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Comparison of Laparoscopic and Open Live Donor Nephrectomy

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ABSTRACT

Objective: To compare laparoscopic live donor nephrectomy with open live donor nephrectomy.
Study Design: Cross Sectional Analytical Study.
Place and Duration of study: Armed Forces Institute of Urology, from May 2023 to Apr 2024
Methodology: With non-probability consecutive sampling technique, the patients who presented in OPD between May 2023 and April 2024 and underwent live donor nephrectomy were selected by non-convenience sampling technique. The kidney donors were divided into two groups: Group A -those scheduled for open donor nephrectomy and Group B - those receiving laparoscopic donor nephrectomy.
Results: There were 22 donors each group. The donors' ages varied from 36 to 59 years, with an average age of 47.75+5.29 years. In the participating group were thirty males and fourteen females. Study involved the performance of 7 right-sided donor nephrectomies (RDN) and 37 left-sided donor nephrectomies (LDN). In cases with Group B, the average length of the procedure was noticeably longer. Furthermore, the initial warm ischemia in Group B - lasted an average of 9.43 + 1.93 minutes, a significantly longer time than in Group A (4.04+1.21 minutes). It was determined that this difference was statistically significant.
Conclusion: Our study concluded that laparoscopic donor nephrectomy showed advantages including less discomfort after surgery, a faster recovery period, and comparable results for graft function when compared to open live donor nephrectomy. These results imply that laparoscopic donor nephrectomy is a practical and well-liked procedure, which adds to its growing acceptance in the medical community.

Keywords: Kidney Transplant, Laparoscopic Live Donor Nephrectomy, Open Live Donor Nephrectomy.

How to Cite This Article: *Hashmi SD, Razik S, Aziz M, Naeem M, Ali M, Saeed B. Comparison of Laparoscopic and Open Live Donor Nephrectomy. Pak Armed Forces Med J 2025; 75(Suppl-5): S768-S772. DOI: https://doi.org/10.51253/pafmj.v75iSUPPL-5.12109*

INTRODUCTION

Kidney transplantation is the most recommended treatment option for end-stage renal disease (ESKD).[1] When Ratner first presented the groundbreaking laparoscopic living-donor nephrectomy in 1995, it marked a significant turning point in the history of kidney transplant surgery. Since then, this ground-breaking technique has developed into the widely accepted gold standard for kidney transplant surgery.[2] Numerous studies have demonstrated the significant influence of the laparoscopic technique on donor adherence. Research continuously shows that donors are more likely to donate for kidney transplants when the laparoscopic procedure is made available. This highlights the significant benefits of minimally invasive nephrectomy in the context of kidney donation, both in terms of encouraging potential donors to take part in the procedure and in terms of surgical results.[3-4]

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Received: 22 Apr 2024; revision received: 09 Sep 2024; accepted: 11 Sep 2024

There are several noteworthy benefits of laparoscopic donor nephrectomy, such as fewer postoperative pain, shorter hospital stays, and a speedier return to normal activities.[5-6] However, there is a significant learning curve involved in becoming proficient in laparoscopic procedures, and a surgeon must have a great deal of experience doing laparoscopic surgeries.

This study aimed to provide a thorough comparative analysis of several intraoperative and postoperative characteristics between donors undergoing laparoscopic and open nephrectomy. The study also sought to evaluate the early transplant success rates of recipients of kidneys from these various donor groups. In order to improve outcomes for both donors and recipients, this study aimed to give a more complete knowledge of the advantages and potential drawbacks of laparoscopic donor nephrectomy.

METHODOLOGY

With permission from the ethical research committees (ERC) of the hospital at the institute (ERC

Reference Number Uro-Adm-Trg-1/IRB/2023/007), we carried a cross-sectional analytical investigation at the Armed Forces Institute of Urology in Rawalpindi. We used the WHO sample size calculator to determine the sample size in order to guarantee the statistical soundness of our inquiry. With a 95% confidence interval, margin of error 5% and reported mortality rate of 0.02% after living donor nephrectomy, a very small sample size of 1 or more was recommended for the study. For accurate results we included 44 individuals in our sample size.[7] We selected participants using a non-probability convenience sampling approach, which made it possible for us to collect data from qualified people quickly. This approach was used to expedite the research process while maintaining the study's ethical and practical viability.

Inclusion Criteria: Donors were between the ages of 18 and 65, satisfy the requirements for live kidney donations, express their readiness to undergo surgery and give consent in writing, and be compatible with the recipient's blood and tissue type.

