International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Clinical and Psychological Outcome Following Living Donor Nephrectomy

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OPEN ACCESS

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Received: 28-09-2025
Accepted: 13-10-2025
Available online: 31-12-2025

ABSTRACT

Background: Living donor kidney transplantation (LDKT) remains the preferred treatment for end-stage renal disease due to superior survival and graft outcomes compared to dialysis. With expanding indications for living donation, concerns about the long-term clinical, renal, and psychological well-being of donors have increased. Evaluating donor safety through comprehensive follow-up is essential for sustaining ethical transplant practices.

Objectives: To investigate clinical and patient outcome following donor nephrectomy which includes renal morphological parameters, biochemical parameters and psychological parameters.

Methods: A prospective longitudinal study was conducted among 162 living kidney donors who underwent unilateral nephrectomy between 2018 and 2023. Donors were evaluated preoperatively and at 3 months, 1 year, 2 years, and ≥3 years post-donation. Clinical parameters (BMI, blood pressure), biochemical markers (serum urea, creatinine, eGFR, 24-hour proteinuria), and renal morphology (size, cortical thickness by ultrasonography) were assessed. Psychological status was evaluated using the Hamilton Depression (HAM-D) and Hamilton Anxiety (HAM-A) scales, and quality of life using the WHOQOL-BREF instrument.

Results: Donors showed a mild, non-significant increase in BMI and transient rise in blood pressure ($p < 0.05$). Serum creatinine increased marginally post-donation, while eGFR declined initially and improved over time ($p < 0.01$). Renal ultrasonography revealed compensatory hypertrophy without structural abnormalities. Psychological assessment demonstrated significant improvement in anxiety, depression, and quality of life scores at ≥3 years post-donation ($p < 0.01$).

Conclusion: Living kidney donation is safe and well-tolerated, with stable long-term clinical and renal outcomes and significant improvement in psychological well-being. Continuous medical and psychological follow-up is recommended to ensure donor health and quality of life.

Keywords*: Living donor nephrectomy; Kidney transplantation; Donor outcomes; Renal function; Quality of life; Psychological adaptation.*

INTRODUCTION

Kidney transplantation is widely recognized as the treatment of choice for patients with end-stage renal disease (ESRD), offering better survival and quality of life compared to maintenance dialysis[1]. The persistent shortage of deceased donor organs has made living donor kidney transplantation (LDKT) an increasingly important source for renal replacement therapy worldwide[2].

Living donation offers several advantages — improved graft survival, shorter waiting times, and greater scheduling flexibility[3]. However, the safety of donors remains paramount. While surgical risks are low, concerns persist regarding long-term effects on renal function, blood pressure, and psychosocial well-being[4–6].

Previous longitudinal studies have demonstrated that most living donors maintain good health, with survival equal to or better than that of the general population[1],[4]. Nonetheless, mild increases in serum creatinine, modest declines in estimated glomerular filtration rate (eGFR), and occasional hypertension have been reported[5],[6]. Ibrahim et al.[1] and Mjøen et al.[5] observed that although kidney function decreases initially after nephrectomy, most donors retain sufficient renal reserve and experience no excess mortality.

The remaining kidney undergoes compensatory hypertrophy to preserve renal function following donation[7],[8]. Studies using imaging modalities have shown increases in renal size and cortical thickness, indicating adaptive growth without adverse effects[9]. Moreover, research has increasingly focused on psychological outcomes, revealing that donors may experience transient anxiety or depression that generally resolves with time[10]–[12].

The present study aims to investigate clinical and patient outcome following donor nephrectomy which includes renal morphological parameters, biochemical parameters and psychological parameters.

MATERIALS AND METHODS

This was a prospective longitudinal study conducted in the Department of Nephrology and Urology at a tertiary care teaching hospital in South India over a period of five years. The study population comprised living kidney donors who had undergone unilateral donor nephrectomy for renal transplantation at our center. A total of 162 donors were enrolled and followed up periodically after donation. Written informed consent was obtained from all participants prior to inclusion, and institutional ethical committee approval was obtained before commencement of the study, ensuring adherence to the principles of the Declaration of Helsinki.

