

Increased Complication Rate in Obese Patients Undergoing Laparoscopic Adrenalectomy

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ABSTRACT

Objectives: Laparoscopic adrenalectomy has become the standard of care for resection of adrenal masses, with extremely low morbidity and mortality. This study investigates the difference in outcomes in patients who underwent laparoscopic adrenalectomy, comparing obese with healthy weight patients.

Methods: A retrospective chart review was performed on patients undergoing laparoscopic adrenalectomy between January 2000 and February 2010. Intraoperative and postoperative complications in the patients were compared. A patient with a body mass index $>30\text{kg/m}^2$ was considered obese.

Results: Eighty patients underwent laparoscopic adrenalectomy between January 2000 and February 2010. Forty-nine patients (61%) were considered obese based on the body mass index criteria. Operative time, estimated blood loss, and length of stay did not differ significantly between the 2 cohort groups. There was no 30-day mortality in the population. There were 9 complications in the obese population and no complications in the healthy weight population ($P<.011$). Four obese patients had intraoperative complications, and 5 obese patients had postoperative morbidity.

Conclusions: A significant increase occurred in intraoperative and postoperative complications for obese individuals undergoing laparoscopic adrenalectomy compared with healthy weight individuals. However, high body mass index should not preclude elective laparoscopic adrenalectomy.

Key Words: Laparoscopic adrenalectomy, Obesity, Complications.

INTRODUCTION

Laparoscopic resection of adrenal masses was first reported in 1992.¹ Laparoscopic adrenalectomy (LA) has gained acceptance due to the size of the typical adrenal mass as well as the retroperitoneal location, making laparoscopic surgery technically less challenging than open surgery. Since first reported in 1992, laparoscopic adrenalectomy has become the standard of care for most benign and some malignant adrenal masses and its advantages have been well proven in a number of large studies within the last 2 decades. The laparoscopic approach for adrenalectomy has been proven to lower morbidity, shorten length of stay (LOS), and shorten periods of disability for the patient.²⁻⁸ Discharge from the hospital is usually within 1 day to 2 days after surgery, and full recovery requires 10 days to 14 days. Time to first oral intake and first ambulation are shorter with LA (1 day to 2 days) versus open adrenalectomy.^{5,7,8}

Over the past several decades, there has been an increase in patients who are obese. Obesity has previously not been shown to increase morbidity or mortality in patients who undergo laparoscopic colorectal surgery, appendectomy, paraesophageal hernia repair (PEHR) and cholecystectomy.⁹⁻¹⁵ However, obesity can lead to higher conversion rates in patients undergoing laparoscopic colorectal surgery and a trend toward more postoperative complications, without reaching statistical significance.¹¹ To date, no study has looked at obesity in laparoscopic adrenal surgery and its effect on patient outcomes.

We are comparing intra- and postoperative morbidity and mortality in obese and healthy weight patients undergoing laparoscopic adrenalectomy, with the hypothesis that obesity would not increase the complication rate.

METHODS

Charts of patients undergoing laparoscopic adrenalectomy between January 2000 and February 2010 were retrospectively reviewed, and intraoperative and postoperative complications in our patient population were compared. Obesity in our patient population was defined as a patient with a body mass index (BMI) $>30\text{kg/m}^2$. Our

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primary outcomes were morbidity (intraoperative and postoperative) and mortality.

Categorical variables were tested using chi-square or Fisher's exact tests, and continuous variables (such as age) were tested using 2-sample *t* tests or Wilcoxon's rank sum test (if skewed). Logistic regression models were fit predicting complications, with the main predictor being obesity group status. Obesity status was kept in the model regardless of significance. Significant covariates were then adjusted for in the model (to adjust for possible demographic/clinical differences between the 2 groups). Results are reported in terms of odds ratios with 95% confidence intervals. Another regression model was fit predicting LOS, where the primary predictor variable was obesity group status; significant covariates were adjusted for in the final model. SAS statistical software was used for all analysis, and P values of <.05 were considered statistically significant.

RESULTS

Eighty patients (45 women and 35 men) underwent laparoscopic adrenalectomy between January 2000 and February 2010. Patients undergoing adrenalectomy as part of a larger operation were excluded. The majority of operations (70, 88%) were performed via a lateral transperitoneal approach, 10 (12%) patients underwent robotic adrenalectomy, and 2 patients had bilateral adrenalectomies performed via a lateral transperitoneal approach.

