Laparoscopic adrenalectomy: the best surgical option

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Abstract

Introduction: The laparoscopic approach has become the gold standard for surgical treatment of the adrenal gland. Nevertheless, controversy remains for the laparoscopic treatment of adrenal carcinoma.

Methods: From April 2005 to April 2012, 37 laparoscopic adrenalectomies were performed. We describe and retrospectively analyze age, gender, side involved, surgical indication, tumor size, length of hospital stay, complications and conversion rate.

Results: Thirty seven patients (19 male and 18 female) aged 51.72 ± 14.42 years were operated on between 2005 and 2012. Twenty-two left-sided lesions (59.45%) and 15 right-sided lesions (40.54%) were involved. Surgical indications were nonfunctioning adenoma >4 cm or rapid growth and hormone-secreting tumors. The diagnosis was confirmed in all cases using computed tomography and/or magnetic resonance imaging and metaiodobenzylguanidine scan if pheochromocytoma was suspected. In all cases, comprehensive pre-operative hormonal study was done.

Conclusions: Laparoscopic adrenalectomy is a safe procedure and the “gold standard” technique for adrenal surgery. Our experience is highly satisfactory with comparable results using the reference standard open approach.

Key words: Laparoscopy, Adrenalectomy, Adrenal tumor.

Introduction

In 1992, Gagner and collaborators described their experience with laparoscopic transperitoneal adrenalectomy in three patients with benign adrenal tumors. Since that time, multiple publications have shown the feasibility and safety of this treatment option. At the end of the 1990s, laparoscopic adrenalectomy became the surgical reference pattern in the treatment of most benign adrenal masses mainly due to its efficacy and the general advantages of minimally invasive surgery. Different authors have described the superiority of the laparoscopic route as compared to open surgery in cases of functionally benign or incidentaloma lesions. Currently, this is a routine technique in numerous hospital centers.

The laparoscopic approach of the adrenal gland is currently considered to be the treatment of choice for adenomas, incidentalomas >4 cm and metastasis at this level, with the exception of the still controversial adrenal carcinoma in which the open approach appears to be most indicated. Advantages of this approach are minimal incision, decrease in postoperative pain and reduction in length of hospital stay, as well as allowing for better control and access to the vascular pedicles. We present a review of our experience in laparoscopic adrenalectomy via the lateral transperitoneal approach carried out from 2005–2012.

Methods

A descriptive, retrospective study was carried out by a review of clinical histories of 37 patients with a discharge diagnosis from the hospital or with adrenal tumor with laparoscopic intervention and histological confirmation and who were treated at the Hospital General Universitario Reina Sofia, Murcia, Spain between April 2, 2005 and April 23, 2012. Patient selection was done from the database of the Documentation Department, selecting those patients whose code was adrenalectomy (07.22) according to the Internal Classification of Procedures (Vol. 3 of the ICD-9-MC). The
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study protocol was approved by the Research Committee of the institution.

The following data were retrospectively analyzed: age, gender, side to be intervened, surgical indication, anatomopathological results, size of the lesion, hospital stay, rate of conversion and perioperative complications.

With regard to the surgical technique, the approach was lateral transperitoneal with the patient in the right or left lateral decubitus position with respect to the side to be intervened, together with pneumatic balloon below the waist to maximize the area between the iliac crest and the costal margin. Pneumoperitoneum was done with a Veress needle at 15 mmHg inserted in the midclavicular line below the costal margin, although we frequently gained access to the peritoneal cavity with an 11-mm trocar under direct vision used for introduction of the scope. Two additional trocars were immediately placed: one 11 mm and another 5 mm. If deemed necessary, a fourth 5-mm trocar was placed (especially for right adrenalectomies for the introduction of the hepatic divider at the epigastric level). The scope utilized was 0° and in all cases a bag was used for extraction of the surgical specimen, surgically widening the 11-mm trocar as necessary in order to obtain the specimen without fragmentation. We generally left a drain in the surgical bed, which was removed with drainage <50 cm³.

