Journal of Institute of Medicine Nepal
Institute of Medicine, Kathmandu, Nepal

OPEN ACCESS

Original Article

JIOM Nepal. 2024 Aug;46(2):29-34.

Renal Function following Donor Nephrectomy in Tertiary Kidney Transplant Center of Nepal

Milan Gyawali, Bhojraj Luitel, Manish Man Pradhan, Pawan Raj Chalise, Suman Chapagain, Prem Raj Gyawali

Author(s) affiliation

Department of Urology and Kidney Transplant Surgery, Maharajgunj Medical Campus, Tribhuvan University Teaching Hospital, Institute of Medicine, Kathmandu, Nepal

Corresponding author

Bhojraj Luitel, MS, MCh
drbhojraj@gmail.com

ABSTRACT

Introduction

Live kidney transplant is the standard of care for patients requiring renal replacement therapy. Donors with increasing age and comorbid conditions such as obesity and hypertension are now included for transplant. This study was performed to evaluate the change in renal function of kidney donors over a period of one year.

Methods

This was an analytical study of patient's who underwent donor nephrectomy from January 2022 to June 2023 at Department of Urology and Kidney Transplant Surgery, Tribhuvan University Teaching Hospital, Nepal. Renal function of donors in terms of serum creatinine, glomerular filtration rate, size of kidney and general physical examination including blood pressure pre-donation were compared with post donation period at three, six and twelve months.

Results

There were total of 76 cases available for analysis. Mean age of the donors was 44.6±10.1 years, ranging from 22 to 67 years, with male: female ratio of 1:2.45. There was no significant change in post donation blood pressure and kidney size. There was increase in serum creatinine level from baseline 70.47±14.96 to 93.20±17.61 ($p<0.001$) at three months follow up. Post donation glomerular filtration rate (GFR) of remnant kidney had increased significantly.

Conclusion

Post donation GFR of remnant kidney as well as serum creatinine level in live donor nephrectomy including the expanded criteria donors had increased significantly. Short-term deleterious effects in renal function post donation were not seen.

Keywords
Donor nephrectomy; live kidney transplant; renal function

DOI
10.59779/jiomnepal.1296

Submitted
Apr 12, 2024

Accepted
Jul 4, 2024

INTRODUCTION

Living kidney transplantation is the standard of care for patient with end stage renal disease (ESRD).[1] There is rise of live kidney transplantation due to benefits of pre-emptive transplantation, superior organ quality with less recipient morbidity and increased graft survival.[2] The benefit of recipient has to be weighed against the possible harm to the donor and studies have shown excellent results following kidney donation in terms of renal function, mortality and morbidity.[3]

Shortage of kidney donors have led to the extension of donor acceptance with comorbid conditions such as obesity, hypertension, increasing age and cardiovascular disease thus emphasizing need for long term follow up in those patients with pre-existing comorbidities.[4-6] Risk of developing ESRD following donor nephrectomy is similar to general population . Studies have suggested live kidney donation as safe procedure with low morbidity and mortality .[7-10]

This study was performed to evaluate the change in renal function among kidney donors including extended criteria of donors (ECD) in our setting following live kidney donation.

METHODS

This was an analytical study of patient's who underwent donor nephrectomy from January 2022 to June 2023 at Department of Urology and Kidney Transplant Center at Tribhuvan University Teaching Hospital, Kathmandu, Nepal. Ethical clearance was obtained from Institutional Review Committee of Institute of Medicine (Ref no. 081/82/21) and consent was taken from patients. Evaluation of donors were carried out by the transplant team as per our institutional protocol in accordance with Amsterdam guidelines and donors were selected for transplant.

In this study, we included all those donors who underwent donor nephrectomy and excluded those who were pregnant or have developed acute kidney injury or had trauma during their post donation period.

Data was collected by reviewing patient's file from the Medical Records section and patient's follow up chart were reviewed over phone. Patient's preoperative clinical data including age, sex, past medical and surgical history, comorbidities, general physical examination including blood pressure (BP), body mass index (BMI), laboratory investigations including serum creatinine (Sr. Cr), complete blood count (CBC), renal function test (RFT), urine RME and urine culture, estimated glomerular filtration rate (eGFR) calculated using Cockcroft-Gault (CG) and Modification of Diet in Renal Disease (MDRD) formula, imaging including ultrasongram- abdomen and pelvis (USG-A+P), CT renal angiogram with urography , 99mTc -diethylene triamine pentaacetic acid (99mTc-DTPA) nuclear renal scan for GFR evaluation, patient's Intraoperative details and Post operative complications, together with patient's post donation follow up evaluation at the period of three months, six months and one year as per our institutional protocol with physical examination including weight, BP, laboratory including CBC, RFT, Urine RME, imaging including USG (A+P), GFR by CG and MDRD were recorded in the performa.

