

## Renal Transplantation-Anaesthetic Experience of 12 years: A Retrospective Study

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### Abstract

**Background:** Renal transplantation is the preferred treatment for end stage renal disease. Patients undergoing renal transplant surgery have several high risk features like cardiovascular diseases, diabetes mellitus and need for haemodialysis. Renal transplant anaesthesia requires a thorough understanding of the metabolic and systemic abnormalities in end stage renal disease, familiarity with transplant medicine and expertise in managing and optimizing these patients for the best possible outcome. The aim of this study was to find out the characteristics of patients, causes of ESRD, anaesthetic management and the impact of pre-existing diseases on intraoperative or early postoperative complications of the recipients.

**Methods:** In this retrospective study we described our experiences of 124 cases of living transplants from November 2004 – December 2016. We reviewed their medical history and noted age, sex, blood groups, causes of ESRD and history of dialysis. Preoperative investigation and preparation, as well as details of anaesthetic management, were also recorded.

**Results:** General anaesthesia was performed in almost 97% of patients and for the rest of them, combined epidural and general anaesthesia were done. The age of the patients was in the range of 15 – 65 years, with the majority of 30 - 39 years group. The mean of surgery duration was 4.5 ( $\pm 1.20SD$ ) hours. The most significant point during surgery is keeping the mean arterial pressure  $> 90mm$  Hg.

**Conclusions:** Preoperative patient optimization, intraoperative haemodynamic stability and postoperative care of renal transplant patients have contributed to the success of renal transplant programmed in our hospital.

**Keywords:** Anesthetic management, end stage renal disease (ESRD), living donor, renal transplant.

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### Introduction

Transplantation provides a near normal life and excellent rehabilitation compared to dialysis and is the preferred method of treatment for end stage renal disease patients. The kidneys are essential for adjusting body fluid

volumes, electrolyte composition, acid base balance and haemoglobin concentration.<sup>1</sup> Absence of the physiologic function of the kidneys leads to uremia. Effective and safe anaesthesia for renal transplantation depends on an understanding of the pathophysiology and biochemistry of uremia and its effect on the pharmacokinetics and metabolism of drugs used.<sup>2</sup> The short and long term outcome of kidney transplantation is influenced by perioperative fluid and drug treatment and the function and viability of the transplanted kidney seems to be optimized if graft perfusion is maximized through mild hypervolemia. At the same time careful balancing of intraoperative fluids is necessary against cardiovascular problems frequently encountered in patients with uremia. Close intraoperative monitoring, optimization of intravascular fluid volume status to maximize kidney perfusion and prompt correction of electrolyte disturbances (especially potassium) are key to short and long term success of renal transplants.<sup>3</sup>

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We conduct a retrospective analysis of 124 cases of living renal transplants to identify the trends according to patient's age, sex, blood groups, causes of chronic kidney disease, anaesthetic management and the outcome of patients in our hospital.

**Methods**

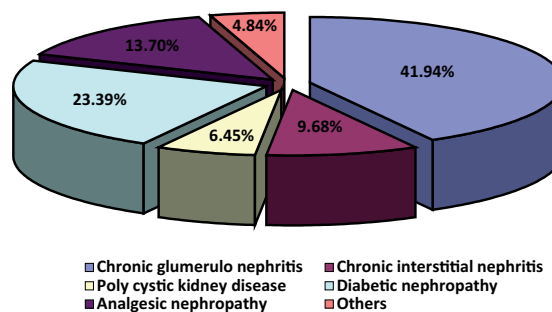
In this retrospective study we reviewed medical records of 124 cases of living kidney transplants conducting from November 2004 – December 2016 at BIRDEM General Hospital, Shahbagh, Dhaka. As per the hospital policy all drugs used and events that occurred peroperatively were recorded manually and a copy of the preoperative assessment and anaesthesia notes written by the concerned authority were preserved. We noted age, sex, causes of ESRD, preoperative status and history of dialysis. Preoperative preparations like premedication, fasting and routine investigations such as CBC, platelet

count, electrolytes, serum glucose, BUN, serum creatinine, PT, PTT, INR, liver function tests, urinalysis, ECG, chest radiograph and 2D Echocardiogram, details of anaesthesia management either general anaesthesia or regional anaesthesia or combined (general & regional) anaesthesia, monitoring and the outcome were also recorded.

All living donor nephrectomies were conducted under general anaesthesia with controlled ventilation. Our study was though focused on the management of the recipients of renal transplant yet we collected data of donors also.

