

PeriAnesthesia Complications

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Objectives

- **Identify perianesthesia complications**
- **Identify pathophysiological changes of common postoperative problems**
- **State nursing interventions and treatment for each problem**

Respiratory

- Maintain pH of blood
- Rids blood of CO₂
- Supplies Blood with Oxygen

Airway Obstruction

- Loss of Pharyngeal muscle tone
 - Soft tissue obstruction
 - Tongue displacement
- Residual neuromuscular blockade
- Laryngospasm
- Airway edema
- Sleep Apnea

AIRWAY OBSTRUCTION

- **Snoring - Flaring of nostrils - Retraction**
- **Asynchronous movement of chest and abdomen**
- **Increased accessory muscle usage**
- **Increased pulse**
- **Decreased Oxygen saturation**
- **Decreased Breath Sounds**

ASPIRATION

- **Factors related to aspiration pneumonitis**
 - **Increased gastric residual volume**
 - **Decreased gastric pH**
 - **Presence of particulate matter in stomach**
 - **Difficulty in protecting airway**

HIGHER RISK POPULATIONS

- **Morbid obese**
- **Diabetics**
- **Surgical factors**
 - **1. Upper abdomen surgery**
 - **2. Straining on ETT**
- **OB patients**
- **Emergency patients: MVA**

TYPES OF ASPIRATION

- Large particle- immediate intervention required
- Clear acidic fluid -pH of aspirated material determines extent of pulmonary injury
- Clear nonacidic fluid- depends on volume and composition
- Food stuff or small particle -within 6 hours may see severe hemorrhagic pneumonia
- Contaminated material -bowel, dental

ASPIRATION

SIGNS & SYMPTOMS

- **Tachypnea**
- **Tachycardia**
- **Hypoxia**
- **Chest infiltrate**
- **Wheezing**
- **Coughing - dyspnea**
- **Apnea**
- **Hypotension**
- **Bradycardia**

INTERVENTIONS

- **Position on side with head turned**
- **Bronch if large particles**
- **Oxygen**
- **Ventilate if needed**
- **Inotropic medications**
- **Antiemetics**

INTERVENTIONS for Airway Obstruction

- **Chin support/Jaw thrust/head tilt**
- **Remove, reposition airways (oropharyngeal, nasal trumpets)**
- **Positive Pressure with mask/ambu**
- **Dentures**
- **HOB Elevated unless contraindicated**
- **Cricothyrotomy**

LARYNGOSPASM

- **Anesthetic agents**
- **Asthma history**
- **Irritable airway**
- **Smoking**
- **COPD**
- **Endotracheal tube usage-irritation**
- **Vocal cord irritation**
 - **Secretions**
 - **Blood**
 - **Vomitus**

SIGNS & SYMPTOMS

- **Dyspnea, Decreased SpO₂**
- **Hypoxia**
- **Hypoventilation**
- **Crowing Sounds, inspiratory stridor, retractions**
- **Hypercarbia**
- **Agitation**
- **Paradoxical rocking motion**
- **Accessory muscle use**

INTERVENTIONS for Laryngospasm

- **Hyperextend head**
- **Elevate Head of Bed**
- **Intubation**
- **Positive pressure ventilation (BVM)**
- **Sedation**
- **Medications**
 - **Oxygen**
 - **Racemic Epinephrine**
 - **Dexamethasone**
 - **Lidocaine**
 - **Atropine**
 - **Muscle Relaxants**

BRONCHOSPASM

Associated with:

- Asthma**
- COPD**
- Smoking**
- **Light anesthesia**
- **Residual effect of muscle relaxants**
- **Irritable tracheobronchial tree**
- **Mechanical factors**

Signs & Symptoms

- **Wheezing**
- **Shallow noisy respiration**
- **Chest retractions**
- **Dyspnea**
- **Tachypnea**
- **Decreased P02**
- **Use of accessory muscles**

Interventions for Bronchospasm

- Remove irritant
- Increase Oxygen
- Administer muscle relaxants
- Deepen anesthesia
- Administer medications
 - Nebulizer with Bronchodilators (Terbutaline or Albuterol)
 - IV Theophylline
 - Steroids (Solu-Medrol or Prednisone)

