Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Pregnancy And Fetal Outcomes After Kidney Donation: The Specialized Transplant Center Experience, Nepal

Sumit Acharya

acharyadrsumit@gmail.com

Shahid Dharma Bhakta National Transplant Centre.

Lushan Singh

Shahid Dharma Bhakta National Transplant Centre.

puja Khadka

Shahid Dharma Bhakta National Transplant Centre.

Shova Sapkota

Shahid Dharma Bhakta National Transplant Centre.

Binita kutu

Shahid Dharma Bhakta National Transplant Centre.

christina shrestha

Shahid Dharma Bhakta National Transplant Centre.

Kalpana Kumari Shrestha

Shahid Dharma Bhakta National Transplant Centre.

Research Article

Keywords: kidney transplant, living donor, pregnancy

Posted Date: July 27th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10067365/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

BACKGROUND

Living kidney transplantation is the preferred treatment for end-stage renal disease (ESRD) worldwide. Globally, about 60% of living kidney donors are female, who may have concerns about how donation could affect future pregnancies, as both kidney donation and pregnancy involve physiological hyperfiltration. Thus, this study aimed to evaluate maternal and fetal outcomes in pregnancies following living kidney donation.

METHODS

We conducted a descriptive, cross-sectional study at Shahid Dharma Bhakta National Transplant Center (SDNTC), Nepal, inclusive of the female donors from January 19, 2013, to October 8, 2024, approved by the institutional review board of the Nepal Health Research Council (protocol number: 290–2025). Data were entered into Microsoft Excel and analyzed with IBM SPSS version 20, using descriptive and inferential statistics to summarize characteristics and outcomes of post-donation pregnancies.

RESULTS

Among the total 24 participants, the mean interval between donation and pregnancy was 2.5 ± 1.351 years. A total of 15 (62.50%) of the participants had vaginal delivery, while 9 (37.50%) had cesarean section with a mean birth weight of 3193.75 ± 441.41 grams. Antenatal complications of gestational diabetes mellitus and preeclampsia were reported in 4 (16.66%) participants. Repeated measures ANOVA test for eGFR demonstrated a significant effect of time in eGFR [$F (3.79, 87.09) = 4.45$, $p = 0.003$, partial $\eta^2 = 0.162$].

CONCLUSION

This study concludes favorable maternal and fetal outcomes, with a low incidence of maternal and fetal complications in post-donation pregnancy. This depicts the importance of further studies exploring post-kidney donation pregnancy characteristics in a larger sample size.

INTRODUCTION

Living donor kidney transplantation is the preferred treatment for end-stage renal disease (ESRD), a unique surgery offering better survival, quality of life, and lower costs compared to dialysis or deceased donor transplants.[1,2,3] Women, especially those of reproductive age, comprise about 60% of living

donors.[4,5] To ensure the safety of female donors who intend to become pregnant, it is crucial to comprehend how kidney donation affects pregnancy.

Both pregnancy and kidney donation lead to hyperfiltration, increasing risks of proteinuria, preeclampsia, hypertension, and long-term renal issues, as well as fetal complications like low birth weight and preterm birth.[6,7] Studies show mixed results, with some reporting increased pre-eclampsia and other pregnancy risks post-donation.[8,9]

However, evidence remains limited and inconsistent, particularly in low-resource settings. No studies to date have explored these issues in the Nepalese population. This study aims to generate context-specific evidence to explore whether living with a single kidney influenced pregnancy, pregnancy-related health risks for the mother, or adverse outcomes for the fetus that can aid pre-donation counseling regarding maternal and fetal outcomes, follow-up care, and decision-making for women of childbearing age.

METHODS

Study Design, Site and Period

This study was a retrospective cohort study with supplementary participant interviews conducted at Shahid Dharma Bhakta National Transplant Center **(SDNTC), Bhaktapur**, Nepal, the country's leading tertiary center dedicated to kidney transplantation. Data from January 19, 2013 to October 8, 2024, were retrieved from the hospital clinical record section and were analyzed.

Study Population

The study population included women of reproductive age (18–49 years) who had undergone kidney donation at least one year before pregnancy, while donors not in regular follow-up were excluded.

Sample Size and Sampling Technique

In this study, all living female kidney donors who underwent transplantation at the center during the study period were included. During the study period, a total of 1315 transplants were performed at our center, comprising 947 living women donors, 642 of whom were of reproductive age (18–49 years). After the donation, 24 of these donors became pregnant after a year of kidney donation and gave birth.

