ANAESTHETIC CONSIDERATIONS: CO INCIDENTAL SURGERY IN A PATIENT WITH TRANSPLANTED KIDNEY

Dr Vanya

University College of Medical Science & GTB Hospital, Delhi

CONTENTS

I. Immunosuppressive therapy
II. Problems in a kidney transplant recipient
III. Indications for surgery
IV. Pre-operative considerations
V. Anaesthetic management
VI. Special cases i.e. obstetric, paediatric

POST TRANSPLANT STATE

- *A chronic kidney disease -* continued organ dysfunction
- Post transplant surgery frequency is ~ 41%
- Surgery unrelated to transplant ~ 6%
- Incidence and urgency of surgery does not vary with the source of donor kidney
- Mortality related to the degree of immunosuppression and *not additional operation.*

POST TRANSPLANT PATIENTS - OVERVIEW

- Chronically unwell
- Actively ill
- Emotionally stressed
- Acutely and chronically immunocompromised

IMMUNOSUPPRESSIVE THERAPY

ADVANCES IN IMMUNOSUPPRESSION

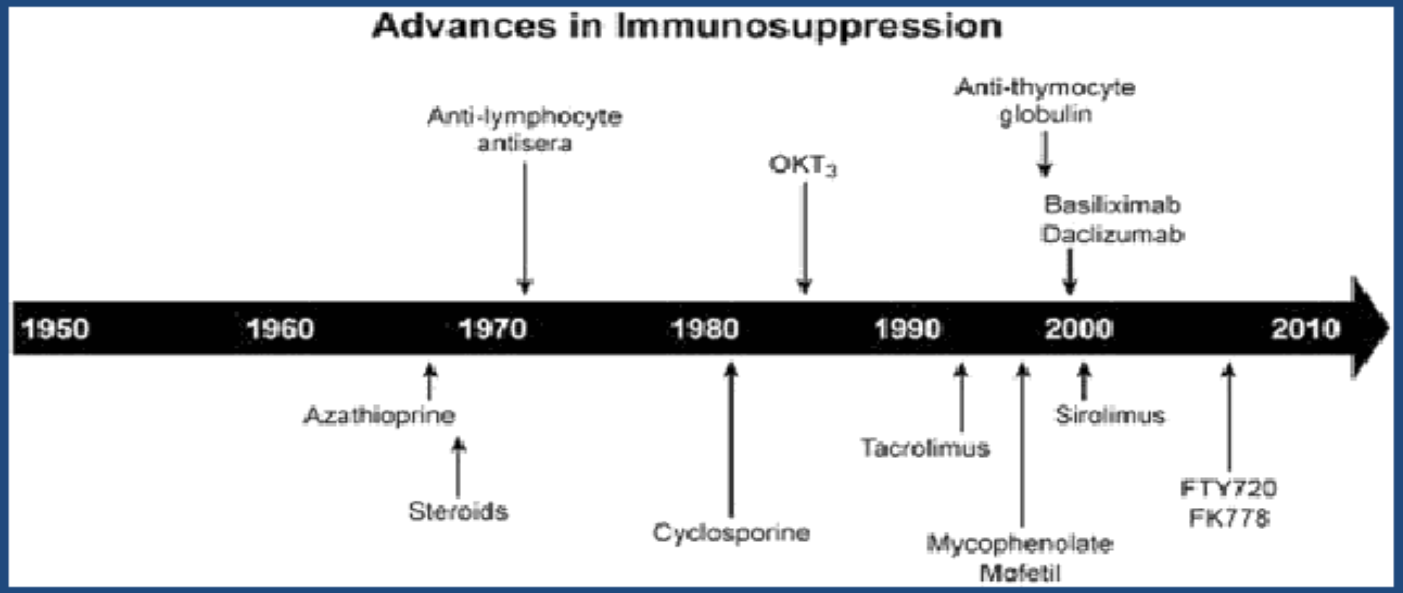


Figure 1. Timeline for the introduction of immunosuppression medications.

