

## 200 hastada renal transplantasyon anestezi deneyimlerimiz: Bir retrospektif çalışma

### Anaesthetic experience of 200 renal transplantation cases: A retrospective study

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#### Özet

**GİRİŞ ve AMAÇ:** Böbrek nakli son dönem böbrek yetmezliği tedavisinde en iyi tedavi şeklidir. Anestezi yönetimi preoperatif, postoperatif ve intraoperatif dönem boyunca iyi planlanmalıdır. Böbrek nakli ile ilgili olarak birçok çalışma yapılmıştır. Bunlardan bazıları anestezi tekniklerini incelemiş olup bazıları anestezi ilaçların hasta ve nakil edilen böbrek üzerine etkilerini incelemişlerdir. Biz bu çalışmada böbrek nakli gerçekleştirilen 200 hastanın anestezi yönetimleriyle ilgili deneyimlerimizi sunmayı amaçladık.

**YÖNTEM ve GEREÇLER:** Verileri elde etmek için hasta dosyaları kullanıldı.

**BULGULAR:** Anestezi induksiyonunda intravenöz ajanlardan propofol (2 mg/kg), fentanil (2-3 µgr/kg) ve kas gevşetici olarak rocuronium (0.6 mg/kg) veya atracurium (0.6 mg/kg) kullanıldı. Operasyonda anestezi idamesi için % 1-2 izofluran (n: 67), % 1-2 sevofluran (n: 49), % 6-7 desfluran kullanıldı. İntraoperatif analjezik olarak remifentanil (0.25-0.5 µgr/kg/min) kullanıldı. Ortalama cerrahi süre 3.18 (±0.64 SS) saat, ortalama anestezi süresi 3,7 (±0.65 SS) saat olarak tespit edildi. Hastaların 135'i (67,5%) erkek 65'i (32,5%) kadındı ve 123 (61,5%) hastada canlıdan canlıya transplantasyon yapılırken 77 (38,5%) hastaya kadavradan yapılmıştır. Bu çalışmada hipertansiyon (27,5%, n: 55), diabetes mellitus ( 22,5%, n: 45), sebebi bilinmeyen (18,5%, n: 37), kronik glomerulonefrit (13,5%, n: 27), amiloidoz (8,5%, n: 17) and diğerleri (9,5%, n: 19) son dönem böbrek yetmezliği nedenleriydi. Akut rejeksiyon 21 (10,5%) hastada görülürken gecikmiş greft fonksiyonu 27 (13,5%) hastada görüldü. 24 (12%) hastada transplantasyon sonrası takiplerinde mortalite tespit edildi.

**TARTIŞMA ve SONUÇ:** Renal transplantasyon böbrek yetmezliği tedavisinde için iyi bir seçimdir ve anestezi yönetimi greft fonksiyonu için çok önemlidir. Bizim çalışmamızdaki anestezi yönetimi ve sonuçlarımız literatürle benzerdir.

#### Abstract

**INTRODUCTION:** Renal transplantation is the best method of treatment for end-stage renal disease. Anaesthetic management should be well-planned during preoperative, intraoperative and postoperative period. Several studies have done for renal transplantation anaesthesia. Some studies have investigated the anaesthesia technique, some of them investigated effect of anaesthetic drugs on patients and transplanted kidneys etc. In this study, we aimed to compare our results with literature and to present our experience of anaesthetic management in 200 renal transplantation patients.

**METHODS:** We used the patients' files for obtaining the data.

**RESULTS:** We used intravenous anaesthetics which were propofol (2 mg/kg), fentanyl (2-3 µgr/kg) and atracurium (0.6 mg/kg) or rocuronium (0.6 mg/kg) were used as muscle relaxants for the induction. During anaesthesia, 1-2% isoflurane (n: 67), 1-2% sevoflurane (n: 49) or 6-7% desflurane (n: 79) was used for maintenance of the anaesthesia. Remifentanil infusion (0.25-0.5 µgr/kg/min) was used for intraoperative analgesia. The average duration of the surgery was 3.18 hrs (±0.64SD) and anaesthesia was 3,7 hrs (±0.65SD). There were 135 (67,5%) male, 65 (32,5%) female patients and type of the transplantation was 123 living-related (61,5%) and 77 cadaveric (38,5%). End stage renal disease (ESRD) reasons were hypertension (27,5%, n: 55), diabetes mellitus ( 22,5%, n: 45), unknown (18,5%, n: 37), chronic glomerulonephritis (13,5%, n: 27), amyloidosis (8,5%, n: 17) and others (9,5%, n: 19) in this study. Acute rejection was seen in 21 (10,5%) cases and the delayed graft function was seen in 27 (13,5%) cases. 24 (12%) patients died during post-transplantation period.