Data Collection Tools and Techniques

Data collection involved a combination of structured interviews, clinical evaluations, and review of existing medical records. Eligible participants were identified through the hospital's transplant registry

and contacted for consent and participation. Written informed consent was obtained from all participants included in the study. Structured interviews were conducted using a pretested questionnaire to collect sociodemographic details, medical history, pregnancy-related complications, delivery outcomes, and neonatal health indicators. Confidentiality was maintained throughout the study. Clinical evaluations included blood pressure measurements, urinalysis, and assessment of kidney function using serum creatinine and estimated glomerular filtration rate (eGFR). Medical records were reviewed to validate self-reported data and obtain additional clinical information on prenatal care and delivery outcomes. Key maternal outcomes assessment included the incidence of gestational hypertension, preeclampsia, proteinuria, and any evidence of post-pregnancy renal impairment. Fetal outcomes included birth weight, gestational age at delivery, APGAR scores, and the occurrence of preterm birth or intrauterine growth restriction (IUGR). The study was approved by the institutional review board (IRB) of the Nepal Health Research Council (NHRC) on 4th June,2025 with **IRB number: 290–2025.** The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Data Management and Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS version 20, with descriptive statistics used to summarize characteristics. eGFR (e Glomerular Filtration Rate) of participants was calculated using CKD-EPI creatinine equation across seven time points. Mauchly's test was done to assess assumption of sphericity and then Greenhouse–Geisser correction was applied. Repeated measures ANOVA was applied to assess the effect of time on eGFR. A p-value < 0.05 was considered statistically significant.

RESULTS

Among 24 participants, 11 (45.83%) were from Bagmati followed by 5 (20.83%) from Gandaki, 4 (16.66%) from Lumbini, 2 (8.33%) from Madhesh, and 1 (4.16%) from Koshi and Sudurpaschim province and there were no participants from Karnali province. Brahmin / Chhetri and Janajati constituted a major ethnic distribution with 10 (41.66%) participants from each group. 3 (12.50%) and 1 (4.16%) participants were Madhesi and Dalit respectively. 5 (20.83%) of the participants were Illiterate whereas 13 (54.16%) were educated at least up to secondary level or above.

Table 1
Characteristics of participants (n = 24)

Variables	Mean ± SD
Age of Donation (Years)	26.25 ± 5.024 (Range: 19 to 36)
Age of Pregnancy (Years)	28.79 ± 5.657 (Range: 20 to 41)
Interval between donation and Pregnancy (Years)	2.5 ± 1.351 (Range: 1 to 5)
BMI (kg/m^2) pre pregnancy	25.73 ± 3.657
Predonation Comorbidity	2 (8.33%)

Mean age at the time of donation was 26.25 ± 5.024 years with a mean interval between donation and pregnancy of 2.5 ± 1.351 years, as shown in Table 1. Mean BMI of participants was 25.73 ± 3.657 kg/m^2 as shown in Table 1, among which, 6 (25%), 5 (20.83%), 9 (37.50%), 4 (16.66%) of them belonged to normal, overweight, obese I, obese II category of WHO BMI classification for Asian population respectively. 2 (8.33%) of the participants had thyroid disorders before donation (Table 1).

Table 2
Characteristics and Outcome of Pregnancy (n = 24)

Variables	N (%)
Primigravida	7 (29.16%)
Multigravida	17 (70.83%)
Gestational age at delivery (mean ± SD)	38.33 ± 0.963 weeks
Antenatal morbidity (n = 4)	
Gestational Diabetes Mellitus	2 (8.33%)
Gestational Hypertension	2 (8.33%)
Mode of delivery (n = 24)	
Vaginal delivery	15 (62.50%)
Cesarean section	9 (37.50%)
Fetal outcomes (n = 24)	
Birthweight (grams) (mean ± SD)	3193.75 ± 441.41
Newborn morbidity	1 (4.16%)

Out of 24 participants, 7 (29.16%) of them were primigravida while 15 (62.50%) of them had one and 2 (8.33%) of the participants had two living children (Table 2). 4 (16.66%) of the participants reported a single incident of abortion following donation, out of which 2 (8.33%) were spontaneous and 2 (8.33%)

were induced. Mean age of gestation at the time of delivery was 38.33 ± 0.963 weeks of gestation (WOG) with the range of 37 to 41 WOG.

Two participants developed gestational diabetes mellitus and 2 participants developed preeclampsia during pregnancy. Both of the patients who developed gestational diabetes mellitus had BMI in Obese I category of the WHO BMI classification for the Asian population. 15 (62.50%) of the participants had vaginal delivery while 9 (37.50%) had cesarean section, out of which 1 was emergency cesarean section for fetal distress.