Immunosuppression in Liver Transplantation. Post et al. *LiverTransplantation, Vol 11, No 11,2005: pp 1307-1314*

MECHANISM OF ACTION OF IMMUNOSUPPRESSANTS – DIAGRAMATIC ILLUSTRATION

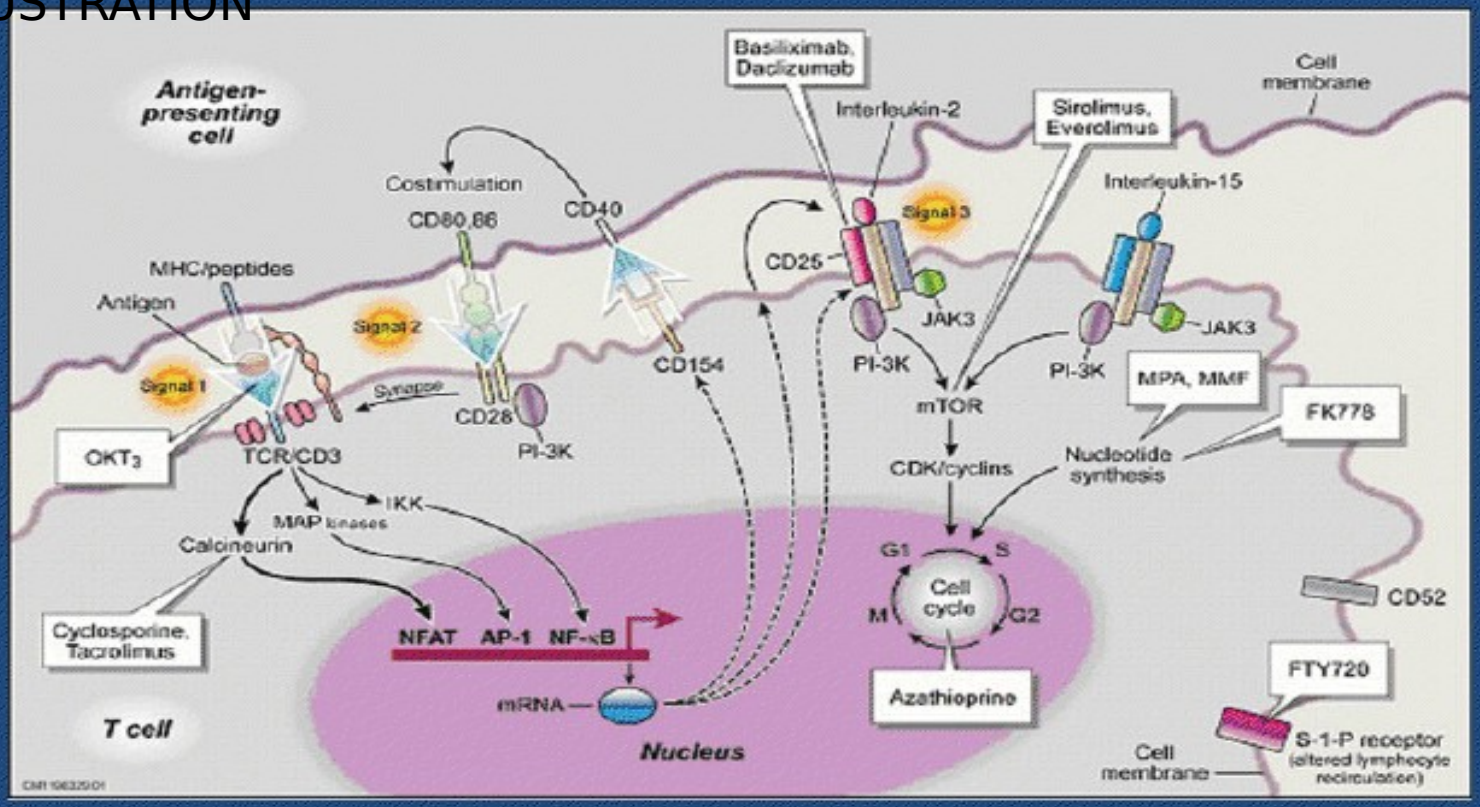


Figure 2. Illustration showing the activation of a T lymphocyte (via 3-signal pathway) by an antigen-presenting cell. Further detail includes the specific sites targeted by the calcineurin inhibitors (TAC and CyA) showing inhibition of IL-2 production. Monoclonal antibodies (basiliximab, daclizumab) target the IL-2 receptor, while OKT3 targets the T-cell receptor. Sirolimus, MPA, MMF, azathioprine, and FK778 interfere with the proliferative phase in the cell cycle. Novel agent FTY720 alters lymphocyte trafficking/homing patterns through modulation of cell surface adhesion receptors inducing a lymphopenic effect.

