus end at the L1 or L2 level of the vertebral column

Ans. All of the above are true

66. About spinal cord

A. Until the third month of fetal life, the spinal cord is as long as the vertebral canal
B. At birth, the cord extends to about the level of the third lumbar vertebra
C. At the 6th month of fetal life, the caudal end lies at the level of the first sacral vertebrae
D. The adult level of the L1 – L2 junction is reached after the third year of life
E. It is about 28 gm in weight

Ans. All are true

67. About branching of spinal nerves

A. Medial posterior primary division is sensory
B. Lateral posterior primary division is motor
C. Anterior primary division form plexuses
D. White rami communicans present in the thoracic and upper lumber nerves
E. Sinuvertebral nerves carry sensory and vasomotor innervation to the meninges

Ans. All of the above are true

68. Inverse stretch reflex is mediated by

A. Ia
B. Ib
C. II
D. III

Ans. B.

69. Number of intrafusal fibres contained within the capsule of the muscle spindles are

A. 02 - 10
B. 10 - 20
C. 20 - 30
D. 30 - 40

Ans. A

70. Gamma motor neuron make up % of fibres in the ventral roots

A. 10 – 15%
B. 15 – 25%
C. 25 – 30%
D. 30 – 40%

Ans. C.

71. Center of accommodation reflex is

A. Midbrain
B. Pons
C. Occipital cortex
D. Medulla

Ans. C.

72. Center for cremastric reflex is

A. L1
B. L2
C. L3
D. L4

Ans. A. i.e. [L1]

- [Afferent – Femoral]
- [Efferent – Genitofemoral]

73. All are true about inverse stretch reflex EXCEPT

A. It is monosynaptic
B. It is disynaptic
C. Mediated by Golgi tendon organ
D. Afferent carried by Ib fibres

Ans. A. i.e. monosynaptic is a false statement

74. The largest cerebellar peduncle is

A. Superior cerebellar peduncle
B. Middle cerebellar peduncle
C. Inferior cerebellar peduncle
D. All of the above

Ans. B

75. GVE fibres are present in

A. III
B. IV
C. VI
D. VII
E. IX

Ans. A, D and **E**

76. Number of true olfactory nerves are

A. 16 - 20
B. 18 - 30
C. 20 - 40
D. 30 - 50

Ans. B. (09 to 15 on each side)

77. External landmarks of the hypothalamus are all EXCEPT

A. Optic chiasm
B. Tuber cinereum
C. Mamillary bodies
D. Tuberculum cinereum

Ans. D

78. Hypothalamus is about

A. 3% of the brain weight
B. 6% of the brain weight

C. 8% of the brain weight
D. 1% of the brain weight

Ans. A. 3% of brain weight, i.e, 4 gm

79. Response to heat and cold is integrated by

A. Anterior and medial hypothalamus respectively
B. Anterior and lateral hypothalamus respectively
C. Anterior and posterior hypothalamus respectively
D. Posterior and anterior hypothalamus respectively

Ans. C.

- Response to heat integrated by Anterior hypothalamus
- Response to cold integrated by Posterior hypothalamus

80. Wernicke's area is present in

A. Posterior third of superior temporal gyrus
B. Anterior third of superior temporal gyrus
C. Middle third of superior temporal gyrus
D. All of the above

Ans. A.

81. Pure word deafness occur due to lesion in area

A. 41
B. 22
C. 21
D. 20

Ans. B.

82. Calcar avis is present in the

A. Frontal horn
B. Temporal horn
C. Occipital horn
D. None of the above

Ans. C. It is the elevation of the ventricular wall produced by the calcarine fissure

83. Tapetum is derived from the

A. Rostrum of the corpus callosum
B. Genu of the corpus callosum
C. Body of the corpus callosum
D. Splenium of the corpus callosum

Ans. C.

84. Choroid plexus is absent in all EXCEPT

A. Frontal horn
B. Occipital horn
C. Cerebral aqueduct
D. Temporal horn

Ans. D.

85. The most common site of obstruction leading to hydrocephalus is

A. Foramen of Monro
B. Cerebral Aqueduct
C. Foramen of Magendie
D. Foramen of Luschka

Ans. B.

86. Number of intervertebral disc present in the spinal column are

A. 22
B. 23
C. 24
D. 25

Ans. B. Twenty three intervertebral disc extend from the C2-3 to the L5-SI intervertebral level. No intervertebral disc exist between the cranium and C1, between C1 and C2, in the sacrum or in the coccyx

87. In diffusion weighted imaging, the apparent diffusion content (ADC) is higher in

A. Epidermoid
B. Arachnoid cyst
C. Abscess
D. Necrotic tumor
E. Lymphoma

Ans. B and D. Diffusion weighted imaging reflects the brownian motion of tissue water. DWI has a sensitivity and specificity of over 90% for distinguishing epidermoid (low ADC) from arachnoid cyst (high ADC) and distinguishing abscesses (low ADC) from necrotic tumor (high ADC). An inverse correlation between minimum ADC and tumor cellularity has been verified in a wide variety of tumor. Lesions having low ADC appear hyperintense on DWI and those with high ADC appear hypointense on DWI

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88. Tight junction between ependymal cell is present in

A. Upper third ventricle
B. Lower third ventricle
C. Lateral ventricle
D. Fourth ventricle

Ans. B.

89. Anterior condylar canal transmit

A. Emissary vein from the transverse sinus
B. Hypoglossal nerve and a meningeal artery
C. Both of the above
D. None of the above

Ans. B.

- XII nerve and a meningeal artery. Anterior condylar canal is also called Hypoglossal canal. Posterior condylar canal transmit emissary vein from the transverse sinus

90. Under normal condition, the pressure in the small cerebral arteries is maintained at

A. 250 mm H_2O
B. 350 mm H_2O
C. 450 mm H_2O
D. 550 mm H_2O

Ans. C.

91. The most common and severe atherosclerotic lesion are in the

A. Carotid bifurcation
B. Origin of the vertebral artery
C. Upper part of the basilar artery
D. Lower part of the basilar artery

Ans. A.

92. Drugs effective in acute attack of migraine are

A. β-blockers
B. Ca^{2+} channel blockers
C. Tricyclic antidepressants
D. 5HT agonist
E. 5HT antagonist

Ans. D

- Ergotamine, DHE are partial agonists at 5-HT 1D/1B receptor
- Sumatriptan is 5-HT 1D agonist
- Rest are used for prophylaxis
- Methysergide is 5-HT 1D antagonist [side effect is retroperitoneal fibrosis]

93. Contribution to the corticospinal tract by giant cell of BETZ is about

A. 03 – 05%
B. 05 – 10%
C. 01 – 03%
D. 10 – 15%

Ans. A.

94. How many % of fibres cross at pyramidal decussation?

A. 85%
B. 87%
C. 90%
D. 100%

Ans. B.

- About 10% of the pyramidal tract does not cross in the pyramidal decussation and in addition up to 3% of the descending fibres in the lateral corticospinal tract are uncrossed.

95. The telencephalon gives rise to each of the following EXCEPT

A. Amygadla
B. Caudate nucleus
C. Claustrum
D. Globus pallidus
E. Putamen

Ans. D.

- Globus pallidus: It is derived from diencephalon

96. Muscle stretch reflexes are abnormal in all lesions of the following EXCEPT

A. Motor end plate
B. Myopathy
C. Cerebellar system
D. Basal ganglia

Ans. D

97. Number of retinotopic maps located in the area 19 are

A. 1
B. 2
C. 3
D. 4

Ans. C

- Area 17 – one retinotopic map (V1)
- Area 18 – two retinotopic maps (V2, V3)
- Area 19 – three retinotopic maps (V3A, V4, V5)

98. All of the following are true match EXCEPT

A. Medial striate artery – Middle cerebral artery
B. Recurrent artery of Heubner - ACA
C. Medial lenticulostriate artery - MCA
D. PCA – Basilar artery
E. Labyrinthine artery - AICA

Ans. A

99. Number of Betz cells in a single hemisphere is approx

A. 10,000
B. 20,000
C. 30,000
D. 40,000

Ans. D.

100. Primary CNS tumor spreading through CSF are

A. Oligodendroglioma
B. Hemangioblastoma
C. Primary CNS melanoma
D. Medulloblastoma

Ans. All of the above are true

101. The most common primary PNET responsible for extraneural spread is

A. Medulloblastoma
B. Meningioma
C. Pineoblastomas
D. Ependymomas

Ans. A. Medulloblastoma is the most common PNET

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102. The most important factor related to radiation myelopathy is

A. Total radiation dose
B. Amount of tissue radiated
C. Extent of cord shielding
D. Rate of application

Ans. D

103. With large field technique (>10cm of cord) the risk of radiation myelopathy is negligible with

A. < 2.3 Gy in 42 days
B. < 3.3 Gy in 42 days
C. < 4.3 Gy in 42 days
D. < 5.3 Gy in 42 days

Ans. B

104. With small field technique, the risk of radiation myelopathy is negligible with

A. < 2.3 Gy in 42 days
B. < 3.3 Gy in 42 days
C. < 4.3 Gy in 42 days
D. < 5.3 Gy in 42 days

Ans. C. 4.3 Gy [i.e. .717 Gy/wk]

105. The upper limit of radiation per fraction to prevent radiation myelopathy is

A. 1 Gy / Fraction
B. 2 Gy / Fraction
C. 3 Gy / Eraction
D. 4 Gy / Fraction

Ans. B.

106. Following neurosurgeon is a Nobel laureate

A. William Harvey Cushing
B. Walter Dandy
C. M Gazi Yasargil
D. Egas Moniz

Ans. D.

- Egas Moniz received nobel prize in 1949 for initiation of psychosurgery (Prefrontal leukotomy)

107. Maximum recommended radiation dose to optic nerve is

A. 100 cGy
B. 50 cGy
C. 10 cGy
D. 1 cGy

Ans. A

Eye lens	– 100 cGy
Optic nerve	– 100 cGy
Skin in bone	– 050 cGy
Thyroid	– 010 cGy
Gonads	– 001 cGy
Breast	– 003 cGy

108. About inverted supinator jerk

A. Finger flexion is the only response
B. Contraction of the brachioradialis and elbow flexion being absent
C. Striking the bicep tendon may produce extension of the elbow
D. Indicates a cord lesion at the fourth or fifth cervical level causing a lower motor neuron lesion at C5
E. It is invaluable in localizing lesion responsible for spastic paraparesis which have no sensory abnormality and applies particularly to cervical spondylosis

Ans. All are true

109. Lesion of the lateral leminiscus produce

A. Bilateral complete deafness
B. Bilateral partial deafness, greater in the contralateral ear
C. Bilateral partial deafness, greater in the ipsilateral ear
D. Unilateral, ipsilateral deafness
E. Unilateral, contralateral deafness

Ans. B.

- Fibres in the lateral leminiscus are both crossed and uncrossed with preponderance of crossed fibres.

110. J shaped sella is seen in

A. Pituitary adenoma
B. ESS (Empty sella syndrome)

C. Craniopharyngioma
D. Optic nerve glioma
E. Hurler's syndrome

Ans. D and E

111. Method of Oon is related to

A. Anterior hypophysis
B. Posterior hypophysis
C. Pineal gland
D. Superior colliculi

Ans. C.

- There are a number of criteria to distinguish an abnormal amount of displacement in the AP or vertical direction. A simple method is the method of Oon. To locate the normal position of a calcified pineal gland on a lateral plain skull X-Ray, draw a line from the tuberculum sellae to the tip of Clivus. 1 cm from the top of this line, draw a 5 cm perpendicular line. The pineal gland normally lies within 1 cm radius circle

112. "Insensitive space" as related to myelography

A. L3 – L4
B. L4 – L5
C. L5 – S1
D. None of the above

Ans. C.

113. About Marcus Gunn pupil

A. Affected pupil is larger than the other
B. Consensual reflex is greater than direct
C. Seen in multiple sclerosis
D. Also called as afferent pupillary defect
E. Detected by swinging flash light test

Ans. All of the above are true

114. Mydriasis due to 3rd nerve compression is usually

A. 05 – 06 mm
B. 06 – 07 mm
C. 07 – 08 mm
D. 08 – 09 mm

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Ans. A.

- A pharmacologically dilated pupil is very large (07 – 08 mm)
- Miosis in Horner's syndrome is [02 – 03 mm)

115. The most frequent site for traumatic SAH is

A. Convexity
B. Basal cistern
C. Tentorial edge
D. Sylvian fissure/Interhemispheric

Ans. A.

- Convexity fissure > Sylvian fissure/Interhemispheric > Basal cistern > Tentorial edge

116. The most common site of cerebral contusion associated with a subdural hematoma is the

A. Frontal pole
B. Cerebral convexity
C. Temporal pole
D. Occipital pole

Ans. C.

Temporal pole > Frontal pole > Cerebral convexity

117. About subdural hematoma

A. Subacute SDH is between 03 to 10 days
B. Acute SDH has better prognosis than EDH
C. Acute SDH can be evacuated by twist drill
D. SDH is more common in infants and elderly patients
E. MRI is more sensitive than CT for detecting isodense SDH

Ans. D and E

- In anemic patients, SDH is isodense and hematocrit has to fall below 23% to become isodense

118. The most common fracture associated with EDH is

A. Parietal bone
B. Squamous part of temporal bone
C. Pterous part of temporal bone
D. Frontal bone

Ans. A.

- Antero inferior portion of the parietal bone cause rupture of anterior branch of middle meningeal artery (most commonly)

119. The most common source of bleeding in EDH is

A. Anterior division of middle meningeal artery
B. Posterior division of middle meningeal artery
C. Superior cerebral vein
D. Dural sinuses

Ans. A.

120. The spinal canal diameter of children reaches adult size by age

A. 3 to 5 years
B. 6 to 8 years
C. 10 to 12 years
D. 14 to 16 years

Ans. B. i.e. 6 to 8 years. The spinal canal grows as the vertebrae grow. But once the neurocentral synchondroses and the midline posterior arch ossify and close, the spinal canal no longer grow. In the newborn and during infancy, the spinal canal is oval in shape and its transverse diameter larger than sagittal diameter. At birth to age 3 months, the sagittal diameter of the spinal canal is 1.0 cm in the cervical region and 1 to 1.3 cm in the lumbar region. At the end of the first decade of life, the spinal canal should approach adult size, whereby the sagittal diameter is 15 to 27 mm in the cervical, 17 to 22 in the thoracic and 15 to 27 mm in the lumbar spine

121. Which of the following drugs is useful in Ischemic head injury [NMDA antagonist]?

A. MK – 801
B. Phencyclidine
C. Dextromethorphan
D. Ketamine

Ans. C.

- Phencyclidine: MK – 801, Ketamine has a lot of side effects in man. However, dextromethorphan may be useful in future

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122. Diffuse axonal injury was described by

A. Howship in 1816
B. Benett and Godlee in 1884
C. Virchow in 1863
D. Strich in 1956

Ans. D.

- Howship, in 1816, first described growing skull fracture
- Bennett and Goalec in 1884 first operated on Glioma

123. The most common segment of optic nerve to be injured in closed head injury is

A. Intracranial
B. Intraocular
C. Intracanalicular
D. Intraorbital

Ans. C

124. About hemodynamics in brain

A. CPP = MAP – ICP
B. Normal adult CPP is > 50 mmHg
C. CPP would have to drop below 40 mmHg in a normal brain before CBF would be impaired
D. Emergency measures should be initiated if ICP > 20 – 25 mmHg
E. Normal ICP in adults and older children is < 10 – 15 mmHg; young children 03 – 07 mmHg; in term infants 1.5 – 06 mmHg respectively

Ans. All of the above are true

125. Traube Hering Waves are

A. Lundenberg Type A waves
B. Lundenberg Type B waves
C. Lundenberg Type C waves
D. None of the above

Ans. C.

- Lundenberg Type A waves or plateau waves — >50 mmHg, 05 — 20 minutes
- Lundenberg Type B waves — 10 — 20 mmHg, 30 sec — 02 minutes
- Lundenberg Type C waves — 04 — 08 per minute

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126. About anastomotic veins

A. Superior anastomotic vein is the Vein of Labbe.
B. Vein of Trolard is present in parietal lobe
C. Vein of Labbe is the vein that crosses the temporal lobe between the sylvian fissure and the transverse sinus
D. Inferior anastomotic vein is Vein of Trolard

Ans. B and C. Vein of trolard drain into superior sagittal sinus.

127. Neurofibromatosis type I is associated with

A. 17 p 11.2
B. 17 p 12.2
C. 17 Q 11.2
D. 17 Q 12.2

Ans. C.

128. Neurofibromatosis type II is associated with

A. 22 p 11.2
B. 22 q 11.2
C. 22 p 12.2
D. 22 q 12.2

Ans. D.

129. High dose barbiturate therapy in trauma results in

A. Reverse steal phenomenon
B. Decrease $CMRO_2$
C. Free radical scavenging
D. Reduced intracellular calcium
E. Lysosomal stabilization

Ans. All of the above are correct

130. Classic CT appearance of EDH occur in

A. 84%
B. 74%
C. 94%
D. 64%

Ans. A.

- Classic appearance – 84%
- Crescent shaped – 05%

131. Spinal trigeminal tract sometime descend as low as

A. C2
B. C3
C. C4
D. C5

Ans. C.

- Normally extend from Pons to C3 level.

132. The best view to demonstrate cervical articular masses is

A. Pillar's view
B. Towne's view
C. Swimmer's view
D. Caldwell – Luc's view

Ans. A

- Pillar's view is reserved for cases suspected of having articular mass fracture. The head is rotated to one side, the X-ray tube is off centered 2 cm from midline in the opposite direction and the beam is angled 25 caudal cornered at superior margin of thyroid cartilage

133. The best view for cervicothoracic junction is

A. Pillar's view
B. OMO view [open mouth odontoid view]
C. Swimmer's view
D. Towne's view
E. Caldwell-Luc's view

Ans. C

134. The most common incomplete spinal cord injury is

A. Posterior cord syndrome
B. Anterior cord syndrome
C. Central cord syndrome
D. Brown-Sequard syndrome

Ans. C.

- Central cord syndrome: Most common type of incomplete spinal cord injury syndrome usually seen following acute hyper extension injury in an older patient

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135. The worst prognosis in incomplete spinal cord injury is seen in

A. Posterior cord syndrome
B. Anterior cord syndrome
C. Central canal syndrome
D. Brown-Sequard syndrome

Ans. B.

- Anterior cord syndrome only 10 – 20% recover functional motor control

136. Syndrome having the best prognosis of any of the incomplete spinal cord injury is

A. Brown-Sequard syndrome
B. Anterior spinal cord syndrome
C. Posterior spinal cord syndrome
D. Central spinal cord syndrome

Ans. A.

- Approximately 90% of patients with this condition will regain the ability to ambulate independently as well as urinary and anal sphincter

137. The most important structure in maintaining atlanto-occipital stablility are

A. Tectorial membrane + Alar ligament
B. AAO ligament + PAO ligament
C. Cruciate ligament
D. Transverse ligament + AA Portion of the alar ligament

Ans. A.

138. Characteristic "cock robin" head position is seen in

A. Atlanto occipital dislocation
B. Atlanto axial rotatory subluxation
C. Anterior atlanto axial dislocation
D. Posterior atlanto axial dislocation

Ans. B.

- 20° lateral tilt to one side, 20° rotation to the other and slight flexion seen in atlanto axial rotatory subluxation

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139. About Odontoid fracture

A. Odontoid # comprise 10 – 15% of all cervical spine fractures
B. Flexion is the most common mechanism of injury
C. Suggestive finding is the tendency to support the head with hands when going between the upright and supine position
D. Early surgery is recommended for all type I A #
E. Surgery is recommended for odontoid type B II # in patients > 7 years age with displacement > 6 mm

Ans. A, B, C and E are correct.

140. The most effective Cervico Thoracic Orthesis for bracing against flexion – extension and rotation is

A. Yale brace
B. SOMI brace
C. Guilford brace
D. None of the above

Ans. A.

141. The most common type of burst # of thoracolumbar region is

A. # of both end plates
B. # of superior end plates
C. # of inferior end plates
D. Burst rotation

Ans. B

- Fracture of superior end plates seen at thoracolumbar junction—Mechanism axial load and flexion

142. About intervertebral disc all are true EXCEPT

A. The disc is a vascular structure at birth
B. The disc is smaller in the newborn and infant
C. Vascularity gradually decreases throughout infancy and early childhood until about age 4 when disc becomes avascular
D. Best imaged on MRI because of its high water content

Ans. B. The disc is larger in the newborn and infant

143. About pediatric spinal meningioma al are true EXCEPT

A. Most frequently occur in the cervical and thoracic regions
B. The marked female predominance noted in adults is not reproduced in children
C. NF type 2 diagnosis should be investigated in all childrens

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D. Cystic changes seen in 50% of pediatric spinal meningiomas
E. Histopathologically spinal meningioma do not share the same subtype as seen with intracranial tumors

Ans. E. Histopathologically, spinal meningiomas share the same subtype as seen with intracranial tumors. Psammomatous lesion seen to be the most common. Cystic change occur less than 5% in adult tumors. Clear cell meningioma has been seen in children and adults, with many patients presenting before the age of 10 years, and present most frequently in lumbar spine. They recur at a high rate. Complete resection is the primary therapy for intradural meningioma

144. The most common cause of strokes in patients under 45 year of age is

A. Trauma
B. Atherosclerosis
C. Embolism
D. Vasculopathy

Ans. A

Trauma	– 22%
Atherosclerosis	– 20%
Embolism	– 20%
Vasculopathy	– 10%

145. The most common lacunar manifestation is

A. Pure sensory CVA
B. Pure motor hemiparesis
C. Ataxic hemiparesis
D. PMH sparing the face

Ans. A.

- Pure sensory CVA
- Pure motor hemiparesis (2nd most common)

146. About Anterior choroidal artery

A. Branch of ICA
B. Supply the choroid plexus of temporal horn
C. Historically ligation was done for parkinsonism
D. Causes contralateral hemiparesis, hemihypesthesia, homonymous hemianopia
E. Supply the ventral half of the internal capsule

Ans. All are correct

147. Terson syndrome which occur in case of aneurysmal SAH is

A. Subhyaloid hemorrhage
B. Intraretinal hemorrhage
C. Vitreous humor hemorrhage
D. Paroxysmal headache

Ans. C.

- [Hemorrhage inside the vitreous humor] Occur in 4-27% patients of subarachnoid hemorrhage.

148. The most sensitive test for SAH is

A. Lumbar puncture
B. MRI
C. Non contrast CT
D. Cerebral angiogram

Ans. A.

149. The "Gold standard" for evaluation of cerebral aneurysm is

A. Lumbar puncture
B. MRA
C. CTA
D. Cerebral angiogram

Ans. D

150. The maximal frequency of rebleeding in aneurysmal SAH is on

A. Day 1
B. Day 2
C. Day 3
D. Day 4

Ans. A

- The maximal frequency of rebleeding is in the 1st day (4% on day 1), then 1.5% daily for 13 days 15 – 20% rebleed within 14 days, 50% will rebleed within 6 months
- The highest risk of rebleeding occurred in the first 6 months following SAH

151. The single most common site of aneurysm presenting with SAH is

A. Anterior communicating artery aneurysm
B. PCoA aneurysm
C. Distal anterior cerebral artery aneurysm
D. MCA aneurysm

Ans. A.

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152. Ophthalmic artery aneurysm result in following visual defect EXCEPT

A. Ipsilateral monocular superior nasal quadrantopsia
B. Junctional scotoma
C. Ipsilateral inferior nasal cut
D. Bitemporal hemianopia

Ans. D

153. Ophthalmic artery in relation to optic nerve is

A. Superomedial
B. Inferomedial
C. Superolateral
D. Inferolateral

Ans. D

154. The most common primary non glial tumor to have hemorrhage is

A. Meningioma
B. Schwannoma
C. Primary CNS lymphoma
D. Pituitary adenoma

Ans. D

- Pituitary apoplexy occurring in 0.6% to 12.3% of pituitary adenoma. Histologically verified hemorrhage within pituitary adenoma is observed in 9.6-17% of cases. Pituitary adenomas bleed 5.4 times more frequently as compared to other intracranial tumor (Wakai 1982)

155. The most common posterior circulation aneurysm is

A. Basilar tip aneurysm
B. VA – PICA aneurysm
C. VA – BA aneurysm
D. VA – AICA aneurysm

Ans. A

- Basliar bifurcation aneurysm AKA Basilar tip aneurysm is the most common posterior circulation aneurysm. Account for 5 % of all aneurysms. VA-PICA aneurysm is the second most common posterior circulation aneurysm

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156. About Mycotic aneurysm

A. 4% of intracranial aneurysm
B. Occurs in 3–15% of patients with subacute bacterial endocarditis
C. Most common location distal MCA branches
D. Most probably start in the adventitia (outer layer) and spread inwards
E. Streptococcus is a common organism

Ans. All are true

- These aneurysms usually have fusiform pathology and are usually friable
- Typical SAH occur in 20% of patients

157. Intervertebral disc constitute how much % of entire height of vertebral column

A. 15%
B. 25%
C. 35%
D. 45%

Ans. B.

- 25%–It varies from 20–33%, but roughly it is 25%

158. The most common vascular malformation is

A. Venous angioma
B. AVM
C. Cavernous angioma
D. Capillary telangiectasia

Ans. A.

159. The most common angiographically occult cryptic vascular malformation (AOVM) is

A. Cavernous angioma
B. Telangiectasis
C. Venous angioma
D. AVM

Ans. D

- AVM > Cavernous angioma > Telangiectasis > Venous angioma

160. The most common cause of lobar ICH in elderly normotensive patients is

A. Tumor
B. AVM
C. Trauma
D. Amyloid angiopathy

Ans. D

- Cerebral amyloid angiopathy is the most common cause of lobar ICH in elderly normotensive patients

161. The most common source of Tumoral intracerebral hemorrhage is

A. GBM
B. Lymphoma
C. Choriocarcinoma
D. Bronchogenic carcinoma

Ans. D.

162. Tumors associated with Intracerebral hemorrhage

A. Low grade astrocytoma
B. Meningioma
C. GBM
D. Pituitary adenoma
E. Acoustic neuroma

Ans. All are true

163. The most common site of Intracerebral hemorrhage is

A. Putamen
B. Cerebellum
C. Thalamus
D. Lobar

Ans. A

164. The physiological calcification is seen in

A. Arachnoid granulation
B. Choroid plexus
C. Pteroclinoid ligament
D. Habenular commisure
E. Vein of Galen

Ans. A to D

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165. The most common benign primary intra-orbital neoplasm is

A. Lymphangioma
B. Capillary hemangioma
C. Lymphoma of the orbit
D. Cavernous hemangioma

Ans. D.

166. The normal spinal canal/vertebral body ratio is approx

A. 1
B. 0.5
C. 0.8
D. 1.5

Ans. A

167. About nucleus pulposus all are true EXCEPT

A. Disc is made up of annulus fibrosus and the nucleus pulposus
B. Nucleus pulposus not in the center but lie a little anterior
C. It has a volume of 0.5 ml and is about 0.5 cm in diameter
D. Remnant of notochord

Ans. C. It has a volume of 0.2 ml and is about 0.7 cm in diameter

168. All of the following are correct match EXCEPT

A. Fusiform gyrus – lateral occipito temporal gyrus
B. Lingual gyrus – medial occipito temporal gyrus
C. Heschl gyrus – primary auditory area
D. Entorhinal area – primary olfactory area

Ans. A to C.

169. The parahippocampal gyrus is separated from the fusiform gyrus by

A. Rhinal sulcus
B. Calcarine sulcus
C. Collateral sulcus
D. Parieto-occipital sulcus

Ans. C.

170. The Vein of Galen is present in

A. Quadrigeminal cistern
B. Ambient cistern

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C. Suprasellar cistern
D. Interpeduncular cistern

Ans. A.

171. The Suprasellar cistern consists of

A. Optic chiasma
B. Internal carotid artery
C. Circle of willis
D. Pituitary stalk
E. All of the above

Ans. E. All of the above

172. Which Fisher grade is associated with severe vasospasm in SAH?

A. Grade 1
B. Grade 2
C. Grade 3
D. Grade 4

Ans. C.

173. Characteristic "Popcorn" appearance seen on T2WI on MRI is seen in which vascular malformation

A. AVM
B. Cavernous angioma
C. Venous angioma
D. Capillary telangiectasia

Ans. B.

174. "Medusa Head" appearance is seen on cerebral angiography in which vascular malformation

A. AVM
B. Cavernous angioma
C. Venous angioma
D. Capillary telangiectasia

Ans. C

175. Tumor occurring in midline is

A. Oligodendroglioma
B. Epidermoid cyst

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C. Cerebral metastases
D. Rhabdomyosarcoma

Ans. A.

- Oligodendroglioma (most common in frontal lobe)

176. The most common primary sites which metastasise to calvarium is

A. Breast
B. Liver
C. Seminoma
D. Follicular carcinoma thyroid

Ans. A.

- The descending order of frequency of primary sites which metastasise to calvarium is Breast >Lung>Prostate> Lymphoma

177. Primary tumor associated with leptomoningeal metastases are

A. Melanoma
B. Ca of breast and lung
C. Lymphoma
D. Leukemia
E. Ependymomas

Ans. All are true

- Primary brain tumor having leptomeningeal spread pattern are GBM, ependymomas and pinealoblastomas
- Dural metastases – Most common sites of primary are breast, lung and kidney

178. Calcified brain metastases occur with

A. Bronchiogenic Ca
B. Ca breast
C. Ovarian Ca
D. Renal cell Ca

Ans. C.

- Ovarian Ca due to secretion of mucin
- Cystic metastases can be seen with lung and breast

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179. The most common site of origin of meningioma in sellar and parasellar region is

A. Dorsum sellae
B. Clinoid process
C. Tuberculum sellae
D. Medial sphenoid wing
E. Diaphragm sellae

Ans. C.

180. The most common site of epidermoid cyst in the head is

A. CP angle
B. Intraventricular (IVth ventricle)
C. Suprasellar
D. Parasellar

Ans. A

- Parasellar is the second most common site in the head after the CP angle

181. Posterior pituitary bright spot on TIWI is absent in all EXCEPT

A. Hand Schuller – Christian disease
B. Stalk transection
C. Pituitary adenoma
D. Hyothalamic glioma

Ans. C.

- Pituitary adenoma arises from adenohypoysis. Hand Schuller Christian disease consist of Diabetes inspidus, Exophthalmos, Lytic bone lesion, AAI – Atlanto axial instability

182. Condition causing Atlanto axial instability are

A. Down's syndrome
B. Upper respiratory tract infection
C. Mastoiditis
D. Gout
E. Tuberculosis

Ans. All of the above are true

- Other options are parotitis, seronegative arthropathy, rheumatoid arthritis, morquio's syndrome

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183. Condition causing abnormal redistribution of K^+ from the intracellular to the extracellular compartment occur in

A. β receptor blocker
B. Succinylcholine administration
C. Acute acidemia
D. Reperfusion of ischemic limb
E. Insulin deficiency

Ans. All are true

184. Steroid responsive conditions are

A. Sarcoidosis
B. Lymphocytic Hypophysitis
C. Tolosa Hunt syndrome
D. None of the above
E. All of the above

Ans. E

185. Negative prognostic factors for low-grade glioma are all EXCEPT

A. Largest diameter of tumor > 6 cm
B. Histology is astrocytoma
C. Age > 30 years
D. Tumor crosses midline
E. Neurologic deficit present

Ans. C. Age > 30 years

186. Which of the following is a WHO Grade II tumor?

A. Ganglioglioma
B. Dysembryoplastic neuroepithelial tumor
C. Central neurocytoma
D. Paraganglioma of the filum terminale

Ans. C.

- WHO Grade 1 tumors are Gangliolioma, Gangliocytoma, DNET, and paraganglioma of the filum terminale

187. The most common feature of 3rd ventricular mass in children is

A. Endocrine disturbance
B. Visual disturbance
C. Hydrocephalus
D. Mental and behavioural changes

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Ans. C

- Diencephalic syndrome which comprises hyperkinesis and alrtness associated with emaciation in infants is the only specific syndrome associated with hypothalamic gliomas

188. The most common posterior fossa neoplasm in children is

A. Medulloblastoma
B. Ependymoma
C. Brainstem glioma
D. Cerebellar astrocytoma

Ans. D.

- Cerebellar astrocytoma > medulloblastoma > Ependymoma > Brainstem glioma

189. % of the CSF entering in the spinal subarachnoid space is

A. 20%
B. 30%
C. 10%
D. 40%

Ans. A.

190. Differential pressure across the arachnoid villi is about

A. 10 – 20 mmHg
B. 20 – 50 mmHg
C. 30 – 70 mmHg
D. 40 – 80 mmHg

Ans. B.

191. Colpocephaly commonly seen in neonate is

A. Disproportionate dilatation of occipital horn
B. Disproportionate dilatation of frontal horn
C. Disproportionate dilatation of temporal horn
D. Disproportionate dilatation of third ventricle

Ans. A

- Colpocephaly – dilatation of occipital horn + trigone

192. Each of the following is characteristic of an acoustic neuroma EXCEPT

A. Beksey type III or IV audiogram
B. Loudness recruitment

C. Low short – increment sensitivity index
D. Poor speech discrimination
E. Pronounced tone decay

Ans. B

- An absence of loudness recruitment is characteristic of a nerve trunk lesion, including an acoustic neuroma. Recruiting deafness occurs with a lesion in the organ of Corti, e.g. Meniere's disease. The other responses are characteristic of a retrocochlear (nerve) lesion

193. Base of dens develop from

A. Proatlas
B. First occipital sclerotome
C. First cervical sclerotome
D. Second cervical sclerotome

Ans. C. i.e. first cervical sclerotome

- Base of dens, which is an analogue of the C1 body develops from first cervical sclerotome

194. The most common genetic abnormality in medulloblastoma is

A. Isochromosome of chromosome 17
B. Deletion of the short arm of chromosome 17
C. Deletion on chromosome 1 q and 10 q
D. Amplification of MYC

Ans. A.

- Isochromosome of chromosome 17, arises in approx 50% of cases. Deletion of the short arm of chromosome 17 occur in 30–45% cases

195. How much genes contribute in formation of human CNS?

A. 10,000
B. 12,000
C. 14,000
D. 16,000

Ans. B.

- 40% of total = 40 x 30,000 / 100 = 12,000

196. All tremors are absent on rest but pronounced on voluntary movement EXCEPT

A. Senile tremor

B. Metabolic tremor
C. Essential tremor
D. Parkinson tremor

Ans. D

197. All of the tumors show calcification EXCEPT

A. Ependymoma
B. Chordoma
C. Pinealoblastoma
D. Germinoma

Ans. D.

- Germinoma does not show calcification

198. About pediatric intracranial aneurysms all are true EXCEPT

A. Cerebral aneurysm in childhood occur at a rate of 0.5-4.6%
B. Male predominance and inversion of sex ratio is present
C. ICA bifurcation is the most common location
D. Rebleeding in the pediatric population is similar to that in adults
E. Vasospasm better tolerated in young age group.

Ans. D. Rebleeding in the pediatric population is significantly higher than adults and is related to delayed diagnosis because of clinical polymorphism of SAH in children

199. Pterional craniotomy is indicated in following aneurysms EXCEPT

A. Anterior communicating artery aneurysm
B. Posterior communicating artery aneurysm
C. Distal anterior cerebral artery aneurysm
D. Middle cerebral artery aneurysm

Ans. C

200. Successful weaning from a ventilator is suggested by presence of which of the following?

A. An alveolar arterial gradient of more than 350 mmHg
B. A PaO_2/FIO_2 ratio of less than 200
C. A $PaCO_2$ over 55 mmHg
D. A tidal volume [V_T] of over 5ml/kg

Ans. D

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201. About Pediatric disc disease all are true EXCEPT

A. The segmental distribution of disc herniation in children is similar to that seen in adults
B. Disc herniation is most often sub-ligamental and more than 80% are posterolateral in position
C. 30 to 60% children with symptomatic lumbar disc herniation have a direct history of trauma
D. Well managed by conservative treatment

Ans. D. Unlike the degenerative discs often found in adults, the highly elastic pediatric disc respond less well to conservative treatment.

202. Venous angle is an important landmark for

A. Aqueduct of sylvius
B. Foramen of Monro
C. Trigone of lateral ventricle
D. Occipital horn of lateral ventricle

Ans. B.

203. About MRI, all are true EXCEPT

A. Most pathology are hyperintense on T2WI
B. Most pathology are hyerintense on T1WI
C. CSF is hypointense on T1WI but hyperintense on T2WI
D. Gray matter is hyperintense than white matter on T2WI

Ans. B.

204. Reduction of sensory nerve action potential and para spinal muscle fibrillation is seen in

A. Plexus lesion
B. Root lesion
C. Both of the above
D. None of the above

Ans. C.

205. The most common muscle involved in the peroneal nerve palsy is

A. EDL
B. Peroneus longus
C. Tibialis anterior
D. EHL

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Ans. D.

- Extensor hallucis longus
- EHL > Tibialis anterior > Toe extensor > Peroneus longus + Peroneus brevis

206. Tarsal tunnel syndrome involves the following nerve

A. Anterior tibial nerve
B. Posterior tibial nerve
C. Common peroneal nerve
D. Musculocutaneous nerve of leg

Ans. B.

207. Endoneurium is intact in which of the following degree of nerve injury

A. 5°
B. 2°
C. 3°
D. 4°

Ans. B.

208. Rotatory paralysis is characteristic of tumor in the following location

A. Clivus
B. Falx
C. Foramen magnum
D. Olfactory groove
E. Tuberculum sellae

Ans. C.

209. Fall of temperature by 1°C slows conduction in motor nerves by

A. 1 m/s
B. 2 m/s
C. 3 m/s
D. 4 m/s

Ans. B.

210. Abductor policis longus is supplied by

A. Anterior interosseus nerve
B. Posterior interosseus nerve

C. Median nerve
D. Radial nerve

Ans. B.

211. Root value of lumbosacral trunk is

A. L5, S1, S2
B. L3, L4, L5
C. L4, L5
D. L5, S1

Ans. C.

212. Meralgia paresthetica is due to involvement of a nerve which has the following root value

A. T12, L1
B. L1, L2
C. L2, L3
D. L3, L4

Ans. C.

- (Lateral femoral cutaneous nerve of thigh)

213. The number of Na+ channel per sqmicro meter of membrane of long axon of unmyelinated neuron is

A. 110
B. 120
C. 130
D. 140

Ans. A.

214. About CNS

A. Brain weighs about 2% of the body weight
B. Blood flow per min in brain is greater than visceral organ
C. Cerebral blood flow per minute in children is less than that of adults
D. Glycogen in brain is greater than in muscles
E. Glucose is responsible for 99% of production of ATP in brain

Ans. A.

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215. Gerstmann syndrome is due to a lesion in

A. Area 39, Right side
B. Area 39, Left side
C. Area 40, Right side
D. Area 40, Left side

Ans. B.

- Area 39 (angular gyrus), Left side

216. About histopathologic finding and immunohistochemistry in schwannoma and Neurofibroma

A. Neurofibroma react to vimentin, S -100 protein and leu-7
B. Schwannomas are positive for S -100 protein and collagen IV or laminin
C. Verocaybodies are more common in spinal schwannomas
D. Neurofibromas cannot be separated from the entire nerve
E. Schwannoma can be dissected free of the affected nerve

Ans. All the above are true

217. In Vernet's syndrome there is

A. External ophthalmoplegia
B. Inability to shrug shoulders
C. Taste disturbance in anterior 2/3rd of tongue
D. Dysphagia
E. Sensory loss in face [onion bulb distribution]

Ans. B and D

- Vernet's syndrome → [IX, X, XI] intracranial involvement

218. About myelination in PNS and CNS

A. Schwann cell is responsible for myelination in PNS
B. Oligodendrocyte myelinate about 60 axons in CNS
C. Schimdt – Lantermann incisure is present in both CNS and PNS axons
D. Ranvier's nodes absent in CNS axon
E. Mesaxon is absent in PNS axon but present in CNS axon

Ans. A to **C.**

219. Which of the following sensory sensations recover first after neurotemesis?

A. Heat and cold sensation

B. Light touch and discrimination
C. Poorly localized superifical pain
D. Pain caused by deep pressure

Ans. D

- Order of recovery of sensation after neurotemesis is pain caused by deep pressure followed by poorly localized superficial pain followed by heat and cold sensation and at last light touch and discrimination

220. About relation of spinal cord segment

A. T12 segment lies opposite to T9 vertebrae
B. T8 segment lies opposite to T6 vertebrae
C. C8 segment lies opposite to T1 vertebrae
D. L5 segment lies opposite to T12 vertebrae
E. Sacrococcygeal segment lies opposite to L1 vertebrae

Ans. A, B, D and E

221. A patient having following values

SBP = 110 mmHg
DBP = 70 mmHg
ICP = 10 mmHg
has cerebral perfusion pressure of

A. 63 mmHg
B. 73 mmHg
C. 83 mmHg
D. 93 mmHg

Ans. B.

- CPP = MAP – ICP
- = (DBP + SBP – DBP/3) – ICP

222. About histological stains in neurology

A. Osmic acid is used for staining myelin which are stained black
B. Holtzer stain is used for showing gliosis
C. Trypan blue is used for showing cerebral oedema
D. Nissl (cresyl blue) is not used for staining myelin
E. Nissl granule stain best with eosinophilic stain

Ans. A to D are correct

- Nissl granule is stained basophilic

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223. About seizures

A. Hyperventilation is used for evocation of petitmal (Absence) seizures
B. Photic stimulation is used for evocation of tonic and clonic seizures
C. Sleep deprivation is used for evocation of partial complex seizures
D. All of the above are true

Ans. D

224. Hypokalemia is associated with

A. Insulin excess
B. Metabolic alkalosis
C. Myocardial infarction
D. Delirium tremens
E. Hypothermia

Ans. All of the above are true

- Refeeding syndrome: Hypokalemia may occur in the malnourished patient after the initiation of parenteral nutrition
- Hypomagnesemia frequently accompanies hypokalemia and generally must be corrected to replenish K+.
- Amphotericin B causes hypokalemia
- Theophylline toxicity
- RTA (Renal tubular acidosis) 1,2,3
- Cushing Disease
- Hyperaldosteronism (Conn's syndrome)

225. Hyperkalemia is associated with

A. Adrenergic receptor blockade
B. Acute acidemia
C. Digitalis intoxication
D. Reperfusion of ischaemic limb
E. Succinyl choline administration

Ans. All are true

- Also seen in insulin deficiency, cell lysis (after chemotherapy), ACE inhibitors, K sparing diuretic non-steroidal anti-inflamnatory drug (NSAID)

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226. Parts of the Ethmoid bone are

A. Cristae galli
B. Cribriform plate
C. Superior nasal conchae
D. Middle nasal conchae
E. Inferior nasal conchae

Ans. A to D

227. Anterior lacrimal crest is formed by

A. Frontal process of maxilla
B. Orbital plate of frontal bone
C. Lacrimal bone
D. Ethmoid

Ans. A.

228. About genetics in neurosurgery

A. Intron and exon both code for protein
B. G2 phase is between S and M phase
C. Protein synthesis occur during the GI phase
D. G2 phase is most susceptible to radiation
E. GI phase duration is variable in different tissues

Ans. B to E

229. About Echinococcus infection

A. Man is a definitive host
B. Caused by *T. solium*
C. Dog is secondary host
D. Hydatid cyst in brain is dissected by hydraulic dissection
E. Albendazole may be used in medical treatment

Ans. E

- Echinococcus caused by encysted larvae of the dog tapeworm echinococcus granulose. Dog is the primary definitive host of the adult worm. Intermedaite hosts for the larval stage include sheep and man. Man is infected either by eating food contaminated with ova or by direct contact with dogs. CNS involvement occur in 3%. Produce cerebral cyst confined to white matter. Primary cysts are usually solitary. Secondary cysts usually multiple. CT density of the cyst similar to CSF does not enhance. Little surrounding edema contains

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germinating parasitic particles (400,000 scolices/ml). Medical treatment with albendazole 400 mg BD, Paed 15 mg/Kg/day × 28 days.

230. About tremors

A. It is an action of simple muscle and its antagonist
B. In hyperthyroidism there are coarse tremors
C. Fine tremors have frequency less than 10/s
D. Multiple sclerosis can present with intention tremor
E. In parkinsonism there is intention tremor

Ans. A.

- Tremors are rhythmic, involuntary, oscillation of a body part. Tremors differ in distribution rate and amplitude whether they occur at rest or during voluntary contraction. Resting tremor is highly characteristic of Parkinsonism. Intention tremor or end point tremor implicates a lesion of cerebellum. Fine tremors have frequency greater than 10/s

231. In multiple sclerosis

A. Two lesions at the same site are diagnostic of MS
B. In CSF IgM is raised
C. Associated with retrobulbar neuritis and blindness
D. Plaques are characteristically present in gray matter
E. Trigeminal neuralgia can be present in MS

Ans. E

- A demyelinating disease affects only white matter of the cerebrum, optic nerves and spinal cord. Produce multiple plaque of various ages in different locations in the CNS. Typically causes exacerbation and remissions in various locations in the CNS. Diagnosing MS after a single, acute remitting clinically isolated syndrome very risky. CSF oligoconal bands or CSF IgG (serum IgG must be normal). Support the diagnosis

232. About immunoglobulin

A. IgG is the only immunoglobin to cross the placenta
B. IgD is related with complement fixation of the foreign body
C. IgA is present in the body secretion
D. IgE is related with type I hypersensitivity
E. IgM is also related with complement fixation of the foreign body

Ans. A, C, D and E are correct

- IgG, IgA, IgM causes complement fixation

233. Hypothalamic nucleus associated with water metabolism are

A. Supra optic
B. Ventromedial
C. Arcuate nucleus
D. Paraventricular
E. Lateral nucleus

Ans. A and D

234. Structures associated with auditory system are

A. Inferior olivary nucleus
B. Superior colliculus
C. Lateral geniculate body
D. Trapezoid body
E. Spiral ganglion

Ans. D and E

235. Cortex associated with olfaction are

A. Lingual gyrus
B. Cuneus
C. Pyriform
D. Precuneus
E. Entorhinal

Ans. C and E

236. About Bell's Palsy

A. Hereditary, diabetes, pregnancy can be the cause
B. It is the most common cause of facial nerve palsy
C. More proximal involvement indicates good prognosis
D. It is peculiar in case that chorda tympani is not involved
E. All the above are true

Ans. A and B are correct.

237. About Medulloblastoma

A. Defect is on the short arm of chromosome 17
B. Leptomeningeal spread is rare
C. Prognosis is good if presentation is below 3 years and residual volume is less than 1.5 sqm

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D. Chemotherapy is preferred over radiotherapy if age is less than 3 years
E. After resection a CT or MRI must be done after 24 to 48 hrs

Ans. A and D

- ErbB2 over expression in MB is associated with worse prognosis

238. About CNS lymphoma

A. Periventricular in position
B. CNS lymphoma prognosis better than non CNS lymphoma
C. CNS lymphoma is of Hodgkins type
D. May disappear on CT after giving steroids
E. Primary CNS lymphoma associated with EB virus

Ans. A, D and E

- Are seen at all ages. PCL represents about 1to 2% of all intra cranial neoplasms and approx 1% of primary non-Hodgkins Lymphoma. PCL occur in about 2% of AIDS cases. PCL in immunologically normal patient has increased three fold in the last decade. Corticosteroids induce apoptosis in lymphoma cells, contributing to cytotoxic effects rather than reduction in cerebral edema. PCNSL is an unusual form of NHL that is restricted to CNS. Poor prognostic factors in PCNSL are Age > 60, elevated serum LDH. Elevated CSF protein. Location of tumor in deep structures

239. About VHL syndrome

A. Autosomal recessive inheritance
B. Ocular retinal angioma
C. Associated with glioma, meningioma
D. Defect on short arm of chromosome 3
E. Associated with pheochromocytoma

Ans. B, D and E

- It is an autosomal dominant disorder with incomplete penetrance. Defect on the short arm of chromosome 3 common lesions. Retinal angiomas 40 to 50%. Hemangioblastomas (40 to 80%). Cerebellum 75% of hemangioblastomas in VHL. Spinal cord 25% of hemangioblastomas in VHL. Renal cell carcinoma, Pheochromocytoma (10%)

240. About Milard Gubler syndrome

A. Lesion in midbrain
B. Ipsilateral VIth nerve palsy
C. Contralateral hemiparesis
D. Contralateral nuclear VII palsy
E. Contralateral weakness of facial muscle

Ans. C

- Facial and abducens palsy and contralateral hemiplegia (corticospinal tract) from lesion in base of pons usually ishemic infarct, occasionally tumor.

241. About branches of Internal carotid artery

A. Lingual artery
B. Posterior communicating artery
C. Ascending pharyngeal artery
D. Middle meningeal artery
E. Middle cerebral artery

Ans. B and E

- Branches of ICA are ophthalmic artery, anterior choroidal artery, posterior communicating artery, superior hypophyseal artery, meningo hypophyseal trunk, terminal branches, anterior cerebral artery and middle cerebral artery

242. Muscle supplied by radial nerve

A. Tricep
B. Brachioradialis
C. Abductor policis longus
D. Brachialis
E. Posterior part of Deltoid

Ans. A to D

243. Lesion of temporal lobe produces

A. Anton's syndrome
B. Balint's syndrome
C. Dysconnection syndrome
D. Object agnosia
E. Complex partial seizure

Ans. D and E

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244. About Dandy Walker syndrome

A. Agenesis of Vermis
B. Dilatation of IVth ventricle
C. Small posterior fossa
D. High torcula
E. Atresia of Foramen Magendie and Luschka

Ans. A, B, D and E

- Atresia of foramina of Magendie and Luschka result in agenesis of the cerebellar vermis with a large posterior fossa cyst communicating with an enlarged IVth ventricle. Some retrocerebellar arachnoid cyst mimic Dandy Walker. Do not have vermian agenesis and the cyst does not open into IVth ventricle. Vallecula is absent in Dandy Walker syndrome. Hydrocephalus occur in 90% of cases. Dandy Walker malformations is present in 2-4 % of all agenesis of the corpus callosum in 17%. And Occipital encephalocele is 7%, if no hydrocephalus patient may be followed. If necessary shunt the posterior fossa cystin rare patient with aqueductal stenosis lateral ventricle is also shunted

245. About nuclear IIIrd nerve palsy

A. Ipsilateral ptosis
B. Ipsilateral medial rectus palsy
C. Contralateral superior rectus palsy
D. Bilateral dilated pupil
E. Ipsilateral intorted eye

Ans. B to E

246. About upper motor neuron Vth nerve palsy

A. Bilateral UMN supply to motor nucleus
B. Unilateral UMN lesion leads to deviation of jaw to the side of the lesion
C. Bilateral UMN lesion leads to absence of jaw jerk
D. UMN lesion is often less harmful

Ans. A and D

247. The most common artery and lobe to be involved in AVM are

A. Middle cerebral artery and Parietal lobe
B. Anterior cerebral artery and Frontal lobe
C. Posterior cerebral artery and Occipital lobe
D. Middle cerebral artery and Parietal lobe

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Ans. A

- MCA and Parietal lobe: The parietal lobe is the commonest region involved in the supratentorial lesions. There is no significant hemispheric preference. Middle cerebral artery is the most common artery to be involved in AVM

248. Tract present in the inferior cerebellar peduncle are

A. Dentatorubral
B. Posterior Spinocerebellar
C. Anterior Spinocerebellar
D. Darsal external arcuate
E. Vestibulocerebellar

Ans. B, D and E.

249. About Valsalva's maneuver

A. It is a cardiovascular reflex
B. It is expiration against closed glottis
C. It is used to expirate cyst from the brain
D. It can be used to measure raised ICP
E. It is used to check post-operative hemostasis in intracranial surgery

Ans. All of the above are true

250. About Cerebello Pontine Angle which of the following statements is true?

A. No vein is found in Cerebello Pontine angle
B. Schwannomas are rare in CP angle
C. Meningiomas constitute the most common CP angle tumor
D. Menigiomas constiute about 10% of all Cerebello Pontine Angle tumor

Ans. D

251. Structure present in cell body (soma) are

A. Nissl substance
B. Lysosomes
C. Golgi complex
D. Neurofilament
E. Microfilament

Ans. All of the above are true

252. Principal ligaments stabilizing atlanto-axial joints are

A. Cruciate ligament
B. Transverse ligament
C. Alar ligament
D. Ligamentum flavum
E. Ligamentum nuchae

Ans. A, B and C

- The principal stabilizing ligments of CI are the transverse atlantal and alar ligaments. The secondary stabilizing ligaments are more elastic and weaker than the primary ligaments and include the apical ligament, anterior and posterior atlanto-occipital membranes, tectorial membrane, ligamentum flavum, anterior and posterior longitudinal ligament and the capsular ligaments. The atlas and axis are united by the cruciform ligament, ALL, PLL and capsular ligament. The cruciform ligament has transverse and vertical component. Transverse component is called transverse ligament is the strongest stabilizer of CI and allows the atlas to pivot around the dens. Vetical component called paired alar ligament. Prevent excessive rotation and 1 ateral bending of CI.

253. Posterior fossa AVM account for how many percentage of all parenchymal AVMs

A. 4%
B. 8%
C. 15%
D. 24%

Ans. C 15%

- 85 % of all pial AVMs are found in the cerebral hemispheres and 15% occur in the posterior fossa. Although they can be found in virtually any location, the typical parenchymal AVM extends from the subpial surface of the brain through the cortex and underlying white matter. AVMs are often shaped like a cone with its base on the cortex and apex pointing towards the ventricle

254. All are true about traumatic subdural hygroma EXCEPT

A. Contain prealbumin
B. Lack membranes
C. Density of fluid is similar to that of CSF
D. Most common site is inter hemispheric fissure

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Ans. D.

- Most likely location of arachnoid tears are in the sylvian fissure or the chiasmatic cistern.

255. Hemangioma Calcificans term is used for

A. Venous Angioma
B. Cavernous Angioma
C. Capillary Telangiectasia
D. AVM

Ans. B.

- Heavily calcified cavernoma. Term given by Penfield and Ward

256. Drugs used for spasticity are

A. Benzodiazepines
B. Baclofen
C. Tiazidine
D. Hyaluronidase
E. Phenothiazine

Ans. All of the above are true

- Drugs used for spasticity are diazepam activate GABAa receptor, increases presynaptic inhibition of alpha motor neuron. Useful in patients with complete spinal cord injuries. Baclofen activates GABAb receptor. Dantrolene reduce depolarization induced calcium influx into srcoplasmic reticulum. Act on all skeletal muscles. Progabide activates both GABAa and GABAb receptor. Useful for severe flexor spasm. Phenothiazine reduce gamma spasticity. Tiazidine and hyaluronidase are also used.

257. Drugs used to treat neurocysticercosis are

A. Albendazole
B. Metronidazole
C. Praziquentel
D. Niclosamide
E. Pyrantal Pamoate

Ans. A and C

- Praziquentel and Albendazole are used to treat neurocysticercosis. Praziquantel given as 50mg/kg divided in 3 doses for 15 days. Significant reduction in symptoms and

in number of cysts seen on CT. Also drug of choice for intestinal stage infestation. Albendazole 15mg/kg per day in 2-3 dose is given for 3 months. Niclosamide may be given orally to treat adult tapeworms in the GI tract. Praziquentel is drug of choice.

258. About Vascular malformation all are true EXCEPT

A. Venous angioma is the most common of vascular malformation
B. Cavernous angioma lack neural parenchyma between the vessels
C. Venous angioma are low flow and low pressure
D. Cavernoma readily respond to radiation

Ans. D.

- Venous angioma represents the venous drainage of the area. Neural parenchyma is between the vessels. Most common in regions suppled by the MCA or in the region of Vein of Galen. These are low flow – low pressure. Surgery is indicated only for documented bleeding or for intractable seizures. Cavernoma are well circumscribed benign vascular hamartoma, consisting of irregular thick and thin walled or large draining vein. Do not respond to radiation including stereotactic surgery.

259. Complications of overshunting are

A. Slit ventricles
B. Orthostatic hypotension
C. Subdural hematomas
D. Stenosis of sylvian duct
E. Craniosynostosis and microcephaly

Ans. All of the above are true

- Complications of overshunting are self explainable. It is due to over-drainage of CSF. High pressure shunt or anti siphon device should be applied

260. GVE fibres are present in cranial nerves

A. III
B. IV
C. VI
D. IX
E. X

Ans. A, D and E

261. A 54 year old patient presents with diplopia. All are true EXCEPT

A. The presence of ptosis, and divergent squint is suggestive of a lesion of cranial nerve III
B. If diplopia is present when reading or looking down, then a lesion of cranial nerve VI is likely
C. The pupil is likely to be spared in diabetic lesion of cranial nerve III
D. Fluctuating diplopia is suggestive of myasthenia gravis
E. If caused by an acute palsy of cranial nerve III , and associated with acute severe headache and signs of menningism, then a posterior communicating artery aneurysm should be excluded

Ans. B

262. In Foville's syndrome there is

A. VII nerve paresis
B. Ipsilateral paralysis of conjugate gaze
C. Contralateral corticospinal hemiplegia
D. Horner's syndrome
E. None of the above

Ans. A to D

263. In Melkerson–Rosenthal syndrome there is

A. Recurring facial palsy
B. Recurring facial edema
C. Lingua plicata
D. Familial begin in childhood
E. Cause is unknown

Ans. All of the above are true

264. In Encephalotrigeminal angiomatosis (Sturge-Weber syndrome) there are

A. Congenital nevi or angiomas
B. Ipsilateral leptomeningeal angioma
C. Intra cortical calcification
D. Cerebral hemiatrophy
E. Ipsilateral hemiparesis and focal convulsions

Ans. A to D

- Localized cerebral cortical atrophy and calcification especially cortical layers 2 and 3 with a predilection for the occipital

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lobe. Calcification appear as curvilinear double parallel lines tram tracking. Cortical atrophy cause contralateral hemiparesis and homonymous hemianopsia occipital lobe involvement. Ipsilateral portwine facial naevus (nevus flammeus) in distribution of V1. Convulsive seizures contralateral to the facial nevus and cortical atrophy. Most cases are sporadic. Reccesive inheritance with chromosome 3 is being implicated. Treatment is supportive

265. In primary optic atrophy

A. Disk paler than normal and somewhat smaller
B. Opaque white or a blue white color
C. Disk margin district
D. Physiologic cup increased in depth and size
E. Lamina cribrosa is prominent and may extend to the margin of the disk

Ans. All of the above are true.

- In primary optic atrophy, the disc is paler than normal, more sharply demarcated from the surrounding retina. Physiologic cup abnormally prominent and extend to the margin of the disc. Appear perceptibly smaller. Bowtie or band optic atrophy refers to pallor of the disc that may develop in an eye with temporal visual field loss, following a lesion of the optic chiasma or tract

266. Causes leading to primary optic atrophy

A. Multiple sclerosis
B. Toxic amblyopia
C. Diabetes
D. Hereditary optic atrophy
E. Paget's disease

Ans. All of the above are true

- Pressure on the optic nerves is due to pituitary tumors, craniopharyngiomas, meningiomas

267. About testing of vision

A. Vision which can be improved by looking through a pin hole usually can be improved by glasses
B. In field defects due to neurologic disease, red is usually lost first (Red desaturation)

C. In disease of the choroid the field for blue lost first
D. The field of vision is wider in the inferior and lateral quadrant than in the superior and lateral quadrant
E. The tangent screen is valuable in measuring the size of physiologic blind spot and in demonstrating central defect

Ans. All of the above are true

268. About visual field changes

A. Concentric contraction frequently seen is an early objective finding in optic atrophy either primary or secondary
B. Tubular contraction regarded as sign of hysteria
C. Spiral contraction is probably more diagnostic of fatigue
D. Wernicke's hemianopic phenomenon localize the lesion anterior to LGB
E. In tract lesions, the hemianopia is usually incongruous

Ans. All of the above are true

- If the lesion is posterior to the lateral geniculate body within the optic radiation, the light reflex is not lost and defect is usually congruous

269. About visual field defect

A. The most frequent site of the lesion responsible for a homonymous defect is occipital lobe
B. Field defect in vascular lesion has steep or abrupt margin
C. Field defect associated with neoplasms are often complete, gradually progressive and have sloping margin
D. Absence of optokinetic nystagmus toward the hemianopic side is found in parietal lobe involvement
E. The most common cause of the bitemporal hemianopia is a pituitary adenoma

Ans. All of the above are true

270. About scotomas

A. Positive scotomas are not regarded as true scotomas
B. A central scotoma is characterized by blindness limited to the area of the visual field
C. A caeco-central scotoma involves macular area and blind spot
D. In annular or ring scotomas loss of vision surrounding the center of visual field
E. None of the above

Ans. A to D

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271. Ectopic ACTH production is seen with

A. Small cell carcinoma of lung
B. Thymoma
C. Carcinoid tumor
D. Pheochromocytoma
E. Medullary thyroid carcinoma

Ans. All of the above are true

272. Following are opioid peptides

A. Dynorphin
B. Alpha MSH
C. Endorphin
D. Glycine
E. GABA

Ans. All of the above are true

273. About Pituitary adenoma

A. It comprises about 10-15% of all intracranial tumors
B. Initially it produces bitemporal superior quadrantopia
C. Mass effect is most likely due to non functioning tumor
D. Among functioning tumors ACTH is likely to cause mass effect early
E. Hyperprolactinemia may be present due to pressure on pituitary stalk

Ans. All of the above are true

274. Cerebral vasodilatation is due to increase extracellular component EXCEPT

A. K^T
B. H^T
C. Na^T
D. Adenosine
E. $PaCO_2$

Ans. C

- Following result in cerebral vasodilation
  ↑ Extracellular K^+
  ↑ Extracellular H^+
  ↑ Adenosine
  ↑ $PaCO_2$
  ↓ PaO_2

275. VIth nerve is involved in

A. Claude's syndrome
B. Benedikt's syndrome
C. Foville's syndrome
D. Millard Gubler syndrome
E. Gardenigo's syndrome

Ans. C to E

- Nothnagel's syndrome – Injury to the superior cerebellar peduncle causes ipsilateral oculomotor palsy and contralateral cerebellar ataxia
- Benedikt's syndrome – Injury to the red nucleus result in ipsilateral oculomotor palsy and contralateral tremor, chorea and athetosis
- Claude's syndrome – Superior cerebellar peduncle and red nucleus are involved
- Weber's syndrome – Injury to the cerebral peduncle causes ipsilatreal oculomotor palsy with contralateral hemiparesis
- Foville's syndrome – Following dorsal pontine injury includes lateral gaze palsy, ipsilateral facial palsy and contralateral hemiparesis (AICA)
- Millard Gubler syndrome – Ventral pontine injury. Involves Lateral rectus palsy ipsilateral only. No gaze palsy. Abducens fascicle is injured rather than nucleus
- Gardenigo's syndrome – Pterous apex, mastoiditis can produce deafness, pain and ipsliateral abducen's palsy

276. Downbeat nystagmus occur in

A. Chiari malformation
B. Basilar invagination
C. Brainstem stroke
D. Cerebellar stroke
E. Lithium intoxication

Ans. All of the above are true

- Also syringobulbia
- Downbeat nystagmus occurs from lesion near the cranio cervical junction (or cervicomedullary junction)
- Upbeat nystagmus is associated with damage to the pontine tegmentum

277. About papilledema

A. Transient visual obscurations is a classic symptom
B. Visual acuity is never affected by papilledema
C. Visual field testing shows increased blind spot and peripheral constriction
D. Papilledema can be present in spinal neurofibroma
E. Papilledema also can be present in GB syndrome

Ans. A, C to E

- Increased protein in CSF in neurofibroma and GB syndrome result in papilledema

278. Following structures derived from the neural crest are

A. Neuronal perikarya in the PNS
B. Axons of ventral roots
C. Axons of dorsal roots
D. Autonomic ganglia
E. Adrenal medulla

Ans. A, C to E

- Much of the PNS drives from the neural crest. The crest derivative includes the dorsal root ganglia and their proximal and distal sensory processes, the sympathetic and parasympathetic ganglia and the adrenal medulla. The axons of the ventral root arise from the ventral motor neuron of the gray matter of the brainstem and spinal cord.