Eligible participants included healthy adults aged between 25 and 55 years who were medically and psychologically fit to donate a kidney. Donors with known systemic diseases such as diabetes mellitus, chronic hypertension, renal abnormalities, or significant psychiatric illness prior to donation were excluded. Baseline data regarding age, sex, relationship to the recipient, and anthropometric parameters were recorded prior to nephrectomy.

All participants underwent comprehensive clinical, biochemical, and radiological assessment both preoperatively and at regular follow-up intervals of 3 months, 1 year, 2 years, and at or beyond 3 years after donation. Clinical examination included measurement of height, weight, and body mass index (BMI), along with systolic and diastolic blood pressure (BP) using a standard mercury sphygmomanometer after adequate rest.

Biochemical investigations included estimation of fasting blood sugar, serum urea, serum creatinine, and 24-hour urinary protein excretion. The estimated glomerular filtration rate (eGFR) was calculated using the Cockcroft–Gault formula, adjusted for age and sex. All biochemical parameters were measured using standard automated analyzers in the hospital's central biochemistry laboratory.

Radiological evaluation of the remaining kidney was performed by ultrasonography at each follow-up to assess morphological adaptation after nephrectomy. Parameters such as longitudinal and transverse diameters and cortical thickness were measured using standardized sonographic protocols by an experienced radiologist. Compensatory hypertrophy was determined by comparing renal dimensions over time.

To assess psychological well-being, validated scales were used at each follow-up visit. Depression and anxiety were evaluated using the Hamilton Depression Rating Scale (HAM-D) and the Hamilton Anxiety Rating Scale (HAM-A), respectively. The Quality of Life (QoL) of donors was assessed using a standardized QoL questionnaire (WHOQOL-BREF). All scales were administered in the participants' preferred language by trained interviewers to ensure reliability and cultural appropriateness.

All donors were followed up regularly at outpatient visits and were counseled regarding healthy lifestyle practices, adequate hydration, and avoidance of nephrotoxic medications. The follow-up compliance was above 90% for the study period, ensuring robust longitudinal data collection.

Data were entered into Microsoft Excel and analyzed using SPSS version 22.0 (IBM SPSS Statistics, Somers, NY, USA). Descriptive statistics such as mean, standard deviation, frequency, and percentage were used to summarize the data. For comparison of continuous variables across different time points, repeated measures analysis of variance (ANOVA) was applied, while Chi-square test was used to compare categorical variables such as psychological scores across follow-up periods. A p-value of <0.05 was considered statistically significant.

This comprehensive assessment allowed evaluation of both physiological adaptation and psychological outcomes among living kidney donors, thereby providing an integrated understanding of post-donation well-being.

RESULTS

A total of 162 living kidney donors participated in the study, comprising 114 females (70.4%) and 48 males (29.6%). The mean age of donors was 34.8 ± 7.2 years (range: 26–55 years). The majority of donors were in the 36–45 years age group (42.6%), followed by 46–55 years (31.5%) and 26–35 years (25.9%). Most of the female related donors were wives (50.6%), followed by mothers (31.2%) and sisters (18.2%) (Table 1).

There was a mild, non-significant increase in BMI from 22.3 ± 4.2 at baseline to 23.8 ± 4.2 at ≥3 years post-donation ($p = 0.927$).The mean systolic blood pressure showed a transient rise at 3 months (124.1 ± 11.7 mmHg), followed by stabilization, with a statistically significant overall difference ($p < 0.01$). Similarly, mean diastolic pressure varied significantly over time ($p = 0.045$).

Blood urea and serum creatinine levels showed minor changes across follow-up periods but remained within normal limits ($p > 0.05$). The mean estimated GFR declined from 132.8 ± 36.2 mL/min/1.73m² at baseline to 101.5 ± 25.6 at 3 months, with gradual improvement thereafter (111.5 ± 29.6 at ≥3 years), showing a statistically significant trend ($p < 0.01$). 24-hour proteinuria remained within the normal range throughout follow-up ($p = 0.999$) (Table 2).

