

Laparoscopic Adrenalectomy – Analysis of 40 Cases of a Surgical Residency Service

Adrenalectomia Laparoscópica: Análise de 40 Casos de um Centro de Residência em Cirurgia

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ABSTRACT

Introduction: Laparoscopic adrenalectomy in the past decade has become the method of choice for surgical approach to adrenal diseases. We analyzed a six year experience and the outcomes of 40 cases of laparoscopic adrenalectomy. **Objectives:** To analyze the safety, morbidity, and outcomes of 40 consecutive cases treated with transperitoneal laparoscopic adrenalectomy. **Patients and Methods:** We retrospectively analyzed 40 cases of laparoscopic adrenalectomy performed from January 2005 to October 2010, evaluating epidemiological factors, pathology findings, postoperative complications, and length of hospital stay. **Results:** The adrenalectomy was unilateral in all cases; 18 (45%) were right-sided; 22 (55%) were left-sided. 13 (32.5%) of the patients were men and 27 (67.5%) women. Anatomic pathology diagnoses were as follows: adenoma – 15, Cushing's syndrome – 3, pheochromocytoma - 4, Conn's Syndrome (aldosteronoma) – 3, metastatic lesions – 7 (Primary Tumors: lung-3, colon-1, prostate-2, breast-1), and others (angiomiolipoma -1, oncocitoma -1, Masson's tumor - 1, cyst - 2, aspergiloma - 1). The mean hospital stay was 2.1 ± 1.6 days and the mean operating time was 76 minutes. There was no conversion to conventional (open) surgery. **CONCLUSION:** The results of laparoscopic adrenalectomy were similar to those reported elsewhere and corroborate the safety and efficacy of the method resulting in an acceptable surgical time, faster postoperative recovery, and shorter hospital stay.

Key words: Adrenal tumor, laparoscopic adrenalectomy, complications, laparoscopy.

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1. INTRODUCTION

Laparoscopic adrenalectomy was first described by Gagner et al¹ in 1992 and quickly gained prominence as a safe and effective surgical therapeutic modality for the treatment of adrenal lesions. It is now considered the standard of care for most adrenal masses. Among the method's principal advantages are a shorter hospital stay, reduced intraoperative blood loss, and the less postoperative pain.²

The incidence of adrenal tumors varies from 1 to 7%, increasing with age.³ Nowadays, the detection of most of these adrenal lesions occurs because of the widespread use of diagnostic methods ordered for other reasons. With early diagnosis, the disease course

of functional adrenal tumors can be changed, permitting even cure in cases of early-stage adrenocortical carcinomas.^{3,16}

2. PATIENTS AND METHODS

We conducted a retrospective analysis of the laparoscopic adrenalectomy cases performed by the General and Oncological Surgery Residency Service of the Santa Rita Hospital, in Maringá, Paraná between January 2005 and October 2010, with a mean follow-up 28 months.

The preoperative diagnosis of the lesion in the adrenal gland was made after an initial clinical suspicion or an incidental finding on ultrasound, and

was subsequently confirmed by computed tomography (CT), magnetic resonance imaging (MRI) when necessary, and biochemical assays (measurement of serum and urinary catecholamine levels, serum cortisol, renin and aldosterone). In two cases in which an aldosteronoma was resected, diagnosis was established by measuring renin and aldosterone collected by catheterization of adrenal veins. Laparoscopic surgery was contraindicated in patients who presented with lesions larger than 12 cm or that had malignant characteristics (rapid growth, calcification, and heterogeneity), signs of invasion of adjacent tissues, or vascular invasion.

The average age was 49.5 ± 16.1 years, with an average body mass index of 28.9 ± 4.7 kg/m². Among patients who underwent adrenalectomy, 13 were men (32.5%) and 27 (67.5%) were women; 15% had previous abdominal surgery. All surgeries were unilateral, with 18 on the right (45%) and 22 (55%) left-sided.

The preoperative evaluation was carried out in conjunction with the endocrinology and cardiology group of the service; in all cases the functionality of the lesion was evaluated. In two cases of right-sided lesions in which there was a suspicion of emboli in the vena cava, magnetic resonance angiography was ordered. Both cases were negative for invasion or the presence of vascular emboli.

Preparation of patients

The clinical preparation of functional lesions took from three to eight weeks during which with time blood pressure and metabolic disorders were monitored. In cases suspicious for pheochromocytoma, the alpha-blocker prazosin is used, and the patient is hospitalized three days before the procedure for clinical management.