279. According to the theory of nerve components, the white sympathetic rami contain

A. GSE Axons
B. GVE Axons
C. GSA Axons
D. GVA Axons
E. All of the above

Ans. B

280. The sublenticular and retrolenticular parts of the internal capsule conveys.

A. Geniculo calcarine tract
B. Temporal radiation
C. Occipital radiation
D. Posterior thalamic radiation
E. Auditory radiation

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Ans. All of the above are true. Sublentiform part consist of auditory radiation, Meyer's loop of optic radiation, Temporo-pontine and parietopontine fibres. Retropentiform part consist of optic radiation, posterior thalamic radiation, parietopontine and occipitopontine fibres.

281. Match procedure or operation with the neurotransmmitter that it would deplete

- **A.** Destruction of spinal interneurons → GABA and glycine in the spinal cord
- **B.** Section of dorsal roots → substance P in the dorsal horns
- **C.** Section of the medial forebrain bundle → serotonin and catecholamine in the cerebral cortex
- **D.** Destruction of the anterior perforated substance → Acetyl choline in cerebral cortex
- **E.** Destruction of the medullary raphe → serotonin in the spinal cord

Ans. All of the above are true

282. Cerebellar glomeruli contains

- **A.** Mossy fiber rosettes
- **B.** Glial capsule
- **C.** Dendrites of granule neurons
- **D.** Axons of Golgi neurons
- **E.** Dendrites of Golgi neurons

Ans. All of the above are true

283. Reduction in pain responses can be produced by

- **A.** Stimulation of the periaqueductal gray matter
- **B.** Anterolateral cordotomy
- **C.** Section of the lateral division of the dorsal roots
- **D.** Section of the medial division of the dorsal roots
- **E.** Cingulotomy

Ans. A, B, C and E. D is false

284. Section of both optic nerves have the following effects on calcarine cortex

- **A.** Decrease in capillarity
- **B.** Loss of the outer stripe of Ballinger
- **C.** Degeneration of cortical neurons
- **D.** Compensatory overgrowth of oligodendroglia
- **E.** All of the above

Ans. A to C.

- Transection causes trans-synaptic degeneration of the geniculate bodies and the geniculocalcarine tract. Degeneration of this tract would deprive the calcarine cortex of its thalamic afferents and causes the outer line of Ballinger to disappear. Because of the loss of neurons, the capillarity decreases

285. Neuronal perikarya assume the following pattern of organization

A. Lamination
B. Nuclear masses
C. Reticular formation
D. Ganglia
E. None of the above

Ans. A to D

- Neuronal perikarya arrange themselves in basically four patterns laminae, nuclear masses, reticular formation, ganglia. Each of these arrangement may show a wide variety of neuronal type

286. Thalamic fasciculus conveys which of the following pathways

A. Medial leminiscus
B. Dentatothalamic tract
C. Pallidothalamic tract
D. Thalamo frontal radiation
E. All of the above

Ans. A to C

- Field of Forel H, or the thalamic fasciculus conveys the medial leminiscus, dentatothalamic tract and the pallidothalamic tract. It separates the ventral surface of the thalamus

287. Major sites at which large number of neurons lodge or accumulate after migration including the

A. Basis pontis
B. Cerebellar cortex
C. Olivary nuclei
D. Neurohypophysis
E. Diencephalic nuclei

Ans. A to C

- Neuroblasts that remain in the periventricular zone form the gray matter surrounding the cavities of the CNS—namely, the nuclei of the spinal cord, the somite nuclei of the brainstem, the diencephalic nuclei and the basal ganglia. The migratory nuclei forms the cortex in the cerebrum and cerebellum and also form the branchial nuclei and reticular formation that surrounds the periventricular nuclei core of the brainstem, the nuclei of the basis pontis and the inferior olivary nuclei.

288. Clinical deficit with the expected lesion site

A. Expressive (fluent) aphasia → Left posterior parasylvian area
B. Loss of recent memory → Inferior medial quadrants of temporal lobes
C. Gerstmann syndrome → Area 39 (angular gyrus) left side
D. Prosopagnosia → Infer Medial Inferior Temporooccipital Region
E. Astereognosis → Right posterior parasylvian area

Ans. A to D

289. Statements regarding fissure or space are

A. Invagination of the medial hemispheric wall with rolling in of the hippocampal formation creates the transverse cerebral fissure
B. The transverse cerebral fissure is continued as the choroid fissure with the hippocampal formation forming its floor in the temporal lobe
C. Corpus callosum constitute the immediate roof of the cavum veli inter positi
D. The roof of the third ventricle is the floor of the cavum.
E. Cavum septi pellucidi lateral walls are formed by the septum pellucidum

Ans. All of the above are true

290. About weakness of muscle

A. Spasticity is velocity dependent
B. Spasticity predominantly affects antigravity muscles
C. Rigidity affects flexor and extensor equally
D. Paratonia result from the disease of frontal lobe
E. Paratonia is present throughout the range of motion and affects flexor and extensor equally

Ans. All of the above are true

291. About localization of sensory loss

A. Harlequin pattern of sensory disturbance localize lesion to the lateral medulla
B. In tegmentum of pons and midbrain lesion cause pansensory loss on the contralateral body
C. Hemisensory disturbance with tingling numbness from head to foot is thalamic in origin
D. In parietal cortex lesion there is contralateral hemineglect, hemi-inattention and tendency not to use the hand and arm
E. Anterior parietal infarction may present as a pseudothalamic syndrome with crossed hemilateral loss of primary sensation

Ans. All of the above are true

292. Akinetic mutism occur in damage of

A. Medial thalamic nuclei
B. Pulvinar nuclei
C. Orbitofrontal surface of frontal lobe
D. Due to hydrocephalus
E. All of the above

Ans. All of the above are true

- Bilateral asterixis – signifies a metabolic encephalopathy hepatic failure
- Myoclonic jerks or tremors are typical of uremic encephalopathy antipsychotic drugs such as lithium, phenothiazines or butyrophenones
- Myoclonus with coma signify anoxic cerebral damage
- Akinetic mutism refer to a partially or fully awake patient who is able to form impression and think but remain immobile and mute, particularly when unstimulated
- The term abulia is used to describe a mental and physical slowness and lack of impulse to activity that is in essence, a mild form of akinetic mutism with the same anatomic origins
- Catatonia→ Curious hypomobile and mute syndrome
- Patient appear awake with eyes open but make no voluntary or responsive movement.
- They blink spontaneously, swallow and may not appear distressed
- Eyelid elevation is actively restricted
- Blinking occur in response to visual threat and the eyes moves concomitantly with head rotation

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- Waxy flexibility
- Locked in state → Pseudocoma
- Verical eye movement and lid elevation remain unimpaired
- Infarction or hemorrhage of the ventral pons which transect all descending corticospinal or corticobutblar pathways is the usual cause
- A similar awake but different state occur as a result of total paralysis of the musculature in severe cases of GB syndrome

293. About staining

A. Basic aniline dyes, such as hematoxylin demonstrates neuronal and glial perikarya but do not show dendrites, axons or myelin sheath
B. Ehrlich homatoxylin and eosin stain is an all purpose stain
C. Luxol fast blue and iron hematoxylin selectively stains myelin
D. Osmium is deposited on cell membranes for electron microscopy and silver is deposited on cell membranes for light microscopy
E. Astrocytes can be demonstrated by Hortega silver impregnation method.

Ans. All of the above are true

- Normal axons – Bodian protagorol method Ramon Y cajal Neurofibillary impregnation Hortega neurofibrillary impregnation
- Degenerating axons – Nauta–Gygax silver impregnation method
- Astrocyles - Ramon Y cajal gold chloride sublimate Hortega silver impregnation method
- Microglia/oligodendroglia – Hortega silver impregnation method
- Entire individual neuron – Golgi silver impregnation method
- Reticulin silver impregnation for reticulin
- The Marchi method → osmic acid reacts with degenerating myelinated fibres so that they show up against unstained background, giving a positive trail of the degenerating tract
- Iron – hematoxylin method shows the surrounding intact myelinated fibre while the tract in question stand out as an unstained void giving a negative trail of the tract

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294. Statement about glia are

A. Astrocytes provide a structural scaffolding for neurons
B. Oligodendrocytes produce myelin sheath
C. Microglia are one type of perineuronal satellite cell
D. Ependymal cells are highly branched
E. Glia serves in place of the fibrous connective tissue of other organs

Ans. All of the above are true

295. About cells in the nervous system

A. In Golgi type I neuron, the axonal volume may greatly exceed the volume of the perikaryon
B. Neurons classified by axonal length are amacrine neurons, Golgi type I and Golgi type II neurons
C. The named tracts of the CNS consist of Golgi type II axons
D. Perineuronal satellite cell that nourish neurons and protect their surface are astrocyte, oligodendroglia and microglia
E. Glial cells that have multiple branches are astrocytes, oligodendrocytes and microglia

Ans. A, B, D and E

- Named tract contain Golgi type I axons

296. The following structures develop by evagination

A. Optic nerve
B. Neurohypophysis
C. Cerebral hemispheres
D. Cerebellum
E. Basis pontis

Ans. A to C

297. Following structures have glial supporting tissues

A. Optic nerve
B. Neurohypophysis
C. Olfactory tract
D. Autonomic ganglia
E. Dorsal root ganglia

Ans. A to C

- All structures that develop as evagination from the wall of the forebrain tube have glial supporting tissues, since they are basically CNS tissues. These structures include the optic nerve, infundibulum, olfactory tract and pineal body

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298. Statements about nerve sheaths are

A. The nerve sheaths strongly resist compression
B. Perineural fibres mainly orient circumferentially
C. The perineural sheath divides the nerve into facicles
D. Endoneurium forms the blood-nerve barrier
E. Epineurium is continuous with the dura matter

Ans. All of the above are true

- The sheaths of the peripheral nerves have different reactions to disease. The endoneurium consisting of connective tissue fibre, is essentially a longitudinal orientation that undergoes proliferation after loss of nerve fibres

299. Branches or connection listed for the following major vessels

A. Anterior cerebral artery/Heubner's artery of medial striate group
B. Middle cerebral artery/lateral striate arteries
C. Galenic vein/inferior longitudinal sinus
D. Basilar artery/PICA
E. Carotid artery/MCA

Ans. All of the above are true

300. Field of Forel H1 (Thalamic fasciculus) convey pathways

A. Medial leminiscus
B. Pallidothalamic tract
C. Dentatothalamic tract
D. Lateral leminiscus
E. All of the above

Ans. A to C

- Numerous pathways run through the laminae of myelinated fibres designated as H Field of Forel. These include afferent to the thalamus from the pallidum, cerebellum and somatosensory systems. The fonix arches over the thalamus band run in the hypothalamus, ventral to the H Field of Forel.

301. About anatomically defined areas and function are

A. A perisylvian network for language
B. A parieto frontal network for spatial orientation
C. An occipito-temporal network for object recognition

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D. A limbic network for retentive memory
E. A prefrontal network for attention and comportment

Ans. All of the above are true

302. About Wernicke's aphasia

A. Due to lesion in posterior part of middle temporal gyrus
B. An embolus to the inferior division of the middle cerebral artery and to the posterior temporal or angular branches is the most common
C. A co-existing right hemi or superior quadrantanopia is common in patient with Wernicke's aphasia
D. Mild right nasolabial flattening may be found
E. All of the above are true

Ans. B to D.

303. Other deficit associated with Broca's aphasia are

A. Right facial weakness
B. Hemiparesis
C. Buccofacial aphaxia
D. Occur due to occlusion of superior divison of the middle cerebral artery
E. All of the above are true

Ans. E

304. About pure alexia without agraphia

A. Due to obstruction of left posterior cerebral artery
B. The patient can understand and produce spoken language, name objects in the left visual hemifield, repeat and write
C. Patient loses the ability to name colors
D. Although they can match color
E. Since the PCA also supplies medial temporal component of the limbic system, the patient with pure alexia may also experience an amnesia

Ans. All of the above are true

305. In Balint's syndrome there is

A. Oculomotor apraxia
B. Optic ataxia
C. Simultanagnosia
D. The problem is central than peripheral
E. Result from bilateral dorsal parietal lesions

Ans. All are true

- Balint's syndrome consists of psychic impairment of visual fixation and alteration in visual attention. The patient has inability to reach for objects using visual guidance despite normal visual acuity and intact visual field. Optic ataxia and inability to voluntarily direct gaze (optic apraxia). Seen in patients with B/L parietooccipital lesion

306. Branches of cervical plexuses are

A. Superior root (C1) and inferior root (C2 and C3) of the ansa cervicalis
B. Lessor occipital nerve (C2)
C. Greater auricular nerve (C2 and C3)
D. Transverse cutaneous nerve of the neck (C2 and C3)
E. Supraclavicular nerve (C3 and C4)

Ans. All of the above are true

- Phrenic nerve (C3, C4, C5)

307. Following statements about the denticulate ligament are

A. A line drawn between the two ligaments bisects the spinal cord into right and left halves
B. They consist of glia rather than collagen
C. They attach directly to the vertebral bodies
D. They travel along the dorsal roots
E. All of the above are false

Ans. E.

- The denticulate ligament attach to the lateral aspect of the spinal cord midway between the dorsal and ventral roots. They extend from the pia to the dura and are composed of fibrous connective tissues. Line bisects cord into dorsal and ventral half

308. Lesion interfering with volitional control of micturition are

A. Medial part of the motor area (area 4) in the interhemispheric fissure
B. Transection of the ventral half of the spinal cord
C. Pelvic splanchnic nerve
D. Obturator nerve
E. Pudendal nerve

Ans. A to C and E

- Efferent to the bladder travel in the dorsal portion of the lateral column of the spinal cord. The primary coordinating center for bladder function reside within the nucleus locus cerulus of the pons. Voluntarily cortical control primarily involves inhibition of pontine reflex and originate in the genu of the corpus callosum.

309. Association between a nerve and its function is

A. Median nerve/flexion of the wrist
B. Ulnar nerve/abduction of the little finger
C. Obturator nerve/thigh adduction
D. Musculocutaneous nerve/elbow flexion by the biceps
E. Common peroneal nerve/extension and flexion of the ankle

Ans. A to D

310. Statements about spinal nerve are

A. Each spinal nerve innervate one somite
B. The nerve trunk is formed by the union of dorsal and ventral roots
C. Each spinal nerves typically has one dorsal root ganglion
D. Most spinal nerves contain parasympathetic efferent axons
E. The spinal nerves convey axons to skeletal muscles

Ans. A to C and E

- The spinal nerves typically contain four components—visceral and somatic efferent and visceral and somatic afferent. For most spinal nerves, the visceral efferent axons derives from the sympathetic nervous system. Only sacral nerves carry a large number of parasympathetic efferent axons.

311. A patient complain of numbness and tingling in the thumb and index finger. A lesion responsible for this complaint are

A. The radial nerve
B. The lower trunk or medial cord of the brachial plexus
C. The C6 dorsal root
D. Nucleus ventralis posterior of the thalamus
E. The post central gyrus

Ans. A, C to E

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312. About Reticular formation

A. It widely disperses axonal connections
B. Its perikarya use a variety of different neurotransmitters
C. It has heterogenous, multiple afferent connections
D. Its output consists of a few discrete myelinated tract
E. It extends from the cervicomedullary junction to the diencephalon

Ans. A to C and E

313. Changes after destruction of both optic nerves are

A. Pallor of the optic disks
B. Dilated pupil non reactive to light
C. Compensatory overgrowth of oligodendroglia in the retina
D. Wallerian degeneration of the optic tract
E. Transneuronal degeneration of the lateral geniculate bodies

Ans. All of the above are true

- The retina normally does not contain myelinated axons and oligodendroglia
- The myelin sheath of the optic nerve begin after the retinal axons pierce the lamina cribrosa
- Degeneration of the geniculo calcarine tract deprive the calcarine cortex of its thalamic afferent and causes the outer line of Baillarger to disappear because it consists of myelinated fibres of thalamic origin

314. About the Nodes of Ranvier

A. A node marks the site of apposition of two adjacent schwann cell
B. The theory of saltatory conduction presumes that the ionic flux of the nerve impulse occurs at the node
C. The internodal distance corresponds to the length of an axon myelinated by one schwann cell
D. The axons continue across the nodes without interruption
E. Many more nodes occur along the smallest nerve fibres than the largest

Ans. A to D

315. Dermatomal level matching the corresponding areas of the body

A. C7/Middle finger
B. T4/Nipple line
C. T10/Umbilicus

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D. L5/Bigtoe
E. S1/Perianal region

Ans. A to D.

- All somite derivative retain their original nerve root wherever they migrate

316. Statements about the thalamic fasciculus (Field of Forel H1) are

A. It conveys many myelinated axons
B. It conveys thalamofrontal axons
C. It conveys pallidothalamic axons
D. It forms the dorsal boundary of the Zona incerta
E. It conveys dentatothalamic axons

Ans. A to D.

317. Statements about Apraxia

A. Bilateral pyramidal tract interruption would preclude testing a patient for apraxia
B. Language apraxia implies a left hemisphere lesion
C. Lesion of the cortex and the thalaemo cortical circuits can cause apraxia
D. Dyslexia is a form of aphasia apraxia
E. Apraxia can affect common learned actions like dressing and walking

Ans. A to C and E.

- Dyslexia is a defect in the language reception, thus it is not an apraxia which means the inability of a non-paralayzed patient to execute a volitional action

318. About the corpus callosum

A. Tapetum arises from the genu of the corpus callosum
B. Its splenium connects cortex of the posterior part of the cerebral hemisphere
C. The fornix and fornix commissure run along its ventral surface
D. It conveys most of the projection fibres from the two cerebral hemispheres to lower centers
E. Far fewer transcallosal axons connect the hand areas than the trunk areas of the sensorimotor cortex

Ans. B, C and E

- Tapetum arise from the body of corpus callosum

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319. About fissures

A. Form earlier than sulci
B. Are longer than sulci
C. Are less numerous than sulci
D. Are shallower than sulci
E. Are not bordered by cortex

Ans. A to C and E.

- Fissures form by evagination of the telencephalon of the hemisphere and of the temporal lobe
- Longer and deeper than sulci
- After evagination, sulcation occurs in a definite timetable sequence
- The embryologic mechanism of sulcation are entirely different from fissuration
- In lissencephaly, the fissure form but not the sulci
- In holoprosencephaly, the fissure fail to form

320. The following statement relating to the type of aphasia are true

A. Motor aphasia/left posterior inferior frontal region
B. Dyslexia/lateral surface of the left occipital lobe
C. Global aphasia/left posterior parasylvian area
D. Fluent aphasia/left posterior parasylvian area
E. Auditory agnosia/left superior temporal gyrus

Ans. A, B, D and E

321. Papez circuit includes

A. Occipitofrontal fasciculus
B. Fornix
C. Ansa lenticularis
D. Mammilothalamic tract
E. Temporo ammonic tract

Ans. B to E

- The amygdala connect with this circuit through the ansa lenticularis

322. About Medial forebrain bundle

A. It interconnects the basal telecephalic olfactory region with the hypothalamus and the brainstem
B. It consists mainly of rapidly conducting myelinated axons
C. It occupies the dorso lateral part of the hypothalamus

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D. It conducts numerous ascending and descending sensory pathways
E. It runs medial to the internal capsule

Ans. A, C to E.

323. Following lesions reduce the afferent fibres to the deep cerebellar nuclei

A. Transection of the inferior cerebellar peduncle
B. Section of the auditory nerve
C. Destruction of purkinje neurons
D. Section of the superior cerebellar peduncle
E. Destruction of the inferior olivary nuclei

Ans. A, C to E.

324. Following are found in the molecular layer of the cerebellar cortex

A. Dendrites of Purkinje neurons
B. Dendrites of Golgi Type II neurons
C. Cerebellar glomeruli
D. Parallel and climbing fibers
E. Stellate neurons

Ans. A, B, D and E

325. Ocular actions mediated through the occipital lobes are

A. Vergences
B. Smooth pursuit
C. Binocular fixation
D. Saccadic kick backs
E. Counter rolling of the eyes

Ans. A to C and E.

326. Statements about the cortical efferent pathways for vertical eye movements are

A. The vertical pathways loop down into the pons and back up to the nucleus of CN III in the midbrain
B. The most axons of the vertical pathways end directly on the lower motorneurons of the optomotor nuclei
C. The vertical pathways act unilaterally so that the left hemisphere pathways elevate the left eye, and the right hemisphere pathways the right eye

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D. The vertical pathways run to all three optomotor nuclei, CN III, CN IV and CN VI
E. The vertical pathways for upward movements run through the pretectum, separate from the pathway for downward movements

Ans. E.

327. About Pia mater

A. It is lined with squamous epithelium
B. It belongs to the leptomeninges
C. It dips into the crevices of the brain and spinal cord
D. It intervenes between the arachnoid and the surface of the cerebral cortex
E. It allows free permeability between the CSF and the CNS

Ans. A to D.

328. Drugs used in Cushing's disease are

A. Cyproheptadine
B. Metapyrone
C. Ketoconazole
D. Mitotane
E. Bromocriptine

Ans. A to D

329. About Cerebello pontine angle

A. Acoustic schwannoma are rare
B. No vein is present in CP angle
C. Posteromedially there is cerebellum
D. Anteromedially there is pons
E. Epidermoid cyst most common location

Ans. C to E.

- Superior petrosal vein is present in CP angle

330. Molecular agents inhibiting EGFR and being used to treat malignant glioma are

A. Erlotinib
B. Imatinib mesylate
C. Cetuximab
D. Bevacizumab
E. Gefitinib

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Ans. A, C and E Molecular agents targeting EGFR are ATP - binding site inhibitors Erlotinib, Gefitinib and lapatinib. Monoclonal antibodies include cetuxima VEGFR inhibitor include monoclonal antibody Bevacizuma PDGFR inhibitor include Imatinib mesylate and Dasatinib

331. About Arachnoid cyst

A. The most common site is interhemispheric fissure
B. It is actually intra arachnoid cyst (between the arachnoid layers)
C. It is associated with temporal lobe agenesis
D. Bone expansion may be seen
E. It can be followed by serial CT scan

Ans. B to E.

- Most common site is sylvian fissure. Temporal lobe agenesis is now obsolete since brain volumes on each side are actually the same

332. In primary optic atrophy

A. Optic disc margins are blurred
B. Optic disc margins are well defined
C. Lamina cribrosa is well defined
D. Disc is pale
E. Disc is chalky white in colour

Ans. B, C and E

333. In a 55 year old woman with a brain tumor all are false EXCEPT

A. In the presence of a dressing apraxia, the lesion is likely to be in the dominant parietal lobe
B. The presence of upper quadrant homonymous field defect suggests that the lesion is likely to be in the temporal lobe
C. Sensory inattention is suggestive of dominant hemispheric lesion
D. The presence of dyscalculia suggests a temporal lobe lesion

Ans. B

- Constructional apraxias are localized to the non-dominant hemisphere. Sensory inattention and neglect are characteristic of non-dominant hemispheric lesions. Dyscalculia suggests dominant parietal lobe damage

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334. Points distinguishing traumatic tap from SAH are

A. Protein concentration will be greater in SAH than in traumatic tap
B. SAH does not clot but traumatic tap clots
C. Supertatene is clear in traumatic tap but xanthochromic in SAH
D. Raio of WBC : RBC is elevated in SAH than in traumatic tap
E. Opening pressure is usually elevated in SAH than in traumatic tap

Ans. All of the above are true

- Fresh bleeding elevates CSF protein from normal by only = 1mg per 1000 RBC
- In SAH blood breakdown product elevate this more than traumatic tap (measured protein exceeds the sum of normal protein + 1mg protein/1000 RBC)

335. Pain sensitive structure in the vertebral body are

A. Periosteum
B. Dura
C. Annulus fibrosus
D. Epidural veins
E. Posterior longitudinal ligament

Ans. A to C and E.

- Also facet joints

336. Drugs shown to reduce the risk of osteoporotic fracture are

A. Biphosphonates
B. Adendronate
C. Tamoxifen
D. Transdermal estrogen
E. All of the above

Ans. A to D.

337. About the brainstem

A. The widest part of the brainstem is the midontine level
B. The smallest cross sectional diameter is located at the caudal medullary level
C. The roof plate of the caudal medulla consists of posterior medullary velum which is a thin membrane
D. The narrowest site of communication between the ventricles is the aqueduct of the midbrain.

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E. Largest indentation in the basis of the site of interpeduncular forsa is midbrain.

Ans. All of the above are true

338. The central substrate of memory are

A. Hippocampal gyri
B. Ammon's horn
C. Fornices
D. Mammilothalamic tract
E. Dorsomedial thalamic nuclei

Ans. All of the above are true

- Bilateral inner circuit of the limbic system. Mammillary bodies, Anterior thalamic complexes cingulate gyri

339. Flexion injuries are

A. Wedge compression #
B. Facet dislocation
C. Hangman's #
D. Atlas avulsion ring #
E. Clay shover #

Ans. A, B and E.

340. Gardenigo syndrome

A. After suppurative otitis
B. III, IV, V, VI Nerve palsy
C. Cavernous sinus thrombosis
D. Hearing Loss
E. Sigmoid sinus thrombosis

Ans. A, C and E.

341. Organism causing meningitis

A. <4yr – *H. influenzae*
B. Trauma → *N. meningitides*
C. V P shunt → *S. epidermidis*
D. CSF leak → *S. pneumoniae*
E. <1month → Gram negative bacilli

Ans. A, C and E.

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342. Subdural effusion in children

A. Post VP shunt
B. *H. influenzae* infection
C. Trauma
D. Arachnoid cyst rupture
E. Congenital communication between ventricle and subdural space

Ans. All of the above are true

343. Severe headache with 3rd nerve Palsy

A. Cavernous sinus thrombosis
B. Pituitary apoplexy
C. Temporal abscess
D. Ant. communicating artery aneurysm
E. Intratumoral hemorrhage

Ans. All of the above are true

344. Hormonal therapy is of proven benefit in

A. Meningioma
B. Pituitary adenoma
C. Lymphoma
D. Astrocytoma
E. Hemangioblastoma

Ans. A and B.

345. Cerebellar cortex

A. Granule cell is inhibitory
B. Golgi cell is excitatory
C. Purkinje cell is excitatory
D. Stellate cell is inihibitory
E. Mossy and climbing fibres are excitatory

Ans. D and E

346. Each of the following is true of decerebrate rigidity EXCEPT

A. It results from tonic activity in the vestibulospinal and pontine reticulospinal neurons
B. It is reduced by cutting dorsal roots
C. It is reduced by destruction of the anterior lobe of cerebellum
D. It occurs with transection between the colliculi
E. There is increased gamma motor neuron activity

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Ans. C

- Destruction of the anterior lobe of the cerebellum releases cells of origin of the lateral vestibular tract from inhibition by Purkinje cells, thereby facilitating extensor motor neurons

347. True about vagus nerve

A. Supplies stylopharyngeus/Tensor veli palatani
B. Somatosensory to esophagus
C. Motor for parotid
D. Supplies ext. auditory meatus
E. Takes taste from epiglottic region

Ans. B, D and E.

348. A patient present with LMN type facial paralysis with hyperacusis and loss of lacrimation, the lesion may be in

A. Facial nucleus
B. Stylomastoid foramen
C. Geniculate ganglion
D. CP angle
E. Distal to N to stapedius

Ans. A, C and D

349. Oligodendroglioma

A. Never calcifies
B. Common in parietal cortex
C. May transform to glioblastoma multiform
D. Very vascular
E. It is an invasive tumor

Ans. C to E

350. About acoustic schwannoma

A. B/L tumors operated at the same time
B. NF-1 with café au lait spots may be associated
C. Autosomal dominant
D. Not operated if hearing is intact
E. Gamma knife can be an alternative

Ans. B, C and E.

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351. Which of the following are intramedullary tumors?

A. Spinal hemangioblastoma
B. Ependymoma
C. Meningioma
D. Neurofibroma
E. Astrocytoma

Ans. A, B and E.

352. β adrenergic receptor function is

A. Bronchoconstriction
B. Vasodilation
C. Increased myocardial contractility
D. Lipolysis
E. Glycogenolysis

Ans. All of the above are true

353. The following have neural crest origin

A. Dura
B. Schwann cells
C. Geniculate ganglion
D. Spiral ganglion (Paravertebral)
E. Visceral plexus

Ans. B to E.

354. Communicating hydrocephalus is seen in

A. SAH
B. Arnold chiari malformation
C. Choroid plexus papilloma
D. Atresia of Foramen of Luschka and Magendie
E. Anencephaly

Ans. A, B and E.

355. About Diastatic fracture

A. Linear fracture upto suture
B. Depressed fracture
C. Vascular line fracture
D. Old age
E. More common in younger children

Ans. E.

- Diastatic fractures extend into and separate sutures.

356. Each of the following is true of Renshaw cells EXCEPT

A. They are part of a negative feedback loop to the motor neurons.
B. They facilitate Ia inhibitory interneurons that act on antagonist motor neurons
C. They inhibit motor neurons that innervate synergist muscles
D. They make divergent connections to motor neurons
E. They receive input from decscending pathways

Ans. B

- Renshaw cells inhibit 1a inhibitory interneurons that act on antagonist motor neurons

357. About anesthetic agents

A. Ketamine increases CBF and $CRMO_2$
B. Isoflurane induces seizure discharges
C. Thiopental decreases CBF and $CRMO_2$ and produces cardiovascular depression
D. Etomidate decreases CBF and $CRMO_2$ and suppresses adrenocortical repose to stress
E. Enflurane is a volatile anesthetic and increases CBF the least

Ans. A, C and D.

- Enflurane induces seizure dicharges. Isoflurane is a volatile anesthetic and increase CBF the least

358. Progressive weakness distal to proximal paraparesis with no sphincter involvement with questionable tenderness at D6

A. Ependymoma
B. Neurofibroma
C. Astrocytoma
D. Meningioma
E. Potts spine

Ans. B, D and E.

359. Inclusion tumors with single tissue type

A. Epidermoid cyst
B. Embryoma
C. Dermoid
D. Lipoma
E. Teratoma

Ans. A and D.

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360. Posterior 3rd ventricular tumor with beta HCG in CSF are

A. Chorio Ca
B. Astrocytoma
C. Embryonal Ca
D. Yolk sac tumor
E. PNET

Ans. A and C

361. Most sensitive test to diagnose cavernous angioma is

A. CT scan
B. DSA
C. T2WI MRI
D. None of the above

Ans. C

362. TIA of vertebral artery may present with

A. Contralateral homonymous hemianopia
B. Transient monocular blindness
C. Hemisensory loss
D. Ataxia
E. Dysphagia

Ans. A, C to E.

363. Early complication of intracranial aneurysm

A. Thromboembolism
B. Rebleeding
C. Hydrocephalus
D. Seizures
E. Cisternal blockade

Ans. All of the above are true

364. Brown Sequard syndrome is most common due to

A. Intramedullary tumor
B. Extradural tumor
C. Intradural extramedullary tumor
D. None of the above

Ans. C. i.e. Intradural extramedullary tumor

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365. Hyperacusis will be present in the lesion in which of the following course or segment of the facial nerve

A. Cisternal segment
B. Meatal segment
C. Labyrinthine segment
D. Horizontal or Tympanic segment

Ans. D

366. Two viruses which are genetically engineered to destroy tumor cells within the CNS and widely used in experimental study are

A. Retro virus and Herpes virus
B. Polio virus and Retro virus
C. Parvo virus and Herpes virus
D. None of the above

Ans. A

367. Radio sensitizing agents are all EXCEPT

A. BUdR
B. IUdR
C. 5-FU
D. Interleukin-2

Ans. D.

- Interleukin-2 is immune response modifier

368. Xanthochromic CSF may be seen in

A. Subarachnoid hemorrhage
B. Some cases of SDH
C. Gullian Barre syndrome
D. Spinal block
E. Acute pyogenic meningitis

Ans. All of the above are true

369. About occipital eye field

A. It is localized to a relatively small area
B. It subserves pursuit eye movements that are largely voluntary
C. Lesion in this area are associated with transient deviation of the eyes away from the side of the lesion

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D. The threshold for excitation in this area is lower than it is in the frontal eye field
E. With lesions in this area, the patient can direct the eyes to a particular location on command

Ans. E

370. Fibres running in anterior white column are

A. Anterior corticospinal tract
B. Lateral corticospinal tract
C. Vestibulospinal tract
D. Ventral spinothalamic tract
E. Fasciculus gracialis

Ans. A to D.

371. About Finger flexion reflex

A. Root value of reflex is C6 – T1
B. Hoffman's reflex is due to extrapyramidal tract lesion
C. Wartenberg's sign is positive when the thumb abduct and extends strongly
D. Rossolimo's reflex significance is the same as the finger flexion reflex in the upper limb
E. Wartenberg's sign and Hoffman's both are because of pyramidal tract disease

Ans. A, D and D

- Hoffman's reflex is due to lesion in the pyramidal tract
- In Wartenberg's reflex, thumb adduct and flex strongly (Pathological)

372. Right sided homonymous superior quadrantopia occur in lesion of

A. Right temporal lobe
B. Left temporal lobe
C. Right lingual gyrus
D. Left cuneus gyrus
E. Left lingual gyrus

Ans. B and E.

373. In carotid angiography under optimal conditions arteries upto what lumen diameter may be visualized

A. .001 mm
B. 0.1 mm
C. 1.0 mm
D. 2.00 mm

Ans. B.

374. Statements regarding the eye movement due to stimulation of various areas are

A. Stimulation of the caudal PPRF causes conjugate horizontal deviation to the same side
B. Stimulation of the rostral PPRF causes conjugate horizontal deviation to the opposite side
C. Stimulation of the superior colliculus causes conjugate horizontal deviation to the opposite side
D. Stimulation of the middle frontal gyrus causes conjugate horizontal deviation to the opposite side

Ans. A, C and D

- The center for horizontal gaze (the abducens nucleus) and the center for vertical gaze (the rostral interstitial nucleus of the medial longitudinal fasciculus, or RiMLF), are joined physiologically by the paramedian pontine reticular formation (PPRF), which lies rostral to the abducens nucleus. Stimulation of the caudal and rostral PPRF produces conjugate horizontal eye deviation and vertical eye movements respectively. Fibers from the caudal PPRF project to the ipsilateral abducens nucleus, while fibers from the rostral PPRF project uncrossed fibers to the RiMLF, which in turn projects to the ipsilateral oculomotor nuclear complex. Lesions of the caudal PPRF may cause paralysis of horizontal eye movements, while lesions of the rostral PPRF can cause paralysis of vertical eye movements. Stimulation of the frontal eye field, located in the caudal part of the middle frontal gyrus (area 8), usually results in conjugate deviation of the eyes to the opposite side. Stimulation of the superior colliculus results in contralateral conjugate deviation of the eyes

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375. About Liliequists membrane (LM)

A. Basically considered to separate the interpeduncular cistern from the chiasmatic cistern

B. The superior leaflet of LM (diencephalic membrane) separates the interpeduncular cistern from the chiasmatic cistern medially and from the carotid cistern laterally

C. The inferior leaflet (the mesencephalic membrane) separates the interpeduncular from the prepontine cistern

D. The diencephalic membrane is thinner and is incompetent not effectively isolating chiasmatic cistern

E. Blood in the carotid or prepontine cistern is compatible with a low–pressure pretruncal source of bleeding. However, blood in the chiasmatic cistern raise suspicion about aneurysmal rupture

Ans. A, C and E.

- Diencephalic membrane is thicker and is more often competent, effectively isolating the chiasmatic cistern. The carotid cistern often communicate with the crural cistern and in turn with the interpeduncular cistern. The sellar segment of LM attaches inferiorly along the dorsum sella and superior diencephalic membrane attatches to mammillary body

376. About different triangles related to approach to the intracavernous internal carotid artery

A. Glasscocks triangle is posterior lateral triangle and this approach exposes posterior and lateral loop of ICA

B. Kawases triangle is posteromedial and bounded laterally by GSPN and medially by Gasserian ganglion and base formed by pterous apex

C. Parkinson's triangle approach exposes post genu of ICA and origin of meningohypophyseal trunk.

D. Mullen's triangle is anterolateral triangle and exposes lateral loop of ICA

E. Parkinson's triangle is also known as infra trochlear triangle

Ans. All of the above are true

377. All of the following statements concerning sensory receptors are correct EXCEPT

A. Nuclear bag fibers receive group IA primary afferent fibers (annulospiral endings) and static and dynamic gamma efferent fibers. They respond primarily to the rate of change of muscle length

B. Nuclear chain fibers receive group Ia primary and group II secondary afferent fibers (flower spray endings) and static gamma efferent fibers. They respond primarily to muscle length
C. Pain and thermal receptors utilize group Ib fibers.
D. Meissner corpuscles are found only in the dermal papillae of glabrous skin
E. Pacinian corpuscles are acceleration detectors that respond to vibration sensation

Ans. A, B, D and E.

- Pain and thermal receptors utilize group A delta (fast pain) and C (slow pain) fibers. Pain and thermal sensations are mediated by lateral spinothalamic tract

378. In a 55-year-old woman with a brain tumor

A. In the presence of addressing apraxia, the lesion is likely to be in the dominant parietal lobe
B. The presence of upper quadrant homonymous field defect suggests that the lesion is likely to be in the temporal lobe
C. Sensory inattention is suggestive of a dominant hemispheric lesion
D. Altered personality and loss of initiative suggests that the lesion is likely to be in the frontal lobe
E. The presence of dyscalculia suggests a temporal lobe lesion

Ans. B and D.

- Constructional apraxia are localized to the non-dominant hemisphere. Temporal lobe damage causes visual field loss of the homonymous upper quadrant. Sensory inattention and neglect are characteristic of non-dominant hemisphere lesions. Personality changes are suggestive of frontal lobe damage. Dyscalculia suggests parietal damage

379. A 66-year-old patient pesents with lower cranial nerve palsies

A. A wasted and fasciculating tongue is suggestive of pseudobulbar palsy
B. The jaw jerk is brisk in pseudobulbar palsy, but absent in bulbar palsy
C. Motor neuron disease causes features of both bulbar and pseudobulbar palsy
D. Speech is monotonous in bulbar palsy
E. Emotional lability is suggestive of pseudobulbar palsy

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Ans. C and E.

- The gag reflex is absent in bulbar palsy. Speech is nasal in quality

380. A 25-year-old man presented with a head injury

A. Skull radiography is essential
B. The risk of chronic subural hematoma is related to the severity of the head injury
C. He is said to have had a concussion if only minor macroscopic brain damage has occurred
D. Extradural hematoma is usually caused by a rupture of the sagittal or transverse sinuses
E. The risk of post–traumatic epilepsy is increased if he develops an epileptic seizures in the first 24 hours after injury

Ans. E.

- A CT scan or MRI may be more appropriate for severe head injury, mild head injury may not require investigation. Minor injuries can cause subdural hematomas. Concussion injuries show no macroscopic damage. Extradural hematoma is caused by tearing of the middle meningeal artery

381. Best diagnostic method to diagnose post-traumatic CSF fistula

A. Tomography
B. Contrast enhanced CT
C. Postitive ventriculography contrast
D. Air ventriculography
E. Intrathecal contrast ventriculography

Ans. E.

382. Early sign of cerebral palsy is demonstration of

A. Moro reflex at 2 months
B. Moro reflex at 5 months
C. Rooting reflex at 2 months
D. Palmar grasp at age of 2 months

Ans. B.

- Moro reflex at 5 months

383. Each of the following has been associated with central pontine myelinolysis EXCEPT

A. Alcoholism
B. Rapid correction of hyponatremia

C. Serum hyper osmolaity
D. Severe burns
E. Vitamin A excess

Ans. E.

- Vitamin A excess is not associated with central pontine myelinolysis

384. About Action potential

A. Inhibitory postsynaptic potentials are caused by increasing membrane permeability to cations e.g. Na
B. Temporal summation occurs only when there is transmission at many synapses
C. There are few Na channels at the axon hillock
D. Conduction velocity m/s in myelinated axons is six times the diameter
E. After demyelination, axonal membranes can store more charge

Ans. D and E.

- Cation entry causes depolarization and an excitatory postsynaptic potential. Spatial summation occurs with simultaneous transmission from many synapses. There is a high concentration of Na channel at the axon hillock as this is here the action potential is generated. Axonal membranes have an increased capacitance after demyelination so can store more charge

385. Regarding neurotransmission

A. There is a single receptor identified for glutamate
B. Muscarinic acetylcholine receptors are associated with a cation channel.
C. Ionotrophic receptors are generally G-protein linked
D. An inhibitory postsynaptic potential is created by increasing the membrane permeability to chloride ions
E. Saltatory conduction is typically bidirectional

Ans. D.

- There are several receptors for glutamate including NMDA, kainite and AMPA. Nicotonic receptors are associated with a cation channel. Metabotrophic receptors are generally G-protein linked. Inhibitory postsynaptic potential hyperpolarize the cell. Under physiological conditions, salutatory conduction is unidirectional

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386. Parkinson's disease

A. Is always an obvious diagnosis
B. Should be treated immediately with L-dopa
C. Is an upper motor neuron disorder and therefore associated with increased tendon reflexes
D. Symptoms may respond to anticholinergic drugs
E. Is associated with depression

Ans. D and E

- Signs may be very subtle. The longer the patient can manage without drugs, the better as tolerance to L-dopa soon develops. Motor neurons are not affected. Anticholinergics inhibit striatal output cells. Depression may aggravate symptoms

387. About primary and secondary GBM following are true EXCEPT

A. Mutations in the p53 protein are found in more than 65% of secondary GBM
B. Unlike secondary GBMs, primary GBMs infrequently display mutation in P53 (< 10%)
C. More than 50% of primary GBMs show MDM2 protein over expression compared with only 10% in secondary GBM.
D. $P16^{ink\ 4a}$ is deleted significantly in secondary GBM than primary GBM

Ans. D. $P16^{ink\ 4a}$ is deleted significantly more in primary GBMs than secondary GBMs (36% versus 4%).

388. Surgical decompression of intracerebral hemorrhage is indicated if there is risk of all of the following EXCEPT

A. Vital structures of the medulla at risk
B. Declining level of consciousness
C. Ventricular enlargement or herniation
D. Hemorrhage in sites like putamen, thalamus

Ans. D.

389. Physiological calcification may be seen in

A. Basal ganglia
B. Corpus callosum
C. Occipital lobe
D. Hypothalamus
E. Choroid plexus

Ans. E.

390. Concerning memory and the limbic system

A. Lesion of the hippocampus and surrounding area can produce amnesia
B. The para hippocampal gyrus is continuous with the cingulate gyrus
C. Primary effects are caused by long-term memory
D. Procedural memory can be spared in amnesia
E. Working memory has a capacity of 7 plus minus 2 units of information

Ans. All of the above are true

- Hippocampus and surrounding areas are involved in memory. The parahippocampal gyrus is the inferior continuation of the cingulate gyrus. The first items in a list are remembered first by activating long term memory. Damage to the medial temporal lobe structure produces disruption of declarative memory, sparing procedural memory. There is a limited capacity for working memory

391. About staining

A. Osmium used in electron microscopy
B. Silver impregnation method used for showing whole of neuron
C. Marachis method used for staining myelin
D. Iron – Hemotoxylin stains myelin
E. Eosin stains rough endoplasmic reticulum + DNA

Ans. A to D.

392. Structures arising from branchial arch are

A. Carotid artery → 2nd arch
B. Aortic arch → 3rd arch
C. Greater cornu of hyoid → 3rd arch
D. Stylopharyngeus → 3rd arch
E. Recurrent laryngeal nerve → 6th arch

Ans. C and D

- 3rd arch → Common and internal carotid
- 4th arch → Aortic arch (L); Subclavian (Rt)
- 6th arch → Pulmonary ductus arteriosus

393. About the muscles of hand

A. Abductor pollicis brevis is the first to show weakness in the carpal tunnel syndrome
B. Froment's sign is postitive in ulnar nerve injury
C. Ape thumb hand is seen in median nerve injury
D. Interossei and lumbricals causes flexion at MCP and extension at DIP and PIP
E. Flexor diagitorum superficialis causes flexion in DIP and profundus in PIP joint

Ans. A to D.

- Flexor digitorum profundus causes flexion in distal inter phalangeal joint
- Flexor digitorum superficialis causes flexion in proximal interphalangeal joint

394. About segmental innervation of spinal reflexes

A. Cremastric is L1 – L2
B. Adductor is L3 L 4 L5
C. Anal is S4 – Co1
D. Bulbocavernous is S3 4
E. Abdominal reflex is T8 – T12

Ans. A, C to E.

- Adductor is L2, L3, L4

395. About cervical plexus

A. Segmental origin is from C1 – C4
B. Phrenic nerve originates from the cervical plexus
C. Phrenic nerve mainly arise from C4
D. Cervical plexus innervate the skin on the back of the head C2 via the greater and lesser occipital nerves
E. Cape areas of the neck and shoulders by the supraclavicular nerves (C3 and C4)

Ans. All of the above are true

396. About the basis of brainstem

A. It transmits corticopontine, corticobulbar and corticospinal tracts
B. Midbrain basis contains no nuclei
C. Medullary basis is the smallest
D. Pontine basis is the largest basis because it contains masses of nuclei upon which the corticopontine efferent synapse

E. The corticofugal tracts in the medullary basis have an oval or pyramidal shape on cross section, they are called the medullary pyramids and hence the pyramidal tracts

Ans. All of the above are true

397. Important decussation occurring at the cervicomedullary transition zone are

A. Reticulospinal pathways
B. Pyramidal tract
C. Trigeminal leminiscus
D. Medial leminiscus
E. Olivo cerebellar tract

Ans. All of the above are true

- The reticulospinal respiratory pathways for automatic breathing just ventral to the obex of the fourth ventricle
- The three decussation that form internal arcuate fibres and occurring at the cervicomedullary transition zone consist of the following
  a. Trigeminal leminiscus, from the spinal nucleus of CNV
  b. Medial leminiscus from the nuclei gracilis and cuneatus
  c. Olivocerebellar tracts from the inferior olivary nuclei

398. Groin, anterior thigh sensory loss, loss of knee jerk, quadriceps weakness, loss of hip flexion the roots involved are

A. L2
B. L3
C. L4
D. L5
E. S1

Ans. A to C

399. Clinically important reflex mediated by trigeminal sensory nuclei are

A. Jaw jerk which is a muscle stretch reflex [V-V reflex]
B. Corneal reflex [V-VII reflex]
C. Tearing [V-VII reflex]
D. Sneezing [V-RF reflex via respiratory center]
E. Many developmental reflex [Rooting, sucking and chewing]

Ans. All of the above are true

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400. Muscles supplied by facial nerve are

A. Platysma
B. Stapedius
C. Stylohyoid
D. Posterior belly of digastric
E. Orbicularis oculi

Ans. All of the above are true

401. The Special Visceral Afferent Axons for taste of anterior 2/3rd of the tongue transverses four named peripheral segments in distal to proximal order

A. Lingual branch of the trigeminal nerve
B. Chorda tympani
C. Trunk of CN VII
D. Intermediate nerve of Wrisberg
E. None of the above

Ans. A to D.

402. Central pathway for taste

A. The primary afferent for taste from CN VII, CN IX, CNX synapse in the nucleus solitarius
B. Nucleus solitarius connect with the adjacent RF and dorsal motor nucleus (GVE) of CNX to mediate salivatory and lingual reflex
C. Neurons of the nucleus solitarius also form part of the medullary respiratory center and project to the phrenic nucleus and thoracic segments of the cord involved in reflex such as coughing and vomiting
D. One taste pathway descend through the central segmental tract to nucleus VPM of the thalamus, this is a non-leminiscal pathway to the thalamus
E. A second taste pathway relays to the parabrachial nucleus to the RF. Related to the emotional aspect of the taste

Ans. All of the above are true

- VPM of the thalamus relays taste impulse to the cerebral cortex, in the caudal orbito frontal region, and to the rostral insular and opercular cortex

403. Central nervous system disorders causing SIADH are

A. Basal skull fracture
B. Acute encephalitis
C. Subarachnoid hemorrhage
D. Cerebral vascular thrombosis
E. Tuberculous meningitis

Ans. All of the above are true

- CNS disorders—Cerebral atrophy, acute encephalitis, tuberculous meningitis, purulent meningitis, GB syndrome, lupus erythematosus, acute intermittent porphyria
- Drugs—Chlorpropamide, vincristine, vinblastine, cyclophosphamide, carbamazepine, oxytocin, narcotics, tricyclic antidepressant
- Ectopic AVP production and release from neoplastic tissue small cell carcinoma of lung, pancreatic carcinoma, lymphoma, Hodgkins disease thymoma, carcinoma of duodenum, inflammatory lung disease, tuberculosis, lung abscess, pneumonia

404. About pathogenesis of SIADH

A. Neoplastic cell obtained from the tumor of patient with SIADH can synthesize, store and release AVP
B. Vasopression also has been demonstrated in tuberculous lung tissue
C. Intracranial lesion (meningitis, encephalitis, trauma, vascular accidents) probably stimulate release of AVP from the neurohypophysis acting through cytokine – mediated mechanism
D. Vincristine, cyclophosphamide, carbamazepine stimulate release of AVP from the neurohypophyseal system
E. Chlorpropamide and NSAID potentiate the ADH action of secreted AVP

Ans. All of the above are true

405. In SIADH there is

A. Urine osmolality over 300 mmol/kg
B. Subnormal plasma osmolality
C. Subnormal serum sodium concentration
D. Sodium excretion is usually above 20 mmol/L
E. Blood urea nitrogen and uric acid tend to fall because of plasma dilution

Ans. All of the above are true

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- Sodium excretion in the urine is maintained above 20 mmol/L by hypervolemia, suppression of the rennin angiotensin aldosterone system
- Because of the hypervolemia, blood pressure shows no orthostatic fall, but in spite of hypervolemia, there is no recumbent hypertension and no peripheral edema. The extracellular hypotonicity leads to intracellular swelling and severe symptoms may result from cerebral edema

406. About clinical mainifestation of SIADH

A. The rate of fall in serum sodium concentration is more important in producing the neurologic features of SIADH
B. When SIADH is mild or with serum sodium concentration of 130 to 135 mmol/L the symptoms may be absent or limited to anorexia, nausea or vomiting
C. When hyponatremia is severe or acute in onset, body weight increases symptoms of cerebral edema predominant including restlessness, irritability, confusion, coma, convulsions
D. Pitting edema is almost always absent

Ans. All of the above are true

- SIADH should be suspected in patients who have hyponatremia, concentrated urine (osmolality > 300 mmol/kg) associated with lethargy and in the absence of edema, orthostatic hypotension and features of dehydration
- The diagnosis is supported by finding of
  a. BUN ↓
  b. Serum uric acid ↓
  c. Serum cretinine ↓
  d. Albumin ↓
- Condition to differentiate from SIADH are -
- Dilutional hyponatremia → orthostatic hypotension, tachycardia, elevated BUN characteristic
- Edematous states → hypothyroidism, congestive heart failure with hyponatremia
- Hypertensive states → associated with hyponatremia caused by renovascular stenosis or diuretic therapy
- Pseudohyponatremia → associated with excessive plasma glucose, triglyceride or protein concentration
- A positive diagnosis can usually be made with water load test. It should not be performed unless the serum sodium concentration has been elevated to a safe level (>125 mmol/L) by restriction of water intake, or by saline administration

- Patient is asked to drink the water load (20 ml/kg of body weight upto 1500 ml) 10 to 20 min
- At least 65% of the water load should be excreted in 4 hrs or 80% in 5hrs and lowest urine osmolality usually reached in the second hour should be below 100 mmol/kg
- Failure to excrete the water load may occur in adrenal insufficiency or renal insufficiency as well as in SIADH

  Treatment-

  Restriction of fluid intake to 800 to 1000 ml daily

  – To verify the effectiveness of fluid restriction by documenting the change in weight and serum Na+ concentration daily until serum Na+ > 135 mnol/L

  In addition to restriction of fluid intake 200 ml to 300 ml 3% or 5% Nacl should be infused IV over 3 to 4 hours in patient with severe confusion, coma, convulsion

  – To identify the cause and correct the case
- Administration of water retaining drug should be stopped
- Meningitis or CNS infection should be treated, phenytoin inhibit AVP release
- Domecloclycline (900 to 1200 mg/dl) is the most potent inhibitor of AVP. Lithium interfere with action of AVP on renal tubule
- Prognosis depend on the cause. If drug induced → rapidly and completely corrected

407. Match of reflexes with their segmental innervation

A. Cremastric reflex – L1, L2
B. Superficial anal reflex – S3, 45
C. Bulbocavernous reflex – S3, S4
D. Plantar reflex – L5 – S2
E. Finger flexion reflex – C7, T1

Ans. All of the above are true

408. Frontal lobe release phenomenon are

A. Glabellar reflex
B. Snout reflex
C. Grasp reflex
D. Sucking reflex
E. Groping reflex

Ans. A to E.

409. High steppage gait is present in

A. Diabetic neuropathy
B. Progressive spinal atrophy
C. Common peroneal nerve palsy
D. All of the above

Ans. D

410 About cortical surface anatomy

A. The central sulcus joins the sylvian fissure in only 2% of the cases
B. Superior temporal sulcus terminates in the angular gyrus
C. Sylvian fissure terminates in the supramarginal gyrus
D. Inferior temporal gyrus contain the pars opercularis, pars triangularis and pars orbitalis
E. In 98% of cases there is sub central gyrus

Ans. A to C and E

- Inferior frontal gyrus contain the pars opercularis, pars triangularis, pars orbitalis

411. About Craniometric points

A. Pterion is the region where there is junction of frontal, parietal, temporal and great wing of sphenoid
B. Asterion is the region where there is junction of lambdoid, parietomastoid and occipito mastoid suture
C. Stephanion is the junction of the coronal suture and superior temporal line
D. Asterion overlies the transverse and sigmoid sinus
E. Bregma is the junction of coronal and superior sagittal suture

Ans. A to C and E.

412. About blood supply to spinal cord

A. Posterior spinal artery are paired and usually arise from PICA and are fed from 10-23 radicular arteries
B. Anterior "corticomedullary" or radicular artery usually arise at C3, C6, C8 level
C. Artery of Adamkiewicz usually arise between T9-L2 on left side from 2nd lumber artery and supply from T8-conus
D. Cephalic branch of artery of Adamkeiwicz give a characteristic hair pin appearance on arteriography
E. Vein from the spinal cord drain into 2 plexiform longitudinal channel than to coronary venous plexus on the cord surface

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Ans. A to C

- The caudal branch and not cephalic branch of artery of Adamkeiwicz give a characteristic hair pin appearance on arteriography
- Vein from the spinal cord drain into 6 plexiform longitudinal channels

413. About cerebral arterial anatomy

A. A balanced configuration of the Circle of Willis is present in only 18% of the population
B. 15-35% of patients supply their posterior cerebral artery on one or both sides from the carotid (via P-comm) instead of via the vertebrobasilar system (Foetal circulation)
C. Hypoplasia of one or both P-communicating arteries occurs in 22-32%, absent or hypoplastic A1 segment occurs in 25%
D. [P-3] segment of the posterior cerebral artery transverses the ambient cistern
E. Recurrent artery of Heubner arises commonly from A2 segment of anterior cerebral artery

Ans. A to C and E

- P-2 segment of the posterior cerebral artery transverses the ambient cistern. P-3 transverses the quadrigeminal cistern and give rise to terminal branches

414. About Dentate ligament

A. It is formed from arachnoid
B. Help in stabilizing spinal cord
C. Consist of 21 teeth on each side
D. It is a landmark (posterior most) limit during anterolateral cordotomy
E. Spinal accessory nerve lies dorsal to the dentate ligament and dentate ligament separates dorsal root from ventral root

Ans. B to E

- Dentate or denticulate ligament arise from Pia and attaches to spinal dura and consist of 21 teeth on each side

415. About Bladder neurophysiology

A. Primary co-ordinating center for bladder function resides within the nucleus locus ceruleus of the Pons. Center synchronizes bladder contraction with relaxation of the urethral spincter during voiding

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B. Voluntary cortical control primarily involves inhibition of the pontine reflex and originate in the anteromedial portion of the frontal lobe and the genu of the corpus callosum
C. Sensory information is carried through sympathetic T10 – L2 segment and the motor outflow is from parasympathetic S2-S4
D. Detrusor hyper-reflexia can result from interruption of efferent anywhere from cortex to sacral cord
E. During spinal shock, the bladder is a contractile and areflexic (detrusor areflexia) sphincter tone usually persists and urinary retention is the rule.

Ans. All of the above are true

416. Failure disorder of Neuronal migration will result in

A. Lissencephaly
B. Schizencephaly
C. Heterotopia
D. Porencephaly
E. Holoprosencephaly

Ans. A to C

- Holoprosencephaly also known as archinencephaly results due to the failure of the telencephalic vesicle to cleave into two cerebral hemispheres. The degree of cleavage failure range from the severe a lobar to semilobar and lobar anomalies

417. About Chiari malformations

A. Beaking of midbrain tectum and cephalad course of upper cervical nerves is characteristic of chiari III malformation
B. Massa intermedia is present in chiari II malformation
C. A menigomyelocele is virtually always present in Chiari I malformation
D. Occipital or high cervical encephalocele is present in Chiari IV malformation
E. Cerebellar hypoplasia with no herniation is present in Chiari III malformation

Ans. B

- Beaking of midbrain tectum or tectal fusion and cephalad course of upper cervical nerves is characteristic of [chiari II] malformation

- Massa intermedia is the interthalamic adhesion due to absorption of intervening septum pellucidum due to hydrocephalus
- A meningomyelocele is virtually present in about 100% cases of Chiari II malformation
- Occipital or high cervical encephalocele is present in Chiari III malformation
- Cerebellar hypoplasia with no herniation is present in Chiari type IV malformation

418. Branches of the Meningohypophyseal trunk are

A. Superior hypophyseal artery
B. Inferior hypophyseal artery
C. Capsular artery of Mc Conell
D. Tentorial artery of Bernasconi and Cassanari
E. Dorsal meningeal artery

Ans. B, D and E

419. Following cisterns are parts of mesencephalic cistern

A. Crural cistern
B. Ambient cistern
C. Quadrigeminal cistern
D. Cisterna magna
E. Infundibular recess

Ans. A to C

- Mesencephalic cistern has four parts. Anteriorly there is interpeduncular cistern. Anterolaterally there is crural cistern. Posterolaterally there is ambient cistern. Posteriorly there is quadrigeminal cistern

420. Regarding immunoglobulin

A. Molecular weight is around 1,50,000 and IgM has the highest molecular weight
B. Carboxy terminus of immunoglobulin is responsible for binding of antigen and aminoterminus is responsible for complement activation and various biologic functions
C. All immunoglobulin classes can activate the complement cascade
D. J Chain is present in the IgD and IgE
E. Mature B cell first express both IgM and IgD following stimulation and there is switch from IgM and IgD to other classes

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Ans. A and E.