Right Adrenalectomy

We usually placed a fourth 5-mm trocar after start of the pneumoperitoneum in the epigastrium to elevate the right lobe of the liver, which allows for exposure of the anterior face of the right kidney and lateral border of the inferior vena cava. We began the dissection by making an opening in the peritoneum at the medial border of the inferior vena cava, mobilizing the liver in a retrograde manner. Once the medial border of the vena cava was exposed, the main adrenal vein was identified and then divided between clips. Dissection was continued until dissection of the gland was complete, where the accessory veins were identified and clipped.

Left Adrenalectomy

The dissection began establishing a plane between the anterior face of the left kidney, lateral and dorsal to the spleen and the tail of the pancreas. The splenocolic ligament was freed and the spleen was mobilized laterally. The splenic angle was also freed in order for the superior pole of the kidney and adrenal gland to be exposed. This plane is highly avascular, which allows for a safe dissection. We then localized and clipped the left adrenal vein, dissecting the inferior and medial border of the adrenal gland to continue the medial dissection to the superior and lateral margin.

Results

Between 2005 and 2012, there were 37 patients surgically intervened (19 males and 18 females) with a mean age of 51.72 ± 14.42 years. There were 22 left adrenalectomies (59.45%) and 15 right adrenalectomies (40.54%).

Pheochromocytoma was the predominant indication in our series with 35.13% of the cases (13 patients). The largest lesion measured 5.5 cm. All patients had α-blocker drugs preoperatively administered in a controlled manner by the Endocrinology Service with acceptable hemodynamic control during the immediate postoperative period.

Of the total number of patients intervened in our series 32.43% of the cases (12 patients) were incidentalomas. The largest lesion intervened with this diagnosis was 7.5 cm.

In our case series, Cushing syndrome comprised 10.81% (four patients); the largest size lesion was 6.5 cm. Subclinical Cushing syndrome represents 8.10% (three patients). To avoid acute adrenal insufficiency, patients were administered 100 mg of hydrocortisone IV every 12 h during the intervention and in the immediate postoperative period, which was progressively decreased until an oral maintenance dose was reached. In 8.10% of the cases (three patients), surgical indication was primary hyperaldosterism. Prior to the surgery, blood pressure and hypopotassemia were controlled with low-dose spironolactone together with nifedipine. The largest size lesion excised was 1.5 cm.

Anatomopathological Results

Anatomopathological analysis demonstrated that 59.45% of the adenomas had a mean size of 3.45 ± 1.64 cm, followed by medullary hyperplasia (13.51%), pheochromocytoma (8.10%), myelolipoma (8.10%), cortical and mixed hyperplasia, and hamartoma.

Mean Hospital Stay, Percentage of Conversion and Complications

The mean hospital stay was 5.45 ± 3.3 days with conversion rate to open surgery of 8.10% (three cases). Reasons for the conversions were adhesions due to prior abdominal surgery, unable to perform a pneumoperitoneum, and giant left renal cyst, making laparoscopic manipulation of the adrenal gland difficult.

There was no mortality in the immediate postoperative period. Of the total patients, three (8.10%) had postopera-
tive complications that prolonged the hospital stay due to poor blood pressure control, evisceration that required re-intervention, and another case of blood through the drain, which was treated conservatively with blood transfusions with good evolution.

Discussion

Indications for adrenalectomy were incidentaloma >4 cm or with rapid growth and hormone-producing tumors (pheochromocytoma, aldosteronoma, Cushing syndrome). In all cases, diagnosis was confirmed with computed tomography, magnetic resonance or both and with metaiodobenzylguanidine scan in cases where pheochromocytoma was suspected. Complete hormonal study was done in all patients.

