Department of Anaesthesia
And Acute Pain Medicine
St Vincent's Hospital, Melbourne
CLINICAL RESOURCE

Anaesthesia for renal transplantation

Version 3

Introduction

The following is to provide guidance for the anaesthetic management of renal transplant recipients at St Vincent's Hospital Melbourne (SVHM).

All renal transplant cases are to have a consultant anaesthetist or experienced senior anaesthetic trainee in attendance.

Preoperative assessment, investigations and preparation

1. Preoperative dialysis will be arranged by renal team
2. ECG, CXR, Hb, EUC, Group and Hold should be checked
3. Preoperative immunosuppressive drugs prescribed and given on the ward as per renal protocol: Methylprednisolone (IV), Tacrolimus / Cyclosporine (PO), Mycophenolate (PO) and Basiliximab (IV) or Anti-Thymocyte Globulin (IV) as per individual patient protocol
4. Commence on sliding scale if history of diabetes or consider insulin infusion if significant hyperglycaemia persisting perioperatively. Endocrine referral should be made
5. Ensure following drugs/products available:
    a. Plasma-Lyte 148 balanced crystalloid 1L bags available
    b. Cephazolin 2g to be given on induction (or Vancomycin 1.5g in patients with severe penicillin allergy; 1g if <60kg).
    c. Frusemide 125mg (IV) aimed to be given slowly over 10 minutes prior to reperfusion
    d. Heparin 5000IU (Subcutaneous) intra-operatively & TED stockings (confirm with surgeon)
    e. Blood products are not routinely requested for, but if indicated, non-irradiated leukocyte depleted blood should be used

Monitoring and vascular access

1. Routine ANZCA monitoring including temperature probe and neuromuscular monitor
2. Label fistula arm, avoid placing vascular access, non-invasive blood pressure cuff or direct compression
3. Large bore peripheral IV access
4. Arterial line can be placed at the discretion of the anaesthetist

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5. Central venous access is not usually required but may be obtained at the discretion of the Anaesthetist, particularly in cases of difficult peripheral IV access
    a. There is insufficient evidence to suggest that routine CVP monitoring improves post-transplant graft function [7,8]
    b. Subclavian venous access is relatively contraindicated due to risk of thrombosis affecting future A-V fistula formation
    c. Vascath may occasionally be requested to aid post-transplant dialysis if indicated
6. Permacath already in-situ should be used for dialysis only
    a. In exceptional circumstances where emergency access is required, ensure the heparin lock is aspirated before use to avoid systemic anticoagulation
    b. Ensure strict sterility maintained at all times
7. Urinary catheter is placed by the surgeon and urine output should be monitored hourly post-reperfusion/ureteric anastamosis with meter burette bag

Intraoperative management

1. Induction
    a. Consider a rapid sequence induction in those patients with delayed gastric emptying
    b. Suxamethonium can be used if necessary, if serum potassium is within safe parameters
    c. Rocuronium is an alternative, used in conjunction with neuromuscular monitoring, bearing in mind this can have prolonged neuromuscular blockade
2. Maintenance
    a. Cis-atracurium and rocuronium can be used to maintain sufficient muscle relaxation as the graft is vulnerable to injury if abdominal muscles contract before wound closure. Sugammadex could be used for reversal if rocuronium is relaxant of choice
    b. Fentanyl is most commonly used due to its safety and tolerability in this cohort. Other opioids may be considered based on patient circumstances and clinician expertise
    c. Epidural analgesia is not used due to potential uraemic coagulopathy and potential difficulties in maintaining systolic blood pressure
    d. Avoid NSAIDs in renal transplants and severe CKD
    e. Propofol and sevoflurane have been shown to have similar outcomes with regards to haemodynamic control and graft outcome, so either can be used
3. Fluids and Reperfusion
    a. Plasma-Lyte 148 is the balanced crystalloid fluid of choice in Renal Transplant at SVHM. Where this is unavailable, a balanced crystalloid solution is appropriate. E.g. CSL
    b. 30-40mL/kg generally required throughout a case to improve perfusion of transplanted kidney
    c. Avoiding hypotension prior to reperfusion may improve early graft function. Fluid resuscitation should be first line, however vasopressors may be required for refractory hypotension
    d. K+ and Hb should be checked at a minimum immediately pre and post reperfusion. More frequent monitoring indicated if serum potassium > 5.0mmol/L, significant bleeding or prolonged cross-clamp time
4. BGL management
    a. BGL should be checked hourly, aiming for glycaemic target of 5-10mmol/L