Ultrasound evaluation of the remaining kidney demonstrated a gradual increase in renal size following nephrectomy, suggesting compensatory hypertrophy. The mean longitudinal diameter increased from 10.93 ± 0.88 cm at baseline to 11.79 ± 0.76 cm after ≥3 years, and the transverse diameter from 4.21 ± 0.59 cm to 4.84 ± 0.50 cm. Mean cortical thickness increased slightly from 6.31 ± 3.24 mm to 7.34 ± 3.18 mm over the same period. However, these changes were not statistically significant ($p > 0.05$) (Table 3).

Analysis of psychological parameters revealed that depression and anxiety scores improved significantly over the follow-up period. The proportion of donors with no depression increased from 5.6% at baseline to 16.7% at ≥3 years, while those with moderate to severe depression decreased markedly from 11.1% to 0.6% ($p < 0.01$). Similarly, donors without anxiety increased from 4.9% to 48.1%, and those with moderate anxiety reduced from 34.6% to 1.9% ($p < 0.01$).

The mean Quality of Life (QoL) score declined transiently at 3 months post-donation (58.8 ± 6.4) but improved progressively to 91.3 ± 8.2 after ≥3 years, showing a significant overall improvement ($p < 0.01$) (Table 4).

Table 1. Baseline Characteristics of Living Kidney Donors (N = 162)

Variable	Category	Number (n)	Percentage (%)
Gender	Male	48	29.6
	Female	114	70.4
Age group (years)	26–35	42	25.9
	36–45	69	42.6
	46–55	51	31.5
Relationship among female related donors	Mother	24	31.2
	Wife	39	50.6
	Sister	14	18.2

Table 2. Trends in Clinical and Biochemical Parameters Following Donor Nephrectomy

Parameter	Baseline	3 months	1 year	2 years	≥3 years	p-value
BMI (kg/m²)	22.3 ± 4.2	23.1 ± 4.7	23.4 ± 4.8	23.3 ± 4.3	23.8 ± 4.2	0.927
Systolic BP (mmHg)	120.8 ± 6.5	124.1 ± 11.7	121.9 ± 12.5	120.9 ± 11.6	118.5 ± 15.9	<0.01*
Diastolic BP (mmHg)	78.9 ± 4.9	80.5 ± 7.1	79.2 ± 8.3	79.1 ± 8.5	77.1 ± 9.6	0.045*
Blood Urea (mg/dL)	14.8 ± 4.3	16.1 ± 3.4	15.7 ± 3.4	15.4 ± 3.7	15.2 ± 4.2	0.713
Serum Creatinine (mg/dL)	0.75 ± 0.14	1.00 ± 0.22	0.99 ± 0.21	0.98 ± 0.20	0.94 ± 0.20	0.998
24-hr Proteinuria (g/day)	0.09 ± 0.03	0.19 ± 0.08	0.16 ± 0.09	0.18 ± 0.05	0.17 ± 0.02	0.999
Estimated GFR (mL/min/1.73m²)	132.8 ± 36.2	101.5 ± 25.6	105.2 ± 27.3	106.7 ± 25.8	111.5 ± 29.6	<0.01*

#Repeated measures ANOVA

Table 3. Renal Morphological Parameters Following Donor Nephrectomy

Parameter	Baseline	3 months	1 year	2 years	≥3 years	p-value
Longitudinal diameter (cm)	10.93 ± 0.88	11.53 ± 0.90	11.55 ± 0.79	11.67 ± 0.73	11.79 ± 0.76	0.923
Transverse diameter (cm)	4.21 ± 0.59	4.51 ± 0.62	4.54 ± 0.64	4.61 ± 0.58	4.84 ± 0.50	0.98
Mean cortical thickness (mm)	6.31 ± 3.24	7.30 ± 3.12	7.32 ± 3.23	7.34 ± 3.17	7.34 ± 3.18	0.791

