

Research paper

Laparoscopic surgery for adrenal tumors. A retrospective analysis

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ABSTRACT

OBJECTIVE. Laparoscopic adrenalectomy has rapidly replaced open adrenalectomy as the procedure of choice for benign adrenal tumors. The aim of this study was to evaluate the short- and long-term results of 100 consecutive laparoscopic and open adrenalectomies performed during a period of 8.5 years in our Surgical Unit. **DESIGN.** A retrospective analysis of patients operated on for adrenal tumors was conducted. From May 1997 to August 2005, one hundred adrenalectomies were performed on 95 patients. Five patients underwent either synchronous or metachronous bilateral adrenalectomy. There were 38 men and 57 women, aged 16 to 80 years. The size of tumors in our series ranged from 3.2 to 27 cm. The largest laparoscopically excised tumor was a ganglioneuroma with a diameter of 13 cm. **RESULTS.** In 73 patients laparoscopic procedure was completed successfully. In 8 cases the laparoscopic procedure was converted to open. Fourteen patients were treated with open approach. One patient with pheochromocytoma succumbed following pulmonary embolus. In one patient with morbid obesity, Cushing's syndrome, and bilateral adrenal macronodular hyperplasia, the left laparoscopic adrenalectomy was complicated by a low output pancreatic fistula, conservatively treated. All other patients had an uneventful course. Operative time for laparoscopic adrenalectomies ranged from 65 to 180 minutes. The average postoperative hospital stay for laparoscopic adrenalectomy ranged from 1 to 2 days (1.5 days), versus 5 to 20 days for patients who underwent open or converted procedure. **CONCLUSIONS:** Laparoscopic adrenalectomy should be the treatment of choice for all benign adrenal tumors. Laparoscopic resection of large adrenal tumors necessitates experience in open and advanced laparoscopic surgery.

Key words: Adrenal tumors, Laparoscopic adrenalectomy, Laparoscopy

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INTRODUCTION

The first laparoscopic adrenalectomy was performed by Michel Gagner in 1992.¹ Since then it has become a standard surgical approach for benign adrenal tumors.

Compared with the traditional open resection, laparoscopic adrenalectomy has decreased requirement for postoperative analgesia and is characterized by a shorter hospital stay, better patient satisfaction, and an earlier return to normal diet and activities.² These clear advantages of laparoscopic adrenalectomy did not encourage any prospective randomized controlled trials comparing the new technique with the classical ‘open’, either transabdominal or retroperitoneal technique.

We present a single institution’s experience on a relatively large number of laparoscopic adrenalectomies.

PATIENTS AND METHODS

From May 1997 to August 2005, ninety-five patients with adrenal tumors were referred to our Department and underwent adrenalectomy. Five patients underwent either synchronous or metachronous bilateral adrenalectomies. There were 38 men and 57 women, aged 16 to 80 years. The most common adrenal diseases were adenomas, pheochromocytomas, Cushing’s syndrome, aldosteronoma, and malignant tumors (Table 1).

Technical aspects of Laparoscopic adrenalectomy

We prefer the transperitoneal lateral decubitus approach as being the best for maximal exposure of the gland. We start with three 10mm trocars, intro-

ducing a fourth 5mm one, if necessary, at a later stage.

Right adrenalectomy. The right triangular ligament and the retroperitoneal liver attachments are cauterized and divided. After dividing the retroperitoneum, the inferior vena cava (IVC) is identified. This phase is very important, especially in obese patients with Cushing’s syndrome, where the IVC is obscured by adipose tissue. The inferior periadrenal fat is carefully dissected from the upper pole of the right kidney and the renal vein is usually identified. The periadrenal fat is either grasped or pushed upwards. The adrenal vein is subsequently identified, dissected, double-clipped, and divided. The inferior and superior adrenal vessels are cauterized or clipped. Ultrasonic scissors are occasionally used.

Left adrenalectomy. The left colonic flexure is mobilized, if necessary, and the left upper renal pole is exposed. The splenic attachments are cauterized and divided, and the tail of the pancreas is identified. The spleen is further mobilized until the stomach is visualized. Gerota’s fascia is then opened, the adrenal gland identified and the adrenal vein dissected, double clipped, and divided. The renal vein is always identified prior to adrenal vein clipping. The upper adrenal vessels are either cauterized or clipped.