**DISCUSSION AND CONCLUSION:** Renal transplantation is a good choice for chronic renal failure and anaesthetic management is so important for graft function. Our anaesthetic management and results are similar to the literature.

**Anahtar Kelimeler:** Anestezi yönetimi, Canlı verici, Kadavra verici

**Keywords:** Anesthetic Management, Living Donors, Cadaveric Donors

#### INTRODUCTION

The most common reason for kidney transplantation is the advanced and irreversible chronic kidney disease (CKD) (1). End-stage renal disease is enhancing

every year. The patients who have end-stage renal disease are commonly on dialysis. However, transplantation is the most important treatment method for many patients. Successful renal

transplantation increases the life duration and the quality of life and costs less than dialysis (2).

CKD patients who were treated by renal transplantation had less mortality rate than patients on dialysis (3). This shows that transplantation increases life expectancy and reduces mortality (4). In the last decade, outcome for both living and cadaver donor recipients has markedly improved due to the improvements in patient care, immunosuppressive treatment and new immunosuppressive agents (5).

We conducted a retrospective analysis of 200 cases of living and cadaveric renal transplants to identify the trends according to patient's age, sex, cause of chronic kidney disease (CKD), anaesthesia management and the outcome of patients in our hospital. The aim of this study is to share our experience of anaesthetic management in our renal transplantation patients.

## **MATERIALS AND METHOD**

In this retrospective study, with the approval of the local ethics committee, we reviewed transplantation unit's patients' medical records of 200 cases of living and cadaveric kidney transplants conducted from January 2005 to January 2014. We

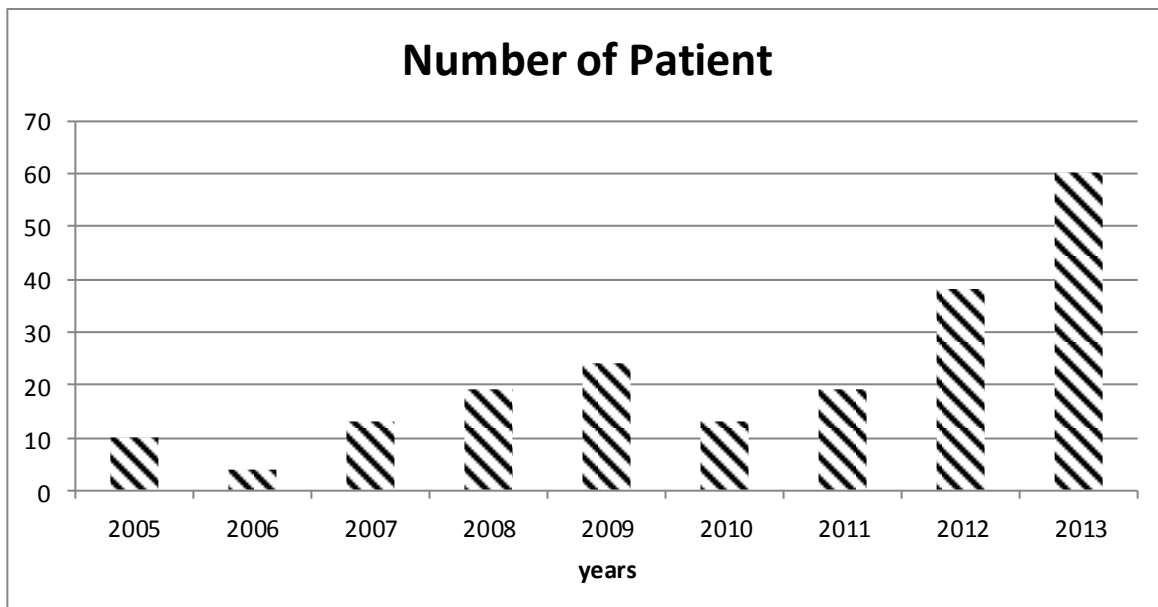
noted age, sex, type of transplant, cause of CKD, preoperative status, history of dialysis, preoperative and postoperative laboratory tests, ejection fraction (EF), mean arterial blood pressure (MAP), hearth rate, SpO<sub>2</sub>, central venous pressure (CVP), hot and cold ischemia time. We used the patients' files for obtaining the data. Preoperative preparations and investigations, details of anaesthesia management and monitoring, and the outcome were also recorded and entered into an electronic database.

