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Original article

Laparoscopic adrenalectomy: Presentation of 43 cases☆

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A B S T R A C T

Introduction: The aim of the study was to present and analyse our experience in laparoscopic adrenalectomy (LA).
Materials and methods: Descriptive and retrospective study including LA performed over 8 years, between 2000 and 2008 in our hospital.
Results: A total of 43 LA were performed in 41 patients using a transperitoneal lateral approach. Indications for adrenalectomy included hyperaldosteronism (19), non-functioning adenoma (8), pheochromocytoma (6), Cushing's syndrome (6), metastasis (3) and adrenal primary tumour (1). Median postoperative hospital stay was 3 days and the median size of the masses was 30 mm (range: 4-155 mm) Complications occurred in 3 patients (2 respiratory infections, and 1 intraoperative bleeding). There was no mortality. Only one case needed conversion to open adrenalectomy; no patients required reintervention.
Conclusion: Laparoscopic adrenalectomy is a safe and effective method in the treatment of adrenal masses and it can be performed with minimal risk and morbidity

Adrenalectomía laparoscópica: presentación de 43 casos

Palabras clave:
Adrenalectomía laparoscópica
Cirugía endocrina
Cirugía laparoscópica
Tumores suprarrenales

R E S U M E N

Introducción: El propósito del estudio es exponer y analizar nuestra experiencia en adrenalectomía laparoscópica (AL).
Material y métodos: Estudio descriptivo y retrospectivo sobre AL realizada en nuestro centro desde enero de 2000 hasta diciembre de 2008.
Resultados: Se realizaron un total de 43 AL a 41 pacientes mediante abordaje transperitoneal lateral. La mediana de edad de los pacientes intervenidos se situó en 53 años. La principal indicación en frecuencia de nuestra serie fue el hiperaldosteronismo (19), seguido de incidentalomas (8), feocromocitomas (6), síndrome de Cushing (6), lesiones metastásicas (3)

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y carcinoma suprarrenal primario (1). La media de estancia hospitalaria poscirugía fue de 3 días y la media del tamaño de las masas fue de 30 mm (rango: 4-155 mm). No hubo mortalidad en nuestra serie. La necesidad de conversión se redujo a un caso; en ningún caso fue necesario reintervenir a un paciente.

Conclusiones: La AL es una técnica segura y eficaz en el tratamiento de tumores suprarrenales que puede realizarse con riesgo y morbilidad mínima.

Introduction

Since Gagner[1] performed the first laparoscopic adrenalectomy (LA) in 1992, this technique has progressively consolidated its position in the field of endocrine surgery in parallel with other techniques in different fields of the speciality, such as splenectomy or laparoscopic colectomy surgery.

Nowadays, laparoscopy is considered the surgical treatment of choice for most benign adrenal tumours. Although very few comparative prospective randomized studies have been published, several retrospective studies and case series have shown the benefits of minimally invasive surgery compared with the open approach. The former benefits both the patients (shorter hospital stay, greater postoperative comfort and better pain control) and the surgeons (better view of the operating field and greater accessibility to it).[2,3]

In recent years, as more experience has been gained, indications for laparoscopic surgery of the adrenal gland have increased. However, the treatment of large and potentially malignant lesions[3] still raises controversy.

Another point of interest is the access route employed, mainly due to the introduction of new techniques such as Natural Orifice Transluminal Endoscopic Surgery (NOTES) or robotic surgery.[4] The recent implementation of robotic techniques is a novelty in this field[5] and is an alternative to traditional LA.[5]

The aim of this study is to review our experience with LA, highlighting the most relevant aspects regarding its indications, such as treating large or malignant lesions.

Materials and methods

This is a descriptive and retrospective study of 43 LA performed in 41 patients between January 2000 and December 2008.

Surgical technique

All the surgical procedures were performed under general anaesthetic. Antegrade colon preparation was carried out in only 2 cases; both were large tumours in the left adrenal gland. In the cases of pheochromocytomas the patients were treated preoperatively with alpha-blockers for approximately 10 days, followed, in some cases, by beta-blocker treatment immediately prior to surgery.

In all the operations a lateral transperitoneal approach was followed, the patients lying on their contralateral side to the gland being operated on, and the operating table was angled at approximately 30°. Pneumoperitoneum was performed with direct vision. 3 or 4 trocars were used on the left gland and 4 on the right. First, the optical trocar was inserted below the costal border at the level of the anterior superior iliac spine. Two 10 mm trocars were inserted under visual control 6 or 7 cm to each side of the first one, also below the costal border. The fourth trocar was positioned about 4-5 cm below the first one and slightly posterior to it.

