Transperitoneal laparoscopic nephrectomy: Assessing complication risk in cases of previous abdominal surgery

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Abstract

Introduction: We aimed to assess the effect of previous abdominal surgery on perioperative outcomes in patients undergoing transperitoneal laparoscopic partial (LPN) or radical (LRN) nephrectomy for renal masses.

Methods: We retrospectively reviewed all cases of LPN and LRN for renal masses at our institution between 2008 and 2014. Patients were divided in two groups, those with and without prior abdominal surgery. Four perioperative outcomes were compared, namely, operative time (OT), estimated blood loss (EBL), length of stay (LOS), and 30-days complications rate. A subanalysis was performed to address the impact of previous open cholecystectomy on right LPN or LRN.

Results: Of 293 patients identified, 146 (49.8%) had previous abdominal surgery. In univariate analysis, no differences in operative time (136 vs. 144 minutes; p=*0*.154), EBL (88 vs. 100 mL; p=0.211), or 30-day complication rate (24 vs. 14%; p=0.069) were recorded between the groups. Only LOS favoured patients without previous abdominal surgery (3 vs. 4 days; p=0.001). In multivariate analysis, prior abdominal surgery was not associated with an increased OT, EBL, LOS, or complication rate. The analysis of right nephrectomies showed increased OT (148 vs. 128 minutes; p=0.049) and complication rate (42 vs. 16%; p=0.004) for patients with past open cholecystectomy compared to those without. Multivariate analysis revealed that prior open cholecystectomy was associated with a longer LOS (OR_{median}=2.7 [1.2–8.0]) and an increased risk of complications (OR_{median}=4.5 [1.6–10.5]).

Conclusions: In this cohort, previous abdominal surgery was not associated with worse perioperative outcomes after transperitoneal LPN and LRN for renal masses. However, previous open cholecystectomy resulted in a higher risk of complication and a longer LOS in patients undergoing right laparoscopic nephrectomy.

Introduction

Previous abdominal surgery is a known risk factor for the development of intra-abdominal adhesions and can develop in more than 90% of patients with a history of major abdominal surgery.[1,2] Adhesions can increase perioperative complications and prolongs operative time.[3-5] Previous open abdominal surgery results in increased hospital length of stay (LOS), complication rate, and operation time (OT) in patients undergoing subsequent laparoscopic general surgery.[6] Previous abdominal surgery also results in more access-related complications in laparoscopic gynecological procedures.[7]

Patient with renal masses, especially those with small renal tumours are currently more often treated with minimally invasive surgical techniques.[8] The laparoscopic nephrectomy has been associated with shorter LOS and lower estimated blood loss (EBL) with similar complication rate when compared with open nephrectomy.[9-11] To date, few studies have addressed the effect of past abdominal surgery on urological laparoscopy and results are conflicting.[12-16] We hypothesized that previous intraperitoneal surgery may have a detrimental effect. Therefore, we evaluated the effect of previous abdominal surgery on operative and perioperative outcomes in adult patients undergoing transperitoneal laparoscopic partial (LPN) or radical (LRN) nephrectomy for renal masses.

Methods

Patient cohort

Both the internal review board and ethics committee approved the study for retrospective chart review of all adult patients who underwent LPN or LRN at our institution between 2008 and 2014. Only cases performed for renal masses without synchronous surgery were included. We stratified the 293 patients into two groups: those with and those without prior abdominal surgery. This population is part of a provincial public health system, where our institution is the only tertiary care referral centre; therefore, virtually all the medical/surgical history of these patients was recorded in our charts. Moreover, if any patients would

have been subjected to a surgery at another institution before being treated at our institution, it should be properly recorded in the chart by the treating physician, the preoperative checklist, and/or the anesthesia perioperative evaluation. All procedures were pure laparoscopic nephrectomies and were performed by two experienced laparoscopic surgeons.

Patient characteristics included age, sex, American Society of Anesthesiologists (ASA) score, Charlson Comorbidity Index (CCI), body mass index (BMI), and past surgical history. Previous abdominal surgery was defined as any open or laparoscopic procedure that entered the peritoneal cavity. Endoscopic procedures and inguinal surgeries were not considered in the abdominal surgery group. Pathological features recorded included pathological stage (2010 TNM classification), as well as tumour size and localization. Operative and perioperative data were compared between the two groups, namely, EBL (in mL), OT (in minutes), LOS (in days), and 30-day complications (Clavien classification).