Hypoxemia

- Atelectasis (Alveolar collapse)
 - Reduced basal air entry
 - Reduced lung volumes on chest x-ray
 - May start immediately but becomes more severe during the 2nd postop day to 4-5th night
 - Due to residual anesthetic effect, upper airway obstruction from airway tissue edema
 - Accumulation of pharyngeal secretions, prolapse of the tongue posteriorly, tongue edema or an allergic reaction
- Treatment:
 - Pre and Postop physiotherapy
 - Humidified oxygen
 - Stir up regimen – deep breathe, cough, early mobilization
 - Analgesia to allow for deep respirations
 - Continuous positive airway pressure

Hypoventilation

- Drug induced CNS depression
- Residual effects of NMB
- Suboptimal ventilatory muscle mechanics
- Increased production of Carbon dioxide
- Coexisting COPD
- Desaturation most frequent event
- Greater than 60 years of age
- Obese patients
- Longer operations
- High dose opioid use

Hoarseness and Sore Throat

- Usually does not cause airway problems unless patient was intubated
- Spontaneous resolution occurs within 2 weeks
- Prevention and Treatment:
 - Aerolized beclomethasone prior to intubation
 - Use of experienced intubator
 - Use of bland lubricant
 - Throat lozenge
 - Warm fluids

Pulmonary Edema

Cardiogenic

- Intravascular volume overload
- Cardiac dysfunction

NonCardiogenic

- Pulmonary Aspiration
- Sepsis
- Airway obstruction
- Transfusion of blood products (TRALI –transfusion related acute lung injury)

PULMONARY EDEMA

SIGNS & SYMPTOMS

- Tachypnea with respiratory distress
- Shortness of Breath
- Adventitious Breath Sounds
- Pink frothy sputum
- Pulmonary infiltrates

INTERVENTIONS

- Oxygen
- Pulmonary toilet
- Maintain unobstructed airway
- Diuretics
- Fluid restriction
- Morphine Sulfate

Pneumothorax

- Types:
 - Penetrating
 - Tension
- Causes
 - External procedures –Central line placement, biopsies
 - Internal procedures – tracheal/bronchial tree injury
 - Fractured ribs, crush injury, CPR
 - Blunt trauma –deceleration injury
 - Airway overpressure

Pneumothorax

- Signs

- Respiratory distress
- Difficulty ventilating
- Desaturation
- Hypotension
- Heart rate changes
- Unilateral chest expansion
- Abdominal distention
- Distended neck veins - ↑ CVP
- Tracheal deviation in tension pneumo

Pneumothorax

- Interventions:
 - Chest x-ray
 - Smaller pneumothorax – tincture of time
 - Medium to large chest tube
 - Emergent needle decompression into affected side
 - Use 10-20 ml syringe with 23 g needle
 - Allow 3 rib mid-clavicular line or above 4th mid-rib axillary line

Allergic Reactions Signs & Symptoms

- **Conjunctivitis**
- **Urticaria**
- **Angioedema**
- **Gastrointestinal disturbances**
- **Laryngeal edema**
- **Bronchospasm**
- **Hypotension**
- **Dysrhythmias**
- **Cardiac arrest**
- **Coma**

TREATMENT

- **Adrenergic agonists (Epinephrine)**
- **Methylxanthines (Aminophyllin)**
- **Anticholinergics (Atropine, Glycopyrrolate, Scopolamine)**
- **Antihistamines (Benadryl)**
- **Corticosteroids**

Cardiovascular

- Transports nutrients to body cells
- Transports waste from cell
- Dysrhythmias
- Hypotension
- Hypertension
- Acute Myocardial Infarction

DYSRHYTHMIA CAUSES

- ***Electrolyte Imbalance - Hypokalemia & hypocalcemia***
- ***Hypoventilation***
- ***Pain***
- ***Hypertension***
- ***Hypothermia***
- ***Preop cardiac dysrhythmias***
- ***Hypovolemia***
- ***Myocardial ischemia***
- ***Anticholinesterase meds***
- ***Respiratory Acidosis***
- ***Hypoxemia***
- ***Fluid overload***

DYSRHYTHMIAS REQUIRING TREATMENT

- ***Atrial Flutter***
- ***Atrial Fibrillation***
- ***Paroxysmal Atrial Tachycardia***
- ***Nodal Tachycardia***
- ***Second & third degree heart blocks***
- ***Premature Ventricular Contractions***
- ***Bradycardia if symptomatic***

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DYSRHYTHMIAS REQUIRING TREATMENT

- ***Ventricular Tachycardia***
- ***Ventricular Fibrillation***
- ***Asystole***
- ***PEA (Pulseless Electrical Activity)***