On the right side, after dissection of the right triangular ligament of the liver and exposure of the adrenal fossa, dissection was begun at lateral edge of the vena cava until the right suprarenal vein was identified and ligated with clips and divided.

With the left adrenal gland, dissection was begun, the splenic angle of the colon was partially freed and the spleen and the tail of the pancreas were mobilized medially to expose the left gland. The adrenal vein was located in the area of the superior border of the left renal vein. Arterial bleeding was treated with a seal and divide device, such as the Ligasure Atlas® Valleylab. The piece was extracted unfragmented using a laparoscopic retrieval bag, but to do this it was necessary to lengthen one of the incisions.

Statistical analysis

For the statistical analysis of the data, we used the SPSS program for Windows, version 11.5. The qualitative variables were expressed as percentages or absolute values; the quantitative variables were expressed as median and interval values.

Results

Our group observed an upward trend in the number of LA performed each year; most operations took place in 2008, when 9 operations were carried out.

The median age of the patients undergoing LA was 53, with ages ranging from 20 to 83. Of the 41 patients

operated on, 22 were male and 19 female. Nineteen patients underwent unilateral left adrenalectomies, 20 unilateral right adrenalectomies, and in 2 cases bilateral adrenalectomies were performed in two stages. The median size of the tumour was 34 mm, with sizes ranging from 4 to 155 mm.

The most common indication in our series was hyperaldosteronism, in 19 patients. Another 8 patients were operated on due to incidentalomas and 6 were diagnosed with pheochromocytoma. In 6 cases Cushing's syndrome was the indication for the operation, and in 3 cases it was the presence of suspicious adrenal lesions of a metastatic origin. Lastly, a patient with primary adrenal carcinoma was operated on (Table 1).

Before surgery, all the patients with hyperaldosteronism had arterial hypertension which was not possible to control with pharmacological measures, and in 10 of them it was associated with hypopotasaemia; one patient had muscle cramps and electrocardiographic disturbances.

The patients with Cushing's syndrome had the typical clinical symptoms: obesity with body fat redistribution, arterial hypertension and port wine stains.

As for the patients with pheochromocytoma, 5 had arterial hypertension and anxiety. One patient had a subclinical pheochromocytoma in the context of a type 2A multiple endocrine neoplasia, and he was operated on as a previous step to performing a thyroidectomy.

All the patients who underwent surgery due to a suspicion of metastatic lesions had a history of cancer: one case of pulmonary epidermoid carcinoma, one of pulmonary adenocarcinoma and one of renal hypernephroma.

The postoperative hospital stay ranged between 1 and 9 days, with a median stay of 3 days.

The histology of the surgical pieces is summarized in Table 2. Immunohistochemical techniques were used for the anatomopathological study of the pheochromocytomas, and all the pieces showed chromogranin and enolase positivity. It should be pointed out that, of the operations performed due to incidentalomas, in two cases the anatomopathological diagnosis was a myelolipoma and in another a low grade lymphoma; the remaining 5 were adenomas (Table 2).

There was no mortality in our series. Only 3 patients had complications: one case of postoperative fever, one case of pneumonia related with bronchoaspiration during anaesthetic intubation and, the most important case was a small tear in the wall of the inferior vena cava during the operation, requiring conversion to open surgery. This was the only case of conversion. No patients required reintervention.

Table 1 – Indications for adrenalectomy

Indication	
Hyperaldosteronism	19
Incidentaloma	8
Cushing's syndrome	6
Pheochromocytoma	6
Metastasis	3
Primary carcinoma	1
Total	*43*

Table 2 – Histological diagnosis

Histology	
Adenoma	24
Pheochromocytoma	6
Cortical hyperplasia	5
Myelolipoma	2
Pulmonary carcinoma metastasis	2
Hypernephroma metastasis	1
Low grade lymphoma	1
Primary carcinoma	1
Normal	1
Total	*43*

Discussion

LA is one of the best-accepted procedures nowadays in the field of endoscopic surgery. Although no randomized prospective studies exist which demonstrate its definitive superiority over open surgery, the positive results from the extensive clinical experience accumulated in recent years have made it the technique of choice in adrenal surgery.[6] Consequently, it seems incorrect to perform an open adrenalectomy on a patient if there are no counter-indications for laparoscopic surgery.

Three different approaches have been described for laparoscopic surgery of the adrenal gland: the anterior transperitoneal, the lateral transperitoneal and the retroperitoneal approaches. At present, the most common is the lateral transperitoneal approach. However, no unanimous agreement exists regarding its use,[7] as each approach has its advantages and disadvantages when compared with the others.

