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Original Research Article

COMPARATIVE OUTCOMES OF INTERNAL VS EXTERNAL ILIAC ARTERY ANASTOMOSIS IN RENAL TRANSPLANTATION: OUR EXPERIENCE AT A TERTIARY CARE CENTRE

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ABSTRACT

Background: Renal transplantation improves end-stage renal disease (ESRD) outcomes, with both internal and external iliac artery (EIA) anastomoses being effective, while careful surgical technique remains crucial for early graft function and reduced complications. This study aimed to compare early postoperative and short-term outcomes of renal transplants using internal versus EIA anastomosis. **Materials and Methods:** This prospective observational study was conducted at Madurai Medical College between January 2023 and January 2025. Fifty patients who underwent single-artery renal transplantation were included and divided into two groups: end-to-side anastomosis of the EIA and end-to-end anastomosis of the internal iliac artery. Baseline characteristics, intraoperative parameters, early graft function, and postoperative complications were recorded. **Result:** Baseline characteristics, including age, gender, donor type, diabetes, hypertension, and smoking history, were similar between the groups ($p>0.05$). The time to urine output was longer in the external iliac group (29.0±5.6 min) than in the internal iliac group (21.0±6.2 min, $p=0.001$). Peak systolic velocity (PSV) was higher in group A (145.6±26.7 cm/s vs. 122.3±24.5 cm/s, $p=0.029$), and nadir serum creatinine was lower (1.39±0.23 mg/dL vs. 1.70±0.27 mg/dL, $p=0.009$). Cold and warm ischaemic times, anastomosis times, resistive index, and hospital stay were similar. Lymphocele formation was higher in the internal iliac group (16% vs 8%, $p=0.042$), while other postoperative complications did not differ significantly. **Conclusion:** Internal and external iliac artery anastomoses are safe and provide comparable early and short-term outcomes. Differences in urine output and lymphocele rates did not affect overall graft function. Arterial choice can be guided by surgical preference and anatomical considerations.

INTRODUCTION

End-stage renal disease (ESRD) is an increasing global health concern, particularly in low- and middle-income countries where access to dialysis and transplantation is limited. Rising rates of diabetes and hypertension, and regional differences in healthcare, contribute to variations in survival outcomes worldwide.[1] Globally, the annual death rate due to chronic kidney disease is estimated to be 735,000, whereas the prevalence of ESRD in India is between 151 and 232/million population.[2] Renal transplantation provides better survival, fewer cardiovascular complications, and improved quality of life than long-term dialysis, supporting its role as the preferred treatment for ESRD worldwide.[3] Recent advancements in immunotherapy, surgical techniques, and kidney preservation have improved the safety and efficacy of renal transplantations, making it the most common form of vascularised solid organ transplantation. The technical skills of the surgeon are key factors affecting early postoperative outcomes, as careful surgical technique can minimise complications such as ureteric injuries and optimise graft function and patient recovery.[4]

In renal transplantation, artery anastomosis can be performed using end-to-side or end-to-end techniques. End-to-side anastomosis connects the donor renal artery to the recipient's external iliac artery (EIA), whereas end-to-end anastomosis connects the donor renal artery to the recipient's internal iliac artery (IIA).[4,5] Both techniques provide comparable graft and patient outcomes; however, technical precision and choice of artery are

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important. End-to-end anastomosis has been associated with a higher risk of distal ischaemia, erectile dysfunction, and claudication.[5] EIA is often preferred because of its larger size, superficial location, and easier surgical access. Its use is associated with technical ease and favourable early postoperative outcomes.[6] The IIA is used when the EIA is unsuitable, but it requires more extensive dissection and may carry a higher risk of certain complications.[5]

Multiple renal arteries, which were once considered a surgical challenge, are no longer a contraindication for kidney transplantation. With careful surgical technique, both the internal and external iliac arteries achieve similar outcomes regarding postoperative complications, graft function, and patient survival.[7] Previous studies have shown that both arteries can be used safely, with comparable early graft outcomes.[8,9] However, IIA anastomosis may increase lymphocele formation, but further information on this is limited, as only a few studies have focused on short-term postoperative outcomes.[10,11] This gap in the literature must be addressed because understanding the early postoperative implications of the anastomotic site is necessary for improving surgical decision-making, minimising complications, and ensuring quick patient recovery. Hence, this study aimed to evaluate institutional experience and compare early postoperative and short-term outcomes of renal transplants using internal versus EIA anastomosis at our tertiary care centre.