DYSRHYTHMIA TREATMENT

- ***Oxygen 1st line drug***
- ***EKG***
- ***Correct underlying cause***
- ***Assure patency of airway***
- ***Chest pain is always cardiac in origin until proven otherwise***
- ***Bradydysrhythmias***
 - Conduction system***
 - Disruption Heart surgery***
 - ***MI***
 - ***Treat with Dopamine epi***
- ***Tachydysrhythmias***
 - ***Pain***
 - ***Anxiety***
 - ***hypovolemia***
 - ***hyperthermia***
 - ***Treat with Beta blockers***

HYPOTENSION CAUSES

- **Hypoxia**
- **Hypovolemia**
- **Decreased Myocardial Contractility**
- **Sepsis**
- **Pulmonary embolus**
- **Pneumothorax**
- **VasoVagal**
- **Cardiac Tamponade**
- **Anesthetics**
 - **Muscle Relaxants**
 - **Narcotics**
 - **Regional Anesthesia**
- **Artifact with equipment**

Hypotension Signs

- ↓ BP, ↑ HR, Dysrhythmias
 - HR may not decrease if cardioaccelerator fibers are blocked (epidural)
- Pallor, cool, moist skin, peripheral vasoconstriction
- Decreased mentation, nausea
- Decreased UO, concentrated urine

Hypotension

- Characterized as
 - Hypovolemic – Decreased Preload
 - Decreased intravascular fluid volume/replacement
 - Third Spacing
 - Loss of sympathetic nervous system tone (Epi or spinal)
 - Bleeding
 - Cardiogenic – Intrinsic Pump failure
 - Myocardial Ischemia
 - Myocardial Infarction
 - Cardiomyopathy
 - Dysrhythmias

Hypotension

Distributive – Decreased Afterload

Iatrogenic sympathectomy from regional anesthesia

Critically ill patients: Rely on exaggerated sympathetic nervous system tone. Minimal anesthetics can decrease sympathetic nervous tone

Allergic Reactions

Consider in all cases of sudden refractory extreme hypotension. Rx with Epi

Sepsis: (Fever and rigor)

Blood cultures then antibiotics

New Onset Hypotension in PACU

- Sign of:
 - Drug overdose
 - Drug interactions
 - Hypovolemia

HYPOTENSION TREATMENT

- **Confirm accuracy of equipment**
- **Fluid Replacement**
- **Treat Dysrhythmias**
- **Reverse anesthetics**
- **Afterload Reduction**
 - **Elevate Legs**
 - **Ephedrine**
- **Oxygen**
- **Inotropic Agents**
 - **Calcium**
 - **Dopamine**
 - **Epi**
 - **Dobutamine**
- **Cardioversion for tachdysrhythmias**

HYPERTENSION

- **Major Organs at Risk**
 - **Heart - Myocardial Hypertrophy**
 - **Kidney - Decreased perfusion, Renal Failure**
 - **Brain - Loss of autoregulation**

HYPERTENSION CAUSES

- **Emergence**
- **Pre-Existing**
- **Pain**
- **Hypervolemia**
- **Respiratory Insufficiency**
- **Hypothermia**
- **Increased Intracranial Pressure**
- **Full Bladder**
- **Stress**
- **Drugs**
- **Urinary distention**
- **Abrupt Withdrawal of Clonidine**
- **Tricyclic Antidepressants**

TREATMENT for Hypertension

- **Correct underlying etiology**
- **Diuretics**
- **Vasodilators**
 - **Hydralazine**
 - **Nitroglycerin**
 - **Nitroprusside**
- **Beta Blockers**
 - **Propranolol**
 - **Labetolol**
 - **Esmolol**
- **Calcium Channel Blocker**
 - **Nifedipine**
- **Environmental interventions - music, warmth**

ACUTE MYOCARDIAL INFARCTION

- **Patients at risk**
 - **Pre-existing coronary artery disease**
 - **Diabetics**
 - **Obesity**
 - **Debilitated state**

Risk Factors for CAD

- Non Modifiable

- Sex
- Age
- Ethnicity
- Genetics

- Modifiable

- Diabetic
- Hypertension
- Smoking
- Hyperlipidemia
- Obesity
- Sedentary Lifestyle
- Stress

His “n” Hers Signs & Symptoms

- **Pain: Substernal characterized by heavy, crushing or squeezing commonly occurring with exertion or emotion.**

Rest or NTG may relieve pain

- **Pain: heaviness, squeezing, pain in left chest, neck, abdomen, midback or shoulder or arm pain without pain in the mid chest**

