SCIENTIFIC ARTICLE

How "simple" is laparoscopic transperitoneal simple nephrectomy for a novice surgeon

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Abstract

Introduction

To assess the perioperative outcome of laparoscopic transperitoneal simple nephrectomy and to see how difficult it is for a novice laparoscopic surgeon.

Materials and methods

The laparoscopic transperitoneal simple nephrectomy database between July 2012 and February 2019 was analyzed. The data of the first 50 cases performed by each of the three surgeons (group 1, 2, and 3) were divided into two subgroups- A: cases 1-25, and B: cases 26-50. Data analyzed included operative time, blood loss, conversion to open, the number of cases taken to reach a steady perioperative outcome and complications.

Results

Baseline characteristics of patients including the aetiology of the non-functioning/poorly functioning kidney were similar between the three groups. Though the mean operative time differs between the three surgeons, it decreased significantly till 20-25 cases and then remained steady thereafter among all three surgeons. The presence of hilar or perinephric inflammation secondary to pyonephrosis or stone disease was the factor associated with longer operative time and the need for conversion to open. The grade 3 or higher post-operative complications were similar between the three groups.

Conclusion

Operative time was the significant perioperative factor that became steady after approximately 20 cases of laparoscopic transperitoneal simple nephrectomy but not the other factors like blood transfusion rate or grade III complications.

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Introduction

Since the first laparoscopic transperitoneal nephrectomy was performed by Clayman et al in 1991, this procedure became increasingly popular for both simple and radical nephrectomy [1]. It is presently considered as a gold standard operative modality for both benign and malignant renal pathology. Advantages of laparoscopic nephrectomy over open nephrectomy include lesser perioperative blood loss, postoperative pain, hospitalization time and patient recovery time. Besides these, laparoscopic nephrectomy offers equivalent clinical outcomes [2]. Laparoscopic simple nephrectomy is not always a "simple" procedure, especially for beginners where the level of difficulty may change with the aetiology of a non-functioning kidney [2-5].

Laparoscopic simple nephrectomy, a proven safe and efficacious procedure, is a procedure that a novice laparoscopic surgeon usually considers approaching before proceeding for more complex laparoscopic urologic procedures [6]. Also, there is a paucity of literature regarding the learning curve of simple laparoscopic nephrectomy. We audited our laparoscopic simple nephrectomy data intending to assess the perioperative outcome and to see how difficult it is for novice laparoscopic surgeons.

Materials and methods

Patients, who underwent laparoscopic transperitoneal simple nephrectomy between July 2012 and February 2019, and satisfied the eligibility criteria, were included in this institutional ethics committee approved retrospective study. Definition of nonfunctioning/poorly functioning kidney (NFK) included a differential renal function <15% and glomerular filtration rate <10ml/min on diethylenetriamin-epentaacetic acid (DTPA) scan. Data of patients, for whom 1 monthly follow up data was not available, were excluded from the analysis. Data analyzed included the first 50 laparoscopic transperitoneal simple nephrectomies each performed by three surgeons. Before starting laparoscopic nephrectomy, all of the three surgeons had vast experience of performing open simple nephrectomy in addition to the experience of assisting in laparoscopic nephrectomy. Fifty patients of three surgeons (groups 1, 2, and 3) were divided into two subgroups: A case 1-25, and B- case 26-50.

Surgical technique

The procedures were performed under general anaesthesia with the patient in a lateral flank position. All three surgeons used the standard technique of nephrectomy. In brief, the position and number of ports were dependent on the individual surgeon choice, patients body habitus, body mass index and presence of previous surgery scar. The dissection began with mobilization of colon and ureter isolation. The ureter was dissected cranially to define the hilar structures of the kidney. The renal vein and artery were identified and doubly clipped with a Hem-o-lok® clip (Weck Closure Systems, Research Park, NC) and divided. Once the hilar vessels were divided, the kidney was removed from the renal bed preserving the adrenal gland. The ureter was divided and the kidney removed intact in an extraction bag by extending the caudal port. All the nephrectomy specimen were sent for histopathological examination.

Data analyzed included operative time (time taken from the skin incision for placement of the first trocar to the closure of last port site), blood loss, need for conversion to open, the number of cases taken to reach a steady level of perioperative outcome and complications up to 1 month follow up (complications as per Clavien-Dindo classification of surgical complications) [7].

Statistical analysis

The study parameters were arranged on a Microsoft Excel spreadsheet (Microsoft, Seattle, WA USA) and analyzed by SPSS version 21.0 (SPSS Inc., Chicago, IL) software package. All the collected data were subjected to a normality test. Those continuous data, which passed the normality test, were analyzed using a one-way ANOVA test and t-test, as applicable. Data that failed to pass the normality test were analyzed using the non-parametric Kruskal-Wallis test and Mann-Whitney test. Categorical data between the groups and subgroups were analyzed by the Chi-Square test/Fisher's exact test. P-value <0.05 was considered significant.