Purposive sampling method was used to select participants. Data was entered in MS-Excel and converted to IBM, SPSS version 25 for statistical analysis. Continuous variables are presented as (mean±standard deviation) and dichotomous variables as percentage. Data analysis was done comparing between pre-donation and post donation

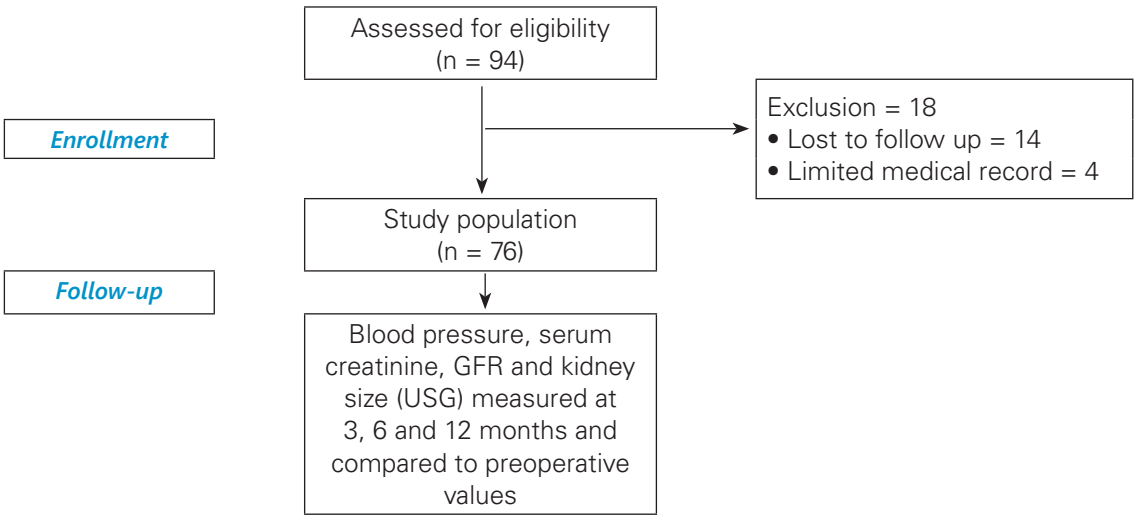

Figure 1. STROBE chart

Table 1. Baseline and laboratory donor characteristics

Characteristics		Frequency (%)	Mean±SD	Range
Age (years)	20-29	6 (7.89)	46.2±10.1	22-67
	30-39	15 (19.74)		
	40-49	20 (26.32)		
	50-59	23] (30.26)		
	60-69	12 (15.79)		
Sex	Male	22 (28.95)	-	-
	Female	54 (71.05)		
BMI (kg/m^2)	Normal	26 (34.20)	25.97±3.21	21.72-33.29
	Overweight	42 (55.30)		
	Obesity I	8 (10.50)		
Comorbidities	Hypertension	7 (9.21)	-	-
	Hypothyroidism	3 (3.94)		
ASA	I	51 (67.1)	-	-
	II	25 (32.9)		
Laboratory parameters	Hemoglobin (g/dl)	-	12.3±1.8	10.6-18.4
	Na^+ (mEq/L)		137.5±3.14	130-148
	K^+ (mEq/L)		4.03±0.21	3.4-4.9

state at different follow up periods using paired t-test for parametric data. Statistical significance was tested at 95% CI and p value <0.05 was considered significant.

RESULTS

There were total of 94 transplant donor nephrectomy cases, out of which 14 patients lost to follow-up and four patient's medical record had limited available data that was inadequate for review. We have analyzed remaining 76 donor nephrectomy cases.

The mean age of the donors was 44.6±10.1 years, ranging from 22 to 67 years and 15.79% of the donors were above 60 yr of age. We had female dominance as a donor with Male : Female ratio of (1:2.45). Most of the donors were overweight (55.30%), seven of our donor had pre-donation Grade I Hypertension well controlled on single antihypertensive medication. Most of the donors were in ASA grade I (67.1%). Baseline donor characteristics and laboratory parameters are presented in Table 1.

Left sided surgeries and laproscopic donor nephrectomy was performed in most of the cases. Operative and post-operative details presented in Table 2.

There was no significant change in the post-donation systolic and diastolic BP and kidney size. There was statistically significant increase in serum creatinine level from base line at three months post donation, however it was still under normal range (Table 3). None of the patient had developed proteinuria post donation.