Pain is accompanied by N&V, indigestion, dyspnea, fatigue, diaphoresis, dizziness, fainting, upper abdominal pain

May not respond to NTG or rest but Antacids may relieve pain

His “n” Hers Signs & Symptoms

- EKG: Concurrent ST segment elevation is common
 - Exercise Stress test is “gold standard” in detecting MI Stress echocardiogram useful to test valves or ventricular function
 - Cardiac Catheterization is a reliable diagnostic tool
- EKG: Concurrent ST elevation is less likely during MI
 - Echocardiogram is more reliable than the exercise stress test
 - Cardiac catheterization is reliable but more risky in the woman.

His “n” Hers Signs & Symptoms

- Man's larger vessels allow better visualization & fewer complications during percutaneous coronary intervention or CABG
- Bleeding at the surgical site or hemorrhagic stroke is more likely with invasive procedures because of woman's smaller vessels

Deep Vein Thrombosis (DVT)

CAUSES

- Vein wall injury – OR straps, leg holders, knee rolls
- Hypercoagulation – malignancy, pregnancy, dehydration, hypothermia
- Hemodynamic changes – stasis & turbulence from surgical positioning, immobilization, hypothermia, casts

SIGNS

- Pain at or below level of clot
- Homan's sign – 50% reliable
- Swollen leg with pitting edema distal to clot
- Slight fever, chills, perspiration
- CAN cause Pulmonary embolus and death

DVT

Prevention

- Sequential compression devices
- Hydration
- Avoid pressure on veins
- Anticoagulation Rx
 - Low dose heparin
 - Low molecular weight heparin
 - Warfarin (Coumadin)
- Early

Treatments

- Bedrest/leg elevation when swollen/painful
- Adequate hydration
- Clinical practice varies with MD
- Heparin/Coumadin (INR goal of 2.5)
- Fibrinolytics
- Monitor labs: D-dimer, PT, PTT
- Vena cava filter

TRALI (Transfusion Related Acute Lung Injury)

- Patients received blood, coagulation factor or platelet intraoperatively
- Manifested within 1-2 hours after transfusion
- Can occur up to 6 hours after transfusion so may develop during PACU stay
- Noncardiogenic Pulmonary Edema associated with fever, systemic hypotension
- Underdiagnosed
- Elimination of female donors of FFP has decreased incidence.

Neurologic

- Regulatory control of all body systems, learning & Memory
- Delayed Awakening
- Emergence Excitement/delirium

Delayed Arousal

- Should expect a response from patients within 60-90 minutes
- Etiology
 - Prolonged action of anesthesia medications
 - Metabolic causes
 - Neurologic causes

Delayed Arousal ANESTHESIA CAUSES

- **Residual anesthesia**
- **Hyperventilation due to high concentration of inhaled agents**
- **Narcotics may contribute to hypercarbia and sedation**
- **Hypothermia**

Delayed Arousal METABOLIC CAUSES

- **Hepatic dysfunction**
- **Renal disease**
- **Diabetic ketoacidosis**
- **Thyroid dysfunction**
- **Malignant hyperthermia**
- **Electrolyte imbalance**
 - **Hypocalcemia**
 - **Dilutional hyponatremia**
 - **High magnesium levels especially eclamptic patients**

Delayed Arousal NEUROLOGIC CAUSES

- **Ischemia**
- **Cardiovascular accident**
- **Intracranial hemorrhage**
- **Air emboli**
- **Uncontrolled hypotension**
- **Embolism**
- **Mass lesions**
- **Seizure disorders**

Delayed Arousal INTERVENTIONS

- **Assess oxygenation needs**
- **Ensure adequate oxygen exchange**
- **Reverse narcotics and benzodiazepines**
- **Warm patient if cold**
- **Treat electrolyte disturbance appropriately**
- **Identify causes to treat specifically**

Emergence Delirium/Excitement

- 10% of adult patients >50 years of age
- Arterial hypoxemia
- Pre-existing cognitive disorder (Parkinson, dementia)
- Hypoventilation with hypercapnia
- Metabolic derangements –renal, hepatic, endocrine
- Meds: Anticholinergics, Benzos, opioids, Beta Blockers
- Drug or ETOH withdrawal
- Electrolyte abnormalities
- Incomplete muscle relaxant reversal
- Acute CNS event – hemorrhage, ischemic stroke
- Seizures
- Infection
- Urinary bladder distention