Table 1 summarizes patient demographics. The mean age of the patient population was 52 years old. The mean diameter of adrenal glands resected was 4.5cm, with a higher proportion of masses resected were left sided (46 versus 32 lesions, 57.5% versus 40% with 2 patients having bilateral tumors). The largest percentage of these lesions were adenomas (39 out of 80, 49%), and no adrenocortical cancers were resected laparoscopically. Median operative time for our patient population was 124.5 minutes (range, 76 to 330), while median estimated blood loss (EBL) was 50mL (range, 5 to 1200). The median length of stay (LOS) was 1 day (range 1 to 14).

Forty-nine patients (61%) were obese by study criteria, with the mean BMI for our patients being 33.4kg/m². **Table 2** compares the 2 cohorts of patients. Patient characteristics for the 2 groups are well matched. There was a trend towards older patients, patients who used tobacco, and patients with cardiac disease in the healthy weight group, but operative time, EBL and LOS did not differ significantly between the 2 cohorts.

Table 1.
Patient Characteristics (n=80)

Characteristics	n	%
Sex		
Male	35	43.7
Female	45	56.3
Mean age (years)	52.4 ± 14	
Mean mass size (cm)	4.5 ± 2.7	
Location		
Right	32	40.0
Left	46	57.5
Pathology		
Cortical adenoma	39	
Aldosteronoma	5	
Pheochromocytoma	16	
Angiomyolipoma	10	
Cyst	2	
Adrenal hyperplasia	4	
Ganglioneuroma	1	
Metastasis	3	
Mean BMI (kg/m ²)	33.4 ± 7	
Median OR time (minutes)	124.5 (108.5, 156)	
Median EBL (mL)	50 (25, 87.5)	

There was no 30-day mortality in the population. For classification, complications were divided into intraoperative and postoperative. Postoperative complications were further classified as major (pneumonia, deep wound infection, abdominal hematoma or abscess, DVT or PE) and minor (ileus, anemia not requiring blood transfusion, UTI, superficial wound infection).

As shown in **Table 3**, there were 9 significant complications in the obese population and no similar complications in the healthy weight population (P<.011). Four obese patients had intraoperative complications including 2 splenic lacerations, 1 pneumothorax, and 1 vein injury. Injuries occurred equally on the right and the left side. Five obese patients had significant postoperative morbidity, including 3 infectious complications, an intraabdominal hematoma, and a deep vein thrombosis. There was one conversion to open adrenalectomy that occurred in an obese patient due to bleeding from a splenic injury, eventually requiring splenectomy.

An unadjusted logistic regression model predicting all postoperative 30-day complications (n=24, 30%) was fit

Table 2.
Patient Characteristics by Obesity Status (n=80)

	BMI<30kg/m ² (n=31)	BMI≥30kg/m ² (n=49)	P-Value
Sex			.112
Male	17 (54.8%)	18 (36.7%)	
Female	14 (45.2%)	31 (63.3%)	
Mean age (years)	56.1 ± 14	50.1 ± 13	.054
Mean mass size (cm)	4.3 ± 2.0	4.5 ± 3.1	.752
Location			.726
Right	13 (41.9%)	19 (38.8%)	
Left	18 (58.1%)	28 (57.1%)	
Median OR time (minutes)	125 (106, 143)	124.5 (111, 170)	.448
Median EBL (mL)	50 (25, 75)	50 (25, 100)	.384
Median LOS (days)	1 (1, 2)	2 (1, 2)	.524
Comorbidities			
Tobacco use	17 (54.8%)	17 (34.7%)	.076
DM	4 (12.9%)	13 (26.5%)	.147
Cardiac disease	9 (29.0%)	6 (12.2%)	.061
Respiratory disease	8 (25.8%)	11 (22.4%)	.731

Table 3.
Complications After Laparoscopic Adrenalectomy

	BMI<30kg/m ²	BMI≥30kg/m ²	P-Value ^a
Early (in hospital) and late (post-discharge) 30-day complications			
Total	6 (19.4%)	18 (36.7%)	.098
Intraoperative or major early postoperative complications			
Intraoperative	0	4	
Early postoperative	0	5	
Total	0 (0%)	9 (18.4%)	.011

