

Differences in Left and Right Laparoscopic Adrenalectomy

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ABSTRACT

Background and Objectives: The classic belief is that right-sided laparoscopic adrenalectomy is technically more difficult to perform than left-sided. The purpose of this study was to determine whether objective outcomes are different for the right- versus left- sided operation.

Methods: A retrospective review of 163 laparoscopic adrenalectomies was performed to compare outcomes. Variables extracted included age, demographics, body mass index (BMI), laterality, indication, operative time, estimated blood loss (EBL), gland size, complications, open conversion rates, and length of stay.

Results: Of the adrenalectomies performed, 109 were on the left and 54 on the right. Age, BMI, and indication were similar for each group. The mean EBL on the left side was 113mL (range, 2 to 3000) and 84mL (range, 10 to 700) for the right ($P=0.85$). The mean operative time on the left side was 187 minutes (range, 62 to 475) and on the right was 156 minutes (range, 50 to 365) ($P=0.02$). There was no difference in complication or conversion rate.

Conclusions: There was no difference in complication or conversion rates between each side, and we observed a trend toward lower blood loss for the right side. Although we report generally similar outcomes, the mean operative time for a right-sided laparoscopic adrenalectomy was significantly less (31 minutes) than the left side.

Key Words: Laparoscopic adrenalectomy, Operative time, Right versus left.

INTRODUCTION

Adrenal pathology requiring surgery is relatively rare with only about 19 cases per 100 000 hospital discharges performed annually in the United States. With the evolution of minimally invasive surgery, this rate appears to be increasing.^{1,2} Since Gagner's first report of laparoscopic adrenalectomy in 1992, it has become the standard approach for benign adrenal masses.^{3,4}

With evolution of laparoscopic technique and increased experience, even very large lesions and arguably adrenal malignancy can be managed laparoscopically.⁵ Laparoscopic transperitoneal and retroperitoneal approaches have been described as successful. The most common approach performed is the anterior transperitoneal approach. Classically, the procedure mimics the open surgical approach with dissection of the adrenal away from the body and early identification and control of the adrenal vein.^{6,7}

Due to the adrenal glands' anatomic location in the upper retroperitoneum, extensive dissection of surrounding structures is sometimes needed. The right adrenal gland in particular is also partially retrocaval. It is drained by a short vein into the inferior vena cava posterolaterally. This can be avulsed easily and can be difficult to control. The left adrenal gland, on the other hand, has a longer vein that drains into the left renal vein. Many feel that because of this, and the relatively few number of cases performed in most training programs, laparoscopic adrenalectomy is an advanced laparoscopic procedure.⁸ Further, anecdotal accounts report the right side to be more challenging because of the retrocaval location of the gland and the short adrenal vein. With this study, we attempted to determine whether there is a difference in right versus left adrenalectomy.

MATERIALS AND METHODS

From July of 1998 to November of 2007, 163 laparoscopic adrenalectomies were performed in Southern California Kaiser Permanente Hospitals. After Kaiser Permanente Regional Institutional Review Board approval, a retrospective review was performed to com-

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pare outcomes of right versus left laparoscopic adrenalectomy. Open adrenalectomy data were not collected, because the scope of the study was to strictly assess the perceived differences in the laparoscopic procedures alone.

Variables extracted for study included age, demographics, body mass index (BMI), previous abdominal surgery, size of the tumor, side of surgery, indication, approach, operative time, estimated blood loss (EBL), pathology, complications, the need for open conversion, and length of stay. Statistical analysis was performed using chi-squares and the Wilcoxon rank-sum test to determine whether significant differences existed (EpiStat DOS version 5.1, EpiStat Software Group, Richardson, Texas.)