Table 2. Operative and post-operative details of donor

Characteristics	Frequency (n)	Mean±SD	Range
Surgery side		-	-
Left	57 (75)		
Right	19 (25)		
Surgical technique		-	-
Open	20 (26.31)		
Laproscopic	54 (71.05)		
Conversion	2 (2.64)		
Hospital stay (days)		5.71±1.02	4-8
Post-surgery complications		-	-
Pneumonia	1 (1.32)		
Superficial SSI	4 (5.26)		
Fever	3 (3.94)		

Table 3. Comparision of pre-donation and post-donation change in BP, Sr. Cr and kidney size

Parameters	Predonation (Mean±SD)	Postdonation Follow-Up (Mean±SD)			p-value
		3 mths	6 mths	1 year	
Blood pressure					
SBP (mm Hg)	117.54±6.82	118.45±5.95	119.2±6.32	119.76±6.54	0.14
DBP (mm Hg)	76.24±3.94	76.83±3.58	76.73±3.14	77.42±3.86	0.18
Kidney size (cm^2)	38.8±4.3	39.28±3.9	40.01±3.71	40.20±4.52	0.25
Serum creatinine (µmol/l)	70.47±14.96	93.20±17.61	95.73±16.42	92.41±16.78	<0.001

Table 4. GFR estimation and change overtime

GFR	Predonation (Mean±SD)	Postdonation Follow-Up (Mean±SD)			p-value
		3 mths	6 mths	1 year	
DTPA (Total)	89.36±16.12	-	-	-	-
DTPA (Remnant kidney)	47.23±6.89				
MDRD	85.43±15.34	64.7±13.60	65.4±12.82	65.20±13.3	<0.001
CG	81.36±17.06	61.56±12.41	61.83±12.73	62.47±13.14	<0.001

GFR estimated through MDRD and CG formula showed post donation remnant kidney GFR to be at 76.31% and 76.67% of the pre-donation level which was statistically significant (Table 4).

DISCUSSION

Live kidney donation is the only available source of kidney for renal transplantation at our center. In this study there were 15.79% of the donors aged more than 60yrs, which was due to inclusion of expanded criteria donors at our center. There were more female donors which was similar to the study by Mehta et al, Grossman et al, and Freedland et al.[11-13] Female dominace as a donor is seen in most of the countries worldwide. This disparity in donation could be due to socio-economical, biological, cognitive, societal, emotional and cultural perception of gender role.[14]

During the follow-up period of one year none of the donors developed hypertension, apart from seven donors who already had Grade I Hypertension well controlled on single antihypertensive medication. Post donation these donors had well controlled blood pressure and were continuing on the same dose of antihypertensive medications. Similar to our study, in the study by Kasiske et al, where they have followed up donors for three years, none of them have developed hypertension.[15] However, in a study by Mehta et al, two patient developed hypertension and there was significant increase in Systolic (6.24 mm Hg) and Diastolic (4 mm Hg) BP post donation ($p<0.001$).[11] Similarly, Garg et al also showed higher incidence of hypertension in donors than control over the period of six years.[16] In a meta-analysis by Boudville et al, they have shown evidence of hypertension post donation after 10 years.[17]

Textor et al and Tent et al, in their study showed no short-term effect of hypertension in GFR post donation.[18,19] However, predictive risk model by Grams et al suggested baseline hypertension projects the incidence of kidney failure.[20] Since, our follow up was for only one-year, long term follow up is required to know the prevalence of hypertension in our donors.

No significant change in kidney size was observed in our study. However in a study by Mehta et al, kidney size increased from (35.12±6.80) cm^2 to (42.32±8.59) cm^2 ($p<0.001$) and in study by Sahey et al (1.17±0.73) cm increase in length of remnant kidney was observed over the period of three year.[11,21] This may be due to discrepancy in measurement of the kidney size by USG(A+P) which is operator dependent , inconsistency in measurement of change in volume of kidney by using surface area calculation and shorter duration of follow up of patient in our study.

