

ANESTHESIA FOR RENAL TRANSPLANT SURGERY IN ADULTS – INSTITUTIONAL PROTOCOL

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ABSTRACT

Renal transplant surgery may be associated with important perioperative complications. In this scenario, the anesthetic technique should provide optimal conditions for the surgical team, guarantee hemodynamic stability and kidney perfusion, and adequate analgesia. Preoperative evaluation should always be performed. In the intraoperative period, standard monitoring is sufficient in most cases. General balanced anesthesia, alone or in combination with spinal anesthesia or peripheral block, is the technique of choice. Management of blood pressure during the surgery is crucial. Before reperfusion, a mean arterial blood pressure of 65 mmHg is recommended, increasing to 80–90 mmHg when reperfusion is imminent until the end of surgery. Vasopressors, such as ephedrine, may be necessary to achieve blood pressure targets. Mannitol and furosemide are commonly used to increase urine output. In the postoperative period, analgesia should be ensured.

Key words: Renal transplantation. Anesthesia. Fluid management.

RESUMO:

A cirurgia para o transplante renal pode estar associada a importantes complicações perioperatórias. Neste cenário, a técnica anestésica deve prover condições ótimas para a equipe cirúrgica, garantir estabilidade hemodinâmica e perfusão renal e analgesia adequada. A avaliação pré-operatória deve sempre ser realizada. No período intraoperatório, a monitorização padrão é suficiente na maioria dos casos. Anestesia geral balanceada, sozinha ou em combinação com raquianestesia ou bloqueio periférico, é a técnica de escolha. O manejo da pressão sanguínea durante a cirurgia é crucial. Antes da reperusão, uma pressão arterial média de 65 mmHg é recomendada, aumentando-se para 80–90 mmHg na iminência da reperusão até o final da cirurgia. Vasopressores, como a efedrina, podem ser necessárias para que os alvos pressóricos sejam alcançados. Manitol e furosemida são comumente utilizados para aumentar o débito urinário. No período pós-operatório, a analgesia deve ser assegurada.

Palavras-chave: Transplante renal. Anestesia. Reposição volêmica.

INTRODUCTION

Renal transplant surgery has become the treatment of choice for most patients with end-stage renal disease, however, the risk of perioperative complications remains¹. In Brazil, about 60% of all kidney recipients suffer from postoperative delayed graft function and 10% have cardiovascular complication²⁻⁴. Furthermore, patients presenting to renal transplantation have extensive comorbidities, which may pose an important challenge to anesthesiologists⁵.

In this scenario, the anesthetic technique should provide optimal conditions for the surgical team, guarantee hemodynamic stability and perfusion of the transplanted kidney, and ensure adequate analgesia in the intra and postoperative period. Besides, acute complications related to the chronic kidney disease, such as hyperkalemia, should be diagnosed and treated.

Institutional protocols are important to establish a standard care, regardless of personal preferences. The protocol presented in this publication relies on international studies and should guide anesthesiologists on perioperative management for renal transplant surgery in adults at the Hospital Universitário Onofre Lopes.

PREOPERATIVE EVALUATION

- After assessing nephrology and other clinical specialties, it is recommended that patients have the following tests updated (maximum validity of 6 months): electrocardiogram, chest X-ray, and echocardiogram.
- Preanesthetic evaluation should be performed at the outpatient clinic (preferably) or at hospital admission.

HOPITAL ADMISSION

- In the moment of hospital admission, the following exams must be collected: complete blood count, glucose, sodium, potassium, calcium, prothrombin time, and partial thromboplastin time.
- Venous blood gases must be collected after hemodialysis prior to the start of kidney transplantation.
- Information about the last dialysis: dry weight, duration, losses, use of heparin, and complications during dialysis. Note: heparin is usually not used in hemodialysis before the transplant at our institution.

INTRAOPERATIVE MONITORING AND EQUIPAMENTS

- Continuous electrocardiogram (preferably DII, AVF, and V1/V5 leads).
- Non-invasive blood pressure measure (use appropriate cuff size).
- Pulse oximeter.
- Nasopharyngeal thermometer.
- Monitoring of the neuromuscular junction (TOF – Train of four).
- Central venous pressure measurement in the presence of central venous access. It should not be performed routinely.
- Invasive blood pressure measure in special clinical situations.
- Thermal blanket or thermal mattress.
- Target-controlled infusion pump.
- Continuous infusion pump.

VASCULAR ACCESSES

- Peripheral venous access (20 Gauge) is usually sufficient for anesthetic induction. A second more calibrated access can be punctured following anesthetic induction. Ultrasonography can be used.
- Catheterization of the radial artery with a 20-Gauge jelco on the opposite side to the arteriovenous fistula, before anesthetic induction, according to the patient's clinical conditions (should not be performed routinely).
- Central venous access must be placed after anesthetic induction, guided by ultrasound, and according to the clinical judgment of the team. It is not a routine recommendation. Preference is given to the internal jugular vein, followed by the subclavian vein. Femoral vein should be avoided.
- Protect the arteriovenous fistula to prevent loss or trauma. Verify fistula functionality before anesthetic induction and at the end of surgery.

ANTIBIOTIC PROPHYLAXIS AND IMMUNOSUPPRESSANTS

- Cefazolin 2g 30 minutes before the surgical incision.
- When indicated by the nephrology team, the administration of thymoglobulin must start in the room. Check if there was administration of hydrocortisone 200 mg previous to the thymoglobulin infusion.
- In the intraoperative period, administer methylprednisolone 500 mg before the release of the vascular clamp (dilution in 250 ml of crystalloid solution, infusion in 30 minutes).