Pheochromocytoma

Pheochromocytomas are tumors derived from chromaffin cells of the adrenal medulla. Tumors located outside the adrenal gland are called paragangliomas (10%). Normally, they are present in a sporadic manner and the involvement is adrenal and unilateral. Familial cases make up 25% of the total and may be part of the MEN 2a syndrome (medullary thyroid carcinoma, pheochromocytoma and hyperparathyroidism) or MEN 2b (medullary thyroid carcinoma, pheochromocytoma and neuromas).

In our case series, there are no cases of families described; all cases were unilateral. The symptoms derived from the excessive production of catecholamines are arterial hypertension, which is found in 90% of the cases and can provoke a paroxysmal crisis in up to 20-50% of patients, headache, sweating, arrhythmias and myocardial disease, etc. The diagnosis of malignant pheochromocytoma is established by the invasion of neighboring structures, local recurrence and metastasis. At present there are no definitive cytological criteria for malignancy. Large-size pheochromocytomas are frequently partially cystic and, therefore, fragile. Therefore, we believe that in cases where dissection is difficult, surgeon experience should determine conversion to open surgery to ensure safe excision.

Incidentaloma

Incidentalomas are silent adrenal tumors that are incidentally discovered in imaging studies. The majority of incidentalomas are benign non-secretory tumors, although 3-5% correspond to adrenal carcinomas. The prevalence of malignancy increases with the diameter of the lesion.

After confirmation on imaging tests of an adrenal tumor, laboratory studies should be carried out that include metanephrines and catecholamines in a 24-h urine sample, plasma ionogram (included in the aldosterone and renin studies in patients with arterial hypertension associated with hypocalcemia) and free urinary cortisol.

Accurate evaluation of the patient’s clinical history is important, with special attention to symptoms such as arterial hypertension, obesity, virilization, or history such as cancer in other locations to rule out the possibility of metastasis at this level.

Surgery is indicated in incidentalomas of 4 cm or greater, those that present growth throughout the follow-up period, producers of hormones or those where malignancy is suspected, independent of the size.

Cushing Syndrome

Cortisol hypersecretion in the adrenal gland causes Cushing Syndrome, which is clinically manifested as truncal obesity, arterial hypertension and diabetes. Also important are asthenia, weakness and muscular atrophy. Glucocorticoid excess may be due to hyperproduction of pituitary adrenocorticotropic due to adenoma or microadenoma at this level and represents 70% of cases, or may be due to ectopic production of corticotropin in 10% of patients (pulmonary cancer, pancreatic tumors, small cell lung carcinoma, and medullary thyroid carcinoma). Cushing syndrome is of adrenal origin or may be adrenocorticotropic-independent, representing 10% of the cases of adenoma at this level, 10% correspond to carcinomas and exceptionally to primary bilateral adrenal hyperplasia.

When there is suspicion of hypercortisolism, plasma determination of free urinary cortisol should be done or the suppression test with 1 mg dexamethasone at 23 h and determine morning plasma cortisol level. If the urinary cortisol level is normal and the suppression test also is normal, Cushing syndrome can be excluded. To determine the dependence or independence of adrenocorticotropic, plasma determinations of baseline adrenocorticotropic should be made after the administration of 8 mg of dexamethasone/day for 2 days.

In cases where adrenocorticotropic is low or undetectable, together with the lack of cortisol suppression, the origin will be adrenal. Elevated levels of adrenocorticotropic together with non-suppressed cortisol are indicative of ectopic secretion of adrenocorticotropic and normal or high values of adrenocorticotropic with suppressed cortisol point to a pituitary origin (Figure 1). A particular clinical scenario is the subclinical Cushing syndrome or pre-Cushing, which applies to clinically nonfunctional adrenal adenomas but
with secretion of autonomous cortisol, although insufficient to produce symptoms. The prevalence is between 5 and 20% and, in general, the greater the number of biochemical alterations at the time of diagnosis, the greater the probability of increase in size of the adenoma or of developing bilateral adenoma.  