Serum creatinine had increased in our study which was similar to the other study.[11,22,23] However, in all of these studies including ours have creatinine below the upper range of the normal value. This increase in serum creatinine is due to post donation status and might be associated with higher age and increase in BMI among the selected donors.[24]

At one year following donation, remnant kidney contributes to around 70% of the pre-donation state.[25] In our study, estimated GFR post-transplant decreased to 76.31%-MDRD and 76.67%-CG at one year which was almost similar to study by Fehram

et al (78%), Kasiske et al, and Sahay et al.[26,15,21] This improvement in the donor remnant kidney post donation is due to hemodynamic changes such as increase in vasodilatation and renal blood flow in the remnant kidney, which leads to hyperfiltration thus increasing the GFR of the remnant kidney.[27] Some studies have shown kidney function beginning to plateau after five years whereas others have shown improvement in kidney function upto 15 year in older donor and for 17 years in younger donor.[28,29]

Risk of ESRD in donors is similar to general population (0.2-0.6%).[30] In our study none had proteinuria and ESRD which was similar to study by Mehta et al and Kasiske et al.[11,15] However in a study by Sahey et al they had incidence of proteinuria up to 14%, thus emphasizing on the long term follow up in renal donors.[21]

This is a retrospective study with small sample size with shorter duration of follow up conducted at single institute. GFR estimation using CG and MDRD formula after donor nephrectomy tend to underestimate the GFR.

CONCLUSION

In this study, post-donation GFR of remnant kidney and serum creatinine level after live donor nephrectomy including the expanded criteria donors had increased. Any short-term deleterious effects in renal function post-donation were not seen. However long-term follow-up of these specific donors is recommended.

FINANCIAL SUPPORT

The author(s) did not receive any financial support for the research and/or publication of this article.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

Study concept and design: MG, BRL, PRC; Data collection: MG; Analysis and interpretation: MG, BRL, PRC, SC; Manuscript draft: MG, BRL, PRC, MMP. All author read approved the final manuscript.

REFERENCES

1. Sharma V, Roy R, Piscoran O et al, Living donor kidney transplantation; Let's talk about it .Clin Med (Lond),2020 May;20(3):346-8. https://doi.org/10.7861/clinmed.2020-0047
2. Baid A, S Frei, Living donor renal transplantation: recent developments and perspectives . Nat Rev Nephrol 2007,3,31-41. https://doi.org/10.1038/ncpneph0383.
3. Morgan BR, Ibrahim HN. Long term outcome of kidney donors. Arab J Urol. 2011, Jun ;9(2):79-84. https://doi.org/10.1016/j.aju.2011.06.006
4. Rease PP , Simon MK, Stewart J et al. Medical follow-up of living kidney donors by 1 year after nephrectomy. Transplant Proc . 2009 Nov; 41(9):3545-50. https://doi.org/10.1016/j.transproceed.2009.04.016
5. Delmonico F. A report of Amsterdam Forum On the Care of the Live Kidney Donor: Data and Medical Guidelines , Transplantation, 2005 Mar 27;79(6 Suppl):53-66. https://doi.org/10.1097/01.TP.0000157343.27949.9F. https://doi.org/10.1001/jama.284.22.2919
6. Abecassis M, Adams M, Adams P et al. Consensus Statement on the live organ donor . JAMA . 2000 Dec;13, 284(22):2919-26. https://doi.org/10.1001/jama.284.22.2919
7. Bia MJ, Ramos EL, Danovitch GM et al, Evaluation of Living renal donors: the current practice of US transplant centers. Transplantation, 1995;60(4):322-7. https://doi.org/10.1097/00007890-199508270-00003
8. Matias AJ, Bartlett ST, Leichtman AB et al, Morbidity and Mortality after kidney donation, 1999-2001: Survey of United States transplant center. Am J Transplant. 2003; 3(7):830-4. https://doi.org/10.1046/j.1038-5282.2001.00400.x-i1
9. Segav DL, Muzaale AD, Caffo BS et al, Perioperative mortality and long term survival following Live Kidney donation. JAMA. 2010;303(10):959-66. https://doi.org/10.1001/jama.2010.237
10. Cherikh WS, Young CJ , Kramer BF et al, Etnic and gender related differences in the risk of End Stage Renal Disease after Living Kidney donation . Am J Transplant . 2011;11(8):1650-5. https://doi.org/10.1111/j.1600-6143.2011.03609.x
11. Mehta KS, Swami R, Pajai A et al. Long-term evaluation of kidney function in live-related kidney donors. Saudi J Kidney Dis Transpl. 2017 Sep-Oct; 28(5):1041- 9. https://doi.org/10.4103/1319-2442.215145
12. Gossmann J, Wilhelm A, Kachel HG et al. Long-term consequences of live kidney donation follow-up in 93% of living kidney donors in a single transplant center. Am J Transplant. 2005 Oct; 5(10):2417-24. https://doi.org/10.1111/j.1600-6143.2005.01037.x
13. Freedland SJ, Blanco-YM, Sun JC et al. Effect of ketorolac on renal function after donor nephrectomy. Urology. 2002 Jun; 59(6):826-30. https://doi.org/10.1016/S0090-4295(02)01514-5
14. Vilayur E, van Zwieten A, Chen M et al. Sex and Gender Disparities in Living Kidney Donation: A Scoping Review. Transplant Direct. 2023 Aug 24; 9(9):e1530. https://doi.org/10.1097/TXD.0000000000001530
15. Kasiske BL, Anderson-Haag T, Israni AK et al. A prospective controlled study of living kidney donors: three-year follow-up. Am J Kidney Dis. 2015, 66:114-24. https://doi.org/10.1053/j.ajkd.2015.01.019
16. Garg AX, Muirhead N, Knoll G, et al. Proteinuria and reduced kidney function in living kidney donors: a systematic review, meta-analysis, and meta-regression. Kidney Int. 2006, 70:1801-10. https://doi.org/10.1038/sj.ki.5001819
17. Boudville N, Prasad GV, Knoll G et al. Donor Nephrectomy Outcomes Research (DONOR) Network. Meta-analysis: risk for hypertension in living kidney donors. Ann Intern Med. 2006 Aug 1; 145(3):185-96. https://doi.org/10.7326/0003-4819-145-3-200608010-00006
18. Textor SC, Taler SJ, Driscoll N et al. Blood pressure and renal function after kidney donation from hypertensive living donors. Transplantation. 2004 Jul 27; 78(2):276-82. https://doi.org/10.1097/01.TP.0000128168.97735.B3
19. Tent H, Sanders JS, Rook M et al. Effects of preexistent hypertension on blood pressure and residual renal function after donor nephrectomy. Transplantation. 2012 Feb 27; 93(4): 412-7. https://doi.org/10.1097/TP.0b013e318240e9b9
20. Grams ME, Sang Y, Levey AS et al. Chronic Kidney Disease Prognosis Consortium. Kidney-Failure Risk Projection for the Living Kidney-Donor Candidate.N Engl J Med. 2016 Feb 4;374(5):411-

