

Laparoscopic Adrenalectomy Ten-Year Experience, 67 Procedures

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Introduction: The purpose of this study was to evaluate the short-term and long-term results of laparoscopic adrenalectomies carried out in our center.

Materials and Methods: A total of 67 laparoscopic adrenalectomies were performed during the 10 years between 1995 and 2005 at Shahid Labbafinejad Medical Center. A transperitoneal lateral approach was used in 65 (97.0%) of the patients, and retroperitoneal approach was used in 2 (3.0%). The clinical characteristics and the outcomes were reviewed in a retrospective study.

Results: Indications for laparoscopic adrenalectomy in our patients were as follows: pheochromocytoma in 28 patients (41.8%), aldosterone-producing adenoma in 15 (22.4%), pseudocyst in 6 (9.0%), Cushing syndrome (macronodular adrenocortical hyperplasia) in 5 (7.5%), nonfunctioning adenoma (incidentaloma) in 5 (7.5%), myelolipoma in 2 (3.0%), almost normal adrenal tissue in 2 (3.0%), adrenal cyst in 2 (3.0%), adenocarcinoma in 1 (1.4%), and schwannoma in 1 (1.4%). The mean operative time for unilateral cases was 149.0 ± 36.1 minutes. The mean intraoperative blood loss was 126 ± 36 mL. Conversion rate to open surgery was 7.5%. Reoperation due to hemorrhage was performed in 1 patient.

Conclusion: Laparoscopic adrenalectomy is a safe procedure in some adrenal tumors and a reasonable option for selected large adrenal tumors when complete resection is technically feasible and there is no evidence of local invasion.

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INTRODUCTION

During the past decade, minimally invasive procedures have been increasingly used, resulting in their current wide application to a variety of disorders.⁽¹⁾ Laparoscopic adrenalectomy was promptly introduced and is now almost universally considered to be the standard technique for the management of benign adrenal masses; however, it

is controversial for large and potentially malignant tumors.⁽²⁻⁴⁾ We report a series of 67 laparoscopic adrenalectomies carried out during a period of 10 years in our center.

MATERIALS AND METHODS

A total of 67 laparoscopic adrenalectomies performed between 1995 and 2005 were reviewed retrospectively. Preoperative characteristics of

Table 1. Preoperative Characteristics of Patients Who Underwent Laparoscopic Adrenalectomy*

Characteristics	Values
Number of patients	67
Sex	
Male	25 (37.3)
Female	42 (62.8)
Mean age, y	39.8 ± 11.6 (22 to 61)
Mean tumor size, cm	6.3 ± 3.5 (2 to 13)
Tumor side	
Right	29 (43.3)
Left	37 (55.2)
Both	1 (1.5)

*Values in parentheses are percents.

the patients are listed in Table 1. Laparoscopy was limited to well-encapsulated masses without radiologic evidence of periadrenal involvement or obvious lymphadenopathy. There were 17 patients (25.5%) among our 67 cases who had a tumor larger than 6 cm in diameter. The most common indication for laparoscopic adrenalectomy in our series was pheochromocytoma (n = 28) that compromised the greatest number with adrenal tumors larger than 6 cm (Table 2). Five patients (7.5%) were classified as having nonfunctioning adrenal tumors. These patients had nonspecific abdominal pain, history of hypertension, and a slight increase in the preoperative 24-hour urine metanephrines. Consequently, they underwent adrenalectomy for a presumed pheochromocytoma, but pathologic examination of their removed adrenal glands showed no evidence of pheochromocytoma. We had 15 patients (22.4%) with aldosterone-producing adenoma, all of which were larger than 3 cm in diameter. Two patients

(3.0%) underwent adrenalectomy, but pathologic examination of specimen showed normal adrenal tissue. They had a history of hypertension and low but normal levels serum potassium with mild increase in serum aldosterone. Imaging findings were indicative of a tiny nodule.

Urinary levels of free cortisol and vanilmandelic acid, along with plasma levels of adrenocorticotrophic hormone, dehydroepiandrosterone, 17-hydroxy progesterone, testosterone, rennin, and aldosterone were measured preoperatively, as indicated. Complete hormonal tests were performed preoperatively in patients with incidentally detected adrenal masses. All of the patients underwent abdominal computed tomography and magnetic resonance imaging. In case of pheochromocytoma, ¹³¹I-metaiodobenzylguanidine scintigraphy was performed in order to detect contralateral or extra-adrenal lesions. Correction of metabolic derangements in patients with Cushing syndrome and hyperaldosteronism, and control of pheochromocytoma-induced hypertension was achieved with α -adrenergic or β -adrenergic blockage before surgical operation.

