ANAESTHESIA FOR RENAL TRANSPLANT (RECIPIENT)

Work with transplant patients is a matter of teamwork and communication. The anaesthetic care is only a small part of the overall care, and must be coordinated with the rest of the transplant team. *(This guideline is abbreviated, summarising anaesthetic/perioperative issues only)*

1.1 Preoperative Problems to consider

GENERAL ISSUES

Elective transplant patients will have been thoroughly assessed in the pre-admission clinic about one week preoperatively, and should be well prepared. Emergency patients will have been accepted onto the waiting list in the past, and may not have been thoroughly reviewed for some time. They need to be carefully reviewed, particularly for new or worsening co-moribidities

- Anaemia, Immunosuppression due to chronic illness, Delayed gastric emptying
- Co-existing disease - hypertension, CAD, generalised vascular disease, diabetes, autoimmune dysfunction, and medication of these.

PREOPERATIVE ASSESSMENT

- Timing of most recent dialysis (& completeness in emergency cases)
- Fluid balance and electrolyte/ acid-base abnormalities
- Note how much residual urine flow there is from the native kidney.
- Dialysis access – How 'fragile' has the fistula been?
- Psychological issues immediately before transplant
- Consider health of donor. Live donors generally are very well. If a cadaveric kidney, the notes (re donor) should be checked especially w.r.t. pre-existing hypertension in the donor.

1.2 Preparation

- Assess and manage co-existing problems
- Patient anxiety – explanation and reassurance plus consider anxiolytic premedication.
- Give usual medications but NOT ACEIs or ARBs ('Sartans'). Nephrologist may also choose to cease calcium antagonists preoperatively.
- Patient should be well hydrated. e.g. Give IV fluids to get weight about 2kg above dry weight.
- Patients are dialysed within 24 hours pre-operatively, or as close to theatre time as reasonably possible for emergencies.
- Check electrolytes/ glucose/albumin/FBC/Coags.
- Group & Screen *(see notes below re blood management and irradiation prior to transfusion)*
- Establish best site and time for CVL placement (n.b. there may be scarring or past problems, particularly from previous dialysis catheters or Permacaths). Generally avoid the subclavian route because subsequent thrombosis may jeopardise further AV fistula formation. Central line insertion may be before or after induction, depending on patient health status, anxiety, time constraints etc.
- PREWARMING by forced air warming in Anaesthetic bay. The Theatre may be cold – keep both the patient and yourself warm!
- The surgeons may spend some time preparing the kidney for transplant, stripping away excess tissue (perinephric fat etc) and revising the vascular (arterial or venous) anatomy so that there is only one site of patient-graft anastomosis. This may take an unpredictable amount of time.

1.2 Immunosuppression Therapy

* Immunosuppressive treatments may be started pre-operatively (This will be organised by the Transplant Unit).
* Immunosuppressive drugs occasionally need to be given in OR – This will be ordered by transplant team. *(Refer to team for ATG protocol if necessary)*
* ALL PATIENTS:- Give 500mg methylprednisolone at start of case (Giving it 'early' allows it time to take effect before graft implantation and associated inflammatory stimulus)

1.4 Anaesthetic Induction

* Arterial Line is not 'mandatory'; generally inserted before induction.
* Use separate pressure bags, manometers etc for Arterial and CVP lines.
* Avoid fistula arm for IV and NIBP. Pad, wrap and protect the fistula. (Fistula can be used if no other access but discuss this with surgeons before accessing)
* Try to avoid using cephalic veins (future fistulas).
* Monitor ECG/NIBP+/-ABP/SpO_2/$ETCO_2$&AA/nerve stimulator/CVP/ temp/UO/+/- Entropy
* Care with doses of drugs
* Either propofol (TIVA) or inhalational anaesthetics can be used.
* Atracurium conventionally used but rocuronium (and suggamadex if needed) also appropriate.

2 Intraoperative Management

* "Extra" care with sterile precautions as patient is immunocompromised.
* Maintain body temperature (Forced Air Warming & warm IV fluids).
* TED stockings plus Sequential Calf Compression Devices (SCDs)
* Check Patient position with surgeon. May require lumbo-sacral spine extension by 20° (position over break in table)
* Routine Antibiotics - 2gm cephazolin IV before skin incision unless allergic to cephalosporins. Give further 1gm IV after 6 hours, and continue for 48 hours.

a) Volume expansion

* Volume expansion is important in preventing transplant acute tubular necrosis.
* Despite 'extra' 2 litres fluid IV pre-operatively, ongoing vascular expansion is often needed.
* Give IV hydration using Hartmanns aiming to achieve a CVP of 14-16mmHg. (2 or even 4 litres may be required).
* Consider use of non-invasive 'cardiac output monitors' to guide fluid therapy
* Low albumin pre-operatively may also mean large fluid volumes are needed.