21. https://doi.org/10.1056/NEJMoa1510491.

21. Sahay M, Narayen G, Anuradha. Risk of live kidney donation-Indian perspective. J Assoc Physicians India. 2007 Apr; 55: 267-70. PMID: 17694785

22. Rowinski W, Chmura A, Włodarczyk Z et al. Are we taking proper care of living donors? A follow-up study of living kidney donors in Poland and further management proposal. Transplant Proc. 2009 Jan-Feb;41(1):79-81. https://doi.org/10.1016/j.transproceed.2008.08.140.

23. Goldfarb DA, Matin SF, Braun WE et al. Renal outcome 25 years after donor nephrectomy. J Urol. 2001 Dec; 166(6): 2043-7. https://doi.org/10.1016/S0022-5347(05)65502-4

24. Mjøen G, Oyen O, Midtvedt K et al. Age, gender, and body mass index are associated with renal function after kidney donation. Clin Transplant. 2011 Nov-Dec; 25(6): E579-83. https://doi.org/10.1111/j.1399-0012.2011.01503.x

25. Altheaby A, Alharbi N, Alzamil A, et al. How Does the Remaining Single Kidney Cope After Contralateral Nephrectomy of the Kidney Donor? A Single-Center Cohort Study. Cureus. 2020 Nov 15; 12(11): e11491. https://doi.org/10.7759/cureus.11491

26. Fehrman-Ekholm I, Dunér F, Brink B et al. No evidence of accelerated loss of kidney function in living kidney donors: results from a cross-sectional follow-up. Transplantation. 2001; 72:444-9. https://doi.org/10.1097/00007890-200108150-00015

27. Sigmon DH, Gonzalez-Feldman E, Cavasin MA et al. Role of nitric oxide in the renal hemodynamic response to unilateral nephrectomy. J Am Soc Nephrol. 2004 Jun; 15(6):1413-20. https://doi.org/10.1097/01.ASN.0000130563.67384.81. https://doi.org/10.1016/j.kint.2020.03.034

28. Lam NN, Lloyd A, Lentine KL et al. Changes in kidney function follow living donor nephrectomy. Kidney Int. 2020 Jul; 98(1):176-86. https://doi.org/10.1016/j.kint.2020.03.034

29. Fehrman-Ekholm I, Kvarnström N, Söfteland JM et al. Post-nephrectomy development of renal function in living kidney donors: a cross-sectional retrospective study. Nephrol Dial Transplant. 2011 Jul; 26(7): 2377-81. https://doi.org/10.1093/ndt/gfr161

30. Ramcharan T, Matas AJ. Long-term (20-37 years) follow-up of living kidney donors. Am J Transplant. 2002 Nov; 2(10): 959-64. https://doi.org/10.1034/j.1600-6143.2002.21013.x