Immunosuppression in Liver Transplantation. Post et al. *Liver Transplantation, Vol 11, No 11,2005: pp 1307-1314*

IMMUNOSUPPRESSION

- CLASSIFICATION OF DRUGS-

1) Inhibition of T cell interaction – prednisone, OKT3

2) Inhibition of cytokine synthesis – cyclosporine, tacrolimus, basiliximab, inolimomab, daclizumab

3) Inhibition B/T cell proliferation – azathioprine, mycophenolate mofetil, sirolimus

4) Inhibition of T cells – ATG, ALG

CURRENTLY APPROVED MAINTENANCE IMMUNOSUPPRESSIVE MEDICATIONS

Medication	Typical Dose Initial/Maintenance	Target Blood Level (Trough)
Cyclosporine (Sandimmune or generic)	5–6 mg/kg PO Q12; maintenance dose determined by blood level	250–400 ng/mL (initial) 125–200 ng/mL (long term)
Cyclosporine microemulsion (Neoral or generic)	4–5 mg/kg PO Q12; maintenance dose determined by blood level	250–400 ng/mL (initial) 125–200 ng/mL (long term)
Tacrolimus (Prograf)	0.1 mg/kg PO Q12; maintenance dose determined by blood level	10–20 ng/mL (initial) 5–10 ng/mL (long term)
Azathioprine (Imuran or generic)	1.5–2.5 mg/kg PO QD (adjusted for blood counts)	Blood level monitoring not used in clinical practice
Mycophenolate mofetil (CellCept)	1.0–1.5 g PO Q12 (adjusted according to gastrointestinal adverse effects and blood counts)	Blood level monitoring not used in clinical practice
Prednisone, prednisolone, methylprednisolone	0.5 mg/kg/day (initial) 0.1 mg/kg/day (long term)	Blood level monitoring not used in clinical practice
Sirolimus (Rapamune)	2–5 mg PO QD (adjusted according to level)	10–20 ng/mL (initial) 5–15 ng/mL (long term)

PO, By mouth; Q12, every 12 h; QD, once daily.

ADVERSE EFFECTS OF IMMUNOSUPPRESSANTS

MEDICATION	ADVERSE EFFECT
CYCLOSPORINE	**Nephrotoxicity, hyperkalemia, gout, HUS, HTN, hyperlipidemia, diabetogenicity, hepatotoxicity, neurotoxicity, hirsutism, gingival hyperplasia**
TACROLIMUS	**Similar to cyclosporine except neurotoxicity more common, hair loss, no gingival hyperplasia, more diabetogenic, less HTN and hyperlipidemia**
AZATHIOPRINE	**Bone marrow suppression, macrocytosis, hepatotoxicity, pancreatitis**
CORTICOSTEROIDS	**Weight gain, cushingoid appearance, cataracts, acne, thinning of skin, easy bruising, osteoporosis, fractures, avascular necrosis, upper GI bleeding, diabetogenicity, psychologic effects, hyperlipidemia**
MYCOPHENOLATE MOFETIL	**Abdominal pain, anorexia, nausea, vomiting, upper GI bleeding,**

GINGIVAL HYPERPLASIA CAUSED BY CYCLOSPORINE



IMMUNOSUPPRESSION

- Vital for prevention or treatment of rejection (acute/chronic)
- Life long therapy
- Multi drug regimens – synergistic action with limitation of drug specific toxicity.
- Phases of regimens- induction, therapy during hospitalization, maintenance and anti rejection phase

PROBLEMS IN A POST TRANSPLANT RECIPIENT

1. *Persistent cardiovascular disease*
2. *Bone disorders*
3. *Electrolyte and acid base imbalance*
4. *Post transplant Diabetes Mellitus*
5. *Malignancy*
6. *Infection*

1. CARDIOVASCULAR DISEASE

- Most common cause of mortality in those with functional grafts – 30-40%
- Increased incidence of : coronary heart disease, CHF, ventricular hypertrophy, hypertension, cerebrovascular disease, peripheral vascular disease.

CARDIOVASCULAR DISEASE contd.