Exclusion Criteria: Patients under the age of 18, as well as donors with serious medical disorders such uncontrolled hypertension, diabetes mellitus, or chronic renal disease, were not included in the study. Exclusions from the research were smokers, extremely obese donors, and those with current hepatitis infection.

The kidney donors were divided into two groups: Group A -those scheduled for open donor nephrectomy (ODN) and Group B - those receiving laparoscopic donor nephrectomy (LDN). The transplant team carefully evaluated each donor. We used a thorough method to assess the donors' anatomy. This required doing a CT urogram in addition to an abdominal contrast-enhanced computed tomography (CECT). Furthermore, we used a 99 m-technetium diethylene-triamine-penta-acetic acid (Tc-99m DTPA) scan to measure the glomerular filtration rate (GFR). Surgical donor nephrectomies were performed at the Armed Forces Institute of Urology.

This study involved the evaluation of donor data and a one-month follow up of patients. The study concentrated on a number of important variables, such as hospital stay duration, warm ischemia time, operation duration, and demographic data. Data from the preoperative phase through 30 days post-transplant were gathered in order to compare recipient complications and early graft performance.

IBM SPSS (Statistical Package for the Social Sciences) version 26.00 was used for statistical analysis. Frequency distribution tables were used to present data summaries, and graphical methods were used to visualize the data. In terms of statistical analysis, t-tests were used where acceptable for continuous data. To compare categorical data, the chi-square test was employed. A 95% confidence interval was used for significance testing, and a *p*-value of less than 0.05 was deemed statistically significant.

RESULTS

There were 22 donors in the Group A - open donor nephrectomy (ODN) and Group B - those receiving laparoscopic donor nephrectomy (LDN), of the research. Throughout the research period, data from both group A and Group B instances were gathered. The donors' ages varied from 36 to 59 years, with an average age of 47.75+5.29 years. In the participating group were thirty males and fourteen females. The two groups' original donor characteristics were comparable. As shown in Table-I.

Table-I: Demographic and Clinical Characteristics of Donor Groups (n- 44)

Variables		Groups		*p*-value
		Group A n-22 (%)	Group B n-22 (%)	
Age (years) Mean + SD		48.64+4.64	46.86+5.82	<0.01*
Gender n (%)	Male	16(72.7%)	14 (63.6%)	0.517
	Female	6(27.3%)	8(36.4%)	
Pre-Op Serum creatinine (umol/L) Mean ±SD		88.18+11.09	92.68+10.79	<0.01*

As per Table-II This study involved the performance of 9 right-sided donor nephrectomies and 35 left-sided donor nephrectomies. The fact that 4 right-sided LDN was carried out is significant. In cases with Group B, the average length of the procedure was noticeably longer. Furthermore, the initial warm ischemia in Group B - lasted an average of 9.43+1.93 minutes, a significantly longer time than in Group A (4.04+1.21 minutes). It was determined that this difference was statistically significant.

There were no discernible differences between the two groups in terms of the mean length of hospital stay, creatinine levels of donors at time of discharge, or post-operative complications in donors. However it's important to note that the LDN group's pain was

much less on the first and second post-operative day. As shown in Table-III.

Table–II: Surgical Characteristics and Outcomes of Study Groups n=44

Variables		Groups n-44		*p*-value
		Group A n-22	Group B n- 22	
Surgery Side n(%)	Left	17(77.27%)	18(81.82%)	0.004*
	Right	5(22.73%)	4(18.18%)	
Surgery duration (mins) (Mean+SD)		127+17.5	169.5+17.3	<0.01
First warm ischemia (mins) (Mean+SD)		4.04+1.21	9.43+1.93	<0.01

Table–III: Postoperative Outcomes and Complications in Study Groups n=44

Variables	Groups n-44		*p*-value
	Group A n-22	Group B n- 22	
Pain Score 1st POD (Mean+SD)	6.13+1.12	5.363+1.04	<0.01
Pain Score 2nd POD (Mean+SD)	5.04+0.78	4.31+0.89	< 0.01
Complications n(%)	4(18.2%)	3(13.6%)	<0.01
Creatinine at Discharge (umol/L) (Mean±D)	97.45+8.58	100.3+.36	<0.01
Hospital Stay (Days) (Mean±SD)	5.40+1.05	4.90+0.97	<0.01
Creatinine after 01 month (umol/L) (Mean±SD)	107.8±5.06	106.5±3.75	<0.01