MATERIALS AND METHODS

This prospective observational study included 50 patients undergoing single-artery renal transplantation at Madurai Medical College from January 2023 to January 2025. Ethical approval was obtained from the institutional ethics committee, and informed consent was obtained from all patients.

Inclusion and exclusion criteria

The study included patients receiving either living or deceased donor kidneys who were willing to provide informed consent and comply with the follow-up. Patients with multi-artery renal transplants, ABO incompatibility, severe coagulopathy, or uncontrolled systemic infections were excluded. Individuals with a prior renal transplant or those unwilling to provide consent or follow-up data were also excluded.

Methods: The study population consisted of 50 patients, who were equally divided into two groups (n = 25 each): Group A underwent end-to-side anastomosis to the EIA, and Group B underwent end-to-end anastomosis to the IIA. Before surgery, all patients underwent a detailed medical history, physical examination, and preoperative imaging of the iliac vessels to assess their vascular anatomy and suitability for the procedure. Patients with significant atherosclerosis, previous pelvic surgery precluding iliac access, or other technical contraindications were excluded.

All transplants were performed by the same experienced surgical team using a retroperitoneal approach. The renal vein was anastomosed end-to-side to the external iliac vein in all cases. Vascular anastomoses were performed using fine Prolene sutures (6-0 or 7-0), selected according to the vessel diameter. Arterial and venous anastomosis times, warm ischaemia time, and cold ischaemia time were recorded. Ureteroneocystostomy was performed using the modified Lich–Gregor technique in all patients. Following surgery, patients were evaluated for time to onset of urine output, resistive index (RI), peak systolic velocity (PSV) on Doppler ultrasound, nadir serum creatinine, duration of hospital stay, and early postoperative complications. The complications assessed included lymphocele formation, postoperative bleeding, wound infection, postoperative hypertension, erectile dysfunction, graft artery stenosis on Doppler, re-exploration or revision anastomosis, delayed graft function, and early graft loss. Follow-up was conducted during hospitalisation and monthly thereafter, with Doppler evaluation of graft perfusion and clinical monitoring of graft function and patient recovery during the short-term postoperative period were performed.

Statistical analysis: Data were analysed using IBM SPSS Statistics v27. Continuous variables are presented as mean ± standard deviation, and categorical variables are expressed as frequencies and percentages. Comparative analysis was performed using the chi-square test, Fisher's exact test or the unpaired Student's t-test, with p-values <0.05 considered statistically significant.

RESULTS

Both groups were comparable in baseline characteristics, with no significant differences in age (41.3 ± 9.1 vs. 40.7 ± 8.8 years), gender (18:7 vs. 17:8), and donor type (21:4 vs. 20:5). The prevalence of diabetes mellitus and hypertension was comparable between the groups (24% and 80% vs. 20% and 84%, respectively). A history of smoking was similar in both groups (28 vs. 24%), and none of these differences were significant (p > 0.05) [Table 1].

The time to urine output was longer in group A, with a significant difference (29.0 ± 5.6 vs. 21.0 ± 6.2 minutes, p = 0.001). Similarly, the PSV was also higher in group A, and this difference was significant (145.6 ± 26.7 vs. 122.3 ± 24.5 cm/s, p = 0.029). The mean restrictive index (RI) was 0.71 ± 0.04 in group A and 0.68 ± 0.05 in group B, with a significant difference of p = 0.052. The nadir serum creatinine was lower in group A, and this difference was significant (1.39 ± 0.23 vs. 1.70 ± 0.27 mg/dL, p = 0.009) [Table 2].