    b. Hyperglycaemia is common in pre-existing diabetes and high dose steroids as part of immunosuppression regime
    c. Sliding scale in most instances is sufficient, however there is a low threshold for an insulin infusion to be commenced, as hyperglycaemia is a modifiable risk factor for ischaemic reperfusion injury
5. Positioning and Temperature
    a. Patient is positioned supine with arms out
    b. If a fistula is present, the arm should be placed on an arm board and appropriately protected to avoid any compression. Regular fistula assessment is warranted
    c. Maintain normothermia via upper body forced air warmer and fluid warmer

Early postoperative management

1. Continue with temperature, BGL and fluid management in recovery
2. Anaesthetist to contact the renal registrar and give relevant handover
3. Renal registrar to review patient and prescribe post-operative fluid orders and ongoing immunosuppression dosing
4. Electrolytes and urine output should be regularly checked
5. The patient should remain in PACU until haemodynamic status, analgesia, body temperature and potassium levels are normalised
6. Refer to APS

Analgesic options

1. In most instances fentanyl PCA + regular paracetamol will be sufficient
2. Consider step down to sublingual buprenorphine (200-400mcg) after 24-48 hours
3. In cases of severe post-operative pain or fentanyl allergy, hydromorphone or buprenorphine would be safe alternate options
4. Low dose Ketamine infusion or regional catheter could also be considered

References

1. Kikic Z, Lorenz M, Sunder-Plassmann G, Schillinger M, Regele H, Gyori G, et al. Effect of hemodialysis before transplant surgery on renal allograft function--a pair of randomized controlled trials. Transplantation. 2009 Dec 27;88(12):1377-85. PubMed PMID: 20029334.
2. Parekh J, Bostrom A, Feng S. Diabetes mellitus: a risk factor for delayed graft function after deceased donor kidney transplantation. American journal of transplantation : official journal of the American Society of Transplantation and the American Society of Transplant Surgeons. 2010 Feb;10(2):298-303. PubMed PMID: 20055796.
3. Parekh J, Niemann CU, Dang K, Hirose R. Intraoperative hyperglycemia augments ischemia reperfusion injury in renal transplantation: a prospective study. Journal of transplantation. 2011;2011:652458. PubMed PMID: 21904663. Pubmed Central PMCID: 3166717.
4. Schmid S, Jungwirth B. Anaesthesia for renal transplant surgery: an update. Eur J Anaesthesiol. 2012 Dec;29(12):552-8. PubMed PMID: 23010898.
5. Murphy EJ. Acute pain management pharmacology for the patient with concurrent renal or hepatic disease. Anaesth Intensive Care. 2005 Jun;33(3):311-22. PubMed PMID: 15973913.
6. Collins MG, Fahim MA, Pascoe EM, Hawley CM, Johnson DW, Varghese J, et al. Balanced crystalloid solution versus saline in deceased donor kidney transplantation (BEST-Fluids): a pragmatic, double-blind, randomised,