c) Muscle Relaxants

* The patient's sensitivity to muscle relaxants may be unpredictable.
* 'Good' predictable muscle relaxation is needed, especially at the time of the graft anastomosis and when the retractors are being removed prior to closure:- vigorous coughing may disrupt the anastomosis with catastrophic results.
* Relaxant either by infusion or 'by the clock' is appropriate.
* Use neuromuscular (TOF) monitoring to ensure relaxation.

b) Blood Management

- Blood transfusion has immunological consequences and is preferably avoided.
- Discuss with transplant surgeon/physician if non-emergent.
- Check with transplant team regarding other management regarding transfusion.

- Group and screen preoperatively:- Most patients are not transfused, so routine 'cross-match' is unnecessary. Note on the form that irradiated products are required if proceeding to transfusion.
- All Australian blood in Australia is now leucocyte depleted:- special leucocyte filters are no longer necessary.
- Blood products should be given in accordance to the Red Cross "flippin blood" guideline, and 'normal' blood intravenous administration sets used.

Donor Blood irradiation

- Irradiated blood is preferred due to possible danger of GVHD during immunosuppression. This risk is very low, but nevertheless irradiation is preferred for non-emergent transfusions.
- Blood irradiation can be performed in about 30 minutes, and reduces the shelf-life of blood stock. Hence for most patients it is reasonable to not irradiate blood until it is required.
- Please notify the laboratory in advance if the patient is a high-risk for transfusion (e.g. preoperative anaemia, surgical factors, etc), or if a large amount of irradiated product is likely to be required
- In emergencies, irradiated blood will not be available, in which case 'normal' blood must be used.

c) Heparin

* Given shortly before clamping of the iliac artery at request of surgeon:-
* Dose is about 2000 Units IV, depending on patient's size and thrombophilia tendency.

d) Transplant specific therapy

* 500mg methylprednisolone should be given at the start of case (as noted earlier). The logic of giving early is to give some time for the steroids to take effect prior to implantation of the graft.
* Before Kidney is reperfused, 120mg frusemide, and 25gm mannitol (0.25-0.5g/kg)
* Kidney is biopsied shortly after reperfusion. (Anaesthetist may be requested to sign path forms etc)

e) Maintenance of blood pressure

The transplant kidney is cold, ischaemic and in vasospasm. High perfusion pressures are needed to reperfuse the renal arteriolar system, particularly in the first fifteen minutes or so. If the donor is/was hypertensive, the graft kidney is expecting a high MAP. Even a healthy donor kidney needs a high pressure while it is reperfused and recovering from the cold ischaemic phase.

It can be sometimes quite difficult to achieve the desired perfusion pressure. Careful titration of anaesthetic depth, optimisation of fluid balance, use of dopamine and judicious use of vasopressor infusions may all be required to produce an adequate perfusion pressure.

Usual practice is to increase perfusion pressure at time of organ revascularisation by:-

* Fluids: keep CVP at levels above 15cmH_2O
* Reducing depth of anaesthesia if possible, while avoiding awareness and ensuring good muscle relaxation, as discussed above. (Entropy or BIS may be useful for this)
* Consider starting a Dopamine infusion to drive a raised cardiac output, and thus maintain increased MAP & hence renal perfusion. (e.g. 200mg in 50mls at 3-6mls/hr)
* Ketamine can be used to reduce inhalational agent or propofol and thus raise Blood Pressure
* Note:- Use of conventional vasopressors (metaraminol & phenylephrine) is somewhat controversial as some consider this may lead to intra-renal vasospasm.
* Discussion with surgeon is needed every time.

3 Postoperative Management

* Analgesia: PCA fentanyl; regular paracetamol; TAP catheter
* Patient goes to recovery for immediate postoperative observation. Transplant nursing staff, Registrar, and RMO review the patient in recovery and receive handover.
* CXR to check position of Central Line in PACU
* Ultrasound assessment of graft perfusion in PACU
* Postoperative diuresis can be vigorous (500-1000mls/hr) and needs to be replaced in equal volumes.
* Watch for pulmonary oedema due to fluid overload, esp. with pre-existing cardiac dysfunction etc.
* Arterial line stays in until the patient is stable in recovery and ready to go to Transplant Unit.
* Patient transferred to Transplant Unit for postoperative care, including ongoing immunosuppressive treatment and fluid/electrolyte management. CV Line is left in situ for postoperative monitoring

Comments

* **Sterility** is of utmost importance, as infective problems can be a major cause of morbidity and mortality
* **Care of fistula** throughout case. (Care with positioning arms.)
* **Check Blood loss,** but don't transfuse without discussion with surgeon;
* **Check Arterial Blood Gases** early in the case (baseline) and then after graft reperfusion.