DISCUSSION

Numerous studies have demonstrated the significant influence of the laparoscopic technique on donor adherence. Research continuously shows that donors are more likely to donate for kidney transplants when the laparoscopic procedure is made available. This highlights the significant benefits of minimally invasive nephrectomy in the context of kidney donation, both in terms of encouraging potential donors to take part in the procedure and in terms of surgical results.[3-4]

In our research work, the ratio of male donors was 68.1%, while research conducted in Nepal showed more female predominance and another research work in US showed percentage of female donors to be 63%.[7,8] In every incidence of LDN, the first warm ischemia time (WIT) was systematically prolonged. The kidney cannot be recovered during an LDN operation until the surrounding tissues have been mobilised following vascular transection.[9] The mean warm ischemia time for LDN in our research was 9.43+1.93 minutes, while for ODN it was 4.04+1.21 minutes. Warm ischemia times in the single centre experience from Nepal were 11.22±4.34 minutes for LDN and 2.3±0.8 minutes for ODN.[7] Another study, the warm ischemia time was investigated. The study found that the warm ischemia times for LDN and ODN were 3.1±1.1 and 1.7±0.8 minutes, respectively. According to this data, LDN operations in this particular centre typically had a somewhat longer warm ischemia period than ODN procedures.[10] The possibility of delayed graft function as a result of longer warm ischemia times was taken into consideration theoretically. However, the results of the study showed that early graft function in instances of LDN was comparable to that of ODN patients. This implies that there were no appreciable variations in the early graft function between the two groups, even with the prolonged warm ischemia period noted in LDN operations.

The duration of surgery in our LDN procedures (169.5+17.3 minutes) was notably longer than that in ODN procedures (127+17.5 minutes). An independent study conducted in the United Kingdom reported a similar trend, with LDN requiring approximately 60 minutes more in the operating room compared to ODN (215 minutes versus 155 minutes).[11] These findings underscore the extended surgical time associated with LDN procedures in both our study and the UK study. Another study shows similar results.[12] Risk factors for a difficult laparoscopic donor nephrectomy have been found to include obesity, managing a kidney on the right side of the body, and having many renal vessels. Dissection of the lumbar vein is a crucial part of LDN because it provides access to the renal artery. Thankfully, our investigation did not reveal any evidence of lumbar vein injury, renal artery injury, or renal vein injury—conditions that potentially necessitate conversion to ODN. These results are consistent with our research's lack of LDN to ODN conversions.[13-16]

On the first postoperative day and second postoperative days, the LDN group-B saw a notable decrease in discomfort as compared to ODN group-A. This phenomena may have a possible explanation in the smaller incision and less surgical trauma linked to

LDN. Given their increased activity and mobilisation on the first postoperative day, it is conceivable that patients in the ODN group had higher pain on the second postoperative day in Group B. The results of our research are comparable to other research works.[7,17-19] The length of hospital stays in both the ODN and LDN patients was the same. The mean hospital stays for ODN and LDN, according to a research, were 6.7 and 6.2 days, respectively.[18] No statistically significant differences were found between the groups. Analogous outcomes were also noted in other researches.[7,10,19] There were no discernible variations between the two groups' recipients' one-month serum creatinine levels. Reasons for the popularity of laparoscopic donor nephrectomy include lower discomfort, faster recuperation after surgery, and comparable results in terms of graft function.

LIMITATION OF STUDY

The employed sampling methodology utilized a non-probability consecutive sampling approach rather than a randomized controlled trial, potentially introducing bias into the dataset. Subsequent investigations should prioritize larger sample sizes due to the increasing prevalence of such surgical procedures.

CONCLUSION

Our research summarizes, a number of significant data were obtained from the cross-sectional study comparing laparoscopic and open live donor nephrectomy. When compared to open donor nephrectomy, laparoscopic donor nephrectomy showed advantages including less discomfort after surgery, a faster recovery period, and comparable results for graft function. These results imply that laparoscopic donor nephrectomy is a practical and well-liked procedure, which adds to its growing acceptance in the medical community.

ACKNOWLEDGMENTS

We are thankful to Dr Muhammad Rafiq Zafar, Dr Aamer Nadeem, Dr Waqas Ranjha and Dr Umer Siddique for their guidance and support throughout the study which was very helpful to us in completion of our research project.

Conflict of Interest: None

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SDH & SR: Data acquisition, data analysis, critical review, approval of the final version to be published.

MA & MN: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MA & BS: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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