

Comparison of Surgical Outcome of Open versus Laparoscopic Nephrectomy

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^{1,3} Conception of study

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Abstract

Introduction: Removal of a kidney is a common surgical procedure for a long time. The procedure was traditionally done by open surgery. Since the advent of laparoscopic surgery, nephrectomy is being done increasingly laparoscopically. The laparoscopic approach has obvious advantages. Better cosmetics, less operative time, lesser need for blood transfusions, fewer analgesia requirements, early mobility, and oral feed, early return to work, and fewer intraoperative and post-operative major complications all contribute to the superiority of laparoscopic nephrectomy.

Objective: To compare surgical outcomes of open versus laparoscopic nephrectomy.

Materials and Methods: This Retrospectives study was conducted in the Department of Urology, Institute of kidney disease, Hayatabad, Peshawar over a period of 2 years from January 2018 to January 2020.

Results: Our study included a total of 78 cases, 48.7% males and 51.3% females. The patient means the age of 42.69 years. 39.7% had hypertension and 19.2% had diabetes mellitus. Open nephrectomy was done in 40 patients and laparoscopic nephrectomy in 38 patients. The average operating time for open nephrectomy was 160.5 minutes and 130.9 minutes for laparoscopic nephrectomy. The average blood loss during open and laparoscopic nephrectomy was 361.25ml and 59.86ml. Blood transfusion rate in open and laparoscopic nephrectomy was 55% and 10.5% ($p=0.001$). Overall, the post-operative complication rate was 52.5% and 21.5% for an open and laparoscopic approach. Post-operative pain was noted in 7.9% of patients in laparoscopic and 97.5% for an open approach. Fever was noted postoperatively in 26.3% and 62.5% of patients in laparoscopic and open approaches ($p=0.001$). The average hospital stay in the laparoscopic approach was 2.8days and 4.5days in the open approach. The mean tumor size was 5.65cm in laparoscopic while 8.1cm in the open approach. Catheter and drain removal was on average 1.18 days and 1.32days post-op day in the laparoscopic group while it was 2.35days and 2.3days post-op day in an open group, respectively. There were no per-op complications in the laparoscopic approach as compared to 2 Cases of minor IVC injury in open.

Conclusion: In our study, we conclude that the laparoscopic approach for nephrectomy is far superior as compared to the open approach and it is recommended that Laparoscopic simple and radical nephrectomy should be considered a gold standard treatment.

Keywords: Open nephrectomy, laparoscopic nephrectomy, tumor, HTN, DM.

Introduction

Removal of a kidney is a common surgical procedure for a long. There are a number of indications for the procedure like non-functioning kidney (symptomatic, hydro/pyonephrotic, with a stone, uncontrolled HTN secondary to scarred kidney), renal trauma, or tumours. The procedure was traditionally done by open surgery. Since the advent of laparoscopic surgery, nephrectomy is being done increasingly laparoscopically (Clayman 1991).¹ The laparoscopic approach has obvious advantages. Better cosmetics, less operative time, lesser need for blood transfusions, less post-operative analgesia requirements, early mobility and oral feed, early return to work, and fewer intra-operative and post-operative major complications all contribute to the superiority of laparoscopic nephrectomy.² Lap nephrectomy is better tolerated by ESRD patients as compared to open.³ Lap donor as similar graft outcomes.⁴ Lap nephrectomy can be discharged on the same day.⁵ Even a hand-assisted laparoscopic nephrectomy is considered better than an open nephrectomy.^{6,7} After long experience, development of better vision⁸, miniaturization of working instruments, and advent of sophisticated energy devices for accurate dissection and vessel sealing, laparoscopic nephrectomy is considered to be the gold standard.⁹

Our unit (Team A at IKD) is a urology and transplant unit where a variety of urological procedures are performed day in and day out including endoscopic, laparoscopic, and open procedures and renal transplantation.

In this comparative analysis, we wanted to report the similarities and differences that we observed between laparoscopic and open nephrectomy.

Objective: To compare the surgical outcome of open versus laparoscopic nephrectomy

Materials and Methods

Setting: Department of Urology, Institute of Kidney Disease, Hayatabad, Peshawar.

Duration: 2 years from January 2018-January 2020.

Study Design: Retrospective study.

