RESEARCH ARTICLE

Short-term clinical outcomes of kidney paired donation in living donor kidney transplants: A retrospective study

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Abstract

Objective: To evaluate short-term outcomes and patient survival among kidney paired donation cases in living donor kidney transplants.

Method: The retrospective, observational study was conducted in December 2024 at the Department of Kidney Transplantation Surgery, Pakistan Kidney and Liver Institute and Research Centre, Lahore, Pakistan, and comprised medical records of patients who underwent kidney paired donation living donor transplants from August 3, 2022, to July 9, 2024. Data included demographics, intraoperative and postoperative variables, delayed graft function, length of hospital stay, surgical site infection, rejection rates, graft survival and patient survival at one year. Data was analysed using SPSS 27.

Results: Of the 28 subjects in 14 pairs, 20(71.4%) were females and 8(28.6%) were males. The overall mean age was 32.62±14.05 years and the median dialysis duration was 8 months (interquartile range: 10 months). The primary cause of end-stage renal disease among the recipients was unknown in 19(67.9%) cases. Postoperative creatinine levels were stable at 3, 6, 9 and 12 months, and there was only 1(3.6%) graft loss which was owing to acute T-cell-mediated rejection. No cases of delayed graft function and 30-day mortality were noted. Mean length of hospital stay was 6.62±1.50 days. There were 2(7.1%) cases facing complications, including surgical site infection and arterial anastomosis leakage. At 12 months, graft survival rate was 27(96.4%) and patient survival rate was 28(100%).

Conclusion: Kidney paired donation in living donor kidney transplants demonstrated favourable short-term outcomes, with high graft survival and low complication rates.

Keywords: Kidney paired donation, Living donor kidney transplant, Graft survival, Patient survival, Perioperative outcomes, Short-term outcomes, Kidney transplantation. (JPMA 76: 893; 2026)

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Introduction

Chronic kidney disease (CKD) is a global health challenge, affecting approximately 11-13% of the population.[1] For patients with end-stage renal disease (ESRD), kidney transplantation remains the treatment of choice due to its superior outcomes in terms of quality of life (QOL), mortality and life expectancy compared to dialysis.[2] However, the shortage of deceased donor organs worldwide has created a reliance on living donor kidney transplantation (LDKT) programmes.[3] Long-term graft survival (GS) for living donor transplants is better than for deceased donor transplants, which may be because of less dialysis time or even the absence of dialysis altogether.[4]

The initial transplantations in Pakistan were conducted from living-related donors in 1979. At present, there are a total of 19 renal transplant centres, consisting of 11 specialised kidney centres dealing with kidney transplantation surgeries.[5] Kidney paired donation (KPD), also known as kidney pair exchange, is the latest strategy adopted to overcome most of the different types of mismatches between a donor and his/her recipient, like blood group ABO incompatibility, donor specific antibodies (DSAs) or positive flow cross-matches (FCXM). This strategy enables incompatible donor-recipient pairs to swap kidneys with other pairs, thereby ensuring compatible transplants for all recipients.[6,7] Advanced algorithms and desensitisation techniques help KPD expand the donor pool and increase the possibility of successful transplantation. Although the results are promising, ethical issues like equal access and donor autonomy require transparent guidelines for its implementation.[7,8]

The Pakistan Kidney and Liver Institute and Research Centre (PKLI&RC), Lahore successfully executed the country's first paired kidney exchange transplant, involving two male recipients, on August 3, 2022. Due to this significant achievement, Pakistan joined the list of countries having the ability to perform such an intricate transplant operation. In case of pre-transplant evaluation of the donor's kidneys, the kidneys were incompatible to their recipients, but compatible transplants were made via the KPD programme.[9]

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KPDs are, potentially, programmes in organ donation through altruistic donation, international coordination, and ethics, aimed at enhancing equitable access to kidney transplantation for patients across the globe. Further development will also help solve part of the outstanding needs.[10,11]

To our knowledge, data on KPD outcomes in Pakistan is scarce. The current study was planned to fill the gap in literature by assessing short-term outcomes and patient survival (PS) among KPD cases in living donor kidney transplants.