Risk factors –

✓ ***Conventional***

- Smoking
- **Hypertension**
- **Hyperlipidemia**
- DM

✓ ***Specific to transplant patients***

- Anaemia
- Chronic fluid overload
- Hyperparathyroidism
- Immunosuppressants

CARDIOVASCULAR DISEASE contd.
HYPERTENSION

- **Causes** –
  - Native kidney disease
  - CNIs (60-80% prevalence)
  - Weight gain
  - Allograft dysfunction
  - Steroids
  - Transplant renal artery stenosis

- Target BP - <120/80

(JNC VII)

CARDIOVASCULAR DISEASE contd.
HYPERLIPIDEMIA

✓ **Causes (GCS)-**

- Steroids
- Sirolimus, CNIs

✓ **Rx-**

- Lifestyle modification - Weight loss, exercise
- ↓ steroid dosage
- Cyclosporine → tacrolimus
- Statins

PROBLEMS IN A POST TRANSPLANT RECIPIENT

2. BONE DISORDERS

- Persistent hyperparathyroidism
- Gout
- Osteonecrosis
- Osteoporosis

2. BONE DISORDERS
HYPERPARATHYROIDISM



- Very common in 1st post transplant year
- **Risk factors** –

➢ Degree of pre- transplant disease

➢ Duration of dialysis

- **Contributing factors**-

➢ Deficiency of vitamin D

➢ Poor allograft function

BONE DISORDERS – HYPERPARATHYROIDISM contd.

- Symptoms – mostly asymptomatic

- Dx – increased plasma Ca
  decreased plasma phosphate

- Rx – vitamin D analogs (stopped if S Ca.>11mg/dl)
  - phosphate supplements

BONE DISORDERS - HYPERPARATHYROIDISM contd.

- Surgery – indications –

1) severe symptomatic hypercalemia in early post transplant period

2) persistent moderately severe hypercalcemia for > one year post transplantation

- Surgery done – subtotal parathyroidectomy

2. BONE DISORDERS
GOUT

- Cyclosporine – most important cause
- Impairs renal uric acid clearance
- Rx –

✓ Colchicine

✓ High dose steroids

✓ Synthesis inhibitor i.e. Allopurinol (dec. dose of azathioprine)

✓ NSAIDS – Avoid

✓ Switch to Tacrolimus

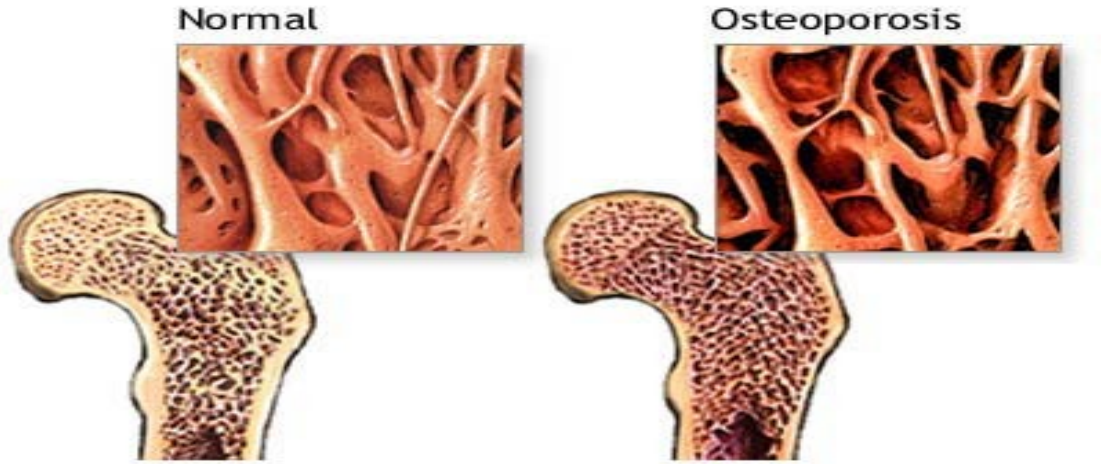


2.BONE DISORDERS
OSTEONECROSIS (AVASCULAR NECROSIS)

- **Cause** - High dose steroids
- **Sites** - humeral head, femoral condyles, proximal tibia, vertebrae
- **Symptom** – mainly pain
- **Rx** – resting the joint , decompression , joint replacement

2. BONE DISORDERS
OSTEOPOROSIS

- **Common bone disorder-** parallel reduction in bone mineral and bone matrix→ Decreased bone mass
- Maximum bone loss – first 6 month



BONE DISORDERS – OSTEOPOROSIS contd.