Table 1. Type of previous abdominal surgery

Previous abdominal surgery (n=146)	n (%)
Appendectomy	68 (47)
Abdominal hysterectomy	52 (36)
Cholecystectomy	46 (32)
Tubal ligation	13 (9)
Partial colectomy	13 (9)
Caesarean section	8 (5)
Bilateral oophorectomy	4 (3)
Total colectomy and end ileostomy, open	3 (2)
Small bowel resection, open	3 (2)
Radical nephrectomy, open	2 (1)
Abdominal abscess drainage, open	2 (1)
Retroperitoneal lymph node dissection, open	1 (1)
Partial nephrectomy (ipsilateral), laparoscopic	1 (1)
Vagotomy, open	1 (1)
Abdominal aortic aneurysm repair, open	1 (1)
Heller myotomy, open	1 (1)
splenectomy (contralateral), open	1 (1)

1 procedure: 86 patients; 2 or more procedures: 60 patients.

Statistics

Categorical variables were compared with Chi-square or Fisher's exact tests. Continuous variables were analyzed with Student's t-tests and Mann-Whitney U tests. Logistic regression analysis was used to determine whether previous abdominal surgery was associated with complications or worse perioperative outcomes. These outcomes were defined as results inferior to the whole cohort's median (i.e., EBL ≥100 mL, OT ≥135 minutes, and LOS ≥4 days). IBM SPSS Statistics for Windows, Version 22.0 was used for statistical analysis (released 2013, IBM Corp Armonk, NY, U.S.) and all tests were two-sided, with a significance level set at $p<0.05$.

Results

Of the 293 patients who met our inclusion criteria, 146 (49.8%) had a history of abdominal surgery (Table 1). Table 2 lists socio-demographic data and tumour characteristics. Previous abdominal surgery was associated with increased age (66.9 vs. 61.2 years; $p<0.001$), female gender (59.6 vs. 19.0%; $p<0.001$), higher CCI (3.3 vs. 2.6; $p=0.002$), smaller tumours size (4.7 vs. 5.4 cm; $p=0.048$), and lower pathological T stage (T1a/b 73.2 vs. 60.6%; $p=0.046$). There were no statistically significant differences between the two groups for BMI, ASA score, tumour side and localization, type of surgery (LPN vs. LRN), or margin status.

Perioperative outcomes are shown in Table 3. Patients with previous abdominal surgery experienced increased LOS (4 vs. 3 days; $p=0.001$). However, no statistically significant difference were found in EBL (88 vs. 100 mL; $p=0.211$), OT (136 vs. 144 minutes; $p=0.154$), warm ischemia time (WIT) (21.8 vs. 22.5 minutes; p 0.635), rate of conversion to open surgery (2.1 vs. 1.4%; $p=0.684$) and rate of 30-day complications (24.0 vs. 13.6%; $p=0.069$). In multivariate analysis, prior abdominal surgery was not associated with an increased OT, EBL, LOS, or complication rate (data not shown).

Cholecystectomy was the most common previous surgery performed near the renal fossa. A subset analysis was performed to determine the impact of previous cholecystectomy on right LPN and LRN (Table 4). A total of 144 patients underwent a right LPN or LRN. Patients with (n=19) and without (n=123) a history of previous open cholecystectomy were compared. Two patients with prior laparoscopic cholecystectomy were excluded from this analysis. Age, BMI, ASA score, and use of nephron-sparing surgery were similar in the two groups. There were no differences in EBL, OT, WIT, or rate of conversion to open surgery. However, OT (148 vs. 128 minutes; $p=0.049$), LOS (4 vs. 3 days; $p=0.050$); and postoperative complication rate (42.1 vs. 16.3%; $p=0.004$) were greater in patients with vs. those without previous open cholecystectomy. In multivariate analysis, prior open cholecystectomy was associated with longer LOS ($OR_{median}=2.7$ [1.2–8.0]) and an increased risk of complications ($OR_{median}=4.5$ [1.6–10.5]) (data not shown). However, prior open cholecystectomy was not associated with an increased OT and EBL.

Discussion

Abdominal surgery almost always leads to some degree of intra-abdominal adhesions.[1-2] Adhesions can increase perioperative risk and have already been considered a relative contraindication to laparoscopy.[3-5] In our study, half of the patients had a history of previous abdominal surgery highlighting the importance of this issue.

