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Laparoscopic Versus Open Adrenalectomy: a Retrospective Comparative Study

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ABSTRACT

Background: Laparoscopic Adrenalectomy (LA) has rapidly become the gold standard in management of adrenal tumors as it has been found to be associated with better cosmeses, shorter hospital stay and rapid convalescence. **Objective:** The aim of this study was to compare laparoscopic and open approach to adrenal glands in terms of operative time, hospital stay, indications and blood loss at a tertiary medical center in Jordan. **Methods:** A retrospective comparative study which included all patients who underwent adrenalectomy (open or laparoscopic) from 2005 to 2015 at King Hussein Medical Center (KHMC). Patients' demographics, outcomes and essential study variables were extracted from patients' files. Data analysis was performed using SPSS17 and Stata 10. **Results:** One hundred and three patients (mean age 44.9 years) were included, 90.2% of them underwent laparoscopic adrenalectomy. The size of the tumors ranged from 2 to 17 cm (mean 6.6 cm). The operative time, blood loss and hospital stay were significantly less in the laparoscopic group (P value <0.001). Patients in Open group had a significantly higher risk of incomplete excision of the tumors (P value=0.020). **Conclusion:** Laparoscopic adrenalectomy is associated with decreased operative time, blood loss and hospital stay compared to open approach. Tumor size and its malignant potential should be no more regarded as an absolute contraindication to laparoscopic adrenal surgery.

Keywords: Laparoscopic adrenalectomy, open adrenalectomy, adrenal tumors.

1. BACKGROUND

The widespread use of non-invasive imaging methods (ultrasound, computed tomography (CT) and magnetic resonance imaging (MRI)) has greatly improved the rate of early detection of adrenal masses. Adrenalectomy is indicated in most functional adrenal neoplasms and large incidentalomas. The traditional open surgical techniques require a large incision or even resection of 12th rib for the adequate exposure (1, 2).

Laparoscopic adrenalectomy (LA) was first described by Gagner et al in 1992 and has rapidly become the gold standard of treatment for benign adrenal tumors. It is associated with significantly decreased morbidity, shorter length of hospital stay, more rapid convalescence, and improved cosmeses compared with open resection (3, 4).

It was not until 2005 we began to perform LA at King Hussein Medical Center (KHMC).

2. OBJECTIVE

The aim of this study was to compare laparoscopic and open adrenalectomy in terms of length of hospital stay, blood loss, indications and adequacy of resection in patients who underwent the procedure at KHMC.

3. MATERIALS AND METHODS

This was a retrospective study in which all patients who underwent adrenalectomy (open or laparoscopic) from 2005 to 2015 at KHMC were included. The patient's files were reviewed after the study had been approved by the institutional board review (IRB) at Royal Medical Services. The information collected from files included patient's demographics, preoperative and histopathological diagnosis, adrenal size by computed tomography scan and histopathology, functionality of the tumor, the status of resection margins, operation time, intraoperative blood loss and length of hospital stay.

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Data analyzed using SPSS 17 and Stata 10 for windows. Descriptive statistics and student t tests were used for means and frequency calculations. Chi square and logistic regressions were used for binary variables while linear regression was used for other variables. P value less than 0.05 is considered statistically significant.

4. RESULTS

One hundred and three patients, with a mean age of 45 years (range 14-75), were included. Most of them (90.3%) underwent LA rather than open adrenalectomy. Table 1 shows comparison and the statistical significance of the parameters assessed. The patients in both groups were not different in terms of age, sex, side of surgery or functional status of the tumors. 77.5% of tumors were non-functional. All functional tumors were operated by laparoscopic approach. Male patients were found more likely to have functional tumors than females (odds ratio, 3.54; 95% CI, 1.33-9.4; P = 0.009). Also younger patients have been found more likely to have functional tumors even when corrected for sex and tumor size (P=0.014). The size of the tumor was significantly larger

	Laparoscopic Adrenalectomy n=93	Open adrenalectomy n=10	P value
Age			
Mean	44.6	48	0.5
Range	14-75	21-73	
Gender			
Male	28	5	0.2
Female	65	5	
Side			
Right	30	4	0.847
Left	62	6	
Bilateral	1	0	
Functionality			
Functional	22	0	0.19
Nonfunctional	69	10	
Excision			
Complete	89	8	0.02
Incomplete	3	2	
Size on CT(cm)			
Mean	4.4	9.7	<0.001
Range	2-8	7-14	
Size on histopathology(cm)			
Mean	5.9	12.2	<0.001
Range	2-9	10-17	
Operative time(minutes)			
Mean	71	115	<0.001
Range	40-100	100-140	
Estimated blood loss(ml)			
Mean	48	138	<0.001
Range	10-130	70-200	
Hospital stay(-days)			
Mean	2	3.4	<0.001
Range	1-4	3-4	

