

Comparison of Open vs Laparoscopic Nephrectomy: Outcomes and Complications

Siavash Falahatkar, Ahmad Enshaei, Ali Akbar Allahkhah, Mani Mohiti Asli, Zahra Panahandeh, Nargess Okhovatpoor

Guilan University of Medical Sciences, Urology Research Center, Razi Hospital, Rasht, Iran

Submitted September 29, 2009 - Accepted for Publication November 24, 2009

ABSTRACT

INTRODUCTION: Nephrectomy is indicated in patients with an irreversibly damaged kidney. The nephrectomy can be performed through open or laparoscopic procedure. Although there is evidence that laparoscopy is the preferred choice, additional evidence is indicated. The purpose of the present investigation was to compare the outcomes of nephrectomy through open and laparoscopic procedures.

METHODS: Between December 2006 and March 2009, 20 patients had laparoscopic nephrectomy and 20 patients had open nephrectomy. The mean patient age was 46.85 years in the group receiving open surgery and 48.15 years in the group receiving laparoscopy, with no significant group difference. Variables included operative time, length of hospitalization, and postoperative duration of nil per os (NPO) state. Complications such as hemorrhage, organ damage, infection, and reoperation were obtained from data in the patient's medical records. The groups were compared using a *t* test and chi square.

RESULTS: Mean operative time for open surgery was 176.25 min; mean operative time for laparoscopy was 188.8 min. There was no significant difference in mean operative time between the groups ($P = .571$). Mean length of hospitalization was significantly longer for patients receiving open surgery than for patients receiving laparoscopy (4.9 days versus 3.45 days, respectively) ($P = .004$). There were no significant group differences in mean postoperative duration of NPO state for patients receiving open and laparoscopic surgeries (24.6 hours and 28.25 hours, respectively) ($P = .542$). Operative complications occurred in 6 patients in the open group and in 5 patients in laparoscopic group. There was no significant group difference in complication rates ($P = .376$).

CONCLUSIONS: The overall outcomes of the two procedures were similar. Laparoscopic nephrectomy, which is a minimal invasive procedure, is a recommended alternative for open surgery.

KEYWORDS: Nephrectomy; Laparoscopic nephrectomy; Open nephrectomy; Radical nephrectomy

CORRESPONDENCE: Ahmad Enshaei MD, Guilan University of Medical Sciences, Urology Research Center, Razi Hospital, Sardare Jangal Street, Rasht, Iran (urc1384@yahoo.com).

CITATION: *UroToday Int J.* 2010 Feb;3(1). doi:10.3834/uij.1944-5784.2010.02.01

INTRODUCTION

Nephrectomy is indicated in patients with an irreversibly damaged kidney due to symptomatic chronic infection, calculus disease, or severe traumatic injury. Nephrectomy is also performed to treat malignant or benign tumors of the kidney, renovascular hypertension due to uncorrectable renal

artery disease, or severe unilateral parenchymal damage from nephrosclerosis, pyelonephritis, reflux, or congenital dysplasia.

Nephrectomy can be performed through open or laparoscopic procedure [1]. During the 20th century, most nephrectomies for benign and malignant renal disease were performed by an open approach [2]. There has been widespread interest

in urologic laparoscopy since the first total laparoscopic nephrectomy was performed by Clayman in 1990 [3].

Laparoscopic nephrectomy is performed through transperitoneal or retroperitoneal approach. When compared with an open procedure, many surgeons find that laparoscopic nephrectomy offers shorter length of hospital stay, shorter time to oral intake, less pain medication requirement, and faster return to normal activity. The procedures have similar complication and cancer-control rates. Numerous studies have documented longer operative time for laparoscopic approaches; however, with surgeon experience, operative times may even be shorter than with open techniques [4].

The purpose of the present study was to compare the outcomes of nephrectomy through open and laparoscopic procedures. Although the present study is not novel, it is important to report such results from different areas of world with different surgeon experience in order to better understand the feasibility of newer techniques in all settings.

METHODS

Participants

Between December 2006 and March 2009, 40 patients were seen in the authors' educational and treatment center. The patients were divided into 2 groups, the order of which was not randomized. Twenty patients underwent laparoscopic nephrectomy (with transperitoneal approach) and 20 patients underwent open nephrectomy.

The mean patient age was 46.85 years (range, 19 to 73 years) in the group receiving open surgery and 48.15 years (range, 22 to 75 years) in the group receiving laparoscopy, with no significant group difference. Other characteristics of sex, side of nephrectomy, previous history of abdominal surgery, and reasons for nephrectomy are contained in Table 1. The most common reason for nephrectomy in both groups of patients was a nonfunctioning kidney.

