Case Report

First Successful Three-Way Kidney Exchange Transplantation in North India

Abstract

Kidney paired donation is the most cost-effective approach in incompatible donor-recipient pairs. Incompatibility may be due to blood group, human leucocyte antigen crossmatch or both. In many cases of a living donor kidney transplant, there is only one potential donor who becomes unsuitable due to any of the above mentioned factors. In kidney paired donation, donor-recipient pairs are exchanged to sort out the incompatibility. We report our first successful three-way kidney exchange transplantation from North India. As deceased donor program is still in evolving stage in most parts of our country and transplant with desensitization protocol is associated with financial constraints, infections, and lack of availability in many centers, kidney paired donation is a valuable approach to expand the donor pool.

Keywords: *Donor-recipient pair, kidney paired donation, living donor kidney transplant*

Irfan Ahmad, Sanjiv Saxena, Ravi Bansal, Rajesh Goel, Prit P. Singh[1], Jagdeep Balyan[1], Amit S. Malhotra[1], Bhaskar Borah[1]

Department of Nephrology & Kidney Transplant Medicine, PSRI Hospital, New Delhi, India, [1]Department of Urology & Kidney Transplant, PSRI Hospital, New Delhi, India

Introduction

Kidney paired donation (KPD) or paired exchange is an exchange of the kidneys from living donors deemed by virtue of blood group or histocompatibility criteria to be incompatible to their intended or designated recipients. KPD is the most cost-effective approach in incompatible donor-recipient pairs (DRPs).[1-4] Many potential living kidney donors are not able to donate due to blood type or antibody incompatibility. Historically, these donors would be turned away and the patients would lose the opportunity to receive a life-saving transplant. KPD overcomes these incompatibilities by swapping kidneys. KPD has expanded to include compatible pairs, nondirected donors, three-way and multiple exchanges, and living/deceased donor exchanges.[5-8]

Here, we report our first successful three-way KPD resulting in the transplantation of a highly sensitized and two ABO-incompatible DRPs.

Case Report

We have an experience of frequently doing two-way paired exchange transplants. After legal permission, all three DRPs were informed about the pros and cons of KPD prior to initiating evaluation. Each pair was counseled separately and then together. They were given sufficient time to discuss among their family members and the transplant team. They were screened for pretransplant immunological risk, occult infections, and other risk factors to reduce unequal transplant outcomes.

Recipient-1 came for preemptive renal transplant with the wife as a potential donor. His native disease was chronic tubulointerstitial nephritis with hypertension as comorbidity. The blood group of recipient was O and donor was A. Anti-A titer was 1:1024. The donor had difficult renal anatomy with two renal arteries on the right side, three renal arteries on the left side, and two renal veins on each side. They opted for KPD due to financial constraints.

Recipient-2 had a blood group matched donor but he had both complement-dependent cytotoxicity (CDC) and flow cytometry crossmatch (FCXM) positive with the donor. Single-antigen bead assays for class-1 revealed anti-human leukocyte antibodies (HLA) with 3 loci showing more than 2000 MFI and 2 loci showing more than 1000 MFI. He was denied for transplant due to high sensitization to donor.

Recipient-3 had blood group A and donor (wife) was B. His native kidney

How to cite this article: Ahmad I, Saxena S, Bansal R, Goel R, Singh PP, Balyan J, *et al.* First successful three-way kidney exchange transplantation in North India. Indian J Nephrol 2021;31:169-72.

Received: 04-04-2019
Revised: 10-10-2019
Accepted: 30-10-2019
Published: 27-01-2021

Address for correspondence:
Dr. Irfan Ahmad,
N-8/A, Abul Fazal Enclave-1,
Jamia Nagar, Okhla,
New Delhi - 110 025, India.
E-mail: drirfan24@gmail.com

Access this article online

Website: www.indianjnephrol.org

DOI: 10.4103/ijn.IJN_116_19

Quick Response Code:

Table 1: Recipient and donor characteristics

	Recipient						Donor					
No.	Weight (Kg)	Age (years)/ sex	ABO Group	Cause of CKD	Duration (months) on dialysis	No of blood transfusion (unit) prior to RTx	Weight (Kg)	Age (years)/ sex	ABO group	HLA match	GFR (mL/min) right /left	Relation
1	62	40/M	O-	CIN	0	0	55	37/F	A+	0/6	57.8/54.8	Spouse
2	53	37/M	B+	FSGS	6	03	62	26/F	O+	0/6	52.9/55	Spouse
3	56	54/M	A+	DN	7	04	81	42/F	B+	0/6	47.5/51.7	Spouse

CKD: Chronic kidney disease, HLA: Human leukocyte antigen, GFR: Glomerular filtration rate, CIN: Chronic interstitial nephritis, FSGS: Focal segmental glomerulosclerosis, DN: Diabetic nephropathy

Table 2: HLA typing of recipient and donor

	HLA typing								
	A		B		DRB1		DR other		
Recipient 1	33	-	13	44	07	15	-	DRB4	DRB5
Donor 1	03	24	35	-	11	13	DRB3	-	-
Recipient 2	11	-	15	40	12	14	DRB3	-	-
Donor 2	03	33	44	52	07	-	-	DRB4	-
Recipient 3	02	29	07	27	03	10	DRB3	-	-
Donor 3	01	68	15	55	04	13	DRB3	DRB4	-

disease was diabetic nephropathy. The donor was obese. She had one renal artery on the right side and two on the left side, and single renal vein on each side. They also opted for KPD due to financial constraints [Tables 1 and 2].