#Repeated measures ANOVA

Table 4. Psychological Outcomes Among Donors During Follow-up

Parameter	Baseline	3 months	1 year	2 years	≥3 years	p-value
Depression (HAM-D)						
No depression	9	1	7	12	27	<0.01*
Mild	77	39	84	89	98	
Mild–Moderate	58	80	68	59	36	
Moderate–Severe	18	42	3	2	1	
Anxiety (HAM-A)						
No anxiety	8	4	20	37	78	<0.01*
Mild	98	96	97	112	81	
Moderate	56	60	45	13	3	
Quality of Life (Total Score) #	86.8 ± 8.8	58.8 ± 6.4	77.4 ± 5.8	89.8 ± 6.0	91.3 ± 8.2	<0.01*

Chi-square test
 # Repeated measures ANOVA

DISCUSSION

This study demonstrates that living kidney donation is a safe procedure with favorable long-term clinical, biochemical, morphological, and psychological outcomes. The results correspond closely with existing international and regional evidence on donor well-being[1–6].

A mild, non-significant increase in BMI was observed during follow-up, consistent with findings from Segev et al.[2] and Patel et al.[6], who found no major metabolic disturbances in long-term donors. Systolic and diastolic blood pressures showed a slight but statistically significant rise, reflecting trends reported by Boudville et al.[7] and Garg et al.[8], who described a modest increase in post-donation hypertension risk. However, the absence of persistent hypertension or cardiovascular complications in our study supports the notion that these changes are physiological and not pathological.

Serum creatinine and urea levels increased marginally after donation, reflecting expected adaptive responses. Similar patterns have been documented by Ibrahim et al.[1] and Mjøen et al.[5]. The decline in eGFR observed at three months, with gradual improvement thereafter, mirrors the functional adaptation reported by Wan et al.[9] and Samhan et al.[10]. Importantly, 24-hour urinary protein excretion remained within normal limits throughout follow-up, aligning with Garg et al.[3] who found no significant long-term proteinuria among donors.

Ultrasound evaluations revealed progressive increases in renal size and cortical thickness, indicating compensatory hypertrophy of the remaining kidney. This is consistent with findings from Bohlouli et al.[11], who demonstrated significant increases in kidney dimensions post-donation. Fehrman-Ekholm et al.[4] also reported similar morphological adaptation, confirming that the remaining kidney enlarges structurally to maintain adequate function. These findings underline the inherent renal reserve capacity and physiologic adaptability following nephrectomy.

Psychological well-being improved markedly in the later follow-up period, with reduced depression and anxiety scores and significant improvement in quality of life. Similar observations were made by Clemens et al.[12], Dew et al.[13], and Garcia et al.[14], who reported that transient postoperative anxiety or mild depressive symptoms typically resolve within the first year. Smith et al.[15] found that living donors' SF-36 health survey scores improved significantly after one year, comparable to our results at ≥3 years.

The transient decline in QoL observed in our donors at 3 months likely reflects postoperative discomfort and adjustment stress, followed by enhanced well-being as recovery and recipient outcomes improved. Lentine et al.[16] also found that initial emotional distress gives way to satisfaction and positive psychosocial adjustment in the long term. These findings highlight the psychological resilience and altruistic reward associated with living donation.

Our findings align with studies from both developed and developing countries, confirming the overall safety of donor nephrectomy[1–6,11,13]. The African study by Abdu et al.[17] and single-center Indian series by Patel et al.[6] similarly reported no major long-term complications, suggesting that careful donor selection and postoperative monitoring ensure favorable outcomes across populations.

The strengths of this study include its comprehensive evaluation of clinical, biochemical, morphological, and psychological parameters with a long-term follow-up. Limitations include the single-center design and absence of a

control group, which limits generalizability. Future multicenter prospective studies with matched controls are recommended to further substantiate these findings.

CONCLUSION

This study supports that living kidney donation is safe and associated with stable clinical and renal outcomes. Compensatory hypertrophy ensures adequate renal adaptation, and donors experience enhanced psychological well-being and quality of life in the long term. Continuous follow-up and psychosocial support remain essential components of post-donation care.

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