Materials and Methods

The retrospective, observational study was conducted in December 2024 at the Department of Kidney Transplantation Surgery, PKLI&RC, Lahore, Pakistan, and comprised medical records of patients who underwent KPD living donor transplants from August 3, 2022, to July 9, 2024.

After approval from the institutional ethics review board, the sample size was calculated using G*Power 3.1.[12] A priori power analysis for chi-square goodness-of-fit tests (contingency tables) was conducted using an effect size (w) of 0.98 based on the one-year GS rate reported by Leeser et al.[13] with alpha level 0.05, power 0.95, and degree of freedom.[5] The sample size was inflated by >30% to achieve higher statistical power. The sample was raised using convenience sampling technique. Those included were patients who had completed at least one-year post-transplant follow-up. Patients with incomplete one-year data or those lost to follow-up before one year were excluded.

Demographic and clinical data was extracted from the electronic medical records using a standardised data-collection form. The primary outcome was the GS rate at one-year post-transplant, defined by the functionality of the transplanted kidney as evidenced by stable serum creatinine levels and the absence of acute rejection episodes. Secondary outcomes included creatinine levels at 3, 6, 9 and 12 months post-transplant, rates of delayed graft function (DGF), graft loss, patient death, and perioperative complications. Additional analyses focused on factors such as donor and recipient age, gender, human leucocyte antigen (HLA) mismatches, and ischaemia times.

Data was analysed using SPSS 27. Descriptive statistics were used to express continuous variables as mean± standard deviation or median with interquartile range (IQR), while categorical variables were expressed as frequencies and percentages. P<0.05 was considered statistically significant.

Results

Of the 32 patients assessed, 28(87.5%) in 14 pairs met the inclusion criteria; 20(71.4%) females and 8(28.6%) males. The overall mean age was 32.62±14.05 years. Majority of the patients were part of the KPD programme due to their incompatible blood group with the family donors 27(94.6%), while 1(3.6%) patient had DSAs against the family donor. The recipient gender was predominantly male 25(89.3%), while the donor gender was predominantly female 20(71.4%). Most recipients were adults 25(89.3%), while 3(10.7%) were paediatric patients. The median duration of dialysis before transplant was 8.0 months (IQR: 10 months). The mean recipient age was 32.62±14.05 years, while the mean donor age was 35.62±7.57 years. The mean body mass index of the recipients was 22.73±5.95kg/m^2, while that of the donors was 24.65±4.43 kg/m^2. The majority 26(92.9%) were cases of first transplant, while 2(7.1%) were cases of second transplants.

In terms of blood group distribution, 13(46.4%) recipients had blood group A, 11(39.3%) B, 2(7.1%) AB, and 2(7.1%) O, while the corresponding values for the donors were 12(42.9%), 13(46.4%) and 3(10.7%). In majority of the patients the cause of renal failure was not known as no renal biopsy had been done, but the patients associated

Table-1: HLA mismatch distribution in recipients at HLA A, B, DRB1 and DQB1 loci.

Number of Mismatches (HLA)	Recipients (n =28) [n(%)]
3/8	1 (3.6)
4/8	7 (25.0)
5/8	1 (3.6)
6/8	5 (17.9)
7/8	2 (7.1)
8/8	12 (42.9)

HLA: Human leucocyte antigen

Table-2: Surgical and intraoperative data.

