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Original Research Article

FACTORS INFLUENCING GRAFT FUNCTION IN DECEASED DONOR RENAL TRANSPLANTATION - A SINGLE CENTRE EXPERIENCE

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ABSTRACT

Background: Kidney transplantation offers improved survival and quality of life compared with long-term dialysis. Deceased donor renal transplantation (DDRT) helps address organ shortage, but delayed graft function (DGF) remains a common complication affecting outcomes. This study aimed to identify donor and recipient factors influencing graft function and assess their impact on early post-transplant outcomes.

Methods: A retrospective analysis was conducted on 48 adult deceased donor renal transplants performed at Government Mohan Kumaramangalam Medical College, Salem, between January 2019 and March 2025. Data on donor age, BMI, comorbidities, ventilatory support, as well as recipient age, BMI, comorbidities, waiting time, and pre-transplant creatinine levels, were collected. Cold ischemia time, graft function, rejection episodes, and early outcomes were analysed.

Results: Donors were young trauma victims with no comorbidities, and ventilatory support duration was slightly longer in DGF cases (2d 12h vs 2d 8h). DGF recipients were younger (38.2 vs 44.8 years), had higher BMI (22.39 vs 21.15), more comorbidities, and higher pretransplant creatinine (5.19 vs 4.56 mg/dL). Cold ischemia time was significantly longer in DGF (382 vs 262 min, p=0.008). Normal graft function at 12–24 months was higher in IGF (89.6% vs 22.9%, p=0.033), while DGF was associated with increased death with functioning graft (31.3% vs 12.5%, p=0.021), graft loss (8.3% vs 0%, p=0.024), and overall mortality (39.6% vs 12.5%, p=0.04). Rejection rates were similar.

Conclusion: Donor and recipient characteristics, particularly prolonged cold ischemia, significantly influence graft function. Optimising donor selection, recipient health, and minimising ischemia time may improve outcomes in DDRT.

Keywords: DGF, Graft Survival, Kidney Transplantation, Organ Transplantation, Renal Dialysis, Transplantation, Organ.

INTRODUCTION

Chronic kidney disease (CKD) affects more than 697 million people worldwide and remains a major public health concern. Its growing prevalence, largely due to ageing populations, increases the risk of cardiovascular complications and progression to end-stage renal disease (ESRD).[1] Kidney transplantation provides better survival and quality of life than long-term dialysis. However, the rising number of ESRD cases and limited organ availability have extended waiting times, highlighting the importance of understanding factors affecting transplant outcomes.[2] Deceased donor renal transplantation (DDRT), including the use of expanded criteria donor (ECD) kidneys, helps reduce the shortage of organs. Although ECD kidneys may show slightly lower graft survival, recipients experience better overall survival than those who continue on dialysis.[3]

India has a very low rate of organ donation and renal transplantation, with only 3.25 transplants per million population. Most patients with ESRD die within

months due to limited access and high treatment costs.[4] Tamil Nadu has a well-established DDRT program with a donation rate of 0.3 per million population, higher than the national average of 0.08. Our tertiary care centre actively participates in this program, receiving donors from nearby districts and managing a large waiting list of recipients, many with multiple comorbidities.[5]

Despite these challenges, our institution continues to perform DDRT with outcomes comparable to other centres. However, the incidence of delayed graft function (DGF) remains higher than that of immediate graft function (IGF). DGF, defined as the requirement for dialysis within the first week after transplantation, is a common early complication of kidney transplants. It occurs in about 20–50% of deceased donor and 4-10% of living donor transplants and is linked to higher risks of rejection and reduced graft survival.[6]

Prolonged cold ischemia time is a key factor affecting transplant outcomes, as each extra hour notably increases the risk of graft failure and patient death.[7] DDRT is uncommon in India, comprising less than 5% of all kidney transplants.[8] Although Tamil Nadu has a structured DDRT program, data from individual public tertiary centres are limited, highlighting the need for outcome evaluation. DGF, seen in about 25% of deceased donor transplants, is a frequent early complication linked to higher risks of acute rejection and reduced graft survival.[9,10] Therefore, this study aims to determine the donor and recipient factors affecting graft function in DDRT at our centre and to assess their relationship with early post-transplant outcomes.

MATERIALS AND METHODS

A retrospective analysis was conducted on 48 deceased donor renal transplants performed at Government Mohan Kumaramangalam Medical College, Salem, between January 2019 and March 2025. Ethical committee approval and informed consent were obtained from all patients.

Inclusion criteria

Adult recipients (≥ 18 years) who underwent DDRT at the centre between January 2019 and March 2025. Only blood group-compatible transplants with complete donor and recipient clinical data, including cold ischemia time, comorbidities, and perioperative details, were considered.