- An individual antibody molecule always consists of identical H and L chains

Properties of Human Immunoglobulin

Sl.	Property	IgG	IgA	IgM	IgD	IgE
1.	Percentage of total	75%	15%	9%	0.2%	0.04%
2.	Serum concentration	Highest	–	–	–	Lowest
3.	Molecular wt	Lowest	–	Highest	–	–
4.	Structure	Monomer	Monomer Dimer	Pentomer	Monomer	Monomer
5.	H chain	Y	α	μ	δ	ε
6.	Placental passage	+	–	–	–	–
7.	Allergic response	–	–	–	–	+
8.	Found in secretions	–	+	–	–	–
9.	Opsonizations	+	–	+	–	–
10.	Antigen receptor on B cells	–	–	+	+	–
11.	J chain	–	+/–	+	–	–

- IgG [IgG1, 2,3] can activate the complement cascade
- J chain is present in the IgA and IgM

421. Match the following antibody in paraneoplastic syndrome

A. Anti Hu → Limbic encephalitis
B. Anti – Yo → Pancerebellar degeneration
C. Anti – VGCC → Lambert Eaton myasthenia syndrome
D. Ani – GAD → Moersch Woltmann syndrome (Stiff man syndrome)
E. Ant – Ri → Opsoclonus Myoclonus

Ans. A to E

422. About shunt in hydrocephalus

A. Third ventriculostomy is usually not considered in congenital hydrocephalus
B. Trokildsen shunt is indicated in adult acquired obstructive hydrocephalus
C. VA shunt has less siphoning effect than VP shunt
D. Lumboperitoneal shunt is often indicated in communicating hydrocephalus in adult
E. Acute overdrainage can be prevented by applying anti siphon device

Ans. All of the above are true

423. About antibiotics use in neurosurgery

A. β-lactam antibiotics reduce seizures threshold and are GABA antagonists
B. Steroid decreases blood brain barrier penetration
C. Inflammation increases BBB penetration
D. Combination of third generation cephalosporin + metronidazole is preferable for temporal lobe abscess than for frontal lobe abscess
E. Frontal lobe abscess is usually secondary to frontal and ethmoid sinus infection and is caused by streptococcus milleri and combination of penicillin G + Metranidazole is used

Ans. A to E

424. About EEG

A. Bilateral periodic lateral epileptiform discharge from temporal lobe is diagnostic of Herpes simplex I encephalitis
B. Bilateral sharp waves [.5–2/sec] with myolconus support diagnosis of C-J disease
C. Petit mal epilepsy is characterized by a dome and spike pattern is three per second (3/S)
D. In subacute sclerosing encephalitis, there is periodic high voltage discharge separated e.g. 4-15 seconds associated with body jerks
E. May be important for differentiating hydrencephaly from severe hydrocephalus

Ans. All of the above are true

- In hydrencephaly, EEG will be silent and there will be no cortical activity. But in maximal hydrocephalus, there will be presence of background activity

425. About regulation of respiration

A. Apneustic center is located in the upper medulla
B. Destruction of the upper pons can lead to apneusis
C. Increased number of impulses in the vagal afferent will lead to fast and shallow breathing
D. Destruction of the medullary respiratory center will result in Biot's breathing (Ataxic breathing)
E. Cheyne stokes breathing is due to increased sensitivity of respiratory center to $PaCo_2$ and can be seen in diencephalic damage or bilateral cerebral cortex damage

Ans. B to E

- Apneustic center is present in the lower pons + middle pons.
- Pneumotaxic center present in upper pons influences the rate of breathing. Inhibits the inspiratory centre and tends to shorten the respiratory cycle.

426. Paintbrush appearance, meniscus sign, wide splaying of the cord are the findings on myelogram is due to following pathology

A. Intradural extramedullary, Intramedullary, Extradural respectively
B. Extradural, Intramedullary, Intradural extramedullary respectively
C. Intramedullary, Extradural, Intradural extramedullary respectively
D. Extradural, Intradural extramedullary, Intramedullary respectively

Ans. D

427. About tuberculous spondylitis or tuberculous vertebral osteomyelitis or Pott's disease are

A. Usually asymptomatic for many months and affect lower lumber level
B. Has a predilection for the vertebral body, sparing the posterior elements
C. Psoas abscess is common because psoas major muscle attaches to the bodies and intervertebral disc from T12 to L5
D. Neurological deficit develop in 10-47% of patients may be due to medullary and radicular inflammation in most cases, infection rarely extend into spinal cord
E. 90% of cases can be managed non surgically with antibiotics and immobilization depending on neruraxis compression

Ans. B to E

- It is usually symptomatic for many months and affects the lower thoracic and upper lumber level

428. About CNS infection

A. HIV infection leads to tropical spastic paraplegia and vacuolar myelopathy
B. Subdural effusion or empyema after meningitis in an infant most commonly develops with *H. influenza*

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C. Meningitis occurring within 72 hours after a basilar skull fracture is most commonly secondary to *Strep pneumoniae*

D. Late post-operative ventriculo-peritoneal shunt infections are almost only by coagulase negative staphylococci and in neonates by *E. coli* and *streptococcus hemolyticus*

E. Most common cause of neonatal meningitis is group B or D streptococci *(Streptococcus aglactiae)*

Ans. All of the above are true

- Subdural effusion is also due to *(Streptococcus pneumoniae)*

429. Most common organism causing post-operative discitis is

A. *Staph. Albus*
B. *Staph. Epidermidis*
C. *Staph. Aureus*
D. *H. Influenza*
E. *Pseudomonas Aeruginosa*

Ans. B.

- *Staph. aureus* is the most common organism isolated from discitis but *S. epidermidis* is the most common pathogen in postoperative discitis. *Pseudomonas aeruginosa* may be more common in IV drug abusers. *H. influenza* is common in juvenile discitis

430. Loss of consciousness is present in all EXCEPT

A. Grandmal epilepsy
B. Petit mal epilepsy (Absence seizure)
C. Complex partial or psychomotor epilepsy
D. Simple partial epilepsy

Ans. D.

431. About side effect of Antiepileptic drug

A. With valproic acid, a rare but serious adverse effect is fulminant hepatitis which occur only in children especially below 3 years

B. At therapeutic levels phenytoin causes gum hypertrophy (20%), hirsutism, pseudolymphoma, megaloblastic anemia, osteomalacia, hyperglycemia

C. Carbamazepine causes water retention and hyponatremia in elderly people

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D. Fatal bone marrow depression can occur with the use of Ethosuximide
E. Hemeralopia (inability to tolerate bright light) is a side effect of Trimethadione

Ans. All of the above are true

432. About drug of choice in epileptic disorder

A. Carbamazepine is the drug of choice for complex partial seizure
B. Ethosuximide is the drug of choice for absence seizures
C. Valproic acid is used for grand mal, partial seizures but not for absence seizures
D. Post traumatic epilepsy is best prevented by carbamazepine and valproic acid because they have effect on kindling but phenytoin has no effect
E. Carbamazepine in the lowest possible dose as long as controlling seizure is recommended first choice of therapy in pregnant woman

Ans. A, D and E.

- Nowadays valproic acid has become the drug of choice in absence seizures ethosuximide used to be in past. Valproic acid is additionally helpful in myoclonic and akinetic seizures
- Phenytoin has no effect on kindling so it is not effective in post traumatic epilepsy

433. About mechanism of action of antiepileptic drug

A. Ethosuximide, trimethadione inhibit T (transient) type Ca^{2+} current exhibited by thalamic neurons
B. Valproic acid prolong inactivation of Na^{+} channel, facilitate GABA mediated Cl channel opening and inhibit T type Ca^{2+} current
C. Carbamazepine prolong in activation of Na^{+} channel and also phenytoin
D. Vigabatrin inhibit GABA transaminase thus inhibiting degradation of GABA
E. Gabapentin increases the release of GABA

Ans. All of the above are true

- Thalamocortical system is involved in the generation of absence seizures. Lamotrigine causes inactivation of Na^{+} channel and inhibit presynaptic release of glutamate

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434. About interaction of antiepileptic drug

A. Carbamazepine is an enzyme inducer and its metabolism is induced by phenobarbitone, phenytoin and vice versa
B. Erythromycin inhibit metabolism of carbamazepine and thus increases its level
C. Valproate increases plasma level of phenobarbitone by inhibiting its metabolism and displaces phenytoin from protein binding site and decreases its metabolism (phenytoin toxicity)
D. Concurrent administration of diazepam and valproate is contraindicated because absence status may be precipitated
E. Chloramphenicol, isoniazide, cimetidine and warfarin inhibit phenytoin metabolism can precipitate its toxicity

Ans. All of the above are true

435. About antiepileptic drug

A. Phenobarbitone has the longest half life
B. Valproic acid has the shortest half life
C. Primidone metabolism give rise to phenobarbitone as an active product
D. Alopecia, curling of hair and increase ammonia can be due to side effect of valproic acid
E. At toxic level of phenytoin, cerebellar and vestibular disturbance can occur like ataxia, nystagmus, vertigo

Ans. All of the above are true

436. About Thoracolumbar spine fractures

A. Burst fractures are the most common
B. Fracture dislocation may involve all three columns
C. Seat belt type injuries are stable injuries
D. Wedge compression fractures are generally unstable
E. Wedge compression fractures involve the middle column

Ans. B

- Wedge compression fractures are the most common fractures in thoracolumbar region
- Seat belt injuries involve middle and posterior column and is thus unstable
- Wedge compression fractures involve only anterior column and hence stable

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437. Factors that lower the seizure threshold

A. Sleep deprivation
B. Hyperventilation
C. Hypoglycemia
D. Alkalosis
E. Cerebral ischaemia

Ans. All of the above are true

438. About Prolactin levels after seizures

A. Transient elevation in human serum prolactin level occur following 80% generalized motor, 45% of complex partial and only 15% of simple partial seizures
B. A serum prolactin level shortly after a questionable seizure may be needful in differentiating non epileptic seizure (which may have elevated cortisol levels but normal serum prolactin levels)
C. Repetitive seizures are associated with progresively smaller serum prolactin elevation
D. No rise follows absence seizures or status epilepticus
E. Greater than two fold serum prolactin elevation consistently follow seizures that produce intense widespread high frequency mesial temporal lobe discharges

Ans. All of the above are true

- The presence of serum prolactin peaks may be strongly indicative of true seizures

439. Features of non-epileptic seizures

A. Most non-epileptic seizure are psychogenic
B. Out of phase clonic upper extremity movement
C. Out of phase clonic lower extremity movement
D. No vocalization or vocalization at start of event
E. Affect only 20% males as compared to 70% in epileptic seizures

Ans. All of the above are true

- In non-epileptic seizure also there is violent, high amplitude side to side head turning

440. About Febrile seizures

A. Febrile convulsions are the most common types of seizures
B. The febrile seizures prevalence is 27%. The risk of developing epilepsy after simple febrile seizure is 1%

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C. The risk of developing epilepsy after complex febrile seizure is 6%
D. Carbamazepine and phenytion are very effective in controlling febrile seizures
E. The best treatment of febrile convulsion is rectal diazepam 0.5mg/kg given at the onset of convulsion

Ans. A, B, C and E

- They are focal seizures not generalized
- Incidence commonest between 6 months – 5 years
- Complex febrile seizures → a convulsion that lasts longer than 15 minutes, is focal or multiple (more than one convulsion per episode of fever)

441. About Status Epilepticus

A. Most common cause in an adult is with previous seizure and subtherapeutic level of antiepileptic drug
B. Mean duration of status epilepticus in patient without neurological sequelae is 1.5 hrs (therefore proceed to pentobarbital anaesthesia before 1 hour of status epilepticus)
C. Recent mortality is <10-12%. Mortality is lowest among children and highest mortality occurs in elderly patients and those with status epilepticus resulting from anoxia or CVA
D. CNS infection in children more commonly with *H. influenzae* and *S pneumoniae* cause *status epilepticus*
E. Electrolyte imbalance hyponatremia (most common in children), hypoglycemia, hypocalcemia, ureamia are the causes

Ans. All of the above are true

- Although status epilepticus is defined for seizures lasting >30 minutes aggressive anticonvulsant therapy is indicated for any seizure lasting >10 mins

442. About treatment of Status Epileticus

A. If seizures continue >20 mins, intubate and begin "general anesthesia" with phenobarbital
B. Using both phenobarbital and a benezodiazepine (i.e., diazepam) is discouraged because of increased risk of respiratory depression
C. Medications to be avoided in status epilepticus are enflurane, narcotics, phenothiazines including promethazine, neuromuscular blocking agents without antiepileptic therapy

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D. Among benzodiazepines, lorazepam is preferred because diazepam redistributes rapidly in fatty tissues
E. Valproic acid is choice for myoclonic status and absence status epilepticus always respond to diazepam

Ans. All of the above are true

443. About antiepileptic drug

A. Therapeutic level of free phenytoin is 10-20 ug/ml
B. At therapeutic level, the elimination of phenytoin becomes zero order kinetic so any change in dosage will lead to a sudden increment in plasma level
C. Carbamazepine can be started at high dose from starting
D. Fluoxetine and valproic acid result in elevated phenytoin level
E. Carbamazepine has more effect on cognitive function than phenytoin

Ans. B and D.

- Therapeutic level of phenytoin is 10-20 ug/ml and of free phenytoin is (1%) i.e. 1-2 ug/ml. 90% of drug is bounded to plasma protein carbamazepine dose range from [600-2000mg/d]. It is started at low dose and increased slowly. Phenytoin has more effect on cognitive function than carbamazepine

444. Match the therapeutic level of following antiepileptic drug

A.	Phenytoin	10-20ug/ml
B.	Carbamazepine	6-12ug/ml
C.	Valproic acid	50-100ug/ml
D.	Phenobarbital	15-30ug/ml
E.	Ethosuximide	40-100ug/ml

- **Note:** Therapeutic level of carbamazepine may be misleading since the active metabolite carbamazepine –10, 11 epoxide may cause toxicity and must be assayed separately

Ans. All of the above are true

445. Following antiepileptic drugs are inducer of liver cytochrome P450 enzyme

A. Primidone
B. Phenytoin
C. Lamotrigine
D. Valproic acid
E. Carbamazepine

Ans. A, B and E.

- Felbamate is a potent metabolic inhibitor, thus it is necessary to reduce the dose of phenytoin, valproate or carbamazepine when used with felbamate

446. Which of the following antiepileptic drug is GABA uptake inhibitor?

A. Gabapentin
B. Phenobarbitone
C. Vigabatrin
D. Tiagabine

Ans. D

447. Which of the following antiepileptic drugs lead to withdral seizure even status and has to be withdrawn over 3-6 months?

A. Phenytoin
B. Valproic acid
C. Phenobarbitone
D. Clonazepam

Ans. D

Recommended AED withdrawal times AED	*Recommended withdrawal period*
Phenytoin, Valproic, arbamazepine	2-4 weeks
Phenobarbital	6-8 weeks (25% per week)
Clonazepam	3-6 months

448. Which of the following antiepileptic drug level increases during pregnancy?

A. Carbamazepine
B. Phenobarbital
C. Phenytoin
D. Valproic acid

Ans. D

Changes in free AED levels during pregnancy

Drug	*Change*
Carbamazepine	↓ 11%
Phenobarbital	↓ 50%
Phenytoin	↓ 31%
Valproic acid	increase 25%

449. About the side effect of antiepileptic drug in pregnancy:

A. Carbamazepine increases the risk of minor malformation but not of major malformation and may increase the risk of NTD so never given in combination with valproic acid
B. Phenytoin may lead to hypoplastic phalanges, microcephaly, cleft plate cleft lip
C. Phenobarbital produced the highest incidence of major malformation (9-1%) and associated with most of the increase in foetal death
D. Valproate causes the highest incidence of neural tube defect (1-2%), thrice dosing may reduce the risk of neural tube defect
E. Benzodiazepine given shortly before delivery can produce the "floppy infant syndrome"

Ans. All of the above are true

450. Which of the following tumor is associated with medically intractable seizures?

A. Central neurocytoma
B. Gliomatosis cerebri
C. Pleomorphic xanthoastrocytoma
D. Dysembryoplastic neuroepithelial tumor (DNT)

Ans. D

451. Corpus callosotomy is most favourable for which form of epilepsy?

A. Atonic
B. GTC (Generalized tonic clonic)
C. SPE (simple partial epilepsy)
D. CPE (complex partial epilepsy)

Ans. A

- Section of corpus callosum when drop attacks are the most disabling seizure type or for multiple bilateral foci, there is 70% reduction with callostomy

452. Disconnection syndrome after corpus callostomy in a patient with a dominant left hemisphere consists of

A. Left tactile anomia
B. Pseudohemianopsia
C. Right sided anomia for smell

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D. Impaired spatial synthesis of right hand resulting in difficulty copying complex figures
E. Left sided dyspraxia may resemble hemiparesis

Ans. All of the above are true

- Inability to match object present in right and left hand. Inability to match object shown in right and left half of visual field. Right sided anomia for smell is because representation for olfaction is asymmetric in prefrontal cortex, it is (Right > Left) more common with larger surgical sections of the corpus callosum. Risk is less if the anterior commisure is spared. Patients usually adapt after 2-3 months, with final function normal for most daily activities

453. Each of the following cell groups is derived from the alar plate EXCEPT

A. Nucleus ambigus
B. Principal sensory nucleus of V
C. Solitary nucleus
D. Spinal trigeminal nucleus
E. Vestibular nucleus

Ans. A

Nucleus ambigus is derived from basal plate

454. Following test recommended for assessing acute low back problem

A. Needle EMG
B. H-reflex + SEP
C. Nerve conduction velocity
D. Surface EMG
E. F-wave

Ans. A to C

- Surface EMG and F-wave response are not recommended for assessing acute low back problems

455. How many % asymptomatic patient show presence of herniated lumbar disc and spinal stenosis respectively on MRI?

A. 24%, 4% respectively
B. 28%, 8% respectively
C. 38%, 12% respectively
D. 12%, 2% respectively

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Ans. A.

- Asymptomatic patient having herniated lumbar disc is about 24% and spinal stenosis about 4%
- In elderly asymptomatic patient, herniated lumbar disc is about 36% and spinal stenosis 21%
- Diagnostic radiology is of limited benefit as the initial evaluation in the majority of spinal disorders

456. About Lumbar disc

A. Disk bulge is broad based occurring due to focal weakness in Posteror longitudinal ligament
B. Protrusion of the disc implies ruptured annulus but Posterior longitudinal ligament remains intact
C. In extrusion, it is mandatory that Posterior longitudinal ligament is ruptured
D. S1 invovement can occur in central disc herniation at L4-L5 level
E. Extreme lateral disc herniation at L5-S1 involves L5

Ans. B, D and E

Note: The bulge is concentric smooth circumferential expansion beyond the confines of end plates. It is broad based short radius of extension < 3 mm with no weakness in annulus or PLL. In protrusion there is focally weakend or ruptured annulus but PLL is intact. In extrusion, disc material is connected with only an isthmus with ruptured annulus or intact PLL or ruptured annulus along with ruptured PLL. Not mandatory for extrusion to have ruptured PLL

457. About diagnostic radiological procedure evaluating vertebral column

A. MRI and myelography both provide information in sagittal plane unlike plain CT scan
B. MRI and myelography both evaluate cauda equine unlike routine CT
C. MRI provide information regarding tissue outside the spinal canal (e.g. extreme lateral disc herniation tumors possibly better than CT)
D. Advantage of CT over MRI is that it has faster scanning, less expensive, less claustrophobic, excellent bony detail and of studying blood early
E. In cases of scoliosis, there is difficulty to interpret in MRI. Myelogram/CT may be superior

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Ans. All are true

- **Note:** Myelography provide [functional] information about degree of stenosis. In cases of scoliosis coronal plane scan give better information than sagittal scan in MRI

458. Regarding artificial disc system all are true EXCEPT

A. Bryan artificial disc system is for lumbar disc
B. Prestige cervical disc system is FDA approved as class III device
C. Charite^{TM} artificial disc is for lumbar disc.
D. Criteria for artificial disc replacement is disc degeneration in the only one disc

Ans. A. Bryan artificial disc system is for cervical disc. Link MB charite III disc prosthesis is for lumbar spine not FDA approved. Charite^{TM} artificial disc is FDA approved

459. Regarding straight leg rising test

A. Crossed SLR is more sensitive for the radiculopathy than ipsilateral SLR (Lasegue's sign)
B. Forced foot dorsiflexion or Bragard's test causes a positive SLR test to become positive at a lower angle of inclination.
C. A positive femoral stretch test or reverse straight leg raising test suggest L5 or S1 radiculopathy
D. Severe pain with straight leg raising at 90 degrees is less sensitive for radiculopathy than positive response at a lower angle
E. In case of SLR test tension in nerve increases little above 60^0 angle

Ans. B, D and E

- [Terminology]
  Lasegue's sign → Straight leg rising test
  Fajersztajn's sign → Crossed straight leg rising test
  Femoral stretch → Reverse SLR test
  Bragard test → Forced foot dorsiflexion + SLR test
- SLR primarily tenses L5 and S1. L4 less so and more proximal root very little
- Nerve root compression produces a positive Lasegue's sign in 83% of cases, more likely to be positive in patient <30yr of age with HLD. May be positive in lumbar plexopathy

Note: Flexing both thighs with the knee extended may be tolerated further than flexing the single symptomatic side alone

- Crossed straight leg rising test → SLR on the painless leg causes contralateral limb pain (a greater degree of elevation is usually required than the painful side. More specific but less senstive than SLR (97% of patients undergoing surgery with this sign have confirmed Herniated lumbar disc, may correlate with a more central disc herniation
- Reverse SLR → Positive with L2, L3, L4 nerve rest compression (e.g., in upper lumber disc herniation) or with extreme lumber disc herniation (may also be position in diabetic femoral neuropathy or psoas hematoma). In these situations SLR (Lasegue's sign) is frequently negative (since L5 and S1 are not involved).

460. Herniated lumber disc is most common at which level

A. L2 – L3 level
B. L3 – L4 level
C. L4 – L5 level
D. L5 – S1 level

Ans. D.

- L3-L4 level → [3-10%]
- L4-L5 level → [40-45%]
- L5-S1 level → [45-50%]

461. About Oculomotor nucleus

A. Lateral nucleus is for superior rectus
B. Intermediate nucleus is for inferior rectus
C. Medial nucleus is for medial rectus and inferior oblique
D. Caudal subnucleus for perlia for accommodation and convergence
E. Cranial nucleus for perlia is for levator palpebrae superioris

Ans. C

- Lateral nucleus is for Inferior rectus and has ipsilateral innervation
- Intermediate nucleus is for Superior rectus and has contralateral innervation
- Medial nucleus is for Inferior oblique + Ipsilateral medial rectus
- Caudal sub nucleus of perlia is for Bilateral levator palpebrae superioris. Cranial nucleus of perlia is for accommodation and convergence
- E – W nuclei is parasympathetic nuclei and is for pupil constriction

462. Statement about nerves

A. C1 passes between C1 and C2 vertebrae
B. Epineurium, perineurium and endoneurium is the continuation of the dura, subarachnoid and pia respectively
C. Endoneural capillaries and their cell form the nerve blood barrier
D. The epineurium may sometime continue as the capsule of Meissner's corpuscles
E. The perineurium continue as the capsule of some specialized nerve ending such as pacinian corpuscles, muscle spindles and Golgi tendon organs

Ans. B to E

- C1 passes between the occiput and the atlas (C1) vertebrae

463. Percentage of injury of the recurrent laryngeal nerve in Anterior cervical disectomy with fusion (ACDF) is

A. 11% temporary, 4% permanent paresis more common on left side
B. 11% temporary, 4% permanent paresis, more common on right side
C. 22% temporary, 8% permanent paresis, more common on right side
D. 22% temporary, 8% permanent paresis, more common on left side

Ans. B.

- More common on right side approaches where the recurrent laryngeal nerve is more variable

464. Cervical sympathetic plexus lies within which muscle

A. Rectus capitis lateralis
B. Obliquis capitis inferior
C. Longus colli
D. Splenius capitis

Ans. C

465. The oxyhaemoglobin dissociation curve is shifted to the right by

A. Acidosis
B. Decreased 2,3 diphosphoglyceric acid (2,3 –DPG)
C. Fever
D. Banked blood
E. All of the above

Ans. A and C.

- The curve is shifted to the right by acidosis, fever, increased 2,3 –DPG and hypoxemia and to the left by alkalosis, hypothermia, banked blood and decreased 2,3 –DPG

466. About Ossification of the spine

A. At birth, most vertebrae have three primary and five secondary ossification centers connected by hyaline
B. Exception to typical ossification occur at C1,C2,C7, lumbar vertebrae, sacrum and coccyx
C. Atlas C1 vertebrae has no secondary ossification centers
D. Lumbar vertebrae has three primary ossification centers per vertebrae and seven secondary ossification centers per vertebrae
E. Sacrum has five ossification centers per vertebrae and four secondary ossification centers

Ans. All options are true. Centrum ossification starts at lower thoracic/upper lumbar spine of fetus. Moves in both cranial, and caudal direction. Neural arch ossification begins at cervicothoracic level and then upper cervical region and lastly thoracolumbar region. Atlas has two to five (three most common) primary ossification centers and no secondary ossification centers. Axis has five primary ossification centers and two secondary ossification centers. C3-6 has three primary ossification centers per each vertebrae and five secondary ossification centers per each vertebrae Co1 has three primary ossification centers. Co_2–Co_4 have one primary ossification center each and no secondary ossification center

467. "Standard" laminectomy for cervical spondolytic myelopathy is

A. C3-C7
B. C4-C7
C. C2-C7
D. C1-C7

Ans. A.

- A C3-7 laminectomy is often considered a "standard" laminectomy. An "extended laminectomy" includes C2 and sometime C7

468. Recognised causes of potassium depletion include

A. Chronic steroid therapy
B. Cardiac failure
C. Hypertension
D. Renal tubular acidosis
E. Triamterene therapy

Ans. A to D

- Triamterene is a K^+ sparing diuretic

469. About subdural hematoma

A. Acute subdural hematoma mostly occur in association with diffuse axonal injury and is more common with head rotation or angular acceleration in coronal plane than in sagittal plane
B. Subdural hematoma occur commonly in the elderly due to some cerebral atrophy and in children less than 3 years because dura is attached more firmly to the skull
C. In chronic subdural hematoma, the size of hematoma increases due to repetitive bleeding into the hematoma from the fragile capillaries from both inner and outer membrane.
D. Both inner and outer membranes covering the hematoma are adhered firmly to the arachnoid and dura respectively
E. During the removal of haematoma adhesion on the outer membrane is not touched due to neocapillaries present which can lead to repetitive bleeding

Ans. A, B and E

- Outer membrane that is derived from dura is very vascular and consist of fragile capillaries. Inner membrane is thin and fibrous
- One characteristic pathological feature of chronic subdural hematoma is that there is adhesion with the dura. Where the contact of the inner membrane with the arachnoid is smooth there is no adhesion

470. In Paget's disease of the skull, most common cranial nerve to be involved is

A. V
B. VIII
C. VII
D. IX
E. X

Ans. B

- 8th nerve is the most common to be involved leading to deafness and ataxia

471. Which of the following drugs is used in the treatment of Hypercalcemia due to bony metastases?

A. Plicamycin or Mithramycin
B. Etidronate
C. Pamidronate
D. Salmon calcitonin

Ans. A.

- Plicamycin or mithramycin-a cytotoxic antibiotic that inhibit RNA synthesis with preferential toxicity for osteoclasts. Not approved for treating paget's disease in any country
- Etidronate a biphosphonate [Pyrophosphate analogue that bind to hydroxypatite crystal and inhibit reabsorption. Except Etidronate other biphosphonate used for paget's disease do not reduce normal bone mineralization

472. Regarding ossification of posterior longitudinal ligament [OPLL]

A. Also known as Japanese disease because of highest prevalence in Japan (2-3.5%)
B. It begins with hypervascular fibrosis in the PLL
C. Changes within the spinal cord involve the white matter more than the posterolateral gray matter.
D. There is average involvement of 2.7 to 4 level and involve cervical region (70-75%) of cases of OPLL which typically begins at C3-C4 and proceeds distally but usually sparing C6-C7
E. Myelography with post myelographic CT is probably best at demonstrating and accurately diagnosing OPLL

Ans. A, B, D and E.

- Involves posterolateral gray matter more than white matter probably ischaemic basis

473. About Spinal AVM's

A. Type I spinal AVM is a dural AVM and is most common type in adults usually traumatic in aetiology with low flow-high pressure dynamics

B. Type II AVM also called Glomus is intramedullary common in lumbar region with high flow-high pressure dynamics and worse prognosis than dural AVM

C. Type III AVM also called juvenile AVM is intradural extramedullary in position with high flow-high pressure dynamics

D. Type IV AVM is intradural and perimedullary in position occur in younger patients than type I and may present catastrophically with hemorrhage into the subarachnoid space also called as Arteriovenous fistulae

E. Regarding treatment dural AVM fed by dural artery usually require surgery, intradural AVM may be amenable to interventional neuroradiological procedure including embolization

Ans. A, C, D and E

- Intramedullary glomus AVM arising from the medullary artery usually present in the cervical region
- Thoracolumbar is the commonost site (-65%). It may be extra or intradural. The main feeding vessels are often dural arteries of the spinal nerve root (Intramedullary lesion) at this site are less common
- Low-flow and high pressure dynamics is present in Type I and Type IV AVM
- High flow and high pressure dynamics is present in Type II, Type III, Type IV but not in Type I
- Type IV and Type II typically present with progressively worsening symptoms without significant clinical improvement
- Coup de poignard of Michon = onset of SAH with sudden excruciating backpain (clinical evidence of SpinalAVM). Foix-Alajouanine syndrome → acute or subacute neurologic deterioration in a patient with a Spinal AVM without evidence of hemorrhage

474. About spinal meningeal cyst(SMC)

A. Type I SMC is also called Tarlov's cyst or perineural cyst

B. Type II SMC is most prominent and symptomatic in sacrum

C. Type III SMC is intradural

D. Type I and Type II are extradural

E. Type II SMC often asymptomatic, but sacral lesion may cause sciatica or sphincter disturbance.

Ans. B to E

Type	*Description*
Type I	Extradural meningeal cysts without spinal nerve root fibers
	IA Extradural meninigeal/arachnoid cyst
	IB Occult "sacral meningocele"
Type II	Extradural meningeal cysts with spinal nerve root fibers/Tarlov cyst
Type III	Spinal intradural meningeal cysts (Intradural arachnoid cyst)

475. Causes of communicating syringomyelia are

- **A.** Dandy Walker malformation
- **B.** Arnold chiari malformation Type I or Type II
- **C.** Cerebellar ectopia
- **D.** Basilar adhesive arachnoiditis
- **E.** Basilar impression (with constriction of the foramina)

Ans. All of the above are true

476. About Spinal epidural hematoma

- **A.** Following trauma occur almost exclusively in patient who is anticoagulated, thrombocytopenia or has bleeding diasthesis
- **B.** Thoracic level is most common
- **C.** Most often located posterior to spinal cord, facilitating removal
- **D.** Immediate decompressive laminectomy is indicated in those patients who can tolerate surgery
- **E.** In high risk patient consider use of high dose methylprednisolone to minimize cord injury or percutaneous needle aspiration may be considered

Ans. All of the above are true

477. Regarding surgical treatment of Parkinson's disease

- **A.** Historically anterior choroidal artery was ligated by Irwin Cooper for Parkinsons' disease
- **B.** Neural transplantation in patient with Parkinson's disease was first suggested by Bjorklund and Perlow et al
- **C.** Primary indication for pallidotomy in cases with levopopa induced dyskinesia .
- **D.** Tremors mainly respond to VOP/VIM (Ventro lateral nucleus) thalamotomy
- **E.** Patient with secondary parkinsonism not idiopathic usually do not respond to surgery

Ans. All of the above are true

478. Match the following Microvascular compression syndromes

A. Hemifacial spasm – Anterior inferior cerebellar artery
B. Trigeminal neuralagia – superior cerebellar artery
C. Glossopharyngeal neuralagia – Posterior inferior cerebellar artery
D. Torticollis – Vertebral artery

Ans. All of the above are true

479. Surgical procedures utilized in treatment of spasmodic forticollis are

A. Dorsal cord stimulation
B. Selective rhizotomy and spinal accessory nerve section
C. Stereotactic electrocoagulation of Forel's H field
D. Microvascular decompression of the 11^{th} nerve
E. Local injection of botulinum toxin work for retrocollis, poor for lateral torticollis and totally ineffective for anterocollis

Ans. All of the above are true

480. About Torticollis

A. Spasmodic torticollis is a specific subtype of torticollis that is idiopathic and shortened sternocleidomastoid is usually in spasm
B. Torticollis from atlanto axial rotatory subluxation the elongated sternocleidomastoid is in the spasm
C. Pseudotorticollis develop as an unconscious correction to diplopia which may occur in trochlear nerve palsy
D. Extrapyramidal lesion [including degenerative] may cause torticollis which is often alleviated by lying down
E. Torticollis due to microvascular compression is usually a horizontal type which is exacerbated when supine

Ans. All of the above are true

481. Match the following glycogen storage disease

	Name of the disease	*Enzyme deficiency*
A.	Von Gierke's disease	Glucose 6 phosphatase
B.	Pompe's disease	alpha (,4) glucosidase
C.	Cori's disease	Amylo 1,6- glucosidase, i.e. debranching enzyme
D.	Andersen's disease	1,4 → 1,6 transglucosylase, i.e. branching enzyme
E.	McArdle's disease	Muscle glycogen phosphorylase

Ans. All of the above are true

- Glycogen storage disease name is based on the name of the patient first diagnosed of that disease
- Hers' disease is due to deficiency of Liver phosphorylase

482. About Brain metabolism

A. Ketones (fat derivative acetoacetate and hydroxybutyrate) normally make up approx. 30% of the fuel for the brain in adults
B. Brain consumes 20% of the body oxygen and 60% of its glucose
C. In infants ketone transport is seven times as high as in adults
D. Glycogen content of the brain is greater than muscle and liver
E. Amount of CO_2 and glutamine produced by brain per minute is about 49 ml and 8.4 mg respectively

Ans.A, B, C and E

- RQ (Respiratory quotient) of cerebral tissue is (95-99) in normal individual
- In a 70 kg man the amount of glycogen in liver will be 60mg
- In muscles total glycogen will be 150 mg
- Brain contains very little glycogen, major energy source is glucose
- Glucose is utilized at a rate of 5.5 mg/100 g/min or total 77 mg/min

483. Match the following rate of utilization or production for brain tissue in 100gm/min

A. Mean blood flow → 54 ml/100 gm/min
B. O_2 utilization → 3.3- 3.5 ml/100 gm/min
C. Glucose utilization → 5.5 gm/100 gm/min
D. Glutamate utilization → 0.4 mg/100 gm/min
E. Glutamine production → 0.6 mg/100 gm/min

Ans. All of the above are true

484. Secondary Hyperhidrosis is due to

A. Hyperthyroidism
B. Diabetes Mellitus
C. Syringomyelia
D. Parkinsonism
E. Hypothalamic tumor

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Ans. All of the above are true

- Essential (Primary or Idiopathic) Hyperhidrosis
  Secondary Aetiologies
  1. Pheochromocytoma
  2. Acromegaly
  3. CNS trauma
  4. Menopause

  Sweat is a hypotonic secretion with saline as the primary constituent most eccrine or merocrine sweat gland serve as thermo regulatory function, however, those on the palms and soles respond primarily to emotional stress

485. Procedures for treating medically refractive pain are

A. Cingulotomy
B. Stereotactic mesencephalotomy 5mm lateral to the sylvian aqueduct at the level of inferior colliculus
C. Anterior thalamotomy
D. Dorsal rhizotomy
E. Anterolateral cordotomy

Ans. A, B, D and E

- It is medial thalamotomy not anterior thalamotomy

486. Regarding complex regional pain syndrome or causalgia

A. The edema and trophic changes are due to over activity of sympathetic outflow
B. Regional sympathetic blockade is effective for complex regional pain
C. Sympathetic outflow to the affected region is increased in most patients
D. Spread of the distribution of pain and sensory change is common and does not implicate a psychogenic etiology.
E. CRPS studies have had an unusually high placebo response rate. Medical therapy is usually ineffective.

Ans. D and E.

- Causalgia term was given by Weir Mitchell in (1864)

487. About Pain relieving procedure

A. Medial thalamotomy can be used in phantom limb pain
B. Morphine intraventricular infusion for nociceptive pain above C5

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C. DREZ rhizotomy can be used for post herpetic neuralgia but is best for deafferentiation pain in brachial plexus avulsion
D. Sympathectomy can be used for causalgia
E. Younger patients, without sensory complication having trigeminal neuralgia of first division microvascular decompression is the procedure of choice

Ans. All of the above are true

488. Which of the following antiepileptic used in case of Trigeminal neuralgia?

A. Carbamazepine
B. Vigabatrin
C. Valproic acid
D. Phenytoin
E. Gabapentin

Ans. A, D and E

- Clonazepam is also used

489. Preganglionic parasympathetic fibres from Edinger westphal nucleus reach to cilliary ganglion via

A. Nerve to superior rectus
B. Nerve to medial rectus
C. Nerve to inferior rectus
D. Nerve to inferior oblique

Ans. D.

490. Regarding contribution of the following in Neurosurgery

A. Victor Horsley first attempted retrogasserian neurectomy for tic douloureux
B. Simpson first pointed out the importance of extent of resection of meningioma as an important determinant in recurrence
C. Cushing first proposed deliberate hypotension to provide bloodless field during surgery
D. Walter Dandy first started choroid plexectomy for hydrocephalus
E. Egas Moniz received nobel prize in 1949 for the initiation of psychosurgery

Ans. All of the above are true

491. Glossopharyngeal neuralgia consist of

A. Lancinating pain radiating to throat and base of tongue
B. Hypotension
C. Syncope
D. Often Cardiac arrest
E. Convulsion

Ans. All of the above are true

492. Prosopalgia is seen in

A. Geniculate neuralgia (Hunt's neuralgia)
B. Trigeminal neuralgia
C. Hemifacial spasm
D. Glossopharyngeal neuralgia

Ans. A.

- Prosopalgia (pain referred to deep facial structures, including orbit Posterior nasal and palatal regions, seen in Geniculate neuralagia

493. About Post Herpetic Neuralgia

A. Caused by Herpes simplex type I virus
B. Occur in peripheral nerve distribution
C. Post herpetic neuralgia is rare in age less than 40 years and usually occurs in age >60 and in those with diabetes mellitus
D. Post herpetic neuralgia is more likely after ophthalmic herpes zoster than after spinal segment involvement
E. Most drug useful for trigeminal neuralagia are less effective for post herpetic neuralgia

Ans. C to E.

- It is caused by Herpes varicella zoster (chickenpox)
- Herpes zoster (Shingles) indicate painful vesicle eruption
- Infection without vesicle [zoster sine herpete]
- In 20% it involves ophthalmic nerve
- In 85% thorax (dermatomal distribution)
- Vesicle eruption is always in the dermatomal distribution not in the peripheral nerve distribution

494. Regarding statement about rigidity

A. Decorticate rigidity is greater than decerebrate rigidity
B. Righting reflex is present in the decerebrate animal
C. Visual righting reflex is present in a thalamic animal

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D. Decorticate rigidity is seen only when the animal is at rest
E. Decerebrate rigidity is popularly called as alpha-rigidity

Ans. C to E

- Decerebrate rigidity is greater than decorticate rigidity
- Righting reflex is integrated in midbrain and hence absent in the decerebrate animal
- Visual righting reflex is integrated in cerebral cortex hence present in thalamic animal
- Decerebrate rigidity is popularly called gamma-rigidity. It is due to release of spinal gamma-motor neuron from an inhibitory extrapyramidal discharge therefore called gamma-rigidity

495. Regarding representation of somatosensory projection areas in the cerebellar cortex and thalamus

A. In cerebellum, there is an ipsilateral projection and is inverted in the anterior lobe
B. In cerebellum, there is a bilateral representation and is erect in the posterior lobe
C. In cerebellum, trunk is represented medially and the extremities laterally
D. In the thalamus, the extremities are represented dorsally and the back ventrally
E. In the thalamus, the head is represented medially and the caudal thorax laterally

Ans. A, B, C and E.

- In thalamus, the extremities are represented ventrally and the back dorsally

496. Which of the following familial syndromes associated with Medulloblastoma and Glioblastoma?

A. Von Hippel-Lindau
B. Tuberous Sclerosis
C. Neurofibromatosis type II
D. Li-Fraumeni syndrome
E. Turcot syndrome

Ans. E.

- Von Hippel Lindau consist of Hemangioblastoma
- In Tuberous sclerosis, there is Subependymal giant cell astrocytoma
- Li-Fraumeni syndrome include Astrocytoma and PNET
- Turcot syndrome include Medulloblastoma and Glioblastoma

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497. Tumor amenable to surgical resection and have most favourable prognosis

A. Juvenile pilocytic astrocytoma
B. Pleomorphic xanthoastrocytomas
C. Ganglioglioma
D. Dysembryoplastic neuroepithelial tumor [DNT]
E. Oligodendroglioma

Ans. A to D

498. Ratio of relative frequency of Glioblastoma : Anaplastic astrocytoma : Low grade astrocytoma is

A. 5:3:2
B. 6:2:2
C. 7:2:1
D. 8:1:1

Ans. A

- Peak age for Low grade astrocytoma is 34 years, for Anaplastic astrocytoma is 41 years and for Glioblastoma, it is 53 years

499. Match the mechanism of the following anti-cancer drug

A. Nitrosoureas → DNA alkylation
B. Temozolamide → DNA crosslinks carbamoylation of aminogroup
C. Vinca Alkaloid → Microtubule function inhibitors
D. Carboplatin or cisplatin → chelation via intrastrand cross links
E. Tamoxifen → Protein Kinase c inhibitor

Ans. C to E

- Chemotherapeutic agent used for CNs tumors
- Nitrosoureas, Carmustine, Lomustine and Nimustine causes DNA cross links, carbamolyation of amino groups
- Alkylating agent Procarbazine,Temozolomide causes DNA alkylation and interfere with protein synthesis
- Carboplatin and Cisplatin causes chelation via intrastrand crosslinks
- Nitrogen mustards –Cyclophosphamide, isofamide, Cytoxan causes DNA alkylation, carbonium ion formation.
- Vinca alkaloids –Vincristine, Vinblastine, Paclitaxel causes microtubule function inhibition. Tamoxifen is a protein kinase with inhibitor. Epidophyllotoxins result in topoisomerase II inhibition

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500. About Reflexes

A. In tonic labyrinthine reflex when the patient is supine maximum tone is in the antigravity muscle
B. In a decorticate patient when the head is moved to one side there is ipsilateral extension of the limbs
C. In tonic labyrinthine reflex when the patient is prone there is minimal tone in the extensor group of muscles
D. Cerebral cortex, basal ganglia, cerebellum has facilitatory effect on the stretch reflex
E. In tonic labyrinthine reflex when the head is flexed there is flexion of upper limb with extension of one hind limb

Ans. A to C.

- Cerebral cortex, basal ganglia, cerebellum has inhibitory effect on the stretch reflex. Reticular facilitatory area and vestibular area facilitilate the stretch reflex whcih is a basic postural reflex
  Option E. is a typical tonic neck reflex

501. Which of the following righting reflex is integrated in midbrain?

A. Optic righting reflex
B. Placing reaction
C. Labyrinthine righting reflex
D. Neck righting reflex
E. Body on head righting reflex

Ans. C to E

- Option A. and B. are integrated in cerebral cortex also hopping reaction

502. A patient has undergone surgery for a brain tumor which has been present for 5 years with seizure, has a benign course and was removed completely with a cure. The most likely histological feature will be

A. Sheet of polygonal cell with psammomatous body
B. "Fried egg" appearance and chicken wire vasculature
C. Necrotic areas with pseudopalisading
D. Section showing Homer Wright Rossetes

Ans. A

- It's a typical presentation of meningioma, a benign tumor and there is cure if it is completely removed. In meningiotheliomatous AKA syncytical type have sheet of polygonal cells

503. About Acoustic neuroma

A. Commonly arise from the superior vestibular division at the Obersteiner Redlich zone
B. Consist of Antoni A and Antoni B area and displace the nerve fibre peripherally
C. High pitch tinnitus is usually present in early cases followed by progressive hearing loss
D. Rate of growth is [1-10mm/yr]
E. If tumor is very small say, <1cm and is lateral to IAC then middlefossa (extradural subtemporal) approach is preferred

Ans. All of the above are true

504. Common tumor with ectopic ACTH secretion

A. Small-cell carcinoma of the lung
B. Thymoma
C. Carcinoid tumors
D. Phaeochromocytomas
E. Medullary thyroid carcinoma

Ans. All of the above are true

505. Which statement is true about Meningioma?

A. Are malignant in 50% of cases
B. Occur predominantly in men
C. Are treated primarily by surgical excision
D. Are cured, when properly treated in nearly 95% of cases
E. Arise from the dura

Ans. C.

- It is basically a benign tumor, malignant only in 1.7% cases
- Occur predominatly in 65% Female: Male ratio – [1.18:1]
- 5 year survival rate is 91.3% and 15 years survival rate is 68%
- Arise from the arachnoid cap cell
- Meningioma constitute 14.3-19% of the intracranial tumor

506. Which of the following pituitary tumor is least likely to produce mass effect?

A. Null cell adenoma
B. Oncocytoma
C. Prolactinoma
D. ACTH secreting adenoma

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Ans. D.

- Null cell adenoma and oncocytoma constitute the bulk of endocrine inactive adenomas of functional tumor, prolactinoma is most likely to become large enough to cause mass effect (ACTH tumor is least likely)
- Mass effect is usually (but not exclusively) seen with nonfunctioning tumors

507. In which of the following conditions there is increased Prolactin?

A. Prolactinoma
B. Phenothiazine
C. Stalk effect
D. Primary hypothyroidism
E. Secondary hypothyroidism

Ans. A to D.

- Phenothiazine is a dopamine antagonist hence lead to increase in Prolactin. In primary hypothyroidism there is increase in TRH which increases release of prolactin

508. Regarding Acid-Base disturbances

A. Primary aldosteronism and Cushing's disease causes metabolic alkalosis
B. Myasthenia gravis will cause respiratory acidosis
C. Addison's disease will cause normal anion gap metabolic acidosis
D. Metabolic alkalosis is often accompanied with hypokalemia
E. Salicylate (overdose) early will cause respiratory alkalosis and ethylene glycol overdose will cause increased anion gap metabolic acidosis

Ans. A to E.

509. Regarding Endocrinologic test to differentiate Cushing's disease, Ectopic ACTH production and Adrenal tumors

A. Low dose dexamethasone test suppresses cortisol in ectopic ACTH production and adrenal tumor
B. High dose dexamethasone test suppresses cortisol in ectopic ACTH production and adrenal tumor
C. Serum ACTH will be low in adrenal tumor
D. In metapyrone test which suppres cortisol synthesis in most patients with Cushing's disease will show a rise in 17-OHCS in urine of 70% above baseline

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E. CRH stimulation test positive in Cushing's disease and negative in ectopic ACTH production and adrenal tumor.

Ans. C to E.

- Petrosal sinus sampling is the best way to distinguish pituitary ACTH producing tumor from an ectopic ACTH producing tumor
- Low dose dexamethasone do not suppress cortisol in Cushing disease or ectopic ACTH production
- High dose dexamethasone do not suppress cortisol in ectopic ACTH secretion but suppress in Cushing's disease

510. Differential diagnosis of Pituitary stalk thickening is all EXCEPT

A. Lymphoma
B. Lymphocytic hypophysitis
C. Granulomatous disease
D. Hypothalmic glioma
E. Pituitary adenoma

Ans. E

- Normal thickness of pituitary stalk is approximately equal to basilar artery diameter
- If there is selective decrease in one pituitary hormone and thickened pituitary stalk, the diagnosis is lymphocytic hypophysitis

511. Regarding treatment of pituitary adenoma

A. Usually medical treatment is treatment of choice for prolactinoma in patients having level >500 ng/ml
B. Surgery is the treatment of choice in GH and ACTH secreting adenoma
C. Ketoconazole, Metapyrone, Mitotane, Cyproheptadine all can be used to treat Cushing's disease
D. Somatostatin analogue octreotide is used for treatment of GH adenoma
E. Bromocriptine can be used for GH secreting adenoma

Ans. All of the above are true

- Usually Transphenoidal surgery is done except in certain circumstances

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512. Epstein-Barr virus is associated with how many % cases of primary CNS lymphoma

A. 30%
B. 50%
C. 80%
D. 100%

Ans. D.

- Epstein-Barr virus is detectable in 30-50% of systemic lymphomas however, it has been associated with 100% of PCNSL

513. Which of the following tumors arise from remnant of notochord?

A. Chordoma
B. Chondroma
C. Chondrosarcoma
D. All of the above

Ans. A

- Chordoma arise from remnant of notochord and have characteristic physaliphorous cells

514. Match the following grading

A.	Simpson grading	Extent of removal of glioma
B.	House and Brackmann grading	Assesment of function of VIII nerve
C.	Hess and Hunt scale	Subarachnoid hemorrhage
D.	Modified Gardener and Robertson scale	Related to VII nerve
E.	Modified Jackson classification	Relate to Glomus jugulare tumor

Ans. C and E

- Simpson grading is related with the extent of removal of meningioma
- House and Brackmann grading is for assessment of the function of facial nerve [VII nerve]
- Modified Gardener and Robertson scale is related to testing of cochlear function of VIII nerve

515. The following primitive neuroectodermal tumor (PNET) are

A. Medulloblastoma
B. Pinealoblastoma
C. Ependymoblastoma

D. Neuroblastoma
E. Esthesioneuroblastoma

Ans. A to E.

- Also Retinoblastoma, and Polar Spongioblastoma

516. About Dermoid and Epidermoid cyst

A. Growth rate is exponential rather than linear
B. Epidermoid constitute 5-1.5% of intracranial tumor and epidermoid constitute 3% of intracranial tumor
C. Epidermoid tumors causes bacterial meningitis, always occur in the midline and associated with congenital malformation in 50% of cases.
D. Dermoid tumor causes aseptic meningitis, occur laterally and not associated with congenital formation
E. Both can be treated by surgery

Ans. E.

- Growth is linear like the skin. It is not exponential which is in malignant tumor
- Dermoid constitute 3% of intracranial tumor and epidermoid constitute 5-1.5% of intracranial tumor
- Epidermoid tumor causes aseptic meningitis, always occur laterally and is not associated with congenital malformation
- Dermoid tumor causes bacterial meningitis (commonly associated with dermal sinus), occur in midline and associated with congenital malformation in 50% of cases. Radiotherapy is not given. Surgical excision is the treatment of choice

517. Tumor arising in pineal region are

A. Pineocytomas and pineoblastomas
B. Astrocytoma
C. Meningioma
D. Ependymoma and chemodectoma
E. Geminoma and choriocarcinoma

Ans. All of the above are true

- Substrate in pineal region - Tumor that may arise
- Pineal glandular tissue - Pineocytomas and pineoblastomas
- Glial cells - Astrocytomas (including pilocytic) oligodendroglioma, glial cyst

- Arachnoid cell - Meningiomas, arachnoid cyst
- Ependymal cell - Ependymoma
- Sympathetic nerve - Chemodectomas
- Rests of germ cells - Germ cell tumors, choriocarcinoma,

518. Poppen/Jamiesson approach for surgery of pineal tumor is

A. Infratentonial supracerebellar approach
B. Paramedian transtentorial approach
C. Occipital transtentorial approach
D. Transventricular approach

Ans. C.

- Krause/Stein approach is infratentorial supracerebellar approach
  Important surgical consideration
- Deep cerebral veins are a major obstacle to operation in this region
- The base of the pineal gland is the posterior wall of the 3rd ventricle. The splenium of the corpus callosum lies above and the thalamus surrounds both sides. The pineal projects posteriorly and inferiorly into the quadrigeminal cistern

519. In Central nervous system melanocytes are concentrated in the

A. Choroid plexus
B. Red nuclei
C. Region of the amygdala
D. Septum pellucidum
E. Ventral medulla

Ans. E

- Melanocytes present in the pia-mater are concentrated in the ventral medulla and upper spinal cord
- Primary CNS melanoma arise from melanocytes in the leptomeninges, and spread through CSF. Peak age of this tumor is fourth decade

520. An infant evaluated for hydrocephalus has dilated ventricles with a thin cortical mantle and normal fontanelle. The management will be

A. Regular measurement of head circumference
B. Immediately ventriculoperitoneal shunt or CSF diversion
C. Start Acetazolamide
D. Immediately lumboperitoneal shunt
E. Angiography and EEG may help in evaluation

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Ans. A, C amd E.

- This condition is likely to be cerebral atrophy (early) stage with thin cortical mantle. So shunt has to be done but not immediately as fontanelle are normal. Lumboperitoneal shunt is avoided in children. Acetazolamide is usually started when the patient can be stabilized before going expectant surgery. To differentiate hydranencephaly from maximal hydrocephalus, EEG is used which will show no change in hydranencephaly

521. Match the following plain X-ray radiological finding with the causative factor

A. Hemangioma → Honey comb appearance common
B. Osteoma → Discrete high density lesion with smooth contour
C. Epidermoid cyst → Scalloping border with sclerotic rim
D. Eosinophilic granuloma → Discrete radiolucent area
E. Multiple myeloma → Multiple discrete round lesions

Ans. All of the abvoe are true

- Eosinophilic granuloma involving cervical vertebrae are called vertebrae plana

522. The most common primary CNS tumor responsible for extracranial spread (systemic) is

A. Medulloblastoma (cerebellar PNET)
B. Meningiomas
C. Malignant astrocytomas
D. Ependymomas
E. Pinealoblastoma

Ans. A.

- Medulloblastoma is the most common primary CNS tumor for extraneural spread

523. About Radiotherapy in CNS tumors

A. The most common external beam radiation therapy regimen for brain metastases is 30Gy in 10 fractions over 2 weeks
B. The most appropriate radiation protocol for gliomas is 6000 cGy in 200 cGy daily fractions
C. Stereotactic radiosurgery has not been proven to be more effective for treatment of malignant gliomas
D. Cerebral PNET's are usually localized and require local radiation after surgery
E. Germinomas are very sensitive to radiotherapy

Ans. A, B, C and E.

- Cerebral PNET (most common medulloblastoma) has high propensity for metastases. Therefore craniospinal irradiation is given prophylactically

524. Failure of a mitotic pupil to dilate after instilling 2-10% cocaine followed by 1% hydroxyamphetamine indicates a

A. First–order Horner's syndrome
B. Second–order Horner's syndrome
C. Third–order Horner's syndrome
D. First–or second–order Horner's syndrome
E. Second-or third–order Horner's syndrome

Ans. C.

- Horner's syndrome can be confirmed by the failure of the mitotic pupil to dilate in response to 2-10% cocaine drops. If the later application of the adrenergic mydriatic hydroxyamphetamine has no effect, then the lesion localizes to the third–order neuron (postganglionic part). A first or second-order lesion is indicated by a failure of the miotic pupil to dilate to cocaine drops followed by dilation (after 24 hours) with 1% hydroxyamphetamine.

525. Radiosensitive cerebral metastases are

A. Small cell lung Ca
B. Large cell lung Ca
C. Lymphoma
D. Germ cell tumors
E. Malignant melanoma

Ans. A, C and D

- Leukemia and Multiple myeloma are also sensitive

526. A male patient aged 50 years is having multiple cerebral metastases. He is posted for emergency surgery due to presence of life threatening lesion. These lesions include

A. Posterior fossa lesion
B. Frontal lobe lesion
C. Occipital lobe lesion
D. Parietal lobe lesion
E. Large temporal lobe lesion

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Ans. A and E.

- Posterior fossa lesion leads to compression of vital centers early. Large temporal lobe lesion leads to early transtentorial herniation

527. Regarding Idiopathic intracranial hypertension (IIH) or pseudotumor cereberi or benign intracranial hypertension

A. Elevated ICP and papilledema (10%) without intracranial mass
B. CSF has normal cell count and sugar level but elevated protein level
C. Abducens nerve palsy (20%), enlarged blind spot (66%) and visual field defect (9%) is present
D. Visual loss in Idiopathic Intracranial Hypertension may occur early or late, may be sudden or gradually progressive and is not reliably correlated to duration of symptoms
E. There is conspicuous absence of altered level of consciousness in spite of high ICP

Ans. A, C to E.

- In IIH or pseudotumor cerebri, the protein is normal or even low <20% but never high

528. An elderly patient present with proximal muscle stiffness with paroxysmal lancinating pain in temporal area present to you with increased ESR, the management will be

A. Steriod should be started immediately
B. CT scan or MRI scan should be done to rule out intracranial pathology
C. Full investigation should be done before starting treatment
D. Symptomatic treatment should be given and patient must be observed for any developing focal deficit

Ans. A.

- This patient is having temporal arteritis. Fifty percent of patients with temporal arteritis have polymyalgia rheumatica which causes increase proximal muscle stiffness. Often there is risk of blindness. In case of slightest suspicion, steroid has to be started immediately

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529 About Empty Sella Syndrome

A. In primary empty sella syndrome, most of these patients are obese women
B. The frequency of empty sella syndrome (primary) is higher in patients with pituitary tumors and in those with increased ICP for any reason
C. Most patients usually present with symptoms that do not suggest an intrasellar abnormality including headache, dizziness, seizures, etc
D. Clinically evident endocrine disturbances are rare with primary empty sella syndrome
E. Surgery is usually not indicated except in case of CSF rhinorrhoea

Ans. All of the above are true

530. A single CAT scan of the head produces how much radiation exposure

A. 1-40 REM
B. 10-40 REM
C. 18-40 REM
D. 10-20 REM

Ans. C.

- I Sievert = 100 REM
- 1 REM is estimated to cause = 300 additional cases of cancer per million persons. The average annual exposure to radiation is 360 MREM. A CXR produces about 10-40 MREM of exposure. A CAT scan of the head = 18-40 REM (1.25 REM/slice) a cerebral arteriogram = 10-20 REM (including fluoroscopy)

531. Nerves arising from posterior cord are

A. Thoracodorsal nerve
B. Dorsal scapular nerve
C. Supra scapular nerve
D. Upper sub-subscapular
E. Lower sub-subscapular

Ans. A, D and E.

- Other branches of posterior cord are axillary and radial nerve

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532. Following statement about brachial plexus lesion with the description are

A. In middle trunk lesion, the median sensory responses from the index and middle finger are low in amplitude, but motor conduction velocities of the hand muscles are normal

B. In lower trunk lesion, the ulnar sensory response from the little finger is abnormal and electromyographic exam of the extensor indicis or indicus proprius and abductor pollicis longus is abnormal

C. In medial cord lesion, the ulnar sensory response from the little finger is abnormal but normal response from the extensor indicis proprius

D. In upper trunk lesion, the action potentials from the deltoid and biceps are of low amplitude

E. In lateral cord lesion, there is abnormal median sensory responses and denervation in the biceps and flexor carpi radialis and normal response from the adductor pollicis brevis

Ans. All of the above are true

533. Match the following

A.	Supraspinatus	Subscapular nerve
B.	Pollicis brevis (deep head)	Median nerve
C.	Palmaris longus	Ulnar nerve
D.	Adductor pollicis	Ulnar nerve
E.	Brachioradialis	Radial nerve

Ans. D and E.

- Supraspinatus is supplied by suprascapular nerve (branch of upper trunk)
- Flexor pollicis brevis (deep head) is supplied by ulnar nerve and superficial head is supplied by median nerve
- Palmaris longus is supplied by median nerve but palmaris brevis is supplied by ulnar nerve

534. Peripheral neuropathy is seen in

A. Zidovudine
B. Lamivudine
C. Didanosine
D. Stavudine
E. Zalcitabine

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Ans. C to E.

- Didanosine causes a painful dose related neuropathy
- Zalcitabine dose related neuropathy is severe and persistent
- Ritonavir (protease inhibitor) can cause peripheral paresthesias
- Amprenavir can cause perioral paresthesias. Zidovudine causes toxic mitochondrial myopathy
- Distal sensory polyneuropathy is the most common neuropathy in patients with AIDS

535. Match the following

A. Greater occipital nerve/Nerve of Arnold
B. Nervus intermedius/Nerve of Wrisberg
C. Long thoracic nerve/Nerve of Bell
D. All the above are false

Ans. A to C.

536. Anterior interosseous nerve supplies

A. Abductor pollicis brevis
B. Flexor pollicis brevis
C. Pronator teres
D. Flexor pollicis longus
E. Pronator quadratus

Ans. D and E.

- Anterior interosseous nerve involvement result in Kiloh-Nervin syndrome
- Abductor pollicis brevis, flexor pollicis brevis, pronator teres are supplied by median nerve
- Anterior interosseous nerve which is pure motor branch of median nerve, supplies flexor digitorum profundus I and II, pronator quadratus, flexor pollicis longus

537. All of the following can be seen in ulnar nerve entrapment at the wrist

A. Motor deficits in the adductor pollicis
B. Motor deficits in the deep head of the flexor pollicis brevis.
C. Motor deficit in the third and fourth lumbricals
D. Sensory deficit in the dorsum of hand
E. Sensory deficit in the palmar surface of the hypothenar muscle

Ans. A, B, C and E

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538. Muscles supplied by Posterior interosseous nerve

A. Triceps brachii
B. Supinator
C. Extensor carpi radialis longus
D. Brachioradialis
E. Extensor carpi ulnaris

Ans. E.

- Posterior interosseous nerve supplies extensor carpi ulnaris, extensor digitorum, extensor digiti minimi, extensor pollicis brevis and longus, abductor pollicis longus, and extensor indicus

539. If the injury to the radial nerve occur in the radial groove, the muscles which are involved are

A. Long head of triceps
B. Lateral head of triceps
C. Medial head of triceps
D. Extensor carpi radialis longus
E. Extensor carpi radialis brevis

Ans. B, D and E

- Branches to long head of triceps and medial head of triceps given before entering into the radial groove

540. Match the following nerves with the structure causing compression

A. Median nerve/TCL (Transverse carpal ligament)
B. Suprascapular nerve/TSL (Transverse scapular ligament)
C. Median nerve/Struther's ligament
D. Posterior interosseus nerve/arcade of Frohse
E. Ulnar nerve/Arcade of Struther

Ans. All of the above are true

- Guyon's canal contain ulnar nerve
- Cubital tunnel syndrome also involves ulnar nerve
- Supinator tunnel syndrome involves radial nerve

541. In Kiloh-Nervin syndrome associated with nerve entrapment neuropathy

A. There is no sensory loss
B. Both sensory and motor deficit
C. Paralysis of pronator teres muscle

D. Paralysis of fexor digitorum profundus [I and II]
E. Paralysis of flexor pollicis longus

Ans. A. D and E.

- Kiloh-Nervin syndrome is due to anterior interosseous nerve entrapment, pure motor branch of Median nerve supplying Flexor digitorum profundus [I and II], Flexor pollicis longus and pronator Quadratus

542. Function of Palmar interosseous muscle

A. Flexion at MCP joint
B. Extension of MCP joint
C. Adduction at MCP joint
D. Extension at PIP joint
E. Extension at DIP joint

Ans. A, C and D.