In order to perform laparoscopic adrenalectomy, retroperitoneal approach was used in 2 patients (3.0%) with aldosterone-producing adenoma and schwannoma during the first cases (learning curve period) to find out the applicability of the approach. Afterwards, lateral transperitoneal approach was our routine in 65 patients (97.0%) since it had more space to work in and anatomy was better during the procedure. All of the patients underwent bowel preparation the day before the procedure. They were secured in a 90-degree lateral position for surgical operation. The techniques of the lateral transperitoneal approach that we used have been previously described.^(1,3) In the right adrenal tumors, if the tumor size was less than 4 cm, the adrenal vein was exposed from its origin on the inferior vena cava and was clipped or coagulated by bipolar cautery. If the adrenal tumor was larger (> 4 cm), we

Table 2. Indications for Laparoscopic Adrenalectomy

Indication	Patients (%)
Pheochromocytoma	28 (41.8)
Aldosterone-producing adenoma	15 (22.4)
Cushing syndrome (macronodular adrenocortical hyperplasia)	5 (7.5)
Pseudocyst	6 (9.0)
Adenocarcinoma	1 (1.4)
Myelolipoma	2 (3.0)
Schwannoma	1 (1.4)
Adrenal cyst	2 (3.0)
Nonfunctioning adenoma (incidentaloma)	5 (7.5)
Almost normal adrenal tissue	2 (3.0)

tried to coagulate or clip the adrenal vein as close to the tumor as possible with special care not to avulse the adrenal vein from the vena cava. We performed adrenalectomy in patients with pseudocysts with thick or irregular walls, suspicious of malignancy. We also performed adrenalectomy in 2 patients with symptomatic large adrenal cysts because the cyst compromised most of the adrenal gland at laparoscopy. In 1 patient undergoing the retroperitoneal approach, an adenoma was removed and the normal adrenal gland was preserved.

Data on the patients' characteristics, hospital records, and follow-up visits were collected. Improvement of hypertension was defined as a lower blood pressure and/or reduction of antihypertensive medications. The results were presented as percentages and mean \pm standard deviation, where appropriate.

RESULTS

Indications for adrenalectomy in our series are listed in Table 2, and the operative results are shown in Table 3. The diameter of the adrenal tumor did not significantly correlate the operative time; grouping patients into 17 with large tumors (≥ 6 cm in diameter) and 50 with tumors (< 6 cm), we did not find significantly longer operative times in patients with larger tumors (159 ± 32 min versus 145 ± 36 min, $P = .34$).

The overall intraoperative complication rate was 6.0% (4 patients). There were 2

hypertensive crisis episodes in patients with pheochromocytoma, 1 bleeding episode in a patient with a right adrenal tumor less than 6 cm, and 1 iatrogenic injury to the ileum in a patient with a history of previous surgery. Prompt intraoperative intervention in the patients with hypertensive crises was performed with a successful control. Bleeding was massive in 1 patient and required intraoperative blood transfusion and conversion. Reoperation due to hemorrhage was performed in 1 patient (insufficient hemostasis). There was 1 case of ileal injury in a patient with a history of previous abdominal surgery and dense adhesions, which were repaired laparoscopically without any postoperative complication (Table 3).

All complications and conversions occurred during the first 5 years of our experience, in the first 25 patients, and there were no major complications in the remaining 42 patients. In addition, the mean operative time decreased significantly in the last 3 years.

Nasogastric drainage usually remained in the end of the procedures and the Foley catheter was removed in the morning following the operation day. All the patients required postoperative analgesics for a mean period of 2.1 ± 0.6 days (range, 1 to 51 days) and were able to resume oral intake after a mean of 2.0 ± 1.2 days (range, 1 to 4 days). Postoperative mean hospital stay was 5.0 ± 2.1 days (range, 3 to 11 days).

At a mean follow-up of 31 months (range, 2 to 69 months), improvement of hypertension was achieved in 41 of 44 patients (93.1%) with pheochromocytoma or hyperaldosteronism. After the operation, all of the patients were referred to an endocrinologist for evaluation. There was no evidence of biochemical relapse in hormonally active tumors. One patient in whom laparoscopic adrenalectomy was attempted to treat adenocarcinoma developed local metastasis after 6 months. The size of tumor was less than 6 cm and we had not diagnosed it preoperatively. There was no perioperative mortality and no capsular disruption during dissection.