Among 24 pregnancies, all of them gave live term births. The mean birth weight of a newborn was 3193.75 ± 441.41 grams with a range of 2500 to 4000 grams. 15 (62.5%) newborns had birth weights from 3000–3500 grams, 5 (20.83%) had 2500–3000 grams and 4 (16.66%) had 3500 to 4000 grams of birthweight. 1 (4.16%) of the newborns developed pathological jaundice following delivery. No newborns had NICU admission. One of the participants had two pregnancies, 1 and 3 years following donation, both of which were uneventful and resulted in live term birth via vaginal delivery.

Figure 1 demonstrates the trend of eGFR (calculated by using CKD-EPI creatinine equation). Mauchly's test indicated that the assumption of sphericity had been violated ($W = 0.194$, $\chi^2(20) = 34.06$, $p = 0.027$); therefore, Greenhouse–Geisser correction was applied. Repeated measures ANOVA demonstrated a significant effect of time on eGFR ($F(3.79, 87.09) = 4.45$, $p = 0.003$, partial $\eta^2 = 0.162$), indicating significant variation in renal function across study time points.

Among 13 participants with available DTPA data, mean eGFR of the remaining kidney increased from 43.52 ± 5.73 to 62.95 ± 7.33 ml/min/1.73m^2. This increase is statistically significant (paired t-test, $p = 0.0001$).

Table 3
Trend of Blood pressure across time (n = 24)

Parameters	**Systolic BP (mmHg) (Mean ± SD)**	**Diastolic BP (mmHg) (Mean ± SD)**
Pre-Nephrectomy	114 ± 5.80	77.50 ± 4.40
Post-Nephrectomy	115 ± 7.20	76.25 ± 6.40
Before Conception	115 ± 6.50	75.83 ± 6.53
1st Trimester	115 ± 12.02	76.25 ± 8.24
2nd Trimester	118 ± 12.03	77.08 ± 6.90
3rd Trimester	120.42 ± 9.99	78.33 ± 4.81
6 Months Post-Delivery	117.92 ± 7.79	74.58 ± 5.09

Table 3 demonstrates the mean systolic and diastolic blood pressure changes across time. It shows slight increase during 3rd trimester of pregnancy.

Out of 24 participants, mean predonation 24 hour urine protein test was 181.71 +/- 64.85 mg/ 24 hour while postdonation 24 hour urine protein test increased to 225.05 +/- 119.44 mg/ 24 hour among which 3 (12.50%) participants had more than 300 mg/ 24 hour.

DISCUSSION

This study offers new insights into pregnancy results after living kidney donation in Nepal, addressing a gap in the literature where no prior data existed. Our research indicates that undergoing pregnancy following kidney donation is generally favorable, resulting in positive maternal and neonatal outcomes along with a minimal occurrence of complications. In this study incidence of antenatal complications such as gestational diabetes mellitus and preeclampsia was relatively low (8.33% each)suggesting that pregnancy following kidney donation is generally safe in selected donors, resulting in positive maternal and neonatal results along with a minimal occurrence of complications which is similar to another study which concluded that there is less chance of pregnancy-related problems after kidney donation.[9] Whereas our study contrasts with the findings of Ibrahim et al., which observed that the risk of gestational hypertension, proteinuria, and pre-eclampsia among pregnancies after kidney donation increased with a lower likelihood of full-term delivery.[8]

The fetal outcomes observed in our study were encouraging, as all pregnancies resulted in live term births, with an average birth weight of 3193.75 ± 441.41 grams. Only a single newborn exhibited morbidity (pathological jaundice), and there were no instances of intrauterine growth restriction or preterm birth, supporting favorable fetal outcomes. These results are consistent with several studies which showed predominantly favorable fetal outcomes following donation.[6,7,10] The trends in renal function among our participants indicated compensatory hyperfiltration in the remaining kidney, accompanied by notable increases in eGFR over time. This study demonstrates stable renal function across pregnancy and postpartum period. This is consistent with prior literature indicating that most living kidney donors maintain adequate renal function during and after pregnancy.[2,8] Blood pressure remained predominantly stable, exhibiting only a slight increase in systolic values during the third trimester, which aligns with the anticipated physiological changes associated with pregnancy which is in line with another study overall blood pressure trends during pregnancy were comparable to expected physiological changes, with most donors maintaining stable values.[11] The relatively consistent blood pressure profile further reinforces the safety of pregnancy in meticulously chosen donors though long-term blood pressure monitoring is required to establish any long term effects.