543. Muscles having dual nerve supply are

A. Bicepbrachii
B. Brachialis
C. Flexor digitorum profundus
D. Bicep femoris
E. Flexor pollicis brevis

Ans. B to E.

- Bicepbrachii is supplied by musculocutaneous nerve. Brachialis is supplied mainly by musculocutaneous nerve but lateral part is supplied by radial nerve also
- Flexor Digitorum Profundus – Medial part supplied by ulnar nerve
- FDP Lateral part supplied by Median nerve (anterior interosseous branch)
- Adductor Magnus supplied by Obturator, Sciatic
- Bicepfemoris (Long head) supplied by Sciatic
- Bicep femoris (Short head) supplied by Common peroneal nerve
- Flexor pollicis brevis (Superficial head) supplied by Median nerve
- Flexor pollicis brevis (Deep head) supplied by ulnar nerve
- Pectineus also has double supply by Femoral nerve and; Obturator nerve

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544. About Trendelenburg sign

A. Due to paralysis of contralateral gluteus medius/gluteus minimus muscle
B. Due to paralysis of ipsilateral gluteus medius/gluteus minimus muscle
C. Involvement of inferior gluteal nerve (Ipsilateral)
D. Involvement of superior gluteal nerve (Ipsilateral)
E. May present in L4 – L5 disc herniation

Ans. B, D and E.

- Trendelenburg sign → occurs when the pelvis tilts down toward the side of the lifted leg indicating weakness of the contralateral thigh abductors (primarily L5 innervated) or ipsilateral thigh abductor Gluteus medius and minimus causes abduction and medial rotation

545. Statement regarding the waves in the somatosensory evoked potential

A. N9 wave absence or delay implies peripheral nerve disease
B. N11 wave absence orderly implies cervical cord disease
C. N13/P13 wave absence or delay implies a lesion in the lower medulla
D. N18 wave absence or delay implies a lesion in the upper pons or midbrain
E. N19 wave absence or delay implies a lesion in the thalamo sensory cortex

Ans. All of the above are true

546. About motor potential during EMG

A. Decreased voltage and decreased duration is found in myopathy
B. Prolonged, low amplitude and polyphasic motor unit potentials are typical in early reinnervation
C. Prolonged, high amplitude and polyphasic motor unit potential are typical in late reinnervation
D. Fibrillation potential are following denervation of a muscle where individual muscle fibers begin firing independently and is not visible through skin.
E. In plexopathy, there is paraspinal muscle fibrillation with normal sensory nerve action potential but in radiculopathy, there is no paraspinal muscle fibrillation but there is reduced sensory nerve action poiential (SNAP)

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Ans. A to D.

- In plexopathy, there is reduced sensory nerve action potential and no paraspinal muscle fibrillation
- In radiculopathy, there is normal sensory nerve action potential and paraspinal muscle fibrillation present
- In myotonic dystrophy classic EMG finding "dive bomber" sound due to myotonic discharges
- Following disectomy for radiculopathy motor potential return if first nerve injury were complete, it would take a month to return. Lost sensory potentials return last or may not return. Paraspinal muscle potential may no longer be useful because the muscles are cut during surgery

547. Which of the following water soluble contrast agent is used both IV and intrathecally and is most preferably used in contrast studies?

A. Iohexol (omnipaque)
B. Diatrizoate meglumine (Reno-60)
C. Ioversol (optiray)
D. Metrizamide (Anaipaque)
E. Pantopaque

Ans. A.

- Diatrizoate meglumine and Ioversol are not for intrathecal use. Metrizamide is superseeded by iohexal and has higher risk of seizures and significant nausea and vomiting
- Pantopaqe is non soluble contrast

548. At how much haematocrit does an acute SDH is isodense to brain on CAT scan?

A. <23%
B. <32%
C. <13%
D. <23%

Ans. A

- Hct <23% will cause an acute SDH to be isodense with brain

549. Match the following Hounsfield unit

A. Air - – 1000 (Hu)
B. Gray matter - 30 to 40 Hu
C. White matter - 20 to 35 Hu
D. CSF - +5 Hu
E. Fresh SAH - 75 to 80 Hu

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Ans. A to E.

- Water – 0 Hu
- Densebone - + 1000 Hu
- Cerebral edema – [10 to 14] Hu
- Bone - + 600 Hu
- Fat – [30 - 40] Hu
- Disc material [55 – 70] Hu
- Thecal sac – [20 –30] Hu

550. Which is the most common primitive persistent Carotid – Basilar anastomoses?

A. Primitive trigeminal artery
B. Primitive otic artery
C. Primitive hypoglossal artery
D. Proatlantal intersegmental artery

Ans. A.

- Primitive trigeminal artery is the most common of the persistent anastomoses. It anastomose proximal cavernous internal carotid artery to basilar artery
- Primitive otic artery connects petrous internal carotid artery to basilar artery
- Persistent primitive trigeminal artery is seen in 0.6% of cerebral angiogram

551. Which of the following is also called as "Italian artery"?

A. Artery of Mc Conell AKA capsular artery
B. Inferior hypophyseal artery
C. Superior hypophyseal artery
D. Artery of Bernasconi and cassinari AKA artery of tentorium

Ans. D.

- Artery of Bernasconi and cassinari AKA Italian, artery. This artery is enlarged in tentorial meningiomas

552. Infundibulum which is funnel shaped initial segment of an artery has to be distinguished from aneurysm, is most commonly found at the origin of

A. Anterior cerebral artery
B. Anterior choroidal artery
C. Posterior communicating artery
D. Middle cerebral artery

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Ans. C.

- Criteria of an infundibulum (1) Triangular in shape (2) Mouth (widest portion) <3 mm) (3) Vessel at apex

553. Regarding magnetic resonance imaging the following statements are

A. Fat is high signal in T2WI and low signal in T1WI
B. Bone is low signal on both T2WI and T1WI
C. CSF is high signal on T2WI but low signal on T1WI
D. Gray matter is low signal on T1WI but high signal on T2WI and for white matter it is just reverse
E. T1WI show pathological image and T2WI shows anatomical image

Ans. B to D.

- Proton rich tissue (eg H_2O) has long T1 and T2
- In T1WI short T1 produce high signal
- In T2WI long T2 produce high signal
- Paramagnetic substance like methaemoglobin when intracellular produce short T1 and short T2
- When extracellular produce short T1 and long T2

554. Which of the following aneurysmal clip is not MRI compatible?

A. Mayfield
B. Yasargil (Phynox)
C. Sugita (Elgiloy)
D. Silver clip

Ans. A.

- Stainless steel is classified as martensitic (ferromagnetic) or austenitic (non-ferromagnetic). Cobalt- based super alloys are non ferromagnetic and include Elgiloy (Sugita clip), Phynox (Yasargil) and Vari angle are MRI compatible

555. Cervical spinal stenosis is present when on AP diameter on a plain lateral C-spin *x*-ray the AP diameter is

A. <12mm
B. <14mm
C. <15mm
D. <17mm

Ans. A.

- Normal canal diameter on lateral C-spin X-ray (from spinolaminar line (SLL) to posterior vertebral body is [17 ± 5mm] (12-22mm)

556. Two neurocentral synchondrosis on atlas fuse at about

A. 8 years
B. 7 years
C. 10 years
D. 12 years

Ans. B.

- Secondary ossification center

557. Secondary ossification center which appears at summit of dens between age 3-6 years fuses with dens by age

A. 10 years
B. 12 years
C. 14 years
D. 16 years

Ans. B

558. The lumbar disc space with the greatest vertical height is

A. L1 – L2
B. L2 – L3
C. L3 – L4
D. L4 – L5

Ans. D.

559. Which of the following radiological measurements is the most sensitive for basilar impression (BI)?

A. McRae's line
B. McGregor's baseline
C. Chamberlain's line
D. Weckenheim Clivus Canal Line

Ans. B

- McRae's line is drawn across foramen magnum (tip of clivus) (basion) to (opisthion) and no part of odontoid should be above this line. It is most specific
- McGregor's baseline is drawn from posterior margin of hard palate to most caudal point of occiput. No more than 4.5 mm of dens should be above this. It is most sensitive

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560. Oscillopsia is present in

A. Arnold Chiari Malformation 1
B. Multiple sclerosis
C. Aminoglycoside ototoxicity
D. Bilateral vestibular neurectomies
E. Dandy's syndrome

Ans. All of the above are true

- Oscillopsia – visual sensation that stationary objects are swaying side to side or vibrating

561. Statements regarding audiometric testing are

A. In conductive loss, there is equal threshold elevation for each frequency
B. In early Meniere's disease, threshold are elevated more in lower than in higher frequency
C. In noise induced hearing loss, threshold is greater in lower than in high frequency
D. Sensory neural deafness tend to have greater threshold elevation at each higher frequency
E. In acoustic schwannoma, loudness recruitment is characteristic

Ans. A to D.

- Loudness recruitment is characterstic of cochlear lesion and not retrocochlear lesion

562. Facial diplegia (Bilateral facial palsy) is present in

A. Moebius syndrome
B. Myotonic dystrophy
C. Neurosarcoidosis
D. Lyme's disease
E. Gullian Barre syndrome

Ans. All of the above are true

- In neurosarcoidosis, VII is the most commonly affected cranial nerve. In Lyme disease, facial diplegia is a hallmark
- In Moebius syndrome, it affects upper face more than lower face
- In tuberculous meningitis, VI is the most common nerve to be involved

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563. About Bell's Palsy

A. Most cases probably represent a viral inflammatory demyelinating polyneuritis due to the herpes simplex virus
B. Usually exhibit proximal to distal progression
C. 100% of cases recover completely
D. Per cases with focal injury to the facial nerve (e.g., trauma, injury during operation) dynamic reconstruction by nerve anastamoses are usually considered superior to static method and without focal cause, e.g. Bell's palsy only "static" method applicable
E. If paralysis is complete at onset, 50% will have incomplete recovery

Ans. A, D and E.

- It usually exhibits distal to proximal progression
- 75 – 80% of cases recover completely

564. Extracranial facial nerve anastomosis can be done by

A. Hypoglossal nerve (Cr. N-XII)
B. Spinal accessory nerve
C. Phrenic neve
D. Glossopharyngeal
E. Crossface grafting (VII – VII)

Ans. All of the above are true

565. Head injury is most frequent among which age group in India

A. Children less than 5 years
B. 20 – 40 years
C. 40 – 60 years
D. > 60 years

Ans. B

Age Group	*% of all Head Injuries*
• Children below 20 years	30
• Young adult 20 – 40 years	60
• Elderly above 60 years	5
• Not surprisingly incidence of head injury is lowest in extremes of age, below five years and above 60 years and the rate is 125 – 150/100,000 population	

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566. Statements regarding head injury and its mechanism are

A. Males had higher incidence of head injury as compared to females also in all age groups except infants and elderly patients above 65 years of age
B. Angular acceleration is most injurious
C. Angular acceleration is a combination of both translational and rotational component. Higher the center of angulation, greater the rotational component and at lower center of angulation, the translational component increases
D. Structural damage to superficial vascular tissue (bridging veins and pial vessels) occur in short acceleration duration with large acceleration magnitude whereas brain tissue injury occurs in longer duration and lesser acceleration magnitude
E. Skull fractures, epidural hematoma coup contusions are due to result of contact injuries while countercoup contusions are due to head acceleration (inertial effect)

Ans. All of the above are true

- Centre of angulation is usually mid cervical to lower cervical region

567. Which statements about mechanism are correct?

A. SDH (subdural hematoma) result from head acceleration that produce short duration, high strain ratio loading
B. Concussion refers to an immediate but transient loss of consciousness associated with a short period of amnesia caused due to transient electrophysiologic dysfunction of reticular activating system in the upper midbrain.
C. Almost all cases of severe diffuse axonal injury, arise from vehicular accident in which acceleration is long
D. Sagittal acceleration occasionally produce Diffuse Axonal Injury of grade I. Angular deacceleration in coronal plane has a high incidence of severe form of Diffuse Axonal injury
E. Linear skull fracture follows local skull bending occurring at the site of impact which exceeds the strain limit for the bone.

Ans. All of the above are true

- Remember, in concussion most of the strain is insufficient to cause structural damage but biochemical and ultrastructural changes such as mitochondrial ATP depletion and local disruptions BBB occur

568. Acceleration injury will result in

A. Coup contusion
B. Concussion
C. Countercoup contusion
D. Extradural hematoma
E. Subdural hematoma

Ans. B, C and E

- DAI is also following acceleration injury

569. Ca^{2+} pump pumps out how many Ca^{2+} ion out of cell per ATP

A. 1
B. 2
C. 3
D. 4

Ans. B.

570. Head trauma results in

A. ↑ extracellular K^+
B. ↑ intracellular Ca^{2+}
C. ↑ extracellular glutamate
D. ↑ adenosine
E. ↓ glutamine intracellulary

Ans. All of the above are true

- **Note:** Adenosine increases CBF and has neuro protective role as it inhibits glutamate release

571. Which statements are correct?

A. Intracranial volume of an adult is approx 1500 ml which is about 2% of total body weight
B. Total CSF volume in normal condition is about 120ml to 140 ml, ventricular volume is about 40 ml, spinal subarachnoid space contains about 30ml and the remaining CSF occupies the cranial subarachnoid space and cistern
C. The total cerebral blood volume is approx. 150 ml
D. Mean CBF is 54 ml/100 gm/min with gray matter and white matter flow being 70 and 20 ml/100 gm/min respectively
E. Cerebral autoregulation fails below 70 mmHg and above 150 mm/Hg

Ans. A to D

- Cerebral autoregulation is maintained between 50-150 mmHg. It has to drop below 40 mHg if the blood supply to brain is to be hampered.

572. Following statement regarding compliance and elastance of brain are?

A. Cerebral compliance of an adult brain is greater than that of infant
B. Cerebral elastance of an infant brain is greater than that of adult brain
C. Cerebral capacitance in case of extradural dural hematoma is greater than that of subdural hematoma
D. Cerebral capacitance in case of meningioma is lower than that of glioblastoma multiform
E. Slope of pressure volume curve is elastance

Ans. E.

- Compliance – Adult skull ↓;Infant skull ↑.dv/dp
- Elastance – Adult skull ↑;Infant skull ↓.dp/dv
- Cerebral capacitance represents the rate at which the brain can accommodate change in intracranial volume and is determined by time dependent derivative of the same variables determining cerebral compliance

573. A patient is having diffuse axonal injury, histologically there are axonal swelling (retraction ball) in cerebral white matter, corpus callosum, dorsolateral quadrant upper brainstem and superior cerebellar peduncle and a focal lesion in the corpus callosum. He is having

A. Grade I DAI
B. Grade II DAI
C. Grade III DAI
D. None of the above
E. All of the above

Ans. B.

- Diffuse axonal injury was first described by Stritch in 1956
- Grade I diffuse axonal injury less common in cerebellum without focal lesion
- Grade II diffuse axonal injury with focal lesion in corpus callosun
- Grade III diffuse axonal injury with focal lesion in corpus callosum and dorsolateral quadrant of brainstem

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574. About contusions

A. Overlying pia mater always remains intact
B. Coup contusion and countercoup contusion has the same mechanism of formation
C. Plaque Jaune are common with countercoup lesion and are found over inferior frontal lobe and temporal tip and occipital pole
D. It is wedge shape with base toward the surface.
E. Herniation contusion are most frequently located along the margin of the falx cerebri, tentorium or foramen magnum

Ans. A, C to E

- In contusion overlying pia mater always remain intact but in laceration it is breached

575. Blood brain barrier is formed by

A. Choroidepithelial cell
B. Endothelial cell
C. Foot process of astrocytes
D. Process of oligodendroglia
E. Pia mater

Ans. B and C.

- Tight junction between choroids epithelial cell form blood-CSF barrier (Arachnoid cells) which also have barrier function

576. Following are indicated in brain edema of head injury

A. Mild hypothermia (33 – 34°C)
B. Barbiturate
C. Phencyclidine
D. Selenium
E. Corticosteroids

Ans. A,B and D

- Vit. E, selenium, superoxide dismutase reduce the free radical and stop lipid peroxidation
- Phencyclidine dextromethorphan, Ketamine, MK-801 are NMDA antagonist and have been used in experimental traumatic model. They have side effect which limit their use except dextromethorphan which have role in future

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577. Regarding vasospasm in subarachnoid hemorrhage

A. Onset is almost never before day 3 post SAH
B. Maximal frequency of onset during day 6 – 8 post SAH
C. Vasospasm leading to clinical deterioration between 5th and 9th day
D. Clinical cerbrovascular spasm almost always resolved by day 12 post SAH and is radiographically demonstrated over 3 – 4 weeks
E. Onset is usually insidious but 10% have an abrupt and severe deterioration

Ans. All of the above are true

- Hypoxia and Hypotension are the two most important causes which lead to ischaemic brain damage

578. Statement regarding Neurentic Cyst are

A. Most common alternate term is enterogenous cyst
B. Occur due to persistence of foramen of kovalavescky
C. Most are simple cyst lined by cuboidal columnar epithelium and mucin secreting globlet cell
D. Recurrent meningitis can occur
E. Most commonly present during the second decade of life

Ans. A to D

- Most commonly present during the first decade of life. Pain or myelopathy are the most common presentation in older children and adult. Neonate and young children may present with cardiorespiratory compromise from an intrathoracic mass or cervical spinal cord compression

579. Which of the following drug raises the cellular pH and combat acidosis and is used widely in head injury patients?

A. Phencyclidine
B. Dextromethorphan
C. MK - 801
D. Tris Hydroxyaminothane (THAM)

Ans. D

- Rest of the drugs are NMDA antagonist and are being used in traumatic experimental study

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580. One and half syndrome is due to destruction of

A. Both PPRF (Bilateral)
B. Both PPRF and MLF (Bilateral)
C. Both MLF (Bilateral)
D. Both PPRF and MLF (Unilateral)

Ans. D

581. At birth, the brain is about what % of its adult weight

A. 25%
B. 40%
C. 60%
D. 75%

Ans. A.

582. About Investigation

A. Non haemorrhagic lesion are better evaluated by MRI than CT scan
B. CT is better for acute SDH than MRI
C. MRI is more sensitive than CT in identifying isodense SDH
D. Subarachnoid hemorrhage is seen better in CT than MRI
E. 50 – 40% linear skull fracture can be missed on axial projection in CT

Ans. All of the above are true

- For diagnosing DAI, MRI is superior to CT

583. About lesions in diffuse axonal injury (DAI)

A. All are haemorrhagic
B. 80% are haemorrhagic and 20% are non haemorrhagic
C. 20% are haemorrhagic and 80% are non haemorrhagic
D. All are non haemorrhagic

Ans. C.

- The vast majority (80%) of DAI lesions are non haemorrhagic and only about 20% of lesions contain small central areas of petechial hemorrhage

584. About position of aneurysm

A. Traumatic aneurysms are usually more peripherally situated and typically do not occur at branching site
B. Traumatic aneurysms located at the distal middle cerebral artery, distal ACA and basal ICA are less 1% of then reported aneurysm

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C. Mycotic aneurysms occur in 3 – 15% of the patients with infective endocarditis and are located peripherally in the middle cerebral artery and fusiform
D. Fungal infection causing aneurysm tends to involve large cranial vessel than bacterial infection
E. Berry aneurysms are more common in anterior (internal carotid artery) circulation and are saccular in shape rather than most posterior circulation aneurysms which are fusiform in shape

Ans. All of the above are true

585. The intracranial hypertension after trauma is maximum between

A. 0 – 24 hr
B. 24 – 48 hr
C. 48 – 72 hr
D. 72 – 96 hr

Ans. C

- In a few patients, secondary raised ICP can occur between 7 – 10 days after treatment

586. Among all the factors in GCS the most PROGNOSTIC is

A. Verbal response
B. Eye opening
C. Motor response
D. All of the above

Ans. C.

- Amongst the all factors motor scoring is probably the most prognostic

587. Regarding mannitol use in head injury for reduction of brain oedema

A. Mannitol is used at a dose of .25gm – 1gm/kg
B. Serum osmolality should not exceed 320mosmol/L
C. Repeated long term use result in dilutional hyponatremia, acute renal failure and disruption of BBB
D. It has a neuroprotective role as it scavanges free radical which produce lipid peroxidation
E. They can be used sometime conjunctive to chemotherapy for the Glioma to increase BBB penetrance

Ans. All of the above are true

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588. About factors influencing outcome in head injury patients

A. Incidence of surgically treatable hematomas increases with age
B. In children, mortality is highest at 1-2 years and decreases till adolscence being minimum at 12 years
C. Motor component alone has been used as single important predictor. Flaccidity has worse outcome (-100%) mortality
D. Patients with normal oculovestibular reflex were generally free of significant deficit 2 years after the injury
E. Patients with GCS ≤8 are comatose and those ≥9 are not

Ans. All of the above are true

589. The triad of head injury with lucid interval, mydriasis on the side of a hematoma and contralateral paresis occur in how many % of cases of EDH

A. 18%
B. 28%
C. 38%
D. 48%

Ans. A.

- i.e., 18% that too in temporoparietal region
- Clinical cause of presentation of EDH - 5 pattern
- Conscious throughout (8-24%)
- Unconscious throughout (23-24%)
- Initially unconscious and subsequently recovered (20-28%)
- Initially conscious followed by loss of consciousness (14-21%)
- Initially unconscious followed by recovery, further followed by a second loss of consciousness (12-34%)

590. Which anatomical landmark correspond to transverse sinus?

A. Inferior nuchal line
B. Superior nuchal line
C. Asterion
D. Pterion
E. Highest nuchal line

Ans. B.

- Superior nuchal line correspond to transverse sinus
- Asterion at junction of lambdoid occipito mastoid, parietomastoid suture marks the junction of transverse and sigmoid sinus

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591. Burst lobe is often referred to as the combination of

A. Acute SDH + extensive lobar contusion
B. Extensive lobar contusion + intracerebral hemorrhage
C. Acute SDH + extensive intracerebral hemorrhage
D. Acute SDH + extensive lobar contusion + intracerebral hemorrhage

Ans. D.

592. Following statements are true

A. Extradural Hematoma crosses both midline and suture line
B. Subdural Hematoma crosses both midline and suture line
C. Extradural Hematoma crosses midline but does not cross suture line
D. Subdural Hematoma crosses midline but does not crosses suture line
E. Subdural Hematoma crosses suture line but does not cross midline

Ans. C and E.

593. A patient is brought to the emergency who has suffered head injury. CT scan appear normal and no visceral injury. The patient dies soon. Which of the following statements are true regarding the case?

A. On histopathology cluster of microglia (microglial star) can be found
B. Axonal retraction ball may be seen
C. Antibody against B-amyloid precusor protein can be demonstrated
D. All of the above

Ans. D.

- These all are indicative of diffuse axonal injury

594. Factors predisposing to chronic subdural hematomas

A. Low intracranial pressure
B. Cerebral atrophy
C. All coagulopathies
D. Anticoagulant
E. Alcoholics

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Ans. All of the above are true

- Low ICP → overdrainage of CSF, VP shunt, dehydration, spinal anaesthesia
- Alcholics → More prone to develop SDH ↑ rate of accident secondary coagulation disturbance vascular fragility as a result of avitaminosis

595. About post-traumatic epilepsy

A. Seizure presenting after 24hr is more common than within 24hr
B. AED do not reduce the frequency of late PE but have effect on the early PE
C. Fe (ferritin) and Hb are epileptogenic as they decrease the release of inhibitory neurotransmitter
D. Cerebral contusion, peneterating SDH injury depressed skull fracture have more incidence of late PTE
E. Hereditary factor probably does not play any role in PTE

Ans. B to E.

- In adults in case of moderate, and severe head injury there is relation between early and late PTE
- After trauma most seizures occur within <24hr

596. Incidence of CSF rhinorrhea following transphenoidal surgery is

A. 3% to 6%
B. 13% to 16%
C. 23% to 26%
D. 1% to 3%

Ans. A

597. About CSF leak

A. Post traumatic CSF rhinorrhea occur in about 2% of closed head injuries and in 9% patients with penetrating head injuries
B. In majority of patients, the CSF leak occur soon after the injury or within 48hr of trauma
C. In 50% of cases, the leak abolishes at the end of first week and almost all stop by 6 months
D. The risk of meningitis is 3% to 11% in patients who have post traumatic CSF rhinorrhea
E. In non-traumatic CSF rhinorrhea, conservative treatment has no role to play

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Ans. All of the above are true

- Prophylactic antibiotics have not been shown to be effective in the prevention of meningitis and are no longer given for closed post-traumatic leaks
- The roof of ethmoid, the cribiform plate are the most frequent site of CSF rhinorrhea

598. Indication for early treatment of carotico-cavernous fistula are

A. Progressive visual failure
B. Early filling of cortical veins
C. Extension into air sinus
D. Disfiguring progressive proptosis
E. Subarachnoid hemorrhage

Ans. All of the above are true

- Also intracerebral bleed
- ICA ligations today have almost no role in CCF (traumatic) management and traping of ICA leads to opening of collateral and recurrence of Carotid Cavernous Fistula
- Endovascular treatment is the safest mode of treating these cases

599. Which statements about optic nerve are correct?

A. It contains about 1 million fibres
B. The intracanalicular portion is relatively avascular and fixed to periosteum and supplied by centripetal branches of pia and is 4-10 mm in length
C. During head injury, the most frequent field defect is temporal field defect
D. The introocular portion is 30mm in length

Ans. A to C.

- Optic nerve is around 5 cm in length. 4 parts
- Intraocular → 1-2 mm
- Intraorbital → 25-30 mm [longest]
- Intracanalicular → 4-10 mm
- Intracranial → 10-15 mm
- Develop from optic stalk

Note: Temporal field defect is due to relative involvement of nasal fibres as the bone on the medial side of the orbit is thin and is likely to fracture frequently

600. Which of the part of the optic nerve is the longest?

A. Intraocular
B. Intraorbital
C. Intracanalicular
D. Intracranial

Ans. B.

601. Secondary brainstem hemorrhage is more frequent in

A. Tectum of midbrain and pons
B. Tegmentum of midbrain and tectum of pons
C. Tectum of midbrain and tegmentum of pons
D. Tegmentum of midbrain and pons

Ans. D.

- Hemorrhage is bilateral and paramedian in position. Primary lesions are less common in tegmentum

602. Which of the following modalities is being used recently in patients of vegetative state due to head injury?

A. Periaqueductal gray matter stimulation
B. Periventricular gray matter of stimulation
C. Anterior column stimulation
D. Dorsal column stimulation

Ans. D.

- Treatment of persistent vegetative state is an unsolved problem. Recently role of dorsal column stimulation (DCS) has been shown to have some role of the management of intractable pain or spasticity and in vegetative states

603. Which of the following segments of the optic nerve is most common one damaged with closed head injury?

A. Intraocular
B. Intraorbital
C. Intracanalicular
D. Intracranial

Ans. C.

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604. How many percent of patients with closed head injury and having normal CT scan will have intracranial hypertension?

A. 13%
B. 3%
C. 23%
D. 33%

Ans. A.

- 60% of patients with closed head injury and an abnormal CT will have ICHTN
- Patients with a normal CT and 2 or more risk factors will have 60% risk of Ic-HTN
- Risk factor for Intracranial-Hypertension with a normal CT
- Age > 40 year
- SBP < 90mmHg
- Decerebrate or Decorticate posturing on motor examination (unilateral or bilateral)
- If only 1 or none are present, ICP will be increased in only 4%

605. Neurofibrillary tangles are found in

A. Progressive supranuclear palsy
B. Post encephalitic parkinsonism
C. ALS – parkinsonism/dementis complex of guam
D. Chronic traumatic encephalopathy
E. Idiopathic parkinsonism

Ans. A to D.

- In idiopathic parkinsonism, lewy bodies (intracytoplasmic eosinophitic bodies) are found. They are however characteristic of Alzhiemer's disease

606. Histologically, which of the following is almost invariable accompaniment of Alzheimer's disease?

A. Neuritic plaque
B. Neurofibrillary tangles
C. Amyloid angiopathy
D. Hiranobody [granulovascular degeneration]
E. Lewy body

Ans. C.

- Amyloid angiopathy gives rise to lobar hemorrhage

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607. Among which of the following incomplete spinal cord injury has the best prognosis?

A. Anterior cord syndrome
B. Posterior cord syndrome
C. Central cord syndrome
D. Brown-Sequard syndrome

Ans. D

- B-S syndrome has the best prognosis of any of the incomplete spinal cord injuries = 90% of patients with this condition will regain the ability to ambulate independently as well as anal and urinary spincter control
- In central cord syndrome (cord contusion without hematomyelia), = 50% will recover enough lower extremity strength and sensation to ambulate independently although typically with significant spasticity

608. About ligaments of the occipito atlanto-axial complex

A. Posterior atlanto-occipital membrane is a continuation of posterior longitudinal ligament
B. Apical ligament is formed by proatlas or fourth occipital scleretome
C. Tectorial ligament is an extension of anterior longitudinal ligament and along with alar ligament help in occipito atlanto stability
D. Transverse ligament is the key ligament in maintaining altanto-axial stability
E. In atlanto-occipital dislocation traction is usually avoided and posterior occipito cervical fusion recommended

Ans. B, D and E.

- Tectorial ligament is an upward extension of the posterior longitudinal ligament. The most important structures in maintaining atlanto-occipital stability are the tectorial membrane and the alar ligaments

609. How much will be the sum total overhang of both C1 lateral masses on C2 that will indicate that transverse ligament is probably disrupted?

A. $\geq$ 4mm
B. $\geq$ 5mm
C. $\geq$ 6mm
D. $\geq$ 7mm

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Ans. D.

- >7mm, it is also called Rule of Spence

610. About Jefferson fracture

A. Unstable but does not have neurological deficit
B. Mechanism is hyperextension and distraction
C. About 41% of cases are associated with C2 fracture, among which type II odontoid is most common (40%)
D. Type II odontoid # ≥ 6mm displacement with Jefferson fracture is treated by open reduction internal fixation
E. As such Jefferson is treated by collar or SOMI brace

Ans. A, C to E.

- Mechanism is axial loading with neck in neutral position
- Hangman fracture (Bilateral Pedicle # of C2 through pars interarticularis). two mechanisms are present in Judicial hanging—hyperextension and distraction. In vehicular accident there is hyperextension and axial loading

611. Which of the following fractures are unstable?

A. Jefferson fracture
B. Type I and II hangman's #
C. Type III hangman's #
D. Type II odontoid fracture
E. Type III odontoid fracture

Ans. A, C and D

- Jefferson # → unstable
- Type I Hangman's # → stable
- Type III Hangman's # → unstable
- Type I odontoid → unstable (controversial)
- Type II odontoid → unstable
- Type IIA odontoid → unstable
- Type III odontoid → stable
- Wedge compression lumbar # → stable
- Burst lumber # → unstable
- Seat belt # → unstable
- Fracture dislocation → unstable
- True tear drop # → unstable (often require stabilization)

612. Cerebrovascular resistance is affected by $PaCO_2$ such that there is a linear increase in CBF with increasing $PaCO_2$ within the range of

A. 40 – 70mmHg
B. 30 – 80mmHg
C. 20 – 80mmHg
D. 20 – 60mmHg

Ans. C

613. The coupling ratio (CBF / $CMRO_2$) in normal quiescent brain is

A. 10 - 14
B. 14 - 18
C. 24 - 28
D. 34 - 38

Ans. B.

- With focal cortial activity, local CBF increases = 30% while $CMRO_2$ increases 5%
- $CMRO_2$ = 3.0 – 3.8ml/100gm tissue/min

614. Lacunar strokes is diagnosed by the presence of the following

A. Aphasia
B. Sensorimotor CVA
C. Monoplegia
D. Homonymous hemionopia
E. Pure sensory CVA

Ans. E.

- Lacunar strokes diagnosis virtually excluded by Aphasia, apractagnosia, sensorimotor CVA, monoplegia homonymous hemianopia, severe impairment, stupor, coma, LOC or seizures
- Pure sensory CVA (most common manifestation)
- Pure motor hemiparesis (2nd most common)
- Typical location for lacunar strokes in descending frequency is Putamen > caudate > thalamus > Pons > IC > convolutional white matter

615. Anterior choroidal artery syndrome result in

A. Hemihyperpathia
B. Hemihyperalgesia
C. Hemihypesthesia
D. Homonymous hemianopia
E. Contralateral hemiplegia

Ans. D and E.

616. Refractory cases of cluster headache can be treated by radiofrequency ablation of

A. Nodose ganglion
B. Pterosal ganglion
C. Otic ganglion
D. Spiral ganglion
E. Sphenopalatine ganglion

Ans. E.

617. An elderly patient present with sudden headache and unilateral pupilary dilatation, the differential diagnosis will be

A. Superior cerebellar artery aneurysm
B. Posterior communicating artery aneurysm
C. Posterior cerebral artery aneurysm
D. Putaminal hemorrhage
E. Cerebellar hemorrhage

Ans. A to D. E is false

618. Bitemporal hemianopia can be present in the following situation

A. Pituitary adenoma
B. Craniopharyngioma
C. Superior hypophyseal artery aneurysm
D. Basilar bifurcation aneurysm or Basilar tip aneurysm
E. Ophthalmic artery aneurysm

Ans. A to D.

- Pituitary adenoma causes bitemporal hemianopia, compression comes from below
- Craniopharyngioma causes bitemporal hemianopia, compression comes from above
- Superior hypophyseal artery aneurysm only suprasellar variant not paraclinoid, compress pituitary stalk and cause hypopituitarism and classic chiasmal visual symptoms (bilateral temporal hemianopsia)
- Enlargement of the basilar artery aneurysm may rarely compress the optic chiasm leading to bitemporal field cut (mimicking pituitary tumor or occasionally may compress the third nerve as it exits from the interpeduncular forsa causing occulomotor nerve palsy)

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619. Conditions causing unilateral compressive occulomotor nerve palsy

A. Post-comm artery aneurysm
B. Basilar tip aneurysm or Basilar bifurcation aneurysm
C. Superior cerebellar artery aneursym
D. Posterior cerebral artery aneurysm
E. Transtentorial herniation or uncinate herniation

Ans. A to E

620. Post traumatic carotid dissection is due to which mechanism of injury

A. Hyperflexion
B. Hyperextension
C. Hyperflexion with lateral rotation
D. Hyperextension with lateral rotation

Ans. D.

- Hyperextension with lateral rotation

621. Following statement regarding CT in SAH

A. CT performed 72 hours after SAH is more sensitive than CT within 24 hours
B. Modern CT is able to detect SAH in a least 90% of patients within 24 hours
C. Modern CT is sufficiently sensitive than LP, it is seldom necessary if the CT is normal
D. If CT suggest SAH, LP is done for confirmation
E. All of the above are true

Ans. B.

- Modern CT is able to detect 90-95% of subarachnoid hemorrhages but this sensitivity declines by 72 hours of CT. If CT is positive, there is little diagnostic utility of LP, so it usually does not need to be performed. However, if CT is negative in patient with appropriate clinical history, LP should be performed to look for blood

622. The content of interpeduncular cistern are all EXCEPT

A. IIIrd nerve
B. VIth nerve
C. P2 of PCA
D. P1 of PCA

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Ans. C.

- P2 of PCA is present in ambient cistern. Interpeduncular cistern also consist of basal vein of Rosenthal and basilar artery tip. The cerebellomedullary cistern which is continued posteriorly as the cisterna magna contain IX, X, XI, XII, PICA and vertebral artery. Prepontine cistern contain basilar artery. The cerebellopentine cistern contains VII, VIII and branches of AICA. Crural cistern contain posterior choroidal artery

623. Predisposition to intracranial aneurysm occur with which of the following conditions?

A. Autosomal dominant polycystic kidney disease [ADPKD]
B. Ehlers-Danlos Type IV (deficient collagen type III)
C. First degree relative with aneurysmal SAH
D. Neurofibromatosis type I
E. Coarctation of aorta

Ans. All of the above are true

- Also AVM including Moya Moya disease
- Marfan's syndrome pseudoxanthoma elasticum
- Osler–Weber-Rendu syndrome
- Atherosclerosis
- Bacterial endocarditis (3-20%)
- Cigarette smoking

624. Statements regarding meningioma

A. Acoustic schwannoma and meningiomas both are associated with abnormalities of chromosome 22
B. Posterior fossa is the most common location for meningiomas in adults
C. Multiple meningiomas suggest neurofibromatosis type 2
D. Progesterone receptor is found in 50% and estrogen receptor in about 20% of meningiomas
E. Intraventricular position is quite common in children than in adults

Ans. A, C to E. B is false

- Most common location is parasaggital or Falcine (24%) and cerebral convexity (18%)

625. In which age group infratentorial pediatric tumor is commonest?

A. 0-6 month
B. 6-12 month
C. 12-24 month
D. 2-16 year

Ans. C.

- 0-6 month 27%
- 6-12 month 53%
- 12-24 month 74%
- 2-16 year 42%

626. About tumors following statements are

A. Nitrosoureas have good blood brain barrier peneterance which make them attractive as chemotherapy for brain tumors
B. Cyclical vomiting and occipital headache suggest a cerebellar tumor
C. Most primary brain tumors are benign
D. Cerebral PNET's are usually localized and require local radiation after surgery
E. Surgical resection of vestibular schwamomas result in facial paralysis and hearing loss in virtually all patients

Ans. A and B.

- Nitrosoureas such as BCNU and CCNU have better penetrance through the blood brain barrier than most other agents, which makes them used widely for patients with malignant brain tumors (These are lipophilic)
- Cerebellar tumors commonly produce vomiting and occipital headache, although these symptoms are not specific, the majority of primary brain tumors are malignant
- Cerebral PNET, have a propensity to metastasize within the CSF, so total neuraxis radiation is indicated following surgery with current state of the art techniques, facial nerve is preserved in 36% of patients and cochlear function is preserved in 26% of patients

627. Match the following selection of antibiotics to be used in meningitis with following organism

A. Gram +ve cocci → Cephalosporin + Vancomycin
B. Gram +ve bacilli → Ampicillin + Aminoglycoside
C. Gram –ve bacilli → Cephalosporin + Aminoglycoside
D. Gram –ve cocci → Penicillin G

Ans. All of the above are true

- Drug of choice
- *S. Pnumoniae* [PCNG] 2nd choice chloramphenicol
- *N. Meningitides* : [PCNG] 2nd choice chloramphenicol

- *H. Influenzae* (Gram +ve bacilli) (A) Non penicillinase producing → ampicillin (B) Penicillnase producing → chloramphenecol
- Group B streptococus → ampicillin
- L Monocytogens → ampicillin
- S-aureus (A) If MRSA, coagulase negative S-aureus vancomycin + Po Rifampicin + Po Trimethoprim (B) Not MRSA Infant <7d – Methicillin; all others – Nafcillin; PCN allergy – vancomycin or (cefazolin both IV)
- Gram negative rods (A) Ceftriaxone, Cefotaxime,
- *P. aeruginosa* → ceftozidime

628. Match the following

A. Post herpetic neuralgia→ Varicella Zoster virus
B. Neonatal meningitis→ HSV-II
C. Hearing loss beginning in childhood→ CMV (cytomegalo virus)
D. Subacute sclerosing panencphalitis→ Measles [Paramyxo virus]
E. PML (Progressive multifocal leukoencephelopathy) → JC virus SV – 40 virus

Ans. All of the above are true

- Ganciclovir is used for CMV

629. Regarding infections following statement

A. Toxoplasma gondii is carried in birds and cats
B. Cysticercosis is caused by pork tapeworm
C. Echinococcus is usually acquired in the household by close contact with dogs
D. Neurologic complication of trichinosis are usually due to direct muscle innervation

Ans. All of the above are true

- T. gondii is carried by birds which has given the organism a world wide distribution. In the household cat, harbor the organism in the gut
- Patient with trichinosis typically present with fever, periorbital edema and myalgia and may progress to muscle invasive phase with pain swelling and weakness which begin proximally and in extra ocular muscle and become more extensive

630. Following statement regarding EEG are

A. Either 12 hour of observation without a confirmatory test or 6 hours with an isocletric EEG are sufficient to establish brain death when the cause is known and it is not anoxia
B. There are currently no established criteria for determination of brain death in children younger than 7 days
C. Either 24 hour of observation or 12 hour with a confirmatory test are required for determination of brain death when the cause is anoxia
D. Burst-suppression pattern, periodic triphasic waves, alpha coma suggest a poor prognosis for good neurologic recovery assuming the absence of a sedative

Ans. All of the above are true

631. Following statements regarding brain oedema are

A. Vasogenic oedema is pericellular edema and is caused by disruption of BBB
B. Vasogenic oedema due to tumor respond mainly to corticosteroids
C. Corticosteroids are usually not indicated in head trauma where there is mainly cytotoxic edema
D. Interstitial edema is transependymal edema seen in hydrocephalus
E. In post anoxic edema which is due to brain necrosis only hyperventilation can reduce intracranial vascular volume, temporarily reducing ICP and osmotic agents are of no value because they will leak out of the vessel into damagd brain and have little effect

Ans. All of the above are true

632. Regarding Ca^{2+} disorder

A. Presence of Ca^{2+} on nerve membrane may play a significant role in keeping Na^{+} gate closed
B. A decrease in extracellular concentration of Ca^{2+} causes decreased membrane stability
C. Hyperparathyroidism is the most common cause of hyper calcemia
D. Papilledema can develop as a complication of hypocalcemia with increased intracranial pressure
E. Hypercalcemia produces confusion and weakness but hypocalcemia can produce seizure and ↑ ICP also extrapyramidal signs which have a parkinsonian appearance

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Ans. All of the above are true

- ↓ Extracellular concentration of Ca^{2+} caused Na+ gates to open and membrane protential decrease (depolarization occur)

633. TRUE Statement about the blinking of the eye is

A. Blinking occurs irregularly at a rate of 12-20 times a minute
B. Increased blink frequency ooccurs with sensitization of trigeminal nerve ending
C. Reduced frequency of blinking is less than 10 per minute is characteristic of progressive nuclear palsy
D. Myerson sign is absent in parkinsonism

Ans. D

- In progressive supranuclear palsy and Parkinson's disease, adaptation to repeated supraorbital tapping at a rate of about 1 per second is impaired, therefore the patient continue to blink with each tap on the forehead or glabella. The failure to inhibit this response is reffered to as glabellar or Myerson sign

634. Following statements regarding Edema and CSF circulation are

A. Tamoxifen may produce intracranial hypertension
B. Patient with Diabetic Keto Acidosis are at greatest risk for cerebral edema during the phase of glucose increase
C. Cerebral edema is a greater problem for acute liver failure than chronic liver failure
D. Acetazolamide reduces CSF production
E. Tight junctions are characteristic of brain capillaries but not peripheral vessel

Ans. A, C to E

635. Statements regarding Myelination of brain pathways

A. The corpus callosum does not complete myelinate until mid-adolscence
B. Most cranial nerves are myelinated before the third trimester
C. Myelination commence in the fourth foetal month in the spinal cord motor roots caudal to rostral direction
D. Axon which will myelinate do not function electrically until the myelination is complete
E. Hypothyroidism causes slowed myelination

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Ans. A to C and E

- Myelination of corticospinal tract continue upto end of the second postnatal period
- Myelination of association neocortex extend into the third decade

636. Match the following congenital anomalies with their time of occurrence in utero

A. Lissencephaly→ 8 – 20 weeks
B. Anencephaly → 1 – 4 weeks
C. Myelomeningocele → 1 – 4 weeks
D. Agenesis of the corpus callosum → 4 – 8 weeks

Ans. All of the above are true

- Lissencephaly is due to failure of neuronal migration from the germinal matrix to cortex during 8 – 20 weeks
- Anencephaly is due to failure of closure of the anterior neuropore during 24th day of gestation
- Meningomyelocele is due to failure of closure of the posterior neuropore during 26th day of gestation

637. About Mucopolysaccharidosis statements are

A. Hurler's syndrome (MPSIH) is caused by deficiency of alpha-1-idurodinase
B. Morquio's syndrome (MPS IV) is characterized by severe skeletal deformities and ligamentous laxity
C. Heparan sulfate only is excreted in urine in Sanfilippo's syndrome
D. Hunter's syndrome is characterized by iduronate sulfatase, pebbling of the skin may occur, X linked recessive
E. Morquio's and Scheies syndrome is characterized by normal intelligence

Ans. All of the above are true

- Heparan-N-Sulfatase is deficient in Sanfilippo's syndrome
- L-Iduronidase deficient in Hurler's syndrome
- Iduronate –2-Sulfatase deficient in Hunter syndrome

638. Following statements regarding Dementia

A. Progressive supranuclear palsy cause subcortical dementia
B. Vascular dementia can be both cortical and subcortical dementia
C. Alzheimer's disease causes cortical dementia

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D. Apraxia is a common feature of cortical dementia
E. Psychomotor slowing is a feature of subcortical dementia

Ans. All of the above are true

639. Statement regarding post traumatic epilepsy

A. Post-traumatic epilepsy is more common with depressed skull # than closed head injuries
B. Prophylactic phenytoin decreases the frequency of late onset post-traumatic seizures
C. Subdural hematoma predisposes to development of post-traumatic seizures
D. Children are less likely to develop early post-traumatic epilepsy than adult
E. In children, hereditary history of seizure has no role in early traumatic seizure but has role in late traumatic seizure

Ans. A, C and E.

- Prophylactic phenytoin decreases the chance of early post-traumatic seizure but not late seizures, so long term prophylaxis is seldom indicated, children are more likely than adults to have early post-traumatic seizures

640. Following statements regarding Herpes-zoster are

A. Acyclovir prevents postherpetic neuralagia if given at the onset of the eruption
B. Corticosteroids may reduce the frequency of post herpetic neuralgia
C. Zoster of the geniculate ganglion has a high risk of stroke from carotid involvement
D. Post herpetic neuralgia develops in about 10% of patients with herpes zoster opthalmicus
E. Incidence of thoracic herpetic neuralgia is greater than ophthalmic post herpetic neuralgia

Ans. B and D.

- Acyclovir does not prevent the development of PHN but it reduces acute pain and speeds healing of the lesions. Zoster of the geniculate ganglion does not increase the risk for stroke from carotid involvement. Incidence of ophthalmic PHN is greater than thoracic herpetic neuralgia

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641. Hemifacial spasm is a focal movement disorder which may be difficult to treat. Following statements regarding HFS

A. May be treated by botulinum toxin injection
B. May be treated by microvascular decompression
C. May follow Bell's palsy
D. There may be bilateral involvement
E. Hemifacial spasm and Palatal myoclonus are the only involuntary movements present during sleep

Ans. All of the above are true

642. Regarding Wilson's disease

A. Elevated serum ceruloplasmin
B. Copper deposition in the cornea
C. Seizures are common
D. Fine action tremor is common
E. It is autosomal recessive

Ans. B, D and E.

- Decreased serum ceruloplasmin is present copper is deposited in the descemet's membrane. Seizures are uncommon. Gene on chromosome 13

643. Statements regarding drug induced Parkinsonism

A. 15% of patients on neuroleptics develop parkinsonian features
B. Careful examination can distinguish drug induced from idiopathic parkinsonism in most patients
C. Tremor is less prominent in drug induced parkinsonism than in idiopathic parkinsonism
D. Parkinsonism typically perists for months or years following discontinuation of the neuroleptic
E. Clozapine an atypical neuroleptic do not produce parkinsonism

Ans. A, C and E.

644. Myelomeningocele may be associated with which of the following malformation

A. Polymicrogyria
B. Hydrocephalus
C. Chilari Malformation
D. Syringomyelia
E. All may be associated

Ans. E

- About 100% of patients with myelomeningocele has MRI evidence of Arnold chiari malformation type II

645. Which of the following clinical features would not be expected in patients with Amyotrophic lateral sclerosis?

A. Head droop
B. Muscle fasciculation
C. Muscle cramps
D. Unsteady gait
E. Sphincter dysfunction

Ans. E.

- Head droop can also occur with polymyositis or myasthenia gravis

646. Which is not expected EMG finding in patients with Amyotrophic Lateral Sclerosis?

A. Active dennervation
B. Chronic reinnervation
C. Fasciculations
D. Early recruitment of motor units

Ans. D.

- Reduced number of motor units is expected in patient with ALS. Early recruitment would be expected in myopathic disorders. Fasciculations are not specific for ALS, but are usually identified in patients with ALS. Active denervation and polyphasic motor units indicative of chronic reinnervation are typical

647. Statements pertaining to the type of neuromuscular condition and relevant clinical finding

A. Mild weakness with total areflexia is seen in demyelinating neuropathy such as Guillain-Barre's syndrome
B. Proximal weakness with preservation of distal muscle strength seen in myopathy
C. Dysproteinemias have produced both axonal and demyelinating neuropathies
D. Most toxins produce an axonal neuropathy

Ans. All of the above are true

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648. Match the following

A. Abnormal unpleasant sensation in response to an ordinary non-noxious sensory stimulus → Dysesthesia
B. Abnormal unpleasant spontaneous sensation with a tingling or pricking character → Paresthesias
C. Painful sensation in response to a non-noxious stimulus → Allodynia
D. Exaggerated pain from a noxious stimulus → Hyperalgesia
E. Exaggerated pain from a non-noxious stimulus (emotional continence) → Hyperpathia

Ans. All of the above are true

649. About Entrapment neuropathy

A. Median nerve compression at the wrist is the most common entrapment neuropathy
B. Sensory latency is the most sensitive electrodiagnostic test for carpal turnnel syndrome
C. Pregnancy, AVshunt for hemodialysis obesity all have shown to predispose to carpal tunnel syndrome
D. Extensor carpi radialis longus and brevis, supinator, and extensor carpt ulnaris will be denervated in a patient with lesion of the posterior interosseus nerve
E. Common peroneal nerve (Fibular) is the most common entrapment neuropathy in the leg

Ans. A to C and E.

- Extensor carpi radialis longus and brevis, supinator are supplied by radial nerve. Extensor carpi ulnaris is supplied by posterior interosseus nerve (a pure motor nerve)

650. About Hereditary Motor Sensory neuropathy

A. HMSN-3 is Dejerine – Sottas disease
B. HMSN 4 is usually autosomal recessive
C. HMSN-2 is dominantly inherited axonal neuropathy
D. HMSN-3 has latest onset after age 30
E. Nerve conduction velocity is normal in HMSN-3

Ans. A to C.

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651. Which of the following interventions for Gullerin–Barre syndrome are felt to have documented beneficial effects?

A. Corticosteroids
B. Intravenous immunoglobulin
C. Azathioprine
D. Plasma exchange
E. Cyclophos phanide

Ans. D.

- Corticosteroid, Azathioprine and cyclophosphamide have no beneficial effect

652. Following statements regarding multifocal motor neuropathy and ALS are

A. ALS has weakness most prominent in the arms while MMN has weakness most prominent distally in the legs
B. Muscle cramps and fasciculation are common in ALS but uncommon in MMN
C. Weakness may be profound in muscles of normal bulk in ALS while patients with MMN have weakness proportional to atrophy
D. Depressed tendon reflexes are common in MMN while hyper reflexia is expected in ALS
E. Uppor motor neuron finding in lower limb and lower motor neuron finding in upper limb is seen in ALS

Ans. D and E.

- Both ALS and MMN have weakness which is most prominent in the arms. Muscle cramps and fasciculation are prominent in both conditions. MMN quite typically has muscles which may be profoundly weak despite normal bulk. However, differences in reflexes can be a helpful differentiating tool

653. Features characteristic of critical illness polyneuropathy

A. Flaccid weakness and hyporeflexia
B. Setting of sepsis and multi organ failure
C. Gradual recovery over 3-6 months
D. Prominent distal pain and paraesthesias

Ans. A to C.

- Pain and other sensory symptoms are uncommon in patients with critical illness polyneuropathy

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654. Sweating changes are common in patients with traumatic myelopathy, which of the following indicates the most common sweating disorder with myelopathy

A. Hyperhydrosis above the lesion and anhydrosis below the lesion
B. Anhydrosis above the lesion and hyperhydrosis below the lesion
C. Normal sweating above the lesion and anhydrosis below the lesion
D. Normal sweating above the lesion and hyperhydrosis below the lesion

Ans. A.

- Hyperhydrosis is above the lesion and anhydrosis below the lesion

655. Following statements regarding the sympathetic skin response are

A. The sympathetic skin response is usually absent in axonal neuropathies
B. The SSR is usually preserved in demyelinating neuropathies
C. The SSR is usually absent in autonomic neuropathies
D. Prolonged SSR latency or reduced amplitude indicates incipient autonomic failure regardless of cause

Ans. A to C.

656. Which of the following findings is least likely in patients with generalized myasthenia gravis?

A. Normal Combined Motor Action Potential amplitude
B. Decremental response to repetitive stimulation more prominent in proximal muscle than distal muscles
C. Increased fitter on single fiber EMG
D. Fibrillation potentiale and positive sharp waves in affected muscle

Ans. D.

- Fibrillation potentials and positive sharp waves are a hallmark of muscle fibre excitability and can be seen in myopathies and neuropathies

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657. Following statements regarding Myasthenia gravis

A. Almost all patients with thymoma and myasthenia have elevated AchR-binding antibodies
B. The best response to thymectomy is in young patients early in their disease
C. Anti cholinesterase and Azathioprine not helpful for myasthenic crisis but cortiocosteroid, plasma exchange and IVIG are helpful
D. Anaphylactic reaction in patients with IgA deficiency, Transmission of hepatitis, vascular headache is a legitimate concern with administration of IVIG for myasthenia gravis
E. Cholinesterase inhibitors are the treatment of choice for initial treatment of patients with pure ocular myasthenia

Ans. All of the above are true

- Patient with Myasthenia Gravis without increased antibody may still respond to plasma exchange
- Approx 55% of patients with ocular myasthenia have binding antibodies and approx 80% of patients with generalized myasthenia have binding antibodies
- Thymectomy usually produces maximal improvement 2-5 years after surgery
- Repeat theymectomy can be performed
- Transthoracic thymectomy preferred against endoscopic thymectomy
- Thymectomy may be helpful not only for seropositive patients but also seronegative patients
- Vascular headache may be sufficient to limit the use of IVIG

658. Following statements concering muscle biopsy and diagnosis of neuromuscular condition

A. Dennervation characteristically produces fiber type grouping, best seen on oxidative stains
B. Increased central nuclei are typically thought of as being caused by myopathy although some increase may be seen in neuropathic disorders
C. Perifascicular atrophy is typically seen in patients with dermatomyositis a myopathy but is not typically seen with other myopathies
D. Atrophy of an entire fascicle is typically seen in chronic progressive dennervation
E. Necrosis and phagocytosis of individual muscle fibres is the principle change in polymyositis with large number of T-cells found in the intramuscular inflammatory exudates

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Ans. All of the above are true

- The grouping is due to reinnervation of denervated muscle fibers by adjacent motor nerves

659. The most common agent implicated in Bell's Palsy is

A. HSV-1
B. HSV-2
C. VZV
D. EBV

Ans. A.

- HSV-1 is the most common agent implicated in Bell's Palsy with VZV a distant second

660. Following statements regarding traumatic cauda equina lesions are

A. Incomplete lesions are more likely to spare sensory function than spare motor function
B. Prognosis for motor recovery is poorer than with central cord syndrome
C. Most injuries causing cauda equina damage are as or below the $L_1 - L_2$ level
D. Bowel and bladder incontinence occurs only with complete or near – complete lesions
E. Knee and ankle jerk will be lost as compared to conus syndrome in which knee and ankle jerk are preserved

Ans. A, C and E.

- Prognosis for motor recovery is generally better for patients with cauda equina lesions than central cord lesion because the LMN have greater resilience and regenerative capacity than the upper motor neuron
- Sphincter disturbance is common with cauda equina lesion even in patients with preservation of leg motor function
- Epiconus [L_4, L_5, S_1, S_2] segment conus $\rightarrow$ S_3, S_4, S_5, Co segment cauda equino $\rightarrow$ L_2 – Coccygeal roots

661. Which of the following pathology does not involve disc space?

A. Potts spine
B. Metastasis
C. Pyogenic infection
D. All of the above

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Ans. B

- Of the many lytic or destructive lesions that involve the vertebrae, destruction of the disc space is highly suggestive of infection which often involves at least two adjacent vertebral level. Although tumors may involve adjacent vertebral levels and cause collapse of disc height, the disc space is usually not destroyed, possible exceptions include some vertebral plasmacytomas. Unlike pyogenic infection, the disc may be relatively resistant to tuberculous involvement in Potts disease

662. Following statements regarding lumbar spine disorders are

A. The prognosis of cauda equina compression is better than that of spinal cord compression
B. Urinary incontinence in the absence of other finding is an indication for immediate surgical evacuation
C. The most common cause of cauda equina compression is extrusion of the L4 – L5 disc
D. MRI is the first choice for evaluation of suspected cauda equina syndrome

Ans. All of the above are true

663. Statements regarding Cerebellar hemorrhage are

A. Cerebellar hemorrhage can be treated by ventriculostomy of the lateral ventricle to treat hydrocephalus
B. The prognosis for good neurologic function for patients with cerebellar hemorrhage who require posterior fossa decompression is poor
C. A patient with cerebellar alaxia who develops stupor with a gaze palsy and a facial palsy usually needs decompression
D. A patient with cerebellar ataxia who has horner's syndrome ipsilateral facial sensory loss is likely to require cerebellar decompression
E. If GCS $\geq$ 14 and hemorrhage is less than 4cm decompression is usually not done

Ans. C and E.

- Ventriculostomy with decompression will lead to an upward herniation
- In option 4, it is likely to be PICA syndrome. It has to be differentiated. Because in the setting of lateral medullary syndrome no role for decompression

664. Which of the following is least likely to be helpful for management of vasospasm in patients with SAH?

A. Plasma expansion with colloid
B. Lowering of blood pressure with labetolol
C. Nimodipine
D. Angioplasty

Ans. B.

- Insetting of vasospasm triple (HHH) therapy is instituted i.e. (i) Hypertension (ii) Haemodilution (iii) Hypervolemia
- So lowering of blood pressure with labetelol will lead to further compromise of blood flow [CPP = MAP – ICP] giving labelelol will decrease MAP, ICP is already decreased leading to ↑ CPP

665. Following statements regarding extracranial carotid dissection

A. Angioplasty with stent placement may be performed
B. TIA may develop from extracranial carotid dissection
C. Horner's syndrome is common
D. Anti-cogulation is contraindicated

Ans. A to C.

- Extracranial carotid dissection usually respond to anti-coagulation and surgery is rarely necessary

666. Following statements regarding air way pressure

A. PEEP should be kept below 15cm H_2O to avoid impending venous return and producing hypotension
B. Sustained high PEEP may cause tension pneumothorax
C. High respiratory rate in a patient with COPD may precipitate high airway pressure and subsequent hypotension
D. PEEP is reserved for patients who have impaired oxygenation despite high FIO_2
E. In PEEP the physiological dead space is increased

Ans. A to C and E.

- PEEP is used routinely by most CCU and need not reserved for those with ↑FIO_2 level
- A level of 5cm H_2O is used
- ↑ Airway pressure in a patient with COPD is termed auto PEEP

667. Which of the following procedures should not be used as supportive evidence of brain death?

A. EEG
B. BAEP
C. VEP
D. Ceretral blood flow
E. Apnoea test

Ans. C.

- VEP cannot be used because there is no certainty that the signal has been transduced in the eye and relayed to the brain

668. Which of the following antiepileptic drug act on glutamate receptor?

A. Carbamazepine
B. Felbamate
C. Topiramate
D. Phenobarbital
E. Valproic acid

Ans. A to D.

669. Following statements are regarding acetylcholine receptor

A. Sympathetic ganglion receptors are only nicotinic
B. Motor endplate receptors are muscarinic
C. Patients with myasthenia have increased receptor turnover, causing fewer receptor to be available for binding with acetylcholine
D. Botulinum toxin blocks binding of acetylcholine to the post synaptic receptors
E. Nicotinic receptor on muscle has 4 type of subunits and on ganglia two type of subunits

Ans. C and E.

- Sympathetic ganglion receptors are nicotinic and also muscarinic (M_2)
- Motor endplate receptors are nicotinic Botulinumtoxin blocks the fusion of Ach Vesicle with the membrane. On ganglia there are two type of subunits with combination of any other

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670. Statements regarding the pharmacology of neurotransmitter in the brain

A. Dopamine is metabolized by MAO-A
B. NE and serotonin is metabolized by MAO-B
C. The action of dopamine is ended by enzymatic degradation at the receptor
D. Dopamine is also metabolized by COMT (catechol methyl transferase)
E. Reserpine depletes dopamine by preventing re-uptake into storage vesicles

Ans. D and E.

- Dopamine is metablozied by MAO-B.
- NE and serotonin is metabolized by MAO-A
- Dopamine is subjected to re-uptake before degradation

671. Statements regarding Acromegaly

A. Most peripheral effect of GH is due to (somatomedin C or IGF-I)
B. Carpal tunnel syndrome is common
C. The patient may have a vertex headache
D. Hypotension is common
E. Proximal muscle weakness is common

Ans. A to C and E

- Hypertension is common not hypotension

672. Statements regarding Vestibular control of eye movements

A. The vestibular system stabilizes gaze during head movement
B. The vestibular system initiate eye movement in response to a novel visual stimulus
C. Rotation of the head to the side activates the ampulla of the horizontal semicircular canal on the same side as the rotation
D. Activation of the horizontal vestibular canal results in excitation of ipsilateral abducens nucleus and inhibition of the contralateral abducens nucleus
E. Semicircular canal signals are insensitive to movement at a constant angular velocity

Ans. A, C and E.

- The vestibular system is responsible for stabilization of visual fixation during head movements, but not for initiation in response to stimuli, which is the province of the frontal eye

field and associated connections with other cortical areas. A horizontal semicircular canal is stimulated by warming of the ipsilateral par or rotation of the head to that side. Stimulation of one horizontal semicircular canal results in activation of the contralateral abducens and inhibition of the ipsilateral abducens nucleus such that eyes look toward the opposite side

673. Following statements regarding visual perceptive deficit are

A. True color perception deficit is only due to congenital retinal abnormality
B. Ishihara plates are most sensitive for central (CNS) causes of color perceptive deficit
C. Visual form agnosia prevent patient from navigating through complex environments
D. Prosopagnosia is usually due to a right posterior cerebral lesion
E. V8 area of the visual cortex is responsible for color vision

Ans. D and E.