In the other cases, the patient was admitted on the eve of the procedure and asked to fast for eight hours. No bowel prep was performed. The patient was shaved in the operating room. Antibiotic prophylaxis was a single dose of a first generation cephalosporin (Cefazolin). The surgical procedure was performed under general anesthesia with endotracheal intubation and passage of an orogastric tube.

Surgical technique

Once anesthetized, patients were placed in 90° lateral decubitus without the use of pads, stabilized

in order to avoid injury to the neuromuscular bundles, with the return plate attached to the inferior leg.

The transperitoneal approach was chosen for all cases. Once patients were positioned, access was obtained using Hasson's (open) technique with the placement a 10mm trocar with camera in the subcostal position in hemi-clavicular line. Pneumoperitoneum was established by insufflation of carbon dioxide (CO₂) at a pressure of 12-14 mmHg.

Three additional five or 10 mm ports were then placed along the line of the rib cage (middle and posterior axillary line). A fourth port can be added, particularly in cases of right-sided adrenalectomies in order to displace the liver for proper exposure of the adrenal and inferior vena cava. After inspection of the cavity and adhesiolysis one proceeds with the mobilization of colic flexures as necessary.

On the right side after adequate exposure of the liver and release of ligaments, we chose the direct approach to the right edge of the vena cava with early identification and initial ligation with clips of the adrenal vein and accessory adrenal vein if present, followed by ligation of the middle adrenal artery.

Continuing with the detachment of the inferior portion of the adrenal gland separating Gerota's fascia from the upper pole of the kidney, ligating the inferior adrenal artery, and finally approaching the upper portion of the gland with ligation of the superior adrenal artery.

On the left side we begin with release of the freno-lienal ligament up to the diaphragmatic crus with dissection of the posterior aspect of the spleen and tail of the pancreas. Exposure of the spleen and pancreas medially exposes the renal vein and the main adrenal vein which is ligated between clips, followed by ligation of the branch of inferior phrenic vein. We opt for the initial ligation of the middle adrenal artery which is a direct branch of the aorta, followed by the superior adrenal artery (a branch of inferior phrenic). Finally with easier access to the pedicle, we performed the ligation of the inferior phrenic artery.

After complete release of the adhesions the surgical specimen is placed inside the extractor bag endoscopically, and then is removed after widening of one of the 10/12 mm ports. We close the muscle aponeurosis of the 10/12 mm trocars without a drain and the skin is closed with intra-dermal sutures.

All patients were evaluated every four months during the first three years and then semi-annually in the 4th and 5th years.

3. RESULTS

The forty adrenalectomies were unilateral. The histopathologic diagnoses of the lesions are presented in table 1. Most lesions were composed of adenomas (37.5%) and other benign lesions such as angiomyolipoma, oncocytoma, cyst and aspergilloma. Functional lesions were found in 25% of the cases. The principal metastatic lesions were prostate, lung, colon, and breast.

The mean length-of-stay and surgical time were 2.1 ± 1.6 days, and 76 minutes, respectively. Lesion ranged in size from 2.8 to 12 cm; the average size was 7.2 cm.

Intraoperative and postoperative complications included three cases requiring blood transfusion, including one due to a lesion of the splenic hilum; two cases of pneumonia and one wound infection; one case of pulmonary thromboembolism from deep vein thrombosis; and one case of a transient difficulty in dorsiflexion of the foot from compression of the right posterior tibial nerve (with recuperation in 5 months).

None of the cases that required transfusion needed to be converted to open surgery. There were no deaths from the procedure. Over the course of follow-up averaging 28 months, several patients with lung or breast metastases to the adrenal died from complications of their primary tumors, and one patient with hyperaldosteronism died of an acute myocardial infarction.

Table 1 - Histopathologic diagnosis of the adrenal lesion.

Diagnoses	Cases
Adenoma	15
Adenoma (Cushing's Syndrome)	3
Pheochromocytoma	4
Aldosteronoma (Conn's Syndrome)	3
Angiomyolipoma	1
Oncocytoma	1
Masson's Tumor	1
Cyst	2
Aspergilloma	1
Ganglioneuroma	2
Metastatic*	7
Total	40

*Primary Tumors: Lung: 3, Colon: 1, Prostate: 2, Breast: 1

4. DISCUSSION

Since 1992, laparoscopic adrenalectomy (LA) has established itself as a safe and effective method for treatment of various lesions of the adrenal gland.⁴ In 1996, just four years after the report of the first surgery, LA began to become the procedure of choice for the treatment of patients with small and benign adrenal lesions, due to its safety and efficacy, duplicating the outcomes of the conventional procedure. The training of surgical residents can be conducted in smaller centers, and when well run the results are similar to those of large series.