The anterior transperitoneal approach allows the surgeon to explore the abdominal cavity and perform bilateral adrenalectomies, as well as other procedures simultaneously.[8] However, this approach makes it necessary to insert more trocars, retroperitoneal dissection is more limited, and it requires more surgery time.

The retroperitoneal approach avoids the peritoneal cavity in patients with previous laparotomies, visceromegaly or with a pregnant uterus, and allows a bilateral adrenalectomy to be performed without repositioning the patient. However, a retroperitoneal cavity does not exist, so it must be created; also, there is a limited operating field and the last thing to be ligated is the suprarenal vein, which could be a problem in cases of pheochromocytoma[9]; it is only recommended for lesions smaller than 6 cm.

The transperitoneal approach with the patient lying on their side does not allow for a complete exploration of the peritoneal cavity or for other associated procedures, and it makes it necessary to reposition the patient in cases of bilateral lesions. However, all these difficulties are minor when considering the advantage of the large operating field and the good retroperitoneal dissection that this allows.[8]

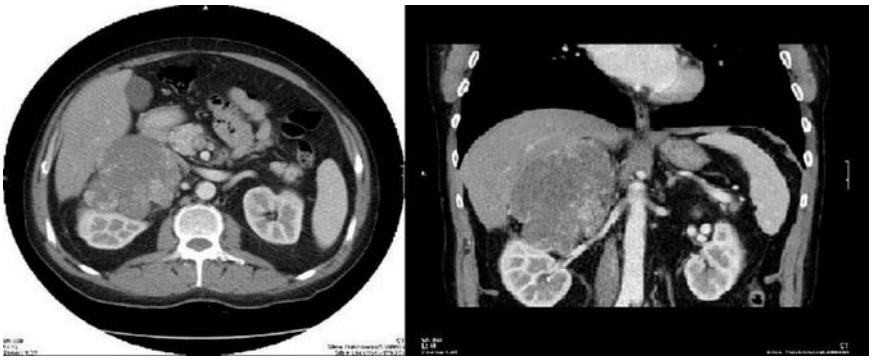

Figure – Computed abdominal tomography: right adrenal carcinoma.

This is the approach that we have used on all the patients and it has allowed fast, comfortable and safe identification and dissection of the anatomical reference points and the vessels. We believe that it must be the approach of choice in the majority of cases.

In most of the published series of cases[10,11] the main indication for LA is an aldosteronoma, followed by Cushing's syndrome, non-functioning adenomas and pheochromocytomas. Other less frequent indications include myelolipomas, cyst lesions and metastases. In our experience, although the main indication was hyperaldosteronism, non-functioning adenomas were more common than both Cushing's syndrome and pheochromocytomas. The increase in non-functioning adenomas may be connected with changes in surgical indications caused by laparoscopy itself; nowadays, doctors send patients for surgery more quickly and with smaller lesions.

At first there was a certain amount of concern regarding the use of the laparoscopic approach in pheochromocytomas due to the safety of the technique. This derived from concerns about the capacity to gain early control of the adrenal vein, the handling of the tumour, and the risk of hypertensive crises and the patient becoming instable during the operation. However, there seems to be no significant differences regarding haemodynamic episodes when compared with open adrenalectomies, although the current tendency includes preparing the patient pharmacologically prior to surgery with alpha-blockers and on occasions beta-blockers.[12] In a paper published in 2005, Kercher[13] showed that the increase of catecholamines in relation to basal levels during pheochromocytoma surgery is greater in open surgery than in laparoscopy, which seems to be connected with the minimal handling of the gland during laparoscopy. At present, the benefit of early ligation of the adrenal vein in cases of pheochromocytoma is under discussion; this is reflected in a paper published recently by Vassiliou et al,[14] in which they conclude that late ligation of the adrenal vein is a safe and effective technique.

The role of LA in cases of malignant adrenal masses continues to arouse controversy, mainly because of initial results which showed high rates of recurrent tumours and carcinomatosis. With the evidence accumulated with endoscopic techniques in recent years, the attitude towards this type of lesion is being reconsidered. Recently, McCauley et al[15] concluded that with malignant adrenal lesions the laparoscopic approach can be used following oncological criteria, providing preferable results to open surgery in selected cases. In these cases it is extremely important to avoid opening the tumour, due to the potential risk of recurrence either locally or in the trocar orifices, and because of the risk of carcinomatosis in the most aggressive tumours. At this time, most authors[15,16] do not recommend the laparoscopic approach for primary malignant lesions which extend beyond the adrenal gland. In our series we have performed 5 LA due to malignant lesions, one on a patient diagnosed with a large primary functioning adrenocortical carcinoma (155 mm), with excellent results to date (Figure).