RESULTS

In 73 patients laparoscopic adrenalectomy was completed successfully. Fourteen patients with either large or malignant tumors underwent open adrenalectomy not preceded by laparoscopic approach (Table 2). There were also 2 open adrenalectomies for incidentalomas, performed during a pancreatectomy and a colectomy for cancer, not included in this series. Two patients with adrenocortical carcinoma underwent en-block resection of adrenal tumor with the spleen and distal pancreas and en-block nephrectomy with adrenalectomy, respectively. Both patients were subjected to open approach from the start (Table 2).

In 8 cases the laparoscopic procedure was converted to an open approach primarily for the pa-

Table 1. Indications for adrenalectomy (95 patients)

Adenoma	33
	(18 functional subclinical tumours)
Cushing’s syndrome	14
Cushing’s disease	4
Pheochromocytoma	16
Malignant pheochromocytoma	1
Recurrent malignant pheochromocytoma	1
Primary cortical adenocarcinoma	3
Metastatic carcinoma	2
Aldosteronoma	14
Myelolipoma	3
Angiolipoma	1
Adrenal cyst	2
Ganglioneuroma	1

Table 2. Patients subjected only to open adrenalectomy (14)

Malignant tumours	7
Malignant renal tumour	1
Large myelolipoma 27x20 cm	1
Large angioliipoma 18x20 cm	1
Post-traumatic cyst 15 cm	1
Pheochromocytoma 12 cm	1
Ectopic pheochromocytoma	1
Cushing's disease (recurrent pituitary adenoma)	1

tient's safety as well as better surgical efficacy. One of these patients with macronodular bilateral adrenal hyperplasia underwent successful right adrenalectomy but the left laparoscopic procedure was converted to open. In one patient with a right adrenal adenoma and Cushing's syndrome, with history of repeat surgery for benign biliary stricture, conversion was necessary because of multiple adhesions. In seven patients presenting difficulty in identification of structures, the procedure was also converted to open approach. Of these 8 patients, 5 had Cushing's syndrome and 3 pheochromocytoma. There have been no conversions during the last 5 years.

The size of the tumors in our series ranged from 3.2 to 27 cm. The largest, laparoscopically excised tumor was a ganglioneuroma with a diameter of 13 cm.

Operative time for laparoscopic adrenalectomies ranged from 65 to 180 minutes (median 110 minutes). The average postoperative hospital stay for laparoscopic adrenalectomy ranged from 1 to 2 days (mean 1.5 days), versus 5 to 20 days in patients who underwent open or converted procedure.

One patient with pheochromocytoma developed pulmonary embolism three hours after the procedure and succumbed in the intensive care unit one month later. The patient initially underwent laparoscopic approach for an 8 cm tumor and was converted to open due to difficulty in mobilization and minor but troublesome bleeding obscuring the operative field. In one patient with morbid obesity, Cushing's syndrome, and bilateral macronodular adrenal hyperplasia, the right laparoscopic adrena-

lectomy was uneventful but the left laparoscopic adrenalectomy was converted to open and was complicated by a low output pancreatic fistula, treated conservatively.

At a mean follow-up interval of 52 months post laparoscopic adrenalectomy (range 2-96 months), no evidence of benign tumor recurrence was observed.

One patient who had been treated for recurrent malignant pheochromocytoma developed local recurrence and extensive metastatic disease and died 18 months following his last operation. Patients with primary cortical adenocarcinoma survived for a period of 18 to 24 months. One patient with metastatic lung carcinoma survived 11 months. One patient with bilateral metachronous adrenal metastasis from colonic carcinoma, underwent bilateral adrenalectomy and is currently free of disease 4 years after the last adrenalectomy.

DISCUSSION

Laparoscopic adrenalectomy has rapidly replaced open adrenalectomy as the procedure of choice in benign adrenal tumors. Associated morbidities, such as morbid obesity, bleeding disorders or previous abdominal procedures, are considered as relative contraindications.³ In our series, three of four patients with previous upper abdominal surgery were successfully treated laparoscopically.