EMERGENCY DELIRIUM CAUSES

- **Anesthetic Agents**

- Ketamine
 - Lidocaine
 - Scopolamine
 - Residual neuromuscular blockers
 - Residual inhalation agents
- Atropine
 - Droperidol

SIGNS & SYMPTOMS Emergence Delirium

- **Responsive or unresponsive agitation**
- **Unable to follow commands**
- **Irrational talking, screaming, shouting Low saturation levels**
- **Restlessness**
 - Crying
- **Disorientation**
 - Tachycardia
- **Confusion**
 - Verbalizations

INTERVENTIONS Emergence Delirium

- **Treat underlying cause**
- **Oxygen if indicated**
- **Opioids or sedation if needed**
- **Reverse narcotics or benzodiazepines**
- **Provide quiet environment**
- **Speak softly and directly to patient**
- **Maintain safety**

Anesthesia Related Complications

- Thermoregulation
 - Malignant Hyperthermia (Emergency)
 - Hypothermia
- Nausea and Vomiting
- Anesthetic medications
- Patient positioning

HYPOTHERMIA

- **Causes**

- **Anesthesia**
- **Surgery**
- **Cold Operating Room**

HYPOTHERMIA

- **Radiation** - Heat transfer between two surfaces of different temperatures
- **Convection** - Heat loss at a surface caused by fluid flowing across at a lower temperature
- **Conduction** - Heat transfer due to a temperature difference between two objects in contact
- **Evaporation** - Insensible water loss from skin, the respiratory tract, open incisions and wet drapes

POTENTIAL COMPLICATIONS

- **Wound infection**
- **Cardiac disturbances**
- **Altered medication effect**
- **Coagulopathy**
- **Shivering**
- **Increased oxygen consumption**
- **Delayed emergency from anesthesia**

INTERVENTIONS

- **Forced air warming devices**
- **Warmed cotton blankets**
- **Thermal drapes**
- **Fluid warmers**
- **Heat-moisture exchangers**
- **Heated humidifiers**
- **Warm operating rooms**
- **Infrared lights**

Risk Factors for PONV

- Female patient
 - Nonsmoker
 - Long Surgery (>60 minutes)
 - History of PONV
 - History of Motion Sickness
 - Use of Opioids
 - Use of volatile anesthetics
 - Use of Nitrous Oxide
- If 0 factors -20% risk
 - If 1 factor – 40% risk
 - If 2 factors- 60% risk
 - If 3 + factors – 80% risk