Procedures

All operations were done under general anesthesia. For patients receiving laparoscopy, a nasogastric tube and urethral catheter were placed before the operation. The procedure was done in a flank position with an Olympus laparoscope (Olympus Europa GmbH, Hamburg, Germany). The primary entrance site was the umbilicus, using a direct trocar insertion method. A pneumoperitoneum was made with CO₂ and the abdominal cavity was inspected with the laparoscopic lens. After colon medialization, access to the retroperitoneum was achieved. During laparoscopy, the surgeons used a LigaSure[®]

Table 1. Characteristics of the Patients Receiving Open Nephrectomy or Laparoscopic Nephrectomy (N = 40).

doi: 10.3834/uj.1944-5784.2010.02.01t1

Characteristic	Open Nephrectomy (n = 20)		Laparoscopic Nephrectomy (n = 20)	
	n	% n	n	% n
Male	6	30	9	45
Female	14	70	11	55
Right kidney	11	55	14	70
Left kidney	9	45	6	30
Previous abdominal surgery	9	45	8	40
Nephrectomy indications				
Nonfunctioning kidney	12	60	11	55
XGP	3	15	3	15
Multicystic kidney	0	0	1	5
Renal tumor	4	20	5	25
Renal abscess	1	5	0	0

Abbreviation: XGP, xanthogranulomatous pyelonephritis

device (Valleylab, Boulder, CO, USA) for dissection and bleeding control, which was particularly useful in difficult cases. The steps in the procedure are provided in Figure 1.

In the group receiving open surgery, 4 patients underwent radical nephrectomy and 16 underwent simple nephrectomy. In the group receiving laparoscopic surgery, 1 patient underwent partial nephrectomy, 4 patients underwent radical nephrectomy, and 15 patients underwent simple nephrectomy.

Data Analysis

Variables included operative time, length of hospitalization, and postoperative duration of nil per os (NPO) state. Complications such as hemorrhage, organ damage, infection, and reoperation were obtained from data in the patient's medical records.

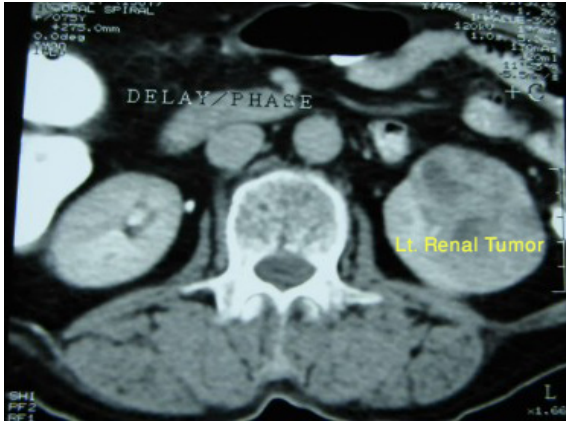
Analyses of group differences were done by SPSS, Inc (Chicago, IL). Descriptive statistics of mean, standard deviation (SD), and range were calculated. A *t* test was used for continuous variables and a chi square test was used for categorical variables. Probability of significant difference was determined at *P* < .05.

RESULTS

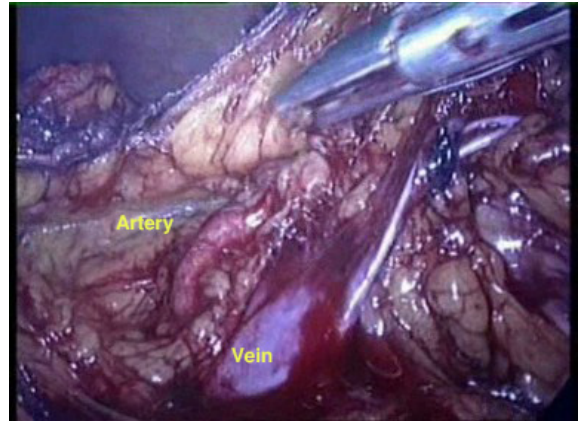
Results of the data analyses are contained in Table 2. The mean operative time for open surgery was 176.25 minutes. The mean operative time for laparoscopy was 188.8 minutes. There was no significant difference in mean operative time between the groups (*P* = .571). Mean length of hospitalization

Figure 1. Procedure for Laparoscopic Left Radical Nephrectomy.