Proteinuria might be prevalent in living donors after several years of kidney donation.[12] Our study revealed 3 (12.50%) of the donors had proteinuria more than 300 mg/ 24 hour which is similar to one study conducted by Garg et al that showed 15% of the donors had proteinuria.

This study further highlights important demographic and clinical characteristics, such as the interval between donation and pregnancy (averaging 2.5 years), which apparently did not adversely affect the outcomes. This suggests that, with appropriate monitoring, pregnancy may be considered safe even a few years after donation. These findings are particularly relevant for counseling female donors in resource -limited settings like Nepal.

Limitations

Despite these encouraging findings, the study has several limitations. The small sample size limits generalizability of the results. The absence of a matched non-donor control group further limits the ability to draw definitive conclusions regarding relative risk. Our study lacks data on long term prognosis of donors in terms of hypertension and proteinuria.

Future multicenter studies with larger sample sizes and control groups are essential to more accurately delineate the risks and improve counseling for women contemplating kidney donation.

Conclusion

This study suggests generally favorable maternal and fetal outcomes following kidney donation in a small cohort of Nepalese population. Renal function remained stable throughout the pregnancy with evidence of compensatory hyperfiltration. Larger multicenter studies are needed to better define risks and guide donor counseling.

Declarations

Ethics Approval and Consent to participate

The study was approved by the Institutional Review Board (IRB) of the Nepal Health Research Council (NHRC) on 4 June 2025 (IRB No. 290-2025). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrollment.

Consent for Publication

Not Applicable

Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request. Data sharing is subject to institutional and ethical guidelines.

Conflict of Interests

All the authors declare that there is no conflict of interest regarding the publication of this paper.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgements

The authors extend their gratitude to the Shahid Dharma Bhakta National Transplant Centre (SDNTC) for granting approval to conduct this research and for its support throughout the study period. The authors also acknowledge Gamma Imaging Center for providing free of cost post donation DTPA scan for the participants.

References

1. Artan AS, Fleetwood V, Guller N, Oto OA, Mirioglu S, Yazici H, et al. Pregnancy in Living Kidney Donors: An Evidence-Based Review. Curr Transpl Rep. 2023;10(3):110–6. 10.1007/s40472-023-00402-8.
2. van Buren MC, Meinderts JR, Oudmaijer CAJ, de Jong MFC, Groen H, Royaards T, et al. Long-Term Kidney and Maternal Outcomes After Pregnancy in Living Kidney Donors. Transpl Int. 2023;36:11181. 10.3389/ti.2023.11181.
3. Ghods AJ. The history of organ donation and transplantation in Iran. Exp Clin Transpl. 2014;12(Suppl 1):38–41. 10.6002/ect.25liver.l29.
4. Kim S, van Zwieten A, Wyld M, Ladhani M, Guha C, Dominello A, et al. Sociodemographic drivers of donor and recipient gender disparities in living kidney donation in Australia. Kidney Int Rep. 2023;8(8):1553–61. 10.1016/j.ekir.2023.05.016.
5. Francisco JT, Freitas J, Sousa C, Coimbra MT, Carvalho R, Vilela S et al. Pregnancy After Kidney Donation: The Experience in a Cohort of Portuguese Living Donors. Transplant Proc. 2023;55(6):1373–6. 10.1016/j.transproceed.2023.05.005
6. Kaul A, Bhaduaria D, Yachha M, Behera MR, Kushwaha R, Prasad N, et al. Impact of Kidney Donation on Pregnancy Outcomes: A Retrospective Analysis. Indian J Nephrol. 2022;32(5):439–44. 10.4103/ijn.ijn_411_21.
7. Wrenshall LE, McHugh L, Felton P, Dunn DL, Matas AJ. Pregnancy After Donor Nephrectomy 1, 2. Transplantation. 1996;62. Available from: https://research.wright.edu/en/publications/pregnancy-after-donor-nephrectomy-1-2/
8. Ibrahim H, Akkina S, Leister E, Gillingham K, Cordner G, Guo H, et al. Pregnancy Outcomes after Kidney Donation. Am J Transpl. 2009;9(4):825–34. 10.1111/j.1600-6143.2009.02548.x.
9. Davis S, Dylewski J, Shah PB, Holmen J, You Z, Chonchol M, et al. Risk of Adverse Maternal and Fetal Outcomes during Pregnancy in Living Kidney Donors: A Matched Cohort Study. Clin Transpl.

2019;33(1):e13453. 10.1111/ctr.13453.