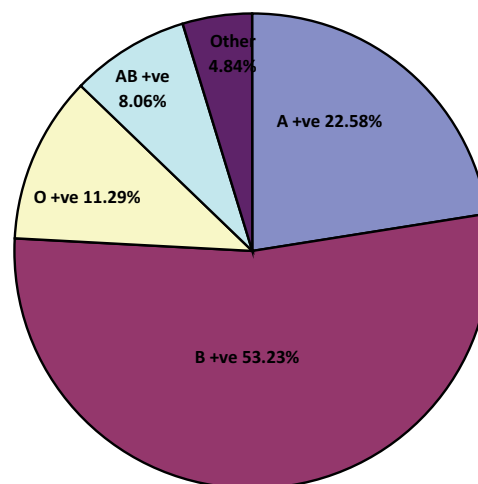
**Results**

A total of 124 patients who underwent renal transplantation at the study hospital from November 2004 to December 2016 were in the age bracket of 15 to 65 years, with majority of the patients were in 30 to 39 years age group. In relation with sex 69.35% patients were males and 30.65% patients were female. Average body weight was 60.15(±8.20SD) kg. The causes of end stage renal disease (ESRD) were chronic glomerulonephritis (CGN) 41.94%, diabetic nephropathy (DN) 23.39%, analgesic nephropathy (An.N) 13.70%, chronic interstitial nephritis (CIN) 9.68%, polycystic kidney disease (PCKD) 6.45%, and in 4.84% patients other causes were noted (Figure 1).



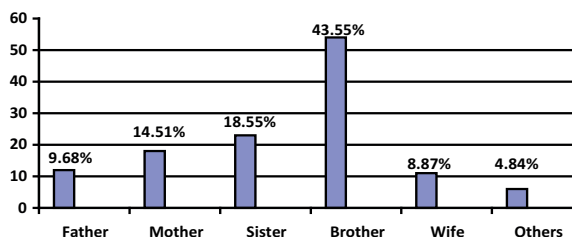
**Figure 1.** Pie chart of causes of end stage renal disease

Most of the patients 79.03% were on hemodialysis and rest 20.97% patients were not on any dialysis. Average duration of dialysis was 8 month. In relation with blood group 53.23% patients were B (+) ve, where 22.58% patients were A (+) ve, 11.29% patients were O (+) ve, 8.06% patients were AB (+) ve and 4.84% patients were other blood groups (Figure 2).



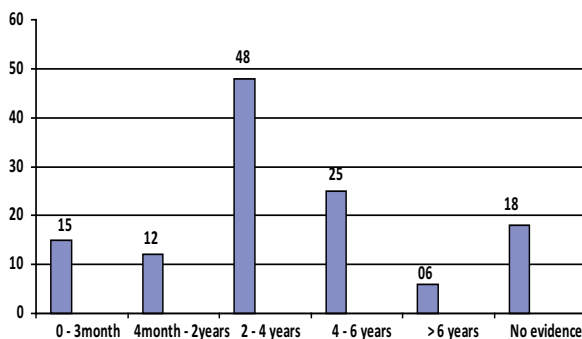
**Figure 2.** Pie chart of relation with blood group

In relation with kidney donor there was predominance of brother 43.55%, where sister were 18.55%, mother 14.51%, father 9.68%, wife 8.87% and others 4.84% were donated their kidney(Fig – 3).



**Figure 3.** Bar diagram of relation with donor

There was predominance of hypertensive patients with 77.42% and rests of 22.58% patients were normotensive. About 76.61% patients were nondiabetic while 23.39% were diabetic. Average duration of surgery was 4.5( $\pm 1.20$ SD) hrs and average duration of anaesthesia was 4.8( $\pm 1.28$ SD) hrs. The survival rate was 0 – 3months 15 cases, 4months – 2 years 12 cases, 2 – 4 years 48 cases, 4 – 6 years 25 cases and > 6 years 6 cases. There was no evidence of 18 cases regarding survival rate (Figure 4).