controlled trial. Lancet. 2023 Jul 8;402(10396):105-117. doi: 10.1016/S0140-6736(23)00642-6. Epub 2023 Jun 18. Erratum in: Lancet. 2023 Jul 1;402(10395):26. PMID: 37343576.
7. Adelmann D, Bicknell L, Niemann CU, Feiner J, Roll GR, Burdine L, et al. Central venous pressure monitoring in living donor kidney recipients does not affect immediate graft function: A propensity score analysis. Clin Transplant. 2018 May;32(5):e13238. doi: 10.1111/ctr.13238. Epub 2018 Mar 30. PMID: 29526051; PMCID: PMC6235164.
8. Wagener G, Bezinover D, Wang C, Kroepfl E, Diaz G, Giordano C, et al. Fluid Management During Kidney Transplantation: A Consensus Statement of the Committee on Transplant Anesthesia of the American Society of Anesthesiologists. Transplantation. 2021 Aug 1;105(8):1677-1684. doi: 10.1097/TP.0000000000003581. PMID: 33323765.
9. Carron M, Andreatta G, Pesenti E, De Cassai A, Feltracco P, Linassi F, et al. Impact on grafted kidney function of rocuronium-sugammadex vs cisatracurium-neostigmine strategy for neuromuscular block management. An Italian single-center, 2014-2017 retrospective cohort case-control study. Perioper Med (Lond). 2022 Jan 13;11(1):3. doi: 10.1186/s13741-021-00231-2. PMID: 35022076; PMCID: PMC8756660.
10. Ono Y, Fujita Y, Kajiura T, Okawa H, Nakashima J, Isobe H, Fujiwara Y. Efficacy and safety of sugammadex in patients undergoing renal transplantation. JA Clin Rep. 2018 Jul 25;4(1):56. doi: 10.1186/s40981-018-0192-z. PMID: 32025948; PMCID: PMC6966977.
11. Davison SN. Clinical Pharmacology Considerations in Pain Management in Patients with Advanced Kidney Failure. Clin J Am Soc Nephrol. 2019 Jun 7;14(6):917-931. doi: 10.2215/CJN.05180418. Epub 2019 Mar 4. PMID: 30833302; PMCID: PMC6556722.
12. Han S, Park J, Hong SH, Lim S, Park YH, Chae MS. Comparison of the impact of propofol versus sevoflurane on early postoperative recovery in living donors after laparoscopic donor nephrectomy: a prospective randomized controlled study. BMC Anesthesiol. 2020 Oct 28;20(1):273. doi: 10.1186/s12871-020-01190-9. PMID: 33115408; PMCID: PMC7592560.
13. Nieuwenhuijs-Moeke GJ, Nieuwenhuijs VB, Seelen MAJ, Berger SP, van den Heuvel MC, Burgerhof JGM, et al. Propofol-based anaesthesia versus sevoflurane-based anaesthesia for living donor kidney transplantation: results of the VAPOR-1 randomized controlled trial. Br J Anaesth. 2017 May 1;118(5):720-732. doi: 10.1093/bja/aex057. Erratum in: Br J Anaesth. 2021 Jan;126(1):340-341. PMID: 28510740.
14. Calixto-Flores A, Moreno-Arias JA. Effect of Intravenous Total Anesthesia on Hemodynamic Changes in Renal Transplant. Transplant Proc. 2020 May;52(4):1106-1109. doi: 10.1016/j.transproceed.2020.02.012. Epub 2020 Mar 17. PMID: 32192744.
15. Aulakh NK, Garg K, Bose A, Aulakh BS, Chahal HS, Aulakh GS. Influence of hemodynamics and intra-operative hydration on biochemical outcome of renal transplant recipients. J Anaesthesiol Clin Pharmacol. 2015 Apr-Jun;31(2):174-9. doi: 10.4103/0970-9185.155144. PMID: 25948896; PMCID: PMC4411829.
16. Othman MM, Ismael AZ, Hammouda GE. The impact of timing of maximal crystalloid hydration on early graft function during kidney transplantation. Anesth Analg. 2010 May 1;110(5):1440-6. PubMed PMID: 20418304.
17. Kinoshita K, Yamanaga S, Kaba A, Tanaka K, Ogata M, Fujii M, Hidaka Y, Kawabata C, Toyoda M, Uekihara S, Kashima M, Miyata A, Inadome A, Kobayashi T, Yokomizo H. Optimizing Intraoperative Blood Pressure to Improve Outcomes in Living Donor Renal Transplantation. Transplant Proc. 2020 Jul-Aug;52(6):1687-1694. doi: 10.1016/j.transproceed.2020.01.166. Epub 2020 May 21. PMID: 32448661.
18. Cavaleri M, Veroux M, Palermo F, Vasile F, Mineri M, Palumbo J, et al. Perioperative Goal-Directed Therapy during Kidney Transplantation: An Impact Evaluation on the Major Postoperative Complications. J Clin Med. 2019 Jan 11;8(1):80. doi: 10.3390/jcm8010080. PMID: 30642015; PMCID: PMC6351933.
19. Pham PC, Khaing K, Sievers TM, Pham PM, Miller JM, Pham SV, Pham PA, Pham PT. 2017 update on pain management in patients with chronic kidney disease. Clin Kidney J. 2017 Oct;10(5):688-697. doi: 10.1093/ckj/sfx080. Epub 2017 Aug 18. PMID: 28979781; PMCID: PMC5622905.

This Clinical Guideline is to be used in conjunction with existing St Vincent's Hospital Melbourne and ANZCA Policies.

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