Three-way exchange transplant was planned for recipient 1 with donor 2, recipient 2 with donor 3, and recipient 3 with donor 1. CDC crossmatch and FCXM were negative with their donors [Table 3]. diethylene triamine pentaacetic acid (DTPA) renal scan of all three donors before transplant had normal glomerular filtration rate (GFR) (GFR >40 ml/min on each side). All recipients and donors had positive cytomegalovirus (CMV) serology for IgG and negative for IgM.

Transplant surgery

After informed and written consent, all surgeries were performed on the same day. The team included nephrologists, urologists, and anesthesiologists. Twenty personnel worked for 14 h for all transplants from 7 am to 9 pm. One donor underwent laparoscopic donor left nephrectomy and two others underwent open right nephrectomy due to difficult renal anatomy. Induction therapy included methylprednisolone (500 mg) initiated a night before the surgery with tapering over next 3 days. r-ATG (1.5 mg/kg each dose) was started on the morning of transplant day. Three doses of ATG were given over 3 consecutive days. Tacrolimus (0.1 mg/kg divided into 2 doses) and mycophenolate sodium (360 mg tab—2 tabs twice daily) were started on the day before surgery.

All patients showed brisk urine output immediately after the transplant and normalization of serum creatinine over the next 3 days. Delayed graft function (DGF) or rejection was not seen in any patient. All had stable graft function on discharge without any medical and surgical complications. All patients were given valganciclovir and trimethoprim/sulfamethoxazole prophylaxis against CMV and *Pneumocystis pneumonia*, respectively. None of the donors suffered from any medical or surgical complications. Donors were discharged on postoperative day 5 (POD 5) and recipients were on POD 8. All patients are doing well over a follow-up period of 9 months [Table 4].

Discussion

ABO incompatibility and HLA sensitization represent two greatest barriers to improving the live donation rate. KPD is feasible, successful, and if applied to a larger donor pool, capable of expanding access to renal transplants.[1-4,9,10] KPD avoids the extra immunosuppression and allows for the usual excellent outcomes associated with living unrelated transplants.

The concept of KPD was first proposed by Dr Felix Rappaport in 1986.[11] In 1991, the first KPD program started in South Korea. In 1999, first European KPD transplants were performed in Switzerland. After 2000, several KPD systems became active in the United States. Three-way KPD was first reported in the United States in 2005. In the United States, the national kidney registry organizes the majority of KPD transplants including the largest swaps.[12] The first large swap was a 60 participants chain in 2012 that appeared on the front page of New York Times and the second, even larger, swap including 70 participants which was completed in 2014.

In the United States, advanced donation began in 2012 and expanded in 2014 to include voucher donations. These innovative approaches are now eliminating the traditional chain and loop swaps, replaced by one deep chain.[13]

In India: The first two-way KPD transplant was performed in June 2000 in IKDRC, Ahmedabad. They performed 10 kidney paired donation transplants on World Kidney Day in 2013.[14] At this center, three-way, four-way, and six-way KPD transplants have been done in recent years.[5-8] We have performed first successful three-way kidney exchange transplant from North India.

When KPD first started, the focus was only on enrolling incompatible DRPs. As paired exchange grew and the process became faster and more reliable, patients with

Table 3: Transplant immunological data

	T & B cell crossmatch					HLA match
	Auto crossmatching	LCM	DTT (%)	T cell FCXM	B cell FCXM	(A, B & DR)
Normal (%)			<20%			
Recipient 1 with donor 2	Negative	Negative	Negative	Negative	Negative	0/6
Recipient 2 with donor 3	Negative	Negative	Negative	Negative	Negative	1/6
Recipient 3 with donor 1	Negative	Negative	Negative	Negative	Negative	0/6

LCM: Lymphocytotoxicity crossmatch, FCXM: Flow cytometry crossmatch, DTT: Dithiothriotol

Table 4: Pretransplantation and surgical data and transplant outcome

Parameter	Recipient 1	Recipient 2	Recipient 3
Type of donor nephrectomy	Laparoscopy (Lt)	Open (Rt)	Open (Rt)
Induction therapy	r-ATG	r-ATG	r-ATG
Warm ischemia time (Min)	3	5	7
Cold ischemia time (Min)	28	23	38
Anastomosis time (Min)	24	21	33
Surgical Complication	No	No	No
Urine output immediately after RTx	Brisk	Brisk	Brisk
Serum Cr on POD3 (mg/dl)	0.80	0.72	1.1
Sr Cr at discharge on POD8 (mg/dl)	0.84	0.83	1.07
Delayed graft function	No	No	No
Serum Cr at 1 month (mg/dl)	0.91	1.20	1.12
Serum Cr at 6 month (mg/dl)	0.98	0.99	1.13
Serum Cr at 9 month (mg/dl)	0.89	1.10	1.08
Rejection	No	No	No

r-ATG: Rabbit antithymocyte globulin, POD: Postoperative day

compatible donors that wanted a better match began enrolling in KPD. Better matched kidney transplant correlates with a lower lifetime mortality rate.

