

# Perioperative anaesthesia management of renal transplant recipients - A national cross-sectional survey

## INTRODUCTION

With the rising incidence of end-stage renal disease, renal transplants are now a standard procedure as they improve quality of life and reduce morbidity and mortality.<sup>[1]</sup> Renal transplant is complex surgery, especially in patients with multiple comorbidities. Evidence-based perioperative management becomes essential as these patients are frail and undergo complex procedures, and it ensures a better graft function and good perioperative outcome.<sup>[2]</sup> Advances in surgical technique, immunosuppressant drugs and anaesthesia management of renal transplants have resulted in better graft function and patient outcomes.<sup>[3]</sup>

There are no consensus national guidelines on the management of renal transplant recipients. Considering this, we designed this cross-sectional study to get an overview of the current practice pattern of anaesthesia management of renal transplant recipients.

## METHODS

A cross-sectional electronic survey was conducted using Google Forms circulated via email and WhatsApp from June 2022 to Jan 2023 to all members of the Indian Society of Organ Transplant and centres performing renal transplants across India (supplementary file s-1). According to the Mohan Foundation Website<sup>[4]</sup> and the National Organ and Tissue Transplant Organization approved hospital list, there are around 373 centres offering transplantation across India. Keyword searches (which included perioperative care, renal transplantation, anaesthesia management, survey and questionnaire) in various combinations were used in web tools, including Google Scholar, Embase, PubMed and Cochrane Review. Based on the literature obtained, a questionnaire was designed. Inputs were taken from specialists, including transplant surgeons, transplant physicians, anaesthesiologists and intensivists. All the critical steps in the perioperative management of anaesthesia for transplant surgery were considered while designing the questionnaire. The final questionnaire covered topics in the preoperative

workup, intraoperative management and postoperative care. We framed 30 questions, which were sent out to an expert panel consisting of 12 experts involved in transplant: transplant surgeons (two), transplant physicians (two) and anaesthesiologists (eight)–for content validation. Out of 12, 11 experts responded. They evaluated each question with their options for relevance. They were asked to rate questions on a 4-point scale. Item wise content validity index (I-CVI) was noted, and questions with I-CVI below 0.78 were rejected. Scale level content validity Index (S-CVI/Ave) for validation was found to be 0.91, and 25 questions were finalised. A pilot study was conducted by sending these 25 questions to all anaesthesiologists in the department. Ethical committee approval was obtained (NUH/IEC/2023/04/02). We ascertained responses by sending out reminders every month. There were no half-filled responses, as Google Forms were designed to make answering all questions mandatory. Data was collected in an Excel sheet, and quantitative data was expressed in frequency and percentages. Advanced statistics was performed using the Chi-square test, Fisher exact test and *t*-test.

## RESULTS

From the 373 transplant centres, 123 responses were received, with a response rate of 32.97%. These 123 centres contribute to more than 70% of transplants done annually in India. Based on responses received from various centres, we divided the data into high-volume (>100 transplants done annually) and low-volume (<100 transplants done annually) centres. The high-volume centres performed significantly more paediatric transplants than low-volume centres ( $P = 0.001$ ). Preoperative antihypertensive medication was continued on the day of surgery in 60.2% centres, while in 23.6% centres, it was withheld. There is a wide heterogeneity on which medications were continued and which were withheld. The time gap between preoperative haemodialysis and renal transplant surgery was longer in low-volume centres than in high-volume centres ( $P = 0.005$ ). Hyperkalaemia, if present, was managed with dextrose insulin infusion (53.7%) and a short spell of haemodialysis in 37.4% centres.

The anaesthesia technique of choice was general anaesthesia with endotracheal intubation in almost all centres. Wide heterogeneity existed in intraoperative fluid management across centres. Overall, 56% of centres used central venous pressure (CVP) to guide

fluid therapy to target a range of 8–18 cm water (H<sub>2</sub>O). Most centres targeted a specific range of systolic blood pressure (SBP) and mean arterial pressure (MAP). The range varied from 20% to 30% above baseline for SBP and 80–110 mmHg for MAP. Noradrenaline, followed by dopamine was the vasopressor of choice if required. Responses to other survey questions have been tabulated [Table 1, Figure 1].