Exclusion criteria

Paediatric recipients < 18 years, living donor transplants, and ABO-incompatible or cross-match-positive transplants. Cases with incomplete donor or recipient clinical data, as well as recipients who died intraoperatively or within 24 hours post-transplant before graft function could be assessed, were also excluded.

Methods

All kidney transplants were blood group compatible. HLA matching was not performed, but cross-match testing used the complement-dependent microlymphocytotoxicity method. Donor data included age, BMI, comorbidities, cause of death, and ventilatory support duration; recipient data included age, BMI, comorbidities, waiting time, and pretransplant creatinine. Cold ischemia time and biopsy-proven complications were recorded. Immunosuppression included steroids, tacrolimus, and mycophenolate mofetil, with anti-thymocyte globulin 1.5 mg/kg and methylprednisolone added after February 2024. Acute cellular rejection was treated with three doses of intravenous methylprednisolone 500 mg each, and antibody-mediated rejection with plasmapheresis and intravenous immunoglobulin 100 mg/kg/day. DGF was dialysed within the first week; IGF required no dialysis. Follow-up included daily renal tests, Doppler ultrasound on day 3, biopsy on day 7, haemodialysis if needed, and rejection management.

Statistical analysis

Data were analysed using IBM SPSS Statistics v27. Continuous variables are expressed as mean ± SD, and categorical variables as frequencies and percentages. IGF and DGF groups were compared using a t-test, with $p \leq 0.05$ as significant.

RESULTS

Among the donors, the mean age was 29 years in the IGF group and 32.1 years in the DGF group. The mean BMI was 25.1 in IGF and 21.48 in DGF. None of the donors had comorbidities. The cause of death was a road traffic accident in all cases. The duration of ventilatory support averaged 2 days 8 hours in IGF and 2 days 12 hours in DGF [Table 1].

Table 1: Donor characteristics between graft functions

Donor characteristics	IGF (Mean)	DGF (Mean)
Age	29	32.1
BMI	25.1	21.48
Comorbidities	Nil	Nil
Cause of death	RTA	RTA
Duration of ventilatory support	2 days, 8 hours	2 days, 12 hours

IGF: Immediate Graft Function; DGF: DGF; BMI: Body Mass Index (kg/m²); RTA: Road Traffic Accident; ventilatory support duration shown in days and hours.

Recipients had a mean age of 44.8 years in the IGF group and 38.2 years in the DGF group. The mean BMI was 21.15 in IGF and 22.39 in DGF. None of the IGF recipients had comorbidities, while in the DGF group, 4 patients (10%) had diabetes mellitus and 2 patients (5%) had pulmonary tuberculosis. The

average time on the waiting list was 3 years and 3 months for IGF and 2 years and 9 months for DGF, and the mean pretransplant serum creatinine was 4.56 mg/dL in IGF versus 5.19 mg/dL in DGF [Table 2].

Table 2: Recipient characteristics between graft functions

Recipient's characteristics	IGF (Mean)	DGF (Mean)	
Age	44.8	38.16	
BMI	21.15	22.39	
Comorbidities	Nil	DM	4
		PTB	2
Time on waiting list	3 years, 3 months	2 years, 9 months	
Serum creatinine pretransplant	4.56	5.19	

IGF: Immediate Graft Function; DGF: DGF; BMI: Body Mass Index (kg/m²); DM: Diabetes Mellitus; PTB: Pulmonary Tuberculosis; waiting time in years and months; serum creatinine in mg/dL

Longer cold ischemia time in DGF (406 min) versus IGF (334 min, p=0.008). Normal graft function at 12 months was higher in IGF (100%) than DGF (82.9%, p=0.373). Death with functioning graft (4 cases of DGF), graft loss (3 cases of DGF), and overall mortality were also higher in DGF [Table 3].

Table 3: Comparison of outcomes between graft functions

Variables	IGF	DGF	P value
Recipient age (years)	44.8	38.16	0.377
Donor age (years)	29	32.1	0.592
Cold ischemia time (min)	334	406	0.008
Normal graft function at 12 months (%)	100	82.9	0.173
Death with functioning graft	0	4	-
Graft loss	0	3	-
Recipient age (years)	44.8	38.16	0.377
Donor age (years)	29	32.1	0.592

IGF: Immediate Graft Function; DGF: DGF; cold ischemia time in minutes; values expressed as mean or number of patients; P value indicates statistical significance

DISCUSSION

This study aimed to identify factors influencing graft function in deceased-donor kidney transplantation. Donor factors such as age, BMI, and ventilatory support, along with recipient factors including age, BMI, comorbidities, waiting-list duration, and pretransplant creatinine, were found to affect graft outcomes. DGF was associated with longer cold ischemia, reduced graft function, higher graft loss, and increased mortality, while rates of rejection were similar.