^aCalculated using Fisher's exact test.

with the obesity status. The unadjusted odds ratio for obese compared to healthy weight is 2.42 (95% CI = 0.84, 7.01, P=.098, same as the Fisher's exact test, **Table 3**). A multivariate logistic regression model was fit with possible covariates of sex, age, tobacco use, diabetes indicator, and history of cardiac disease. Using a step-wise model selection technique, the final multivariate logistic regression

model for 30-day complication included obesity and sex as predictors. Adjusting for sex, the final logistic regression model predicting 30-day complications found obese patients were significantly (P=.038) more likely to have complications compared to healthy weight patients (O=3.41, 95% CI=1.07, 10.82). Males were significantly (P=.012) more likely to have 30-day complications (OR=3.96, 95% CI=1.36, 11.55). The final regression model for LOS had no significant predictors. Since skewed, LOS was also modeled as a log-transformed variable with no significant predictors. Obesity status was not significant in predicting minor postoperative complications (n=9, 11%).

DISCUSSION

With an increase in obesity over the last several decades, surgeons are facing new challenges. The purpose of this study was to evaluate results of laparoscopic adrenalectomy, comparing obese with healthy weight patients. The advantages of LA compared to an open procedure are well documented by numerous studies within the last decade. A recent study by Erbil et al¹⁶ in 51 consecutive patients showed a positive correlation between BMI and operating time, postoperative complications, and hospital stay, suggesting that increased amount of retroperitoneal fat mass is responsible for these findings.

Previous studies in the literature have shown comparable intraoperative and postoperative complication rates in obese versus healthy weight patients after various laparoscopic procedures (laparoscopic cholecystectomy, colorectal surgery, appendectomy, PEHR).^{9–15} It is unclear why complication rates differ in LA but may be a result of specific organs that are manipulated during this operation. Specifically, left-sided LA required splenic colon mobilization and mobilization of the greater omentum of the spleen, which can lead to splenic laceration (a major cause of intraoperative complication in this patient cohort). Obese patients have a more significant burden of omentum making this maneuver more difficult. This may also attribute to the higher risk of complications in men versus women in this study, because men typically have a higher amount of intraabdominal fat and omental fat compared with women. Size of the adrenal mass was not a risk factor for complication in this patient cohort. Only one out of the 4 intraoperative complications occurred in a patient with a mass >6cm in size (splenic injury during LA for a left 13.5-cm adrenal myelolipoma). Increased intraoperative complication rates in obese patients may also be the result of suboptimal visualization in the context of the increased amount of intraperitoneal fat. Surgeon experience may also affect complication rates, as all intraoperative complications occurred within the first 30 procedures performed by the respective surgeon; postoperative complications were equally distributed through our patient population.

Conversion rates seem to increase in obese patients according to some studies^{11,14,15}; the only conversion in this group occurred in an obese patient with uncontrollable bleeding after iatrogenic splenic injury. According to the literature^{17–20} bleeding is the most common intraoperative complication of LA and also the most common reason for conversion. In our study, there was no difference between the 2 groups regarding intraoperative blood loss or operative time.

The significant increase in cardiopulmonary comorbid conditions in obese patients reported in the literature^{11,12,14,15} was not reproduced by our group. Despite having higher comorbidities, the healthy weight patients had only minor postoperative complications. This may be associated with decreased functional reserve in obese patients, impaired immune system resulting in a higher rate of infectious complications and delayed ambulation due to body habitus and increased narcotic use.

CONCLUSION

Laparoscopic adrenalectomy can be performed in healthy weight as well as obese individuals. Although there is a statistically significant increase in intraoperative and major postoperative complications for obese individuals undergoing laparoscopic adrenalectomy, the clinical significance seems less obvious, as it was shown that the laparoscopic approach has fewer complications than open surgery has. These results should rather challenge physicians to optimize obese patients prior to surgical intervention to avoid such complications. The results should amend the consent process in the preoperative period and will allow physicians to predict possible complications in this patient population but does not preclude the use of LA in obese individuals.

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