Parameter	Value (n=28)
Side of Surgery	
- Right Side	26 (92.9%)
- Left Side	2 (7.1%)
Warm ischemia time (mean±SD)	99.15 ± 10.27 seconds
Cold ischemia time (mean±SD)	52.08 ± 11.86 minutes
Anastomosis time (mean±SD)	27.85 ± 6.84 minutes
Operative time (mean±SD)	193.69 ± 41.26 minutes
Intraoperative Blood Loss (median, IQR)	100.00 ml (IQR: 50)
Arterial Anastomosis Techniques	
- Single artery-single anastomosis	20 (71.4%)
- Two arteries-single pantaloon anastomosis	3 (10.7%)
- Two arteries- two separate anastomoses	4 (14.3%)
- Three arteries- pantaloon of two arteries + separate third artery anastomosis	1 (3.6%)

SD: Standard deviation, IQR: Interquartile range.

their renal failure to hypertension 19 (67.9%), followed by diabetes mellitus (DM) 3(10.7%), and 1(3.6%) case each of systemic lupus erythematosus, tubulointerstitial nephritis, cystinosis, juvenile nephronophthisis, acute rejection, and chronic allograft nephropathy. The distribution of HLA mismatches was noted in detail (Table 1)

All 28(100%) recipients exhibited negative results for both B and T cells FCXM. In terms of Class I Luminex testing, 26(92.9%) of the recipients were negative, while 2(7.1%) were positive. For Class II Luminex, 20(71.4%) recipients were negative, and 8(28.6%) were positive. Mean donor preoperative creatinine level was 0.72±0.16mg/dl. Prophylactic antibiotics, specifically a single dose of cefazolin 1gm, were administered to all 28(100%) recipients and all 28(100%) donors. The median glomerular filtration rate (GFR) of the procured kidney was 51.00ml/min (IQR: 5ml/min). Surgical and intraoperative data was noted in detail (Table 2).

Table-3: Postoperative outcomes and complications.

Parameter Postoperative Creatinine	Value (n=28) (Mean ± SD)
3 months	1.25 ± 0.44 mg/dl
6 months	1.43 ± 0.43 mg/dl
9 months	1.16 ± 0.81 mg/dl
1 year	1.42 ± 0.42 mg/dl
Complications	**n (%)**
Surgical Site Infection	1 (3.6%)
Arterial Anastomosis Leakage	1 (3.6%)
Other Outcomes	**n (%)**
Rejection	1 (3.6%)
Graft Loss	1 (3.6%)
Delayed Graft Function	0 (0%)
30-Day Mortality	0 (0%)
Patient Survival	28 (100%)

SD: Standard deviation.

Table-4: Correlation of predictors with 1-year serum creatinine (n=13).

Predictor	Correlation Coefficient (r/rho)	*p*-value
Recipient age (years)	0.626*	0.022
Donor age (years)	0.433	0.140
Cold ischaemia time (min)	–0.221	0.469
Dialysis duration (months)	0.220	0.470

*Significant at <0.05.

Table-5: Kaplan-Meier survival analysis of graft survival (n=28).

Survival Parameter	Value
Total recipients	28
Events (graft loss)	1 (at 9 months)
Censored cases	27
Survival estimate	96.4%
Mean survival time (months)	11.89 ± 0.567
Median survival time (months)	12.00
Interquartile range (IQR)	0
Range (months)	3

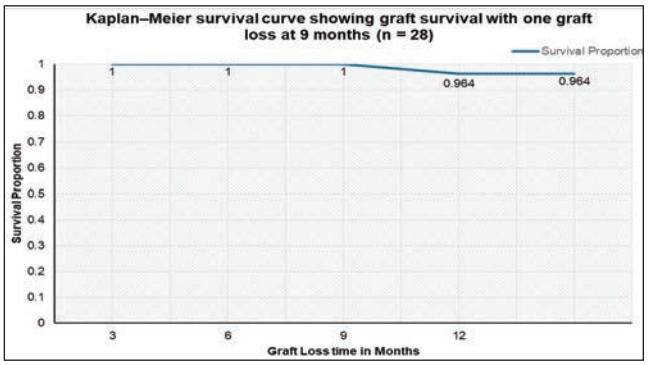

Figure: Survival curve for graft loss in kidney transplant recipients.