Adrenal tumors are classically divided into functional and nonfunctional, and benign or malignant. Most lesions are encountered/discovered as non-functional incidentalomas,^{5,6} an experience replicated in our study. In a recent meta-analysis⁶ 1800 cases of incidentalomas found from 1980 to 2008 were reviewed. Benign nonfunctional tumors accounted for 89.7% of the cases; in our series, however, the rates was lower (58%). Functional lesions such as subclinical Cushing's syndrome, pheochromocytoma and primary aldosteronism together represented about 10% of the cases. In our series about 25% of the lesions were functional, likely a consequence that our service receives referral from endocrinologists and cardiologists from various cities.

Only 2.6% of the lesions were malignant tumors: adrenocortical carcinoma 1.9% and metastasis 0.7%.^{5,6} From the original series cases of carcinoma were excluded by preoperative imaging studies, thus 17.5% of our cases involved metastases to the adrenal referred by our oncology service.

The incidence of adrenocortical carcinoma (ACC) is approximately 1 case per 1,000,000 population with a bimodal age distribution with peaks at 5 and 50 years.^{6,7} The clinical presentation of ACC was associated with Cushing's Syndrome in 45% of cases, and lower percentages of cases of virilization, feminization, or hyperaldosteronism.⁸

Although there is no consensus among the various authors, surgery for adrenal gland tumors is broadly accepted for the following indications: unilateral mass with documented pheochromocytoma and hyperaldosteronism, selected cases of subclinical Cushing's Syndrome, and adrenal masses with a suspicious appearance on imaging and/or a diameter exceeding 4 cm.^{9,13,14}

With surgical conversion rates as low as 5%, low morbidity, earlier discharges and thus shorter hospitalizations, less postoperative pain, and better cosmetic results all contributed to the growing preference of the laparoscopic method.^{9,10} Characteristics suggestive of malignancy found intraoperatively, adhesions, bleeding, and lesion size are the main reasons for conversion.

In our study there was no conversion, but the cases of longer operative time and splenic hilum injury occurred in patients with a BMI > 40. The single case of nerve damage occurred after loss of fixation of the patient during the table changes during surgery, which was only noted at the end of the procedure.

Among the intraoperative complications of the technique, the most common are vascular injuries, principally of the vena cava near the liver and of the left adrenal vein (0.7% to 5.4%), and intestinal, spleen, and pancreas injuries (1.3%).^{9,10} All these complications can add significant morbidity to the procedure when not recognized quickly.¹¹ Various several serious and potentially fatal complications related to laparoscopic adrenalectomy have been reported, including: transection of the porta hepatis, ligature of the ureter, and loss of renal function secondary to ligature of the renal artery, which occurs more frequently in malignant lesions or in institutions beginning their experience. Prevention of such complications requires good knowledge of local anatomy, which includes a thorough preoperative investigation (which can include vascular studies of the adrenal gland) and which can determine a trans- or retroperitoneal approach; careful placement of the trocars under direct visualization and caution when manipulating the instruments outside the visual field of the surgeon.¹² Most injuries occur from the puncture with the Veres needle and from the placement of the first trocar, so we always chose the open technique with the first puncture.

The literature defines as determinants and limiting factors for the use of the LA method the size of the tumor and characteristics suggestive of malignancy. Parnaby et al¹³ evaluated the role of laparoscopic surgery for tumors 6 cm or larger and came to the conclusion that as long as there was no local invasion, the results in terms of duration of anesthesia, postoperative complications, length of stay, and recurrence rates site were comparable to those obtained from surgical patients with tumors smaller than 6 cm. Currently, the contraindications to LA

include the detection of invasion of peritumoral tissues in preoperative examinations and lesions with diameter exceeding 12 cm.¹⁴ In our study we managed to extract a 12 cm ganglioneuroma, without complications, which after being bagged was extracted by a small Pfannenstiel incision.

Assessing malignant tumors, Miller published a retrospective analysis comparing laparoscopic and conventional techniques in the treatment of adrenocortical carcinoma. In this study, the average size of the lesions was 7.0 cm versus 12.3 cm (LA vs. Open) with recurrence occurring in 63% of the cases in the laparoscopic group and 65% of open group. The big difference was in the percentage with positive margins: 50% among those who underwent laparoscopic adrenalectomy (LA) and 18% for those who underwent open adrenalectomy. They concluded that considering that the only effective treatment recommended for adrenocortical carcinoma is surgical resection with free margins, LA should not be considered as initial treatment.