Retrospective analysis of all the nephrectomies performed from January 2018 to January 2020. Data was collected by retrospectively reviewing the patients' files. All the patients undergoing nephrectomies during this period were included in the study. Note that donor nephrectomies are not

included. Similarly, pediatric laparoscopy is not routine, so patients undergoing nephrectomy but at or below 14 years of age were excluded. A total of 78 files of nephrectomies patients were retrieved from the record room and thoroughly reviewed by a single observer for the entries of all the parameters in question. All the patients were operated on by a single experienced surgeon. Patients undergoing both simple and radical nephrectomy were included. The open simple nephrectomy (OSN) was performed by retroperitoneal approach and supra twelve incision and the standard nephrectomy steps were followed. All the laparoscopic simple nephrectomies (LSN), laparoscopic radical nephrectomies (LRN), and open radical nephrectomies (ORN) were performed transperitoneally. The LSN, LRN, and ORNs were performed by standard techniques except that only three ports were used for the left-sided and four ports for the right-sided laparoscopic procedures as opposed to the standard of four and five ports respectively. The laparoscopic specimen was retrieved through different incision sites according to the surgeon's preference, mostly through the extension of the 10mm port site incision subcostal. The information retrieved was about age, gender, co-morbidities (Diabetes, Hypertension, renal impairment), clinical T-stage, hospital stay, operating time, estimated blood loss, post-operative analgesia requirement, laterality, indication for nephrectomy, placement of drain and catheter and their removal, conversion and its indications, per-operative complication, and early and late complications. All the data were analyzed by SPSS Version 22. The categorical data were compared using the Chi-Square test and the numerical data by student t-test and a p-value of less than 0.005 were considered to be statistically significant.

Results

Our study included a total of 78 cases, 38(48.7%) males and 40(51.3%) females. The patient's ages ranged from 17 to 100 years with a mean of 42.69 years. 37 (47.4%) had left-sided nephrectomies and 41(52.6) had right-sided. 31(39.7%) had hypertension and 15(19.2%) had diabetes mellitus. Open nephrectomy was done in 40 patients (17 Simple and 23 Radical) and laparoscopic nephrectomy in 38 patients (28 Simple and 10 Radical) as shown in (Table 1). The average operating time for open nephrectomy was 160.5minutes (Minimum 80 min and Maximum 240 min) and 130.9 minutes (Minimum 70 min and Maximum 240 min) for laparoscopic nephrectomy. The average blood loss

during open and laparoscopic nephrectomy was 361.25 ml (Minimum 50 ml and Maximum 750 ml) and 59.86 ml (Minimum 10 ml and Maximum 300 ml) respectively. Blood transfusion rate in open and laparoscopic nephrectomy was 55% and 10.5% respectively ($p=0.001$). In the laparoscopic group, 3 patients required a single pint transfusion, and 1 patient required 2 pints. While in the open group 9 patients required a single pint, 9 patients 2 pints, 3 patients 3 pints and 1 patient required 5 pints of blood transfusion. Overall, the post-operative complication rate was 52.5% and 21.5% for an open and laparoscopic approach. Post-operative pain was noted in 7.9% (3) patients with a laparoscopic approach and 97.5% (39) for an open approach. Fever was noted postoperatively in 26.3% (10) And 62.5% (25) patients in laparoscopic and open approaches respectively ($p=0.001$). Student's T-test was used to calculate the p-value. The average hospital stay in the laparoscopic approach was 2.8 days (Minimum 2 days and Maximum 6 days) and 4.5 days (Minimum 2 days and Maximum 23 days) in the open approach. The mean size of the tumor was 5.65 cm (Minimum 4.0cm and Maximum 9.0 cm) in the laparoscopic approach while 8.1cm (Minimum 3.5 cm and Maximum 16.8 cm) in the open approach. Catheter and drain removal were on average 1.18 days (Minimum 1 day and Maximum 3 days) and 1.32 days (Minimum 1day and Maximum 2 days) post-op day in the laparoscopic group while it was 2.35 days (Minimum 1 day and Maximum 11 days) and 2.3 days (Minimum 1 day and Maximum 5 days) post-op day in an open group, respectively. There were no per-op complications in the laparoscopic approach as compared to 2 Cases of minor IVC injury in the open approach. There were no conversions from laparoscopic to open.

Table 1:

	Procedure			Total
	Simple Nephrectomy	Radical Nephrectomy		
Approach	Open	17	23	40
	Laparoscopic	28	10	38
Total		45	33	78

Table 2

		Approach		Total
		Open	Laparoscopic	
DM	No	31	32	63
	Yes	9	6	15
Total		40	38	78

Table 3:

		Approach		Total
		Open	Laparoscopic	
HTN	No	19	28	47
	Yes	21	10	31
Total		40	38	78

Discussion

Open surgery is being replaced by a laparoscopic approach since 1986 when the first laparoscopic cholecystectomy was done. Over a period of time, laparoscopic nephrectomy has become the gold standard treatment.⁹ In our study, we have, retrospectively, done a comparative analysis of the outcomes of open and laparoscopic nephrectomy. In our study, the file records of a total of 78 patients, who underwent nephrectomies from January 2018 to January 2020, were reviewed and various parameters were observed.