- True color perceptive defect can be due to central lesions as well as retinal lesions
- The Ishihara plates are designed to identify predominantly color perceptive deficit related to retinal lesions but deficit with central processing can also result the abnormal interpretation of the Ishihara plates
- Patients with visual form agnosia are often able to navigate through novel environment despite their deficit in interpretation of forms

674. What proportion of left handed individuals have the right hemisphere dominant for language function?

A. 90%
B. 70%
C. 30%
D. 15%
E. 10%

Ans. D.

- In human population 91% are right handed. Among them 96% has left hemisphere dominant, and 4% right hemisphere dominant

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- In left handed individuals 70% have left hemisphere dominant, 15% right hemisphere, and 15% no lateralization

675. Statements regarding Cortical function

A. Left hemisphere lesion may produce constructional apraxia
B. Left hemisphere lesion often give more difficulty with writing to dictation than copying written material
C. Ideomotor apraxia can be manifest on examination as difficulty mimicking the examiner's movements
D. Left hemisphere neglect does not occur
E. Lesion of left angular gyrus causes Gerstmann's syndrome

Ans. A to C and E.

- Left hemisphere lesions are less likely to produce constructional apraxia than right hemisphere lesion, but this defect can occur, but has a different character than constructional apraxia due to a lesioin of the right hemisphere
- Ideational or Ideosensory apraxia more involves the performance of a sequence of movement composing a previously learned task

676. Regarding Neuroimaging

A. Functional MRI has best spatial resolution
B. SPECT has least sensitivity to patient co-operation and motion
C. PET has best absolute quantification of neuronal function
D. In PET patient in complex partial seizures, there is focal zone of hypometabolism in the interictal state which becomes hypermetabolic during seizures
E. Volume flow rate is the best indication of the degree of stenosis in Doppler ultrasound

Ans. All of the above are true

677. Statements regarding Neuroimaging

A. MRA tend to over estimate the degree of carotid artery stenosis
B. CT angiography is less susceptible than MRA to errors introduced by tortuosity of the vessels
C. CT angiography has better localization of the level of the carotid bifurcation than MRA
D. Spinal vessels cannot usually be visualized well on MRA
E. CT aniography is relatively insensitive for ulcerated plaques

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Ans. All of the above are true

- MRA cannot detect virtually all intracranial aneurysm in a co-operative patient
- MRA and carotid Doppler sonography have comparable sensitivity and specificity
- Flow gap is not due to technical issues
- MRA has better visualization of tandem lesion than CT angiography
- CT angiography is more sensitive for level of moderate to high grade stenosis than MRA
- MRA can visualize venous thrombosis well.
- MRA provide direction of flow which CT angiography does not provide

678. Regarding Neuroimaging

A. Fat suppression techniques on MRI are used for visualization of skull based and orbital lesions
B. CSF appear bright on T-2 weighted images and dark on FLAIR images
C. Medulloblastoma appear high density on CT and isointense on T2 wt. MRI
D. MRI is less sensitive to subarachnoid blood than CT
E. MRI with contrast is the best screening test for cerebral metastases of systemic neoplasm

Ans. All of the above are true

- Fluid-attentuated inversion recovery (FLAIR) produces attenuation of CSF signal whereas white matter lesion remain bright
- MS plaques appear hyperintense on both T-2 wt. image and FLAIR
- Frontal and temporal atrophy are charactesistic of Pick's disease rather than Parkinson's disease
- MRI does not show subarachnoid blood acutely because, methemoglobin has not yet formed in sufficient quantities to be visualized
- MRI in acute herpes encephalitis shows increased intensity on T-2 wt. image in the anterior temporal and inferior frontal lobe
- Nerve root avulsions may be detected better on post myclogrophic CT than on MRI

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679. Demyelinating neuropathy will produce following neurophysiologic finding

A. Increased F-wave latency
B. Slowed nerve conduction velocities
C. Increased distal motor latency
D. Dispersal of the compound motor action potential

Ans. All of the above are true

- Dispersal of the compound motor action potential waveform is because the change in conduction velocity is to a different extent in different axon

680. Increased Jitter on single-fiber EMG can occur in all of the following EXCEPT

A. Myasthenia Gravis
B. Lambert-Eaton myasthenic syndrome
C. Partial dennervation
D. Muscular dystrophy
E. All of the above

Ans. E.

- While neuromuscular transmission defect such as myasthenia gravis and Lambert-Eaton myasthenic syndrome are the classically described cause of increased jitter

681. Fasciculation potential is present in

A. Amyotrophic Lateral Sclerosis
B. Spinal Muscular Atrophy
C. Acetylcholinesterase toxicity
D. In the legs in cervical myelopathy

Ans. All of the above are true

682. Myokymic discharges are common in

A. Radiation plexopathy
B. Brain stem tumor
C. Multiple sclerosis
D. Neoplastic infiltration of a plexus

Ans. A to C.

- Neoplastic infiltration typically does not produce myokymic discharges, a fact that help to differentiate this condition from radiation plexopathy, in which myokymic discharges are common

683. Following statements regarding vascular imaging

A. Diagnosis of suspected AVM is best performed by MRI with MRA
B. Duplex USG has diagnostic sensitivity for carotid plaque and ulceration which is comparable to that of a conventional angiography
C. Magnetic resonance angiography tends to over estimate the level of carotid stenosis
D. Conventional angiography should be performed on all patients with transient cerebral ischemia in the carotid circulation

Ans. A to C.

684. Elevated CSF protein content is present in

A. Pseudotumor cerebri
B. Guillain – Barre syndrome
C. CIDP
D. Spinal cord compression
E. Tuberculous meningitis

Ans. B to E.

- Pseudotumor cerebri increases ICP but CSF protein remain normal or even low but is NEVER RAISED

685. Statements regarding lumbar radiculopathy are

A. L3 radiculopathy can produce a depressed knee reflex
B. Patients with fibromyalgia usually have spinal pains spanning multiple dermatomal distribution
C. A knee reflex graded 3 is pathologic and indicates a cortiospinal lesion
D. Weakness of the extensor hallucis longus may be the only clinical sign of L5 radiculopathy
E. Isolated back pain without extremity pain, numbness, or weakness is seldom due to focal lumbar radiculopathy

Ans. A, B, D and E.

- Knee reflex grade 3 is hyperactive but is not always pathological, it can be due to anxiety

686. Neurogenic claudication due to lumber stenosis and peripheral arterial claudication concerning statements are

A. Both produces pain which is prominent with walking but is alleviated by sitting

B. Both can produce distal leg pain
C. Standing is most likely to alleviate pain of peripheral vascular claudication
D. Both are related to reduced blood flow and change in metabolic pathway for energy production
E. Anthropoid posture is characteristic for neurogenic claudication

Ans. All of the above are true

687. Carpal tunnel syndrome will produce following clinical finding

A. Electric sensation in digit 1 and 2 with percussion of the wrist crease over the median nerve
B. Decreased sensation over the thenar eminence
C. Increased distal latency of motor fibers to the abductor pollicisbrevis
D. Increased distal latency of motor fibers to the opponent pollicis
E. Denervation of the median innervated portion of the flexor digitorum profundus

Ans. A, D and E

688. Which of the following nerve is not a branch of the sciatic nerve?

A. Superficial peroneal
B. Saphenous
C. Sural
D. Lateral cutaneous nerve of the call
E. All are branches of the tibial

Ans. B

- Saphenous nerve is a branch of femoral nerve

689. Match the following muscle with the root which is most responsible for its innervation

A. Tibialis anterior/L4
B. Extonsor hallucis longus/L5
C. Deltoid/C5
D. Gastrocnemius/S1
E. Brachiordialis/C6

Ans. All of the above are true

690. Left hemiparesis from a Cortical lesion, such as MCA CVA would be expected to produce

A. Deltoid weakness more prominent than hand intrinsic muscle weakness
B. Proximal lower limb muscle weakness more than distal muscle
C. Deficit in visuospatial orientation
D. Left hemianopia
E. Neglect

Ans. B to E

- With hemiparesis or monoparesis from cerebral cortical lesions, distal muscles are usually affected more prominently than proximal muscle, especially for the arm. With MC Alesion Proximal muscle of the leg may be more affected than distal muscle because the vascular supply to the proximal leg overlaps between MCA and ACA whearas cortex serving the lower limb is clearly in the ACA distribution

691. Statements regarding cerebellar ataxia

A. Hemisphere lesions produce predominantly appendicular ataxia
B. Paraneoplastic cerebellar degeneration may cause predominantly gait and leg ataxia relatively sparing arm coordination
C. Ataxia due to lesion of the vermis may have relatively preserved appendicular coordination
D. The phylogenetically oldest portion of the cerebellum serves appendicular coordination
E. Medulloblastoma produces truncal ataxia rather than gait or leg ataxia

Ans. A, B, C and E. D is false.

- Lesion of the cerebellar hemisphere produce predominantly limb incoordination rather than gait ataxia. Vermis lesion produces predominantly gait ataxia with relative preservation of appendicular coordination paraneoplastic cerebellar degeneration commonly produces gait and leg ataxia.

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692. Potential causes of Internuclear ophthalmoplegia includes

A. Multiple sclerosis
B. Cerebral hemorrhage with herniation
C. Lacunar infarction
D. Myasthenia gravis

Ans. A to C

- Medial rectus paralysis or weakness look like INO but it is not INO

693. Parinaud syndrome or dorsal midbrain syndrome can be caused by

A. Pineal tumor
B. Aqueductal stenosis
C. Vascular malformations
D. Stroke
E. Multiplesclerosis

Ans. All of the above are true

- Trauma also

694. Statements regarding skull are

A. Anterior cranial fossae is formed by cribriform plate of ethmoid, frontal bone body of sphenoid and lesser wing of sphenoid
B. Middle cranial fossae is formed by body of sphenoid, greater wing of sphenoid, squamous part of temporal bone and pterous part of temporal bone
C. Posterior cranial fossa is formed largely by occipital bone and pterous part of temporal bone
D. Superior, Middle and inferiorconchae are part of ethmoid bone
E. Nasal septum is formed by perpendicular plate of ethmoid and vomer bone

Ans. A to C and E

- Ethmoid bone contain following parts
  - Cribriform plate
  - Crista galli
  - Sup nasal conchae
  - Middle nasal Conchae
  - Perpendicular plate of ethmoid
  - Inferior conchae is an independent bone attatched to maxilla

695. Statements regarding the skull are

A. Optic canal lies between the body of the sphenoid and its lesser wing
B. Superior orbital fissure is bounded above and medially by the lesser wing of the sphenoid and below and laterally by the greater wing of sphenoid
C. Inferior orbital fissure is bounded above and laterally by the greater wing of the sphenoid and below and medially by the orbital surface of the maxille and is continuous anteriorly with the infraorbital groove which open on the surface through the infraorbital foramen
D. Superior nuchal lines run laterally from external occipital protuberance and inferior nuchal line run laterally from external occipital crest
E. Four bones, the parietal, frontal, sphenoid (greater wing) and temporal (squamous part) form the pterion

Ans. All of the above are true

696. Which of the following are openings of the pterygoplatine fossa?

A. Foramen ovale
B. Foramen rotundum
C. Greater palatine canal
D. Palatinovaginal canal
E. Sphenopalatine foramen

Ans. B to D

- Opening into pterygopalatine fossa are
- Inferior orbital fissure communicate to orbit
- Foramen rotundum communicate to middle fossa
- Petrygoid canal communicate to foramen lacerum
- Palatinovaginal canal
- Sphenopalatine foramen communicate to nasal only
- Greater palatine canal communicate posterior part of palate

697. Which of the following bone form the medial wall of the orbit?

A. Greater wing of sphenoid
B. Body of sphenoid
C. Ethmoid
D. Lacrimal bone
E. Orbital plate of palatine

Ans. B to D

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698. Which of the following foramina are present in the greater wing of sphenoid?

A. Foramen rotundum
B. Foramen ovale
C. Emissary sphenoidal foramen
D. Foramen spinosum

Ans. A, B and D

699. Structures passing through the tendinous ring (annulus of zinn) of superior orbital fissure are

A. Superior ophthalmic vein
B. Trochlear nerve
C. Abducent nerve
D. Nasocilliary branch of Vth nerve
E. Lacrimal branch of Vth nerve

Ans. C and D.

- Structures passing through superior orbital fissure—Upper and lateral part are trochlear nerve, Frontal and lacrimal branch of Vth, recurrent branch of the ophthalmic superior ophthalmic vein
- Middle within the Tendinous Ring or Occulomotor Foramen passes
- Superior and inferior division of occlumotor nerve
- Abducens nerve
- Naso-cilliary nerve branch of V nerve
- And Lower part contain inferior ophthalmic vein

700. Structures passing through the foramen ovale are

A. V2 (maxillary branch of V cranial nerve)
B. V3 (mandibular branch of V cranial nerve)
C. Accessory meningeal artery
D. Emissary vein connecting cavernous sinus to pterygoid venous plexus
E. Lesser pterosal nerve

Ans. B to E

- V2 (maxillary branch of V cranial nerve passes through foramen rotundum
- Lesser pterosal nerve passes through canalis innominatus but when it is absent it passes through foramen ovale

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701. Statements regarding the skull

A. Through anterior part of juglar foramen inferior pterosal sinus pass
B. Through middle part of the jugular foramen cranial nerve IX, X, XI and meningeal branch of ascending pharyngeal artery pass
C. Posterior part contain the sigmoid sinus, emissary vein connecting sigmoid sinus to occipital vein and meningeal branch of the occipital artery
D. Nerve of pterygoid canal is formed by combining of deep pterosal nerve and greater pterosal nerve
E. Foramen magnum transmit spinal cord through it

Ans. A to D

- Foramen magnum transmit lower medulla which continue as spinal cord lower down

702. Structure opening into the middle meatus of the nasal cavity are

A. Maxillary sinus
B. Frontal sinus
C. Nasolacrimal canal
D. Anterior ethmoidal sinus
E. Posterior ethmoidal sinus

Ans. A to D.

- Sphenoid sinus open into the sphenoethmoidal recess above the superior concha
- In the superior meatus, posterior ethmoidal sinus and sphenopalatine foramen opens
- Into the ethmoidal infudibulum opens the for frontal sinus, and anterior ethmoidal sinus
- Maxillary sinus open into the hiatus semilunaris
- Nasolacrimal canal opens into the inferior meatus middle ethmoidal sinus opens into ethmoidal bulla

703. About Ossification of skull

A. Inferior nasal concha and ethmoid are formed due to ossification of cartilage
B. Mandible, sphenoid, occipital, temporal are formed partly in cartilage and partly in membrane
C. Frontal bone has two centers of ossification on each side and at birth, the two halves are united by a midline suture called the metopic suture

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D. Ethmoid bone has three centers of ossification
E. Basilar part of the occipital bone fuses with the corresponding part of the sphenoid bone between 18 and 25 years

Ans. All of the above are true

704. Conditions involving the Abducen's nerve or causing its paralysis are

A. Pseudotumor cerebri
B. Sphenoid sinusitis
C. Gardenigos syndrome
D. Carotid cavernous fistula
E. Clival fracture

Ans. All of the above are true

705. Regarding the cerebellopontine angle neuromas

A. Acoustic neuroma show "transhiatal" extension from posterior fossa to middle fossa
B. Facial neuroma shows spread across the midpetrosal bone
C. Trigeminal neuroma shows trans apico pterosal extension
D. Facial neuroma tend to erode the anterosuperior aspect of the IAC
E. Acoustic neuroma tend to enlarge the IAC

Ans. All of the above are true

706. Nystagmus (to and fro movement of the eye ball)

A. Is not seen in people whose nervous system is normal
B. May result from disease of the cochlea
C. Is a feature of cerebellar disease
D. Does not affect the acuity of vision
E. Result from cerebral lesion

Ans. C

707. Statement about first order neuron

A. Tactile receptor pass up the spinal cord in the ipsilateral column to the medulla
B. Pressure receptors synapse in the dorsal horn with second order neurons which pass up the contralateral ventral spinothalamic tract to the thalmus
C. Touch and pressure receptors are not segregated from one another in the spinal cord

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D. Touch and pressure receptors are well characterized by all of the above statements
E. Sensory neurons are not segregated in the spinal cord by function

Ans. A to D

708. Unipolar or pseudounipolar neurons are present in

A. Cranial nerve ganglia
B. Dorsal root ganglia
C. Mesencephatic nucleus of the trigeminal nerve (cranial V)
D. Vestibular ganglia
E. Spiral ganglia

Ans. A to C

- Vestibular and spiral ganglia contain the bipolar neuron
- Also in the eye and olfactory neuron

709. Following structures are derived from alar plate

A. Nucleus ambigus [SVE]
B. Nucleus solitarius [GVA + SVA]
C. Inferior olivary nucleus
D. Pontine nucleus
E. Hypoglossal nuclei [GSE]

Ans. B to D

- Nucleus ambigus develop from basal plate and hypoglossal nuclei

710. Regarding lesions of the central nervous system

A. In lateral medullary syndrome, there is contralateral long tract sign
B. In medial medullary syndrome, tongue deviation is toward contralateral site
C. In Arnold chiari malformation II tectal beaking is characteristic
D. In Millard Gubler syndrome, there is ipsilateral loss of lateral gaze to that side
E. In weber syndrome there is ipsilateral long tract sign

Ans. A, C and D

- XII nerve → (ipsilateral deviation not contralateral deviation

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711. Which of the following cause myelopathy?

A. Varicella Zoster Virus
B. HSV-II
C. HSV-I
D. CMV
E. HTLV-I

Ans. A, B, D and E

- Varicella Zoster Virus → Necrotizing myelopathy
- HSV-II → Ascending myclitis
- Cyto Megalo Virus → Transverse myelitis

712. Statement regarding auditory system

A. In auditory receptors (hair cells) deflection of stereocillea toward the basal body causes depolaristion
B. Deflection of stereo cilia of hair cells away from the basal body would hyperpolarise the cells
C. The hair cells depolarize when stereocillia moves away from limbus and basilar membrane move upward
D. The hair cell hyperpolarize when stereocillia moves toward the limbus and basilar membrane move downward
E. Regarding primary auditory cortex the anterior part receive only low frequency tone arising from apex of the cochlea and the posterior part of the gyrus receives impulses arising from the base of the cochlea i.e. high frequency

Ans. All of the above are true

713. Disease affecting lower motor neurons are

A. Poliomyelitis
B. Amyotrophic Lateral Sclerosis
C. Werdnig Hoffman disease
D. Kugelberg – welander disease
E. Tetanus

Ans. All of the above are true

714. GSE fibers are contained in the

A. III
B. V
C. VII
D. XI
E. XII

Ans. A and E.

715. SSA fibers are contained in the cranial nerves

A. I
B. II
C. IV
D. VIII
E. X

Ans. B and D.

716. About sulcus

A. Central sulci is a limiting sulcus
B. Calcarine sulcus is an example of axial and complete sulcus
C. Lunate is an operculated sulcus
D. Parieto occipital sulcus is associated with the development of the corpus callosum
E. Lateral sulcus is an example of secondary sulcus

Ans. All of the above are true

717. Match the following Neurotransmitter with the site

A. Ventral tegmentum → Dopamine
B. Dorsal tegmentum → Enkephalin
C. Lateral legmentum → Norepinephrine
D. Pars reticulata of substatia nigra → Dopamine
E. Locus ceruleus → Norepinephrine

Ans. A, B, C and E

- Pars compacta of substantia nigra - Dopamine
- Pars reticulata of substantia nigra → GABA

718. Which layer of cerebral cortex is the major source of corticothalamic fibres is

A. Layer II (External granular layer
B. Layer III (External pyramidal layer)
C. Layer IV (Internal granular layer)
D. Layer V (Internal pyramidal layer)
E. Layer VI (Multi form layer)

Ans. E.

719. Regarding pathophysiology of pain

A. Ascending pathway consist of spinoreticular fibre projecting pain impulses to the periaqueductal gray of the midbrain

B. Excitatory neurons of the periaqueductal gray project to the nucleus raphae magnus of the pons
C. Excitatory neurons of the nucleus raphe magnus project serotonergic fibre to enkephalinergic inhibitor neurons of the substantia gelatinosa
D. Enkephalinergic neurons of the substantia gelatinosaa inhibit afferent pain fibers (substance P) and tract neurons that give rise to the spinoreticular and spinothalamic tract
E. Descending ceruleospinal pathway from the locus cerulus is thought to directly inhibit tract neurons that give rise to ascending pain pathways

Ans. All of the above are true

720. Thalamic nuclei having sensory function are all EXCEPT

A. VPL nuclei
B. VPM nuclei
C. LD nuclei
D. MGB nuclei
E. VL nuclei

Ans. C and E.

- VL is a motor nuclei
- LD is a limbic nuclei

721. Neurofibrillary tangles are found in

A. Progressive supranuclear palsy
B. Alzheimer's disease
C. Pick's disease
D. Dementia complex of Guam
E. Post encephalitic parkinsonism

Ans. A, B, D and E.

- Also in chronic traumatic encephalapathy

722. Phenytoin causes following side effects except

A. Nystagmus
B. Vertigo
C. Diabetes Insipidus
D. SIADH

Ans. D

- It is a side effect of carbamazepine causing retention of water and hyponatremia in elderly

723. All of the following are nerve supplying dura mater except

A. Mandibular nerve
B. Anterior ethmoidal nerve
C. Posterior ethmoidal nerve
D. Auricotemporal nerve

Ans. D

724. True regarding cilliary ganglion is

A. Lies near apex of orbit, between optic nerve and medial rectus
B. Preganglionic fibre comes from EW nucleus
C. Sensory root comes from lacrimal nerve
D. Sensory fibres relay in the ganglion

Ans. B.

- Option 1 should be between optic nerve and lateral rectus
- Option 3 should be sensory root comes from nasocilliary nerves
- Option 4 should be sensory fibres passes through the ganglion

725. Chromosomal alteration associated with medulloblastoma is

A. 17P
B. 6Q
C. 16Q
D. 1P
E. 19Q

Ans. A, C

- Chromosome alteration include 1q, 8p, 10q, 16q, 17p. Deletions on chromosome 1q and 10q are found in 20-40% of MB. Sonic hedge hog (shh) pathway, wingless (wnt) and ErB signaling pathway are defective in MB.

726. Chromosomal alteration associated with meningioma is

A. 19Q
B. 20Q
C. 22P
D. 22Q

Ans. D.

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727. Chromosomal alteration associated with oligodendroglioma is

A. 1P
B. 9P
C. 19Q
D. 22Q
E. 6Q

Ans. A and C.

728. According to WHO classification Grade I astrocytic tumor include all Except

A. Subependymal giant cell astrocytoma
B. Pleomorphic xanthoastrocytoma
C. Juvenile pilocytic astrocytoma
D. oligodendroglioma

Ans. D.

729. A young hypertensive housewife suddenly severe right retro-orbital pain, prostration and a right–third cranial nerve palsy. The most probable cause is rupture of aneurysm of

A. Anterior communicating artery
B. Posterior inferior cerebellar artery
C. Posterior communicating artery
D. Middle cerebral artery

Ans. C.

730. Schwannoma arise from following cranial nerve except

A. V and VIII
B. V and VI
C. VI and VIII
D. I and II

Ans. D.

- Schwannomas may arise from any cranial or spinal roots except the optic and olfactory nerves because they are myelinated by oligodendroglia rather than schwann cell
- Superior vestibular division of eighth cranial nerve common site.
- 2nd most common Vth nerve
- Schwannoma characteristically present as progressive unilateral hearing loss rather than with dizziness or other vestibular symptoms

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- Acoustic schwannoma enlarge the internal audiory meatus and imaging feature that help distinguish the other CP angle mass

731. A 46 – year old woman, had the sudden onset of jargon speech and hysteria. She was admitted to the psychiatric ward with a diagnosis of schizophraenia. Physical examination reveals only a right Babinski sign and right hemiparesis. The most probable diagnosis is

. **A.** Malingering
B. Drug induced parkinsonism
C. Left temporoparietal lesion
D. Right temporoparietal lesion

Ans. C.

732. Infratrochlear nerve is a branch of

A. Frontal nerve
B. Nasocilliary nerve
C. Maxillary nerve
D. Mandibular

Ans. B.

733. Supraorbital and supratrochlear nerve are branches of

A. Frontal nerve
B. Nasocilliary nerve
C. Maxillary nerve
D. Mandibular nerve

Ans. A.

734. Cranial nerves not having Obsteiner-Redlich zone are

A. I and III
B. IV and V
C. V and VIII
D. I and II

Ans. D.

735. Trigemino thalamic tract project to which of the thalamic nuclei

A. VPL nuclei
B. VPM nuclei
C. Pulvinar nuclei
D. LP nuclei

Ans. B.

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736. Teres major is supplied by

A. Upper subscapular nerve
B. Lower subscapular nerve
C. Dorsal subscapular nerve
D. Axillary nerve

Ans. B.

- Upper subscapular nerve supplies subscapularis
- Dorsal scapular nerve → Rhomboids and Levator scapulae
- Axillary nerve → deltoid

737. Glomus juglare arise from

A. Superior vagal ganglion
B. Inferior vagal ganglion
C. Pterosal ganglion
D. Auricular branch of vagus

Ans. A.

- Inferior vagal ganglion [Nodose] give rise to glomus intravagale
- Auricular branch give rise to glomus tympanicum

738. Rathk's ceft cyst arise from

A. Rathke's pouch
B. Pars tuberalis of pituitary
C. Pars intermedia of pituitary
D. Pars distalis of pituitary

Ans. C.

- Craniopharyngioma arise from Rathke's pouch

739. VIII nerve is not damaged in which of the following # of pterous part of temporal bone

A. Tansverse
B. Oblique
C. Tip
D. Longitudinal

Ans. D

740. Naevus flammeus is

A. A naevi
B. A hemangioma
C. Inflammation occurring in a naevi
D. A premalignant lesion

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Ans. B.

- Naevus flammeus is port wine stain [capillary hemangioma]

741. Which of the following cause the cerebral vasodilatation?

A. $\uparrow CO_2$
B. $\downarrow P_aO_2$
C. Adenosine
D. $\uparrow K^+$
E. $\downarrow PH$

Ans. All of the above are true

742. Structure derived from Neural ectoderm

A. Retina with its pigment epithelium
B. Epithelial layer of cilliary body
C. Epithelial layer of iris
D. Sphincter and dilator pupillae muscle
E. Melanocytes

Ans. A to E.

743. Which of the following sequence is not present in MRI ?

A. FLAIR
B. GRE
C. HASTE
D. SMASH
E. BEST

Ans. E.

- FLAIR is fluid attentuated inversion recovery, GRE is gradient echo imaging, HASTE is half acquisition single shot turbo spin echo, SMASH is simultaneous acquisition of spatial harmonics.

744. Which of the following muscle is not attached to Occiput ?

A. Rectus capitis major
B. Obliqus capitis superior
C. Obliqus capitis inferior
D. Rectus capitis minor

Ans. C

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745. Chroid plexus is absent in

A. Anterior horn or Frontal horn of lateral ventricle
B. Occipital horn of lateral ventricle
C. Aqueduct of Sylvius
D. Lateral recess of the IVth ventricle
Ans. A to C

746. Spinal leminiscus contain the

A. Lateral spinothalamic tract
B. Anterior spinothalemic tract
C. Spinotectal tract
D. Fasciculus Gracilis
Ans. A to C.

747. Markers for Asrocytes are

A. Glutamine synthase
B. Glycogen
C. GFAP (Glial Fibrillary Acidic Protein)
D. Vimentin
Ans. A to C

748. About mechanisms of headache in tumors

A. Traction on the veins draining into the large venous sinuses
B. Traction on the middle meningeal artery
C. Traction on the major arteries at the base of brain
D. Distension and dilatation of the intracranial and extracranial arteries
E. Most of the dura and pia, arachnoid the brain parenchyma and the lining of the ventricles were sensitive to pain
Ans. A to D

- The mechanism of pain in patients who have brain tumor is presumed to be the result of traction on the large blood vessels and dura and direct pressure on cranial and cervical nerve fibers by tumor. The venous sinuses, some of dura at the base of brain were sensitive to pain

749. About central neurocytoma

A. Well differentiated intraventricular tumor affecting young men and women equally
B. Present in anterior portion of the lateral ventricle around the foramen of Monro

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C. CNC metabolism is more oxidative than that of other brain tumor
D. Hallmark characteristic of CNC is positivly for synaptophysin
E. Derived from bipotential progenitor cells from the subependymal plate

Ans. A to E

750. Commisural and association fibers arise from

A. Layer II, III, IV, V of cerebral cortex
B. Layer III and VI of cerebral cortex
C. Layer II, III and VI of cerebral cortex
D. Layer III and IV of cerebral cortex

Ans. C

- Layer II give rise to Association fibers
- Layer III give rise to Association and commissural fibers
- Layer VI give rise to Association, commissural and projection fibers

751. About Basal ganglia

A. Globus pallidus is derived from Telencephalon
B. GPi: and Pars reticularis are the main output centres
C. Field of forel H_2 is Thalamic fasciculus
D. Field of forel H_1 is lenticular fasciculus

Ans. B.

752. Match the following

A. Superior cerebral vein - Sagittal sinus (superior)
B. Superficial middle cerebral vein - Cavernous sinus
C. Decepmiddle cerebral vein - Anastomotic vein → Cavernous sinus
D. Inferior pterosal sinus - Internal jugular vein
E. Superior pterosal sinus - Sigmoid sinus

Ans. A, B, D and E.

- Deep middle cerebral vein drain into either the saggital sinus (superior) or Transverse sinus – through two anastomotic vein. Vein of labbe drain into transverse sinus. Vein of trolard drain into superior sagittal sinus.

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753. Match the following

A.	Tensor veli palatani	- Vagus nerve
B.	Posterior belly of digastric	- Mandibular nerve
C.	Levator veli Palatani	- Mandibular nerve
D.	Palatoglossus	- Hypo glossal nerve
E.	Cricothyroid	- Internal branch of superior Laryngeal nerve

Ans. All of the above are false

- Tensor veli palatani is supplied by Mandibular division of Trigeminal nerve
- Posterior belly of digastric is supplied by facial nerve
- Levator velipalatani is supplied by accessory nerve through pharyngeal branch of vagus
- Palatoglossus is supplied by vagus nerve
- Cricothyroid is supplied by external branch of superior laryngeal nerve. Internal branch is sensory
- All muscle of soft palate except tensor veli palatani is supplied by accessory nerve [XI] through pharyngeal branch of vagus

754. Match the following

A.	Olivocerebellar fibre	- Mossy fiber
B.	Dorsal spinocerebellar tract	- Superior cerebellar peduncle
C.	Ventral spinocerebellar tract	- Inferior cerebellar peduncle
D.	Pontocerebellar fibre	- Middle cerebellar peduncle
E.	Juxta restiform body	- Superior cerebellar peduncle

Ans. D.

- Olivocerebellar fibers are climbing fibres. Dorsal spinocerebellar tract enter through inferior cerebellar peduncle. Ventral spinocerebellar tracts enter through one superior cerebellar peduncle. Juxta restiform body is a part of inferior cerebellar peduncle

755. Solitary nucleus is shared by nerves

A. V
B. VII
C. IX
D. X
E. XII

Ans. B, C and D

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756. Ambigus Nucleus is shared by nerves

A. VI
B. VII
C. IX
D. X
E. XI

Ans. C to E

757. About craniopharyngiomas

A. Dual theory of embryological development is implicated
B. Bimodal incidence with highest incidence between 5-15 years and between 50-75 years
C. Papillary variant are less aggressive than the adamantinomous variety
D. Papillary variant more common in children
E. Lack of calcification predicts a better survival rate

Ans. A, B, C and E

- The embryonic rest cells from the craniopharyngeal duct are responsible for the development of craniopharyngioma. The second theory says that the existing rest cells of the adenohypophysis undergo metaplasia. Form up to 12% in pediatric brain tumor and 7-9% of all intracranial tumor. The pediatric population in more than 95% have adamantinomatous variety whereas papillary variant is more common in adults. Admantinomatous craniopharyngioma are more often in the suprasellar area. They contain crank case oil/Machine oil like fluid due to cholestrol droplets. Papillary craniopharyngioma are solid and lack cholestrol droplet. Immunostaining for cytokeratin is valuable in the investigation of craniopharyngioma.

758. Branches of cervical plexus are

A. Supraclavicular nerve
B. Suprascapular nerve
C. Phrenic nerve (C3, C4, C5)
D. Great auricular nerve (C2, C3)
E. Lesser occipital nerve (C2)

Ans. A, C to E.

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759. Muscle supplied by Ansacervicalis

A. Sternohyoid
B. Sternothyroid
C. Thyrohyoid
D. Geniohyoid
E. Omohyoid [inferior belly]

Ans. A, B and E.

- Superior belly of omohyoid not supplied by Ansa cervicalis

760. Basal vein of Rosenthal is formed by

A. Superior cerebral vein
B. Anterior cerebral vein
C. Superficial middle cerebral vein
D. Deep middle cerebral vein
E. Inferior striate veins through anterior perforated substance

Ans. B, D and E.

761. About verebral column

A. Only a small amount of movement is possible at the atlanto-occipital joint, most of which is in flexion and extension (nodding movement) of the head
B. The atlanto-axial joint allows rotation and in fact accounts for most of the rotation which occurs in the cervical spine
C. The vertebral artery and vein does not pass through C7 instead accessory vertebral vein pass through C7 [Foramen transversium]
D. The articular facet joint in the upper thoracic spine is in coronal plane thus allowing rotation in addition to flexion extension and lateral flexion
E. The articular facet joint in the lower thoracic and lumbar spine is in sagittal plane thus preventing rotation between vertebrae

Ans. All of the above are true

- The coronal orientation of the facets in the upper thoracic spine leads to significant resistance to anterior translation, but little resistance to rotation. In the lower thoracic spine, the facet becomes more-saggitaly oriented and less resistance to anterior translation is offered

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762. Axons of the First order neuron are present in the

A. Fasciculus gracilis
B. Dorsal spinocerebellar tract
C. Fasciculus cuneatus
D. Ventral spinocerebellar tract
E. Lateral spinothalamic tract

Ans. A and C.

763. About Spinal cord

A. Substantia gelatinosa is present at all levels
B. Dorsal intermediate sulcus is present only rostral to T6
C. Nucleus Dorsalis of Clarke is present from L1 to S3 level
D. Intermedio lateral horn extend from T1 to L2 or L3
E. White rami communicans is present at all levels

Ans. A, B and D.

764. About central nervous system development

A. Mantle zone of neural tube form the grey matter of the spinal cord and the alar and basal plate separated by sulcus limitans form the Dorsal and ventral grey horn respectively
B. Leptomeninx is formed by neural crest cell
C. Microglia and Pachymeninx are mesodermal in origin
D. Marginal zone form the white matter of the spinal cord
E. Anterior and posterior neuropore closer at day 24 and day 27 of the development

Ans. All of the above are true

765. About Filum terminale

A. Consist of arachnoid, glial fibres and often contains a vein
B. It is difficult to differentiate a tethered cord from a congenitally low lying cord. Filum diameter is generally less than 1mm in latter
C. The filum is differentiated from nerve roots by presence of characteristic squiggly vessel on surface of filum
D. Filum has a distinctively whiter appearance than the nerve root
E. Myxopapillary ependymoma occur in the filum terminale

Ans. B to E.

- Filum terminale consist of Pia, glial fibres and often a vein
- Normal diameter is less than 1mm and >2mm is definitely pathological

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- Arachnoid and dural meninges surround the filum terminale in its upper 15cm. The central canal is continued in the filum terminale for [5.6mm]

766. Various opening in the pterygopalatine fossa are

A. Foramen Rotundum
B. Pterygoid canal
C. Palatinovaginal canal
D. Sphenopalatine foramen
E. Greater palatine canal

Ans. All of the above are true

- Other is the inferior orbital fissure

767. Bones of the skull that are formed in membrane are

A. Frontal
B. Parietal
C. Occipital
D. Temporal
E. Maxilla

Ans. A, B and E.

- Bones that are formed in cartilage are → Inferior nasal concha, Ethmoid
- Bones formed from both [membrane + Cartilage] → Mastoid, sphenoid, temporal

768. Sphenoid bone form the following boundary of the orbit

A. Roof
B. Floor
C. Medial wall
D. Lateral wall

Ans. A, C and D.

- Lesser wing of sphenoid along with the orbital plate of the frontal bone form the roof of the orbit
- Floor of the orbit is formed by maxilla, Zygomatic and in posterior part by orbital process of palatine
- Lateral wall is formed by Zygomatic process and greater wing of sphenoid
- Medial wall is formed by body of sphenoid Ethmoid Lacrimal bone and Maxilla

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769. Match the following opening of Sinuses

A.	Sphenoid sinus	- Bulla ethmoidalis
B.	Maxillary sinus	- Upper part of hiatus semilunaris or infundibulum
C.	Anterior ethmoidal sinus	- Lower part of hiatus semilunaris
D.	Middle ethmoidal sinus	- Superior meatus
E.	Posterior ethmoidal sinus	- Sphenoethmoidal recess

Ans. All of the above are false

- Sphenoid sinus open above the superior concha into sphenoethmoidal recess
- Maxillary sinus open into the hiatus semilunaris (lower part)
- Anterior ethmoidal sinus open into the upper part of the hiatus semilunaris or infundibulum
- Middle ethmoidal sinus open into the bulla ethmoidals posterior ethmoidal sinus open into the superior meatus
- Frontal sinus open into middle meatus
- Nasolacrimal duct open into inferior meatus sphenopalatine foramen open into the superior meatus

770. About association fibers

A. Superior longitudinal fasciculus connect the occipital to temporal lobe

B. Inferior longitudinal fasciculus connect the Frontal to temporal and occipital lobe

C. Uncinate fasciculus connect the orbito frontal gyri to the temporal lobe

D. Arcuate fasciculus connect the superior and middle frontal convolution to the anterior temporal lobe

E. Cingulate fasciculus connect the medial part of the frontal and parietal lobe to parahippocam pal gyrus

Ans. C to E.

- Inferior longitudinal fasciculus connect occipital to temporal lobe. It is essential for visual recognition. Cerebral damage as that caused by carbon monoxide poisoning can destroy the inferior longitudinal fasciculus bilaterally. In such cases the individual has intact elementary vision but cannot identify the nature of objects (object agnosia) or individual faces (prosopagnosia) although he/she can depict and match them
- Superior longitudinal fasciculus connect the frontal to temporal and occipital lobe

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- Uncinate fasciculus is important in the regulation of behaviour
- Arcuate fasciculus is important in language function
- Inferior longitudinal fasciculus constitutes to the function of visual recognition

771. Following statement about derivative of the pharyngeal arch

A. Facial nerve is the nerve of second arch
B. Lesser cornu of hyoid bone and body is derivative of first arch
C. Maeckl's cartilage, malleus incus are derivative of second arch
D. Cricothyroid muscle, Thyroid cartilage is the derivative of fourth arch
E. Arytenoid cartilage, Greater cornu of the hyoid derivative of sixth arch

Ans. A and D.

- Lesser cornu of hyoid bone and body is derivative of second arch
- Maeckl's cartilage, malleus, incus are derivative of the first arch
- Arytenoid cartilage is derivative of the sixth arch
- Greater cornu of hyoid is derivative of third arch

772. About nerves of the arches

A. Mandibular branch of the trigeminal nerve is the nerve of second arch
B. Facial nerve is the nerve of the first arch
C. Glossopharyngeal nerve is the nerve of the fourth arch
D. Superior laryngeal nerve is the nerve of the sixth arch
E. Recurrent laryngeal nerve is the nerve of the third arch

Ans. All of the above are false

- First arch → Mandibular division of the trigeminal nerve
- Second arch → Facial nerve [VII]
- Third arch → Glossopharyngeal nerve [IX]
- Fourth arch → Superior laryngeal nerve [X]
- Sixth arch → Recurrent laryngeal nerve [X]

773 . Nerve conduction velocity is reduced in

A. Gullian Barre Syndrome
B. Amytotrophic lateral sclerosis

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C. Myasthenia gravis
D. Multiple sclerosis
E. HMSN II

Ans. A.

774. SVE fibers are present in

A. III [Occulomotor nerve]
B. V [Trigeminal nerve]
C. VII [Facial nerve]
D. IX [Flossopharyngeal nerve]
E. XI [Spinal accessory nerve]

Ans. B to E.

775. About ataxia

A. Romberg sign is positive in sensory ataxia
B. Frederich ataxia has the same lesion in the spinal cord as of subacute combined degeneration of cord
C. Destruction of the neocerebellum result in the Truncal ataxia
D. Destruction of the vermis result in appendicular ataxia
E. Most of hereditary spinocerebellar ataxia are due to trinucleotide repeat

Ans. A, B and E.

776. Following statements concerning brainstem auditory evoked potentials are

A. Increased I – III interpeak latency is a suggestive for acoustic neuroma
B. Absence of all waves is supportive of brain death
C. Wave I is generated by charge movement in the cochlea
D. In acoustic neuroma, there is prolongation of the III – V interpeak interval
E. There is loss of all waves including I in acoustic neuroma

Ans. All of the above are false

- Explanation →
- Acoustic neuroma is strongly suspected in patients with increased I – III interpeak interval, although this finding is not specific. Absence of all waves beyond wave I or distortion of following wave forms can occur, making measurement of this interval impossible. BAEP can be supportive of brain death, but not if there is no wave I since one cannot rule

out failure of transaduction of the auditory stimulus to a neural signd. Wave I is generated by the dibtal portion of CN-8.

- Wave I is present in the patient of acoustic neuroma
- Increased III-V interpeak interval could not be expected since the segment which serve this conduction is in the brain stem
- Wave I—Cochlear nerve
- Wave II—Cochlear nuclei
- Wave, III—Superior olivary nucleus
- Wave IV—Lateral leminiscus
- Wave V—Nucleus of inferior colliculus
- Wave VI—Medial geniculate nucleus
- Wave VII—Auditory radiation

777. Light – Near dissociation is seen in

A. Holmes-adie pupil
B. Argyll robertson pupil
C. Parinauds syndrome
D. Marcus gunn pupil
E. Lupus Erythematosus

Ans. A, B, C and E

778. About Fornix

A. Fornix contain 27 million fibers and is the largest projection to the hypothalamus
B. Bilateral destruction result in acute amnestic syndrome
C. Hippocampal commisure or commisure of the fornix band of transverse fiber connecting two column of fornix
D. Part of the fornix in correct order are Fimbria, Crura, Alveus, Body, column
E. Axons from the subicular neurons via post commissural fornix enter the medial mammilary nucleus

Ans. A, B and E

- Hippocampal commisure or commisure of the formix connect two crura of the fornix
- Correct order of part in the fornix relaying from hippocampal formation are Alveus, Fimbria, Crura, Body and Column

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779. About Commisures

A. Corpus callosum is the largest commisure and the first commisure to appear
B. Anterior commisure connect the superior and middle temporal gyri of the two lobes (temporal) and anterior olfactory nuclei
C. Destruction of posterior commisure will result in light-Near dissociation
D. In patient with agenesis of corpus callosum only minimal deficit can be demonstrated with neuropsychological testing as compared to a patient with commisurotomy
E. Commisure of the fornix (Hippocampal) commisure is the second commisure to appear in development

Ans. D and E.

- Development of commisure in order
- Anterior commisure 1st to appear
- Hippocampal or Fornical commisure 2nd to appear
- Corpus callosum 3rd to appear
- Anterior commisure connect the middle and inferior temporal gyri of the temporal lobe
- Posterior commisure contain the puppilary reflex fibres from the pretectal nuclei to the parasympathetic nuclei bilaterally
- Destruction of posterior commisure will abolish the consensual reflex

780. Following are found in Kluver-Bucy syndrome

A. Hyperorality
B. Hypersexuality
C. Psychic Blindness or visual agnosia
D. Docility
E. Due to destruction of bilateral frontal lobe

Ans. A to D

- It is due to destruction in the bilateral temporal lobe

781. Destruction of the Otic ganglion will result in

A. Inability of secretion of parotid gland
B. Decreased sensation
C. Hyperacusis
D. Paralysis of tensor veli palatni
E. Paralysis of stapedius muscle

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Ans. A to D.

- A few somatic motor fibers from the trigeminal nerve pass through the otic ganglion and supply the tensor tympani and tensor veli palatani

782. Deviation of the eyes to the right is most likely to occur with occlusion of the

A. Calcarine artery on the ipsilateral side
B. Calcarine artery on the contralateral side
C. Ipsilateral paramedian branch of the basilar artery
D. Ascending frontal branch of the ipsilateral middle cerebral artery
E. Ipsilateral superior cerebellar artery

Ans. A and D.

783. Grestmann's syndrome comprise of

A. Agraphia [copying is not affected]
B. Dressing apraxia
C. Finger agnosia
D. Right-left disorientation
E. Dyscalculia

Ans. A, C to E.

784. GABA ergic neurons are present in

A. Pars reticularis of substantia negra
B. Neostriatum
C. Pyramidal cell of the cerebral cortex
D. Stellatecell, Basket cell purkinje cell of the cerebellar cortex
E. Climbing fibres of the cerebellar cortex

Ans. A, B and D

785. Dopaminergic neurons are present in the

A. Pars compacta of the substania nigra
B. Ventral tegmental area
C. Raphe nuclei
D. Periaqueductal grey matter
E. Superior colliculus, arcuate nuclei of the hypothalamus

Ans. A, B, and E.

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786. About Lesion

A. Occlusion of left posterior cerebral artery result in alexia without agraphia or aphasia
B. Occlusion of right posterior cerebral artery may result in propsagnosia
C. Destruction of inferior parietal lobule of dominant side result in dressing apraxia, hemineglect, topograptic memory loss, constructional apraxia, anosognosia
D. Destruction of arcuate fasciculus result in fluent, good comprehension and non-repetitive speech
E. Destruction of right angular gyrus in inferior parietal lobule result in Gerstmann's syndrome

Ans. A, B and D

787. About sweat glands

A. Holocrine, eccrine, apocrine are three type of sweat glands
B. Apocrine sweat gland has got the highest concentration in the axilla
C. Sweat is the ultrafiltrate of the plasma
D. Evaporation of sweat relased by the eccrine gland result in thermoregulation
E. Apocrine sweat gland receive post ganglionic norephinephine releasing sympathetic fibres

Ans. A, B, D and E.

- Eccrine or merocrine sweat glands are distributed through out the body. They receive cholinergic sympathetic fibres

788. About Internuclear opthalmoplegia

A. Lesion causing it is always intra-axial
B. Result in horizontal diplopia
C. Eyes never cross the midline
D. When bilateral in adults is suggestive of multiple sclerosis
E. When occur in the elderly is usually due to hypertensive bleed and is unilateral

Ans. B, D and E

- Internuclear opthalmoplegia can also occur in transtentorial herniation. But commonly it is due to intra-axial lesion.

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789. About olfactory and gustatory pathway

A. Parabrachial nucleus of the pons is related with emotional aspect of the taste
B. Pyriform and entorhinal cortex are associated with olfaction
C. Olfactory fibers are not relayed in thalamus
D. Gustatory fibers are relayed in small cell of the ventro posteromedial nucleus of the thalamus
E. Sweet and sour taste area are present on the tip of tongue and dorsum of the tongue respectively

Ans. All of the above are true

790. About olfaction and gustation

A. There are four types of primary taste
B. Alpha Gusducin is related to salty and sour taste
C. Conscious perception of smell take place in Pyriform cortex
D. Olfactory nerve comprise of the axons of the granule and tufted cells
E. Entorhinal cortex (Area 28) is the association alfactory cortex

Ans. E.

- There are five types of primary taste: salty, sour, sweet, bitter and umami
- Alpha Gusducin linked to G-Protein is related to sweet and bitter taste
- Conscious perception of smell take place in the prefrontal cortex (9-12)
- Olfactory nerve arise from receptor cells. Axons of the mitral and tuffted cell form lateral and medial olfactory tract

791. About Internal capsule

A. Anterior radiation and fronto pontine fibres are present in the anterior limb
B. Sensory radiation is the superior radiation
C. Hemorrhage lateral to the internal capsule has worst prognosis than when it is medial to the internal capsule
D. Genu of the internal capsule is supplied by recurrent artery of heubner
E. Anterior choroidal artery supply the genu and posterior limb of the internal capsule

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Ans. A, B and E.

- Putaminal hemorrhage or hemorrhage just lateral to the posterior limb of internal capsule tend to compress the fiber but the hematoma that is medial to the internal capsule invade or distruct the fibres. So medial hemorrhage has got worst prognosis than the lateral one
- Anterior limb of internal capsule is supplied by medial striate branch i.e. recurrent artery of heubner branch of anterior cerebral artery and lateral striate branches of middle cerebral artery
- Genu is supplied by anterior choroidal artery and the some direct branches from the internal carotid artery

792. The Last Fontanelle to close is

A. Posterior
B. Anterolateral
C. Posterolateral
D. Anterior

Ans. D.

- Anterior closes in the middle of second year. Posterior and sphenoidal (anterolateral) closes in 2-3 months
- Posterolateral (mastoid) closes at the end of first year

793. About CSF

A. CSF is produced only by choroid plexus
B. Compensatory CSF absorption may be done by choroids plexus
C. CSF drainage occur along the I, II, V, VI cranial nerves into the cervical lymphatics
D. Arachnoid villi which result in CSF absorption is mainly distributed along the cavernous sinus
E. PH of CSF is 7.3 and density is 1.007

Ans. B and E.

- CSF is also produced by ependymal cell and along the dural sleeves of spinal nerves also produce it
- CSF drainage occur along the I, II, VII, VIII cranial neve into the cervical lymphatics
- Arachnoid villi is mainly distributed along the superior sagittal sinus
- Compensatory CSF aborption done by choroids plexus, epedymal cell and dilated central canal of the spinal cord

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794. Number of arteries taking part in the blood supply of Optic chiasma are

A. 9 **B.** 10
C. 11 **D.** 12

Ans. C.

- Branches from pairs of internal carotid artery, middle cerebral aretery, anterior cerebral artery, anterior choroidal artery, posterior communicating and anterior communicating artery

795. Normal position of optic chiasma is

A. Sulcus chiasmaticus
B. Diaphgram sellae
C. Dorsum sellae
D. Posterior to dorsum sellae

Ans. C

- Sulcus chiasmaticus – 5%
- Diaphgram sellae – 12%
- Dorsum sellae – 79%
- Posterior to Dorsum sellae – 4%

796. About Craniovertebral Junction development

A. First two occipital scleretome form the basiocciput
B. Third occipital scleretome form the anterior tubercle of the clivus
C. Odontoid process has two primary and one secondary ossification centre
D. First cervical vertebrae [Atlas] is formed entirely by first cervical sclerotome
E. Proatlas is fourth occipital sclerotome

Ans. A, C and E.

- First two occipital sclerotome leads to development of basiocciput
- Third occipital scelrotome leads to development of two jugular tubercles
- Fourth occipital sclerotome (Proatlas) leads to formation of anterior margin of the foramen magnum, two occipital condyles, anterior tubercle of clivus, apical ligament of odontoid, Superior articular facet of the atlas, superior part of the posterior arch of the atlas and the apical segment of the odontoid

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- The first cervical sclerotome form the rest of the atlas
- The second cervical sclerotome form the body of the axis.
- Development of axis
- Odotoid process, apical segment is developed from proatlas and remaining portion from first cervical scelerotome and the body of the axis from the second cervical sclerotome

797. Biochemical defect present in the majority of brain tumor measured by Magnetic resonance spectroscopy are

A. Decreased NAA
B. Decreased Lactate
C. Decreased Lipid
D. Decreased Choline
E. Increased Creatinine

An. A.

- There is increase in lactate, lipid and choline but decrease in NAA and total creatinine

798. About Cerebral abscess

A. In both developed and developing countries otogenic abscess is the commonest cause of brain abscess
B. Cut off margin of the size of the abscess above which it should be treated by surgical means is 5cm
C. Metastatic brain abscess is more common in occipital lobe
D. Risk for epilepsy is more after surgical excision than after aspiration of abscess
E. *Staph-aureus* is the most common cause for epidural spinal abscess but not for intradural and intermedullary abscess

Ans. All of the above are false

- In developed countries, the cause of brain abscess is due to haematogenous spread secondary to lung infection. In developing countries, it is still otogenic abssess
- Cut off margin is 3cm
- Metastatic brain abscess is more common in frontal lobe
- Risk for epilepsy is more after aspiration of abscess than after surgical excision because scar after aspiration is much more denser than after surgical excision
- Staph aureus is the common cause for epidural, Intradural and Intramedullary abscess

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799. Which of the following is the correct match?

A.	PICA	-	Choroid plexus of the IVth ventricle
B.	PCA	-	Choroid plexus of the lateral and third ventricle
C.	Anterior choroidal artery	-	Choroid plexus temporal horn of the lateral ventricle
D.	AICA	-	Labyranthine artery
E.	PICA	-	Posterior spinal artery

Ans. All of the above are true

800. Which of the following is a frequent symptom of extramedullary intradural tumor?

A. Muscle fasciculations
B. Bladder and rectal involvement
C. Muscle atrophy and trophic skin changes
D. Spinal fluid changes

Ans. D.

801. Destruction of right occlumotor nucleus will result in

A. Drooping of the only right eyelid
B. Paralysis of only left superior rectus
C. Paralysis of right inferior rectus, inferior oblique and medial rectus
D. Right pupil will be dilated
E. Right "Down and out" position of the eye

Ans. C to E.

- Drooping of the both eyelid will take place because of presence of single caudal subnucleus of Parelia for levator palebrae superioris
- Paralysis of both right and left superior rectus will take place because of the fibres of the right superior rectus from left side pass very close to the right subnucleus for superior rectus

802. The content of ambient cistern are all EXCEPT

A. Superior cerebellar artery
B. P3 of PCA
C. P2 of PCA
D. IVth cranial nerve

Ans. B

- P3 of PCA present in quadrigerminal cistern.

803. About spinal cord

A. Cord transverses the whole vertebral column at birth
B. Neurofibroma mainly involves the structure derived from basal plate
C. Lumbosacral cistern is present from [$L_2 - S_5$]
D. C_6 is the most common nerve root to be involved in the cervical spondylosis
E. Weight of spinal cord is about 5% of the weight of the brain

Ans. D.

- At birth, cord ends at the L3 level. Alarplate give rise to the sensory structures and neurofihbroma has predilection for dorsal root. Lumbo sacral cistern is present from [$L_2 - S_5$]. Weight of spinal cord is about 2% of the weight of the brain [28gm]

804. Which of the following tumor is correctly matched to its histology?

A. Prolactin secreting adenoma - Fibrous body
B. Growth hormone secreting adenoma - Nebenkerns
C. Chordoma (Notochord) - Veroccay bodies
D. Acoustic schwanomima - Physalipharous cell
E. Medulloblastoma - Homer Wright Rosettes

Ans. E.

- Prolactin secreting adenoma is characterized by concentric whorl of rough endoplasmic reticulum called [NEBENKERNS]
- Growth hormone secreting adenoma is characterised by Fibrous body
- Chordoma is characterized by presence of physalipharous cells or swollen or vacuolated or Bubbly cells
- Acoustic schwannoma is characterized by Antoni A, Antoni B areas and veroccay bodies

805. About Derivatives of arches

A. Posterior belly of digastric, stapedius and orbicularis oris are derivative of hyoid arch
B. Tensor tympani, anterior belly of digastric mylohyoid, Tensor levi palatani are the derivative of first arch
C. Meckel cartilage, Malleus, incus, Sphenomandibular ligament, Stylomandibular ligament are derivative of first arch

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D. Arytenoid cartilage is derivative of sixth arch
E. Styloid process, stylohyoid ligament, lesser cornu and upper body is derived from second arch or hyoid arch

Ans. All of the above are true

806. Stylohyoid ligament is derived from

A. First arch
B. Second arch
C. Third arch
D. Fourth arch

Ans. B.

807. Unprovoked uncontrolled laughter is present in

A. Chordoma
B. Chondroma
C. Clival meningioma
D. Nasopharyngeal growth
E. Basilar aneurysm

Ans. All of the above are true

- Unprovoked, uncontrolled laughter is a characteristic symptom of Prepontine Tumors. May respond to Selective serotonin reuptake inhibitor therapy (e.g. Paroxetine)

808. About Papilledema

A. Earliest indication of papilledema is the enlargement of the blind spot
B. Loss of visual acuity is earlier in papilledema
C. Papilledema is due to stasis of axoplasm
D. Fluorescein angiograply helps to differentiate from pseudopapilledema
E. Spinal neurofibroma may present with papilledema

Ans. A, C to E.

- Loss of visual acuity is late in papilledema

809. The ratio of crossed and uncrossed fibres in the optic chiasma is

A. 70 : 30
B. 30 : 70
C. 50 : 50
D. 53 : 47

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Ans. D.

- The ratio of crossed and uncrossed fibres is about 53:47, a large proportion of uncrossed fibres that has been reported in the past. Approximately 53% of optic nerve axons cross in the optic chiasm. These subserve the temporal field for each eye

810. Regarding scotomal progression in pituitary and craniopharyngioma

A. Clockwise in right eye in pituitary adenoma and craniopharyngioma
B. Anticlockwise in left eye in Pituitary adenoma and craniopharyngioma
C. Anticlockwise in right eye in Pituitary and clockwise in left eye in craniopharyngioma
D. Clockwise in right eye in pituitary and clockwise in left eye in craniopharyngioma

Ans. D.

- Pressure from Pituitary tumor is from downward and from craniopharyngioma is from above

811. According to Collins law, the risk of recurrence of tumor for a patient presented at an age of 2 years with Medulloblastoma is within

A. 32 months
B. 33 months
C. 34 months
D. 35 months

Ans. B

- Collins law – the rule states that the period of risk for recurrence is equal to the age at presentation plus 9 month of gestational age
- Applying collins law – [12 + 12] + 9 months = 24 + 9 months = [33] months

812. About Obsteiner – Redlich zone

A. Found at the junction of the central and peripheral myelin
B. Give rise to acoustic shwanomma
C. Is absent in cranial nerve II
D. Is often a site for microvascular compression
E. It is present at internal acoustic meatus in case of vestibulocochlear nerve

Ans. All of the above are true

813. Thalamic peduncle which carry sensory information is

A. Anterior
B. Superior
C. Posterior
D. Inferior

Ans. B

814. The principal postnatal change in the pyramids is due to

A. an increase of corticospinal neurons from the paracentral lobule
B. an increase in the total number of corticospinal axons
C. an increase in endoneural tubes to guide sproutingaxons
D. myelination of pre-existing corticospinal axons

Ans. D

- The corticospinal fibers are not completely myelinated at birth. This does not occur until between 18 months and 2 years of age. During this time, the Babinski reflex is elicitable later it is suppressed

815. Which of the following gas increases the cerebral metabolism?

A. Halothane
B. Enflurane
C. Isoflurane
D. N_2O

Ans. D.

816. Isoelectric EEG produced by

A. Morphine + fentanyl
B. Mepridine
C. Barbiturate
D. Barbiturate + Isoflurane

Ans. D

- Arbiturate + Isoflurane produces Isoelectric EEG. Narcotics do not produce Isoelectric EEG

817. Regarding steroids

A. In primary adreno cortical insufficiency (Addison's disease) both mineralocorticoid and glucocorticoid has to be replaced
B. In secondary adrenocortical insufficiency due to decreased release of ACTH only glucocorticoid has to be replaced and mineralocorticoid is normal

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C. Most common cause of cushing's syndrome is iatrogenic
D. Cushing disease is due to Pituitary adenoma releasing ACTH
E. In Nelson's syndrome, there is increased level of blood ACTH but no increase incortisol.

Ans. All of the above are true

818. Side effects of steroid due to prolonged administration are

A. Progressive multifocal encephalopathy
B. Hyperkalemia
C. Spinal cord compression from spinal epidural lipomatosis
D. Hyperosmolar nonketotic coma
E. Avascular necrosis of the rib or other bone or vertebral compression fracture

Ans. All of the above are true

- Possible side effect are the following:
- Cardiovascular and renal include hypertension and Na and H_2O retention.and hypokalemic alkalosis
- CNS- Progressive multifocal leukoencephalopathy (PML), Steroid psychosis, Spinal cord compression from spinal epidural lipomatosis. Pseudotumor cereberi
- Endocrine- growth supression in children, secondary, amenorrhoea, risk of adrenal insufficiency with steroid withdrawal, cushingoid feature with prolonged usage
- GI (risk) on with steroid therapy > 3 weeks' duration and regimen of prednisolone >400- 1000 mg/ day. Gastritis, pancreatitis, intestinal or sigmoid diverticular perforation
- Inhibition of fibroblast
- Subcutaneous atrophy, Posterior subcapsular cataract, Glaucoma, Hyperlipidemia
- Imparied wound healing

819. In Addisonian crisis, there is

A. Hyponatremia
B. Hypokalemia
C. Hyperglycemia
D. Hypothermia
E. For emergency start methyl prednisolone

Ans. A

- In addisonian crisis there is postural hypotension or shock, hyponatremia, Hyperkalemia, hypoglycemia, hyperthermia, as high as 105°F

- For emergency treatment Methyl prednisolone is not recommended
- For "gluco corticoid" emergency use hydrocortisone sodium succinate and cortisone acetate. For mineralocorticoid emergency use deoxycorticosterone and fludicortisone

820. In Schwartz Bartter syndrome there is

A. Serumosmolality < 280mosm/L
B. Serum Na^+ < 13 meq/L
C. Ratio of urine : Plasma osmolality [1.5 – 2.5:1]
D. Fluid restriction should be done
E. Normal adrenal or Normal renal function and thyroid function

Ans. All of the above are true

- Schwartz Bartter syndrome is another name for (SIADH). Urine sodium -> 20meq

821. Following are associated with major depletion of K^+

A. Steroid therapy
B. Addison's disease
C. Insulin
D. Renal tubular acidosis
E. SIADH

Ans. A, C and D

- Prolonged steroid therapy causes hypokalemia there is hyperkalemia in addison's disease. Insulin shift the K^+ inside the cell. Type I – III Renal tubular Acidosis result in Hypokalemia but Type IV Renal Tubular Acidosis in hyperkalemia. SIADH result in hyponatremia

822. A Lindegaard ratio Vmca **/ V** ica **consistent with vasospasm is**

A. greater than 1
B. greater than 2
C. greater than 3
D. None of the above

Ans. C i.e. Ratio greater than 3 is consistent with vasospasm.