CHECKLIST FOR TRANSPLANT RECIPIENTS

- **Check Preop Electrolytes Hb BGL**
- **G&S**
- **Preoperative Fluid status – aiming for good** *hydration*
- **Protect Fistula**
- **Avoid Hypothermia**
- **Any requests from Transplant team?**
  - *Continued communication is of importance throughout the whole procedure*
- **Antibiotics**
- **Methylprednisolone**
- **Heparin, Mannitol, Frusemide before reperfusion**
- **Maintain good muscle relaxation (especially during vascular anastomosis and for removal of retractors)**
- **Raised arterial pressure for fifteen minutes after graft reperfusion**
- **CRITICAL TIMES:-**
  - **Induction**
  - **Vascular anastomosis & reperfusion**
  - **Removal of Retractors**
  - **Handover to Transplant Unit team**

References

- Mayhew D, Ridgway D, Hunter JM Update on the intraoperative management of adult cadaveric renal transplantation. *BJA Education* 2016; **16(2)**; 53–57,
- Morkane CM et al Perioperative management of adult cadaveric and live donor renal transplantation in the UK: a survey of national practice. *Clinical Kidney Journal* 2019 (epub)
- Robertson E, Logan N, Peck N Anaesthesia for renal transplantation. *Anaesth Intensive Care Med* 2018; **19(2)**; 552-6
- Department of Anaesthesia, St Vincent's Hospital, CLINICAL RESOURCE - Anaesthesia for renal transplantation. Available at https://anaesthesia.org.au/web/resources.php

ANAESTHESIA FOR DONOR NEPHRECTROMY (LAPAROSCOPIC or OPEN)

Preparation

- Respect and honour the patient's altruism.
- Patients are 'by definition' healthy. They are well prepared by the Transplant Unit and Perioperative Clinic.
- Haemoglobin and Group & Screen are required at time of organ donation.
- Patients are prehydrated overnight (e.g. 120 mls/hr of Hartmanns from 8pm).
- DVT prophylaxis (Clexane, TEDS plus intraoperative SCDs)
- Offer an Anxiolytic Premedication
- Omit ACEIs or Sartans for at least three days preoperatively.
- Note:- No NSAIDs (such as Indocid) to be given preoperatively.
- 18g or 16g Intravenous line, ideally on ipsilateral (Donor) side. Fluid requirements are (usually) not great, and a hotline is not needed.

Induction etc

- Routine Induction (Inhalational or TIVA) Dexamethasone at start, ondansetron at end.
- Sterile Precautions (Mask, Goggles Gloves etc)
- Avoid hypothermia – prewarming and intraoperative forced air warming,
- Routine monitoring. Nasopharyngeal Temp. Arterial Line optional. CVL not needed.
- Urinary catheter inserted after induction.
- Prophylactic antibiotics
- TRICKY POINT - Avoid any drugs the recipient is allergic to.
- Avoid 'optional' drugs (especially NSAIDs) until after nephrectomy.

Operative Management

- Patient is positioned in lateral position (with bean bag) with some break in table and slightly head down.
- Mannitol 0.25 - 0.5 gm/Kg is given about 20-30 minutes before renal artery clamping.
- Heparin 2-3000u IV given shortly before renal artery clamping, at request of surgeon.
- Parenteral NSAIDs (if used) should not be given until after nephrectomy.
- Intravenous paracetamol & prophylactic antiemetic (ondansetron) given after nephrectomy.
- Note that the case ends reasonably promptly after nephrectomy.
- Ropivicaine 0.2% is infiltrated into wounds by surgeon.

(Laparoscopic Technique)

- Pneumoperitoneum increases CO_2 load but CVS effects seem not as dramatic as for cholecystectomy.
- In addition to the usual laparoscopy incisions, a low transverse abdominal incision is made to deliver the kidney.
- 'Good' relaxation during delivery of the kidney minimises graft trauma, but note that the case finishes promptly after delivery.
- Patients generally do 'well' on strong oral analgesia with 'rescue' prn parenteral fentanyl for PACU.
- PCA should be charted so that it is available, although many patients do not use it.

(Open Nephrectomy)

- Surgeon may insert a TAP catheter, or may be inserted with ultrasound.
- Regular Paracetamol and PCA Fentanyl is the main analgesic technique.
- Short-term regular NSAIDs may be considered.

Postoperative Management

- Hypovolaemia or dehydration may be bad for the sole remaining kidney. Hence chart IV fluids at 150-200 mls/hr
- Regular Paracetamol, 1gm qid (Oral or IV if not taking orally)
- p.r.n. Endone.
- Antiemetic & Fentanyl increments in recovery.