Causes

- Steroids
- Ongoing hyperparathyroidism
- Vit D def /resistance
- Phosphate depletion

Rx

- Weight bearing exercise
- Steroid minimization
- Elemental calcium and calcitriol

Clinical implication – Increased risk of fracture

PROBLEMS IN A POST TRANSPLANT RECIPIENT

3.ELECTROLYTE $ ACID BASE IMBALANCE

HYPERKALEMIA

Causes:

- CNI induced impairment of tubule potassium secretion
- Poor graft function
- Excessive intake
- ACE-I, SMX-TMP

Clinical implication – muscle weakness, ECG changes

- ***HYPOPHOSPHATEMIA***
- **Due to excess urinary excretion**

➢ residual hyperparathyroidism

➢ Glucocorticoids

➢ low Vit D state

Implication – Profound respiratory muscle weakness

ELECTROLYTE IMBALANCE contd.

- ***HYPERCALCEMIA***
- **Causes –**

✓ Persistent Hyperparathyroidism

✓ Co- administration of calcium and vit D

Implication – shortened Q-T interval and arrhythmias

ELECTROLYTE IMBALANCE contd.

HYPOMAGNESEMIA

- **Cause** - CNI induced
- Asymptomatic
- **Rx** – magnesium supplements if plasma Mg levels < 1.5mg/dl

Clinical implication - ↑ risk of perioperative arrhythmias, impaired respiratory muscle power

ACID BASE IMBALANCE

METABOLIC ACIDOSIS

Causes

- Distal (hyperchloremic) renal tubular acidosis - occurs due to:
- CNI
- Rejection
- Residual hyperparathyroidism

Clinical Implication - intraoperative electrolyte imbalance
prolonged NM blockade
interference with drug PK

PROBLEMS IN A POST TRANSPLANT RECIPIENT

4. POST TRANSPLANT DIABETES MELLITUS

- New onset DM – Common
- Increased CV risk
- ***Risk factors*** –
  - Older age
  - Obesity
  - Positive hepatitis C antibody status
  - Family history
  - Deceased donor allograft
  - Steroids
  - CNI
  - Episodes of acute rejection

POST TRANSPLANT DM (contd)

Rx

- Steroids minimized
- Tacrolimus avoided
- Oral hypoglycemic drugs and Insulin
- Metformin- most effective

PROBLEMS IN A POST TRANSPLANT RECIPIENT
5.MALIGNANCY

- **Causes of ↑ cancer incidence** –

➢ Immunosuppressants → *inhibit normal tumor surveillance mechanisms*

↓

uncontrolled proliferation of oncogenic viruses

➢ Factors related to primary renal disease (analgesic abuse, HBV , HCV, certain herbal preparations)

➢ Renal cystic disease

RISK OF MALIGNANCIES IN RENAL TRANSPLANT PATIENTS COMPARED WITH GENERAL POPULATION

Type of cancer	approx. relative risk
CA COLON, LUNG, PROSTATE, STOMACH, OESOPHAGUS, PANCREAS, ONARY, BREAST	2
TESTICULAR, BLADDER	3
MELANOMA, LEUKEMIA, HEPATOBILIARY, CERVICAL , VULVOVAGINAL CANCERS	5
RENAL CELL CANCER	15
NON MELANOMA SKIN CANCER, KAPOSI SARCOMA, NHL	20

MALIGNANCY contd.

Treatment

- ↓ the dose of immunosuppression
- Sirolimus – increasing evidence of antineoplastic effects

Post Transplant Lymphoproliferative Disorder (PTLD)

- 1-2% incidence
- Feared complication
- Cause- Infection and transformation of B cell by EBV

6. PROBLEMS IN A POST TRANSPLANT RECIPIENT

INFECTIONS

Factors affecting the risk-

- intensity of exposure
- overall state of immunosuppression

Can be divided based on time periods –

- **0-1 MONTH**
- **1-6 MONTHS**
- **>6 MONTHS**

INFECTIONS (contd.)

- **0-1 MONTH -** ~ to those seen in non transplant patients after surgery.
  - UTI
  - lung infections
  - related to vascular catheters
- Bacterial> fungal

INFECTIONS (contd.)

- **1-6 MONTHS** – Oppurtunistic infections
- CMV, EBV, listeria, pneumocystis carini, nocardia

- ***Prevention*** – Antiviral prophylaxis (3-6 months)
- SMX-TMP prophylaxis (6 to 12 months)

INFECTIONS (contd.)

❖ **> 6 MONTHS** – risk of infection decreases

- can be divided into 2 groups –

1) Good graft function, no need of late supplemental immunosuppression – infection risk similar to general population

2) ***Poor graft function, received large cumulative doses of immunosuppression*** – remain at risk of oppurtunistic infection

-need long term SMX- TMP prophylaxis

INFECTIONS (contd.)