Table I. Patients demographics, clinical and perioperative data

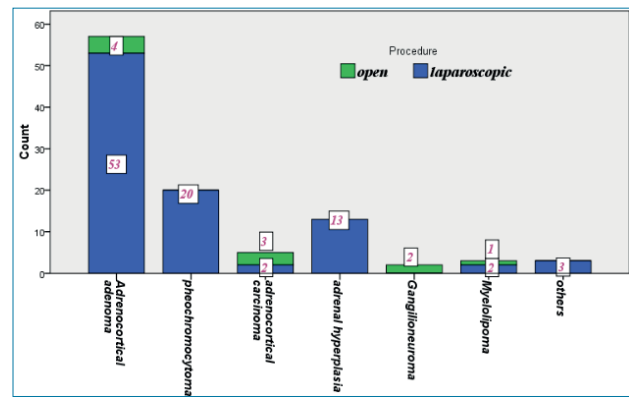


Figure 1. Final histopathological diagnosis for both patients groups

in open compared to LA group. All tumors of 9 centimeter (cm) or less were operated by laparoscopic approach, and all tumors of 10 cm or more were operated by open approach. A strong positive correlation was found between the preoperative size measured on CT scan and postoperatively on the histopathology report (r = 0.955, P<0.001). Figure 1 shows the final histopathological diagnosis for patients in open and laparoscopic groups.

Estimated intraoperative blood loss, operative time and hospital stay were more in the patients who underwent open adrenalectomy than LA (P<0.001). Regression analysis showed that intraoperative blood loss was an independent factor that increased both operative time and hospital stay (P values were <0.001 and 0.006, respectively). In addition, there was a strong positive correlation between tumor size and blood loss, hospital stay and operative time (r = 0.744, 0.546 and 0.725, respectively, P<0.001).-However, there was no difference in respect to the side of surgery (P values were 0.992,0.227 and 0.566, respectively).

5. DISCUSSION

From the surgical point of view, the adrenal glands are considered relatively inaccessible due to their small size, fragility and their retroperitoneal location deep inside the fat. Propper exposure requires extensive incisions much larger than their size. Because of this, LA represented an attractive alternative to open approach since first report of LA in 1992 (3, 5, 6). Adrenal tumors which need surgical intervention are broadly classified into functional or nonfunctional. In our study, supported by other studies (1, 5, 7-9), the majority of operated tumors were non-functional. Younger patients were found to be more likely to have functional tumors, but in contrary to what reported by Wooten and King (10), we found that males were more likely than females to have functional adrenal tumors. Two controversial issues are found in the selection of patients for either open or laparoscopic techniques: the size of the tumor and the presence of malignancy. Recently most author's advice offering LA for tumors not exceeding 8 cm (11-13), although others reported successful LA for tumors up to 12 cm (14) and even Fiszer P et al (15) reported an 18 cm tumor removed successfully via laparoscopic approach. In the present study, all tumors of 9 cm or less in diameter were operat-

ed laparoscopically, whereas open surgery was offered to tumors of 10 cm or more. The other controversial area in LA is the suspicion or the presence of malignancy. The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), in its 2013 published Guidelines for minimally invasive treatment for adrenal pathology, did not recommend laparoscopic surgery for tumors suspected to be malignant especially if more than 6 cm in diameter (16), on the other hand, the European Society of Endocrine Surgeons has suggested that LA can be considered for stage I and II adrenocortical carcinoma with tumors <10 cm in size (17). In their systematic review, Norman et al (3) concluded that open approach is recommended in patients with tumor invasion, vascular thrombi, and lesions larger than 10 cm, however, there is concern regarding the ability to achieve consistent oncological resection of lesions between 6 and 10 cm by LA and there is a need for further research in this area. The choice of LA over open approach is not related only to smaller incisions and better exposure. In the present study, we found that estimated intraoperative blood loss was significantly less with LA, which is consistent with other studies (2, 21, 24). Also, the postoperative hospital stay length was significantly less with the laparoscopic approach, a finding that has been proved by most other authors (2, 6, 21-26). The operation time was found in our study to be less with LA in keeping with other studies (21, 24, 25), although others found that this time was similar (2) to open approach or even longer (6). Of note, we found that operative time, estimated blood loss and hospital stay were significantly increased as the size of the tumor increased. This finding was reported by some authors (13, 14), although Serji B et al (20) showed that only operation time will increase as tumor size increases. We didn't find in this study any significant difference in these parameters (blood loss, operation time, hospital stay) between left and right sided tumors. This was reported by other authors (18, 19) who concluded that the popular say that right sided surgery is more difficult than left sided is not justified. Other advantages for LA reported in the literature was the decrease in pain scale and analgesia demand (2), while overall complications rate was similar (2) or even less with LA (6).

Our study has many limitations. First, information regarding postoperative complications and follow up could not be obtained. Second, details involving conversion rate could not be clearly extracted from patients' files.

6. CONCLUSION

LA has become the gold standard in adrenal surgery. We found that it has the benefits of decreased operative time, decreased intraoperative blood loss and decreased hospital stay without jeopardizing the complete excision. The size of the tumor and its malignant potential should be no more regarded as an absolute contraindication for minimally invasive approach in adrenal surgery.

- **Patient Consent Form:** Appropriate patient consent forms were obtained.

- **Authors' contributions:** All authors contributed equally to the manuscript and read and approved the final version of the manuscript.
- **Conflicts of interest:** The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.
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