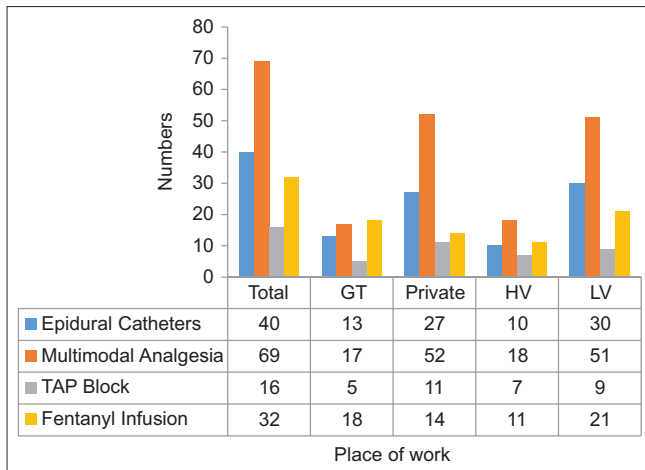
## DISCUSSION

We found wide variations in the perioperative management of renal transplant recipients across the country, and certain areas are not in consensus with the current literature reviews and meta-analysis. For instance, preoperative cardiac work is ambiguous. Treadmill test (TMT) is being used in some centres;

Table 1: Survey response to questions

Question	Number of centres (n=123)
Number of renal transplants done annually	
<25	38 (30.9)
25–100	51 (41.5)
100–250	23 (18.7)
>250	11 (8.9)
Paediatric renal transplants	
Yes/no	61 (49.6)/62 (50.4)
Anaesthesia part of multidisciplinary meet	
Yes/no	74 (60.2)/49 (39.8)
Schedule of haemodialysis before surgery	
Previous day	102 (82.9)/21 (17.07)
Yes/no	
Gap between haemodialysis and surgery	
12 h/24 h	90 (73.2)/33 (26.8)
Premedication used	
Anxiolysis/acid prophylaxis/both	17 (13.8)/34 (27.6)/72 (58.5)
Intravenous fluid of choice**	
0.9% Normal saline	78 (63.4)
0.45% Normal saline	13 (10.5)
Ringer lactate	27 (21.9)
Plasmalyte	42 (34.14)
Dextrose 5%	1 (0.8)
Various modalities for cardiac workup**	
Echocardiography	39 (31.7)
Treadmill test	48 (39)
Stress echocardiography	57 (46.3)
Coronary angiography	36 (29.2)
Myocardial perfusion scan	15 (12.2)
Diuretics used	
Furosemide/mannitol/both	50 (40.7)/18 (14.6)/55 (44.7)
Post-vascular anastomosis arterial blood gas and electrolytes sent	
Yes/no	73 (59.3)/50 (40.7)
Cardiac output monitoring for fluid therapy	
Yes/no/sometimes	15 (12.2)/85 (69.1)/23 (18.7)
Vascular access placed	
Central venous catheters always	53 (43.1)
Arterial and Central venous catheter	67 (55.3)
Arterial line sometimes	25 (20.3)
Deep venous thrombosis prophylaxis used	
Sequential compression devices	59 (48)
Low-molecular-weight heparin	42 (34.1)
Antiembolic stockings	33 (26.8)
None	23 (18.7)
Post-transplant patient shifted	
Specific renal transplant unit	119 (96.7)
General intensive care unit	4 (3.3)

Data expressed as numbers (percentages). n=numbers, \*\*Numbers may not match the total as there is an overlap of modalities



**Figure 1:** Commonly used modes of analgesia. GT = Government medical colleges/teaching institutes, HV = high-volume centres (>100 transplants annually), LV = low-volume centres (<100 transplants annually), TAP = Transversus Abdominis Plane

however, feasibility may be of concern due to limited effort tolerance in these patients. According to the American Heart Association guidelines, stress echocardiography is the modality of choice for pretransplant cardiac workup.<sup>[5]</sup> Invasive tests like coronary angiography are indicated if stress echocardiography/TMT is positive, though performed in almost one-third of the centres.

Multiple literature evidence advocates using a balanced salt solution as the perioperative fluid of choice. However, we found a statistically significant result ( $P = 0.02$ ) that low-volume centres continue to use normal saline, known to cause hyperchloraemic acidosis and hyperkalaemia with decreased blood flow to the graft kidney and acute kidney injury (AKI).<sup>[6,7]</sup>

The most controversial and challenging aspect of intraoperative fluid management is the crystalloid infusion required to maintain adequate graft perfusion. Goal-directed, targeted hydration to maintain a higher MAP (>80 mmHg) is recommended to preserve graft function.<sup>[8]</sup> Although commonly employed, administering fluids targeting CVP (used by 56.09% of respondents) can be replaced by newer parameters like transoesophageal echocardiography, pulse pressure variation and stroke volume variation.<sup>[9]</sup>

Preoperative haemodialysis reduces the risk of bleeding from uraemia and has an added advantage in correcting hyperkalaemia and fluid overload. A minimum 12 h gap between surgery and haemodialysis is recommended, as heparin is used during dialysis.<sup>[10]</sup> Our survey responses showed that almost all centres use diuretics

after clamp release despite doubtfulness of its real indication.<sup>[11]</sup> The incidence of delayed graft rejections, AKI and post-transplant diabetes mellitus increases with loop diuretics.<sup>[12]</sup> Mannitol in a lower concentration decreases the need for loop diuretics, resulting in reasonable diuresis in renal transplant surgery.