Clinical implication –

- *Minimizing infection should be the goal*
- *Require meticulous surgical technique*
- *Antiviral prophylaxis*
- *Avoidance of excess immunosuppression*

REASONS FOR SURGERY

- ***Within first 48 hours of transplant:***
- Exploration – bleeding, inadequate urine output
- Patient is acutely ill – SIRS, hypotension, hypoxemia, metabolic acidosis
- ***At a later stage:***
- Urologic complications
- Wound infections
- Orthopaedic problems
- G I bleeding
- Coronary artery bypass
- Hyperparathyroidism
- AV fistulae

ANAESTHETIC CONSIDERATIONS

GENERAL CONSIDERATIONS

- High level of vigilance
- Diminished reserve of transplanted organ
- Minimally invasive option
- Plan for peri-operative immune suppression
- Close coordination of all team members

PREOPERATIVE CONSIDERATIONS

1. ***Function of graft, other organs and concomitant disease***
2. ***Infection prophylaxis***
3. ***Immunosuppressive prophylaxis***
4. ***DVT Prophylaxis***

EVALUATION OF THE GRAFT FUNCTION

- Reserves limited to one functional kidney, and graft deteriorates with time – *Chronic renal allograft nephropathy*
- Immunosuppressants (Cyclosporine/Tacrolimus) - 20% reduction in renal function
- Half life of transplanted kidney:

  Cadaveric donor - 12yrs

  Living donor - 18 yrs

EVALUATION OF THE GRAFT FUNCTION contd.

- Transplanted kidney – more vulnerable to acute insults- hypovolemia, radiocontrast media, furosemide
- Rejection - Important cause of mortality in transplant recipients
- Surgery during rejection – higher morbidity
- Signs of rejection – hypertension, proteinuria, ↑ S.creatinine

FUNCTION OF OTHER ORGAN SYSTEMS

- **Lungs**- rule out infection – CXR and clinical examination sufficient

- **Liver** - Hepatic failure may occur (is the leading cause of death in long term survivors of kidney transplantation)

  Coagulation studies – appropriate test

FUNCTION OF OTHER ORGAN SYSTEMS contd.

HAEMATOLOGICAL INVOLVEMENT

- Leucopenia- Azathioprine
- Anaemia – *Causes*: immunosupressive drugs, iron deficiency, occult bleeding or hemolysis.
- Erythrocytosis - ↑ EPO after transplantation
- Hypercoagulability –Cyclosporine (thromboxane release, thromboplastin generation, fac VII activity)

Increased risk of thromboembolic complication- ***DVT prophylaxis***

PREOPERATIVE CONSIDERATIONS

1. Function of graft, other organs and concomitant disease
2. **Infection prophylaxis**
3. **Immunosuppressive prophylaxis**
4. **DVT Prophylaxis**

PREOPERATIVE CONSIDERATIONS contd.
INFECTION PROPHYLAXIS

- Maintenance antibiotic therapy to continue
- Avoid nephrotoxic drugs
- If bacteraemia anticipated, prophylaxis same as in non transplant patients -

  30 mins before incision and continued in post op for

  24-48 hrs.

PRE OP CONSIDERATIONS contd.

IMMUNOSUPRESSIVE PROPHYLAXIS

- Therapy should be maintained at all times
- Peroral therapy preferred
- Azathioprine intravenously requires no dose adjustment
- Postponement of elective surgery in case WBC ≤ 2000 cells/µl.
- Prednisolone can be used as an emergency replacement, when cyclosporine is discontinued or in acute rejection
- Supplemental “***stress coverage***” steroids – not necessary except if they were withdrawn recently

IMMUNOSUPRESSIVE PROPHYLAXIS contd.

- Advice should be taken from Transplant unit.

- Altered drug effects and interactions with CNIs should be considered as :

1. Pharmacokinetics of CNIs change in presence of other drugs
2. Co administration with various drugs can increase the nephrotoxicity
3. In Renal dysfunction – dose is reduced, stopped or replaced

Table 1. Drugs That Affect Cyclosporine and Tacrolimus Blood Levels

Increase blood levels	Decrease blood levels
Bromocryptine	Carbamazepine
Chloroquine[a]	Octreotide[a]
Cimetidine[b]	Phenobarbital
Clarithromycine	Phenytoin
Co-trimoxazole	Rifampycin
Danazole	Ticlopidine[a]
Diltiazeme	
Erytromycin	
Fluconazole	
Itraconazole	
Ketoconazole	
Metoclopramide	
Nicardipine	
Verapamil	

[a] Reported with cyclosporine; may not interact with tacrolimus.
[b] May not interact with cyclosporine.