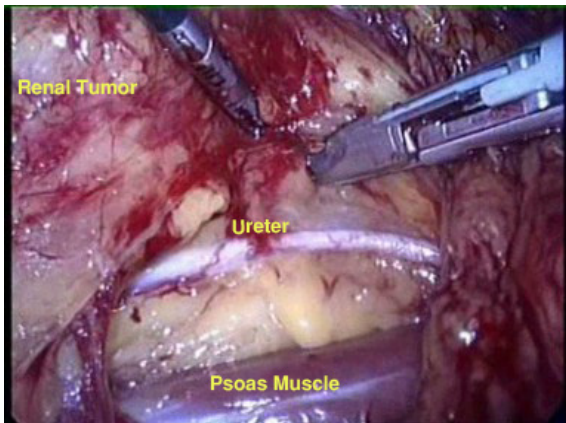
doi: 10.3834/uj.1944-5784.2010.02.01f1



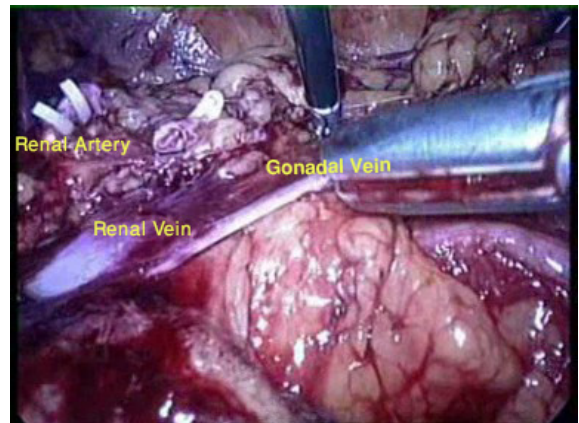
A. Computed tomography scan shows a 67 mm tumor in the midpolar area of the left kidney.



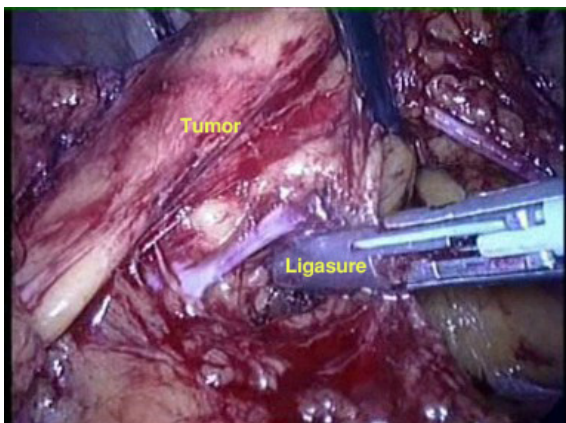
D. The renal artery and vein are shown after initial dissection.



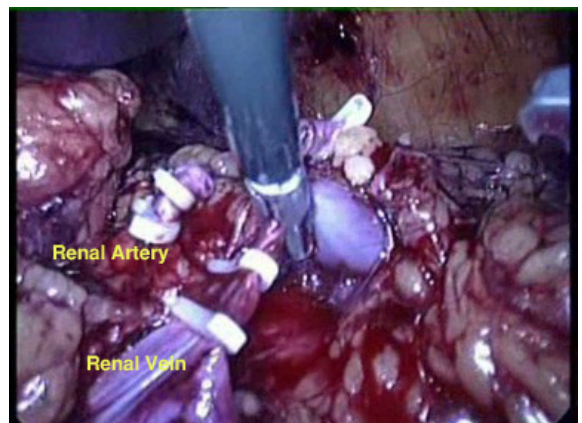
B. The psoas muscle and ureter are visible in the retroperitoneum.