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Table 1: Comparison of baseline clinical characteristics between groups

Categories	Group A	Group B	p-value
Age (years)	41.3 ± 9.1	40.7 ± 8.8	0.814
Gender (Male: Female)	18:07	17:08	n/a
Type of donor (Live: Deceased)	21:04	20:05	0.81
Presence of diabetes mellitus	6 (24%)	5 (20%)	0.74
Hypertension	20 (80%)	21 (84%)	0.71
Smoking history	7 (28%)	6 (24%)	0.76

Footnotes: Data are presented in mean ± standard deviation, ratios, frequencies and percentages. Comparisons are made using the chi-square test, and a p-value < 0.05 was considered significant.

Table 2: Comparison of intraoperative and early postoperative outcomes between groups

Categories	Group A	Group B	p-value
Cold ischemic time (min)	65.8 ± 7.5	66.2 ± 8.1	0.857
Arterial anastomosis time (min)	24.8 ± 3.2	23.9 ± 2.7	0.288
Venous anastomosis time (min)	11.4 ± 1.9	11.2 ± 2.1	0.726
Warm ischemic time (min)	27.5 ± 3.5	26.8 ± 3.2	0.464
Time to urine output (min)	29 ± 5.6	21 ± 6.2	0.001
Mean RI	0.71 ± 0.04	0.68 ± 0.05	0.052
PSV (cm/s)	145.6 ± 26.7	122.3 ± 24.5	0.029
Nadir serum creatinine (mg/dL)	1.39 ± 0.23	1.70 ± 0.27	0.009
Hospital stays (days)	11.2 ± 3.1	11.9 ± 3.7	0.478

Footnotes: min (minutes), RI (resistive index), cm/s (centimetre per second), mg/dL (milligrams per decilitre), PSV (Peak systolic velocity). Data are presented as mean ± standard deviation. Comparisons between groups were performed using the unpaired Student's t-test. A p-value < 0.05 was considered significant.

Lymphocele formation was higher in group B (16 vs. 8%), and this difference was significant (p = 0.042). Other complications, including bleeding, wound infection, hypertension, erectile dysfunction, graft stenosis, re-exploration, delayed graft function, and early graft loss, had no significant differences (p > 0.05) [Table 3].

Table 3: Comparison of postoperative complications between groups

Categories	Group A	Group B	p-value
Lymphocele formation	2 (8%)	4 (16%)	0.042
Postoperative bleeding	1 (4%)	1 (4%)	0.99
Wound infection	1 (4%)	2 (8%)	0.611
Postoperative hypertension	6 (24%)	5 (20%)	0.737
Erectile dysfunction (in males)	2 (11%)	3 (18%)	0.442
Graft artery stenosis on Doppler	1 (4%)	2 (8%)	0.578
Re-exploration/revision anastomosis	1 (4%)	2 (8%)	0.620
Delayed graft function	2 (8%)	3 (12%)	0.662
Early graft loss	0	1 (4%)	0.311

Footnotes: Data are presented in frequencies and percentages. Comparisons are made using the Chi-square test or Fisher's exact test, and a p-value < 0.05 was considered significant.

DISCUSSION

This study evaluated the early and short-term outcomes of renal transplants using internal versus EIA anastomosis to guide surgical decisions and optimise patient outcomes. Baseline characteristics, including age, gender, donor type, and comorbidities, were comparable between groups. Similarly, Howard et al. found that 37.9% of patients undergoing vascular surgery were smokers, a higher rate than that in patients undergoing other types of surgery.[12] Kang et al. reported that among patients undergoing vein stent procedures, 51.1% had hypertension, 23% had diabetes, and 22.2% were smokers.[13] These results align with previous studies indicating that diabetes, hypertension, and smoking are common among patients undergoing vascular procedures.