IMMUNOSUPRESSIVE PROPHYLAXIS contd.

- Advice should be taken from Transplant unit.

- Altered drug effects and interactions with CNIs should be considered as :

1. Pharmacokinetics of CNIs change in presence of other drugs
2. Co administration with various drugs can increase the nephrotoxicity
3. In Renal dysfunction – dose is reduced, stopped or replaced

DRUGS THAT MAY CAUSE RENAL DYSFUNCTION WHEN ADMINISTERED WITH CYCLOSPORINE OR TACROLIMUS

- Amphotericin
- Cimetidine
- Ranitidine
- Melphalan
- NSAIDS
- Cotrimoxazole
- Vancomycin
- Tobramycin
- Gentamycin

PRE OP CONSIDERATIONS contd. – **DVT PROPHYLAXIS**

- *Cyclosporine - causes hypercoagulability*
- *Should be considered if other risk factors of DVT present.*

BLOOD PRODUCTS

- *Adequate blood should be arranged in advance – cross matching may be delayed*
- *Transfusion reactions, refractoriness to platelet transfusion, transmission of infection can occur*
- *Leucocyte poor/irradiated blood products preferred*

ANAESTHETIC MANAGEMENT

PRE-OP INVESTIGATIONS

- **Hb , TLC , DLC and ESR** - *for anemia, infection*
- **KFT** - *graft function*
- **LFT** – *liver function and coagulation status*
- **Serum electrolytes** - to r/o hyperkalemia, *hypercalcemia*
- **Urinalysis** - *graft function and infection*
- **Blood glucose** – *DM common*
- **Cyclosporine and tacrolimus levels** – *to maintain optimum therapeutic levels*
- **ECG, CXR** – *cardiovascular status*
- **Advanced test -** Dobutamine stress ECHO

TYPE OF ANAESTHESIA

- Both general and regional anaesthesia safe

- Choice depends on –

✓ Nature of surgery

✓ Condition of patient

✓ Preference of anaesthesia provider

GENERAL ANAESTHESIA

❖ ***PREMEDICATION***

- Usual premedication
- Aspiration prophylaxis
- Antisialogogues
- Glycopyrrolate – prolonged duration of action
- Cyclosporine(4 to 7 hrs before)
- Metoclopramide - avoid

GENERAL ANAESTHESIA contd.

❖ ***INTRA OP MONITORING***

- **Standard non invasive**- ECG, NIBP, $EtCO_2$, spO_2, NMT monitoring

- **Invasive monitoring** – limited to minimum
  - used when necessary
  - under strict aseptic precautions

INTRA OP MONITORING contd

- Use of antiseptic impregnated catheters – reduces infection rate
- NMT monitoring needed because-
  - Azathioprine, cyclosporine - prolong NMB
  - Electrolyte and acid base abnormality
  - Organ dysfunction
- Blood sugar monitoring – in diabetics

GENERAL ANAESTHESIA contd.

❖ ***AIRWAY CONTROL***

- Risk of aspiration - ↑ed

  Causes – DM

  - Cyclosporine (gastric atony)
- Mask and LMA – best avoided
- Preoxygenation – anaemia, CV risk
- Rapid Sequence Intubation (RSI)
- Intubation – oral > nasal (nosocomial infections)
- Difficult intubation – DM

  - Lymphoproliferative growth
- Vapour sterility should be ensured
- Early extubation is recommended

GENERAL ANAESTHESIA contd.

❖ ***ANAESTHETIC AGENTS***

- **Intravenous agents**– No contraindication to any per se (?)
  - Thiopentone – with dose reduction
  - Propofol is a safe induction agent
  - Etomidate preferred if haemodynamic compromise + ; preserves autonomic tone (DM/uremic dysfunction)
  - Ketamine best avoided

- ***Cyclosporine increases the effect of barbiturates and fentanyl in animal studies whereas in human no difference in the duration of action is detected*.**

ANAESTHETIC AGENTS contd.

- **Inhalational agents**

- Isoflurane and Desflurane – *preferred*

- Halothane – *not recommended for repeated use*

  – *so avoid*

- Enflurane/Sevoflurane- *avoid (nephrotoxic)*

GENERAL ANAESTHESIA contd.