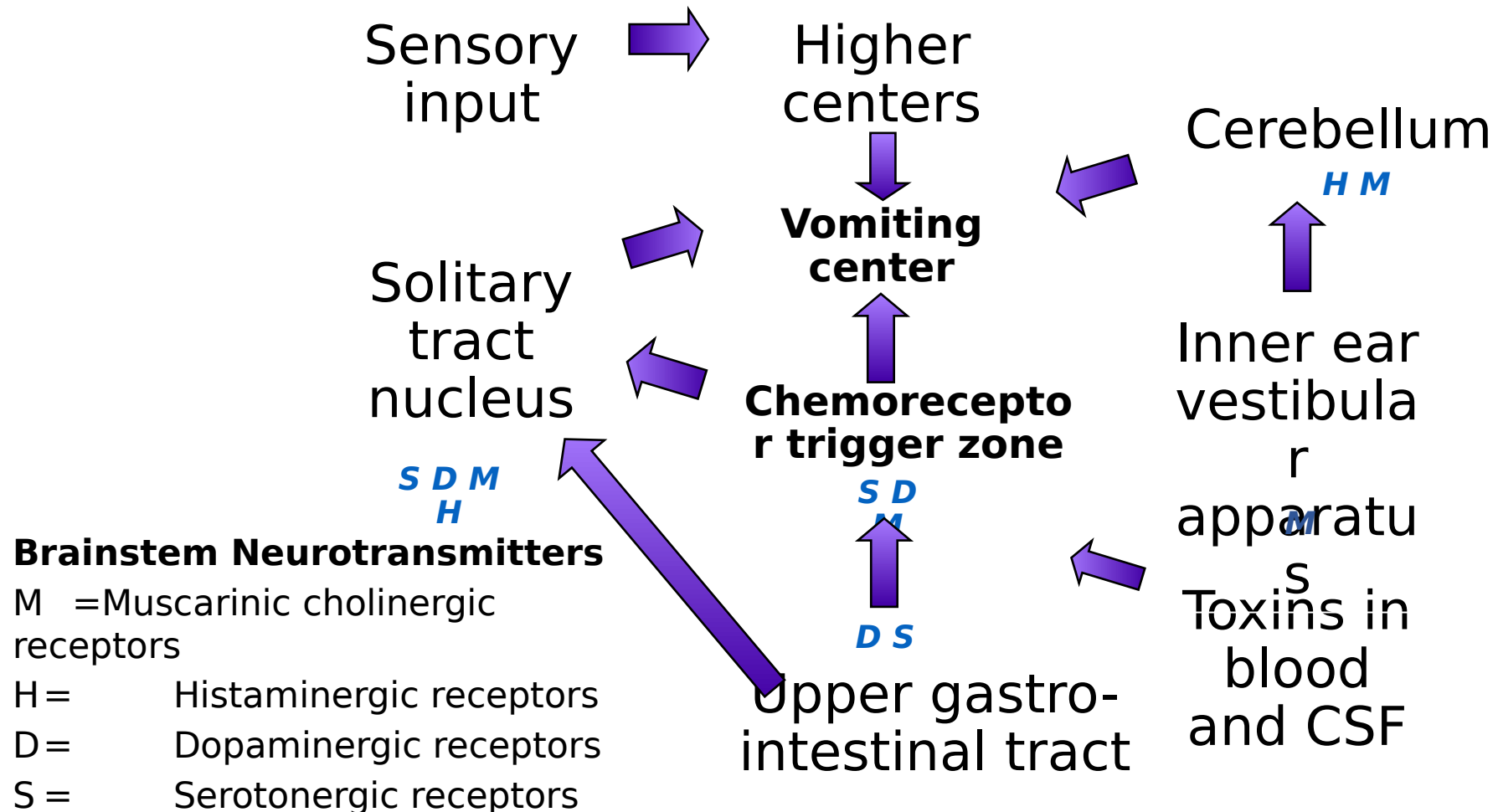
NAUSEA & VOMITING

- **PHYSIOLOGY**
 - **Neuromuscular interaction**
 - **Emetic Center**
 - **Vagal viscera**
 - **Sympathetic viscera**
 - **Vestibular**
 - **Cerebral Cortex/Limbic**
 - **Chemoreceptor Trigger Zone (CTZ)**

PONV-PDNV CAUSES

- ↓ Blood sugar – prolonged NPO; LR in OR
- ↓ Na – Fluid overload
- Hypotension/tachycardia/dysrhythmias
- Hypovolemia – vasodilation, ↓ IV fluids, NPO, drains, insensible surgical loss, diarrhea, N/V preoperatively
- Hypoxemia - ↓ O₂ & ↑ CO₂
- ↑ ICP, eye pressure, trauma
- Motion sickness – whipping through the halls

Physiology of Vomiting: Neurotransmitters



Brunton LL. In: Goodman and Gilman's The Pharmacological Basis of Therapeutics. 1996;917-936.

ANTIEMETICS

- **Serotonin (5HT₃)**

- Ondansetron (Zofram)
- Dolasetron mesylate (Anzemet)
- Granisetron (Kytril)
- Palonosetron (Aloxi)

- **Histamine (H₁)**

- Hydroxyzine (Vistaril)
- Promethazine (Phenergan)
- Dimenhydrinate (Dramamine)
- Diphenhydramine (Benadryl)

OTHER: Ephedrine,
Alcohol, Quease Ease

- **Dopamine Receptors**

- Butyrophenome
 - Droperidol (Inapsine)
 - Haloperidol
- Benzamides
 - Metoclopramide (Reglan)
- Phenothiazines
 - Prochlorperazine (Compazine)
 - Chlorpromazine (Thorazine)

- **Muscarinic (anticholinergics)**

- Transdermal Scope

- **NK-1**

- Aprepitant - Emend

Comparative Receptor Affinities of Antiemetic Drug Classes

Receptor Affinity	Antiemetic Drug Class		
	Dopamine	Muscarinic	Histamine Seroton
Anticholinergic agent	+	++++	+
Antihistamines		+	++++
Phenothiazines		++++	++
Butyrophenones		++++	+
Benzamides		+++	+
Selective Serotonin Antagonists			++++