Results

Baseline characteristics of patients including age, body mass index, sex and side of nephrectomy were similar among the three groups (Table 1). The common causes of NFK were stone disease and PUJO. Others included renal dysplasia, vesicoureteral reflux, megaureter and idiopathic among others. None of these patients had malignant disease on histopathology. Three, 5 and 2 patients of groups 1, 2 and 3 respectively, had a history of abdominal surgery. Also, 4, 3 and 7 patients respectively, were on percutaneous nephrostomy (PCN) for at least 4 weeks for infected hydronephrosis or pyonephrosis.

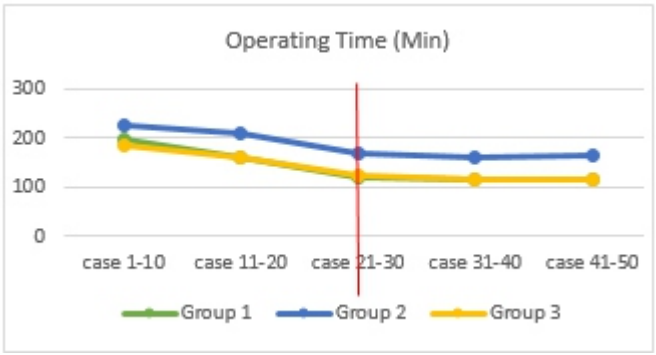

Figure 1. Operating time

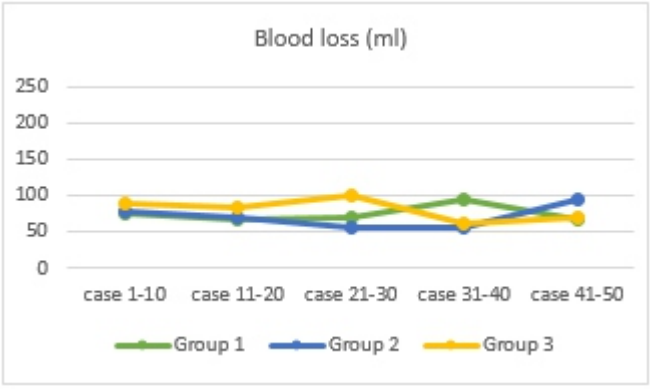

Figure 1. Blood loss

The peri-operative parameters are reported in table 2. The mean operative time of group 1 and 3 patients were significantly different from group 2 patients but no significant difference was noted between group 1 and 3 (p1 vs 2 vs 3<0.0001, p1vs2=0.0004 & p2vs3=0.0001, p1 vs3=0.77). In all the three groups, the mean operative time decreased significantly from subgroup A to B. On analyzing the data of each group in subgroups of 10 chronological cases, we observed a steady level after approximately 20 cases in all three groups. (Figure 1) Also, the operative time was significantly higher among patients with hilar or perinephric inflammatory adhesions secondary to stone or pyonephrosis. The mean blood loss among the three groups and their respective subgroups were similar with no significant difference noted between them. Throughout 50 cases in each group, the blood loss did not differ significantly between subgroups (Figure 2).

Among the three groups, three, 3 and 4 patients respectively, required conversion to open nephrectomy either due to bleeding or due to inability to proceed further. Among those 10 patients, seven had the stone disease and the rest 3 were on PCN for pyonephrosis. We could not record the exact amount of blood loss among these patients who required conversion to open. Of these, six out of 7 patients, who were converted to open due to bleeding, were transfused blood based on the decision of an anaesthetist. The grade I and II complications

Table 1. Baseline characteristics

		Group 1(n=50)	Group 2(n=50)	Group 3(n=50)	P value
Age (years)		40.94±17.83	43.42±16.16	44.10±16.08	0.61
BMI (kg/m2)		23.17±3.92	22.82±3.34	22.38±2.69	0.50
M/F		30/20	27/23	25/25	0.59
L/R		25/25	24/26	21/29	0.70
Kidney size (cm)		9.23±2.32	8.97±2.23	8.60±2.27	0.37
Etiology	Pelviureteric junction obstruction	12	15	13	0.85
	Stone	32	27	26	
	others	6	8	11	