❖ ***MUSCLE RELAXANTS***

- Atra/cisatracurium – preferred
  Risk- laudanosine formation ↑ in RF
- Mivacurium – short duration of action, metabolised by
  plasma cholinesterases
- Sch – Can be used
  Not if hyperkalemia
- Rocuronium - can be used for RSI
- Vecuronium - can cause-

  renal vasoconstriction
  prolonged action in acidosis
- Pancuronium/ Alcuronium – not indicated

GENERAL ANAESTHESIA contd.

❖ ***FLUID POLICY AND KIDNEY PROTECTION***

- Euvolemia - maintenance of adequate volume status to prevent dysfunction of allograft
- Aim is to prevent ATN → ARF
- If hyperkalemia present – potassium free fluids
- Osmotic diuretics preferred over tubular diuretics

POST OP CARE

Concerns-

- Pain
- Airway complications
- Infections

POST OP CARE

PAIN –

- Opioid based pain relief
- Morphine , pethidine – avoid if RFT deranged
- Paracetamol - in paediatric patients
- NSAIDS to be avoided
- Epidural analgesia

POST OP CARE

- ✓ Cardiovascular collapses have occured upto 2 days post op.
- ✓ All monitoring should be continued till 2nd post op day.

- ✓ In patients with CV disease :
- Perioperative beta blockers – can be considered
- Maintain normothermia
- Haematocrit > 30%
- Adequate analgesia

POST OP CARE

Cornerstones of therapy :

- Intensive physiotherapy
- Early mobilization
- Early removal of catheter and drains
- High suspicion of complications
- Continuation of immunosuppressive therapy

REGIONAL ANESTHESIA

- No contraindication
- Platelet count, clotting studies
- Bupivacaine - decrease in renal function may increase the toxic effects – NOT SEEN IN CLINICAL DOSES

SPECIAL CASES

SURGERY IN POST RENAL TRANSPLANT PREGNANT PATIENTS

- Pregnancy may affect long-term graft dysfunction by accentuating nephron hyperfiltration and overwork.
- Problems – hypertension, preeclampsia, UTI, spontaneous abortion
- Immunosuppressants -

✓ No ↑ in morbidity

✓ Cross placenta, but not teratogenic

✓ MMF and Sirolimus - avoided (teratogenic in animals)

LSCS IN A RENAL TRANSPLANT RECIPIENT

- Indication – obstetric
- Anaesthetic considerations - same
- RFT monitoring for 3 months

SURGERY IN A PAEDIATRIC TRANSPLANT RECIPIENT

- More challenging
- Graft failure is commoner
- Contact transplant centre – associated disorders present
- Non compliance with immunosuppressive therapy common

SALIENT POINTS

- ***Higher incidence of death from myocardial infarction and stroke, particularly in diabetic post transplant patients.***
- ***High CV risk – persistent risk factors – HTN, DM, dyslipidemia, hyperparathyroidism.***
- ***Apart from cardiac risk – graft rejection, infections, anemia, Immunosuppressive treatment side effects***
- ***Immunosuppression is a double edged sword***
- ***Proper assessment of graft function and co morbidities required***
- ***Both general and regional anaesthesia safe.***
- ***Strict asepsis, euvolemia, quick surgery, early mobilization in post op recommended***
- ***All prophylaxis to be continued in post op.***

REFERENCES

- Harrison’s principles of internal medicine, 17th edition
- Paul G Barash. Clinical Anesthesia, 6th edition
- Ronald D Miller. Miller’s Anesthesia, 7th edition
- K.D.Tirpathi. Essentials of medical pharmacology, 5th edition

REFERENCES contd.

- *Georgia Kostopanagiotou et al. Anesthetic and perioperative management of adult transplant recipients in non transplant surgery. Anesth Analg 1999;89:613-22*
- *H J Toivonen. Anaesthesia for patients with a transplanted organ. Acta Anaesthesiol Scand 2000;44:812-33*
- *Stephen B et al.Elective and Emergency Surgery in Renal Transplant Patients.Ann Surg 1976;3:266-70*

REFERENCES contd.

- *K.K. Venkat et al. Care of the renal transplant recipient in the emergency department. Annals of Emergency Medicine 2004;44(4):330-41*
- *Post et al. Immunosuppression in liver transplantation. Liver transplantation 2005;11(11):1307-14*
- *M.T.Keegan et al. The transplant recipient for nontransplant surgery. Anesthesiology Clin N Am 2004;22:827-861*

THANK YOU