Opioid-sparing, multimodal analgesia is preferred in these patients. Epidural analgesia may not be the best choice due to uraemia-associated platelet dysfunction and circulating heparin post-haemodialysis.<sup>[3]</sup> Our survey results showed that newer blocks like erector spinae plane block and quadratus lumborum blocks, though safe and effective in recipients, are not yet preferred for postoperative analgesia.<sup>[3]</sup>

## CONCLUSION

Owing to wide heterogeneity in the management of renal transplant surgeries, it is prudent to formulate a national guideline for perioperative anaesthetic management using evidence-based approaches for consistent outcomes.

### Study data availability

De-identified data may be requested with reasonable justification from the authors (email to the corresponding author) and shall be shared after approval per the authors institution policy.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### ORCID:

Alka Sachin Deo: <https://orcid.org/0000-0002-6885-2686>

Deepti Manjunath: <https://orcid.org/0000-0002-2307-0103>

Ambika Prasad: <https://orcid.org/0009-0006-3326-3175>

Deepa D: <https://orcid.org/0009-0000-6376-0996>

**Alka S. Deo, Deepti Manjunath, Ambika Prasad,  
Deepa D**

Department of Anaesthesiology, NU Hospitals, Bangalore,  
Karnataka, India

### Address for correspondence:

Dr. Alka S. Deo,  
Lumbini-35 Palace Garden Apartment, 23-24 Palace Cross Road,  
Bangalore, Karnataka - 560 020, India.  
E-mail: adeos2003@gmail.com

**Submitted:** 27-May-2023**Revised:** 26-Sep-2023**Accepted:** 02-Oct-2023**Published:** 21-Nov-2023**REFERENCES**

- Shroff S. Current trends in kidney transplantation in India. *Indian J Urol* 2016;32:173-4.
- Pérez Fernández M, Martínez Miguel P, Ying H, Haugen CE, Chu NM, Rodríguez Puyol DM, *et al.* Comorbidity, frailty, and waitlist mortality among kidney transplant candidates of all ages. *Am J Nephrol* 2019;49:103-10.
- Kumar L, Sahu S, Deo AS, Selvakumar R, Panchwag AA, Pavithran P. Recent advances in anaesthesia for abdominal solid organ transplantation. *Indian J Anaesth* 2023 67:32-8.
- Organ donation in India [Internet]. Available from: <https://www.mohanfoundation.org/>. [Last accessed on 2023 Sept 01].
- Lentine KL, Costa SP, Weir MR, Robb JF, Fleisher LA, Kasiske BL, *et al.* Cardiac disease evaluation and management among kidney and liver transplantation candidates: A scientific statement from the American Heart Association and the American College of Cardiology Foundation. *Circulation* 2012;126:617-63.
- Adwaney A, Randall DW, Blunden MJ, Prowle JR, Kirwan CJ. Perioperative Plasma-Lyte use reduces the incidence of renal replacement therapy and hyperkalaemia following renal transplantation compared with 0.9% saline: A retrospective cohort study. *Clin Kidney J* 2017;10:838-44.
- Toyonaga Y, Kikura M. Hyperchloremic acidosis is associated with acute kidney injury after abdominal surgery. *Nephrology (Carlton)* 2017;22:720-7.
- Singh A, Ramachandran R, Chandralekha C, Trikha A, Ray BR, Bansal VK, *et al.* Timing of intraoperative crystalloid infusion may decrease total volume of infusate without affecting early graft function in live related renal transplant surgery: A randomised, surgeon-blinded clinical study. *Indian J Urol* 2022;38:53-61.
- Kannan G, Loganathan S, Kajal K, Hazarika A, Sethi S, Sen IM, *et al.* The effect of pulse pressure variation compared with central venous pressure on intraoperative fluid management during kidney transplant surgery: A randomised controlled trial. *Can J Anaesth* 2022;69:62-71.
- Fielding-Singh V, Vanneman MW, Grogan T, Neelankavil JP, Winkelmayr WC, Chang TI, *et al.* Association between preoperative hemodialysis timing and postoperative mortality in patients with end-stage kidney disease. *JAMA* 2022; 328:1837-48.
- Sandal S, Bansal P, Cantarovich M. The evidence and rationale for the perioperative use of loop diuretics during kidney transplantation: A comprehensive review. *Transplant Rev (Orlando)* 2018;32:92-101.
- Sokooti S, Klont F, Tye SC, Kremer D, Douwes RM, Hopfgartner G, *et al.* Association of diuretic use with increased risk for long-term post-transplantation diabetes mellitus in kidney transplant recipients. *Nephrol Dial Transplant* 2022;37:1375-83.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**Access this article online**