Procedures in obese patients with Cushing's syndrome associated with adrenal hyperplasia require experience in laparoscopic approach. Absence of the tactile sense and rigidity of the laparoscopic instruments may result in fragmentation of the gland and necessitate conversion to an open operation to avoid recurrence of the disease.⁴ Most of our conversions to open surgery, although early in our experience, are patients with Cushing's syndrome. Intraoperative ultrasonography is reported to be useful in locating the adrenal gland, especially in complex cases, during the surgeon's 'learning curve'.⁵

The size at which an incidentally detected adrenal tumor requires excision ranges from 2.5cm to 6cm in various institutions.⁶⁻⁸ Although principles in surgery should not change with the introduction of

a new technique, we witnessed a trend toward surgical referral earlier in the course of adrenal diseases.⁹ An increase in the number of laparoscopic adrenalectomies in the United States without concomitant increase in the incidence of adrenal cancer has recently been reported.¹⁰

Gagner and associates consider that non-functional tumors over 3 cm in young and fit patients should be resected.⁵ Others suggest that, in view of the safety and efficacy of laparoscopic approach, all tumors larger than 2.5 or 3 cm should be excised laparoscopically.⁸ We currently resect tumors either hormonally active or larger than 4cm, and even smaller if they appear suspicious for malignancy on computerized tomography. In an extensive literature search we found only one case of adrenal incidentaloma, benign in imaging, sized less than 4 cm, which proved to be malignant.¹¹ However, in young patients we advocate surgery for smaller tumors in view of a long-term follow-up and the concomitant patient's anxiety.

From a technical standpoint, large adrenal masses are difficult to dissect laparoscopically. In our series the largest tumor resected laparoscopically was a 13 cm ganglioneuroma, which was our sixty-fifth laparoscopic adrenalectomy. The patient was a young woman with a large, benign on CT tumor, discharged on the second postoperative day. Several authors limit the laparoscopic adrenalectomy to lesions less than 6 cm in size,¹² whereas others perform laparoscopic adrenalectomy on tumors up to 13 cm in diameter, with no morbidity.^{5,13} Extensive experience in advanced laparoscopic techniques and in open adrenal surgery are mandatory to manipulate and excise large tumors with a laparoscopic approach.

At present, laparoscopic adrenalectomy for invasive malignant tumors is contraindicated.¹⁴ En-bloc extensive resections as nephrectomy, hepatectomy and splenectomy are not well suited to the laparoscopic technique.¹⁵ Several cases of laparoscopic adrenalectomy for malignant tumors, followed by local recurrence and disseminated abdominal carcinomatosis within a few months, have been published.¹⁶ On the other hand, series of laparoscopic adrenalectomies for metastatic adrenal tumors,

followed for 0.5 to 19 months without recurrence, have been reported.¹⁷

Although most institutions perform open procedures for adrenal cancer, the number of laparoscopic adrenalectomies carried out for malignant tumors is a notable phenomenon of the last few years.¹⁸ However, the series are not large, the results are conflicting, and there are no prospective trials. At present, laparoscopic adrenalectomy is an acceptable approach for metachronous solitary metastasis of a variety of primary tumors.¹⁹

Early ligation of the central adrenal vein to facilitate pharmacologic control in pheochromocytoma has been emphasized in reports and textbooks. One of our patients with an 8 cm pheochromocytoma developed hypertension during laparoscopic adrenalectomy, successfully treated with hydralazine.²⁰ An extensive search of the literature showed that hemodynamic instability during surgery has been successfully treated.²¹ Other investigators suggest that laparoscopic approach to pheochromocytoma decreases the intraoperative release of catecholamines compared to open technique, therefore minimizing the risk of hypertensive crisis.²²

Laparoscopic adrenalectomy is currently the gold standard for all benign adrenal diseases. Our series confirms that laparoscopic adrenalectomy is a safe and effective procedure associated with low morbidity, short hospital stay, and recovery. However, the procedure necessitates experience in open adrenal surgery, advanced laparoscopic techniques, and familiarization with new technologies. Careful preoperative planning and support from the endocrinology team minimize the occurrence of intraoperative or postoperative complications.

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