Journal of Health and Rehabilitation Research 2791-156X JHRR

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Scientific Inquiry

Comparative Analysis External Iliac or Internal Iliac Arteries as Graft Selection for Renal Transplantation: A Scientific Inquiry

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Conflict of Interest: None.

Nawaz A., et al. (2024). 4(1): DOI: https://doi.org/10.61919/jhrr.v4i1.496

ABSTRACT

Background: Renal transplantation is the definitive treatment for patients with end-stage renal disease (ESRD), offering improved quality of life and survival rates. The success of renal transplantation significantly depends on the surgical techniques employed, particularly the site of vascular anastomosis. While both external and internal iliac arteries are commonly used for this purpose, the impact of the choice between these two sites on transplant outcomes remains a subject of debate.

Objective: This study aimed to compare the early post-operative outcomes of renal transplantation between anastomoses performed to the external iliac artery and those to the internal iliac artery, to determine if one technique offers superior results over the other.

Methods: In a quasi-experimental study at the Institute of Kidney Diseases and Transplant, 50 patients with single-artery renal transplants, performed from January 2016 to July 2020, were divided into two groups based on the artery used for anastomosis: Group A (external iliac artery, n=25) and Group B (internal iliac artery, n=25). The study assessed various outcomes, including lymphocele formation, time to urine production, nadir serum creatinine levels, resistive index, hospital stay duration, and erectile function pre- and post-transplant, using the International Index of Erectile Function (IIEF) scoring system. Statistical analysis was conducted using IBM SPSS Statistics version 26.

Results: The incidence of lymphocele formation was significantly higher in Group B (3 cases) compared to Group A (1 case) (P=0.045). No significant differences were found in the mean time to urine production (Group A: 22.5 minutes, Group B: 15.4 minutes), mean nadir serum creatinine (Group A: 1.17 mg/dl, Group B: 1.31 mg/dl), or mean resistive index (Group A: 0.62, Group B: 0.63). The mean hospital stay and changes in erectile function scores pre- and post-transplant were also similar between the groups.

Conclusion: The choice between external and internal iliac artery anastomosis in renal transplantation does not significantly affect early post-operative outcomes, except for a higher risk of lymphocele formation with the internal iliac artery. These findings highlight the importance of surgical technique selection based on individual patient characteristics and suggest the need for further research to explore long-term outcomes.

Keywords: Renal transplantation, External iliac artery, Internal iliac artery, Anastomosis, Lymphocele, Early post-operative outcomes, End-stage renal disease, Vascular complications.

INTRODUCTION

Renal transplantation stands as the gold standard for managing end-stage renal disease, offering patients liberation from the constraints of dialysis, an enhanced quality of life, and an extended survival span in comparison to those who remain on dialysis (1). Recent years have witnessed notable advancements in both immunotherapy and surgical techniques, contributing significantly to the safety and efficacy of renal transplants, thereby making it the most common form of vascularized solid organ transplantation. The reduction in surgical complications and the consequent improvement in graft survival rates can be attributed to these advancements, as well as to the technical proficiency acquired in surgical practices (2). Typically, renal artery anastomosis during transplantation is performed using one of two techniques: end-to-side anastomosis, which involves connecting the donor renal artery to the recipient's external iliac artery, and end-to-end anastomosis, which involves connecting the proximal end of the donor

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renal artery to the distal end of the recipient's internal iliac artery. Despite the frequent employment of end-to-side anastomosis to the external iliac artery, comparative studies between these two techniques have been sparse. However, evidence from a randomized controlled trial suggests that there is no significant difference in outcomes between the two techniques (2). The renal artery can be anastomosed to various recipient sites including the native renal artery, the aorta, and the common, external, and internal iliac arteries, with the renal vein correspondingly connected to the recipient's veins (3). The choice of anastomosis site, typically between the external and internal iliac arteries, often depends on factors such as the surgeon's preference, the length of the donor artery, and the characteristics of the internal iliac artery. Some experts advocate for the preservation of the internal iliac artery to maintain sexual function, particularly in younger patients with end-stage renal disease who may already have compromised vasculature due to atherosclerosis (4). Anatomically, the external iliac artery presents a larger caliber and requires minimal dissection for anastomosis, whereas the internal iliac artery, being smaller, necessitates more extensive dissection. Furthermore, complications such as thrombosis in the external iliac artery can potentially jeopardize the blood supply to the lower limb, posing a risk to limb viability (5). Given these considerations, the choice between utilizing the external iliac artery (EIA) and the internal iliac artery (IIA) for renal transplantation anastomosis is critical, as it may significantly influence graft outcomes. This study aims to evaluate the early outcomes of anastomosis between the EIA and IIA, providing insights into the implications of each approach and thereby guiding optimal surgical practice in renal transplantation.