Table 3. Operative Outcomes of Laparoscopic Adrenalectomy*

Outcome Parameter	Value
Mean operative time, min†	149.0 \pm 36.1 (130 to 290)
Right side	165.0 \pm 33.6 (150 to 230)
Left side	121.0 \pm 39.2 (80 to 290)
Mean blood loss, mL	126 \pm 36 (70 to 850)
Conversion to open surgery	5 (7.5)
Reoperation for bleeding	1 (1.4)
Ileal injury‡	1 (1.4)
Hypertension	2 (3.0)

*Values in parentheses are minimum and maximum values or percentages where appropriate.

†Operative time for unilateral tumors was considered.

‡The patient had bowel adhesion due to appendectomy. Injury was repaired laparoscopically with no further problems.

DISCUSSION

Laparoscopy has become the gold standard approach to routine adrenalectomy.^(3,5,6) Abandoning large incisions and minimizing bowel manipulation result in decreased preoperative morbidity, shortened hospital stay, and rapid functional recovery. Concerning the treatment of adrenal masses, despite absolute contraindication of laparoscopy for large adrenal cortical carcinoma with local periadrenal invasion or venous thrombus,⁽¹⁾ there is still no consensus regarding the maximum tumor size for laparoscopy. While the size of an adrenal tumor is an important indicator of its malignant risk, many large adrenal tumors are benign.⁽²⁾ If size is the only criterion on which the operative approach is based, many patients with benign large adrenal tumors will have an unnecessary open adrenalectomy that might increase their morbidity.

Several surgeons reported successful laparoscopy performed in patients with adrenal tumors larger than 5 cm.⁽⁷⁻⁹⁾ They had similar results as other surgeons who chose 6 cm as the cutoff point.^(10,11) Data in our series also confirm that laparoscopy for tumors larger than 6 cm can be performed successfully without any increase in conversion rate, morbidity, or mortality. In our patients, all conversions or malignancies were seen in patients with tumors smaller than 6 cm, but we emphasize that oncological surgical principles should be considered in detail. From our data and those just reviewed, it is difficult to conclude whether laparoscopy offers the same therapeutic efficacy for malignant tumors, because in all series, malignant tumors are rare. It is very difficult to conduct a comparative study of open versus laparoscopic adrenalectomy for large or malignant tumors in a single center. Also, still no reliable preoperative diagnostic test exists for determining the malignant potential of adrenal tumors.⁽¹²⁾ In neither of our patients, preoperative laboratory or imaging evaluation indicated malignancy.

During the first five years of our experience,

we limited the laparoscopic approach to benign tumors less than 6 cm in diameter, and our first laparoscopic resection of adrenal tumors larger than 6 cm were performed after we had the experience of 20 laparoscopic adrenalectomies in patients with smaller adrenal tumors, and thus, we had considerable experience with this procedure before we encountered patients with this large adrenal tumors, and this may have influence our results.

In our study group, the mean size of adrenal masses resected by laparoscopic adrenalectomy was 6.3 cm (range, 2 cm to 13 cm). The larger lesions, often involving numerous vessels, required special perioperative attention, but no increase in conversion rate was noted because there was no complication or conversion in large tumors. Regarding the relationship between malignancy and tumor size, some authors have reported that tumors larger than 6 cm in diameter or weighing more than 100 g are highly likely to be malignant.^(13,14) Furthermore, inhomogeneous features visible in a computed tomography scan and elevated dehydroepiandrosterone or estradiol levels are considered reliable criteria to determine the nature of the adrenal tumor. However, the malignant potential only becomes true when confirmed by evidence of spreading beyond the adrenal capsule or adrenal vein on pathological examination. Additional concerns about port-site metastases and local recurrences are theoretically justifiable, but the actual risk has remained unknown.⁽¹⁵⁻¹⁷⁾ We did not have any port-site metastasis.

CONCLUSION

Our series confirmed that laparoscopic adrenalectomy is a safe and effective procedure, associated with minimal morbidity. Also, we concluded that most adrenal masses are potentially amenable to a laparoscopic approach if there is no evidence of periadrenal invasion or lymphadenopathy. However, meticulous preoperative workup should be performed in order to classify the type of

lesion and to attain more certainty about its anatomical relations. Careful preoperative planning will help the surgeon to optimize surgical indications and will minimize the occurrence of unexpected events during surgical operation.

CONFLICT OF INTEREST

None declared.

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