Table 2. Patient and tumour characteristics based on previous abdominal surgery status

Variables	Past abdominal surgeries (n=146)	No abdominal surgery (n=147)	p
Age, years (SD)	66.9 (11.6)	61.2 (12.6)	<0.001
Male, n (%)	59 (40.4)	119 (81.0)	<0.001
Charlson score (SD)	3.3 (2.0)	2.6 (2.0)	0.002
BMI, kg/m^2 (SD)	28.4 (5.6)	27.9 (5.1)	0.402
ASA, n (%)			0.520
1	7 (4.8)	11 (7.5)	
2	88 (60.7)	96 (65.3)	
3	48 (33.1)	39 (26.5)	
4	2 (1.4)	1 (0.7)	
Right side tumour, n (%)	75 (51.4)	69 (46.9)	0.484
Partial nephrectomy, n (%)	48 (32.9)	57 (38.8)	0.330
Tumour size cm, (SD)	4.7 (2.5)	5.4 (3.4)	0.048
Tumour localization, n			0.805
Upper pole	43	50	
Inter-polar pole	44	45	
Lower pole	51	44	
Hilar	8	8	
Pathological stage, n			
Benign	19	10	0.082
pT1a	54	56	0.046
pT1b	39	27	
pT2a	11	11	
pT2b	1	7	
pT3a	20	32	
pT4	0	2	
Metastatic	5	6	1.000
Positive margin, n			
Radical nephrectomy	0	0	1.000
Partial nephrectomy	5	9	0.566

ASA: American Society of Anaesthesiologist Classification; BMI: body mass index; SD: standard deviation.

Table 3. Univariate comparison of operative and perioperative outcomes

Variable	Past abdominal surgeries (n=146)	No abdominal surgery (n=147)	p
Median EBL, mL (IQR)	88 (50–150)	100 (50–200)	0.211
Operative time, min (SD)	136 (47)	144 (52)	0.154
Warm ischemia time, min (SD)	21.8 (7.8)	22.5 (6.5)	0.635
Open conversion, n (%)	3 (2.1)	2 (1.4)	0.684
Median LOS, days (IQR)	4 (3–5)	3 (3–4)	0.001
Clavien grade complication, n (%)			
0	111 (76.0)	127 (86.4)	0.069
I–II	26 (17.8)	16 (10.9)	
III–IVa	9 (6.2)	4 (2.7)	

EBL: estimated blood loss; IQR: interquartile range; LOS: length of stay; SD: standard deviation.

Several groups have evaluated the impact of previous abdominal procedure on non-urological laparoscopic surgeries. In a recent study of more than 160 000 patients, Seetahal et al concluded that previous open abdominal surgery increased the hospital LOS, complication rate, and OT in patients undergoing various subsequent laparoscopic general surgery.[6] Previous abdominal surgery resulted in more access-related complications in laparoscopic gynecological procedure.[7]

To date, few studies evaluated the impact of previous abdominal surgery on urological laparoscopic procedures and most were early in the laparoscopic experience.[12-16] Moreover, few patients included in those studies had a LPN or LRN.[12-14] Seifman et al reported longer hospital stay (3.8 vs. 2.6 days; p=0.002), OT (16 vs. 4%; p=0.009), and major complications (16 vs. 5%; p=0.022) in patients with previous surgery.[12] This study included 190 patients who underwent upper tract standard and laparoscopic hand-assisted procedures, including four cases of LPN and 18 cases of LRN. A study by Parsons et al of 700 cases of various laparoscopic procedures revealed similar perioperative outcomes in patients with and without previous abdominal surgery, except for a higher rate of transfusion in patients undergoing nephrectomy (p<0.001) and pyeloplasty (p=0.02).[13] More recently, in a study of 79 cases of laparoscopic nephrectomy for non-functioning kidneys, patients with vs. without previous ipsilateral renal surgery experienced increased OT (98.6 vs. 62.3 minutes; p=0.03).[15] Other operative data were similar between the two groups. Authors concluded that laparoscopic nephrectomy can be done safely in patients with a history of ipsilateral renal surgery, but recognize that their results may not be applicable to the setting of radical nephrectomy for malignant tumour. Aminsharifi also found no difference in the outcomes of laparoscopic simple nephrectomy in patients with a history of ipsilateral open vs. percutaneous surgery.[17] Turna et al described their experience with transperitoneal and retroperitoneal LPN in 25 patients with previous ipsilateral renal procedures.[16] Although no intraoperative complications occurred, even in experienced hands, such cases involved a long WIT of 35.8 minutes and OT of three hours.