Adverse Effects

- **Sedation**: Anticholinergics, Phenothiazines, Antihistamines, Droperidol
- **Hypotension**: Promethazine, Prochlorperazine, Droperidol
- **Extrapyramidal Symptoms**: Phenothiazines, Metoclopramide, Droperidol
- **Dry Mouth**: Atropine, Scopolamine, Hydroxyzine, Antihistamines
- **Blurred Vision**: Anticholinergics, Antihistamines
- **Urinary Retention**: Anticholinergics

POSITIONING

- **SUPINE**

- **Pressure points**
- **Nerve Injuries**

- **SITTING**

- **Postural Hypotension**
- **Airway embolism**

- **PRONE**

- **Eye abrasion**
- **Ear compression**
- **Neck pain**
- **Nerve injury**
- **Joint damage**

- **LATERAL**

- **LITHOTOMY**

Orthopedic Complications

- Compartment Syndrome
- Nerve damage

Compartment Syndrome

- Increased pressure within muscle compartment causes circulatory compromise
- 2 Main causes:
 - Constriction from outside
 - Increased pressure within compartment

Compartment Syndrome

- When edema or bleeding increases pressure within a compartment impeding circulation
- Signs & Symptoms
 - Intense deep throbbing pain out of proportion to the injury without improving with analgesia
 - Numbness & tingling distal to affected muscle
 - Absent peripheral pulses
 - Pallor or mottling of affected area
 - Decreased movement, muscle strength & sensation in affected extremity
 - Sharp pain on passive stretching of middle finger or large toe of affected extremity

Compartment Pain measurement

5 P's

- **P Pain**
- **P Paresthesia**
- **P Pallor**
- **P Paralysis**
- **P Pulselessness - poor prognostic sign**

RISKS

- **Constrictive casts & dressings**
- **Long bone fractures**
- **Orthopedic Surgery**
- **Crush injuries**
- **Thermal injuries**

• Nerve Function Tests

**• Radial: Sensory - pinch web site
Motor - hyperextend thumb**

**• Median: Sensory - Pinch distal surface of index finger
Motor - Oppose thumb with little finger & flex wrist**

• Ulnar: Sensory - Pinch distal end of little finger

Motor - Abduct all fingers

Orthopedics

- **Peroneal:** Sensory - Pinch lateral surface of great toe and medial surface of second toe
Motor - Dorsiflex ankle & extend toes
- **Tibial:** Sensory - Pinch medial and lateral surface of sole of foot
Motor - plantar flex ankle, flex toes

FAT EMBOLISM

- **Seen with fractures of long bones**
- **Release of fat droplets into circulation**
- **Migrate to lungs**
- **Break down into acids**
 - **irritates vascular walls**
 - **causes extrusion of fluids into alveoli**
 - **alters ventilation leading to hypoxemia**

FAT EMBOLISM

- **Tachypnea**
- **Tachycardia**
- **Anxiety**
- **Petechiae over chest**
- **Mechanical ventilation**
- **PO₂ < 60 mm Hg**
- **Fever**
- **Confusion**
- **Pallor**

FAT EMBOLISM

- **Interventions**
 - **Oxygen**
 - **Keep patient quiet**
 - **Prevent motion of fractured site**

Nerve Damage

- Nerve damage can be caused by diabetes, alcoholism, B-vitamin deficiencies and trauma such as car accident or sport injury. The main symptoms of nerve damage are:
- Numbness in hands, feet or other parts of the body. Numbness may develop gradually
- Burning or stabbing pain. Pain may be intermittent
- Extreme sensitivity to touch. Even a light touch may cause pain
- Muscle weakness. The injured arm or leg fails to regain its previous strength
- Symptoms of nerve damage are frequently caused by injury – or surgery-induced inflammation and not by manipulation or cutting of nerves

Renal Dysfunction

- Renal insufficiency leading to Acute Renal Failure
 - Dehydration
 - Hypovolemia
 - Use of IV dyes
 - Use of meds cleared via renal system

Oliguria

- Low urine output (0.5 ml/kg/hour)
- Pre-renal *Hypoperfusion*
 - Hypotension
 - Hypovolemia
 - Reduced cardiac output
 - Drugs that influence renal perfusion (NSAIDs, ACE inhibitors, Angiotensin II receptor antagonists)
- Renal – *intrinsic renal disease*
 - Ischemia from hypoperfusion
 - Nephrotoxins (aminoglycosides)
 - Glomerula disease
- Post-renal *Outflow obstruction*
 - Benign prostatic hypertrophy
 - Blocked urinary catheter
 - Inadequate urge to void (post spinal)
 - Renal calculi