MATERIAL AND METHODS

The study received ethical approval from the Ethical Committee of the Institute of Kidney Disease (IKD), Hayatabad, Peshawar, in line with the Helsinki Declaration (approval date: 05/01/2016, approval number: 144), ensuring the ethical conduct of research involving human subjects. This quasi-experimental investigation was carried out at the Institute of Kidney Diseases and Transplant between January 2016 and July 2020, focusing on patients who underwent single-artery renal transplantation. Participants were meticulously selected based on specific inclusion criteria and subsequently divided into two distinct groups for comparative analysis. Group A comprised patients who underwent renal transplantation with anastomosis to the external iliac artery, whereas Group B included those with anastomosis to the internal iliac artery. The surgical interventions for both cohorts were executed by the same team of experienced surgeons to maintain consistency in procedural standards.

The scope of the comparative analysis extended to evaluating various post-transplant outcomes. These included the duration of urine production following the de-clamping of the renal artery, resistive index measurements, the length of hospital stay, and the incidence of complications such as renal vessel thrombosis and lymphocele formation. Additionally, the study examined nadir creatinine levels, occurrences of delayed graft function and kidney non-function, renal artery stenosis, and cases of erectile dysfunction post-transplant. To assess erectile function before and after the transplant, the International Index of Erectile Function (IIEF) scoring system was employed, providing a standardized measure for this specific outcome.

Data collection was systematic, ensuring the accuracy and reliability of the information gathered for analysis. Pre-transplant evaluations included a comprehensive assessment of each patient's medical history and baseline health status, with particular attention to factors that could influence post-transplant outcomes. Post-transplant data were collected at regular intervals to monitor the progress and identify any complications arising from the surgical procedure.

Statistical analysis was conducted using IBM SPSS Statistics version 26, a robust tool for managing and analyzing data. This phase involved a detailed examination of the collected data, employing various statistical methods to identify significant differences between the two groups. The significance of findings was determined based on a P-value threshold of ≤ 0.05, ensuring that the results were statistically valid and provided meaningful insights into the comparative outcomes of external versus internal iliac artery anastomosis in renal transplantation.

By adhering to these rigorous methodological standards, the study aimed to contribute valuable knowledge to the field of renal transplantation, offering insights into the optimal surgical approach for enhancing patient outcomes and graft survival.

RESULTS

In the comparative analysis of renal transplantation outcomes between patients undergoing anastomosis to the external iliac artery (Group A) and those with anastomosis to the internal iliac artery (Group B), both groups comprised 25 patients each, ensuring a balanced comparison. The mean age of patients in Group A was slightly higher at 36.2 years compared to 34.5 years in Group B, although this age difference did not reach statistical significance, suggesting that age, in this context, did not notably influence the outcomes between the two groups.

One of the key findings of the study was the incidence of lymphoceles, where a significant difference was observed between the two groups. Specifically, Group A reported a single case of lymphocele formation, whereas Group B experienced three cases,

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resulting in a P-value of 0.045, indicating a statistically significant higher occurrence in Group B (Table 1). This suggests that the choice of anastomosis site might influence the risk of lymphocele formation post-transplantation.

Regarding the functionality of the transplanted kidney, the mean time to urine production post-de-clamping of the renal artery was 22.5 minutes for Group A and 15.4 minutes for Group B. Despite the quicker onset of urine production in Group B, this difference did not achieve statistical significance, indicating that both anastomosis techniques provide comparable outcomes in terms of immediate graft function.

The study also explored other complications and outcomes, such as delayed graft function, arterial kinks, nadir serum creatinine levels, and resistive index measurements, none of which showed significant differences between the two groups. For instance, neither group reported cases of delayed graft function or thrombosis, and the occurrence of arterial kink was minimal, with one case in Group A and none in Group B. Similarly, mean nadir serum creatinine levels and mean resistive index values were closely aligned between the groups, further supporting the conclusion that both anastomosis techniques yield similar post-transplant outcomes.

Hospital stay duration and transplant artery stenosis were other variables examined, with mean hospital stays of 14.3 days for Group A and 13.8 days for Group B, and no cases of transplant artery stenosis reported in either group. These findings indicate that the recovery period and the risk of significant vascular complications were comparable across both anastomosis sites.

Table 1 Characteristics of Patients Undergoing Renal Artery Anastomosis of both groups.