Long-term hemodialysis is not widely available in our country and morbidity and mortality on dialysis are unacceptably high. A kidney transplant offers significant survival and quality-of-life advantages so living donor kidney transplant (LDRT) soon after the diagnosis of ESRD is the only viable form of long-term renal replacement therapy for most patients. KPD is the first opportunity to substantially increase donor pool by utilizing high-quality organs, rather than merely accepting more organs of uncertain caliber. A large majority of patients are not aware of KPD. However, after counseling, we can achieve strong support for it. National KPD program may act as a final authority in this regard.[4]

Indian Society of Organ Transplantation (ISOT) has recently published the guidelines for KPD to increase LDRT in our country.[15] They suggested that a three-way exchange has optimum quality and quantity of matching. Their recommendations were based on meeting organized at Chennai in March 2017 followed by a workshop in New Delhi in April 2017 under the aegis of ISOT.

Conclusion

As the deceased donor program is still in evolving stage in most parts of our country and transplant with desensitization protocol is associated with financial constraints, infections and lack of availability in many centers, KPD is a valuable approach to expand the donor pool in renal transplant.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Montgomery RA. Living donor exchange programs: Theory and practice. Br Med Bull 2011;98:21-30.
2. Kute VB, Gumber MR, Patel HV, Shah PR, Vanikar AV, Modi PR, *et al*. Outcome of kidney paired donation transplantation to increase donor pool and to prevent commercial transplantation: A single-center experience from a developing country. Int Urol Nephrol 2013;45:1171-8.
3. Gentry S, Segev DL. Living donor kidney exchange. Clin Transpl 2011:279-86.
4. Kute VB, Gumber MR, Vanikar AV, Shah PR, Patel HV, Engineer DP, *et al*. Comparison of KPD transplantations with LDRT: Implications for national KPD program. Ren Fail 2013;35:504-8.
5. Kute VB, Gumber MR, Shah PR, Patel HV, Vanikar AV, Modi PR, *et al*. Successful three-way kidney paired donation transplantation: The first Indian report. Indian J Nephrol 2014;24:45-7.
6. Kute VB, Vanikar AV, Gumber MR, Shah PR, Patel HV,

Engineer DP, *et al*. Successful three-way kidney paired donation with compatible pairs to increase donor pool. Ren Fail 2014;36:447-50.
7. Kute VB, Patel HV, Varyani UT, Shah PR, Modi PR, Shah VR, *et al*. Six end-stage renal disease patients benefited from first non-simultaneous single center 6-way kidney exchange transplantation in India. World J Nephrol 2016;5:531-7.
8. Kute VB, Patel HV, Shah PR, Modi PR, Shah VR, Kasat GS, *et al*. Four-way kidney exchange transplant with desensitization increases access to living-donor kidney transplant: First report from India. Exp Clin Transplant 2017. doi: 10.6002/ect.20170089.
9. Pahwa M, Saifee Y, Tyagi V, Chadha S, Jauhari H. Paired exchange kidney donation in India: A five-year single-center experience. Int Urol Nephrol 2012;44:1101-5.
10. Jha PK, Sethi S, Bansal SB, Jain M, Sharma R, Phanish MK, *et al*. Paired kidney exchange transplantation: Maximizing the donor pool. Indian J Nephrol 2015;25:349-54.
11. Rapaport FT. The case for a living emotionally related international kidney donor exchange registry. Transplant Proc 1986;18:5-9.
12. National Kidney Registry. Available from: http://www.kidneyregistry.org/index.php. [Last accessed on 2011 Jul 13].
13. Wall AE, Veale JL, Melcher ML. Advanced donation programs and deceased donor initiated chains – 2 innovations in kidney paired donation. Transplantation 2017;101:2818-24.
14. Kute VB, Vanikar AV, Shah PR, Gumber MR, Patel HV, Engineer DP, *et al*. Ten KPD transplantation on World Kidney Day 2013: Raising awareness and time to take action to increase donor pool. Ren Fail 2013;35:1269-72.
15. Kute VB, Agarwal SK, Sahay M, Kumar A, Rathi M, Prasad N, *et al*. Kidney paired donation to increase living donor kidney transplantation in India: Guidelines of Indian society of organ transplantation – 2017. Indian J Nephrol 2018;28:1-9.