Our study included a total of 78 cases, 38(48.7%) males and 40(51.3%) females. The patient's ages ranged from 17 to 100 years with a mean of 42.69 years. The mean age of patients in the laparoscopic group was 38.34 years (Min 17-Max 73) and it was 46.83 years (Min 18 - Max 100). The mean age in our study shows a younger population for the laparoscopic group (28 simple and 10 Radical) as compared to the open group (17 Simple and 23 Radical). But it is worth mentioning here that our study was not limited to only malignant cases but also simple nephrectomies and patients with non-functioning kidneys may present at an early age, as opposed to the findings in the study of Yang et al. However, our study showed a similar trend in laterality of the pathology.¹⁰ 37 (47.4%) had left-sided nephrectomies and 41(52.6) right-sided.

31(39.7%) had hypertension and 15(19.2%) had diabetes mellitus. Diabetes was present in 6(15%) cases in the laparoscopic group and 9(22%) in open cases while hypertension was present in 10(26.3%) cases in the laparoscopic group and 21(52.5%) cases in an open group. This finding is supported by the findings of Hakmin Lee et al.¹¹

Open nephrectomy was done in 40 patients (17 Simple and 23 Radical) and laparoscopic nephrectomy in 38 patients (28 Simple and 10 Radical).

The average operating time for open nephrectomy was 160.5 minutes (Minimum 80 min and Maximum 240 min) and 130.9 minutes (Minimum 70 min and Maximum 240 min) for laparoscopic nephrectomy (p -value). Here we can see the difference of 29.6 minutes with an advantage to the laparoscopic group.

Similarly, the difference in time has been shown in many other studies where laparoscopy has an advantage over the open approach.^{2,8,9,12} Xu H et al noted advantage of 27.9 minutes for open surgery¹³ while Reifsnnyder JE et al noted it to be 42 minutes in favour of laparoscopy¹⁴. This time advantage may be due to several reasons but the prominent one is that laparoscopy has smaller incisions which are quicker to be made and quicker to be closed as compared to open surgery. The dissection of the kidney and especially the pedicle is easier in laparoscopy as compared to the open approach.

The average blood loss during open and laparoscopic nephrectomy was 361.25 ml (Minimum 50 ml and Maximum 750 ml) and 59.86 ml (Minimum 10 ml and Maximum 300 ml) respectively (p-value). We noted a significant difference in blood loss with advantage laparoscopy. Our findings are endorsed by many.^{12,14,15} However, Xu H et al noted no difference between the two groups¹³, and Lee H et al noted an increased blood loss in the laparoscopic group. In our opinion, the decreased amount of blood loss in the laparoscopic group may be the result of improved magnified vision and access to visualize and coagulate even the smaller bleeders which may, by the end of the procedure, contribute to the overall blood loss.

Blood transfusion rate in open and laparoscopic nephrectomy was 55% and 10.5% respectively (p=0.001). In the laparoscopic group, 3 patients required a single pint transfusion, and 1 patient required 2 pints. While in the open group 9 patients required a single pint, 9 patients 2 pints, 3 patients 3 pints and 1 patient required 5 pints of blood transfusion.

Overall, the post-operative complication rate was 52.5% and 21.5% for an open and laparoscopic approach.

Post-operative pain was noted in 7.9% (3) patients with a laparoscopic approach and 97.5% (39) for an open approach.

Fever was noted postoperatively in 26.3% (10) and 62.5% (25) patients in laparoscopic and open approaches respectively (p=0.001).

The average hospital stay in the laparoscopic approach was 2.8 days (Minimum 2 days and Maximum 6 days) and 4.5 days (Minimum 2 days and Maximum 23 days) in the open approach. 8(9.2-7.6) 9(5.0&2.6)

The mean size of the tumor was 5.65 cm (Minimum 4.0cm and Maximum 9.0 cm) in the laparoscopic approach while 8.1 cm (Minimum 3.5 cm and Maximum 16.8 cm) in the open approach. This is a similar finding as shown by Parker PA et al.¹⁶

Catheter and drain removal were on average 1.18 days (Minimum 1 day and Maximum 3 days) and 1.32 days (Minimum 1 day and Maximum 2 days) post-op day in the laparoscopic group while it was 2.35 days (Minimum 1 day and Maximum 11 days) and 2.3 days (Minimum 1 day and Maximum 5 days) post-op day in an open group, respectively.