Our study shows that the time to urine output was significantly longer in group A compared to group B. In contrast, Nawaz et al. reported no significant difference in the meantime to urine output between the external (22.5 min) and internal iliac artery groups (15.4 min, p = 0.45).[14] Thus, the longer time to urine output in the EIA group indicates delayed early graft function, which may be influenced by surgical technique or institutional practices.

In our study, the PSV was higher and the nadir serum creatinine was lower in Group A than in Group B. Similarly, Luna et al. examined PSV in renal transplant recipients and reported that the mean renal artery anastomosis PSV was 174 cm/s, while the external iliac artery PSV was 134 cm/s, showing a significant correlation (p < 0.001).[15] In contrast, Nawaz et al. reported similar nadir serum creatinine levels between the groups (1.17 vs. 1.31 mg/dL, p = 0.68).[14] This shows that higher PSV and lower nadir creatinine in the EIA group suggest better early graft blood flow and kidney function.

In our study, intraoperative measures, such as cold ischaemic time, arterial and venous anastomosis

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time, warm ischaemic time, mean RI, and hospital stay duration, were similar between the groups, and none of these differences were significant. Similarly, Pal et al. found that the cold ischaemia time was slightly longer in Group A (80 ± 14.8 min) than in Group B (74 ± 15.1 min), but the difference was not significant (p = 0.22). The arterial anastomosis time was similar between Group A (23.8 ± 7.2 minutes) and Group B (24.6 ± 7.5 minutes) (p = 0.65). Similarly, the resistive index also showed no significant variation, with values of 0.69 ± 0.11 in Group A and 0.67 ± 0.09 in Group B (p = 0.20).[16] Agarwal et al. found that the arterial anastomosis time was significantly shorter in the first group (15.35 ± 3.07 min vs. 22.70 ± 7.47 min, p = 0.001), while venous anastomosis, warm and cold ischaemia times, and hospital stay were similar between groups (p > 0.05).[17] Therefore, similar ischaemic times, anastomosis times, resistive index, and hospital stay indicate comparable surgical complexity and immediate graft function, aligning with previous studies showing that minor operative differences do not affect outcomes.

In our study, lymphocele formation occurred more often in group B than in group A. Similarly, Nawaz et al. in a study found that lymphocele formation was more frequent in the IIA group (16%) compared to the EIA group (8%, p = 0.042).[14] In this case, higher lymphocele rates in the internal iliac group suggest increased lymphatic complication risk, probably due to anatomical factors, consistent with previous studies.

In our study, postoperative complications, including bleeding, wound infection, hypertension, erectile dysfunction, graft artery stenosis, re-exploration, delayed graft function, and early graft loss, were similar between the two groups. Similarly, Matheus et al. found that surgical complications occurred in 21% of patients in both groups (p = 0.80), and clinical complications were 21% vs 26.3% (p = 0.55). Bleeding, wound infection, graft loss (13%), and 3-year graft (68.4% vs 73.7%) and patient survival (84.2%) showed no significant differences.[18] Thus, similar rates of bleeding, infection, graft loss, and other complications indicate that both arterial anastomosis techniques are safe and effective.

Our study shows that both internal and external iliac artery anastomoses are safe with similar early and short-term outcomes; differences in urine output and lymphocele rates did not affect overall graft function.

Limitations: The study's single-centre design and small sample size limit generalizability, with follow-up restricted to early outcomes. Variations in surgical techniques, unmeasured patient factors, and lack of long-term graft evaluation may have influenced the results.

CONCLUSION

Both internal and external iliac artery anastomoses are safe and provide comparable early postoperative and short-term outcomes in renal transplantations. Although differences in urine output and lymphocele formation were observed, they did not affect the overall graft function. These findings suggest that the choice of artery can be guided by surgical preference and anatomical considerations. Future studies with larger patient populations and longer follow-up periods are needed to assess long-term graft and patient outcomes.

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