Delayed graft function (DGF, defined as the need for dialysis within the first week following the transplantation), acute rejection (AR), postoperative surgical complications, postoperative infectious complications, serum creatinine - serum potassium at the hospital discharge and graft and recipient survival were the recorded outcomes of the current study. Lengths of hospital stay were also recorded.

## **RESULTS**

200 patients who underwent renal transplantation from 2005 to 2014, between the ages of 9 and 62, were included in the study (Figure 1). Patients' demographic data (age, height, body weight etc.) are shown in Table 1.

	All (n=200)	Living (n=123)	Cadaveric (n=77)
Age	35,29 ± 12,44	33,77 ± 12,89	37,70 ± 11,35
Sex (m/f)	135/65	90/33	45/32
Weight (kg)	65,30 ± 15,16	65,41 ± 15,77	65,13 ± 14,25
Height (cm)	164 ± 13,22	165,38 ± 13,21	162,75 ± 13,16
Anaesthesia time (min)	222,60 ± 55,80	226,80 ± 58,80	214,80 ± 50,40
Surgery time (min)	190,80 ± 54,60	196,20 ± 57,60	183,20 ± 49,20
Cold ischemia time (min)	448,75 ± 540,30	44,80 ± 7,47	1094,03 ± 279,89
Hot ischemia time (min)	38,15 ± 8,53	36,22 ± 6,97	41,23 ± 9,85
Hospital stay (day)	22,30 ± 9,73	21,11 ± 11,35	24,19 ± 11,40
Values are expressed in mean ± SD			
Table 1. Patients' Demographic Data			



**Figure 1:** Number of Patient According to Years

The most common anaesthesia technique was general anaesthesia (n:195,) and epidural anaesthesia was used in a few cases (n:5). In all cases which were applied general anaesthesia, we used the same intravenous anaesthetics which were propofol (2 mg kg<sup>-1</sup>), fentanyl (2-3 µgr kg<sup>-1</sup>) and atracurium (0.6 mg kg<sup>-1</sup>) or rocuronium (0.6 mg kg<sup>-1</sup>) were used as muscle relaxants for the induction. 1-2% isoflurane (n:67), 1-2% sevoflurane (n:49) or 6-7% desflurane (n:79) were used in the

oxygen-air mixture (Inspired O<sub>2</sub> 50%) for the maintenance of the anaesthesia. Analgesia was maintained with continuous remifentanyl infusion (0.25-0.5 µgr kg<sup>-1</sup> min<sup>-1</sup>). Heart rate, non-invasive or invasive blood pressure, oxygen saturation, end tidal CO<sub>2</sub> and electrocardiogram were monitored in all patients. Also, a central venous catheter was inserted in right or left and internal jugular or subclavian vein and central venous pressure was monitored in all patients. Invasive blood pressure was monitored in 12 (6%)

patients. Postoperative analgesia was controlled by Patient-controlled analgesia (PCA) which contains fentanyl. The average duration of the surgery was 3.18 hrs ( $\pm 0.64$ SD) and anaesthesia was 3,7 hrs ( $\pm 0.65$ SD). Immediate diuresis is achieved in 95% of kidneys from living donors and 65% from cadaveric donors. At the end of the operation, 0.04 mg/kg neostigmine and 0.02 mg/kg atropine were used intravenously to reverse the neuromuscular blockade. We extubated 178 of the patients in the operating room and patients were transferred to the surgical intensive care unit. The average length of the stay in hospital was 22.29 days.