In this study, donors were young, healthy trauma-related deaths, with slightly longer ventilatory support in DGF cases. Similarly, Kernig et al. the mean donor age was 51.4 ± 15.3 years in the IGF group and 55.7 ± 14.4 years in the DGF group; older donor age is linked to a higher risk of DGF.[10] Weissenbacher et al., the mean donor BMI was 24.69 ± 3.44 kg/m². DGF rates increased with donor BMI: 22.5% for <18.5 kg/m², 31.0% for 18.5–24.9 kg/m², 37.3% for 25–29.9 kg/m², and 51.2% for ≥30 kg/m². Higher donor BMI is associated with increased risk of delayed DGF.[11] Mehta et al. in a study of 37 deceased-donor kidney transplants, the mean donor ventilatory support duration was 3.5 ± 1.5 days, indicating donor ventilatory support averaged 3.5 days in deceased-donor transplants.[12] Therefore, donor age, BMI, and ventilatory support influence DGF; careful donor selection and optimised management may improve transplant outcomes.

In our study, recipients in the DGF group were younger, had slightly higher BMI, more comorbidities, shorter waiting-list times, and higher pretransplant serum creatinine than IGF recipients. In Kernig et al. the mean recipient age was 50.9 ± 13.6 years in the IGF group and 54.3 ± 13.3 years in the DGF group. Recipient characteristics like age, BMI, and comorbidities affect DGF.[10] Veroux et al. in a study of deceased-donor kidney transplantation, recipients with DGF had a longer mean waiting-list time of 19.4 ± 12.8 months, and longer waiting-list time is associated with increased risk of DGF.[13] Thus, recipient age, BMI, comorbidities, and waiting-list duration influence DGF; careful recipient evaluation may improve transplant outcomes.

Our study shows that transplant outcomes were worse in the DGF group, with longer cold ischemia, lower graft function, higher graft loss and mortality. Similarly, Nieto-Ríos et al. in a large cohort of deceased-donor kidney transplants, longer cold ischemia time was significantly associated with DGF, with each additional hour increasing the risk (OR 1.10, 95% CI 1.04–1.16, p < 0.01). Longer cold ischemia increases DGF, worsening transplant outcomes.[14] Hall et al. in a multicenter cohort of 560 deceased-donor kidney transplants, recipients with DGF had lower 12-month eGFR (48 ± 22 mL/min/1.73 m²) compared with those without DGF (60 ± 22 mL/min/1.73 m²) and were more likely to have eGFR below 30 mL/min/1.73 m² (18% vs 8%, adjusted RR 1.9, 95% CI 1.2–3.1), DGF reduces 12-month eGFR and increases renal impairment risk.[15] Lim et al. in a paired kidney

transplant study of 74 donor-pairs, recipients with DGF had a higher 3-year graft loss rate compared to those without DGF (14% vs 4%, P = 0.04). DGF increases three-year graft loss compared to immediate function.[16]

Similarly, Salguero et al. reported in a single-centre study of deceased-donor kidneys, DGF was an independent risk factor for graft loss (HR 4.17, 95% CI 1.93–9.01, P < 0.01). DGF independently increases the risk of graft loss significantly.[17] Tapiawala et al. in a large study of deceased-donor kidney transplant recipients, DGF was associated with a higher risk of death with a functioning graft (adjusted hazard ratio 1.53, 95% CI 1.45–1.63). DGF increases the risk of death with a functioning kidney graft.[18] Li et al. in a study of single-centre kidney transplants, patients with DGF had higher odds of mortality at one-year post-transplant (OR 2.32, 95% CI 1.53–3.50, P < 0.01). DGF increases the one-year post-transplant mortality risk significantly.[19] This shows that DGF is associated with longer cold ischemia, reduced graft function, lower eGFR, higher graft loss, and increased mortality. Reducing ischemia time and careful donor-recipient selection may improve graft survival and patient outcomes.

Limitations

The study's retrospective, single-centre design with a small sample limits generalizability. Lack of HLA matching and detailed immunological data, short follow-up, and potential donor-recipient selection bias may have influenced outcomes and associations with DGF.

CONCLUSION

Graft function in deceased donor kidney transplantation is influenced by both donor and recipient factors, with longer cold ischemia time strongly linked to DGF and poorer outcomes. Recipients with comorbidities and higher pretransplant creatinine are at more risk of complications. Optimising donor selection, managing recipient health, and reducing ischemia time can improve graft survival and patient outcomes. Careful monitoring and early intervention remain crucial for transplant success. This highlights the need for strategies to enhance graft function and overall survival in deceased donor transplants.

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