**Figure 4.** Bar diagram of rate of survival

#### Preoperative status

The most of the patients 98(79.03%) had been on hemodialysis & anemic. Average haemoglobin(Hb) was 7.8gm % (hematocrit 23.4). Hb was less than 7.8gm% in 21% of the patients. Iron supplements were given to 75% patients, while 5% received erythropoietin and 9% underwent preoperative blood transfusion. Serum potassium levels were in the range of 5 – 6.2 meq/l with an average of 4.5 meq/l( $\pm 0.64$  SD). Serum creatinine levels were in the range of 3.4 – 16 mg/dl with an average of 7.4 mg/dl ( $\pm 2.45$ SD). Human leukocyte antigen (HLA) match between donor and recipient tissue was done in all patients.

#### Anaesthetic management

The anaesthetic choice, in most of the cases (120) was general anaesthesia. For the rest of them, who were severely cardiac compromised we administered combined epidural and general anaesthesia.

In our center, all renal transplants were done electively. Perioperative immunosuppressive therapies were administered to all patients, according to our institutional protocol.

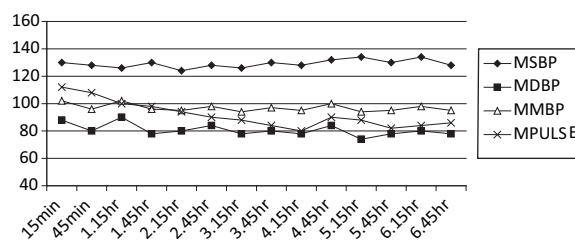
For reducing the risk of volume overload, hyperkalemia and achievement of a better hemostasis, hemodialysis

was performed for almost all recipients, within 24 hours before surgery. Pre medication one hour before surgery consisted of Ranitidine hydrochloride 150mg orally in addition to all other medications that the patients were receiving on a regular basis. Central venous line was inserted for all patients in Subclavian approach. Induction of anaesthesia was done with Propofol (2mg/kg) in 108(87.10%) cases, thiopentone (5mg/kg) in 12(9.68%) and with etomidate (0.2mg/kg) in 04(3.22%) patients. Neuro muscular blockade was maintained with Atracurium 0.5mg/kg. All patients were intubated and ventilated. Anaesthesia was maintained with 40% N<sub>2</sub>O in oxygen supplemented with fresh gas flow of 2l/min and continuous infusion of Propofol@ 20-30 ml/ hour. Analgesia was maintained with 25 $\mu$ g fentanyl every 30 minute interval.

Intraoperative monitoring included heart rate, non-invasive blood pressure, central venous pressure, continuous electrocardiogram, oxygen saturation and end tidal CO<sub>2</sub> in all patients. Intra operative hypertension was controlled with single or double bolus IV injection of 5 – 10 mg labetalol (28 cases) and inj. nitroglycerine 100 – 200  $\mu$ g (14 cases), to keep the mean arterial pressure (MAP) in the range of 90 – 105 mmHg. Average duration of surgery was 4.5hrs ( $\pm 1.20$ SD) and during this period intravenous fluid administered was normal saline and ringer lactate-based crystalloid.

The mean time of vessel grafting was 45 $\pm 7.5$  minutes, the renal artery was usually grafted to external iliac artery. After declamping of vessels all patients received injection furosemide 100mg (1 – 2mg/kg) and sodium bicarbonate 50 meq/l(1mEq/kg) IV slowly. In this period, according to color, stiffness and turgidity of the transplanted kidney in the hand of the surgeon, we tried to optimize the blood pressure (MAP > 90 mmHg), using rapid infusion of crystalloid or lower the level of anaesthesia.

Haemodynamic parameters were recorded on half hourly basis from the intraoperative charting. (Figure 5).

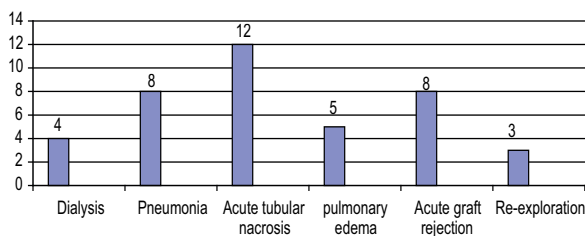


**Figure 5.** Hemodynamic parameter

At the end of operation, neuromuscular blockade was reversed with IV injection of neostigmine (0.05 mg/kg) with atropine (0.025mg/kg) and all patients were extubated smoothly.