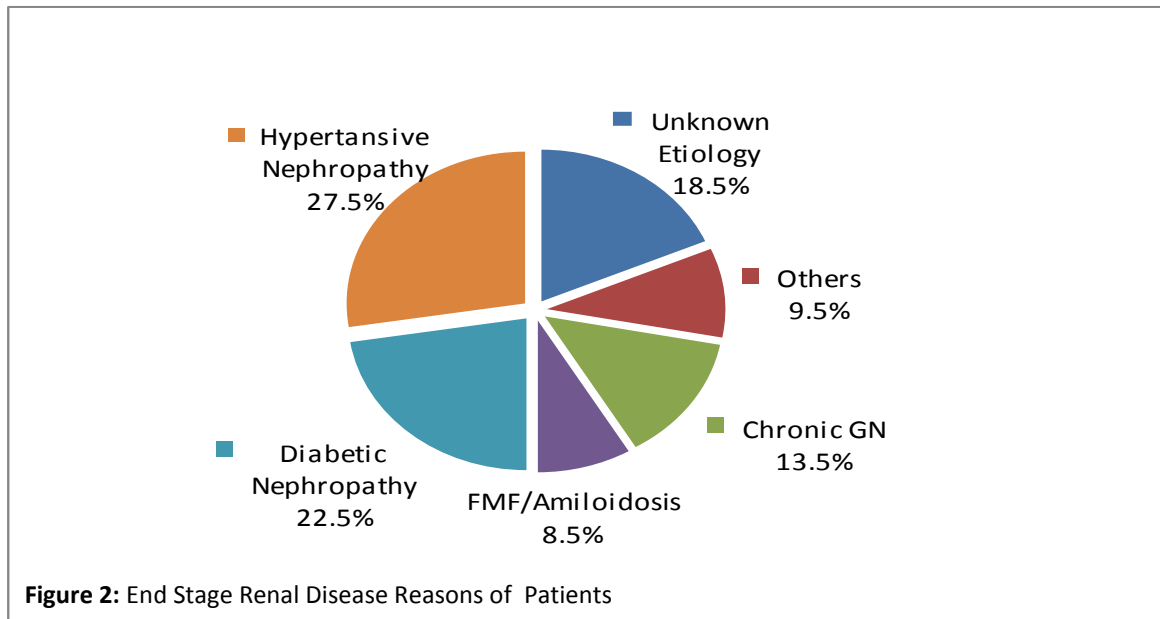
There were 135 (67,5%) male, 65 (32,5%) female patients and type of the transplantation was 123 living-related (61.5%) and 77 cadaveric (38.5%) Of the 123 living-related donors, 36 (%29.2) were mothers, 25 (%20.3) were sisters/brothers, 22 (%17,8) were wives, 22 (%17,8) were fathers (Table 2). For all living donors, because of the longer length of the renal vessels, the left kidney was chosen. The mean cold ischemia time (CIT) in the living donor was 44,80 min ( $\pm 7.47$ SD) and in the cadaveric donor was 1094,03 min ( $\pm 279,89$ SD). The mean hot

		Count	%
<b>Donor</b>	Living	123	61.5
	Cadaveric	77	38.5
<b>Relationship of Living Donor</b>	Mother	36	29.2
	Sister/brother	25	20.3
	Wife	22	17.8
	Father	22	17.8
	Others	18	14.6
<b>Diagnosis</b>	Hypertension	55	27.5
	Diabetes mellitus	45	22.5
	Chronic glomerulonephritis	27	13.5
	Amyloidosis	17	8.5
	Others	19	9.5
	Unknown	37	18.5
<b>Type of Dialysis</b>	Hemodialysis	105	52.5
	Peritoneal dialysis	48	24
	No dialysis	47	23.5
<b>Complications</b>	Acute rejection	21	10.5
	Delayed Graft Function	27	13.5
<b>Death Reasons (n:24)</b>	Renal Failure	8	33.3
	Sepsis	5	20.8
	Acute myocardial Infarction	4	16.6
	Pulmonary Infection	6	25
	Unknown Reason	1	4.1

**Table 2:** Patients' Data

ischemia time (HIT) in the living donor was 36.22 (6.97SD) and in the cadaveric donor was 41.23 ( $\pm 9.85$ SD). End stage renal disease (ESRD) reasons were hypertension (27.5%, n:55), diabetes mellitus ( 22.5%, n:45), unknown (18.5%, n:37), chronic glomerulonephritis (13.5%, n:27), amyloidosis (8.5%, n:17) and others (9.5%, n:19) in this study (Figure 2).

When the patients were evaluated preoperatively, of the 200 patients, 105 (52.5%) patients were on haemodialysis, 48 (24%) patients were on continuous ambulatory peritoneal dialysis (CAPD) and



47(23.5%) were on no dialysis. Preoperative average of haemoglobin (Hb) was 11.33 ( $\pm 2.17$ SD) g dl<sup>-1</sup>. Minimum Hb level was 6.7 g dl<sup>-1</sup> and maximum Hb level was 16.3 g dl<sup>-1</sup>. Preoperative average of the serum creatinine levels were 8.08 mg dl<sup>-1</sup> ( $\pm 2.76$ SD). Preoperative average of serum potassium levels were 4.69 mEq l<sup>-1</sup> ( $\pm 0.85$ SD). At the hospital discharge, average serum creatinine levels were 1.61 ( $\pm 0.08$ SD) and serum potassium levels were 4.11 ( $\pm 0.04$ SD). The major abnormality of electrocardiogram was ventricular hypertrophy (n:83). The mean ejection fraction was 60.45% in the preoperative echocardiography. The most common blood group among the patients was A group (41.5%). It was determined that 8 patients were infected with hepatitis B virus, 26 were infected with

hepatitis C virus and 3 were infected with both of them.