In all cases where an adrenocortical carcinoma was suspected our service opted for conventional surgery using the extended subcostal approach. There was one death in the immediate postoperative period due to release of a thrombus from the adrenal vein.

On the other hand, an Italian group evaluating LA for adrenocortical carcinomas found equivalence between the laparoscopic and conventional surgery for the disease in stages I and II when comparing recurrence rates, disease-free survival, and overall survival.¹⁶

Today, comparable results also have been obtained for laparoscopic resection of isolated adrenal metastases when evaluating by criteria such as margin involvement, local recurrence, disease-free interval, and mean five year survival.¹⁷

As part of the workup, computed tomography (CT) and magnetic resonance imaging (MRI) have great value in the differential diagnosis of these lesions, with CT the imaging study of choice for initial evaluation of adrenal masses. The evaluation of the enhancement of the images calculated in Hounsfield units during the CT scan allows one to distinguish benign from malignant lesions accurately. Among the invasive methods, fine needle aspiration (FNA) has low sensitivity for the detection of adrenocortical carcinoma, while somewhat better accuracy in the assessment of metastases to the adrenal gland.^{18,19} Thus, due to its low sensitivity and the risk of seeding

tumor in the puncture path FNA is a little-used procedure in the diagnostic evaluation of adrenal masses.

Although well defined, in some situations, biochemical or radiological clinical tests do not always permit the preoperative identification of a malignant adrenal lesion requiring a conventional (open) surgical treatment.

With regard to the nature of the lesion to be addressed (benign, malignant, functional or nonfunctional) recent studies inform recommendations/guidelines for the various indications for LA. Thus, in spinal cord injuries and in cases of pheochromocytomas, in order to avoid the conversion, it is important to prepare the patient with alpha and beta blockers. In this way the conversion rate approaches rates of other functional

lesions, thus avoiding an increased in the morbidity and mortality.²⁰

5. CONCLUSIONS

Adrenalectomy is indicated for lesions exceeding 5 cm, lesions that are rapidly growing, when there is a suspicion of metastasis from other organs, and when the lesion is functional regardless of its size. In our series, laparoscopy was demonstrated as an effective method, with morbidity and mortality comparable to those of large series. Adrenocortical carcinomas in early stages with lesions less than 12 cm in diameter without signs of malignancy on CT appear to have outcomes equivalent to those obtained with conventional surgery. Thus, common sense should always guide the surgeon facing an adrenal lesion.

RESUMO

Introdução: A adrenalectomia videolaparoscópica desde o início da década de noventa vem sendo consagrada como método de escolha para abordagem cirúrgica das doenças da adrenal. Analisamos a experiência de seis anos e 40 casos. **Objetivos:** Analisar a segurança, a morbidade e os resultados de 40 pacientes submetidos à adrenalectomia videolaparoscópica. **Pacientes e métodos:** Análise retrospectiva de 40 casos de adrenalectomia transperitoneal laparoscópica realizados entre janeiro de 2005 a outubro de 2010, avaliando-se fatores epidemiológicos, achado anatomopatológico, complicações pós-operatórias e tempo de internamento. **Resultados:** Em todos os pacientes a cirurgia foi unilateral, sendo 18 à direita (45%) e 22 à esquerda (50%). Entre os 40 casos operados, 13 foram em homens e 27 em mulheres. Foram encontrados os seguintes diagnósticos anátomopatológicos: adenoma – 15 casos, síndrome de Cushing – 3, feocromocitoma – 4, aldosteronoma – 3, metastáticos – 7 (pulmão-3, cólon -1, próstata-2, mama-1), ganglioneuroma – 2, e outras lesões benignas (angiomiolipoma- 1, oncocitoma- 1, tumor de Masson- 1, cisto -2, aspergiloma- 1). O tempo médio de internação foi de $2,3 \pm 1,9$ dias, o tempo médio de cirurgia foi de 76 minutos. Não houve casos de conversão para cirurgia aberta (convencional). **Conclusão:** Os resultados apresentados são similares aos relatados pela literatura, demonstrando que a adrenalectomia videolaparoscópica pode ser realizada de maneira segura e eficiente com benefícios como tempo cirúrgico aceitável e alta precoce.

Descritores: Tumor adrenal, adrenalectomia videolaparoscópica, complicações, laparoscopia.

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