RESULTS

Over an 8-year period, 163 laparoscopic adrenalectomies were performed by 27 surgeons in 9 Southern California Kaiser Permanente Hospitals. Fifty-eight percent of the cases were performed by urologists, while 42% were performed by general surgeons. Of these procedures, 109 were left sided and 54 were performed on the right. All of the operations were performed transperitoneally. Mean patient age was 54 (range, 21 to 83). Forty-four percent were males and 56% were females (**Table 1**). Indications for adrenalectomy included cancer (primary and metastatic), functional adenoma, nonfunctional adenoma, pheochromocytoma, incidentaloma, and 3 patients who did not fit into these previous categories, which we classified as "other" (**Table 2**). The indications did not differ between the 2 groups. The mean size of the mass was 3.06cm on the left and 2.68cm on the right ($P=0.16$). Mean BMI was 29.9kg/m² (range, 16 to 58.6), and did not differ between sides ($P=0.15$). Overall, 28% of the patients had previous major abdominal surgery; this did not include Cesarean delivery or hysterectomy, and there was no difference between the 2 sides (left 21%, right 22%, $P=0.35$). The overall mean EBL was 103mL. The mean EBL was 113mL (range, 2 to 3000) on the left side and 84mL (range, 10 to 700) on the right. This difference was not statistically significant ($P=0.85$). Mean overall operative time was 177 minutes. The mean operative time on the left side was 187 minutes (range, 62 to 475), and on the right it was 156 minutes (range, 50 to 365), which was statistically significant ($P=0.02$) (**Table 1**). The complication rate on the right was 3.7% and on the left was 5.5% ($P=1$). These included pneumothorax, port-site

hematoma, Veress needle injury to the stomach, nephrectomy, postoperative congestive heart failure, and 3 postoperative pulmonary embolisms, one of which was fatal. The conversion rate was 5.5% on the right and 1.8% on the left. Reasons for conversion were bleeding, mass that was larger than expected and had metastasized to the surrounding organs, and dense adhesions from previous operations. These findings were not statistically significant ($P=0.33$). Length of hospital stay was 1.44 days on the right and 1.87 on left, which was also not statistically significant ($P=0.73$).

DISCUSSION

Though laparoscopic adrenalectomy is considered standard care for most adrenal pathologies requiring surgery, it is still an uncommon procedure. General and urologic surgery residents perform relatively few adrenal cases during their training and unless practicing in a tertiary care center, many surgeons will rarely see such pathology. A survey of general surgery residents showed they performed on average 1.5 laparoscopic adrenalectomies during their training.⁹ A survey of urology residents showed only about one-third of responders performed 1 to 5 cases during the year prior to responding to the survey.¹⁰ This relative unfamiliarity with adrenal surgery might explain some of the apprehension to attempt laparoscopic adrenalectomy in general.

Maccabee et al⁸ stated that extra training is needed to overcome the learning curve of this advanced procedure, while Reynolds et al¹¹ felt differently, stating that an experienced laparoscopic surgeon could be taught a variety of complex procedures including laparoscopic adrenalectomy with minimal extra training. This might hold especially true for the modern trained urologic surgeon who is familiar with the anatomy and the similar dissection between laparoscopic adrenalectomy and laparoscopic nephrectomy. All surgeons in the current study were experienced laparoscopists, and we have shown that this diverse group of surgeons can perform this procedure with low complication and open conversion rates.

We saw no difference in outcomes based on the size of the adrenal mass, pathology, or BMI regardless of laterality. Similar to our findings, Ramacciato¹² did not show a negative correlation between outcomes and tumor size. This is contrary to Shen et al¹³ who showed that size >5cm, BMI>25, and pheochromocytoma were all significant independent risk factors associated with

Table 1.
Summary of Outcomes of Laparoscopic Adrenalectomies

	Left Side (N=109)	Right Side (N=54)	Total (N=163)	P Value ^a
Age				
Mean (SD)	54 (12.6)	53 (13.1)	54 (12.7)	0.6128
Median	55	53	54	
Range	24–83	21–78	21–83	
Gender				
Male	46 (42%)	26 (48%)	72 (44%)	0.4718
Female	63 (58%)	28 (52%)	91 (56%)	
Ethnicity				
White	43 (39%)	25 (46%)	68 (42%)	0.8414
Hispanic	28 (26%)	14 (26%)	42 (26%)	
Black	20 (18%)	8 (15%)	28 (17%)	
Asian	17 (16%)	7 (13%)	24 (15%)	
Missing	1 (1%)	0 (0%)	1 (0%)	
BMI				
Mean (SD)	30.3 (6.6)	29.2 (6.9)	29.9 (6.7)	0.1527
Median	29.5	27.8	28.7	
Range	16.0–48.6	19.0–58.6	16.0–58.6	
Operative time (min)				
Mean (SD)	187 (85.3)	156 (77.2)	177 (83.7)	0.0207 ^b
Median	175	130	160	
Range	62–475	50–365	50–475	
Blood loss (mL)				
Mean (SD)	113 (301.2)	84 (114.5)	103 (254.8)	0.8523
Median	50	50	50	
Range	2–3000	10–700	2–3000	
Adrenal mass (cm)				
Mean	2.68 (1.69)	3.06 (1.65)	2.80 (1.68)	0.1642
Median	2	3	2.45	
Range	0.7–7.1	0.8–8.0	1–8.0	