Quick response code



Website:  
<https://journals.lww.com/ijaweb>

DOI:  
10.4103/ija.ija\_492\_23

**How to cite this article:** Deo AS, Manjunath D, Prasad A, Deepa D. Perioperative anaesthesia management of renal transplant recipients – A national cross-sectional survey. *Indian J Anaesth* 2023;67:S288-91.

## SUPPLEMENTARY MATERIAL [FOR ONLINE]

### S-1: Survey Questionnaire

1. Name of the hospital where you work.
2. Your designation?
3. Number of renal transplants done annually in your centre?
4. Does your centre perform paediatric renal transplants?
  - a. Yes
  - b. No
5. Preoperative cardiac function assessed (select whichever is applicable)
  - a. Treadmill test
  - b. Stress Echocardiography
  - c. Myocardial perfusion scanning
  - d. Coronary angiography
  - e. Others (please specify)
6. Prior to renal transplant, does a cardiologist evaluate these patients?
  - a. Always
  - b. Only if there is a significant history of cardiac disease
  - c. Patients above 50 years of age
7. Is there a multidisciplinary meeting, and is the anaesthesiologist part of it?
  - a. Yes
  - b. No
8. What is the schedule of dialysis preoperatively?
  - a. Two consecutive haemodialysis prior to surgery
  - b. Previous day
9. Time gap between surgery and haemodialysis
  - a. 12 h
  - b. 24 h
10. What is your practice on antihypertensive medications on the morning of surgery?
  - a. Withheld
  - b. Given
  - c. Some are given; please specify
11. What is the routine premedication used?
  - a. Anxiolysis
  - b. Acid prophylaxis (H2 blockers)
  - c. Both
12. What are routine investigations ordered on the day of surgery?
  - a. Complete blood counts, electrolytes, prothrombin time, international normalised ratio
  - b. Only serum electrolytes and bicarbonate
  - c. Complete blood counts, serum electrolytes
13. How is hyperkalemia managed on the morning of surgery?
  - a. Dextrose insulin infusion
  - b. Short spell of dialysis
  - c. Other, please specify
14. Technique of anaesthesia used for the renal recipient?
  - a. General anaesthesia
  - b. General anaesthesia with epidural anaesthesia
  - c. General anaesthesia with transversus abdominis plane block
  - d. Other, please specify
15. Intravenous fluid predominantly used in
  - a. 0.9% Normal Saline
  - b. 0.45% Normal Saline

- c. Ringer lactate
  - d. Plasmalyte
  - e. Others (please specify)
16. What vascular accesses are placed regularly in transplant recipients? (select applicable)
- a. Central venous access always
  - b. Central and arterial vascular access always
  - c. Arterial vascular access sometimes
  - d. No
17. Is cardiac output monitoring routinely done to guide fluid therapy in your centre?
- a. Yes
  - b. No
  - c. Sometimes
  - d. Comments
18. Do you target a specific central venous pressure value?
- a. Yes
  - b. No
  - c. If yes, what is your target central venous pressure?
19. Do you maintain a specific range of mean arterial pressures and systolic blood pressure in transplant recipients?
- a. Yes
  - b. No
  - c. If yes, please specify mean arterial pressures and systolic blood pressure range
20. Do you use vasopressors, and if yes, which ones are used?
- a. Dopamine
  - b. Noradrenaline
  - c. Phenylephrine
  - d. Not used
21. Do you routinely use deep venous thrombosis prophylaxis in your centre?
- a. Yes
  - b. No
  - c. If yes, sequential compression device/anti-embolic stockings/low molecular weight heparin
22. Post-vascular anastomosis, do you routinely send blood for arterial blood gases and electrolytes?
- a. Yes
  - b. No
23. What drug do you use to promote diuresis in a renal transplant recipient?
- a. Furosemide always
  - b. Mannitol always
  - c. Both sometimes
24. What is your routine protocol for postoperative pain management (select applicable)?
- a. Epidural catheters
  - b. Transversus abdominis plane block/catheters
  - c. Fentanyl infusion
  - d. Patient controlled analgesia
  - e. Multimodal analgesia
25. Postoperatively, where is renal transplant recipient shifted?
- a. Specific renal transplant unit
  - b. General Intensive Care Unit
  - c. Wards
  - d. Others (please specify)