The most frequently described hormonal alterations (up to 28%) are decrease in the concentrations of dehydroepiandrosterone and adrenocorticotropin. Loss of the circadian rhythm with elevation of nocturnal cortisol is also a frequent finding and considered the first marker of the clinical picture with baseline cortisol figures within normal limits. Adrenocorticotropin also tends to be low or undetectable (Figure 2).  

With respect to imaging tests, iodine-cholesterol scan shows unilateral uptake. Some authors defend that this uptake represents an early sign of functional anatomy; however, it should be used in a systematic manner. On positive emission tomography (PET) there is increase in the fluoro-deoxyglucose uptake compared to those nonfunctioning, which would indicate increase in the metabolic and hormonal activity. Despite there not being a consensus with regard to a diagnostic algorithm for this disease, the majority of authors agree that modifications in two of the tests should be demonstrated to establish the diagnosis.  

Although mild hypercortisolism is not sufficient to cause a phenotypic alteration of Cushing syndrome, there is evidence that it is sufficient to induce insulin resistance with greater frequency of cardiovascular risk factors and metabolic syndrome. For this reason, the primary therapeutic option is adrenalectomy. This seems to improve the clinical and biochemical parameters of cardiovascular risk, although for now the long-term complications are unknown and there are no guidelines for follow-up of patients who are not intervened. In our experience we believe that these patients are optimal for surgical treatment. After adrenalectomy, improvements in laboratory and clinical parameters have been seen, which do not indicate that a co-morbid condition has been added to the patient.  

*Primary Hyperaldosteronism*  

Primary hyperaldosteronism is characterized by hyperproduction of adrenal aldosterone and suppression of serum renin. Different disease are considered within the concept of primary hyperaldosteronism, which comprise adrenal adenoma (25%) whose size varies between 1.5 and 2 cm and hyperplasia (75%), which encompasses idiopathic hyperplasia (in which surgery is contraindicated), primary adrenal hyperplasia, and unilateral adrenal hyperplasia (Figure 3).  

From the clinical point of view it is typical to find elevated blood pressure together with hypokalemia, which increases cardiovascular risk, independent of the blood pressure numbers.
For diagnosis, it is necessary to determine serum and urine levels of potassium and concentrations of aldosterone and renin, discontinuing hypotensive drugs that may modify their secretion. Aldosterone-renin index should also be determined; hyperaldosteronism is suggested when it is >30. Postural test and captopril test allow for differentiation of the adenoma from hyperplasia because the former demonstrates functional autonomy and hyperplasia is dependent on the renin–angiotensin system. With respect to MR imaging tests, the results are similar to a CT.5

Adrenal Carcinoma

Adrenal carcinoma affects one or two patients per million annually. Two-thirds of the patients experience symptoms at the time of diagnosis due to hormonal secretion (cortisol 30%, androgens 20%, estrogens 10% and less frequently aldosterone 2%), abdominal tumor or pain caused by large tumor or local invasion.5 Although in our case series we do not have data of patients intervened laparoscopically, we believe it timely to highlight the importance of performing a safe resection, taking care not to rupture the capsule, which may result in tumor dissemination. Until now, the general consensus regarding this disease defends the intervention with open surgery, although recent publications support the laparoscopic option because results are similar with regard to local recurrence and distance metastasis.5,10

In the multi-institutional series published by Bergamini et al.,11 there were 833 patients described who had adrenalectomies performed and were studied for a period of 10 years with postoperative complication rates (surgical and medical) between 8.5% and 6 ± 4 days of hospital stay, which confirms that the technique is ideal if and when it is performed in specialized centers and with surgeons experienced in laparoscopic surgery.

Laparoscopic adrenalectomy continues to be the technique of choice in the approach of the adrenal gland because it is safe and effective as confirmed in our series with results similar to those presented in the rest of the literature.11

References