In our study, patients with previous abdominal surgery were older. This could be explained by the fact that older patients are more likely throughout the years to have surgical indications. The proportion of females was also higher because of the incidence of gynecological procedures. Increased CCI is attributed to older age in patients with prior surgery and to the substantial proportion of prior oncological surgeries. We report similar perioperative outcomes in patients with previous abdominal surgery. In multivariate analysis, prior abdominal surgery was not associated with complication or with worse perioperative outcomes, defined as results inferior to the whole cohort's median (i.e., EBL ≥100 mL, OT ≥135 minutes, and LOS ≥4 days). A possible

Table 4. Right-sided LPN and LRN based on previous open cholecystectomy status

Variables	Open cholecystectomy (n=19)	No cholecystectomy (n=123)	p
Age, years (SD)	67.5 (11.7)	63.8 (12.9)	0.239
Male, n (%)	7 (36.8)	82 (66.7)	0.007
Charlson score (SD)	4.1 (2.5)	2.8 (1.9)	0.016
BMI, kg/m^2 (SD)	29.0 (4.1)	27.9 (5.1)	0.390
ASA, n (%)			0,915
1	1 (5.3)	9 (7.4)	
2	11 (57.9)	74 (60.7)	
3	7 (36.8)	37 (30.3)	
4	0 (0)	2 (1.6)	
Partial nephrectomy, n (%)	9 (42.9)	38 (30.9)	0.318
Tumour size cm, (SD)	4.1 (1.8)	5.1 (3.0)	0.044
Median EBL, mL (IQR)	50 (50–200)	100 (50–200)	0.474
Operative time, min (SD)	148 (57)	128 (39)	0.049
WIT, min (SD)	25.9 (4.7)	21.9 (7.2)	0.152
Open conversion, n (%)	0 (0)	4 (3.2)	1.000
Median LOS, days (IQR)	4 (3.5–5.0)	3 (3.0–5.0)	0.050
Clavien grade complication, n (%)			0.004
0	11 (58)	103 (84)	
I–II	4 (21)	17 (14)	
III–IVa	4 (21)	3 (2)	

ASA: American Society of Anaesthesiologist classification; BMI: body mass index; EBL: estimated blood loss; IQR: interquartile range; LOS: length of stay; SD: standard deviation; WIT: warm ischemia time.

explanation is that prior abdominal surgery was not necessarily in the same anatomic location as the LPN or LRN and adhesiolysis was sometimes very limited.

To assess the impact of previous surgery in the same anatomical site, we performed a subset analysis of patients with and without previous open cholecystectomy undergoing right LPN and LRN. Even if open cholecystectomy is now rarely performed, many patients in our cohort (n=42) had this surgery performed in the last decade. Previous open cholecystectomy resulted in a 4.5-fold increased risk of complication and a longer LOS in patients undergoing right laparoscopic nephrectomy. This is likely attributed to the increased difficulty of laparoscopic surgery in previously operated anatomical site because of impaired visualisation due to adhesions, distorted tissue plane, difficult renal mobilization, and the need to perform more extensive adhesiolysis. Therefore, we believe that patients with a history of open cholecystectomy undergoing right LPN or LRN may be counselled about their increased risk of complications. Our results might also suggest that prior open surgery in the same anatomic location could results in an increased risk of complication. Longer LOS is likely a consequence of the higher complication rate. Our conclusions may not be applicable to patients with a history of laparoscopic cholecystectomy, as this results in less adhesion formation.[18] We did not have enough laparoscopic cholecystectomy cases (n=2) in those treated with right nephrectomy to perform a thorough analysis. Further studies are needed to answer that question.

Limitations of our study include its retrospective nature and the potentially missing data concerning previous abdominal surgery. Data-recording may contain errors, but it is very unlikely that any major abdominal surgery would not have been be noticed or recorded after several assessments, including complete history and physical examination. Sample size may also undermine the strength of our analysis; since most of the outcomes did not differ after statistical analysis, we wonder if the analysis was underpowered. However, in general our data does not show a clear and strong association between previous surgery and worse outcomes, therefore, if there is any association, it is likely weak.

Conclusion

Previous abdominal surgery was not associated with worse perioperative outcomes after transperitoneal LPN and LRN for renal masses. However, previous open cholecystectomy resulted in an increased risk of complication and longer LOS in patients undergoing right laparoscopic nephrectomy; those patients should be counselled about their increased surgical risk.

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