Postoperative Urinary Retention

- Predictive event with:
 - Anorectal surgery
 - Joint replacement
 - Periop meds used
 - Anticholinergics
 - *B*-Blockers
 - Narcotics
- Risk Factors
 - Age > 50 years
 - Male gender
 - Intraop fluid volume
 - Duration of surgery
 - Bladder volume on admission

Urine Retention

- Absence of voiding for 1st 12 hours post op
- Bladder distention above symphysis pubis
- Complaints of discomfort & pain in bladder area
- Anxiety & restlessness
- Hypertension
- Help pt. ambulate ASAP
- Help into normal voiding position
- Prepare for catheterization
- Adult capacity: 350 to 700 ml
 - *urge to void with 150 ml*
 - *bladder fullness 400-450 ml*

Endocrine System

- **Regulates secretion of hormones that alter metabolic body functions:**
 - **Chemical reactions & transport of chemicals**
 - **Growth & development**
 - **Metabolism**
 - **Fluid & Electrolyte balance**
 - **Acid Base balance**
 - **Adaptation**
 - **Reproduction**

Endocrine System

- Regulates & integrates body's metabolic activities
- Maintains internal homeostasis
- Consists of
 - Glands- Secrete hormones and chemical transmitters
 - Hormones- chemical substances secreted by glands
 - Receptors –Protein molecules that trigger physiologic changes to hormone stimulation

Endocrine System

- Major glands include
 - Pituitary gland
 - Thyroid gland
 - Parathyroid glands
 - Adrenal glands
 - Pancreas
 - Thymus
 - Pineal gland
 - Gonads

Potential Endocrine Disorders

- Addison's disease – Adrenal hypofunction (insufficiency)
 - Progress to Addisonian Crisis –deficiency of mineralcorticoids and glucocorticoids
 - Acute Addisonian crisis both hormones suddenly depleted
 - BP drops due to vascular collapse
 - Pressor therapy is difficult to regulate
 - Blood glucose plummets and coma & death ensue
 - Treatment with Hydrocortisone, aggressive fluids vasopressors, blood glucose management

Potential Endocrine Disorders

- Diabetes Insipidus: Water metabolism disorder caused by deficiency of ADH (Vasopressin). Filtered water is excreted rather than be absorbed
- Causes:
 - Pituitary tumor, Hypothalamic tumor, cranial trauma, stroke
 - Medications including Lithium, Phenytoin, Alcohol

Potential Endocrine Disorders

- Diabetes Mellitus: Chronic disease of insulin deficiency or resistance
- Disturbances in carbohydrate, protein or fat metabolism
- Type I: Autoimmune process
- Type II: Beta cell exhaustion due to lifestyle habits & hereditary factors

Potential Endocrine Disorders

- Diabetic Ketoacidosis: Acute complication of hyperglycemic crisis in patients with diabetes.
- May result from:
 - Infection
 - Illness
 - Surgery
 - Stress
 - Insufficient or absent insulin

Potential Endocrine Disorders

- Hyperosmolar Hyperglycemic Nonketotic Syndrome:
Acute hyperglycemic crisis accompanied by hyperosmolality and severe dehydration without ketoacidosis
- Most common in type II diabetics but can occur in pts having peritoneal dialysis, hemodialysis or total parenteral nutrition
- Ketones are absent so no acidosis

Potential Endocrine Disorders

- Myxedema Coma – progresses from hypothyroidism
- Primary hypothyroidism is disorder of thyroid gland
- Secondary hypothyroidism is caused by failure to stimulate normal thyroid function or inability to synthesize thyroid hormone due to iodine deficiency or use of antithyroid meds
- Treat with Hydrocortisone and Levothyroxine, fluids, ventilation warming devices

Potential Endocrine Disorders

- Syndrome of Inappropriate antidiuretic hormone (SIADH)
- Common complication after surgery. ADH is secreted & body retains water
- Causes: Oat-cell lung cancer, Neoplastic disease, Brain abscess, Stroke, Guillain-Barre syndrome, pulmonary disorders, adrenal insufficiency, anterior pituitary insufficiency

Potential Endocrine Disorders

- Thyroid Storm(thyrotoxic crisis)
- Have a surge of thyroid hormones
- Signs & Symptoms
 - Tachycardia
 - Irritability and restlessness
 - Tremor
 - Weakness
 - Heat intolerance
 - Angina
 - Shortness of breath
 - Exophthalmos

QUESTIONS?

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