823. Which of the following Low Molecular Weight Heparin is primarily responsible for spinal epidural hematomas in patient undergoing spinal / epidural anaesthesia

A. Dalteparin
B. Ardeparin

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C. Logiparin
D. Enoxaparin

Ans. D.

- [Primarily Enoxaparin]

824. Lab findings in DIC are

A. FDP > 16ug/ml (Most common abnormality)
B. Fibrinogen < 100 ug/dl
C. PT > 16 sec
D. PTT > 50 sec
E. Platelet < 50,000 (Most uncommon abnormality)

Ans. All of the above are true

- FDP (Fibrin degradation product) – Normal 1-8 ug/ml Borderline 8-16 ug/ml. Some labs require >40 ug/ml for diagnosis of DIC
- Fibrinogen- < 100 ug/ml (some use 130)
- In chronic DIC, PT and APTT may be normal, platelet and fibrinogen is low, Fibrin split product elevated
- Pseudo – DIC – FDP increased, Normal Fibrinogen seen in Liver failure

825. Brain tumor responsible for highest risk for DVT and Pulmonary Embolism include

A. Meningioma
B. Malignant glioma
C. Metastasis
D. Medulloblastoma

Ans. A

- Brain tumor autopay prevalence of DVT is 28% and that of Pulmonary Embolism is 8.4% by using 125 I fibrinogen. Meningioma (72%), malignant glioma (60%), metastasis (20%) – Risk is decreased by using aspirin pre operatively

826. About deep vein thrombosis

A. Clinical diagnosis of DVT is very reliable
B. Risk of cmbolism is greater with Calf DVT than proximal DVT
C. Doppler ultrasound with B mode imaging is 95% sensitive and 99% specific both for proximal and calf DVT
D. Impedance plathysmography is more sensitive for calf DVT than proximal DVT
E. Radiolabled 125 I fibrinogen is better for calf DVT than proximal DVT

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Ans. E.

- The clinical diagnosis of DVT is very unreliable. A patient with the classic signs of hot, swollen and tender calf or a positive homanssign will have a DVT only 20% - 50% of the time. 50% - 60% of patients with DVT will not have these findings
- Reported mortality from DVT in LE is from 9% - 50% DVT limited to the calf has a low threat (< 1%) of embolization but in proximal deep veins it is [40% - 50%]
- Doppler ultrasound with B mode and impedance plethymsagrophy both are less effective for calf DVT

827. About pulmonary embolism

A. Post-op PE generally occur 10-14 days following surgery and the reported incidence vary from 0.4 -5%
B. The most frequent finding is sudden dyspnea and the triad of haemoptysis, pleuritic chest pan, dyspnea is rare
C. A negative D-dimer test reliably exclude PE in patient with a low clinical probability of PE or in those with nondiagnostic VQ seen
D. In ECG "classic" S, Q_3, T_3 is rare and usually nonspecific ST and T changes occur
E. Chest X-ray is normal in 25 - 30% and the use of heparin shortly after surgery and in patient with brain tumors is controversial and vena caval interruption may be a consideration (e.g. Greenfield filter)

Ans. All of the above are true

828. Which of the following may induce seizures?

A. Phenothiazines
B. Methohexital
C. Enflurane
D. Metrizamide
E. Thiopental

Ans. A to D

829. About pediatric intramedullary spinal cord tumors following statements are

A. Accounts for 4–6% of all CNS tumors
B. Equal male and female distribution

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C. Ependymomas are the largest group of pediatric intramedullary spinal cord tumor
D. Astrocytomas are mostly located in the thoracic region
E. Gross total resection cannot be achieved in most ependymonas

Ans. A, B and D

- Astrocytomas are the largest group approximately 60% of pediatric intramedullary spinal cord tumors. They are typically large and mostly located in the thoracic region. In children the most common intramedullary spinal cord tumor is the pilocytic astrocytoma, which is a well-circumscribed and often cystic tumor with a indolent course. Spinal cord ependymoma occur commonly in the cervical region. The treatment of choice for intramedullary tumors ependymomas and astrocytoma is surgical resection. Gross total resection can be achieved in most ependymomas and is likely to result in cure

830. About cervical vertebrae all are true EXCEPT

A. Vertebrae prominens is C6
B. Cuneiform vertebrae is another name for hemivertebrae
C. Axis vertebrae has 5 primary and 2 secondary ossification centre
D. Vertebral artery do not traverse the foramen transversium of C-7

Ans. A.

- [Vertebrae prominens is C-7]

831. About Multisystem atrophy or shy dragger syndrome is

A. Autonomic substrate present
B. Idiopathic orthostatic hypotension
C. IPA (Idiopathic paralysis agitans)
D. Loss of IML nucleus
E. No response to L-dopa

Ans. All of the above are true

- Striatonigral destruction

832. About Myasthenia gravis

A. It is due to auto antibodies against Muscarinic Ach Receptor
B. In 70% of cases there is Thymoma

C. Edrophonium or Tensilon test can be used for diagnosing for patient with limb or respiratory muscle weakness
D. During myasthenic crisis tt is O_2 inhalation and anticholinesterases
E. Aetiology of congenital MG is same as of adult form

Ans. All of the above are false

- Auto antibodies are present against Nicotinic Acetylcholine receptor
- In 15% there is thymoma and 70% thymic hyperplasia is present
- Anti striated muscle antibody present in case of thymoma
- Edrophonium or Tensilon is very short acting so it is used in testing for ocular or cranial nerve weakness. Neostigmine is used in patient with limb or respiratory muscle weakness
- During Myasthenic crisis anticholinesterases are withdrawn and O_2 inhalation is given after only the patient is able to walk without assistance then the anticholinesterases are added
- Congenital Myasthenia Gravis is due to abnormal structure of the receptor. NA chR antibodies are not present. Thymectomy is contraindicated

833. Following are the examples of involvement of basal ganglia

A. Kernicterus
B. Status marmoratus [double athetosis]
C. Carbon monoxide induced hypoxia
D. Methanol toxicity
E. Wilson's disease

Ans. All of the above are true

- In neonates, the BBB is not developed so that billirubin is deposited in globuspallidus
- Hypoxia in perinatal period result in destruction of striatum. Again there is myelination resulting in marble like appearance hence called status marmoratus or double athetosis
- Carbon monoxide induced hypoxia causes bilateral cavitation or destruction of globus pallidus
- Methanol causes destruction of bilateral putamen.
- Wilson's disease causes destruction of striatum

834. Basal ganglia includes

A. Amygadla
B. Claustrum
C. Subthalamus
D. Substantia Nigra
E. Globus Pallidus

Ans. A, B and E

- Subthalamus and substantia nigra are included in striatal motor system complex

835. About Neurotransmitters in genesis of sleep

A. NREM sleep is produced by stoppage of serotonergic neurons of raphe nuclei
B. Discharge of nor-ephinephrine from neurons in pontine reticular formation produce REM sleep
C. Ponto Geniculo Occipital spikes due to discharge of cholinergic neurons is necessary for shifting NREM to REM sleep
D. NREM sleep to waking is a reversible process with 5 HT acting as a neurotransmitter
E. Waking to REM sleep is never possible except in narcolepsy

Ans. All of the above are true

836. Match the following

A. Hepatic encephalopathy – Alzheimer type II astrocytes
B. Neurosyphillis – red cells (Microglia)
C. Shy dragger syndrome or multi system atrophy – Lewy bodies
D. Pilocytic astrocytoma (cerebellar) – Rosenthal fibres
E. Alzheimer's disease – Hirano bodies

Ans. A, B, D and E. C is false

- In Shy dragger syndrome, there is loss of striatonigral fibres and intermedialateral nucleus column. There is no lewy body and in contrast to IPA there is no response to L-dopa

837. About Parinaud's syndrome

A. Due to compression from upward at inferior colliculus level
B. Loss of downward gaze
C. Lid retraction

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D. Mostly due to pineal tumors
E. Nystagmus retractorius

Ans. C, D and E

- Parinaud syndrome is due to compression by a mass on quadrigeminal plate or midbrain tectum at superior colliculus level. Thus leading to loss of upward gaze first, there is lid retraction, light near dissociation and after that loss of convergence accomodation when there is loss of downward gaze also than it is called syndrome of sylvian aqueduc

838. About Jugular foramen syndrome

A. Villaret syndrome is caused by an intracranial lesion
B. Vernet syndrome is posterior retropharyngeal syndrome
C. In Collet sicard syndrome IX, X, XI, XII is involved
D. Horner's syndrome is present only in villaret syndrome
E. X nerve involvement is present in all Jugular Foramen syndrome

Ans. C, D and E.

- Jugular foramen syndromes include
- Vernet syndrome caused due to an intracranial lesion and involve IX, X, XI nerves
- Colletsicard syndrome involve IX, X, XI, XII nerves
- Villaret syndrome also known as Posterior retropharyngeal syndrome involve IX, X, XI, XII, sympathetic plexus
- Tapia include X, XII, XI sympathetic plexus
- Jackson include X, XI, XII

839. About Paraneoplastic syndrome

A. The most common paraneoplastic syndrome is type II B muscle atrophy
B. Pan cerebellar degeneration is due to anti-yo antibodies present in ca breast, ca uterus or ovary
C. Pure motor neuropathy is almost always due to Lymphoma usually (Hodgkins)
D. Opsoclonus myoclonus syndrome usually in paeds indicate neuroblastoma
E. In Lambert Eaton syndrome, 66% of patients will have ca that too most commonly oat cell Ca having anti Ca voltage gated channel antibodies

Ans. A to E.

840. Most patients with intrinsic brain stem gliomas initially present with

A. Cranial neuropathies
B. Headache
C. Hydrocephalus
D. Nausea and vomiting

Ans. A

- Initial symptoms with brain stem glioma are cranial nerve palsies (68%). Headache used to occulate

841. Surgical approach for thoracic disc herniation is associated with maximal neurologic injury is

A. Costoransversectomy
B. Transpedicular
C. Transthoracic
D. Midline laminectomy

Ans. D.

- Morbidity with laminectomy for thoracic disc herniation is around 59%

842. Which approach favoured for a patient with an 6 mm acoustic neuroma in which hearing preservation is a goal?

A. Middle forsa approach
B. Suboccipital
C. Translabyrinthine
D. None of the above

Ans. A.

843. Uncinate seizures typically produce

A. Auditory hallucination
B. Gustatory hallucination
C. Olfactory hallucination
D. Vertiginious sensations

Ans. C.

844. The ossification centers of the odontoid consist of

A. One primary and two secondary centres
B. One secondary and three primary centres
C. Two primary centres
D. Two primary and one secondary centre

Ans. D

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- The secondary center is apical and the primary center lie inferiorly on either side of midline

845. The most common single suture synostosis is

A. Coronal
B. Lambdoid
C. Metopic
D. Sagittal

Ans. D

- Sagittal: Most common in male (scaphocephaly or dolicocephaly)

846. Each of the following is true of basilar impression EXCEPT

A. Cerebellar and vestibular complaint more common than motor and sensory complaint
B. McGregor's line is helpful in routine screening
C. McRac's line is most specific measurement
D. Short neck and torticollis are common

Ans. A

847. Following fracture has the poorest prognosis for healing without surgical intervention

A. Hangman's
B. Jefferson fracture
C. Type I adontoid
D. Type II adontoid

Ans. D.

848. Statements regarding fracture of cervical spine along with its mechanism, all are true EXCEPT

A. In Jefferson's fracture, the force is compresing and neck neutral
B. In Burst fracture, the force is compresing and neck flexed
C. In Hangman's fracture, the force is distracting and neck extended
D. In Tear drop fracture, the force is compresing and neck posture flexed

Ans. B

- Force should be compressing and neck neutral position

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849. Lateral recess syndrome is most commonly caused by

A. Hypertrophied pedicles
B. Inferior articular facet hypertrophy
C. Ligamentum flavum hypertrophy
D. Superior articular facet hypertrophy

Ans. D

850. Lateral recess syndrome is most common at which level

A. L3 – L4
B. L4 – L5
C. L5 – S1
D. None of the above

Ans. B.

- L4 – L5 level

851. Trilateral retinoblastoma describes bilateral ocular retinoblastomas and

A. Astrocytoma
B. Medulloblastoma
C. Neurofibroma
D. Pinealoblastoma

Ans. D.

852. Adherence of posterior communicating artery aneurysm to the temporal lobe is most likely in a patient that presents with

A. Loss of consciousness
B. Seizures
C. Third nerve involvement
D. No third nerve invovement

Ans. D

- No third nerve invovelemt

853. The articular facet joint in the upper thoracic and lower thoracic region are oriented

A. Axially and coronally respectively
B. Coronally and sagittally
C. Sagittally and coronally
D. Sagittally and axially

Ans. B.

- Coronal orientation of the facet in upper thoracic region leads to significant resistance to anterior transation but little to rotation in the lower thoracic spine the facet become sagittally oriented and less resistance to anterior translation

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854. The single most important factor in the recurrence of meningiomas is

A. Age of the patient
B. Bone invasion
C. Postoperative tumor residual
D. Atypical histology

Ans. C.

- Postoperative tumor residual

855. The transverse crest separates the

A. Cochlear and inferior vestibular nerves from the facial and superior vestibular nerves
B. Facial and cochlear nerves from the superior and inferior vestibular nerves
C. Cochlear and inferior vestibular nerves from the facial and superior vestibular nerves
D. None of the above

Ans. C.

- Bill's bar is a vertical bar that separate facial from superior vestibular nerve. Transverse crest is also known as crista falciformis.

856. Trigonocephaly result from the premature closure of the

A. Coronal suture bilaterally
B. Coronal suture unilaterlly
C. Lamboid sutures
D. Metopic sutures

Ans. D

- Metopic sutures

857. Most important factor determining aggressive clinical course of a dural AVM are

A. Durations of symptoms
B. Location
C. Size
D. Leptomeningeal venous drainage

Ans. D.

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858. The Least-common location of intracranial menengiomas is

A. Olfactory grove
B. Intraventricular
C. Posterior forsa
D. Sphenoid Ridge

Ans. B.

859. Cerebral salt wasting and SIADH may be distinguished by

A. Serum osmolality
B. Serum sodium
C. Urine sodium
D. Volume status

Ans. D.

- Volume status hypervolemia in SIADH, and hypovolemia in CSW syndrome

860. Rosenthal fibers are associated with all except

A. Reactive gliosis
B. Alexander's disease
C. Pilocytic artrocytoma
D. Pick's disease

Ans. D

- Pick's disease

861. Which vascular malformation has no intervening brain parenchyma between blood vessels?

A. Capillary telangiectasias
B. Cavernous hemangiomas
C. Cryptic arteriovenous malformation
D. Venous angiomas

Ans. D.

862. Each of the following is a result of the use of PEEP in the ventilated patient EXCEPT

A. Decreased cerebral perfusion pressure
B. Decreased physiologic dead space
C. Decreased work of breathing
D. Improve lung compliance

Ans. B.

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863. The most common sites of hypertensive hemorrhage, in decreasing order of frequency are

A. Lobar, putamen, cerebellum, thalamus, pons
B. Putamen, lobar, thalamus, cerebellum, pons
C. Putamen, thalamus, pons, lobar, cerebellum
D. Thalamus, lobar putamen, cerebellum pons

Ans. B.

864. The most sensitive monitor of venous air embolism is

A. Transoesephageal echocardiography
B. Precordial doppler
C. End-tidalp CO_2
D. End-tidal pN_2

Ans. A.

- TEE > Precordial Doppler > $EpCO_2$ > EpN_2

865. The pterion corresponds to the following EXCEPT

A. Anterior pole of insula
B. Middle cerebral artery
C. Transverse sinus
D. Lateral cerebral sulcus

Ans. C.

- Transverse sinus

866. Sigmoid – Transverse sinus junction corresponds to

A. Pterion
B. Asterion
C. Bregma
D. Stephanion

Ans. B.

867. The approximate time for S phase in the biological cell cycle is

A. 2-10 hours
B. 1 hour
C. 0-30 hours
D. 10-20 hours

Ans. D.

868. Multiple organ failure includes the failure of the following organs except

A. Lung
B. GI tract
C. Kidneys
D. Pancreas

Ans. D.

869. Betz cells are present in

A. Area 6, Anterior paracentral lobule
B. Area 4, Posterior paracentral lobule
C. Area 4, Area 6, Anterior Paracentral lobule
D. Area 4, Anterior paracentral lobule

Ans. D.

870. Broca aphasia may result from occlusion of which of the following arteries

A. Anterior temporal artery
B. Anterior choroidal artery
C. Operculofontal artery
D. Medial striate artery of heubner

Ans. C.

871. Which of the following groups of cranial nerves is closely related to the corticospinal tract?

A. CN III, CN IV, and CN V
B. CN III, CN V, and CN VII
C. CN III, CN VI and CN VIII
D. CN III, CN VI and CN XII

Ans. D.

872. Neurologic examination reveals paralysis of upward and down ward gaze, absence of convergence and absence of papillary reaction to light the lesion site responsible is the

A. Rostral midbrain tectum
B. Caudal midbrain tectum
C. Rostral pontine segment
D. Caudal midbrain segment

Ans. A.

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873. Paramedian infraction of the base of the pons involves which of the following structure

A. Trapezoid body
B. Descending trigeminal tract
C. Rubrospinal tract
D. Pyramidal tract

Ans. D.

874. Statements concerning INO (Internuclear Ophthalmoplegia) are correct EXCEPT

A. Result from a lesion in the dorsal pontine tegmentum
B. It has no effect on convergence
C. It is frequently seen in multiple scerosis
D. It results in a lateral rectus palsy on attempted lateral conjugate gaze

Ans. D.

- It results in a medial rectus palsy on attempted lateral conjugate gaze

875. Most common anomaly of odontoid maldevelopment is

A. Type 1
B. Type 2
C. Type 3
D. Type 4

Ans. B.

- Type 2 (ossiculum terminale) when there is failure of fusion of apex to base. Type 1 (osodontoiedum) when the fully developed dens does not unite with the body of the axis

876. Statements concerning the dura mater are correct except

A. It forms the perioesteum of the vertebral canal
B. It forms the wall of the venous sinuses
C. It forms the roof of the pituitary fosa
D. It is innervated by two cranial nerves

Ans. A.

877. The criterion for tonsillar ectopia in the fourth to the eighth decades is

A. 6 mm
B. 5 mm
C. 4 mm
D. 3mm

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Ans. C. i.e 4 mm

- In general, the cerebellar tonsils ascend with increasing age. In the first decade of life, 6mm should be used as the criterion for tonsillar ectopia. This decreases to 5mm in the second and the third decades, to 4mm between the fourth to the eighth decades, and to 3mm by the ninth decade.

878. Which of the following ocular muscle not originating from annulus of zinn

A. Superior oblique
B. Inferior oblique
C. Superior rectus
D. Inferior rectus

Ans. B.

879. During operating a fourth ventricular tumor, facial colliculus get damaged resulting in paralysis of all EXCEPT

A. Buccinator
B. Lateral rectus
C. Lateral pterygoid
D. Orbicularis oculi

Ans. C. Facial colliculus is the elevation seen in the floor of the fourth ventricle which overlies abducens nucleus and the fibres of the facial nerve

880. The middle cerebral artery irrigates each of the following structures or areas EXCEPT

A. The paracentral lobule
B. The inferior parietal lobule
C. Brocas speech area
D. Wernicke's speech area

Ans. A.

881. Statements regarding the pupillary light pathway are correct EXCEPT

A. Transection of the optic tract eliminates the direct pupillary light response
B. Transection of the optic nerve would not eliminate the consensual pupillary light reflex
C. Destruction of LGB would not interrupt the pupillary light pathway
D. The efferent limb of the pupillary light reflex is the oculomotor nerve (CN III)

Ans. A.

882. The thalamus receives precortical sensory input from all of the following modalities EXCEPT

A. General somatic sens **B.** Gustation
C. Audition **D.** Olfaction

Ans. D.

883. Epiconus syndrome involves segments

A. $S_3 - C_0$ **B.** $L_4 - S_2$
C. $L_3 - C_0$ **D.** $L_5 - S_4$

Ans. B.

- Epiconus involve $L_4 - S_2$

884. Conus medullaris syndrome involves segments

A. $L_4 - S_2$ **B.** $L_3 - C_0$
C. $S_3 - C_0$ **D.** $L_2 - S_4$

Ans. C.

- $S_3 - C_0$ is conus

885. During third ventriculostomy stoma is made in

A. Roof of the third ventricle
B. Anterior wall of the third ventricle
C. Lateral wall
D. Pre-mamillary membrane

Ans. D.

- Pre-mamillary membrane is pierced

886. About skull, statements are true except

A. 90% of adult head size is achieved by age 1 year
B. Skull growth essentially ceases at age 7 years
C. Diploe spaces appear by 4th year and reach maximum by 25th year
D. Mastoid process aerates till end of 2nd year

Ans. D.

- Mastoid process aerate till 6th year

887. Tumor involving posterior element of the vereterae are all except?

A. Osteoid osteoma
B. Osteoblastoma
C. Eosinophilic granuloma
D. Aneurysmal bone cyst

Ans. C.

- Primary tumor of posterior element are Aneurysmal bone cyst, Hydatid cyst, Hemangioma, Osteoblastoma, Osteoid osteoma and Giant cell tumor

888. Statement about myelination—all are true except

A. Occurs between 24 weeks' gestation and 18 months
B. Caudal to cranial in progression
C. Motor nerve myelination occurs earlier than sensory nerve myelination
D. Dorsal to ventral
E. Premature infants myelinate at the same rate as in utero

Ans. C.

889. Cystic metastases in brain is due to

A. Squamous cell carcinoma of lung
B. Malignant melanoma
C. Choriocarcinoma
D. Renal cell carcinoma

Ans. A.

890. Resting membrane potential and action potential of a nerve fiber is

A. -20 mV and +40 mV
B. - 80 mV and +40 mV
C. -60 mV and + 40 mV
D. - 40 mV and +40 mV

Ans. B.

- In resting unstimulated state, a nerve fiber is polarized so that the interior is negative to the exterior, potential difference is about -80 mV and is called resting membrane potential. The action potential is about +40 mV with the outside of the membrane negative to inside. In small diameter axons, the action potential may not rise to as much as 40 mV

891. CSF is absorbed along the perineural lymphatics of cranial nerves

A. I, III, VI, IX
B. I, II, VII, VIII
C. I, IV, VII, VIII
D. I, III, VII, X

Ans. B.

892. Chance fracture is a

A. Compression fracture
B. Burst fracture
C. Seat belt fracture
D. Fracture dislocation

Ans. C

- Seat-belt fracture – failure of both posterior and middle column

893. Presence of following genotype pretends a worse prognosis following traumatic brain injury

A. ApoE allele **B.** ApoA allele
C. ApoC allele **D.** ApoD allele

Ans. A.

- Apolipoprotein E (ApoE) E4 allele also a risk factor for Alzheimer's disease as well as for chronic traumatic encephalopathy

894. Chassaignac's tubercle also known as carotid tubercle is

A. Posterior tubercle of transverse process of C5
B. Anterior tubercle of transverse process of C6
C. Anterior tubercle of transverse Process of C7
D. Anterior tubercle of transverse process of C4

Ans. B.

- Anterior tubercle of transverse process of C6 most prominent in C spine usually at the level of the cricoid cartilage approx 1.5-2 inches above clavicle.

895. The intracranial length of the shunt to be inserted should be

A. Approximately 1/3rd of the length of the skull
B. Approximately 2/3rd of the length of the skull
C. Approximately 1/4th of the length of the skull
D. None of the above

Ans. B

- In adults without macrocrania, the inserted length is usually 12cm. In hydrocephalic infant usually 7-8 cm.

896. Which of the following point place the shunt in Trigone?

A. Dandy's point **B.** Kocher's point
C. Keen's point **D.** Frazier burr hole

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Ans. C

- Keen's point – 2.5 or 3cm posterior and superior to pinna

897. Safe extent of resection of temporal lobe on dominant side from temporal tip is

A. 3 – 4 cm **B.** 4 – 5 cm
C. 5 – 6 cm **D.** 6 – 7 cm

Ans. B

- One can usually safely resect up to 4 – 5 cm from temporal tip on dominant side. One can resect up to 6 – 7 cm in non-dominant hemisphere before running the risk of injury to optic radiation

898. Bone wax for use in neurosurgery originated by

A. Sir Victor Horsely **B.** Harvey cushing
C. Walter Dandy **D.** Ambroise Pierre

Ans. A.

- Sir Victor Horsely. Bone wax inhibit bone formation

899. Which of the following are encapsulated receptors?

A. Merkels disc
B. Hair follicle receptor
C. Ruffinis corpuscle
D. Meissners corpuscle
E. Neuromuscular spindle

Ans. C, D and E

- Non capsulated reeceptors include free nerve ending, Merkels disc (found in hairless skin and are slowly adapting touch receptor), hair follicle receptor. Encapsulated receptors include Meissners corpuscle (very sensitive to touch and are rapidly adapting mechanoreceptors). It enables two point discrimination. Pacinian corpuscle is rapidly adapting mechanoreceptor sensitive to vibration. Ruffinis corpuscle is a slow adapting mechanoreceptor. Neuromuscular spindles and Neurotendinous spindles are encapsulated.

900. Regarding statement about central nervous system all are false except

A. There are roughly equal number of glial cells and neurons
B. Microglia are phagocytic

C. Astrocytes regulate interstitial calcium concentration
D. L-glucose is preferentially transported across the blood-brain barrier

Ans. B.

- Astrocytes regulate interstitial potassium concentration. D-glucose is the isomer transported across the blood-brain barrier. There are many more glial cell than neurons

901. While examining a patient there is papilledema differential diagnosis should include all EXCEPT

A. Intra cranial tumor
B. Schwanomma
C. Gulliain – Barr syndrome
D. Hypercapnea

Ans. D.

- Hypercarbia causes papilledema. High CSF fluid protein level causes papilledema in GB syndrome and schwanomma

902. True statement regarding optic fundus

A. The optic disc is darker than the surrounding retina
B. If the margin of the disc is indistinct, then papilledema is a possibility
C. Arteriovenous nipping is a sign of diabetic retinopathy
D. Pigmentation is always caused by a disease process

Ans. B.

903. Destruction of the ventral horn results in all of the following deficit except

A. Loss of muscle stretch reflex
B. Loss of muscle bulk
C. Flaccid Paralysis
D. Babinski sign

Ans. D.

904. Corticospinal tract receives contribution from all of the following areas except

A. Prefrontal cortex
B. Premotor cortex
C. Motor cortex
D. Somaesthetic cortex

Ans. A.

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905. Spinothalamic tract arises from rexed laminae

A. I, II, V
B. I, IV, V
C. I, IV, VII
D. II, IV, VII

Ans. B.

- From rexed laminae – I, IV, V

906. Which of the following is superior anastomotic vein?

A. Vein of Galen
B. Vein of Labbe
C. Vein of Trolard
D. Pre central cerebellar Vein

Ans. C.

- Inferior anastomotic vein is vein of Labbe

907. Choroid plexus of the IVth ventricle is supplied by

A. AICA
B. PICA
C. AICA and PICA
D. None of the above

Ans. C.

- Supplied by both. Vertical and proximal part by AICA and lateral half, plexus at CP angles by PICA. Choroid plexus of the fourth ventricle is T shaped with vertical limb being duplicate.

908. Choroid plexus of the atrium or trigone supplied by

A. Anterior choroidal artery
B. Posterior choroidal artery
C. Branches from AICA
D. Branches from PICA

Ans. B.

- Posterior choroidal artery from posterior cerebral artery supplies choroids plexus of the body. Choroid plexus of temporal horn supplied by anterior choroidal artery

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909. Trendelenburg sign will be positive in which nerve injury

A. Superior gluteal nerve
B. Inferior gluteal nerve
C. Common peroneal nerve
D. Sciatic nerve

Ans. A.

- Superior gluteal nerve that supply thigh adductor (gluteus medius and minimus)

910. All of the following require urgent Neurosurgical evaluation and treatment EXCEPT

A. Cerebellar infarction
B. Subdural hematoma
C. Sub arachnoid hemorrhage
D. Embolic stroke

Ans. D.

- Embolic stroke can be managed conservatively

911. All of the following characterize Peripheral vertigo except

A. Acute onset
B. Non-fatiguable nystagmus
C. Nausea and vomiting
D. Positive Nylen – Baranay manoeuvre

Ans. B.

- Nystagmus is fatiguable

912. All of the following are potential cause for the comatose state of a patient present in coma in Emergency EXCEPT

A. Hypoglycemia
B. Hyperammonemia
C. Hyponatremia
D. Lacunar infarct

Ans. D.

913. Which electrolyte is most affected by acid-base changes?

A. Sodium
B. Chloride
C. Calcium
D. Magnesium
E. Potassium

Ans. E.

- Potassium – A change in the PH of 0.10 results in a decrease or increase in K+ concentration in 0.5 mg/L increment

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914. Chordomas are nervous system neoplasm that have all of the following characteristic except

A. Occurrence in childhood
B. Location in the sacrococcygeal region
C. Characteristic physalipharous cells
D. Slow growth

Ans. A.

915. Astrocytomas of the cerebellum are characterized by

A. Multiple recurrences
B. Poor survival rates
C. Transformation into glioblastoma
D. Occurrence in childhood and adolscence

Ans. D

916. A pt received in emergency. CT scan showed SAH with acute blood intraventricularly and in the septum pellucidum probably the aneurysm to bleed is

A. Anterior communicating artery aneurysm
B. ICA bifurcation aneurysm
C. M2 segment aneurysm
D. Posterior communicating artery aneurysm

Ans. A.

917. Following statements concerning the nuclear characteristic of tumors as determined by DNA flow cytometry are true except

A. A diploid lesion can be benign or malignant
B. An aneuploid tumor is a malignant tumor
C. A malignant tumor can be diploid
D. Reactive lesions should be diploid

Ans. B.

- An aneuploid result does not equate with malignancy, most aneuploid lesions are neoplastic there are exceptions

918. Following statement regarding central dopamine receptors are true except

A. D1 receptor activation inhibit adenylate cyclase system
B. D2 receptors are inhibitory in some brain tissue
C. Neuroleptic side effects are thought to be mediated through D2 receptors in the pituitary
D. D3 receptors found principally in limbic system

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Ans. A.

- D1 receptor is excitatory and directly activates the adenylate cyclase system

919. The revised trauma score is the most commonly used physiologic, estimates of injury used in trauma centers it is based on all of the following except which

A. Systolic blood pressure
B. Pulse rate
C. Respiratory rate
D. Glasgow coma scale

Ans. B.

- Pulse rate – Revised Trauma Score based on GCS, systolic blood pressure and respiratory rate

920. Nerve root existing between C4 – C5, C7 – D1, D8 – D9 and L4 – L5 vertebrae are

A. C5, D1, D8 and L4 nerve roots respectively
B. C5, C8, D8 and L4 nerve roots respectively
C. C4, C8, D9 and L5 nerve roots respectively
D. C5, D1, D9 and L4 nerve roots respectively

Ans. B.

921. Most preferred approach for lumbar discectomy is

A. Anterior
B. Posterior
C. Anterolateral
D. Posterolateral

Ans. B.

922. Most preferred surgical approach for pituitary tumors is

A. Peritoneal
B. Subfrontal
C. Transcallosal
D. Trans sphenoidal

Ans. D.

923. About transcranial Doppler ultrasound all are true except

A. Is becoming part of the standard care for sub-arachnoid hemorrhage

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B. Useful in diagnosis and monitoring of cerebral vasospasm
C. It measures the velocity of flowing blood
D. Useful in detecting brain tumors

Ans. D.

924. Victor Horsley's sign in a case of intracranial hemorrhage consist of

A. Elevation of body temperature above 30°C
B. Elevation of body temperature as high as 34°C
C. Difference of one degree of temperature between the two sides of the body, higher on the paralysed side
D. Difference of two degrees of temperature lower on the paralysed side

Ans. C.

925. A seizure arising in one motor cortex starts most frequently in any of the following except

A. Thumb
B. Eyelid
C. Angle of mouth
D. Great toe

Ans. B.

926. A patient with loss of function of posterior columns of spinal cord will present with all except

A. Normal plantar response
B. Romberg sign positive
C. Partial loss of pain sensation
D. Diminished vibration sense

Ans. C.

927. Which type of seizure among the following does not follow head trauma

A. Absence (petitmal)
B. Partial complex, psychomotor variety
C. Partial motor with Jacksonian march
D. Partial motor with secondary generalization

Ans. A.

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928. After lumbar puncture recumbency for which duration will prevent headache

A. 6 hours **B.** 12 hours
C. 24 hours **D.** 1 weeks

Ans. C.

929. Characteristic of congenital hydrocephalus include all the following except

A. Large head with wide and bulging fontanelle
B. Transillumination
C. Crackpot sign
D. Convulsions

Ans. D.

930. Following artery most frequently affected in embolic or thrombotic cerebrovascular disease

A. Anterior cerebral
B. Anterior communicating
C. Middle cerebral
D. Posterior cerebral

Ans. C.

931. Following are reliable signs of upper motor neuron lesion except

A. Babinski sign
B. Positive Hoffman's sign
C. Positive Rossolimos sign
D. Generalized increase in tendon reflexes

Ans. D.

932. CSF volume is maximum in

A. Lateral ventricle
B. Subarachnoid spaces centrally
C. Spinal subarachnoid space
D. IIIrd ventricle

Ans. C.

- Total volume of CSF in adults is 100-150 ml, Lateral ventricles consist 10-15 ml each. Rest of ventricular system contain 5ml. Cranial subarachnoid spaces consist of about 25 ml of CSF. Spinal subarachnoid space consist of 75 ml of CSF.

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933. In pseudopapilloedema, which of the following is the most diagnostic sign in fundus

A. Exudates
B. Hemorrhages
C. Elevation of optic disc
D. Unchanging appearance of fundus on repeated examination

Ans. D.

934. If corticosteroids are used for cerebral decongestation which of the following should be monitored

A. Blood pressure
B. S. cortisol
C. Urine output
D. Serum potassium

Ans. D.

935. In Intracerebral hemorrhage, lumber puncture will be negative for first

A. 8 – 10 hours
B. 12 – 16 hours
C. 16 – 24 hours
D. 24 – 48 hours

Ans. A. i.e. 8-10 hours

936. The venous thrombosis is most frequent during pregnancy pueperium in

A. Superior sagittal sinus
B. Inferior sagittal sinus
C. Cortical venous system
D. Transverse sinus

Ans. A.

937. Which of the following is often the site of origin of Jacksonian epilepsy?

A. Orbitofrontal area
B. Frontal lobe
C. Pre rolandic gyrus
D. Post rolandic gyrus

Ans. C.

938. Following symptoms indicate the extension of thrombosis from transverse sinus to superior sagittal sinus

A. Faciobrachial paresis
B. Hemiparesis
C. Paraparesis
D. Hemianopia

Ans. C.

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939. Foetal circulation present in

A. 10 – 15% **B.** 15 - 35 %
C. 30 – 45% **D.** 25 – 45%

Ans. B.

940. First branch of supraclinoid ICA is

A. Ophthalmic artery
B. Superior hypophyseal artery
C. Inferior hypophysed artery
D. Posterior communicating artery

Ans. B.

- Superior hypophyseal artery supplies anterior lobe of pituitary and stalk

941. PICA (Posterior inferior cerebellar artery) has

A. 3 segments, 3 branches
B. 4 Segments, 3 branches
C. 5 segments, 4 branches
D. 6 segments, 6 branches

Ans. B.

- 4 segments – anterior medullary, lateral medullary, posterior medullary and supratonsillar
- 3 branches – choroidal artery, tonsillohemispheric and inferior vermian artery

942. Benign external hydrocephalus all are true except

A. Ventricles are normal or minimally enlarged
B. Does not resolve spontaneously
C. Enlarged subarachnoid spaces over the frontal poles
D. May be associated with plagiocephaly

Ans. B.

- Usually resolve spontaneously by 2 years of age

943. The most common cause of Communicating hydrocephalus

A. Infections
B. Post hemorrhagic
C. Secondary to masses
D. Neurosarcoidosis

Ans. A.

- Post-hemorrhagic second most common

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944. After Endoscopic third ventriculostomy the most common aneurysm tend to occur as a result of long term complication is

A. AICA aneurysm
B. PICA aneurysm
C. SCA aneurysm
D. Basilar artery aneurysm

Ans. D.

945. Percent risk of seizures in the first year after placement of a shunt is

A. 5.5 %
B. 6.5%
C. 8.5%
D. 10.5%

Ans. A.

946. The most common cause and site of shunt malfunction is

A. Obstruction, Distal end
B. Obstruction, Proximal end
C. Disconnection, Distal end
D. Disconnection, Proximal end

Ans. B.

- The most common cause of shunt malfunction is obstruction and proximal ventricular catheter is the most common site

947. Regimen of antibiotics for an operated patient of cerebral abscess which is true

A. IV antibiotics for 6 weeks and oral antibiotics for 4 weeks
B. IV antibiotics for 2 weeks and oral antibiotics for 2 weeks
C. IV antibiotics for 1 week and oral antibiotics for 1 week
D. IV antibiotics for 2 weeks only

Ans. A.

- IV antibiotics for 6-8 weeks and oral antibiotics for 4-8 weeks. IV antibiotic for 6-8 weeks (most commonly 6) may then discontinue even if the CT abnormalities persist (neovascularity remains). Oral antibiotics may be used following IV course. 5-20% of abscesses recur within 6weeks of discontinuing antibiotics.

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948. Which of the following Midline brain cavities is associated with congenital anomaly?

A. Cavum septum pellucidum
B. Cavum vergae
C. Cavum velum interpositum
D. None of the above

Ans. B.

- Cavum vergae is associated with apert syndrome

949. The most common posterior circulation aneurysm is

A. Basilar top aneurysm
B. Basilar – SCA aneursym
C. Basilar – AICA aneurysm
D. Verterbral – PICA aneurysm

Ans. A.

- Account for 5% of all intracranial aneurysm

950. Loss of chromosome arms in patient of oligodendroglioma resulting in good response to chemotherapy and longer free tumor survival

A. 1P, 19Q
B. 2P, 19Q
C. 5Q, 22Q
D. 3P, 18Q

Ans. A.

951. Spondylolysis is an alternative term for

A. Isthmic spondylolisthesis
B. Traumatic spondylolisthesis
C. Degenerative spondylolisthesis
D. Congenital spondylolisthesis

Ans. A.

- Isthmic spondylolisthesis defect in pars inter articularis

952. Intradural disc herniation has an incidence of about

A. .01 – 0.08%
B. .04 – 0.09%
C. .04 – 1.1%
D. .08 – 1.8%

Ans. C.

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953. H reflex which measures sensory conduction through nerve roots used mostly to assess

A. L4 radiculopathy
B. L5 radiculopathy
C. S1 radiculopathy
D. L3 radiolopathy

Ans. C.

954. About SCIWORA **all are true EXCEPT**

A. Age range of children is 1.5 - 16 years
B. Attributed to increased elasticity of spinous ligament
C. Higher incidence in age >9 years
D. Increased risk with asymptomatic Chiari 1 malformation

Ans. C. Higher incidence in age < 9 years. SCIWORA means spinal cord injury without obvious radiographic abnormality

955. The precentral cerebellar vein usually drains into the

A. Internal cerebral vein
B. Lateral mesencephalic vein
C. Straight sinus
D. Vein of Galen

Ans. D.

956. Anterior temporal lobe masses characteristically displace the

A. Anterior choroidal artery laterally
B. Anterior choroidal artery medially
C. Anterior choroidal artery upward
D. Posterior choroidal artery downward

Ans. B

957. The most common site of origin of the recurrent artery of Heubner is the

A. A1 segment
B. A2 segment
C. Internal carotid artery
D. M1 segment

Ans. B

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958. Most common site for occurrence of Choroid plexus papilloma in children and adults respectively

A. Right atrium and Fourth ventricle
B. Left atrium and Third ventricle
C. Left atrium and Fourth ventricle
D. Right atrium and Third ventricle

Ans. C.

959. Lesions in diffuse axonal injury are commonly found in the following EXCEPT

A. Corpus callosum
B. Gray-White junction
C. Rostral brain stem
D. Temporal lobe
E. Superior cerebellar peduncle

Ans. A, B, C, and E

960. Acute subarachnoid hemorrhage is more difficult to diagnose on MRI than on CT because

A. Extracellular methemoglobin is isointense on T1 and T2
B. Hemosiderin is isointense on T1 and T2
C. The high oxygen tension in the subarachnoid space prevents conversion of oxyhemoglobin to deoxyhemoglobin
D. The low oxygen in the subarachnoid space prevents conversion of deoxyhemoglobin to oxyhemoglobin

Ans. C

961. Which of the following is true of myelination?

A. It has no effect on transmembrane resistance, but increases membrane capacitance
B. It decreases both transmembrane resistance and membrane capacitance
C. It decreases transmembrane resistance and increases membrane capacitance
D. It increases transmembrane resistance and decreases membrane capacitance

Ans. D

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962. Testing the sense of taste would be most important in patient presenting with

A. Loss of hearing
B. Diplopia
C. Dystaxia
D. Hemifacial paralysis

Ans. D.

963. The posterior plane of cutaneous innervation by the trigeminal nerve is at the

A. Occipito cervical junction
B. Lambdoid suture plane
C. Interaural plane
D. Intercanthal line

Ans. C.

964. The descending root of CNV ends at the

A. Obex
B. Mid-medullary level
C. Pontomedullary junction
D. Upper cervical level

Ans. D.

965. In locked in syndrome, the lesion usually involves the

A. Midbrain tectum
B. Midbrain tegmentum
C. Pontine tegmentum
D. Basis pontis

Ans. D.

- Basis ponits – complete paralysis of all voluntary movement except vertical eye movement, Pt retain consciousness

966. Disorders resulting due to defect in secondary neurulation are

A. Tethered cord syndrome
B. Meningocele
C. Encephalocele
D. Lipomeningocele
E. Chiari malformations

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Ans. A, B and D

- The formation of the brain and spinal cord is referred to as a dorsal induction. The two general stages of dorsal induction are primary and secondary neurulation. Primary neurulation involves the formation of the brain and upper spine. Secondary neurulation refers to formation of the distal spine. Disorders of primary neurulation are mostly neural tube closure defects and early central nervous system anomalies occurring at around 3 or 4 weeks gestational weeks. These include chiari malformations, cephaloceles, and myelomeningoceles. During secondary neurulation, interaction between the notochord and mesoderm form the skull, dura, pia and vertebrae. These occur at 4-5 gestational weeks. Abnormalities of secondary neurulation result in spinal dysraphic disorders that range from simple, isolated anomalies such as spina bifida occulta to more complex malformations such as meningocele and lipomeningocele, neurentric cysts, dermal sinus and the caudal regression syndrome

967. The dececrebrate posture generally indicates a lesion of the

A. Pons
B. Medulla
C. Midbrain
D. Diencephalon

Ans. C.

968. Dystaxia resulting from lesions of the cerebellar hemisphere reflects dysmodulation of impulses relayed through which pathway

A. Dentato vestibulospinal
B. Olivo cerebellar
C. Dentatorubral
D. Dentatothalamo cerebro cortical

Ans. D.

969 Part of the cerebellum that may undergo transforminal herniation and strangle the medullocervical junction is the

A. Rosteral vermis
B. Flocculo nodular lobe
C. Inferior peduncle
D. Tonsil

Ans. D.

970. A lesion affecting CN III, CN IV and CN VI would most likely to be in the

A. Pontine tegmentum
B. Superior orbital fissure
C. Cavernous sinus
D. Midbrain tegmentum

Ans. C.

971. After CN III enters the subarachnoid space of the interpenduncular fossa, it immediately encounters

A. CN IV
B. Infundibular stalk
C. The posterior cerebral artery
D. The posterior clinoid process

Ans. C.

972. The development of the human embryo may be divided into 23 stages. At which stage of embryo formation the cranial defect use to occur

A. Stage 8 **B.** Stage 9
C. Stage 11 **D.** Stage 12

Ans. C

- The closure process leaves an opening rostrally, the anterior neuropore, which closes around the 24-25th day of gestation (stage 11). And an opening caudally, the posterior neuropore, which closes by the 27 to 30th day of gestation (stage 12). This explains why most congenital abnormalities are located in the cranial and caudal region.

973. The most important structure for describing the location of various thalamic nuclei is the

A. Nucleus pulvinaris
B. Nucleus reticularis
C. Stratum zonale
D. Zona incerta
E. Internal medullary lamina

Ans. E.

974. A single lesion that interrupts axons of the fornix, striaterminalis and stria medullaris would involve the

A. Roof of the third ventricle
B. Floor of the third ventricle
C. Genu of the corpus callosum
D. Midregion of the anterior commissure

Ans. D.

- The fornix which arches over the roof of the third ventricle, splits into an anterior and a posterior component around the anterior commisure, the stria medullaris and the stria terminalis course across the midportion of anterior commissure

975. In addition to field cuts, lesion that destroy the optic chiasm and immediately related overlying part of hypothalamus would most likely cause

A. Hypertension
B. Precocious puberty
C. Hypothermia
D. Diabetes Insipidus

Ans. D.

976. Main efferent layers of the cerebral cortex are

A. Layer IV and VI
B. Layer V and VI
C. Layer I and II
D. Layer III and IV

Ans. A.

977. The sublenticular and retrolenticular parts of the internal capsule convey

A. Thalamoparietal and Thalamogeniculate radiation
B. Thalamoparietal and geniculocal carine radiations only
C. Thalamofrontal and thalmoparietal radiation
D. Geniculocalcarine, temporal and occipital radiation

Ans. D.

978. The spinal cord reflects the Law of Bell and Magendie since

A. The dorsal horn is sensory and the vertal horn is motor
B. Spinal cord develops as intermediolateral cell column
C. Corticospinal tracts run in the lateral column
D. Ventral horn contains no interneuror

Ans. A.

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979. The original somite-spinal nerve relationship is best shown at which level of the neuraxis

A. Cervical **B.** Thoracic
C. Lumbar **D.** Sacral

Ans. A.

980. A lesion that would most effectively disconnect the frontal and temporal lobes would interrupt the

A. Uncinale fasciculus
B. Inferior longitudinal fasciculus
C. Central segmental tract
D. Fornix

Ans. A.

981. The subdivisons of the CNS that lacks direct sensory connection with the external environment is the

A. Telencephalon
B. Diencephalon
C. Midbrain
D. Pons

Ans. C.

982. During adduction of an eye, the elevator action of the superior rectus and inferior oblique

A. Decrease simultaneously
B. Increases simultaneously
C. Decreases and increases simultaneously
D. Increases and decreases simultaneously

Ans. C.

- The superior recti rotate the eye ball superiorly as the primary action when the eyes are turned outward. Inferior oblique rotates the eye superiorly with eyes adducted.

983. A patient's MRI shows right frontal space occupying lesion extending 4.5cm behind the coronal suture with minimal deficit. All are true except

A. Anterior approach preferred to prevent damage to motor cortex
B. Posterior approach will result in hemiplegia

C. After complete removal, the sensory deficitis are prominent-than motor deficits
D. None of the above

Ans. C.

984. Following form of aphasia would most likely to be associated with a right sided UMN facial paresis

A. Auditory word agnosia
B. Dyslexia plus dysgraphia
C. Auditory word aphasia plus dyslexia (Fluent aphasia)
D. Expressive aphasia, non fluent type

Ans. D. i.e. Broca's aphasia

985. The afferent axons for the muscle stretch reflexes (MSRS) synapse on the

A. Substantia gelatinosa
B. Lamina I of Rexed
C. Ventral motoneuron
D. Nucleusreticularis

Ans. C.

986. To eliminate pain in a particular dermatome without causing loss of the sense of touch would make a cut at the following site

A. Where the lateral fibers of the dorsal root attach to the cord
B. Where the medial fibres of the dorsal root attach to the cord
C. In the mid portion of the root as it crosses the subarachnoid space
D. In the nerve trunk about 1cm distal to the ganglion

Ans. A.

987. The ultimate function of blood brain barrier is to

A. Exclude small molecules
B. Actively transport protein
C. Keep out white blood cells
D. Protect the polarization of the neuronal membrane

Ans. D.

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988. The cellular neuropathology of Alzheimer's disease resembles most closely that seen in

A. Huntigton disease
B. Multi-infarct dementia
C. Pick's disease
D. Trisomy 21

Ans. D.

989. The most common cause of cerebral embolism is

A. Cardiac prosthetic valves
B. Endocarditis
C. Atrial fibrillation
D. Dilated cardiomyopathy

Ans. C.

990. Following are common causes of seizures in adults older than 50 years of age except

A. Cerebrovascular disease
B. Degenerative disease
C. Subdural hematoma
D. Mesial temporal sclecosis

Ans. D.

991. Following are side effects of phenytoin except

A. Ataxia
B. Gum hyperplasia
C. Leukopenia
D. Lymphadenopathy

Ans. C.

- Leukopenia more common with carbamezepine

992. The most common presenting finding or symptom of multiple sclerosis is

A. Internuclear opthalmoplegia
B. Optic neuritis
C. Transverse myelitis
D. Cerebellar ataxia

Ans. B.

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993. Types of cancer commonly metastasize to the central nervous system (CNS) except

A. Ovarian
B. Breast
C. Melanoma
D. Acute lymphoblastic leukemia

Ans. A.

994. Arcuate eminence is present in the

A. Squamous part of the temporal bone
B. Pterous part of the temporal bone
C. Body of sphenoid
D. Greater wing of sphenoid

Ans. B.

995. Vertical conjugate saccade controlled by

A. Para pontine reticular formation
B. Medial longitudinal fasciculus
C. Rostral interstitial nucleus of MLF
D. None of the above

Ans. C.

996. What percent of the cardiac output and total body oxygen consumption is utilized by brain

A. 20% of the cardiac output and 10% of total body oxygen consumption
B. 20% of the cardiac output and 20% of total body oxygen consumption
C. 30% of the cardiac output and 20% of total body oxygen consumption
D. 20% of the cardiac output and 20% of total body oxygen consumption

Ans. B.

- 20% of the cardiac output and 20% of total body oxygen consumption

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997. Paralysis of tenth cranial nerve may be produced by thrombosis of artery

A. Middle cerebral artery
B. Posterior cerebral artery
C. Posterior communicating artery
D. Posterior inferior cerebellar

Ans. D.

998. Among which of the following embolic material is not used for definitive (non operative) cure

A. Arterial minicoils
B. Cyanoacrylate adhesive
C. Polyvinyl alcohol particles
D. Silk suture pieces

Ans. C.

- Polyvinyl alcohol particles. Most interventional neuro radiologist feel polyvinyl alcohol particle embolization should not be used for definitive (non operative) cure

999. Kanofsky performance scale of a patient who cares for self but unable to carry on normal activities is

A. 80
B. 70
C. 60
D. 50

Ans. B.

- 100 – Normal
- 90 – Normal activity with effort, some moderate symptoms
- 70 – Care for self but unable to carry on normal activities
- 60 – Cares for most needs but require occasional assistance
- 50 – Require considerable assistance to carry on activities of daily living

1000. The first removal of a ruptured lumbar intervertebral disc was by

A. Mixter and Barr
B. Victor Horsely
C. Walker Dandy
D. Harvey Cushing

Ans. A.

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1001. About Walter Dandy all are correct EXCEPT

A. Developed the technique of pneumoencephalography
B. First to show acoustic neuromas could be totally removed
C. Introduce the technique of choroids plexectomy to reduce production of CSF
D. Trained under William Halsted

Ans. D.

- He was trained under Harvey William Cushing. William Halsted was the mentor of Harvey William Cushing. Harvey William Cushing is also known as father of American neurosurgery

1002. Which of the following are true about growing skull fractures

A. Can cross suture line
B. May be associated with underlying bone injury
C. Dural defect is always greater than bone defect
D. Most common in frontoparietal region
E. Most common in the three five year old age group

Ans. A to D. Most common in less than 3 years of age

1003. The most common mechanism of translational $C_1 - C_2$ subluxation is

A. Axial loading
B. Distraction
C. Extension
D. Flexion

Ans. D.

1004. Nervus intermedius contain

A. SVA + GVE fibres
B. SVA + GSA fibres
C. SVA fibres
D. SVA + GSA + GVE fibres

Ans. D.

1005. The anterior choroidal artery supplies portion of each of the following structure EXCEPT

A. Amygdala
B. Globus pallidus
C. Hippocampus
D. Hypothalamus

Ans. D.

1006. Most common cause of epidural metastases in childrenis

A. Osteosarcoma
B. Ewing's sarcoma
C. Neuroblastoma
D. Rhabdomyosarcoma

Ans. B. Approximately 3-5% of children with a systemic malignancy develop spinal cord compression. The responsible tumor in order of decreasing frequency are Ewing's sarcoma, osteosarcoma, neuroblastoma, rhapdomyosarcoma, non-Hodgkins lymphoma, germ cell tumor, Hodgkins lymphoma

1007. In a Peripheral nerve, sensory fibers are about

A. 20% **B.** 30%
C. 40% **D.** 50%

Ans. C.

- 40% Unmyelinated to myelinated fibre ratio 4:1

1008.Position of head relative to orbitomeatal line for superior visualization of the brain stem and cerebellum in CT scan is

A. Angled 15° relative to orbitomeatal line
B. Angled 25° relative to orbitomeatal line
C. Angled 35° relative to orbitomeatal line
D. Angled 45° relative to orbitomectal line

Ans. A.

Important Points in Neurosurgery

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IMPORTANT POINTS IN NEUROSURGERY

- Most ancient mansuscript on Surgery— Edwin Smith Surgical Papyrus (1700 BC). Complete treatise on Surgery.
- Sir Victor Horsley— Founder of Modern Neurological Surgery.
- Charles Sherrington— Father of Modern Neurophysiology.
- Franz Josef Gall— First to draw widespread attention to the Cerebral Convolutions and their function.
- Julien Jean Legallois— Earliest precise localization of functions in brain, discovery of Respiratory Center in Medulla.
- Pierre Paul Broca of Paris in 1876— First surgeon to localize neurologically an Occult Intracranial Lesion.
- First text book on Surgery of the Nervous System in 1870 by Ernest Von Bergman.
- Harvey Cushing was the first to map the Human Cerebral Cortex with faradic electrical stimulation in the conscious patient. Founded the first School of American Neurological Surgery.
- William Mcewan, a pupil of Joseph Lister strongly believed in Lister's principles of Antisepsis.
- William Bennett introduced the operation of Posterior Rhizotomy for the relief of pain.
- Victor Horsley best remembered today for removing a neoplasm in the spinal cord in 1887 and attempting a Retrogasserian Neurotomy for Tic Doulourex in 1890.
- Egas Moniz — Cerebral Angiography —Began Prefrontal Leucotomy for abnormal behaviour. For the intitiation of psychosurgery, Egas Moniz was awarded nobel prize in 1949.
- Irving Cooper — started ligation of anterior choroidal artery for Parkinson's disease used chemopallidotomy.
- Charles Frazier did first successful Retrograsserian Neurectomy.
- M. Gazi Yasargil of Zurich performed the first EC-IC procedure on a human being on October 30, 1967 (Microsurgical procedure). Recently credited as "Neurosurgeon of the Millennium".
- The first department of Neurosciences in India was set up in 1949 by Jacob Chandy at Christian Medical College and Hospital in Vellore, South India.
- Dr. Baldev Singh — Founder of Modern Neurology in India.
- Dr. Baldev Singh was a founder member of the Neurological Society of India.
- Theodore Kurze in Los Angeles, in 1957 was the first neurosurgeon to use the Operating Microscope on a human patient.

- Peardon Donoghy performed a middle cerebral artery embolectomy in 1960 in Burlington and the first completely successful MCA endarterectomy was done by Shelly Chou of Minneapolis in 1963.
- Peripheral nerve microsurgery was initiated by James smith of New York and Chaffee and Numoto in 1964.
- Dr CG Drake pioneered the management of Posterior circulation aneurysms and A-V malformations.
- Deliberate hypotension to provide a bloodless field and better neurosurgical operative condition was first proposed by Harvey Cushing.
- PET scan was developed by Phelpsetal in 1975.
- Pneumoencephalography initiated first by Walter Dandy in 1918.
- Failure of closure of the neural tube was first suggested, in 1886, by Von Recklinghausen].
- First Stereotactic instrument for human use by Spiegel and Wycis in 1947.

GENERAL POINTS IN NEUROSURGERY

Fluid, Electrolyte and Metabolic Disturbance

- The incidence of diabetes insipidus in patients with severe head injury is about 2%.
- Hyponatremia may be seen in 5-12% of head injured adults and in upto 25% of head injured children.
- Laboratory criteria for the diagnosis of SIADH include

Serum Sodium	< 135 meq/L
Urinary Sodium	> 25 meq/L
Serum Osmolality	< 280 mosm/Kg

  Urine osmolality high compared to the serum osmolality. Patient must have normal renal, adrenal and thyroid functions.
- When the serum sodium falls below 110mEq/L, signs of cerebral dysfunction due to brain oedema supervene.
- In cerebral salt wasting syndrome there is negative salt balance and volume contraction.
- Persistence of high salt loss in the urine despite fluid restriction differentiate Cerebral Salt Wasting from SIADH where salt loss in the urine is dependent on a liberal fluid intake.
- Cerebral salt wasting is due to unregulated release of Atrial natriuretic peptide.

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- Mechanism of hypoklemia soon after head injury is that catecholamine causes a shift of potassium into the intracellular compartment.
- Hyperglycemia frequently follows a head injury.
- Blood glucose levels are inversely related to the GCS score and outcome.
- In rare instances, moderately severe head injury may be followed by diabetes mellitus in an individual who was not diabetic before.
- Hypothermia is the best treatment for central hyperpnoea.
- Lundberg classification of ICP

Normal	< 10 mmHg
Slightly increased	11-20 mmHg
Moderately increased	21-40 mmHg
Severely increased	> 40 mmHg

- The total cerebral blood volume is about 150 ml. About 25-50ml is found in the arterial system.
- Mean regional cerebral blood flow is 54 ml/100gm/ minutes.
- CPP (Cerebral Perfusion Pressure) is the major stimulus for cerebral autoregulation CPP = MAP – ICP.
- The major arteries are capable of dilating to 15 – 40% of their normal diameter.
- The cerebral arterioles are critical for CBF and are mainly responsible for autoregulation.
- They are approx. 50 microns in diameter and are capable of diameter change of up to 200-300 percent.
- Cerebral metabolic rate for oxygen ($CMRO_2$) is 3.3 ml/100g/minute.
- Cerebral capillary pore size is about 1-2 microns which is one percent of that in the systemic capillaries.
- Grey matter cerebral blood flow – 70ml/100gm/minute, White matter CBF – 20 ml/100gm/minute. The critical blood flow below which infarction occurs is18 ml/100gm/minute.
- CPP = [MAP-ICP] where CPP is cerebral perfusion pressure. MAP is mean arterial pressure. ICP is intra cranial pressure.
- Antiemetic should be administered when required especially in patients with posterior fossa tumors.
- A drop in end tidal CO_2 means a reduction in gas exchange and therefore indicates air embolism.
- Inhalational anaesthetic

  Halothane → increase in CBF and increase in ICP

Enflurane → Increase in CBF and ICP less than halothane but produces SEIZURE like discharge in EEG.

Isoflurane → It is found to have least effect on ICP.

- Desflurance increases ICP with hyperventilation.
- Sevoflurane has similar effect as those of Isoflurane.
- N_2O is a potent cerebral vasodilator and does not have an effect on $CMRO_2$.

INTRAVENOUS ANESTHETICS

- All the intravenous agents except ketamine reduce $CMRO_2$, CBF and ICP.
- Barbiturate suppresses the component of cerebral metabolic rate linked to cellular functional integrity and not the component linked to the maintenance of structural integrity.
- Propofol produces cerebral vasodilation and hypotension and this offsets its minor advantage over thiopentone.
- Fentanyl in higher dose can cause convulsion and in these patients there is increase in CMR and CBF.
- Ketamine produces a large increase in ICP.
- Muscle relaxant- VECURONIUM is the most inert and is safe with regard to cerebral physiology. D-tubocurarine, Metocurine, Atacurium release histamine. D-tubocurarine increases release of histamine to a greater extent.
- Pancuronium causes a 10-20% increase in heart rate and mean arterial pressure.
- Succinylcholine by virtue of the fasciculation causes an increase in ICP and CBF.
- Comparative Effect of Anesthetic Agents on Cerebral Physiology

Agent		*ICP*	*CBF*	*CBV*	*CMR*	*CSF Production*	*CSF absorption*
Nitrous oxide	+	+	±	-	±	±	±
Barbiturate	-	-	-	-	±	+	+
Etomidate	-	-	-	-	±	+	+
Propofol		-	-	-	-	?	?
Halothane	++	++	++	-	±	-	-
Enflurane	++	+	++	-	+	-	-
Isoflurane	+	+	++	-	±	+	+
Benzodiazepines	-	-	-	-	±	+	+
Narcotics	±	±	±	±	±	+	+
Ketamine	++	++	++	±	±		-
Lidocaine	-	-	-	-	?	?	?