There were no per-op complications in the laparoscopic approach as compared to 2 Cases of minor IVC injury in the open approach. There were no conversions from laparoscopic to open.

It is evident from the results that overall, patients undergoing laparoscopic nephrectomies had no intraoperative complications as compared to the open approach. Two patients in the open group had a small tear in the inferior vena cava and in both cases, a repair with a 5/0 prolene was done and the patients fared well. Another limitation of our study is that in the open radical nephrectomy group, the majority of patients had tumors of larger sizes, the majority being more than 6cm while in the laparoscopic radical nephrectomy group, there was no tumor above 9cm. One patient in the laparoscopic radical nephrectomy group developed an incisional hernia over a period of 6 months. This patient was a 65 years old lady who was multi-para and was having very thin/weak abdominal muscles the specimen was retrieved through a grid iron incision as compared to other cases where organ retrieval was done through a small subcostal incision by just enlarging a 10mm port site. One patient who died on the first post-op day in the open simple nephrectomy group was a 59 years old lady who had COPD, CRF and her possible cause of death was PE rather than a surgical complication. One patient in the open group developed renal failure and Jaundice secondary to severe hypotension in a peri-operative and post-operative period which was attributed to an acute cardiac event and this patient was managed successfully and recovered fully. Patients in the laparoscopic group developed wound infections which were managed successfully with IV antibiotics. However, 2 patients in the open group developed wound infections that required repeated debridement and hence prolonged hospital stay, and their wound swabs revealed pseudomonas infections. All the patients in the laparoscopic group who developed fever post-operatively were managed with paracetamol as the maximum temperature recorded was 100 F.

The transfusion rate in our review of open and laparoscopic nephrectomy was 55% and 10.5% respectively (p=0.001). In the laparoscopic group, 3

patients required a single pint transfusion, and 1 patient required 2 pints. While in the open group 9 patients required a single pint, 9 patients 2 pints, 3 patients 3 pints and 1 patient required 5 pints of blood transfusion. The transfusion rate for open cases was high but the file review showed that patients who received 2, 3, or more pints of blood received them preoperatively due to low Hb, and 3 patients required even clot evacuation from the bladder secondary to hematuria.

A study conducted in India by Tapan Agrawal et al¹⁷ revealed that out of 97 procedures 6 were converted to open surgeries due to vascular injuries, adhesions, and bowel injuries and 46% of patients develop complications while no mortality was in patients undergoing laparoscopic surgeries for renal pathology. A similar study conducted in South Africa reveals that the mean duration of hospital stay and HDU admission in the laparoscopic group was 5 days, 12.1% as compared to 10 days and 50% in open nephrectomy. Open surgeries were having 9.9% while laparoscopic nephrectomies were having no complications.¹⁸

A study conducted in Rajavithi hospital Thailand shows that the rate of complications was 31.0% in open and 13.2% in laparoscopic. Average blood loss and length of hospital stay in open versus laparoscopic surgery were 871.59+1,125.62 ml vs. 290.00+262.00; $p = 0.002$) while in our study blood loss was 361.25ml and 59.86ml, and hospital stay were 8.91+3.89 days vs. 6.58+1.87 days; $p = 0.001$, while in our study were 2.8days and 4.5days respectively.¹⁹

Our study has limitations that need to be addressed such as a retrospective, single-center study with small sample size and a shorter follow-up. A prospective, randomized controlled analysis with a longer follow-up may give a better understanding of the oncological outcomes of laparoscopic versus open radical nephrectomies especially.

However, it is recommended that more and more surgeons need to be trained in laparoscopy as this approach has obvious advantages in terms of fewer peri-operative and post-operative complications, shorter hospital stay, less pain, early drain, and catheter removal, reduced blood loss and transfusion rates, and last but not the least, cosmetically more acceptable scars.

Conclusion

After the analysis of our study, we can conclude that the laparoscopic approach for nephrectomy is far superior as compared to the open approach and it is

recommended that Laparoscopic simple and radical nephrectomy should be considered a gold standard treatment. It is further recommended to do awareness programs in our region to ensure that more and more surgeons and surgical trainees be trained in laparoscopic surgery in order to compete with the rest of the world where minimally invasive techniques are the standard of care.

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