ANESTHETIC TECHNIQUE

- General balanced anesthesia.
- Balanced general plus spinal anesthesia: perform neuraxial block only if a recent coagulogram is available and normal.
- Balanced general plus ultrasound-guided Transversus Abdominis Plane (TAP) block.
- Balanced general anesthesia plus wound infiltration with 0.5% ropivacaine.
- Note: there is no preference for any of the anesthetic modalities mentioned above. Epidural anesthesia is not recommended due to the increased risk of blood dyscrasia in chronic dialysis patients.

General anesthesia

Anesthesia induction

- Propofol 2.0 mg/kg or etomidate 0.2–0.3 mg/kg (evaluate hemodynamic status).
- Fentanyl: 3.0–5.0 mcg/kg or an equipotent dose of sufentanil.
- Cisatracurium: 0.2 mg/ kg.
- In obese, diabetic, uremic patients, or those without adequate fasting time, rapid sequence intubation must be performed with succinylcholine 1.0 mg/kg if serum potassium is < 5.5 mEq/L.
- The use of rocuronium for rapid sequence intubation or maintenance requires the use of sugammadex to reverse neuromuscular blocking, which is not recommended in patients with creatinine glomerular filtration rate < 30 ml/min/1.73m².

Anesthesia maintenance

- Sevoflurane 2.0–2.5% MAC.
- Maintain deep neuromuscular blocking with cisatracurium 0.05 mg/kg based on TOF or the estimated neuromuscular blocking agent half-life, especially after vascular clamping.

- Remifentanyl can be used for anesthetic maintenance (initial dose 0.05–0.1 mcg/kg/min).
- Dexmedetomidine can be used for anesthetic maintenance (0.3–1 mcg/kg/h). The loading dose (1 mcg/kg) is not essential. This α -2-agonist has been associated with decreasing incidence of ischemia-reperfusion injury and inflammation, as well as improvement in renal function.

Spinal anesthesia

- Hyperbaric bupivacaine: 5–10 mg.
- Morphine: 80–100 mcg.
- Fentanyl: 20 mcg (optional).

Ultrasound-guided Transversus Abdominis Plane (TAP) block

- Only ipsilateral to the surgical incision.
- Ropivacaine 0.5% or bupivacaine without vasoconstrictor 0.375%: 15–20 ml.

FLUID MANAGEMENT

- Do not use colloids.
- Do not use 0.9% saline solution as exclusive crystalloid
- Do not use pure ringer's solution.
- Use balanced volumes of 0.9% saline (50%) and buffered solutions (50%) (lactated ringer or PlasmaLyte®).
- Average crystalloid infusion of 10-15 ml/kg/hour, with the highest hydration rate in the ischemia period prior to reperfusion. The total average of fluids during the surgery must be 2000–2500 ml.
- If central venous pressure measure is available, a target of 5–8 mmHg is recommended at the beginning of vascular anastomoses and 12–15 mmHg at the reperfusion.
- Maintain mean arterial blood pressure > 65 mmHg before reperfusion.
- Maintain mean arterial blood pressure around 80–90 mmHg when reperfusion is imminent until the end of surgery.
- Extremely high blood pressure must also be avoided at the end of the procedure, due to the risk of vascular rupture. Control with sodium nitroprusside is recommended.

DIURETICS

- Mannitol: 0.5–1.0 g/kg (maximum 50 g). Start infusion during the preparation of venous and arterial anastomoses.
- Furosemide: 1.0–2.0 mg/kg after unclamping the arterial anastomosis.

VASOPRESSORS

- Use as single dose if mean blood pressure decreases more than 10%.
- Ephedrine 5.0 mg/ml.
- Metaraminol 0.2–0.5 mg/ml.
- Consider continuous infusion of noradrenaline (4 mg in 100 ml of 0.9% saline) if multiple doses of ephedrine or metaraminol are necessary, especially after reperfusion. Central venous access at the end of the procedure must be performed, if not previously placed.

INTRAOPERATIVE EXAMS

- Venous blood gas analysis in the following moments:
 - At the beginning of the surgery (after anesthetic induction).
 - After unclamping the arterial anastomosis.
 - Collect arterial blood gases, instead of venous, only if you have invasive arterial pressure.
- If previous reperfusion, potassium > 5.0 mEq/L, adjust with polarizing solution as mention bellow.

MANAGEMENT OF INTRAOPERATIVE HYPERKALEMIA

- Calcium gluconate 10%: 10 ml intravenous in 3 minutes, can be repeated after 5 minutes. Administer if electrocardiographic repercussions. In patients using digitalis, dilute in 100 ml of 5% glucose solution and infuse within 30 minutes.
- Furosemide: 1 mg/kg.
- Polarizing solution: 10 units of regular insulin in 100 ml of 50% glucose solution, infusion in 10 minutes. Action starts in 30 minutes. If the patient has very high blood glucose level, consider reducing the volume of 50% glucose solution to 50 ml.
- Sodium bicarbonate 8.4%: calculate base deficit (weight x base excess x 0.3) and replace half of the deficit in 15–20 minutes. If empirical administration, do not exceed 50 mEq (50 ml). Beware of the risk of pulmonary congestion and hypocalcemia.

POSTOPERATIVE ANALGESIA AND ANTI-EMETICS

- Dipyrone 30 mg/kg (maximum 2 g).
- Ondansetron 0.15mg/kg (maximum 8 mg).
- Tramadol 100 mg.
- If pain on awakening: morphine 0.05 mg/kg. Be careful when administering high doses of morphine due to the active metabolite M6G (morphine-6-glucuronide).

- Consider TAP block if it has not been done previously.
- Do not use NSAIDs.

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