- CSF production is increased by enflurane.
- Halothane and enflurane decreases CSF absorption and isoflurame increases its absorption.
- Barbiturate result in dose dependent reduction of CMR and CBF.
- The maximum reduction of CMR is 50-60% of the baseline.
- The true lateral position is used for occipital and posterior parietal craniotomies. In prolonged operations atelectasis of the dependent lung can occur and lead to a ventilation/perfusion mismatch.
- Sitting position is mainly used for posterior fossa surgeries. The advantages have a very minimal effect on ventilation and drainage of blood and CSF from the operative field. ICP is reduced due to reduced venous pressure.
- Venous air embolism is a potential lethal complication and occurs in about 10-40 percent of patients operated upon in the sitting position.
- Most sensitive method for detection of venous air embolism in decreasing order are Transesophageal echocardiography > Precordial Doppler > End tidal CO_2 > End tidal N2 > Transcutaneous O_2> Right atrial catheter > Oesophageal stethoscope.
- Most sensitive method is Transesophageal echocardiography.
- Transcutaneous O_2 is as sensitive as $EtCO_2$ and is useful in infants.
- Hypocapnia causes the cerebral vessel to constrict with a four per cent decrease in CBF for every mmHg change in Pa CO_2 down to 25 mmHg.
- Below level of 25 mmHg vaso constrictive effect of hyopcapnia is dimnished or nullified by the ensuring hypoxia.
- Hyperventilation causes prompt reduction in intracranial pressure by acute reduction of Pa CO_2. Since CO_2 rapidly equilibrate across the blood brain barrier and induce prompt vasoconstrictive effect on the cerebral vessel.
- The change in cerebral blood volume from variation of Pa CO_2 is 0.05 ml/100 gm / mmHg Pa CO_2.
- The reduction in cerebral blood volume persists for approx. 15 minutes after Pa CO_2 return to its original value.
- Pure metabolic acidosis or alkalosis has no effect on the CBF unless accompanied by compensatory Pa CO_2 changes, since the HCO_3 ions cannot rapidly enter the cerebral extracellular fluid.
- Hyperoxia is another benefit of hyper ventilation therapy and aids in the protection of border line ischemic region of the brain.

- Hyperventilation also reduces the rate of CSF production, thus augmenting the control of ICP.
- Hyperventilation therapy alters the cardiopulmonary physiology secondary to the increase in intrathoracic pressure leading to decrease in venous return depression of cardiac output and an elevation of central venous pressure.

Positive End Expiratory Pressure (PEEP)

- Often necessary adjuvant therapy for treating respiratory failure in ventilated patients.
- Major effect of PEEP is to increase the functional residual capacity and thereby normalize ventilation perfusion (V/Q) maldistribution.
- By redistributing the alveolar fluid, PEEP improves the gas – exchange in pulmonary oedema.
- On the whole PEEP improves the PaO_2 for a given FiO_2 by minimizing V/Q mismatch.

Disadvantages

- In patients with highly compliant lung, PEEP reduces cardiac output by impeding the venous return leading to hypotension and hypovolemia.
- Successful management of the cardiovascular system with PEEP required careful fluid balance.
- The pulmonary complication of PEEP are dominated by barotrauma.
- Increase in pneumothorax increases in poorly compliant lung and high PEEP.
- PEEP greatly increases the effort of breathing and successful weaning of patient while on PEEP is difficult.
- Increase in the ICP more common in presence of low cerebral compliance. (can be eliminated by raising patient need 30-45° head up and limiting the PEEP to 12 CM H_2O).
- Delivering PEEP at the maximum pulmonary compliance is a clinically useful method of optimum PEEP therapy.
- Abrupt discontinuation of PEEP can lead to reflexive hypertension with subsequent elevation of ICP.
- Result of use of PEEP -
  - Decreased cerebral perfusion pressure
  - Increase physiologic dead space
  - Decrease work of breathing (controversial)

  - Improved lung compliance
  - Predisposition to barotrauma
- Sodium nitroprusside, Nitroglycerine and Hydralazine should not be used in patients with intracranial pathology until the dura is opened or until an ICP monitor has been inserted so that appropriate measures can be taken to control ICP.
- Rarely severe anaemia may cause Papilloedema.
- Polycythemia suggests the possibility of hemangioblastoma or a leukaemic deposit.
- The problem of low blood pressure acquires importance in patients with spinal cord lesions.
- In paraplegics and quadriplegics, blood may pool in the paralysed limb with a resultant hypotension.
- Dilantin sodium hastens the removal of dexamethasone from plasma.
- The maximum dose of 20% mannitol is 1.5 gm/kg body wt/24 hrs.
- In the absence of ICP monitoring the optimal dose of mannitol is 100 ml given over a period of 15 minutes every 6 hours.
- Oral glycerine in a dose of up to 4-60 ml a day in adult is effective in controlling ICP.
- Diuretic like furosemide and acetazolamide reduce ICP.
- The use of mannitol with furosemide appears to have greater effect than when either is used alone.
- Lidocaine in doses of 1.5 mg/kg IV can rapidly reduce ICP.
- Steroids are effective antioedema agents especially in patients with brain tumors but have little or no role in patients with head injuries.
- It is essential to obtain a preoperative X-ray chest before starting steroid to prevent a flare-up of any pre-existing tubercular focus.
- Steriods are administered preoperatively to those patients who have sellar or parasellar tumors who have severe symptoms of intracranial hypertension or whose vision is threatened.
- Fits are more common after surgery in the supratentorial compartment than after surgery in the posterior fossa.
- It is preferable to use anticonvulsants in all major supratentorial intracranial operations, where the cortex has been interfered with.
- Those subscribing to this view usually start anticonvulsant four to six days before surgery to obtain proper drug level during surgery.

- The ratio of FEV and FVC is a sensitive indicator of pulmonary obstructive pathology in the large airways.
- In restrictive disease, FEV and FVC reduces proportionately without affecting the ratio.
- Neurological disease result in a restrictive disease.
- Respiratory failure is defined as a fall of arterial oxygen tension to less than 50 torr and a rise of CO_2 tension above 50 torr. Clinical diagnosis is made when the respiratory rate is 40/min and above or less than 8/min.
- In a 70kg adult, respiratory failure ensues when the tidal volume is less than 250ml or the vital capacity is below one litre.
- A sensitive indicator of ventilation perfusion mismatch is the alveolar arterial oxygen gradient and a difference of greater than 20 torr suggest respiratory insufficiency.
- Because of the higher diffusion capacity of carbon dioxide, a greater degree of ventilation perfusion mismatch and alveolar hyperventilation is required to cause arterial hypercapnia as compared to arterial hypoxaemia.
- Neurogenic pulmonary edema.
  - Due to raised ICP in the postoperative period without evidence of any heart, lung, kidney or liver disease.
    - Result of hypothalamic dysfunction, lead to a massive sympathetic discharge.
    - Pulmonary arterial hypertension and subsequent endothetial damage and interstitial oedema.
    - Resistant to oxygen therapy and has to be managed with PEEP.
    - Pulmonary oedema due to direct or indirect injury to lung take a few hours to two days to develop.
    - ARDS is differentiated from pulmonary oedema due to increased hydrostatic pressure by a low pulmonary arterial wedge pressure (<12 torr) and a raised gradient between the pulmonary artery diastolic pressure and the pulmonary capillary wedge pressure, which reflects the increased pulmonary vascular resistance.
- Aspiration causes a chemical pneumonitis which reaches its maximum severity over 12-36 hours and in the uncomplicated patient subside over the next 72 hours.
- Clinical diagnosis of deep vein thrombosis is notoriously unreliable.
- Pulmonary embolism is less common in tropical countries.

- In pulmonary embolism, there is a perfusion defect without a ventilation abnormality.
- The daily requirement of potassium is 40 mEq/day and of sodium 70 mEq/day.
- SIADH may occur in any intracranial disorder and when drugs such as carbamzepine, tricyclic antidepressants, barbiturates, chlorthiazide, clofibrate chlorpamide are ingested.
- Tumor of the lung, pancreas duodenum with ectopic production of the hormone may also give rise to SIADH.
- Laboratory value of cerebral salt wasting syndrome and SIADH are same.
- Plasma volume is markedly reduced in cerebral salt wasting syndrome.
- Cerebral salt wasting syndrome — ADH is normal and atrial natriuretic peptides are high.
- Cerebral salt wasting syndrome is an important cause of hyponatremia in tuberculous meningitis with hydrocephalus and in subarachnoid haemorrhage.
- Hypernatremia — >145meq/L seen in patients on osmotic diuretic agents such as mannitol, on tube feeding and in patients with Diabetes inspidus.
- In diabetes insipidus replacement is with 5% dextrose. The drug used in DI are DDAVP, aqueous pitressin, long acting pitressin tannate. In most situation it is mild and treated with carbamazepine 200mg.
- Anion gap represents the negatively charged proteins, sulfates, phosphates and other minor organic and inorganic anions, whose negative charge is normally balanced by sodium.
- Most postoperative intracranial hematomas manifest within 24-48 hours.
- The brain has high level of tissue thromboplastin and minimal manipulation of the normal brain is expected to activate the haemostatic system.
- In DIC, EACA (epsilon aminocaproic acid) blocks plasminogen activity and has been shown to be of use when extrinsic system is activated.
- Fibrinolytic activity is high in brain tumors especially meningiomas.
- The causes of postoperative acute intracranial hypertension in the absence of haematoma are either obstruction to the CSF pathways hypercarbaemia and fulminant brain oedema.

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- In the absence of hypercarbaemia, convulsions or an obstruction to the ventricular CSF pathways, brain oedema is nearly always evident between 24-72 hours after surgery.
- A reduction of $PaCO_2$ from 40 to 25 torr leads to fall in the cerebral blood volume by 10.5ml.
- A further fall of $PaCO_2$ below 25 torr fails to produce any further decrease in cerebral blood flow.
- Cerebral vasospasm is a common phenominon associated with subarachnoid haemorrhage. Triple H therapy-Hypertensive, Hypervolaemic, Hemodilution appears to be beneficial.
- Hyperpyrexia of non-infective origin occurs specially after surgery in the neighbourhood of the hypothalamus, e.g. removal of a pituitary adenoma or a craniopharyngioma.
- Diabetes and the use of steroids appear to have little or no bearing on the postoperative infection rate.
- In a sterile meningeal reaction (meningismus) the neurological deterioration is not as profound, the peripheral leucocytosis is absent, the CSF: Serum glucose ratio is generally not less than 0.4 as seen in bacterial meningitis and culture is sterile.
- Packing the sellae with haemostatic cellulose during surgery should be avoided.
- The protective airway reflexes are lost in a predictable manner depending on the level of consciousness. The first reflex to be lost is the pharyngeal reflex, followed by the laryngeal, tracheal and lastly the cranial reflex.
- It is estimated that 1gm of nitrogen requires 50cc of water for its excretion.
- Prevention is by limiting the daily intake of proteins to 1g/kg body weight.
- Isoelectric EEG may be seen in barbiturate poisoning, hypothermia and metabolic disorder.

ELECTRODIAGNOSIS IN NEUROLOGY

- Triphasic wave is seen in hepatic coma.
- Periodic spike complexes are seen in SSPE.
- Rhythm are frequently found posteriorly in head region.
- Activity of similar frequency as alpha, but more widespread and non responsive to external stimulae is seen in some comatose patients: this state is termed as "alpha coma" and carries a poor prognosis.

- Generalisation and non response to arousal stimuli are the features of beta rhythms (sometime frontocentral region). It is altentuated by contralateral motor movements.
- Asymmetry of beta frequency rhythm could be the earliest sign of pathology over the concerned hemisphere.
- Orhytm is prominent in children during wakefulness. It is the most frequent component of stage I sleep and hyperventilation. [Temporal region].
- Delta activity is a normal finding in infants and during stage III and IV of sleep in adult when seen in awake individuals, it should be considered an abnormal finding.
- ORIDA occipital rhythmic intermittent delta activity is seen in children.
- FRIDA — Frontal rhythmic intermittent delta activity is seen in adult, attentuated by attention, it is enhanced by hyperventilation and drowsiness.

  It probably relates to dysfunction of subcortical structures.
- Mu Rhythm — alpha range rhytm unaffected by arousal but attenuated by movement or thought of a movement.

  Similar rhythm seen in patients with skull defects subsequent to craniotomy is termed breach rhythm.
- "BURST SUPPRESSION" is usually seen in patients with overdosage of drugs, severe anoxic encephalopathy deeper stage of anaesthesia.
- Stage II of sleep is characterized by 12-14 HZ sleep spindles or K complexes.
- Sleep accentuates focal EEG discharges particularly in patients with complex partial seizures.
- SSPE shows characteristic periodic complexes time locked with the motor myoclonus, these consist of 1-3 per sec complexes occurring regularly at interval of 4-14 sec.
- Periodic complexes occurring in Creutzfeldt Jacob disease are more frequent and brief in duration and assume a triphasic form with a sharp outline.
- The earliest and the most sensitive electrophysiological finding in carpal tunnel syndrome is slowed sensory conduction. [Distal sensory latency].
- Measurement of jitter of muscle fibres with single fibre EMG pick up end plate dysfunction earlier.

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- The H response is considered the electrical equivalent of the clinically elicited deep tendon jerk.
- H response require submaximal stimulus F response require supramaximal stimulus.
- A supramaximal stimulus delivered to a mixed nerve sustained contraction of the appropriate muscle produces a transitory decrease in the EMG. This transitory suppression is the "silent period" and is a normal phenomenon in all muscles.
- Absence of silent period is pathological.
- The absence of a silent period in a patient with a spinal cord dysfunction would suggest an intramedullary lesion.

Visual Evoked Potential

- P-100 component is the dominant wave form.
- P-100 wave form has a W shape.
- Absent P-100 or a latency outside the 95-99 percentile boundaries considered abnormal.
- Most frequent abnormality - Normal amplitude but prolonged latency difference of greater than 10 m/sec- considered abnormal.

In Electroretinogram

There is a major contribution from the muller cells of the retina.

- BSAEP— Brain stem auditory evoked potential
  - Peak and IPLS are prolonged in children below the age of 2 years.
  - Females have a significantly shorter III-V and I-III inter peak latency as compared to males.
- The peak and interpeak latencies are relatively insensitive to drugs and anaesthetics and hence have their usefulness in intraoperative monitoring during posterior fossa surgery.
- Wave V is the most reliable component — It can be obtained by very low stimulus intensities.
- III-V Inter peak latency indicates the central conduction time of the auditory system. It is decreased in multiple sclerosis.
- Prolongation of wave I-III lnter peak latency is elicited from the ipsilateral ear, is the single most common abnormality elicited in the presence of extra axial brainstem tumors, i.e. acoustic schwannomas.

- BAEP is usually normal in hereditary ataxia other than Friedreich's variety.
- Somatosensory Evoked Potential (SEP).
  - Downward peak is designated as Pand upward peak as N

Upper limb (SEP) recorded median nerve		*Lower limb posterior*
N9	(Erb point)	tibial nerve
N/P11	(Dorsal root entry zone)	
N/P13/14	(Cervicomedulary junction)	P/N 31
N 18	(Upper pons + midbrain subcortical)	N 34
P 19/20	(Sensory cortex) point to orgin from thalamus	P 37/N37
P 22		(Motor cortex)

- SEP are normal in brainstem lesions unless the medial leminiscus is involved.
- SEP is abnormal in the "locked in state" and central pontine myelinolysis.
- Brain dead patients show clear correlation with consistent and reproducible presence of N9-N14 potential with absence of all potential beyond 14 millisecond in response to median nerve stimulation
- In event related potentials (ERPs)
  - P(3) (P300) component is found to be the most consistent.
  - Useful in differentiating dementia.
  - The intactness of sympathetic skin response also indicates intactness of small "C" fibre function.

Intracranial Pressure

- Modified Monro–kellie doctrine introduced into neurosurgery by Cushing.
- Monro-kellie doctrine does not hold true in infants because the skull is not rigid.
- Normal CSF pressure [Lumbar route in lateral decubitus position] – 50-200 mm H_2O
- Lundberg described three pressure waves—

  A wave: Pathological and develop over a background of raised ICP

  — Plateau waves (5-20 minutes)

— *Atypical* or trauncated wave [exceed an elevation of 500mmHg. It is an early indicator of clinical deterioration.

— Accompanied by clinical feature of raised ICP and respond to CSF drainage, hyperventilation and osmotic diuretics.

B wave: .2-2 per minute related to respiration can occur in ICH and in normal people.

C wave: Low amplitude with a frequency of 4-8 per minute. Related to Traube Hering Mayer waves which are of little clinical significance.

- Increased intracranial pressure is indicated by a sustained elevation in pressure above 15mmHg or when intermittent A or B waves are recorded.
- As much as (one ml of CSF) fluid per minute or 60ml per hour can be expressed from the intradural space in the presence of elevated ICP.
- The classical pressure— Volume curve is exponential.
- In a semilogarithmic coordinate system, the curve will be linear.
- Compliance– dV/dP Measure of distensibility of the intracranial space
- Elastance– dP/dV Measure of resistance offered to an expanding intracranial mass
- Slope of the volume pressure curve is the elastance.
- Cereberal perfusion pressure = MAP – ICP
  - MAP – Mean arterial pressure
  - ICP – Intracranial pressure
  - MAP = [DBP + SBP – DBP /3] where DBP is diastolic blood pressure and SBP is systolic blood pressure.
  - Cushing Response:
    - — Hypertension — Cerebral ischemia secondary to intracranial hypertension result in removal of supratentorial inhibition of brainstem vasopressor centers, resulting in the release of sympathomimetic factors, in turn cause peripheral vasoconstriction.
    - — Bradycardia —It is unaffected by dennervation of the carotid sinuses, is abolished by section of the vagus and is independent of the rise in blood pressure.

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— Respiratory irregularities — Due to release of the respiratory centers in the medulla as a result of damage to the supramedullary mechanism.

- Changes in respiratory pattern may be depending upon the level of involvement of the brainstem.
  Damage to the mid brain is associated with cheyne-stokes or rarely normal respiration. In mid brain and upper pons damage the patient develops sustained hyperventilation. In upper medulla respiration becomes more rapid and shallow.
  Final stages become ataxic.
- In certain non neurosurgical conditions like Reyes syndrome and fulminant hepatic failure, ICP monitoring is beneficial.
- The first subdural- subarachnoid device to measure intracranial pressure was introduced by Vries et al in 1973 and is also called the Richmond screw.
- Intraventricular monitoring remains one of the most popular technique and is the current gold standard against which other methods are compared.
- Functional MRI has the best spatial resolution and SPECT is the worst, PET is intermediate between these two extremes.
- Functional MRI is the most sensitive to patient cooperation and motion (degradation of images). SPECT is least sensitive.
- PET offers best absolute quantification of neuronal function.
- Radio-Isotope scanning of brain is useful in
  - NPH
  - CSF fistulae
  - CSF flow studies
  - Determination of the functioning of venticular shunt
  - Intracranial venous sinus thrombosis
- Five biochemical defects in varying dgrees are common to majority of brain tumors as measured by Magnetic Resonance Spectroscopy—
  - Decreased NAA (N-acetyl Aspartate).
  - Increased Lactate.
  - Increased Choline.
  - Increased Lipid.
  - Decreased Total Creatinine.
    — CSF Dynamics
    — In normal pressure hydrocephalus 111-In-DTPA is used.
    — Tc99m human serum albumin [Diagnosis of CSF fistula]
    — Tc99m technetate [efficacy of shunt function].

- PET scan was developed by Phelps et al in 1975.
- In the unstimulated healthy young adult with eyes open and ears unoccluded, the maximum glucose metabolism is in the calcarine cortex and amongst the subcortical structures in the striatum.
- PET scanning
  Alzheimer's disease— Hypometabolism is seen in posterior parietal lobe.
  Pick's disease— Hypometabolism in frontal and the anterior temporal lobe
  Progressive supranuclear palsy— Superior frontal cortex
  Normal pressure hydrocephalus— Globally diminished glucose metabolism
- Glucose metabolism is the most important prognostic factor in strokes.
- PET has the maximum clinical utility in the selection of patients, with medically refractory epilepsy, for resective surgery.
- A hypometabolic zone which becomes hypermetabolic during a clinical seizure, is pathognomic of an epileptic focus.
- PET scanning gives the most accurate qualitative and quantitative information about brain metabolism and perfusion.
- Acute infarct detected in decreasing order of sensitivity [SPECT > MRI > CT].
- Chronic stroke detection is

MRI	> SPECT	> CT
100%	91%	79%

Neuro-ophthalmology

- Central vision is normally tested with Snellen's visual acuity chart
- Prechiasmal and posterior occipital lobe lesions produce central visual loss, whereas lesions in other areas of the visual pathway produce visual field loss with retention of central visual acuity.
- Diffuse involvement of the optic nerve due to compressive or inflammatory disease produce a colour vision defect whereas segmental involvement in vascular lesion does not do so.
- The border of the peripheral field of vision are 100 degrees temporally, 60 degrees superiorly and 75 degree inferiorly.
- Central 30 degrees of the field of vision is called the central field.
- Central field is measured by Bjerrum's screen.
- Peripheral field by Lister's or Goldmann's perimeter.
- Diplopia is tested with red green goggles and a slit beam of light.

- Uniocular movements are controlled by III, IV, VI nerves.
- Binocular or conjugate eye movements are controlled by supranuclear centers.
- Saccadic movements
  - Rapid conjugate eye movement in response to command
  - Fast phase of optokinetic and vestibular nystagmus
  - Centre Frontal lobe (areas) caudal part of middle frontal gyrus
- Both frontal lobes control vertical movements.
  Pursuit eye movements are smooth and slow eye movements which are involuntary.
  Centre— Lies in Anterior occipital and posterior callosal areas of the opposite hemisphere.
  Vergence eye movement— Centre Anterior occipital and posterior callosal area in the midline.
  Vestibular eye movements— Sensory organs for vestibular eye movement are the semicircular canals, the utricle and the saccule.
  - The right horizontal semi circular canal drives the eyes to the left and vice versa.
  - Brainstem gaze centers— Horizontal gaze center is situated in the paramedian pontine reticular formation.
  - Vertical gaze center is situated in the Pretectum.
  - The center for upward gaze movement is situated near the superior colliculus and that for downward gaze movement is situated near the inferior colliculus.
  - Unlike vertical gaze palsy which is usually produced by a midbrain lesion, horizontal gaze palsy may be produced by lesion anywhere along the horizontal gaze pathways.
  - Frontal saccadic horizontal gaze palsy recovers within a week to ten days either by recovery of the affected gaze center or by the contralateral gaze center taking up its function
  - PPRF lesion produces complete gaze palsy (both pursuit and saccades) to the same side. Complete recovery take many months.
  - Parieto-occipital lesions produce loss of pursuit movement to the same side with normal saccades (command movement). (Point controversial) regarding side.
  - In anterior internuclear opthalmoplegia, convergence is absent and in posterior internuclear opthalmoplegia, convergence is intact.
    - Anterior INO— convergence is absent.
    - Posterior INO— convergence is present.

- Inferior division of the occlumotor nerve contain the parasympathetic fibres from the Edinger Westphal subnucleus via nerve to Inferior oblique.
- A complete nuclear involvement of occlumotor nerve causes–
  - on the same side.
    - — Absence of elevation, adduction
    - — Depression of the eye
    - — Ptosis is bilateral due to common nucleus for both levator muscles
    - — Both the superior rectus are involved.

- Opposite eye shows absence of elevation due to crossed innervation of the contralateral superior rectus muscle.
- The same side superior rectus is also involved because fibres from the contralateral subnucleus pass through the ipsilateral nuclear complex.
- Intrinsic vascular lesions due to diabetes, Hypertension Atherosclerosis and Temporal arteritis produce third nerve palsy with pupillary sparing.
- Enlargement of the blind spot is an early feature of papilledema
  - Branchor of Opthalmic division of Vth nerve are
    - — Lacrimal
    - — Frontal branch give rise to Supraorbital branch which supply lateral half and Supratrochlear which supply medial half. Nasocilliary nerve – Sole sensory supply of the eye—its branch is Infratrochlear. Infraorbital branch is of maxillary nerve.
- In the pretectal area, the pupillary fibres for the light reflex and near reflex are separated so that any lesion in the pretectal area can cause light near reflex dissociation.
  Light reflex fibres are situated dorsally, near reflex fibres are situated ventrally.
- Physiologic anisocoria is present in 10-20% of population.
- Tawne's pupillary reaction—In extreme lateral gaze, the pupil of the adducting eye is smaller than abducting eye.
- Hutchinson's pupil in a patient with raised ICP is an ominous sign.
- Midbrain pupil— compressive lesion in the region of the posterior third ventricle such as pinealoma are frequently associated with light-near dissociation pupillary abnormality i.e. absent or diminished light reflex and normal near reflex. This peculiarity is due to the more dorsal location of the pupillomotor fibres. With the extension of the lesion ventrally, the more ventrally situated

near reflex fibres are also affected resulting in complete internal ophthalmoplegia.

- Wernick's pupil occurs in patients with homonymous hemianopia and lesion anterior to lateral geniculate body.
- Light near dissociation is present in
  - Argyl Robertson pupil
  - Parinaud's syndrome
  - Diabetes mellitus
  - Alcoholism
  - Herpes zoster
  - Trauma
- Light-near dissociation following head injury
- Adie pupil include tonic pupil + absent deep tendon reflex
- Amaurotic pupil ! result from a blind eye have following criteria

i. absent ipsilateral direct light reflex
ii. absent contralateral consensual reflex
iii. present ipsilateral consensual reflex
iv. present contralateral direct light reflex

Criteria ensure that pupillary defect is afferent and not efferent.

Neuro-radiology

- The structure in the midline that calcify are the pineal body, falx cerebri, pachionian granule and the habenular commissure.
- Away from the midline are choroids plexus, the petro clinoid ligament, the lateral edge of the diaphragame sellae and the carotid artery.
- **Rail road calcification** is seen in Sturge weber syndrome.
- Craniopharyngioma shows **Speckled** calcification. Of all brain tumors **oligodendroglioma** show the **highest incidence of calcification.**
- Pneumoencaphlography or Ventriculography is still used in functional neurosurgery.
- CT has become the first line of investigation in SAH.
- Cerebral mantle is the shortest distance between the frontal horn and the inner table of skull.
- Intracellular deoxyhaemoglobin is not found in neoplastic haemorrhages.
- Peripheral haemosiderin is also typically absent in tumoral haemorrhage.

- Deoxyheamoglobin, Methaemoglobin (Paramagnetic) shows
  Short T_1 - Bright image
  Long T_2 - Bright image
  Note— Intracellular paramagnetic substance result in [T_1 and T_2 shortening]

Oxyhemoglobin (0 - 24 hr)	– Isointense on T_1 – Isointense to hyperintense on T_2
Deoxyhaemoglobin [1 – 3 days]	– Isointense on T_1 Hypointense on T_2
Intracellular Methemoglobin [3 – 14 days]	– Hyperintense on T_1 Hypointense on T_2
Extracellular Methemoglobin [More than 2 weeks]	– Hyperintense on T_1 and T_2
Non Paramagnetic Heme pigments	– Hypointense on T_1 and Hyperintense on T_2
Hemosiderin around Periphery	– Hypointense on T_1 and T_2

Methemoglobin Results in T_1 Shortening

- In CT scan — If the patient is anaemic and the haemoglobin is below 5gms/100ml, the haemorrhage may be isodense.
- Venous angiomas have a spoke-wheel appearance due to the collection of small draining veins.
- Oedema is maximal during the 4th to 5th postinfarct day and subsides over the next two to three weeks.
- MR is superior to CT in imaging an acute ischaemic insult to the brain.
- MR imaging using the sodium nucleus is much more sensitive than hydrogen proton imaging in the detection of early ischaemia.
- Lacunar infarcts are found in hypertensive patients due to lipohyalinosis in the deep perforating arteries.
- Basal ganglia are never affected in viral infection.
- The peripheral rim of a tuberculoma is thick walled, slightly irregular and the content of the cavity are more isodense when compared to the hypodense necrotic content of an abscess.

- Cystic fluid → ↑ Protein leading to T_1 shortening [Bright image].
- Scolex is seen as an eccentric hyperintense nodule and is best seen on T_1W and proton density images.
- Ill defined margins, a lack of calcification severe oedema and heterogenous enhancement point to aggressive meningiomas.
- Meningioma — $T_1W \rightarrow$ 60% isointense remaining hypointense
  $T_2W \rightarrow$ isointense
  or hypointense. Hyperintense (very rare).
  - Fibroblastic or Transitional→ T_2W image hypointense, Angioblastic or syncytial→ T_2W image hyperintense
  - Extra axial origin of meningioma causes white matter 'buckling'. Seen on T_1W images.
  - Dural tail sign is suggestive of meningioma. Gadolinium administration strongly enhances the meningioma.
  - On contrast injection, 91-100 percent of glioblastomas show contrast enhancement.
  - Oligodendroglioma is common in frontal lobes
  - Calcification of pineal gland under the age of 6 years should be looked upon with suspicion (of tumor).
  - Germinomas, pinealoblastoma, pinealocytomas enhance well with contrast but germinoma do not calcify.
  - On MR colloid cyst at the foramen of Monro are usually hyperintense because of the presence of paramagnetic material such as haemosiderin or copper within the lesion.
  - **Pericallosal cisterns harbour the majority of intracranial lipomas**.
  - Lipoma— Hyperintense on T_1W image and hypointense on T_2W image.
  - Medulloblastomas— on noncontrast CT scan. These are hyperdense or isodense.
    On contrast – all enhance except 5% recurrent tumors which do not enhance.
    These tumors are cellular with less water content on the MR, medulloblastomas share the features of T_1 and T_2 prolongation as is seen with most of the infratentorial tumors.
  - T1 image is Isointense or Hypointense
    T2 image is Hyperintense.
  - Calcification is not seen in **hemangioblastoma,** a point of differentiation between these tumors and cystic astrocytoma.

- In hemongioblastoma when large vessels form an intrinsic part of the lesion, the tumor has **salt and pepper appearance**.
- **Calcification** is a hallmark of **ependymoma** with up to 50% showing fine punctuate calcification.
- Ependymona on CT— are Isodense

  On MRI— T_1W they are Isointense or Hyperintense and on T_2WI they are hyperintense.

  Acoustic Schwannomas are mostly Isodense on non contrast CT.
- [Enhancement is present] Lesion which are of Antoni type A show homogenous enhancement while Antoni Type B tumor show non-homogenous enhancement. Calcification is rarely seen except as an associated feature of NF-2.
- **Erosion or widening of the internal auditory meatus is the specific sign of an acoustic neuroma.**
- Acoustic neuroma on T_1W are Hypointense and on T_2W – Hyperintense.
- [Colloid cyst and also arachnoid cyst do not enhance.

- Meningioma in the CP angle is a Hyperdense lesion on CT.
- The medial free border of the meningioma forming an obtuse angle with the posterior surface of the pterous bone, this is in contrast to an acoustic neuroma which forms an acute angle.
- The non-enhancing uniformly hypodense appearance of the tumor is fairly typical of an epidermoid.
- Epidermoids, dermoids and arachnoid cyst are typically hypointense on T_1W image and hyperintense on T_2W image.
- Cerebral neuroblastoma, medulloblastoma and undifferentiated glioma are grouped as [PNT] (Primitive neuroectodermal tumor].
- Sturge-weber syndrome— Gyriform calcification is typically noted in posterior parietal or parieto-occipital region.
- **Calcified lesion appear hypointense on both T_1 and T_2 weighted images.**
- The inter pedicular distance increases from C_2 to C_6 and then narrows from C_6 to T_4 below which there is a progressive increase.
- In myelogram of chronic arachnoiditis. Best appreciated in lumbar region. There is 'Faggot stick' appearance.
- Cervical disc prolapse is most frequent at C_{5-6} or C_{6-7} levels.
- Lumbar vertebrae have a greater coronal than sagittal diameter.

- The spinal canal is widest at the level of the [5th lumbar vertebra]
- The spinal cord is oval in contour and centrally located except in the upper dorsal region where it is rounded.
- When the annulus is intact, the disc herniation is called prolapse. Extrusion indicates disruption of annulus fibres and protrusion of the nucleus pulposus through the annulus.
- A sequestrated disc has a high intensity than a normal nuclear pulposus on T2 weighted images.
- MR is the initial non-invasive investigation of choice in the evaluation of disc disease.
- MR is more accurate than myelography in evaluating post operative scarring and recurrent disc herniation.
- The hyperintense appearance of schwannomas on the T_2 weighted images differentiate them from meningioma which are hypointense or isointense on T_2 weighted images.
- Astrocytomas predominantly occur in the cervical region and ependymomas in the lumbar region.
- In the thoracic region astrocytomas and ependymomas have a relatively equal incidence.
- **In the Spinal Cord, In children as compared to adults there is high incidence of astrocytomas than ependymomas.**
- **Calcification is not a feature of spinal astrocytomas.**
- Most commonly the anterior spinal artery supplies intramedullary arteriovenous malformation in young patients.

Intraoperative Monitoring

- ECG is particularly important during posterior fossa surgery.
- Operation in sitting position→ controlled hypotension→ for arterial pressure monitoring the dorsalis pedis artery is cannulated.
- Central Venous Line→ To be maximally useful in treating air embolism, the tip of the catheter is placed at the junction of the Superior vena cava and the right atrium.
- Isoflurane will not suppress spike activity from the cortex if the concentration is maintained between 0.25 – 1.25%
- N_2O and O_2 are maintained at 50 – 70%.
- VEP originates primarily from the cones of the central retina which project to about half of the visual cortex.
- Well defined positive evoked potential occur in the occipital region at about 100msec and is designated as P100.

- Peak is generated mainly from the striate cortex near the calcarine fissure.
- Factors influencing VEP are

Hypothermia	$\rightarrow\downarrow$	VEP amplitude
Anaemia and hypoxia	$\rightarrow\uparrow$	VEP amplitude
Blood pressure	$\rightarrow\downarrow$	Amplitude

  Pupils – dilation cause an increase in VEP amplitude. Barbiturate low dose cause increase in VEP. Concentration above 2% of halothane abolishes VEP.
- BAEP – [Brain auditory evoked potential] I-V interpeak interval is normally below 4.5msec. III-V interpeak interval is usually less than 2.4msec.
  Interpeak latency should not be normally more than 0.4msec.
- Isoflurane administration result in increase in BAEP peak latencies and also the inter peak latencies.
- A definite intraoperative indicator of postoperative brainstem dysfunction is loss of wave V morphology.

Spinal and Cranial Dysraphism and Chiari Malformations

- Embryological event related to postovulatory day
  Day 13 — Formation of the primitive streak
  Day 17 — Notochord
  Day 22 — Formation of neural tube
  Day 24 — Closure of cranial neuropore (stage 11 of embryo formation)
  Day 26 — Closure of caudal neuropore (stage 12 of embryo formation)
- Lissencephaly is due to defective formation of Sulci and gyri and is related to failure of formation of folds during this period of neuronal migration, i.e. 8-20 weeks.
- Anencephaly is due to failure of closure of the anterior neuropore at about 24 days gestation [1-4 weeks].
- Myelomeningocele is due to failure of closure of the posterior neuropore at about 26 days gestation [1-4 weeks].
- Agenesis of the corpus callosum is due to either failure of formation of the commissural plate or failure of degeneration of the part of the plate which would form a barrier to axonal crossing [4-8 weeks].

- The vertebral column grows faster than the cord, so that at the 6th month of foetal life, the caudal end of the spinal cord lies at the level of the first sacral vertebra and at birth, at the lower border of the third lumber vertebrae.
- The adult level at the L1-12 junction is reached after the third year of life (at birth according to few) with the roots taking vertical course to exit from their respective position.
- Neurulational defects, which occur by stage 12 constitute only a subgroup and are characterized by the absence of skin covering the defect.
- Spinal dysraphism applied to all forms of closed and open spina bifida and does not depend on whether a skin cover is present or not.
- **Etiology of spinal dysraphism**
  1. Valproic acid
  2. Maternal hyperthermia
  3. Diabetes mellitus
  4. Hyperzincaemia
  5. Maternal age greater than 35 years
  6. Infections like rubella, cytomegalo virus, toxoplasma, irradiation.
- **Prenatal diagnosis of spinal dysraphism**
  - Maternal Serum Alfa Foeto Protein (MSAFP)
  - Amniotic Fluid Alfa Foeto Protein (AFAFP)
  - Acetyl Cholinesterase Level together give detection rate of 95-98% for open NTD
  - Maternal serum unconjugated estradiol (MSUE)
- Low level of MSAFP are associated with Down's syndrome occur in all trisomy.
- Chorionic villus sampling can be performed in the first trimester, fetal blood sampling and amniocentesis have to be carried out in the second trimester.
- Spina bifida occulta : Failure of fusion of the vertebral arches, most frequently the fifth lumbar and first sacral.
- Meninogocoeles present without any neurological defect.
- An associated chiari malformation is probably the commonest cause of hydrocephalus. [chiari II is associated almost in 100% cases with myelomeningocele].

- It is unlikely that immediate repair (within 24 hours) can improve existing paralysis.
- Early operation does not lead to any significant difference in the incidence of hydrocephalus.
- Principles of Surgery— This is usually transverse incision in the lumboscral and vertical in the cervical and thoracic region.
- If dysjunction of the neuroectoderm occurs before the neural tube, closure is complete, mesenchymal cells gain access to the central canal of the tube. The mesenchymal cells then differentiate into fatty tissue to form a lipomyelomeningocele.
- Lipomyelomeningococle and a thickened filum terminale are responsible for 70% of Tethered Cord Syndrome.
- Hypertrichosis is commonly associated with diastematomyelia (split cord).
- The cleft in diastematomyelia is located in the lumbar region in 47%, thoracolumbar region in 27%, thoracic region in 23%, sacral or cervical region is 1.5% of cases. Mainly upper lumbar region is involved. The lesion manifest itself commonly in children with a higher incidence in females. It is the spur and not the divided cord that is the cause for the symptoms.
- Congenital Dermal Sinus— Result of failure of separation of the neuroectoderm from the epithelial or surface ectoderm, this separation normally take place between the 3rd-5th week of intrauterine life, commonest site for the defect is the region of the posterior neuropore i.e. the lumbosacral region, the next frequent site being the sub-occipital region.
- Thus **every child with bacterial meningitis needs careful examination to detect the presence of a dermal sinus as the cutaneous opening may be inconspicuous and no larger than a pin hole**.
- The commonest site for encephalocele is the occipital region.

Syringomyelia

- Hydromyelia— A cavity within the spinal cord that is partially or completely lined by ependyma. Syringomyelia lies eccentric to the central canal and is not lined by ependyma.
- Gardner gave "Hydro Dynamic Theory" for causation of syrinx.
- Increased incidence of HLA-A9 is seen in patients with syringomyelia.

- Dissociated sensory loss, seen in about 50% of patients, is more common in syringomyelia than in any other intramedullary lesion
- X-ray of the spine may show an enlargement of the spinal canal with an increase in the sagittal diameter.
- "Collapsing Cord Sign" by air myelography before the advent of the MR was used to diagnose syringomyelia.
- Percutaneous drainage of the syrinx cavity was described by Vitek in 1929.
- Syringo— subarachnoid shunting has been used extensively for treating it.
- Terminal ventriculostomy by Gardner et al in 1977 should be used as a definite procedure only in cases of tethered filum with a distal hyotrophy.

[Dandy-Walker Malformation]

- Vermian hypoplasia, large posterior fossa and cyst in posterior fossa constitute Dandy Walker Malformation.
- Subarachnoid space degeneration occur congenitally in association with Dandy Walker Malformation.
- First described by Dandy and Blackfan in 1914, the condition was named the 'Dandy Walker Malformation' by Benda in 1954.
- The Dandy – Walker variant is a less severe but perhaps more common anomaly. It is characterized by a milder degree of vermian dysgenesis, a less pronounced hydrocephalus and a normal appearing fourth ventricle.
- On the CT Scan, the absence of the vallecula suggest a Dandy – Walker Malformation, while a normal valleculla and a compressed fourth ventricle suggest an arachnoid cyst.
- 'Keyhole Sign' is seen with a cyst which is isolated from the ventricular system.
- Stunting procedure is the treatment of choice of Dandy Walker Syndrome.

Hydrocephalus

- Under normal condition, the choroids plexus is the main source of CSF.
- Ependymal formation of CSF occurs to a lesser extent.
- The choroids plexus, a tuft of capillaries covered by ependyma appear as a mesenchymal invagination of the roof of the ventricle [at 35 days of gestation].

- At the 50th day, normal CSF circulation begins.
- Capillaries of choroids plexus lack Blood Brian Barrier.
- Arachnoid villi are the principal sites of absorption of CSF under normal condition.
- Compensatory absorption of CSF occur through the
  1. Ependyma
  2. Choroid Plexus
  3. Dilated Central Canal into the spinal cord.
- CSF drainage occur along the I, II, VII, VIII cranial nerves into the cervical lymphatics.
- Arachnoid villi and granulations (Pacchinonian granulations) are seen microscopically as highly cellular invagination of the leptomeninges into the wall of the sinuses. They are mainly distributed along the superior sagittal sinus, but are also seen along the transverse, cavernous, superior petrosal sphenoparietal, straight sinuses and the middle cerebral vein.
- CSF have been reported to exist in the spinal meninges and around the optic nerve.
- CSF absorption occur by a simple process of membrane filtration.
- Transport of CSF across the endothelium of arachnoid villi occur by Pinocytic vacuole formation.
- The vacuolar mechanism are consistent with the transport of protein and CSF across the cytoplasm of endothelial cells by an active process.
- Berring postulated in 1955 that the ventricular enlargement in hydrocephalus is not due to the force of CSF proximal to the site of obstruction but is caused by an undamped pulse wave generated by the choroids plexus.
- Aqueductal gliosis may be congenital or acquired.

  It is the commonest cause of hydrocephalus associated with meningomyelococle.
- Hydrocephalus associated with chondrodystrophy- result in Kiecblattschadel or clover leaf skull syndrome.
- Of the inflammatory causes of fourth ventricular block, the commonest in India is Tuberculous meningitis
- Protein transudates from brain and spinal cord tumor can cause subarachnoid blocks. Astrocytomas ependymomas and neuro-fibromas are commonly implicated.

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- The most common inherited form of hydrocephalus, X linked hydrocephalus (HSAS) is characterized by mental retardation adducted thumbs and spastic paraplegia.
- In infants, an increase in the head circumference by more than two cm in any month is a sign of progressive hydrocephalus.
- Setting Sun Sign— Dilated suprapineal recess compresses the quadrigeminal plate.
- Illumination is always positive in cases of Hydroencephaly.
- **Hydrocephalus does not produces papilledema in infants**.
- Real time high frequency ultrasound is an excellent screening procedure in infants with open fontanelle and procedure of choice for imaging a foetal brain.
- Acetazolamide is presently used in patients with hydrocephalus, if intracranial pressure is not high and arrest of the disease is anticipated.
- Oral glycerol has also been found useful in slowing the progression of hydrocephalus.
- **Shunting of CSF into the Peritoneal cavity** began with **Ferguson's work in 1898**, but did not gain any degree of acceptance till **William Cone revived the operation in 1949.**

Craniovertebral Anomalies

- The notochord disappear at the vertebral bodies, but its remnants persist at the intervertebral discs as the nucleus pulposus.
- Apical ligament of the odontoid owes its origin to the proatlas [Fourth occipital sclerotome].
- Platybasia means flatness of the base of the skull. [basal angle greater than 140°].
- Basilar invagination— in Anterior type— Clivus is short, in Paramedian—region there is Hypoplasia of the occipital condyles. (Vertebral column (odontoid) invaginates into the posterior fossa).

  Basilar impression or also called secondary basilar invagination. [Hyperparathyroidism, Paget's disease or osteomalacia of the base of the skull causes softening of the bone resulting in invagination. It is also seen in osteogenesis imperfecta and rickets.
- McGregor's line is helpful in routine screening.
- MeRae's line is helpful in clinical assessment.
- Short neck and torticollis are common.
- Vertebral artery anomalies are common.

- Motor and sensory complaint typically overshadow cerebellar and vestibular complaints.
- The most common etiology of osodontoideum is traumatic.
- **Atlanto axial dislocation is the commonest bony abnormality observed at the CV junction be it congenital or acquired.**
- Hypaesthesia over the C2 dermatomal distribution is highly suggestive of atlanto axial dislocation (Synkinesis).
- Synkinesis (Mirror movements) of the hands are often seen in patients particularly in association with the Klippel Feil Syndrome.
- The atlanto odontoid interval was considered to be normal upto 2.5-3.00 mm in adults, and 4.5mm in children.
- Growth in the anterior cranial fossa is completed earlier while the middle cranial fossa continues to grow up to the age of six or seven years.
- The growth of posterior fossa along the intra occipital synchondrosis ceases in early childhood whearas the spheno-occipital synchondrosis continues to grow until well past puberty.
- Basilar part of occipital bone joins to sphenoid bone between 18 to 25 years.
- Bilateral coronal suture synostosis (Brachycephaly). The lesser wings of the sphenoid bone are markedly elevated giving the characteristic "Harlequin" appearance.
- Pi procedure is used for sagittal synostosis.

HEAD INJURIES

1. 21 AMINOSTEROIDS (Lazaroids) – U74006F and U74500A are shown to be potent inhibitor of lipid peroxidation.
2. Thrombocytopaenia of less than 150,000 platelets per cu/mm is almost pathognomic of fat embolism.

- Children coma scale given by Hahn and Mclone.
- Gaze palsies can occur following head injury upward or downward. Gaze palsies as well as lateral conjugate gaze palsies could occur. At time slow deviation may also be noted.
- Retinal oedema (angiopathia retinae traumatica) also known as Puertscher's disease.
- On CT scan contused area in the brain show the "salt and pepper" appearance on CT.
- In head injury, early localization of Haematomas is not possible on MR and bone lesions are missed.

- A negative cold caloric response indicate a poor prognosis and could be employed as a valid test instead of BAER.
- While testing BAER one should remember that the responses are unaffected by hypothermia and barbiturates but are affected by anaesthetic agents and lidocaine.
- Differential diagnosis of an unconscious patient.
  - CVA— The age of the patient and the presence of dense hemiplegia with a disproportionately mild depression of consciousness may give clue to the primary illness.
  - Spontaneous SAH— Haemorrhages in the fundi and neck stiffness in a young or middle aged patient may give a clue to the true diagnosis.
  - Barbiturate Poisoning— Unembarrased respiration and subnormal temperature often point to over dosage of barbiturate. Hypotension and small blisters on the limb filled with serum may be present.
  - Epileptic Seizure— Past history of epilepsy, in epilepsy, the pupillary reflexes return and the level of consciousness improves within a minute.
  - Alcoholism leading to Hypoglycemia and Tachycardia, a flushed face and sweating may suggest this diagnosis.
- Usually restlessness after head injury is due to cerebral anoxia and may improve with proper oxygenation.
- The most dangerous cause of restlessness is an expanding intra cranial haematoma and this should be anticipated.
- **In children suture do not close firmly till about four years of age.**
- **Lambdoid suture** is particularly liable to tramatic suture separation.
- Leforte – I— Transverse maxillary fractures also known as (Guerin #)

  Leforte – II— Pyramidal maxillary fractures

  Leforte – III— Intermaxillary zygomatic fractures
- Extradural haemorrhage being uncommon in the very young and the old in whom the dura adheres to the bone.
- To become clinically significant, extradural haematoma should be at least 25gm in weight or about 25ml in volume.
- The firm adherence of the dura to the inner table in childhood explain the infrequency of EDH in children below 3 years of age.
- Jacobson in 1885 described EDH.

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- Double lucid interval is reported in children and in posterior fossa EDH.
- Of all the intracranial haematomas, the best prognosis is carried by patients with chronic subdural haematoma.
- The presence of continuous extensor spasms of the legs as an early symptom in chronic subdural haematoma in infants, so called 'Mesencephalic Syndrome', as an expression of incipient mesencephalic herniation.
- Diagnostic investigation of choice for chronic subdural haematoma is CT scan.
- Attenuation Coefficients

  50 – 90 HU Hyperdense

  30 – 50 HU Isodense

  05 – 30 HU Hypodense

  This change in density is due to the change in protein concentration and not due to calcium or iron of the blood.
- In any collection of blood inside the body, haemoglobin break down products are formed. In temporal sequence these are deoxy haemoglobin (hypointense in MR), Methaemoglobin (hyperintense in MR) and haemosiderin (hypointense in MR).
- The non surgical treatment of chronic SDH is based on the principle that the haematoma will reduce in size and get absorbed by a reduction of pressure inside the haematoma.
- Transient parosmia is more likely to be an abortive temporal lobe seizure.
- Administration of ACTH has been advocated with the claim that, when it is given at the onset of traumatic facial palsy, the recovery is good.
- Injury to visual system.

  Four types of injuries
  - Anterior marginal tears injury (12%)
  - Anterior optic nerve injury (14%)
  - Posterior and canalicular optic nerve injury (67%)
  - Optochiasmal injury (7%)
- Intracanalicular involvement of the optic nerve is much more common than its involvement at other sites. And leading to Temporal field defect.
- When the P100 wave was present, 90% of patients showed improvement.

- "Growing skull fracture" (cranio-cerebral erosion) a condition seen only in children, usually below three years of age.
- The incidence of post-traumatic epilepsy is much higher (in the range of 30-50%) in compound fractures and missile injury.
- Wounds in the parietal region, especially those at the vertex were more epileptogenic as also tangential injuries of the skull and through and through brain injuries.
- Depressed fractures of the skull increase the incidence of epilepsy.
- Prophylactic anticonvulsants are used for the following indications:
  1. Previous history of epileptic fits or febrile convulsions
  2. Depressed fracture of the skull
  3. Intracranial haemetoma
  4. Cerebral laceration
- Paradoxical CSF rhinorrhoea is seen in middle fossa fracture where CSF through eustachian tube comes into nose.
- Dandy termed reservoir sign— when the fluid leaks occur only when bending the head is forward, because CSF has accumulated in the sphenoidal sinus.
- A glucose level of more than 30mgm/dl confirms the fluid to be CSF.
- Estimation of the B2 transferrin and the albumin/ prealbumin ratio in the collected fluid is both specific and sensitive.
- Usually any defect less than three cm in diameter does not need cranioplasty.
- A wide defect over the fronto-parietal region may result in a flopping syndrome. Flap collapsing in the erect position and bulging in the supine position.

  With experience over long years, it has been found that properly fashioned split rib grafts give the best result, without post operative problem.
- The semiprone position should be used while patients are transported from one place to another.
- As the absorption value of wood is around minus 300HU resembling air, a penetrating injury by wood may be mistaken for a of pneumocoele.
- "Brain fungus" term is used for herniated brain presenting on the surface invariably grossly contaminated.

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Spinal Column

- Transverse ligament limits the anterior posterior movements between the C1 and C2 vertebrae.
- The transverse ligament is one of the strongest ligaments of the spine.
- Cruciate ligament complex (consisting of the apical and the alar ligaments) serves to limit rotation.
- **At the occipito-atlantal joints 13-16 degree of flexion-extension and up to eight degrees of lateral tilt can take place. No rotation is allowed.**
- At the atlanto axial region, 10-13 degree of flexion-extension is allowed. A 50 degree axial rotation is seen at this level as an individual motion which accounts for about 50% of the total rotation seen in the cervical spine.
- Sagittal translation is limited to two or three mm at C1-C2 because of the transverse ligament.
- Hyperextension is limited by the tectorial membrane and the anterior longitudinal ligament. Tectorial membrane is the continuation of posterior longitudinal ligament (at C_1 and C_2).
- The facet joints are at 45° angle to the horizontal in the coronal plane at C_1 and C_2 level.
- The lateral aspect of each vertebral body has a superior projection (the uncinate process) as the disc degenerate this process approximate with the body of the vertebrae above with resulting in degenerative change in the uncovertebral joint of Luschka.
- C2 has large bifid spinous process.
- **The spinous process of C3 to C5 are bifid.**
- The laminae and spinous process of C7 are the largest. Also known as "Vertebrae Prominens".
- The ability of the vertebral body to resist compression decreases by about 50% by 40 years of age mostly because of a decrease in the osseous tissue.
- The spinous process project inferiorly in the upper thoracic region but in the lower thoracic region they become horizontally oriented.
- T1 to T10 facets are oriented in the coronal plane, they lie in the sagittal plane at the lower levels.

  This abrupt change in the orientation of the facets make these transitional regions of the spine highly suceptible to dislocation.
- In the lower thoracic region where they acquire the lumbar pattern they limit rotation rather than anteroposterior translation.

- ALL (Anterior Longitudinal Ligament) prevent hyper extension and overdistraction.
- Anterior Longitudinal Ligament is capable of withstanding much more tensile loading than the other ligament of the thoracic spine.
- The Posterior Longitudinal Ligament (thickest in the thoracic region) act to limit hyperflexion.
- The main function of the ligamentum flavum, which has high degree of elastin is to allow flexion of the spine with separation of the laminae and the return of laminae to their normal position.
- The importance of this is that spinal cord is not compressed when the spine goes from the flexed to the extended position.
- **In the cervical spine, flexion and extension are evenly distributed, while axial rotation and lateral tilt are not.**
- **Axial rotation occur mostly between C1 and C2 with no lateral tilt occurring here.**
- In the thoracic spine while lateral tilting is evenly distributed, axial rotation occur more in the upper thoracic spine and flexion extension more in the lower thoracic spine.
- Dennis proposed a three column model of the spine

  Anterior Column — ALL + Anterior portion of the annulus fibrosus and the vertebral body.

  Middle Column — PLL + Posterior portion of the vertebral body and the annulus fibrosus.

  Posterior Column — Posterior bony arch + Posterior ligamentous complex (Supraspinous and interspinous ligament).

  The spinal cord fills about 35% of the canal at the level of the atlas and approx 50% of the canal in the lower cervical (C2-C7) and thoracolumbar segments.
- The grey matter is predominant in the cervical and lumbar enlargements and the content of the white matter increases from sacral to cervical segments.
- Nerve root being part of the peripheral nervous system are more resistant to trauma than the spinal cord.
- The bulbocavernous reflex indicated that the S3-S4 region of the conus is physiologically and anatomically functional.
- 99% of patients have return of the bulbocavernosu reflex within 24 hours. The return of this reflex means the end of the spinal shock.

- The bulbocavernous reflex has no bearing on lesions below the level of the conus.
- Sustained penile erection indicate a severe cervical cord injury.
- In Brown— Sequard Syndrome— Prognosis is good and nearly 50% of the patients recover.
- Central cord syndrome is caused by Hyperextension of the cervical spine.
- Atlanto-dental measurement (extending from the back of the anterior arch of the atlas to the anterior surface of the dens) should not exceed 3.0mm in the adult and 5.0mm in a child.
- In Stretch test— Increase in the interspace separation of greater than 1.7mm or an angulation greater than 11^0 suggest a ligamentous disruption.
- Traumatic spondylolisthesis of the axis (C2 vertebrae) is also called Hangman's fracture.
- Atlas has 6 types of fracture.
- Type II odontoid process may result in cruciate paralysis.

Peripheral Nerve Injury

- The recruited macrophage play an important role in both degeneration and regeneration of peripheral nerve axons after injury.
- The slow degeneration and poor monocyte recruitment in the CNS contribute to the poor regeneration in the CNS.
- The capacity of the schwann cell to proliferate remain intact for several year after the injury.
- Member of the EGF family of proteins play an important role in the peripheral nerve response to injury.
- The fasciculi and nerve trunk below the injury show atrophy due to shrinkage of the endoneural tube. The cross-sectional fascicular area is reduced by about 40-50% at 2 months, 50-60% at 3 months and 60-70% at 4 to 5 months.
- Apoliporotein E (apo E) is a predominant protein in the developing mammalian brain and in damaged peripheral nerves.
- After peripheral nerve injury, there is an increase in the production of apo E.
- This endoneurial apo E plays a role in the redistribution of lipids from the degenerating axonal and myelin elements to the regenerating axons and myelin sheaths.

- Alteration in plasma cytokines (interleukin 1,2,6) and tumor necrosis factor, induced as a response to trauma provide a basis for the regeneration and degeneration of the peripheral neurons after trauma.
- Lateral cutaneous nerve of forearm (C_{5-6}) arises from Musculocutaneous nerve.

  Lower lateral cutaneous nerve of arm (C_{5-6}) arises from Radial nerve.
- Pseudomeningocoeles seen on myelography are usually indicative of root avulsion in nerve injury cases.
- **The common nerves for obtaining cable nerve graft are the sural nerve and the posterior cutaneous nerve of the thigh.**
- The old rule of regeneration at the rate of 1.0mm/day after the first week of anastomosis still hold true.

  The points of delay are at the site of anastomosis and the motor and sensory end organs.

Entrapment Neuropathy

- In a peripheral nerve 40% of fibres are sensory, unmyelinated to myelinated fibre ratio is 4:1.
- In compression neuropathy of the peripheral nerves, the larger myelinated fibre situated at the periphery of the nerve are likely to suffer more than the smaller or the unmyelinated fibre.
- Kiloh Nervin Syndrome— Anterior interosseous nerve entrapment, involving motor branch of the median nerve.
- Commonest of the entrapment neuropathies is carpal tunnel syndrome.
- Pain worsening during sleep is so characteristic that it can be taken as pathognomic sign of carpal tunnel syndrome.
- The palmar cutaneous branch of the median nerve leaves the median nerve about 2cms above the retinaculum and proceed laterally to the skin over the thenar eminence.
- The motor branch to the thenar muscles leaves the nerve distal to the retinaculum but in about a third of the cases it may arise inside the retinaculum or traverse the ligament, leading to difficulties during surgery.
- An abducted position of the little finger (Wartenburg's sign) is an early sign of ulnar nerve entrapment. Muscle involved is 3rd palmar interosseous.

- Meralagia paraesthetica, Bernard Roth syndrome or Swashbuckler disease is due to entrapment of lateral femoral cutaneous nerve arising from the L2 and L3 lumbar nerves in the lumbar plexus.
- It is entraped between the two attachments of the inguinal ligaments to the anterior superior iliac spine.

  In intractable case, the lateral cutaneous nerve can be decompressed by cutting the inferior attachment of the inguinal ligament to the anterior superior iliac spine.
- Morton's neurinoma— digital nerves compressed between the head of metatarsal bones usually between the third and fourth or occasionally between the second and third metatarsal bones due to wearing of high healed shoes.

Microbiology of Pyogenic Infections

- A predominant polymicrobial aetiology due to Proteus spp, Bacteroides sp along with anaerobic streptococci is often encountered in otogenic brain abscess.
- A less frequent polymicrobial aetiology by Haemophilus spp and microaerophilic streptococci is associated with metastatic brain abscess.
- Acute pyogenic meningitis following skull fractures associated with dural tears is most often due to streptococcus pneumoniae.
- Staphylococci and Microaerophilic streptococci major aetiological agent in sub dural empyema
- Infants have Group B streptococci and enterobacteriaceae monomicrobial aetiology
- Cranial epidural abscess complicating craniotomy, compound akull fractures, proximity of an area of osteomyelitis is due to STAPH AUREUS
- Spinal— epidural abscess - Staph. aureus [50 – 60%]
  — subdural abscess - Staph. aureus
  — Intramedullary abscess - Staph. aureus
  — Staph aureus – is a Gram positive cocci.

Pyogenic Infections

- The first successful operation for brain abscess was reported by Morand in 1768.
- The incidence of brain abscess is more frequent among the young age group, with a slightly greater incidence in males.

- Haematogenous brain abscess usually develop in the territory of the middle cerebral artery, the left side being more often involved than the right.
- Brain abscesses of haematogenous origin secondary to pleuro-pulmonary suppuration tend to be multiple.
- Abscesses in congenital cyanotic heart disease are usually solitary and in the middle cerebral artery territory in 70-90% of cases.
- Among brain abscesses, otogenic abscess is the commonest.
- Otogenic abscess can develop inside the temporal lobe or, the cerebellum.
- In otogenic abscess multiple abscess occur more frequently in the temporal lobe than in the cerebellum.
- In brain abscess of cyanotic heart disease, streptococcus is the commonest organism encountered, and the wall of the abscess is thin.
- The majority of metastatic brain abscesses are secondary to chest infections like bronchiectasis, lung abscess or empyema.
- The most frequent site of metastatic brain abscess is the frontal lobe.
- For an abscess in the sensorimotor or speech cortex, aspiration is the treatment of choice.
- The recurrence rate is highest in those patients in whom the abscess was excised after repeated aspiration, and those where the infecting organism was Staph. Aureus.
- In children, the sequelae of brain abscess tend to be more severe than in adults.
- Cerebellar abscesses after proper treatment rarely result in neurological deficits.
- The onset of epilepsy after a temporal lobe abscess was earlier than that following frontal abscess.
- **Excision of the abscess would lessen the risk of epilepsy, as the scar left after aspiration is likely to be denser than the scar following excision.**

Pyogenic Infection of the Spine

- As adults normally have no distinct vascular communications between the vertebral body and the intervertebral disc, the body is infected initially and the disc space involved secondarily.

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- In children, the disc space is primarily infected with secondary involvement of the body.
- Staphylococcus aureus is the most common pathogen causing vertebral osteomyelitis.
- Osteomyelitis rarely involve the posterior elements.
- Spinal epidural abscesses occur more commonly in the thoracic region and more common in the posterior part of the spinal canal.

Tuberculosis of the CNS

- In 18th century CNS tuberculosis was primarily identified as "Dropsy in the brain" or "Febris hydrocephalica".
- Increased suspectibility to infection associated with following subtypes of HLA DR2 HLA-A10, B-8, DR-2.
- CNS tuberculosis is secondary to a haematogenous spread from a primary infection elsewhere in the body.
- CNS tuberculosis is caused by mycobacterium tuberculosis hominis.
- 50% AIDS patients at necropsy harbour mycobacterium avium complex.
- Enzyme linked **immunoabsorbent assay of IgG reactivity to LAM** (**Lipo arabino mannon**) in the CSF is very useful in the early diagnosis of TB meningitis and **is superior to PPD in the diagnosis of TBM.**
- Increased proteins in the CSF retard CSF absorption and lead to raised ICP.
- **Basal exudates characteristic of tuberculous meningitis are not absolutely diagnostic and can be seen in other bacterial, fungal and caracinomatous meningitis.**

Sarciodosis of the Nervous System

- Has been reported in about 1-15% of all cases.
- The cranial and peripheral nerves are most frequently affected.
- **Extra-ocular palsies, pupillary abnormality facial paralysis and involvement of other cranial nerves may be seen but unlike in tuberculosis they are transient and recurrent.**
- Of all the structures in the CNS, the **pituitary gland** and the **optic chiasm** are the most frequently affected.
- A history of uveo-parotitis or transient cranial nerve palsy and peripheral neuropathy may indicate sarcoidosis.