10. Reisæter AV, Røislien J, Henriksen T, Irgens LM, Hartmann A. Pregnancy and Birth After Kidney Donation: The Norwegian Experience. Am J Transplant. 2009;9(4):820–4. 10.1111/j.1600-6143.2008.02427.x.
11. Garg AX, Nevis IF, McArthur E, Sontrop JM, Koval JJ, Lam NN, et al. Gestational Hypertension and Preeclampsia in Living Kidney Donors. N Engl J Med. 2015;372(2):124–33. 10.1056/NEJMoa1408932.
12. Garg AX, Arnold JB, Cuerden MS, Dipchand C, Feldman LS, Gill JS, et al. Hypertension and kidney function after living kidney donation. JAMA. 2024;332(4):287–99. 10.1001/jama.2024.8523.

Figures

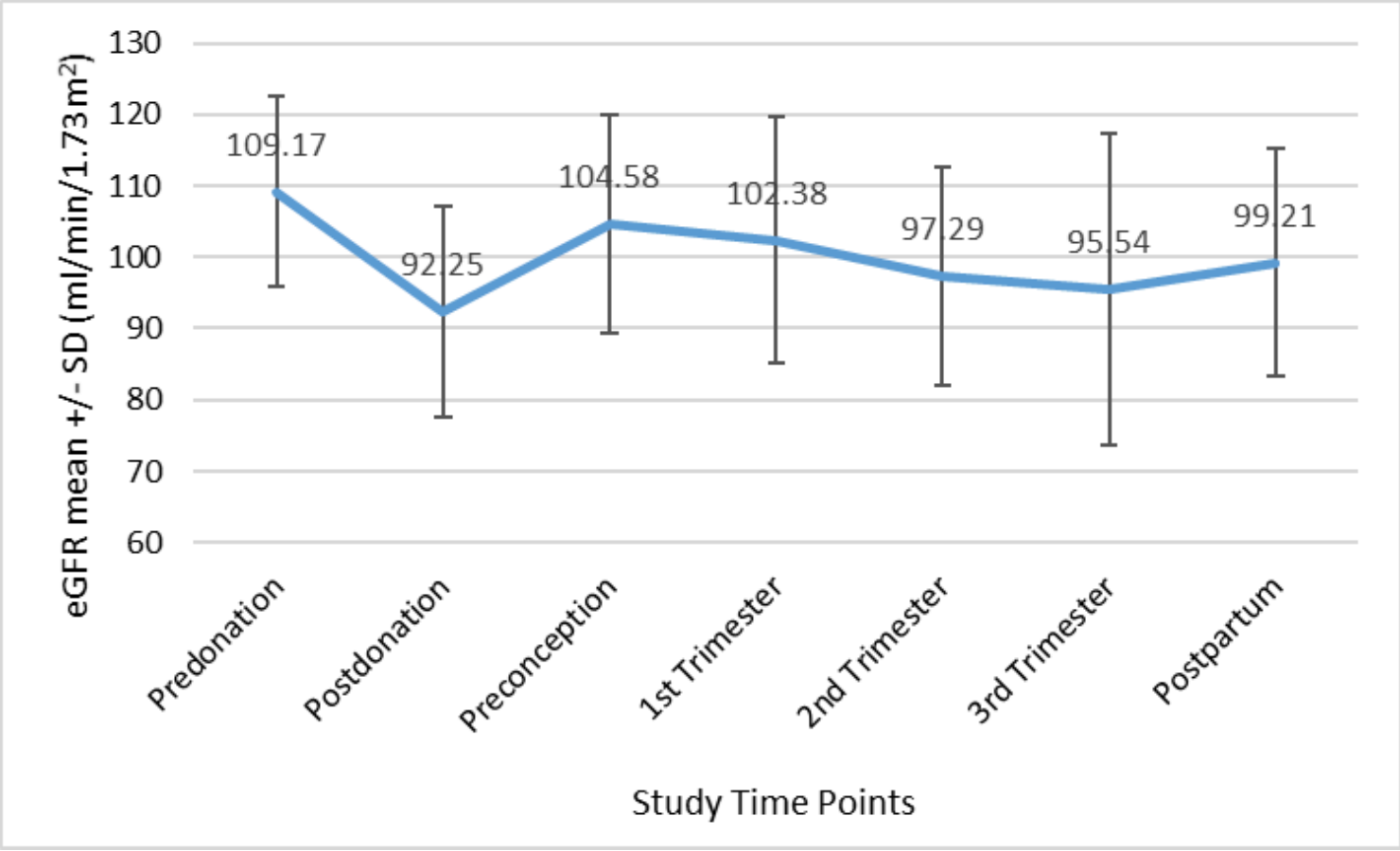


Figure 1

Trend of eGFR across time