E. The renal artery after ligation, the renal vein, and the gonadal vein before ligation are visible.

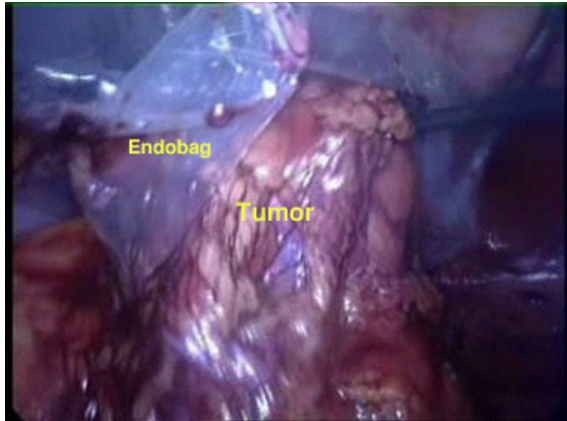


C. LigaSure[®] device is used to help the surgeon dissect the tumor with minimal bleeding.

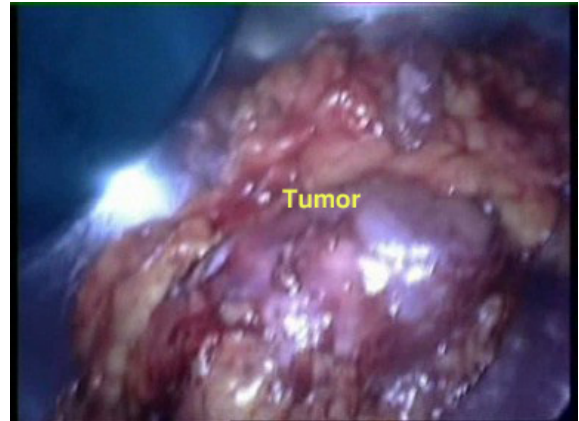


F. The renal artery, the renal vein, and the gonadal vein after ligation are visible.

Figure 1, continued. Procedure for Laparoscopic Left Radical Nephrectomy. doi: 10.3834/uij.1944-5784.2010.02.01f1



G. The tumor is placed into the endobag to prevent tumor spillage.



H. The tumor is shown after retrieval.

was significantly longer for patients receiving open surgery than for patients receiving laparoscopy (4.9 days versus 3.45 days, respectively) ($P = .004$). There were no significant group differences in mean postoperative duration of NPO state for patients receiving open and laparoscopic surgeries (24.6 hours and 28.25 hours, respectively) ($P = .542$).

Operative complications and their treatments are listed in Table 3. There was no mortality in either group of patients. There was no significant group difference in complication rates ($P = .376$).

Operative complications occurred in 6 patients (30%) receiving open surgery. These included bleeding that required blood transfusion ($n = 1$), wound infection that occurred 2 weeks after surgery and required rehospitalization and antibiotics ($n = 1$), peritonitis that required reoperation the day after nephrectomy ($n = 1$), and organ damage ($n = 3$). One patient with organ damage had pyelonephritis that needed adrenalectomy. One patient had injury to the capsule of the spleen due to severe

adhesion, and 1 patient had injury to the inferior vena cava (IVC); both of these injuries were repaired immediately. Operative complications occurred in 5 patients (25%) receiving laparoscopic surgery. They included bleeding ($n = 3$) and organ damage ($n = 2$). The organ damage included injury to an artery, which was ligated immediately, and injury to the pancreas. Conversion to open nephrectomy occurred in 2 patients receiving laparoscopy because of uncontrolled bleeding in 1 patient and massive perirenal adhesions in the other patient.

DISCUSSION

In the present study, there was no significant group difference in mean operative time (176.25 minutes for open surgery; 188.8 min for laparoscopy). Devoe et al [5] reported that mean operative time was shorter for laparoscopic nephrectomy than open nephrectomy (161 versus 191 minutes). In the present study, the first patients receiving laparoscopy had a longer operation time when compared with the last patients studied. This was probably due to the experience level of the surgeon and implies that learning curve plays an important role in

Table 2. Means, Standard Deviations (SD), and Ranges for Operative Time, Hospital Stay, and Duration of Nil Per Os (NPO) State Following Open Nephrectomy and Laparoscopic Nephrectomy (N = 40). doi: 10.3834/uij.1944-5784.2010.02.01t2

Characteristic	Open Nephrectomy (n = 20)			Laparoscopic Nephrectomy (n = 20)			p
	Mean	SD	Range	Mean	SD	Range	
Operative time (minutes)	176.25	36.17	120-240	188.8	91.83	90-300	.571
Hospital stay (days)	4.9	1.21	4-8	3.45	1.70	1-5	.004
Duration of NPO state (hours)	24.6	12.44	6-72	28.25	23.42	15-48	.542

Table 3. Complications and Treatment for Open Nephrectomy and Laparoscopic Nephrectomy (N = 40). doi: 10.3834/uij.1944-5784.2010.02.01t3

Type of Surgery	Complication	n	%n	Treatment
Open nephrectomy (n = 20)	Bleeding	1	5	Blood transfusion
	Wound infection	1	5	Antibiotics
	Organ damage	3	15	Surgical repair
	Peritonitis	1	5	Reoperation
Laparoscopic nephrectomy (n = 20)	Bleeding	3	15	Conversion to open surgery (n = 1) Blood transfusion (n = 2)
	Organ damage	2	10	Surgical repair

laparoscopic nephrectomy.

El-Galley et al [6] reported that postoperative hospital stay was 2 ± 2 days after laparoscopic nephrectomy and 3 ± 2 days after open nephrectomy ($P = .01$). The authors of the present study also found that the mean postoperative hospital stay following laparoscopy was significantly shorter than the stay following open surgery (3.45 versus 4.9 days, respectively) ($P = .004$).