Table 2. Perioperative parameter

		Operative time minutes(range)	Blood loss ml(range)	Conversion to open	Hospital stay days (range)	Bowel injury	Other complications
Group 1	A (1-25)	164.3 (101-216) *	72.8 (0-125) *	2	2 (1-3)	1(3b)	
	B (26-50)	116.6 (92-142) **	72.3 (0-240) **	1	2.04 (1-3)	1(3b)	
Group 2	A (1-25)	208.2 (148-278) ***	71.8 (0-250) ***	3	2.04 (1-3)		1(3a)
	B (26-50)	166.3 (142-214)	70.4 (0-180)	0	2(1-3)		
Group 3	A (1-25)	161.2 (98-224)	90.4 (50-190) ***	3	2.1 (2-3)		1(3b)
	B (26-50)	116.5 (76-142)	72.1 (0-240) **	1	2 (1-3)		1(3a)
P value 1A vs 1B, 2A vs 2B, 3A vs 3B		<0.0001	0.76, 0.66, 0.08		0.71, 0.64, 0.30		

*n=23, **n=24, ***n=22

were statistically similar between the two groups and their respective subgroups. The grade III or higher complications were reported among 2 patients in group 1 (bowel injury that required exploratory laparotomy on postoperative day 1), one patient in group 2 (post-operative collection in renal bed which required percutaneous drainage) and 2 patients in group 3 (one had a post-operative collection in renal bed which required percutaneous drainage and the other one developed pyoperitoneum secondary to pus spillage during nephrectomy, which required exploratory laparotomy on postoperative day 7).

Discussion

The word 'simple' nephrectomy implies excision of a kidney with or without Gerota's fascia leaving behind the adrenal gland. At times, the word “simple” appears to be a misnomer as the level of difficulties may increases with the presence of renal stones or inflammatory renal diseases, requiring highly skilled laparoscopic surgeons [2-5]. Thus, like any other surgical procedure, laparoscopic simple nephrectomy requires a certain learning curve to accomplish this procedure safely and successfully.

In a retrospective review, Keeley and Tolley assessed the outcome of the first 100 laparoscopic nephrectomies for various benign and malignant renal pathology. They reported a progressive and significant decline in operative time from 204 minutes in the first 20 cases to 108 minutes in the last 20 cases. However, the complication rates didn't show a similar trend with increasing experience.

Five patients, with a history of pyonephrosis, xanthogranulomatous pyelonephritis, polycystic kidney disease, previous renal surgery and staghorn calculus, required open conversion. In addition, they reported 15% and 3% minor and major complications, along with a 10% blood transfusion rate [2].

Jeon SH et al in a study, involving 50 laparoscopic radical nephrectomies by each of the 3 surgeons, reported that 15 cases are required for a novice surgeon to become competent. They reported similar post-operative complications between novice and competent groups (8.9 vs 9.5%), except for the blood loss (236.4mL vs 191.5 mL, p=0.04) and transfusion rates (17.8% vs 4.8%, p=0.02) which were significantly higher among the novice group [10].

Angerri O et al in a retrospective analysis of 96 laparoscopic transperitoneal nephrectomies reported 7.3% open conversion in cases of xanthogranulomatous pyelonephritis and pyonephrosis. They also reported 18.7% minor and 3% major complications [3].

In another review including 32 patients, Kaba M et al compared the outcome of laparoscopic transperitoneal nephrectomy in kidney with or without stone and found higher blood loss, operation time, haemoglobin change and

length of hospital stay in patients with stone disease, but it didn't reach a level of statistical significance [4]. Naghiyev R et al reported a similar outcome of laparoscopic nephrectomy among patients with or without the urinary stone disease [8].

Kurt O et al reported the outcome of transperitoneal laparoscopic nephrectomy among 22 inflammatory and 27 non-inflammatory kidneys. Though the perioperative parameters, including operation time, blood loss, haemoglobin drop and hospitalization time, were favourable in nephrectomy of non-inflammatory kidneys, it didn't reach a level of statistical significance. The only significant difference was a higher incidence of post-operative fever among patients with inflammatory kidneys (3.7 vs 22.7%) [5]. Manohar T et al reported longer operating times among patients with significant hilar scarring and altered anatomy consequent to tuberculosis and xanthogranulomatous pyelonephritis. Also, renal size >10 cm and significant hilar lymphadenopathy were found to be predictive of adverse outcomes after laparoscopy [9].

In our study, all three surgeons reached a steady level of operative time after approximately 20 cases. Though the mean operating time of the two surgeons was significantly different from the third surgeons, it did reach a plateau for each surgeon after 20 cases. The need for conversion, blood loss, Clavien grade III or higher complications did not reach a significant level between groups and their respective subgroups. The presence of hilar or perinephric inflammation secondary to pyonephrosis or stone disease was the factor associated with longer operative time and the need for conversion to open, but the number of such cases was not adequate for definitive statistical analysis.

Limitations of the study

- retrospective design, so there may be inherent selection bias,
- follow up was limited to 1 month.

Conclusion

Operative time was the significant perioperative factor that became steady after approximately 20 cases of laparoscopic transperitoneal simple nephrectomy but not the other factors like blood transfusion rate or grade III complications.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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