^aP value obtained from Chi-square test (gender & ethnicity) or Wilcoxon rank-sum test (age, BMI, operative time & blood loss).

^bP value < 0.05.

complication and conversion rates. Rosoff stated in a recent review that for experienced surgeons, size, suspicion of malignancy, or invasive disease should not be considered an absolute contraindication to laparoscopic adrenalectomy.⁵ We also saw no difference in outcome for right or left adrenalectomy in patients with

previous abdominal surgery. Morris et al¹⁴ showed a trend for longer operative times in patients with previous surgery, but this difference was not significant.

Surgery on the right adrenal gland has been thought to be more difficult than the surgery on the left. This belief

Table 2.

Indications for Laparoscopic Adrenalectomy

Pre Operative Diagnosis	Right Side	Left Side
Cancer (primary and metastatic)	0 (0%)	5 (4.6%)
Functional Adenoma	30 (55.5%)	69 (63.3%)
Non-functional Adenoma	6 (11.1%)	15 (13.8%)
Pheochromocytoma	13 (24.1%)	14 (12.8%)
Incidentaloma	4 (7.4%)	4 (3.7%)
Other	1 (1.9%)	2 (1.8%)

is anecdotal and mainly based on the retrocaval location of the right adrenal gland and short adrenal vein coming directly off of the vena cava. However, this study shows that right-sided operative time is significantly less difficult, and there was a trend towards less EBL for the right side as well. Several plausible explanations exist for these findings. It is important to remember that the left side can also be difficult because of the close proximity to the tail of the pancreas, the splenic vasculature, and the unforgiving nature of the spleen itself. Varkarakis et al¹⁵ reported an 8% rate of distal pancreatic injury with laparoscopic adrenalectomy. The left side also requires dissection of the left renal hilum to gain vascular control of the adrenal vein, which potentially increases the complexity of the left-sided procedure. This may explain one of the reasons we found increased time needed to perform left-sided versus right-sided laparoscopic adrenalectomy. Another explanation for increased time to perform left-sided adrenalectomy is that on the left side the splenic flexure requires more mobilization than the right colon. The liver reflection often only requires simple retraction. Lezoche¹⁶ also observed faster times for right adrenalectomy versus left (80 versus 109 minutes), but this difference was not statistically significant.

One shortcoming this study suffers from, based on its retrospective design, is selection bias. We could not account for the experience of each individual surgeon. However, in a pool of 27 surgeons, it was assumed that the difference of experience between the 2 cohorts would be minimal. We note that our surgeons performed twice as many left-sided adrenalectomies as right-sided. It is unclear whether this finding represented a difference in management of other right-sided adrenal pathology that was either observed, treated medically, or for which patients underwent open right-

sided adrenalectomy. Some surgeons likely preferentially performed open right-sided adrenalectomy for large tumors or pheochromocytomas based on previous biases. We did not search or compare rates of open adrenalectomy in our hospitals for the same time period since the focus of our study was to specifically address the perceived belief that laparoscopic right adrenalectomy is more difficult than left. The question of whether to approach certain adrenal pathologies by open or laparoscopic procedures was beyond the scope of this study. Including the open data in our cohorts may, in fact, have introduced results that would not have addressed our original question.

CONCLUSION

No difference existed in complication or conversion rates between each side. Though not statistically significant, we observed a trend toward lower blood loss for the right side. While we report generally similar outcomes versus sides, the mean operative time for a right-sided laparoscopic adrenalectomy was significantly faster than that for the left side. To further evaluate surgeons' perceived difficulty for laparoscopic adrenalectomy, a prospective trial using an intraoperative grading scale should be considered.

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