### Postoperative care

Patients were transferred to post kidney transplant care unit. The most common problem in post kidney transplant care unit was pain & it was about 80% cases. The rescue analgesia was provided with IV morphine (4 – 6 mg) for 88 cases, IV pethidine (25 – 30 mg) for 24 cases, IV tramadol (50 mg) 08 cases and continuous epidural analgesia for rest of 04 cases. Dialysis support was needed in 4 cases in the post operative period due to anuria. Acute tubular necrosis (ATN) developed in 12 cases, 8 cases developed pneumonia and 5 cases developed pulmonary edema. Acute graft rejection was seen in 8 cases, of which 7 cases responded to thymoglobulin and immunosuppressants but one case was died. Re- exploration was needed in 3 cases, one for the thrombus in graft vessel, one for haematoma and another for releasing for obstruction (Figure 6). The rest of the patients received life-long triple drug immunosuppression.



**Figure 6.** Postoperative complication

### Discussion

The kidneys are essential for adjusting body fluid volumes, electrolyte composition, acid base balance and haemoglobin concentration.<sup>1</sup> Absence of the physiologic function of the kidneys leads to uremia. Effective and safe anaesthesia for renal transplantation depends on an understanding of the pathophysiology and biochemistry of uremia and its effect on the pharmacokinetics and metabolism of drugs used.<sup>2</sup>

Kidney transplantation is the treatment of choice for patients with end-stage renal disease.<sup>4</sup> It is more cost effective than maintenance dialysis and usually provides

the patient with better quality of life.<sup>5</sup> Any surgical procedure, in patients with CKD has a significant increase in the perioperative morbidity and mortality. Preoperative work-up and intraoperative management of patients with end-stage organ disease are certainly among the most difficult and challenging areas in anesthesia.

Factors responsible for good outcome are proper planning and team efforts by all concerned in the transplant team in addition to good preoperative preparation of the patient. Preoperative control of the systemic effects of CKD in recipients, well controlled intraoperative hemodynamic and good postoperative medical care resulted in success of the transplant programme.

The American Society of Anesthesiologists standard monitoring recommendation is usually followed. Patients with more advanced comorbid condition, like heart failure, may require more extensive monitoring, such as invasive blood pressure.<sup>6</sup>

Fluid management remains a controversial subject, in organ transplantation.<sup>7</sup> To keep the intravascular volume, crystalloid solutions are usually preferred. At the beginning of our experience, normal saline was the crystalloid of choice, although it might make the underlying acidosis worse and may eventually aggravate hyperkalemia. However in a recent randomized, double blind study comparing Ringer's solution and 0.9% normal saline during renal transplant the authors have shown those who received Ringer's solution had less hyperkalemia and acidosis. Therefore we changed our policy to use a combination of normal saline and Ringer's solution in equal amount<sup>8</sup>, our study shown the same result as previously authors have found. In another study, it has been shown that intraoperative tight control of metabolic acidosis by infusion of sodium bicarbonate, improves early post-operative renal function in renal transplant recipients.<sup>9</sup>

It is noteworthy that urinary flow rate is not subject to autoregulation. Tubular water reabsorption determines urinary flow rate and is closely related to the hydrostatic pressure in the peritubular capillaries.<sup>10</sup> Care should be taken to maintain normovolemia and normotension, to evade decreases in renal perfusion. Avoiding intraoperative renal insults and maintaining isovolemia, adequate cardiac output and renal perfusion pressure

are the best interventions to prevent postoperative kidney injury and are more important than the choice of a specific anesthetic technique.<sup>11</sup> In our experience, the color, stiffness and turgidity of kidney, under the hand of the surgeon, were the best indicators of adequacy of renal perfusion and predictors of graft functionality in the postoperative period.

In one study by Avner Sidi and Richard Kaplan, prolonged neuromuscular blockade has been reported in 8 out of 65 patients of renal transplant who had received either vecuronium (4 out of 29) or atracurium (4 out of 36).<sup>12</sup> In our study we used atracurium and no major complication was reported.

In the postoperative period, control of pain and agitation were the other challenges of the anesthesiologists. In the epidural technique used for four cases we observed postoperative pain would be better control.

Transplant anesthesia is a specialized field and poses a challenge for the attending anesthesiologist. Proper patient selection, preoperative patient preparation and intraoperative physiological stability with close association between nephrologist, urologists and anesthesiologists have found a valuable place in the management of our renal transplant patients and has given us good results. The type and amount of fluid replacement therapy and optimizing hemodynamic status before and during reperfusion of the transplanted kidney are of particular importance during renal transplantation surgery. Therefore, performing an appropriate anesthesia management and not a particular anesthetic regime can improve renal outcome, after renal transplant surgery.

**Conflict of interest:** Nothing to declare.

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