Ku et al [7] reported that mean time to oral intake was faster following laparoscopic nephrectomy. The present authors found no significant difference between groups for this variable. This may be attributed to ileus after the transperitoneal approach in the patients receiving laparoscopy in the present study.

Goel et al [8] reported that the complication rate from laparoscopy was 11% compared with 15% from open nephrectomy. In the present study, operative complications occurred in 6 patients (30%) receiving open surgery and in 5 patients (25%) receiving laparoscopy, with no significant difference between groups. In the group receiving laparoscopy, 81% of the complications occurred during the initial 5 cases, probably because the surgeon was less experienced.

Laparoscopic nephrectomy has been found to be an attractive and viable alternative to open surgery. It results in more patient comfort, less narcotic intake, improved cosmetic results, shorter hospital stay, and rapid return to normal activity [4]. Laparoscopic radical nephrectomy for large tumors is a technically challenging operation. However, in experienced hands, it is a reasonable therapeutic option for the management of larger renal cell carcinoma [9]. Vanderbrink et al [10] reported that even in the most experienced hands, open or laparoscopic nephrectomy for xanthogranulomatous pyelonephritis (XGP) remains the most difficult of all treatments. In another study, the present authors suggested that when patients with XGP

have laparoscopy and there is a difficult dissection of the renal artery and vein, the surgeon should initially clamp and cut the vein and then ligate and cut the artery [11].

CONCLUSION

The present study showed that there were no significant differences between laparoscopic and open nephrectomy procedures for the variables of operation time, postoperative duration of NPO state, or number of complications. Laparoscopic operation time appears to be reduced with surgeon experience. The length of the hospital stay was significantly shorter following laparoscopy. Laparoscopic nephrectomy, which is a minimal invasive procedure, is a recommended alternative to open surgery even in difficult cases.

Conflict of Interest: none declared

REFERENCES

- [1] Novick AC, Bishoff JT, Kavoussi LR. Open and laparoscopic surgery of the kidney. In: Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA, eds. *Campbell-Walsh Urology*. 9th ed. Philadelphia, PA: Saunders; 2007:1686-1810.
- [2] Salam YA, El Anany F, Latif AA, Latif HA, Ibrahim AF. Retroperitoneal laparoscopic nephrectomy versus open nephrectomy for benign renal disorders. *Arab J Urol*. 2005;3:12-16.
- [3] Clayman RV, Kavoussi LR, Long SR, Dierks SM, Meretyk S, Soper NJ. Laparoscopic nephrectomy: initial report of pelviscopic organ ablation in the pig. *J Endourol*. 1990;4:247-252.
- [4] Wolf SJ Jr, Stoller ML. Laparoscopic surgery. In: Tanagho EA, McAninch JW, eds. *Smith's General Urology*. 16th ed. New York, NY: McGraw-Hill; 2004:140-163.

- [5] Devoe WB, Kercher KW, Hope WW, Lincourt AE, Norton HJ, Teigland CM. Hand-assisted laparoscopic partial nephrectomy after 60 cases: comparison with open partial nephrectomy. *Surg Endosc.* 2009;23(5):1075-1080.
- [6] El-Galley R, Hood N, Young CJ, Deierhoi M, Urban DA. Donor nephrectomy: a comparison of techniques and results of open, hand assisted and full laparoscopic nephrectomy. *J Urol.* 2004;171(1):40-43.
- [7] Ku JH, Yeo WG, Choi H, Kim HH. Comparison of retroperitoneal laparoscopic and open nephrectomy for benign renal diseases in children. *Urology.* 2004;63(3):566-570.
- [8] Goel MC, Modlin CS, Mottoo AM, et al. Fate Of Donor Kidney: Laparoscopic Versus Open Technique. *J Urol.* 2004;172(6 Pt 1):2326-2330.
- [9] Rosoff JS, Raman JD, Sosa RE, Del Pizzo JJ. Laparoscopic radical nephrectomy for renal masses 7 centimeters or larger. *JSLs.* 2009;13(2):148-153.
- [10] Vanderbrink BA, Ost MC, Rastinehad A, et al. Laparoscopic versus open radical nephrectomy for xanthogranulomatous pyelonephritis: Contemporary outcomes analysis. *J Endourol.* 2007;21(1):65-70.
- [11] Falahatkar S, Nikpour S, Akbarpour M. New method in laparoscopic surgery of xanthogranulomatous pyelonephritis. *Pak J Med Sci.* 2007;23(6):953-955.