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Protozoal Infections

- Toxoplasmosis, being the most common opportunistic infection of the CNS has become a very common cause of intracerebral mass lesions in patient with AIDS.

Cysticercosis

- Man is both definitive and secondary host.
- Pigs act as secondary host.
- Dexamethasone can increase the plasma levels of albendazole by 50% and reduce the plasma levels of praziquantel.
- Carbamazepine and phenytoin significantly decrease concentrations of praziquantel due to increased clearance secondary to induction of first pass liver metabolism.
- **Intraventicular cyst do not respond to medical therapy and require surgical excision.**

Hydatid Disease

- Liver is affected in about 65% of cases, lungs 15-20%, brain 2-5%.
- The **hydatid cyst has a predilection for the white matter which in contrast to cysticerosis which has predilection to grey matter**.
- Daughter cyst are more frequent in the brain than elsewhere.
- Average growth of hydatid cyst is estimated at about 1.5 cm/year to 10 cm/year.
- **Known as the Tetrad of Schroeder** not specific for hydatidosis
  - Country dweller
  - Good general condition
  - ↑ ICP
  - Without marked focal finding
- Peritumoral oedema and mural nodules are significantly absent.
- Hdydraulic dissection is done to remove Hydatid cyst. Hydatid cyst is present in thoracic spine in 50%, sacral spine in 20%, lumbar spine in 20%.
- Increase in symptoms on palpation and percussion of the spine is characteristic of hydatidosis.
- Non-involvement of the intervertebral disc differentiate vertebral hydatidosis from spinal tuberculosis.

- In spinal schistosomiasis progression of symptoms could mimic a Guillain-Barre syndrome.
- The post-treatment inflammatory exacerbation of lesion is not seen in schitosomiasis unlike in cysticercosis.
- Paragonimiasis (lung fluke infestation) multiple cystic calcification looking like "soap bubbles" are highly suggestive of paragonimiasis. Praziquanteles is drug of choice.

Fungal Infections

- Meningeal Syndromes→ Common symptoms are headache, nausea, vomiting, neck stiffness and fever. In 40% of the cases of cryptoccocosis visual impairment, diplopia and papilledema occur.
- Space occupying lesions→ Granuloma, abscess or hydrocephalus cause symptoms and signs relating to the affected area.with ↑ICP. ASPERGILLOSIS typically presents in this way.
- Blastomycosis present with
  - Progresive paraplegia
  - Gibbus
- Extradural or intradural cryptococal granulomas are known for causing compressive myelopathy.
- Rhinocerebral syndrome→ Zygomycosis where blackish necrotic areas called eschares are seen on the hard palate or the nasal turbinate.
- Stroke like Syndromes are caused by Aspergillosis and Zygomycosis.
- **Unlike bacterial mycotic aneurysms fungal mycotic aneurysms occur in the larger arteries.**
- Candida infection may result in embolic stroke.
- Cryptococcosis appears to be the commonest type of mycosis in AIDS.
- Amphotericin B is useful for all fungi except rare dermatiaceous fungi e.g. P boydie. Amphotericin B damages fungal cell membrane by binding to ergosterol.
- Flucytosine— is used for cryptococcus, candida, aspergillus, chromoblastomycosis contracted to 5FU in fungal cells causing interference with protein synthesis and fungal death.
- Azole derivatives— Interfere with ergosterol synthesis, and useful for coccidoides, candida Histoplasma, Aspergillus, Mucormycosis.
- Fluconazole— Specifically in cryptococcosis with AIDS.

- Blastomycosis affects middle-aged healthy males who have a history of high alcohol consumption.

  Incidence of bone involvement is about 30%.
- Mucormycosis ! Rhinocerebral form is the commonest type of penetration and is seen in 80-90% of cases.
- Cryptococcus neoformans is the commonest cause of meningitis which occurs in 5% of all cases.
- **Reye's syndrome is (1963) of neurosurgical interest because of the cerebral oedema and high intracranial pressure seen in the condition**.
- **Administration of aspirin during a viral illness in children has been identified as a probable cause of Reye's syndrome.**
- Bacterial meningitis is very rare in AIDS patients.
- Toxoplasmosis is the commonest CNS space occupying lesion in patients with AIDS and occurs in 2-13 percent of such patients.
- The most frequent tumor in AIDS patients is Kaposi's sarcoma, rarely involve the CNS.
- PML (Progressive Multifocal Leucoencephalopathy) is an infection demyelinating disorder caused by a papova virus, JC or SV-40 virus.
- The commonest Peripheral neuropathy seen in patients with AIDS is a symmetrical, distal, predominantly sensory neuropathy characterized by painful dysaesthesias especially of the feet.
- A vacuolar myelopathy of the spinal cord is seen on autopsy is about a quarter of patients with AIDS involving dorsal column.

  It is characterized by vacuolation in the spinal white matter, especially the lateral and posterior column of the thoracic spinal cord.

  Syndrome is similar to that seen with Vitamin B12 deficiency.
- Retinitis caused by cytomegalo virus is the commonest cause of reduced visual acuity in AIDS patients.
- After excluding all iatrogenic causes, diabetes insipidus should be suspected when the urinary output is more than 200ml/hr or 1000ml in four hours.
- Classical features of SIADH are
  1. Low serum sodium <125meg/L
  2. High urine sodium >25meq/l
  3. Low serum osmolality <280msom/kg
  4. Urine osmolality more than plasma osmolality
- **The prognosis in patients with hyponatremia is better than those with hypernatremia.**

- **The recurrent artery of Heubner arises from the A2 segment in about 80% of cases.**

  Patient with anterior communicating aneurysm has four type of collateral circulation:

  Type I— Ipsilateral (66%). In this type the aneurysm , and the distal ACA fill from one proximal ACA.

  Type II— Bilateral (14%) the aneurysm and both the ACA fill from both carotid injections.

  Type III— Dominant ACA (12%) the aneurysm arises from the axilla of the two anterior cerebral arteries both of which fill from one anterior cerebral. The contralateral A1 segment is hypolastic.

  Type IV— Dominant ACA with foetal posterior cerebral artery (8%).
- M1 or sphenoidal segment of middle cerebral artery give rise to large and longer lateral group of vessels and a smaller medial group. It runs in a characterististic S-shaped carve.
- Middle cerebral artery - Medial lenticulostriate artery
  (MI Segment] - Lateral lenticulostriate artery
- Occlusion of Anterior choroidal artery result in contralateral
  1. Hemiplegia
  2. Hemianaesthesia
  3. Hemianopsia
- There is constant anastomosis of the anterior choroidal artery with the lateral posterior choroidal at the level of the lateral geniculate body.
- **Aneurysms with size of 2.5cm or over in any diameter are labelled as giant aneurysm**.
- Giant aneurysm can present at any age but they are three times more common in women.

Cerebral Protection

- Increasing blood flow
  - Hypertension— Initially only upto 10-15 percent above the normal blood pressure of the patient has role in protection.
  - Hypervolaemia— Hypervolaemia with haemodilution helps to increase the cerebral blood flow in ischaemic areas.
  - Reducing blood viscosity— Viscosity of blood is inversely proportional to blood flow.
    - Optimal haematocrit in ischaemia is 30-35%.

- Fluids that have been used are low molecular weight—dextran, plasma, albumin and betastarch.
- Prevention of Oedema ! Mannitol is the osmotic diuretic that is used commonly.
- Mannitol also lowers blood viscosity and may act as a free radical scavenger.
- Steroids have not been proved to be effective in ischaemic injury, but are useful in brain protection during neurosurgical procedures, in tumors and during brain retraction.

- A new class of steroids (lazaroids) 21 – aminosteroids are devoid of glucocorticoid activity.
- Hyperbaric oxygen therapy has been found to be useful in cerebral protection but has not been used widely.
- Hyper and hypoglycaemia have an adverse effect on neural tissue and therefore, the blood glucose should be maintained at the normal level.
- Perfluorocarbons $\rightarrow\uparrow O_2$ carrying capacity
  $\rightarrow\downarrow$ Blood viscosity
- Perfluorocarbons require a high proportion of inspired oxygen to reach saturation and this limits their clinical use as artificial blood.
- Increasing the resistance of neural tissue, barbiturates
  - Reduces the CMR, CBF and ICP.
  - Dose dependent reduction of CMR and CBF occur.
  - Maximum reduction that is possible is about 50%.
  - Further increase in the dosage, do not reduce the CMR further.
  - Have a profound cardiovascular depressive effect.
  - Cause reverse steal phenomenon → causes vasoconstriction in the normal artoregulated vasculature lead to the increased blood flow in the ischaemic area where autoregulation is lost.
  - Act as free radical scavenger, reduce free fatty acid production, →cerebral oedema.

Etomidate→
- $\downarrow$CBF $\downarrow CRMO_2$
- Minimal cardiovascular depressive effect
- Reduces adrenocortical reponse to stress

Ca^{2+} Channel Blocker→
- Nimodipine (Maximum cerebral peneteration) is useful in prevention of excitotoxicity

– NMDA and AMPA antagonists have been tried in experimental setting with good benefit

Free Radical Scavengers or brain protecting agents include

– Steroids–Mannitol
– Barbiturates
– Vitamin C and E
– Suzuki et al used a combination of mannitol, dexamethasone and vitamin E along with fluosol and called as **"Sendai cocktail"**
– Hypothermia [Mild]

Vascular malformations

– The risk of haemorrhage from an AVM in an child is three fold compared to adults and the incidence of rebleed is 7 times more
– Cerebral AVM's clinical presentation

Children	Adults
91% with bleed	78% bleed
2% Seizures	14% seizures

– Haemorrhage peak at (11-35 years) of age
– AVM's during sleep bleed unrelated to stress, activity, trauma or hypertension.
– Risk of bleed from an AVM progressively declines after the age of 40 years.
– Small AVM is likelihood of bleeding.
– High risk of bleed in the presence of only one draining vein (89%), deep drainage (94%), demonstration of venous obstruction (94%)
– A haemorrhagic diathesis may be encountered in patient with cavernomas due to a consumption coagulopathy because of extensive spontaneous thrombosis within the malformation known as **Kasalbach Merrit Syndrome** or due to a qualitative platelet defect (the storage pool disease).

Malformation of the Vein Of Galen

Type I: Pure cisternal fistula between the pericallosal arteries (anterior + posterior), PCA (P4 and its branches) and the Vein of Galen

Type II: Fistulous connection between the thalamoperforators (basilar artery and P1 segment of PCA) and the Vein of Galen.

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Type III: Mixed forms of Type I and II with feeders from the pericallosal, the choroidal branches of the posterior cerebral (P4), the thalamopforators from (P1) segment and the basilar artery.

Type IV: [Plexiform AVM].

Clinical Presentation

Neonatal group— High output cardiac failure

Infantile group— Hydrocephalus

Childhood group— Progressive hydrocephelus or subarachnoid haemorrhage

Adult group— SAH (Subarachnoid haemorrhage)

In the Vein of Galen aneurysm there is a Pathological C shaped calcification. Vein of Galen aneurysm is a misnomer.

Spinal Vascular Malformations

Venous Drainage

Vein of the spinal cord drain into

- 6 Plexiform longitudinal channel then into
- Coronal venous plexus on the cord surface
- Pia drained by medullary veins peneterate dura
- Carry blood from intradural space to the epidural venous plexus
- The medullary veins and coronal venous plexus and radial veins, the venous component within the intrathecal space and devoid of valves
- Internal vertebral venous plexus present epidurally.

- Type I (dural) spinal AVMs are the most common type of spinal AVM, believed to be acquired lesions and manifest low flow but high pressure. They typically present with a slowly progressive course without significant clinical improvement. No steal phenomenon present.
- Etiology of types II, III and IV spinal AVMS is believed to be congenital. Type II (glomus) AVMS are intramedullary. Type III (Juvenile) AVMS are predominantly intradural. They are both true AVMS with rapid blood flow and are at risk for subarachnoid or intramedullary hemorrhage. Type IV AVMS vary in size and in rapidity of blood flow. They are intradural extramedullary or perimedullary.

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- Treatment

  Dural AVM

  1. Selective embolization
  2. Excision and coagulation of fistula

  Intradural AVM — Surgery

  Type IV — Perimedullary AVF

  Natural history one of relentless progression and hence treatment is worthwhile even if it produces no clinical improvement.

  Type I — Surgery

  Type II — Surgery

  Type III — Embolisation

  Glomus Type II AVM — Cervical glomus AVM'S are totally excised.

Mycotic Aneurysms

- Bacterial endocarditis form the most common cause of mycotic aneurysm.
- 3-15% patients with infective endocardities will develop aneurysm [=10%].
- Subarachnoid heamorrhage occur in less than 20%.
- The commonest organism involved in the formation of mycotic aneurysms are staph aureus, staph albus and streptococcus viridans.
- A mycotic aneurysm is classically located peripherally on the middle cerebralvartery and is seen as fusiform dilatation of the vessel rather than as a classical saccular aneurysm.

Tumor of the Spinal Cord and Cauda Equina

- Intradural extramedullary tumors are the common intraspinal tumors, neurinomas and meningiomas being the most frequent.
- Both astrocytomas and ependymomas are more benign in the spinal cord (intramedullary) than in the brain.
- Aneurysmal bone cysts usually affect the posterior neural arch, i.e. the spinous process, lamina and transverse process.
- Secondary malignant deposits are the commonest tumors of the vertebral column. Breast lung thyroid and prostate are the common site of the primary lesion.
- Lymphomas and multiple myeloma may cause multiple deposits in the bone.

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- Pressure at the level of the 4th and 5th dorsal segments may cause a greater deficit because of the watershed area in the vascular supply of the cord at this level [=T4] watershed.
- Root pain is most commonly seen in extramedullary tumors. Root pain occurs in 2/3rd of Intradural and 1/3rd of extradural.
- Fasciculations in region of the body far remote from the involved spinal segment is due to interference with Pyramidal tract function, a phenomenon termed Parabiosis.
- Subjective sensory disturbances are more common in intramedullary lesions.
- In cervical lesions, irritation of the posterior column leads to Lhermittes sign.
- Lhermittes sign was originally described in 1918 by Babinski and Dubois.
- Lhermitte in 1924 only pointed out the value of this sign in multiple sclerosis but somehow his name got attached to this sign.
- Lhermittes sign → shock – like sensation all over the body when the neck is flexed.
- **Sparing of sacral dermatomes is a characteristic feature of an intramedullary growth.**
- In both extra and intramedullary tumors, the intensity of loss of tactile sensation is less than that of pain and temperature because of presence of dual pathway for touch.
- Asymmetry in weakness, in spasticity and in reflex disturbances between the two side is characteristic of a tumor, in contrast to degenerative disorder like primary lateral sclerosis or Amyotrophic lateral sclerosis.
- Intramedullary tumors affect bladder function early, as the upper motor neuron fibres to the bladder lie deeper in the lateral column and occupy an area nearer the center of the spinal cord.
- Intramedullary tumors when slow growing may cause scoliosis due to weakness of the muscle supplied by the involved segments.
- Pain in the neck and in the occipital region made worse by movements of the neck is a characteristic feature of high cervical lesions.
- Epiconus Syndrome — is formed by [L4 L5 S1 S2] spinal cord segments and has cord segment involvement with
  Knee jerk preserved and the ankle jerk is lost.

- Conus syndrome — Lower three sacral and the coccygeal segments comprise the conus medullaris.

  Sensory disturbance occurs in the S3, S4, S5 dermatome [Knee and ankle jerk normal].
- Cauda Equine Syndrome — Cauda equine consist of the five lumbar, five sacral and two coccygeal nerve roots in the spinal canal [A total of about 48 nerve roots]. The clinical picture in tumors of the cauda equina varies according to the level and the number of nerve roots affected.
- A pure conus medullaries lesion is not seen in practice [S3 – C0]
- An extramedullary tumor at the level of the conus compresses both the cauda equina and the conus [Mixed picture in the early stage].

	Extramedullary	*Intramedullary*
Root pain	Commmon and early	Late and uncommon
Sensory loss at the level of the tumor	Nil or slight	Wide
Dysathesiae Parasese-thesiae (due to irritation of long sensory tracts)	Seldom if at all	Common at all stages
Subjective sensation of intense cold	Characteristic of high cervical tumor	Not seen
Distant sensory loss (long sensory fiect involvement)	Ascending sensory disturbance and no dissociation	Descending sensory disturbance with dissociation
Muscle spasms (due to irritation of anterior nerve roots)	Fairly common	Infrequent
Lower motor neuron paralysis with muscle atrophy	Absent except when nerve roots with extensive motor supply like C8, T1 are involved	Wide
Upper motor neuron paralysis	Late	Early
Sphincter disturbances	Late unless it is in the region of sacral cord	Early
Brown Sequard type of clinical picture	A feature of laterally placed tumors	Uncommon
Trophic disturbance of skin	Absent	Fairly uncommon
CSF protein	Marked increase	Moderate increase
X-ray spine	Bone changes common	Bone changes only in a few cases
Tenderness of spine	Common	Uncommon

ENLARGEMENT OF THE INTERVERTEBRAL FORAMEN IS CAUSED BY

- Dumb bell neurinomas growing along the nerve root
- Paraspinal sympathicoblastoma.

- Scalloping affecting a number of vertebral bodies occurs in Von Recklinghausen's disease in the absence of any tumor. Seen in some cases of congenital hydrocephalus.
- Xanthochromia is more frequently seen in tumors of the lower thoracic and lumbosacral cord and in neurofibromas [Venous stasis below the level of a tumor leads to a capillary haemorrhage into the CSF].
- **Increase in the total CSF proteins is nearly a rule in spinal cord tumors.**
- **With increased quantity of protein, globulin is present in abnormally high concentration.**
- **Highest average protein values in intradural tumors, lowest in extradural tumors with intramedullary lesions in between.**
- **The lower the level of the tumor in the spinal canal, the greater are the protein contents.**
- **Neurinomas cause a greater rise in protein level than other tumors.**
- **As a rule, there is no increase in CSF cells in spinal tumors.**
- **Froin syndrome include Xanthchromia, increase protein, normal cell count in CSF and is characteristic of spinal compression.**
- **The highest point of the illiac crest which is in line with the spine of the 4th lumbar vertebra, is a useful landmark during lumbar puncture coinciding with [L3-L4 interspace].**
- **Extradural meningiomas are more difficult to remove completely than intradural meningiomas. At least one nerve may be incorporated in the tumor and may have to be sacrificed during the removal. Malignant transformation of extradural meningiomas is more common and these may require post operative radiation.**
- **Following below is the order of functional recovery after operation on spinal cord.**

[Functional recovery]

Motor Power
↓
Sensory
↓
Pain
↓
Touch
↓
Temperature
↓
Joint Sense
↓
Vibration Sense

- **Neurofibromas occur more frequently in the thoracic region (56%).** Either posterior or posterolateral to the spinal cord thus ensuring a greater percentage of surgical success without complication.
- These are multiple in cases of Neurofibromatosis I (von Recklinghausen's disease) when they are more common in the **lumber region and in the cauda equina.**
- **Majority of the neurinomas are situated intradurally though occasionally they are extradural or exist in both the intradural and extradural space.**
- **The rise in CSF protein values is highest in neurofibromas as compared to other intraspinal tumor.**
- **Extradural meningioma — These tumors arise from the point of emergence of the nerve roots where the arachnoid is in contact with the dura.**
- **Malignant transformation is more common in epidural meningiomas**
- Intraspinal dermoids were located mostly below the twelfth dorsal vertebra.

  Mostly in the region of the conus and they were commonly extramedullary.
- Radiological feature of spinal dermoid may be
  1. Spina bifida
  2. Fusiform widening of the spinal canal
  3. Scalloping of the posterior surface of the vertebrae is pathognomic.

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- Spinal epidermoids are largely intramedullary and occur in the conus and the lower dorsal regions.
- When dorsal intramedullary tumors occur in children below fourteen, scoliosis may be the only sign.
- Nearly half of the astrocytomas are present in the thoracic cord.
- Radiation myelopathy may simulate an intramedullary spinal cord lesion in its symptomatology.
- Post laminectomy extradural cysts are more frequent in the lumbar than in the cervical or dorsal regions.
- Intracranial tumor spreading through CSF -
  1. Medulloblastoma
  2. Ependymoblastoma
  3. Malignant pineal tumor
- Vertebral chordomas -
  - Arise from ectopic notochordal elements.
  - Commonly found in the clival and sacrococcygeal regions.
  - Invariably arise from vertebral body.
  - It is curious that despite their embryonic origin chordomas are rare in infancy and childhood. Common in 3rd-7th decade.

  Calcification is frequent, it is peripheral and amorphous and not dense.

  Characterised by the presence of Physalipharous cells or (bubbly cells)
- The presence of squamous epithelial cells in the CSF is diagnostic of a dermoid cyst.

Lumbar disc Protrusion

- **The adult disc is the largest avascular structure of the body.**
- Its metabolism is mainly anaerobic.
- The thoracic discs are thicker in front and the lumbar and cervical discs are thicker posteriorly.
- The fibres in the lamella are oriented at 60 degrees to the vertical axis of the disc and adjacent lamellae run in the opposite direction.
- Water content of intervertebral disc is 88% in newborn, it falls to 80% at 12 years and to 70% at the age of 72.
- The fibrous or lamellar ring (annular fibrosus) consisting of approx. 90 concentric layers of collagenous fibres arranged in 12 lamellae.

- The normal intervertebral disc shows a diminution of height by just 0.4mm with a load of 100kg.
- A degenerated disc diminishes in height by 2mm.
- **In situ, the disc is very slightly compressible.**
- **Nucleus pulposus is under considerable intrinsic pressure i.e. – [60 kg / sqcm] [in the lumbar region]**
- The largest mobile segment of the spine is the disc. The cartilagenous end plate is atypical as compared to the other joints, in that there is no anchoring structure between it and bone.
- The development of the sacral invertebral discs differ from that of the other.
- The first sacral disc between S1 and S2 is formed in almost the usual manner.
- The more caudal the discs, the more incompletely differentiated they are.
- Without having reached complete development at any time, the sacral discs ossify from the age of 15-16 years, the process being completed by 40 years.
- Disc development does not play a part in the fusion of coccygeal segments.
- **Union of the coccyx and the sacrum is by a synchondrosis without the interposition of a disc.**
- Schmorl's node is a prolapse of nucleus pulposus into the vertebrae.
- Jugular compression may result in accentutation of pain and paraesthesiae in the affected limb (Naffziger's sign).
- Vertebral disc is absent between C1 and C2.
- Disc space infection usually occur in the lumbar region and is rarely seen in the cervical region.
- The presence of a paraspinal abscess favours tuberculosis.
- **The diameter of the lumbar canal is maximal in flexion.**
- **FAR OUT SYNDROME (Root canal stenosis) is seen in Spondylolisthesis, wherein the root is compressed by the transverse process of the subluxed vertebra.**
- An AP dimension of less than 15mm may be taken to signify a narrowed lumbar canal.
- **Spondylolisthesis**

  Type I (Dysplastic type)

  Type II (Isthmic)

due to pars interarticularis defect

↓

A. Defect in the pars interarticularis
B. Pars is elongated but intact
C. Acute pars fracture

Type III (Degenerative)
Type IV (Traumatic)
Type V (Pathological)

- The Pars defect most often involves L5 and may be associated with spine bifida occulta
- PHALEN - DICKSON SYNDROME
  Dysplastic Spondylolisthesis
  Complete slippage of L5 over SI
  Neurological signs
  Tight hamstrings
- CT is the best method to demonstrate lateral entrapment of the L5 nerve root between the transverse process and the ala of the sacrum (FAR OUT SYNDROME).

Thoracic Disc Prolapse

- .04% of all disc prolapse.
- T-11 is commonest spinal cord level affected.
- Central protusion common.
- Evidence of cord compression is an indication for surgery.
- Conservative treatment rarely helps.
- Thoracic disc is best approached by anterolateral route.
- The approach to treatment for ossified ligamentum flavum is different from that of the thoracic disc and OPLL.

Cervical Spondylosis

- Japanease disease is ossification of posterior longitudinal ligament (OPLL) Though the anterior radicular arteries exist at every level, the main artery runs between C4-C6. As cervical spondylosis occur mainly at these levels, compression of the main radicular artery in the intervertebral foramen may be responsible for ischemia of the cord.
- Commonest root affected are C5 and C6.
- Root 4, 5 and 6 have strong attachment to the vertebral column.

- The shoulder abduction relief sign and provocation of arm pain with induced narrowing of the neural foramen (by oblique cervical extension, i.e. Spurling's sign) are described as highly suggestive of radiculopathy due to spondylosis while differentiating it from other causes of cervicobrachialgia.
- The physical sings may be a mixture of upper motor neuron signs in the lower limb and lower motor neuron signs in the upper limbs and may simulate motor neuron disease or Syringomyelia.
- Dynamic Hoffman's sign has been found to be useful in the early detection of myelopathy.
- There is male predominance (approx 2:1) in the incidence of cervical spondylosis.
- MR is the preferred diagnostic modality in cervical spondylotic myelopathy.
- Segmental dysfunction of the cevrical cord can also be confirmed by an abnormality of the spinal N13 potential on SSEP.
- The levels of neuron specific enolase and S-100 proteins in the CSF could be used as markers, to assess the degree of cord damage in cervical spondylosis.
- Medical treatment of cervical spondylosis mainly targets at pain relief.
- After disectomy high non union rates are reported with fibular autografts.
- Ceramics are osteoconductive and osteoblasts form bone directly on their surface and may therefore be a better substitute for bony autograft.

Spinal Arachnoiditis

- The commonest cause of arachnoiditis is an infective process, the source being hematogenous, i.e. Tuberculosis.
- Commonest site of arachnoiditis being the thoracic region.
- Multiple areas of softening (multicystic myelomalacia) may be seen to develop.
- A **special feature** of **spinal arachnoiditis** is that the **motor disturbances** are more marked than objective sensory changes.
- Fluoroscopic examination depicts **Fractionated wax drop or stalactites.**

Fluorosis

- Flouride content of drinking water is more than 0.5 PPM.
- Restriction of spinal movements is the earliest clinical sign of fluorosis.
- Poker back deformity commonly seen in fluorosis.
- The cervical cord is more commonly affected by fluorosis than the dorsal segments.

Pathology of Intracranial Tumors

- Pinealomas are more common in Japan than elsewhere in the world.
- A Glioblastoma derived growth factor similar to the platelet derived growth factor has been identified.
- To date no chemical carcinogen has been implicated in the production of a human cerebral neoplasm.
- In man, the only known virologic disorder of the brain associated with the production of bizarre astrocytes consistent with cytologic features of malignant cell is the rare condition of **Progressive Multifocal leucoencphelophathy (PML).**
- Abnormalities in cell mediated immunity are more severe in patients with higher grade astrocytomas.
- Blepharoplasts are diagnostic of ependymomas.
- Spinal ependymomas are intramedullary and often found in the lumbosacral region.
- Homer Wright s rosettes present in Medulloblastmas are typical carrot shaped cells bearing central eosinophillic cores.

  Homer wright rosettes are present in the Medulloblastoma and in Neuroblastoma present in 50% of total.
- Reticulin framework is seen in
  - Meningeal sarcomas
  - Medulloblastomas
  - Cerebral neuroblastoma
- Endodermal sinus tumor consist of Schiller Duval bodies

Choroid plexus papilloma is characterised by presence of
- Vascular connective tissue stroma
- Single layer of columnar epithelium
- Absence of cillia

- Endodermal sinus tumors and Embryonal carcinoma may include cell positive for cytokeratin and for Epithelial membrane antigen.

- For choroid plexus papilloma in adults, the commonest site is IVth ventricle and in children it is in left lateral ventricle. (Most common in atrium or trigone).
- Overall the commonest site is the fourth ventricle, next in frequency is the lateral ventricle and then the cerebello-pontine angle.
- Colloid cyst contain thick glairy fluid with no cholesterol crystals feature differentiating it from a craniopharyngioma.
- Craniopharyngioma has long been thought to arise from embryonic rests of the original Rathkes pouch.

  Recent view is that they are the result of metaplasia of cells of the adenohypophysis and **especially the pars tuberalis.**

  Contain thick fluid rich in cholesterol crystals **characteristically described to resemble "machine oil" that is present in adamantinomous variety of craniopharyngioma which is common in children.**
- Epidermoid tumor or cyst is more frequent than the dermoid in intracranial compartment.
- Both the **epidermoid and dermoid result from the inclusion of epithelial element at the time of closure of the neural groove between the 3rd and 5th week of foetal life.**
- **Epidermoid- frequent site is the Cerebello Pontine angle and the parasellar region.**
- Dermoid and epidermoid cysts occur in the spinal canal, dermoids frequent site being the lumbosacral region.
- Chordoma contains PHYSALIPHAROUS CELL or vacoulated or swollen cell or bubbly cell.
- **Abundance of collagen is the one feature which distinguishes the neurofibroma from the Schwannoma.**
- Nerve sheath tumors are derived mainly from the schwann cell.
  - Acoustic schwannomma in NF-2 is Bilateral.
  - Tendency to **whorling of the cells, and addition to the formation of bundles.**
  - **The typical arrangement of compact bundle of Antoni A type cell is not found and nerve fibres are frequently encountered. Antoni B type cells are found in abundance thus leading to more vascularity in the schwannomas associated with NF-2.**

Pituitary Adenoma

- **Electron microscopic structure in case of GH secreting adenoma consists of fibrous body harbouring Growth hormone secreting cell.**

- **Prolactin secreting adenomas have rough endoplasmic reticulum present in concentric whorls and is termed as Nebenkerns.**
- One of the characteristic feature of Prolactin cell adenomas is the presence of abundant rough endoplasmic reticulum cisterns. The rough endoplasmic reticulum profile may form concentric whorls and were first described as **"NEBENKERNS" by Kovac and Horvath.**
- **Fibrous body is a typical feature of growth hormone producing cell.**
- **Oncocytic transformation applies to increased mitochondrial content in the cytoplasm and it is common in null cell adenomas.**

CEREBRAL EDEMA

- **The normal water content of grey matter is 80% of the wet weight 800mg/g, while that of white matter is hardly 68 percent of the wet weight (680mg/g).**
- **The subcortical arcuate fibres, where the water content approaches that of grey matter is an exception.**
- In cerebral oedema, it has been found that the water content of grey matter rises to 81-82% while that of white matter to 76-79%.
- Cerebral oedema is a usual feature in brain tumors such as **meningioma, glioma and metastasis.**
- **Diffuse bilateral swelling of the brain mostly occurring in children during head injury is not true brain oedema, but is caused by severe hyperaemia.**

Clinical Features of Intracranial Tumors

- Tumor arising in the medial temporal region, in the suprasellar region and in the posterior fossa near the fourth ventricle even a small lesion may lead to an early rise of ICP.
- The intracranial veins are one of the earliest structures to suffer the effects of increased ICP.
- A **spinal neurofibroma** which elevates the **protein level in the CSF may raise the ICP and cause papilloedema.**
- **The nerves most liable to be involved in rising intracranial pressure are the sixth nerve, because of their long intracranial course and their angulation over the petroclinoid ligament and passage through Dorello's canal.**

- Brain itself is insensitive to pain but the dura mater as well as the major blood vessels in the brain are pain sensitive structure.
- A characteristic feature of the headache due to raised ICP is its occurrence when the patient is sleeping.
- The throbbing headache often wakes the patient up in the early hours of the morning.
- **Such headaches coincide with REM sleep (dream sleep) during which normally the ICP shows a tendency to rise due to cerebral vaso dilatation.**
- Cough and syncope may occur in cases of herniated cerebellar tonsils.
- The earliest indication of the papilloedema is the enlargement of the blind spot.
- Another early sign of increasing intracranial pressure is the enlargement and congestion of the retinal veins.
- In optic neuritis or retrobulbar neuritis, the change in the optic discs are minimal compared to the degree of loss of vision.
- It is uncommon to have retrobulbar pain in papilloedema.
- **Hypermetropia, congenital anomaly of the disc or deposits of Drusen may simulate Papilloedema.**
- **Fluoroscein angiogram** demonstrating leakage of the contrast in true papilloedema is a differentiating feature in contrast to lack of leakage in **Pseudopapilloedema.**
- **Epilepsy is often seen in low grade gliomas and meningiomas.**
- Glioblastomas are least likely to be accompanied by convulsions of a long duration.
- **A greater loss of the intellectual function** occurs in **right handed individuals** with left frontal tumors, than in those with right frontal tumors.
- **In frontal lobe lesions, there is difficulty in moving the eyes to the side on command whereas follow - on movements are possible i.e. (Pursuit movement).**
- **When both the frontal lobes are affected, signs of dementia may be apparent.**
- **Appreciating differences in weight (abarognosia) is present in Parietal lobe lesion.**
- An early sign of a frontal lobe lesion is the fall of the out stretched arm known as Pronator drift.
- The outstretched hand shows a peculiar hyperextended position of the fingers (PSEUDOATHETOSIS).

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- In pure parietal lobe lesion, inattention is an early feature.
- Phantom limb phenomenon - The patient claims to have an extra limb or an extra half of the body.
- When the medial temporal lobe is affected, the commonest manifestation is complex partial seizures (temporal lobe epilepsy).
- The patient may have cephalic or visceral sensation as an aura. There may be psychosensory or psychomotor disorder like Deja Vu phenomenon and a dreamy like state.
- Hallucination of taste or smell are a common feature of limbic lobe epilepsy and are more often seen in pt with tumors as compared patient to the more **common medial sclerosis.**
- Posterior temporal lesions result in a superior quadrantanopia (Meyer'sloop).

  Note - Inferior quadrantic defect in parietal lesions.
- In more medial temporal lobe lesions, the optic tract could be affected leading to typical homonymous hemianopia.
- Temporal lobe tumors have greater tendency for uncal herniation than any other tumors.
- **In occipital lesions causing Homonynous hemianopia, the patient can detect moving objects but not stationary objects in the visual field it is called Ridloch Phenomenon.**
- Seizures are less common in occipital lobe lesions compared to the other lobes.
- Lesion near the falx - **When the pressure is chiefly on the supplementary motor area of the dominant hemisphere, the patient may have the rare clinical phenomenon of spastic dysphonia.**
- Pinealomas and Posterior third ventricle tumors may present with the classical sign of difficulty in conjugate upward deviation of the eyes with or without overt ocular nerve paralysis (Parinand's syndrome). **This is seen only in about 50% of the cases and is due to pressure on the superior colliculi by the tumor.**
- Pressure on the inferior colliculus may cause tinnitus.
- Cyst of the **third ventricle** have been reported to result in a to and fro movement of the head and trunk in children - 'HEAD BOBBING'.
- Pubertas praecox is a rare clinical entity seen in association with third ventricle tumor. It is due to interference with the hypothalamus.

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- Precocious puberty is due to destruction of the posterior hypothalamus, leading to uninhibited action of anterior hypothalamus on the pituitary and the gonads.
- Precocious puberty due to hypothalamic involvement is characterised by excessive development of both the penis and testes, adolescent body contours and adults level of 17 ketosteroids. Whereas in **adrenal precocity, the testis is immature the body contours are that of a child and the 17 ketosteroids are greatly in excess of the adult values.**
- Diencephalic syndrome in infants include
  1. Marasmus
  2. Euphoria
  3. Nystagmoid eye movement
- In lesion of the **Vermis** an early symptom is **truncal ataxia** and **difficulty in controlling the lower limb.** The first evidence of such a disability in a **child may be its tripping over steps which it could negotiate easily previously. Nystagmus is usually absent but when seen is rapid fine and symmetrical.**
- Large tumors of the vermis extend into the cerebellar lobes producing signs in the upper limb.
- Nystagmus, evidence of asynergia of eye muscles, is seen in cerebellar lesions only when the vestibulo-cerebellar connection begin to get affected.
- Nystagmus is not seen in laterally placed cerebellar hemisphere lesions.
- In unilateral cerebellar lesions, the nystagmus is slower and coarser when the eyes are directed towards the side of the lesion than towards the opposite side. Such nystagmus disappears in a few weeks.
- If persistent, it will indicate pressure on or invasion of the vestibular nuclei.
- **Unprovoked, uncontrolled laughter is a characteristic symptom of Prepontine tumors. [Chordomas, Chondromas, clivus meningiomas, nasopharyngeal growths, basilar aneurysm].**
- Beside unilateral or bilateral horizontal conjugate gaze palsy and INO another ocular phenomenon seen in brainstem lesion is **vertical** nystagmus as labyranthine disease cannot produce vertical nystagmus. This sign is always indicative of nervous system involvement especially of the caudal brainstem.

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False Localizing Signs Include

1. Ipsilateral hemiplegia
   i. Kernohans notch or phenomenon
   ii. Direct pressure acting on the opposite internal capsule due to the configuration of the falx cerebri
   iii. Longitudinal stretching of the opposite internal capsule
   iv. Dilatation of the opposite lateral ventricle especially when there is a block of the formen of Monro.
   v. Uncrossed pyramidal tract
2. Presence of frontal lobe signs in cerebellar tumors and cerebellar signs in frontal lobe tumors.
3. Cerebellar signs in a craniopharyngioma.
4. A highly vascular lesion of the temporal lobe may steal blood from the frontal region leading to the appearance of frontal lobe localising signs.

Visual Field Defects in Intracranial Tumors

- **The bipolar cell layer of the retina is the first order neuron of the visual sensory system.**
- The ganglion cell layer of the retina which continues as the nerve fibre layer is the beginning of the second order neuron.
- The second order neurons travel in the optic nerve, the optic chiasma and the optic tract to relay in the LGB (lateral geniculate body).
- The majority of the **axons serve** the central **25 degree** of the visual field and **constitute** as much as 92% of the total **nerve fibres and are** called central visual fibres.
- Axons that originate from the ganglion cells in the perifoveal area travel in a relatively straight line to the temporal portion of the optic nerve head and are called papillo-macular bundle.
- Fibres originating from the temporal retina arc around the papillo-macular bundle and enter the optic nerve head at the superior and inferior poles and are called superior and inferior arcuate fibres.
- Fibres from the nasal retina pass in a straight line to the nasal border of the optic nerve head and are called superior and inferior radiating fibres.
- Within the optic chiasma, the central and peripheral fibres originating temporal to the fovea pass to the optic tract of the same side, whereas the central and peripheral fibres originating nasal to the fovea cross to the opposite side and travel in the opposite optic tract.

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- **The fibres from the inferior nasal retinal quadrant cross at the anterior portion of the chiasma and loop for a short and variable distance into the optic tract of the opposite side. The loop is called [Von Wille Brandt's Knee].**
- If the parieto temporal branch of the middle cerebral artery is thrombosed, the ventral portion of the optic radiation is involved resulting in a homonymous upper quadrantic defect.
- In isolated homoymous hemianopia without any other positive neurological findings, it is not possible clinically to say whether the field defect is due to middle or posterior cerebral artery occlusion.
- The field in vascular occlusion are usually dense and absolute with steep margins.
- A static visual field defect with absolute field loss and a steep margin indicates a bad prognosis.
- A field defect with a sloping margin, varying in density and with preservation of macular field indicates a good prognosis.

Lesion at Various Sites and Defect

1. At the level of the optic nerve - unilateral blindness.
2. At the level of the anterior angle of the Chiasma - junctional scotoma.
3. At the middle of the optic chiasma - bitemporal hemianopia.
4. At the lateral aspect of the optic chiasma - bilaterlal nasal hemianopic defect.
5. In the posterior part of the optic chiasma when the pressure is from the inferior aspect - bitemporal scotoma.
6. At the level of the optic tract and geniculate body - incongruous incomplete homonymous hemianopia.
7. The optic radiation in the temporal lobe incongruous homonymous superior quadrantic defect.
8. The optic radiation in the parietal lobe - incongruous homonymous inferior quadrantic defect.
9. The optic radiation in the posterior portion - congruous homonymous hemianopia with macular sparing.
10. In the midportion of the calcarine cortex - contralateral loss of the temporal crescent.
11. At the tip of the occipital lobe - congruous homonynmous hemianopic scotoma.

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In the optic tract, the inferior peripheral axons are lateral, the superior peripheral **axons are medial** and the **macular fibres are central and superior.**

- The extent of the peripheral visual fields is approx. 100 degrees temporal, 60 degrees nasal, 60 degrees superior and 70 degrees inferior to the fixation point.
- **A central scotoma is a depressed area of the visual field around the central fixation point and is found in association with lesion of the macula and the optic nerve.**
- **A caecocentral scotoma** is an area of depressed vision that includes the blind spot and point of fixation, is present in toxic amblyopias and extensive retinal disease.
- **A paracentral scotoma is an area of depressed visual perception around the central fixation point. This is found in retinal diseases around the macula.**
- **Junctional scotoma** implies the presence of central scotoma in one eye with upper temporal quadrantanopia in the contralateral eye. The lesion involve the junction of optic nerve with the optic chiasma where contralateral upper temporal quadrantopia is due to involvement of Von Will Brandt Knee.
- The blind spot is a physiological scotoma representing the optic nerve head which lack neurosensory elements.
- Blind spot enlargement present in-
  Papilloedema
  Juxta papillary choroiditis
  Glaucoma
  Drusen of the optic nerve head
- The normal area of macular vision is from 2-10 degrees around the fixation point.
- Macular sparing occur in lesion of the optic radiation and the occipital cortex.
- **Macular splitting is more likely to occur in association with homonymous hemianopia produced by lesions in the anterior portion of the post chiasmal pathway.**
- Bitemporal hemianopia is characteristic of a chiasmal lesion.
- Hemianopic scotomas with a superotemporal peripheral defect are commonly seen in pituitary tumors.
- Binasal hemianopia occur only at the level of the optic chiasma.

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- Binasal Hemianopia occurs in-
  - Opto chiasmal arachnoiditis
  - Intraventricular tumors
  - Aneurysm of one internal carotid artery
  - Meningoma arising from the lesser wing of the sphenoid.
- Optic nerve differs from other peripheral nerves by the absence of the sheath of Schwann.
- Optic nerve is consituted by axons of about one million neurons.
- Total length of the optic nerve is 50mm.
- Intraocular portion is 1mm in length and 1.5mm diameter.
- Intraorbital portion is 20-30mm long and is the longest part.
- Intracanalicular - portion is 6mm long.
- Intracranial portion is 10mm long.
- **When the papilloedema is prolonged optic atrophy sets in and because of the marked glosis of the optic nerve head, the size of the enlarged blind spot is reduced.**
- **Glioma of the optic nerve causes a central scotoma.**
- **Foster kennedy syndrome due to olfactory groove meningioma, or a basi frontal lobe lesion comprises of**
  1. Ipsilateral anosmia
  2. Ipsilateral central scotoma
  3. Ipsilateral optic atropy
  4. contralateral Papilloedema
- Optic chiasma measures
  1. 13mm transversely
  2. 8mm anteroposteriorly and is 4mm in thickness

  The space between the optic chiasma and the diaphragm sellae is about (5-10mm).
- **THE RATIO OF CROSSED AND UNCROSSED FIBRES IS ABOUT 53:47**
- Infrachiasmatic or Intrasellar lesion like pitutiary tumor has progression of the scomatous defect which is typically clockwise in the right eye and anticlockwise in the left eye.
- **Colour fields especially for red are important for early diagnosis of chiasmal lesions. In an early case of pituitary tumor, the peripheral fields may be normal for white objects but the colour fields may reveal a bitemporal defect.**
- **The typical visual defect in the aneurysm of the anterior cerebral and anterior communicating arteries is unilateral blindness and inferior temporal defect in the contralateral eye.**

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- **It is worth remembering that aneurysms** of the circle of willis can produce visual field defects indistinguishable from those **secondary to a pituitary tumor.**
- **Each optic tract contains visual pupillomotor fibres both crossed and uncrossed.**
- The blood supply to the optic tract is from two sources, the anterior one-third is supplied by branches from the internal carotid, the middle cerebral and the posterior communicating arteries whereas the posterior 2/3 is supplied by the anterior choroidal artery.
- The presence of fundus changes (optic atrophy) helps to distinguish field defects in an optic tract lesion from field defect of in lesions of the optic radiation.
- **Lateral geniculate body**

Medial aspect	Lateral aspect
supplied by	supplied by
Posterior cerebral	Anterior choroidal
artery	artery
Its lesion causes	Its lesion causes
Lower Contralateral	Contralateral
homonymous, Quadrantopia	upper homonymous
	Quadrantanopia

- If both the geniculate bodies are involved in lesions affecting their medial aspects, there will be **defect of the lower visual fields with sparing of the macula, as the upper retinal fibres are involved.**
- **The Meyer's loop** (or temporal knee) **lies six cm behind the temporal pole.**
- **The anterior part of the optic radiation is supplied by the anterior choroidal, posterior choroidal and the middle cerebral arteries.**
- **The middle paraventricular part of the radiation is supplied by deep optic branch of the middle cerebral artery.**
- The posterior part is supplied by branches from the posterior cerebral directly and through its calcarine artery.
- A posterior temporal lobe lesion causes homonymous superior quadrantopia showing considerable incongruity. In the development of this quadrantic defect, the loss for colours precedes that for white objects.
- A lesion in the lower part of the temporal lobe produces an upper quadrantic field defect.

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- A lesion in the upper part of the temporal lobe results in a complete hemianopia which is quite indistinguishable from that observed in a lesion of the occipital lobe.
- **As the upper portion of the optic radiation is situated in the posterior inferior parietal lobule, the characteristic field defect in a parietal lobe tumor would be contralateral inferior homonymous quadrantanopia.**
- With **parieto-occipital involvement,** there is more congruity of the defect than with **temporoparietal involvement.**
- Another intresting feature in a parietal lobe lesion is the extinction phenomenon.
- The characteristic visual field defect in lesions of the striate cortex is congruous homonymous hemianopia with macular sparing.
- The macular area escape because of dual blood supply from the middle cerebral artery.
- At the **internal capsule level,** an occlusion of the branches of the middle **cerebral artery can account for hemianopia of a congruous type, hemiplegia and hemianaesthesia. loss of temporal crescent** with otherwise normal visual fields.

Supratentorial Astrocytoma

- **The incidence of gliomas after the age of 50 declines, whereas that of secondaries and meningioma show a corresponding increase.**
- **All types of attacks with the exception of classical petit mal seizures have been reported in supratentorial glioma.**
- Radiosensitizers are Bromodeoxyuridine
  - (BUDR) and Iodeoxyuridine (IUDR)
  - BUDR is a DNA sensitizer.
  - Metronidazole and Misomidazole are hypoxic cell sensitizers.
  - **BCNU at present is the standard single agent for the treatment of malignant glioma.**
- **Human recombinant interleukin 2 is used to enhance the preferential entry of chemotheraputic agent into the tumor.**
- **Gamma -IL2 known to breakdown the BBB (blood brain barrier).**

Cerebellar Astrocytoma

- The cerebellar astrocytoma offers the best prognosis for normal survival of any brain tumor in any age group.

- Rosenthal fibres which are stout, opaque carrot-shaped, brightly eosinophilic masses, are seen in the cytoplasm of the piloid cells, characteristic of [Pilocytic astrocytoma].
- Treatment of choice is excision only.

Oligodendroglioma

- Supratentorial more commonly affecting frontal lobes.
- Epilepsy constitutes the most common initial symptoms.
- **Highest incidence of epilepsy in patient with supratentorial glioma was observed in cases of oligodendroglioma.**
- Dictum for treatment
  - Chemotherapy for all
  - Surgery for few
  - Radiotherepy for anaplastic transformation
- Chemotherapy - PCV
  - P - Procarbazine
  - C - Cyclophosphamide
  - V - Vincristine

Medulloblastoma

- The median does is 5000 rads to posterior fossa divided into 28 fraction given over a period of 40 days.
- Whole brain - the median dose is 3500 rads divided on an average into 20 fractions given over a period of 28 days.

Ependymomas

Have Bimodal peak that is 5 yr and 34 yr.

- Pattern of Occurrence - 4th ventricle > lateral ventricele > 3rd ventricle
- Subarachnoid metastases is more common in Medulloblastoma tha in Ependymomas
- Consensus today is against the routine use of spinal cord irradiation in intracranial ependymomas.
- **Subependymomas**

  A characteristic feature of this neoplasm is the Proliferation of fibrillary **subependymal astrocytes.**
- Frequency of occurrence in descending order IVth ventricle > Septum pellucidum > third ventricle

- Calcification is present.
- Subependymal giant cell astrocytoma is relatively benign tumor and is associated with tuberous sclerosis or may occur independently in region of foramen of monro.
- They are well circumscribed and truly subependymal in location but do fungate into the ventricle

CENTRAL NEUROCYTOMA

Characterised by

1. a lateral ventricular location
2. occurrence in young adults
3. characteristic radiological findings
4. a favourable prognosis
5. Homogenous vascular staining on angiography is another characteristic of this tumor

- Central neurocytoma is isointense with the cerebral cortex on T1, T2 weighted and proton density images. It has got highest oxidative metabolic rate as compared to the other tumor.
- **Colloid cyst is commonest between 20-40 years of age. The incidence is equal in both sexes.**
- Colloid cysts are **endodermal** in origin.
- A 'drop attack' due to sudden weakness of the lower limbs accompanied with features of raised ICP may be the presenting feature.
- **The Trigonal region is the commonest site for lateral ventricular tumor.**
  The choroid plexus, the septal vein and the thalamostriate vein lead to the Foramen Monro. The close relationship of the genu of the internal capsule to the Foramen of Monro must be kept in mind.
  Endodermal sinus tumor is characterized by presence of Schiller Duval bodies with secretion of alpha fetoprotein. Choriocarcinomas secretes beta HCG
- Pinealtumor calcification in a female patient is suggestive of a pineal parenchymal tumor
- **Tumor calcification was seen more often in pineal parenchymal tumor and was an important feature distinguishing them from germinomas.**
- CT scan features in Pineal region tumor

Tumors	*Without Contrast*	*With Contrast*	*Calcification*
Germinoma	Hyperdense	Uniform enhancement	Absent
Pinealocytoma	Isodense	Uniform enhancement	+
Glioma	Hypodense	Variegated enhancement	+/-
Meningioma	Hyperdense	Uniform enhancement	+/-

- Chemotherapy is playing an increasingly important role in the treatment of Pineal tumors especially of germinomas and non-germinomatous germ cell tumors.
- The latter which have a very bad prognosis with conventional therapy appear to be the group in which chemotherapy will be the most beneficial.
- The drug regimen includes Cisplatin, Vinblastine and bleomycin. Cisplastin seems to be the most effective agents.
- As **Germinomas** are highly radiosensitive, chemotherapy has a role only in recurrent and systemic disease.

Pituitary Tumors

- **The inferior hypophyseal artery is the most important artery supplying the pituitary gland, its diameters being larger than any other arterial structure coursing through the region.**
- The significance of the portal system is in that it carries the hypothalamic regulating hormones to the anterior lobe, thus controlling the secretion of the anterior pituitary hormones.
- Mean sellar volume is 594 cubic mm.
- The proximity of the carotid arteries to the midline is extremely important in pituitary surgery. The arteries bulge into the superolateral wall of the sphenoid sinues in 71%. They are usually covered by bones but in 4% there may be no bone between the carotid arteries and the mucosa of the sinus.
- The **average distance** between the **intercavernous portions of the two carotid arteries is [12-14 mm].**
- **Sparsely granulated PRL cell adenoma is the commonest pituitary tumor.**

- **Misplaced exocytosis is characteristic of prolactin cell adenoma.**
- Fibrous bodies are the most conspicuous morphologic marker of the **sparsely granulated GH adenomas.**
- Most tumors found in cushing disease are microadenomas, whereas those in Nelson's syndrome (after bilateral adrenalectomy) are macroadenomas which are aggresive and invasive.
- Commonest type of mixed adenoma is GH-PRL cell adenoma.
- Common combination is **densely granulated GH cells with sparsely granulated PRL cells.**
- Prolactinomas in women lead to galactorrea amenorrhea syndrome.
- Surgery for prolactinomas when indicated is best performed within twelve months of starting dopamine agonist therapy, i.e. Bromocriptine.
- **Present indication for surgery either trans sphenoidal or trans cranial are limited to**
  1. Patient in whom the tumors are unresponsive to dopamine against treatment, **especially cystic prolactinomas.**
  2. Unable to tolerate dopamine agonist medication.
  3. Patients in whom there is rapid progression of visual loss.
  4. Patients in whom the tumor grows while on dopamine agonist therapy.
  5. Pituitary apoplexy.
- Hypocortisolism is known as Addison's disease and concern the neurosurgeon when it occur as the result of treatment of a pituitary tumor.
- Hypercortisolism, when it is chronic produces Cushing's syndrome. The commonest cause is iatrogenic.
- Endogenous Cushing's syndrome may be ACTH dependent (85%) when it is called Cushing's disease or may be ACTH independent (15%).
- The majority of patients with endogenous hypercortisolism have a pituitary tumor (70-80%).
- Nelson's syndrome is due to increased ACTH secretion by a Pituitary adenoma following bilateral adrenalectomy. There is no hypercortisolism and the presentation is of cutaneous hyperpigmentation.
- Very high levels of plasma ACTH (>1000pgm/ml) imply ectopic ACTH secretion or Nelson's syndrome.

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- Lancotide is a recently evolved long acting somatostatin analog that has been used in TSH secreting adenomas.
- In prolactinomas; medical treatment is the first choice.
- The recognition of the sphenoid sinus is important during transsphenoidal surgery and the landmarks are the **"keel of a boat"** appearance and **the two ostia on either side of the midline.**
- Craniopharyngioma have bimodal age distribution—First peak at 5-10 year and the other at 55-60 years. histologically of two types, Papillary and Admantinomous types.
- An aetiological profile of optic atrophy in India in 1992, has shown craniopharyngioma to be the most frequent tumor responsible for bilateral optic atrophy before the age of 20 years.
- The commoner classic form is adamantinomatous type, usually seen in children. They are always cystic with small solid component which frequently calcifies in (80%) of cases. Papillary variety of craniopharyngioma seen in adults are solid often located within the third ventricle and do not calcify. They are encapsulated and easily removable and hence have a lesser tendency to recur than adamantinomatous variety
- Dermoid of the scalp may cause erosion of the bone, often the outer table of the skill. The margins of the erosions are typically sclerotic

Acoustic Schwannmona

- Acoustic schwannomas are commonest in the fourth to 6th decades. There is a slight female prepronderance in most series.
- Aggravation of symptoms occur during pregnancy.
- The internal auditory canal has a length of 6-7mm and a height of 3-7mm.
- The length of the vestibulocochlear nerve with central myelin, myelinated by oligodendroglia is 8-12mm, the transition zone normally lying near the internal auditory meatus.
- The origin of the tumor is from the Junctional (Obersteiner - Redlich) zone where the central and peripheral myelin meet.
- The hearing loss is a high frequency retrocochlear sensorineural type and is slowly progressive.
- The classic presentation of an acoustic neuroma, therefore is a
  - High frequency sensorineural hearing loss.
  - Moderate to severe speech discrimination scores.

- Positive tone decay test
- Negative Short Increment Sensitivity Index and Alternate Binaural Loudness Balance test (ABLB)
- An absent or delayed acoustic reflex
- An acoustic reflex decay of >50dB
- Prolonged waves 1 to V in the BAER

- The acoustic or stapedial reflex is a sensitive indicator of retrocochlear pathology.

Phakomatoses

- Lisch nodules are pigmented hamartomas of the iris. Present in up to 94% of NF-1 patients. They are usually seen only after **puberty.**
- Cutaneous neurofibromas are characteristic on [NF-I]
- **Vogts triad** in Tuberous sclerosis include
  - Seizures, mental deficit and adenoma sebaceum

Skin Manifestation of Tuberous sclerosis include

1. Ash leaf spots seen in wood's lamp. It is a depigmented macule.
2. Adenoma sebaceum is an Angiofibroma. It has rapid growth around puberty.
3. **Shagreen or shark skin patches are dermal fibromas which usually develop after 10 years of age and are present in lumbosacral region.**
4. **Khoenen's tumor or ungual fibromas -** are angiofibromas which are common in toes than in the fingers.

- Subependymal periventricular calcification is the most frequent and characterstic finding on CT scan in the tuberous sclerosis.
- **Fabry's disease —** accumulation of ceramide trihexoside in media and endothelium of small blood vessels due to deficiency of alpha galactosidase. It is an X Iinked recessive disorder characterised by telangiectasias of the lower half of the body

Intracranial Meningioma

- Multiple meningioma associated with NF2
- Meningioma in childhood are more commonly malignant and often of the hemangiopericytic and papillary type
- No sex preference
- A particularly high incidence of intraventricular tumors
- Significant association with Neurofibramatosis.

- Radiation induced meningiomas are at least 5 times more numerous than gliomas or sarcomas.
- Etiology
  1. Head injury
  2 Chronic irritation
  3. Ionizing radiation
  4. Carcinogenic substance (thorium dioxide)
  5. Genetic factor
  6. Chromosomal abnormalities
  7. Hormonal factor
- Binding assay techniques in meningiomas suggest
  1. High levels of progesterone receptors
  2. Moderate concentration of androgen receptor
  3. An equivocal report about the states of oestrogen receptor
- En-plaque meningioma often arise from the outer aspect of the sphenoid wing.
- Most common sites are the parasagittal, falx, convexity and sphenoid ridge.
- Vimentin and epithelial membrane antigen are expressed by the majority of menigiomas.
- Glial tumors are the most common primary neoplasms associated with intracranial meningiomas.

  [When both the tumors develop in close juxtaposition as has been reported in one-third of cases, these tumors are labelled as **"Collision tumors".**
- Meningiomas arising originally in connection with the dura and arachnoid derive blood supply from the **external carotid system.**
- As tumor grow larger, pial vessel feed the tumor.
- Depending on the anatomical site, the main source of blood supply varies.
- Meningiomas have been found to produce prostaglandin E2 and thromboxane B2 of which are derived from arachidonic acid, produce brain oedema.
- High (Alanine/creatinine) ratio in Meningioma helps to differentiate them from Astrocytomas on MRS.
- **The completeness of surgical removal is the single most important prognostic factor in Meningioma.**
- Simpson was the first to demonstrate that the most important factor in the occurrence of meningiomas was the extent of removal.

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- Recurrence is more common at locations like the posterior fossa, medial sphenoid wing, parasagittal and tuberculum sellae.
- A higher AgNOR count is suggestive of aggressive behaviour in meningiomas and is associated with an increased risk of recurrence.

Hemangioblastoma

- Hemangioblastoma occur most commonly in the cerebellar hemisphere. On MRI there is Salt and Pepper appearance.

  Salt and Pepper appearance is also present in Cerebral contusions and Glomus jugulare tumors.

  In hemangioblastoma there is erythrocythemia which occur in 9-49 percent of patients.
- The erythrocytosis is due to secretion of erythropoietin by the tumor.
- During follow up Hb, RBC count and PCV are important.

Metastatic Deposits

- Metastasis

  Bronchial adenocarcinoma (19-23%)
  Squamous cell ca of lung (11%) > ca breast (5-19%) > Melanoma (12%) > (Renal, colon, thyroid, parotid, pancreas, testes, bladderea.
- Frontal lobe is a common site for secondary deposit (33%).
- Neuropsychological disturbances common.

  Seizures occur less commonly in brain metastases as compared to primary tumor of brain.
- Solitary Metastasis -
  - Lung
  - Breast
  - Melanoma
  - Kidney (Most favourable)
- Meningeal carcinomatosis

  Breast, Lung, Ca stomach

  Epstein Barr test in CSF is diagnostic of lymphoma.
- Striking difference between primary and secondary lymphoma is that dura is the site of involvement in the secondary CNS lymphoma.
- Lymphoma may show disappearance on the CT scan after steriod administration **(Ghost tumor).**

- Melanotic pigmentation may be seen in
  1. Auditory Neurofibromas
  2. Meningiomas
  3. Medulloblastomas
  4. Ependymomas
  5. Choroid plexus tumors

Radiosurgery

- Father of Radiosurgery - Lars Leksell
- The first Gamma knife was installed in Karolinska Institute, stockholm in 1968.
- The Leksell gamma knife delivers a single high dose of ionising radiation emanating from [201] collimators of cobalt 60.
- The collimator size for the gamma knife is restricted to 4, 8, 14, 18mm whereas collimators for LINAC radiosurgery are available upto 50mm.
- AVM constitute the single largest indicator (50%) for radiosurgical procedure.
- Radiosurgery is the treatment of choice for all AVM upto 3cm in diamater.
- Gamma knife is the only neurosurgical tool which has been used for functional neurosurgery.
- Earliest sign in Parkinson's disease is the disappearance of the associated movement.
- Stereotactic surgery for Parkinsonism abolishes tremors and reduces rigidity. There is no effect on bradykinesia.
- L-dopa, Improve Bradykinesia in 60%, Rigidity, in 30%, Tremor in 10%. Tremor are least improved.
- Introduction of the neurotoxin **Ibotenic acid,** into the **Subthalamic nucleus** reduces **tremor, rigidity and bradykinesia** in the **MPTP - lesioned monkey.**
- Ibotenic acid does not affect fibres of passage but only cell bodies.
- Neural transplantation in patient with Parkinson's disease was first suggested by Bjorklund et al and Perlow et al.
- There has not been a full reversal of the parkinsonian syndrome in any case.
- A prolonged effect of L-dopa therapy has been observed.
- The most consistent improvement has been in rigidity and bradykinesia. There is little improvement in tremors.

- Foetal substantia nigra transplantation in the striatum have a proven potential to relieve at least partly, the manifestation of Parkinson's disease.
- Best site for the lesion in the thalamus is the POSTERIOR part of the ventrolateral nucleus.
- Lesioning or stimulation techniques have therefore gained popularity with renewed interest in the Posteroventral pallidium as the target.

STEREOTACTIC SURGERY FOR CEREBRAL PALSY

- For rigidity, the best results are obtained with VL and sub VL lesions.
- Rigidospastic cases need thalamotomy or dentatectomy depending on whether rigidity or spasticity predominates.
- Spasticity is relived by denta tectomy.
- Sensory - induced involuantry movements need Centro Median thalamotomy for their relief.
- Normotonic involuntary movements are relived by VIM lesions.
- Infantile hemiplegics with spasticity and athetosis do very well with a combination of ipsilateral dentatectony and contralateral VIM thalamotomy.