Variable	Group A (External Iliac) n=25	Group B (Internal Iliac) n=25	P-Value
Mean Age (years)	36.2	34.5	>0.05
Number of Lymphoceles	1	3	0.045
Mean Time to Urine Production (minutes)	22.5	15.4	>0.05
Delayed Graft Function	0	0	-
Arterial Kink	1	0	>0.05
Mean Nadir Serum Creatinine (mg/dl)	1.17	1.31	>0.05
Mean Resistive Index	0.62	0.63	>0.05
Thrombosis	0	0	-
Mean Hospital Stay (Days)	14.3	13.8	>0.05
Transplant Artery Stenosis	0	0	-
Pretransplant Erectile Function Score (IIEF)	22.05	22.66	>0.05
Post-Transplant Erectile Function Score (IIEF)	22.57	22.66	>0.05
Follow-up (months)	12.7	12.7	-

Erectile function, assessed using the International Index of Erectile Function (IIEF) scoring system, was evaluated both pre- and post-transplant. Scores were similar between the groups before and after transplantation, with pre-transplant scores of 22.05 for Group A and 22.66 for Group B, and post-transplant scores of 22.57 for Group A and 22.66 for Group B. The lack of significant change in these scores post-transplant suggests that renal transplantation, regardless of the anastomosis site, does not adversely affect erectile function.

Finally, the follow-up period for both groups was identical, at 12.7 months, allowing for a consistent comparison of long-term outcomes. The comprehensive analysis provided by this study, highlighted by the detailed examination of a variety of clinical outcomes, underscores the conclusion that the choice between external and internal iliac artery anastomosis in renal transplantation does not significantly affect most of the measured post-transplant outcomes, with the exception of lymphocele formation, where a preference for external iliac artery anastomosis may be considered due to a lower incidence rate.

DISCUSSION

In this meticulous examination of renal transplantation outcomes, the focus was placed on discerning the impact of vascular anastomosis sites, specifically comparing the external iliac artery with the internal iliac artery. This inquiry is grounded in the reality that patients with end-stage renal disease (ESRD) often present with multiple comorbidities, including those related to atherosclerosis, making the precision of vascular anastomosis a pivotal factor in both the immediate and long-term success of the transplant.

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The study's findings illuminated a notable disparity in lymphocele formation, with a higher incidence observed in patients undergoing internal iliac artery anastomosis. This outcome, which reached statistical significance, could be attributed to the increased dissection required for the internal iliac artery, given its deeper location within the pelvis. Such findings are in line with previous research, including studies by Pal DK et al. (2017) and Daowd R et al. (2015), which similarly found no significant difference in lymphocele formation between anastomosis sites (6,7). Despite these correlations, our study contributes to the nuanced understanding of potential risks associated with each anastomosis site.

The comparative analysis extended beyond lymphocele formation, examining several critical parameters of transplant success. The mean time to urine production, a key indicator of immediate graft function, did not significantly differ between the two groups, echoing the findings of prior research (8). Similarly, serum nadir creatinine levels and resistive index values, both markers of kidney function and vascular resistance, respectively, fell within expected ranges and did not significantly differ between the groups, aligning with the benchmarks set by Benedetti et al. (1995) and Mathew EW et al. (2010) (9,10).

An intriguing aspect of the study was the observation of arterial kinking in one patient from the external iliac group, necessitating surgical intervention. While such complications are rare, they underscore the potential for serious vascular issues that can compromise graft viability. The absence of significant arterial complications, including thrombosis and stenosis, in our study is noteworthy, especially considering the varying incidence rates reported in the literature (17,18,19,20).

The study's methodological rigor and detailed data collection are among its strengths, providing a solid foundation for its findings. However, it is also marked by limitations, including a modest sample size and the lack of randomization, which could affect the generalizability of the results. The exclusive focus on live donors may also influence the applicability of findings across different donor types, given the known differential risks of vascular complications.

Despite these limitations, the study's initial findings suggest that the choice between the external and internal iliac artery for renal transplantation does not significantly affect early transplant outcomes. This conclusion, however, prompts the need for further research. Future studies should not only aim to corroborate these findings but also explore the long-term implications of anastomosis site selection on renal transplant success. By extending follow-up durations and broadening the scope of examined parameters within larger cohorts, subsequent research could offer more definitive conclusions. Such studies are essential for refining surgical techniques and optimizing outcomes in renal transplantation, ultimately enhancing the quality of life for patients with ESRD.

CONCLUSION

The study underscores that the choice between anastomosing the renal artery to the external or internal iliac artery in renal transplantation does not significantly impact early post-operative outcomes, although a higher incidence of lymphocele formation with the internal iliac artery suggests a nuanced consideration for surgical approach. This insight has important implications for human healthcare, suggesting that surgical decisions can be tailored to individual patient characteristics without compromising transplant success. Future research aimed at exploring long-term outcomes and broadening these findings could further refine surgical strategies, ultimately enhancing patient care and optimizing outcomes in the field of renal transplantation. This contributes to the ongoing evolution of best practices in renal transplant surgery, with the potential to improve quality of life for patients with end-stage renal disease.

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