Acute rejection was seen in 21 (10.5%) cases and the delayed graft function was seen in 27 (13.5%) cases. 24 (12%) patients died during post-transplantation period. The death reasons were renal failure (n:8), sepsis (n:5), acute myocardial infarction (n:4), pulmonary infection (n:6), unknown reason (n:1) (Table 2). Nephrectomy was performed in 6 (3%) patients after the transplantation.

## DISCUSSION

Kidney transplantation increases survival for 5 years compared to dialysis (70% vs. 30%, respectively) (6). Because of this reason, kidney transplantation is the best treatment method for the patients with end stage renal disease (4). Also kidney transplantation improves the quality of life

and survival, and it is more cost effective than dialysis (7).

In this present study, 153 patients were in a dialysis program (haemodialysis or peritoneal dialysis) and 47 patients were not. Preemptive renal transplantation was applied on all of the 47 patients. Innocenti et al. emphasized that end stage renal disease can be treated the pre-emptive kidney transplantation successfully. To avoid unnecessary dialysis, preemptive kidney transplantation should be the initial therapy for the patient who suffers end stage renal disease (8). Because of this reason we aim to increase the number of pre-emptive renal transplantation.

In the United States, survival in the 1<sup>st</sup> and 5<sup>th</sup> years is 94% and 80% for living donor, respectively. However, survival in the 1<sup>st</sup> and 5<sup>th</sup> years is 89% and 60% for cadaveric donor, respectively (6). Due to better clinical condition and long-term survival, living donor transplantation percentage has increased about 5.8% between 2007 and 2011 (9). In the present study, according to the encouraging results in literature, number of living donor transplantation increased year by year and number was 6 in 2005 and 38 in 2013.

Anaesthetic management is important and also difficult in kidney transplantation.

Avoidance of nephrotoxic drugs is very important in the anaesthesia practice. And also fluid therapy should be applied cautiously. Sevoflurane, isoflurane and desflurane can be used safely for the renal transplantation anaesthesia (10). There are some concerns about sevoflurane due to Compound A. However, there is no evidence that Compound A effects the human renal function (11). In this study, the data showed that all of these volatile anaesthetics which were used safely in the study above (sevoflurane, desflurane and isoflurane) were used in our cases and It was consistent with the literature.

Prolonged neuromuscular blockade can be seen in both rocuronium and atracurium usage (12). In this present study, 178 patients operated under general anaesthesia were extubated in the operating room and we determined prolonged neuromuscular blockade in 17 patients and they needed mechanical ventilation supporting postoperatively.

Remifentanil was used in all cases operated under general anaesthesia in this study. Remifentanil is an opioid that is metabolized by esterase. Hoke et al. have shown that pharmacokinetics and pharmacodynamics of remifentanil do not change in renal diseases (13). Remifentanil

can be used safely in the renal transplant patient (14).

MAP should be maintained as 75 - 80 mmHg and the CVP should be maintained within the range of 10 to 12 mmHg (15). Campos et al. in 1966, performed consecutive renal transplants in their clinic; Graft survival with a MAP <93 mmHg were lower than MAP  $\geq$  93 mmHg (16). The results of our work in this current study were similar to the literature and intraoperative mean MAP was 95,9 ( $\pm$ 4.17SD) and mean CVP was 12.5 ( $\pm$ 0.6SD). 0.9% saline was infused in all of the 200 patients and average volume was 3547 ml ( $\pm$ 111SD).

Regional anaesthesia can be used as an anaesthetic technique in kidney transplantations. Postoperative pain control can be better with regional anaesthesia. However, it does not affect the prognosis (3). There were 5 patients who operated under epidural anaesthesia in our study and post-operative pain was controlled through the epidural catheter. 195 of the 200 patients were operated under general anaesthesia and postoperative analgesia was controlled by PCA. The average fentanyl consumption was 657,55  $\mu$ gr ( $\pm$ 18.4).

Anaesthetic management, anaesthetic drugs, intraoperative hemodynamics and intraoperative fluid therapy affect the graft function and survival. Preemptive renal transplantation may be preferred as a method of transplant.

In conclusion, our anaesthetic management and results are similar to the literature and according to our data, renal transplantation is an important treatment method for CKD. Because of importance, number of renal transplantation increases year by year. Although general anaesthesia was used in most cases, regional anaesthesia is a method which can be used for renal transplantation.

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