In the case of metastatic lesions, the results published to date are extremely good, so they are not considered to be a formal counter-indication for endoscopic surgery.[16-18]

It is often debated whether to perform a bilateral LA in one operation or two, with a gap between the two operations of between one week and one month. In a series of 30 bilateral LA published in 2008, Takata et al[19] defend the safety and effectiveness of the technique. A bilateral adrenalectomy performed in one stage increases operating time, but there are no significant differences with regard to complications, reconversion to open surgery or mortality. The main indication for performing a bilateral adrenalectomy is Cushing's syndrome. Our series included 2 bilateral adrenalectomies, both due to Cushing's syndrome and performed in two stages. We had one case of bilateral hyperplasia and another of unlocalized ectopic ACTH secretion with secondary Cushing's syndrome. With the experience that we have gained at this time we believe that, whenever possible, bilateral adrenalectomies must be performed in one single stage.

Adrenal tumours larger than 10-12 cm were traditionally considered a limitation for the laparoscopic approach. However, more recent results show that minimally invasive techniques are a suitable mode of therapy for large adrenal tumours,[20] in which cases hand-assisted laparoscopic surgery

can be used. Since beginning to perform laparoscopic surgery in our department, with more experience the indications for the use of the laparoscopic approach have been extended in terms of the size of the tumour, without any complications to date.

The percentage of complications with LA described in the medical literature ranges between 3 and 20%, depending on the series.[21,22] The most important and most common intraoperative and postoperative complication is bleeding, which can originate from large or medium-sized vessels (adrenal vein, renal vein or vena cava). However, it is bleeding from small vessels in the perinephric fat or the gland itself that most frequently hinders laparoscopic surgery. This is due to these structures being very fragile, which means they have to be treated very carefully to avoid pinching them directly. In our series there was one important haemorrhage-related complication during a right LA, caused by a tear in the lateral wall of the vena cava, making conversion to open surgery necessary.

In large series, the conversion rate ranges between 1 and 12%, and mortality in all these is below 1.2%.[21,22] In our surgical operations, conversion to open surgery was limited to one single case and there was no mortality. Several articles have linked the importance of the surgeon's skill in laparoscopic techniques and the learning curve in LA with the complication rate and conversion to open surgery.[23]

Now that laparoscopy has become the approach of choice in adrenal gland surgery, there are widening expectations for the future with the development of emerging technology and robotic surgery. Although our group has no experience with these techniques, we think that they deserve a mention because of their growing importance in adrenal surgery.

In recent years several series of cases of "robotic adrenalectomy" have been published[24,25] showing that the technique is both effective and safe, and highlighting its advantages over conventional LA. Hyams et al[5] concluded that robotic adrenal surgery has advantages compared with conventional laparoscopy, but an objective superiority has not been proven, and the authors class it as an acceptable option in centres with a large volume of robotic surgery. In our opinion, robotic surgery still has to prove its superiority in terms of shorter operating times, fewer intra- and postoperative complications, and shorter hospital stays.

Another subject arousing controversy nowadays is adrenal-sparing surgery and the role of laparoscopic surgery in partial adrenalectomies. New surgical strategies such as cryosurgery or the radiofrequency ablation of adrenal lesions are becoming of greater interest as imaging techniques continue to develop. In this sense, intraoperative ultrasound plays an important role in locating lesions, allowing them to be removed or destroyed while preserving the normal adrenal tissue and its functioning.[26]

NOTES adrenalectomies are still in the assessment phase. Recently, Perretta et al[27] have published results obtained with porcine and cadaver models. They use a retroperitoneal transvaginal approach and conclude that it is feasible and safe in the porcine model, and they point out the need for further studies to be carried out before it can be applied on humans.

Conclusions

LA is considered the technique of choice for surgical treatment of most adrenal diseases. This type of approach has significant advantages compared with open adrenolectomies; for the patient because of shorter hospital stays and better postoperative pain control, and also for the surgeon due to an improved view of the operating field and greater accessibility. However, it is necessary to bear in mind that this is an uncommon complaint, that the learning curve is long and surgeons are needed who are familiar with both endoscopic and endocrine surgery. Thus, some kind of regionalisation of surgery for this complaint would be necessary in order for it to be performed successfully.

Experience accumulated in recent years has shown that LA is feasible for dealing with large tumours. Although experience is limited, with malignant lesions it seems that, as long as oncological principles are followed, laparoscopic surgery is useful. The data published to date in this respect are very positive.

In parallel with the consolidation of the use of LA, there are widening expectations for the future about NOTES surgery and robotics.

Conflict of interest

The authors affirm that they have no conflicts of interest.

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