Mean length of hospital stay (LOS) was 6.62±1.50 days and the mean follow-up time of the patients was 11.71±6.89 months. Postoperative creatinine levels were stable at 3, 6, 9 and 12 months, and there was only 1(3.6%) graft loss which was owing to acute T-cell-mediated rejection. No cases of DGF and 30-day mortality were noted. There were 2(7.1%) cases facing complications, including surgical site infection and arterial anastomosis leakage. At 12 months, GS rate was 27(96.4%) and PS rate was 28(100%) (Table 3).

Exploratory correlation analysis showed a significant positive correlation of graft function with 12-month creatinine (r=0.626, p=0.022). Donor age (r=0.433, p=0.140), cold ischaemia time (r=-0.221, p=0.469), and dialysis duration (rho=0.220, p=0.470) were not significantly associated with graft function (Table 4).

Kaplan-Meier survival analysis estimated the graft survival rate to be 27(96.4%). The mean survival period was 11.89±0.567 months, and the median survival period was 12.00 months (IQR: 0 months) and a total range of 3 months (Table 5, Figure).

Discussion

KPD allows LDKT by pairing incompatible donor-recipient pairs. This overcomes barriers, such as ABO blood group incompatibility and DSAs to HLA.[14,15] Such barriers are present in about 54% of donor-recipient pairs.[15] For ABO-incompatible transplants, favourable outcomes can be achieved through plasmapheresis, immunoadsorption, rituximab and immunosuppression.[16] However, HLA-incompatible cases, especially with preformed DSA and positive crossmatch, remain associated with higher risks of rejection and graft failure. Desensitisation treatments, while effective, are costly, complex and linked to inferior long-term outcomes compared to KPD.[14,15]

KPD has emerged as an effective modality for patients with incompatible donors, particularly in countries with low deceased donor rates or limited ABO-incompatible

transplant programmes.[16-19] HLA-matched KPD transplants reduce immunosuppression requirements, infection risks and costs, offering better survival rates. This makes KPD a viable and cost-effective option in developing countries, where maintenance dialysis is often the only alternative for ESRD patients.[20,21] KPD programmes have evolved from simple two-way exchanges to complex multi-way exchanges (e.g., 3-way and 4-way), improving match rates up to 66% .[22,23] Variations include "conventional balanced" exchanges (e.g., A donor to B recipient), "conventional unbalanced" (compatible pairs exchanging for better matches), and "unconventional paired" donations to overcome crossmatch incompatibilities.[24,25] These innovations have made KPD a globally adopted approach to expanding the donor pool and improving transplant outcomes.

Chipman et al.[26] studied paired exchange among compatible living donor-recipient pairs and reported benefits from excellent HLA matching with appropriate quality donors. Similarly, the current results relate favourably towards postoperative outcomes with minimal complications, and support the efficacy of KPD in enhancing transplant outcomes. Chipman et al. highlighted the issue of counselling the compatible pairs in paired donation, which is an area not touched by the current study. The current results showed outcomes consistent with earlier findings of benefits through KPD regarding improved donor quality and matching in patients who are highly immunised or difficult to match.[27]

The current study has its limitations. Due to a small sample size and low number of adverse events, multivariate regression analysis to identify independent predictors of complications was not feasible. Therefore, the assessment was limited to exploratory correlation analyses, which should be interpreted with caution.

Future studies should continue to explore the impact of donor characteristics, and refine techniques to further reduce complications and improve long-term outcomes for both donors and recipients.

Conclusion

KPD in LDKT demonstrated favourable short-term clinical outcomes, with high GS and low complication rates, highlighting the potential of KPD to expand transplant opportunities in Pakistan, and emphasising the need for ongoing evaluation to enhance clinical practices and outcomes.

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Conflict of Interest: None.

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Author Contribution:

AB: Concept, supervision and critical revision.
NM: Data collection, analysis and drafting.
FAT: Literature review and interpretation of results.
ZUHA: Statistical analysis and preparation of tables/figures.
AA: Editing and final approval.
SJ: Data collection, editing and critical revision.