Laparoscopic Adrenalectomy: A Single-Center Experience of 43 Cases

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ABSTRACT

Purpose: To evaluate the surgical feasibility of laparoscopic adrenalectomy and what laparoscopy offers for the surgeon and the patient.

Patients and Methods: From March 1996 to June 2004, 43 transperitoneal laparoscopic adrenalectomies were performed for various pathological states. Functioning adrenal masses and solid masses ≥5 cm were the most common indications. The mean size of the masses on abdominal CT was 6.8 cm in the largest diameter. All patients were assessed regarding the operative time, blood loss, complications, and conversion to open surgery. The postoperative course was reported with special attention to the complications and hospital stay.

Results: The mean operative time was 125 minutes with a mean blood loss of 60 mL. Intraoperative complications occurred in 3 cases (6.9%), necessitating conversion to open surgery in 2 to control bleeding from the avulsed right adrenal vein. A third case of conversion was elective because of difficult dissection of a large left pheochromocytoma from the renal hilum, so there was a 6.9% rate of conversion to open surgery. All patients showed early ambulation, early start of eating, and a short hospital stay (mean 2.6 days).

Conclusion: Laparoscopic adrenalectomy is surgically feasible and can be applied for different adrenal pathologies. The procedure can be performed with a reasonable operative time, minimal blood loss, and an acceptable rate of complications. Laparoscopic adrenalectomy provides excellent postoperative recovery and convalescence with a short hospital stay.

INTRODUCTION

THE SURGICAL APPROACH to the adrenal gland varies widely according to the size and the endocrine nature of the tumor to be resected, with the anterior, posterior, flank, and thoracoabdominal approaches being preferable in individual cases. The incision of open adrenalectomy is still quite large, leading to significant postoperative pain that may necessitate the use of epidural catheters, in addition to wound sepsis, especially in cases of Cushing’s syndrome, and a cosmetic defect.1,2 Morbidity after open adrenalectomy has been reported to be as high as 40%, with the mortality rate in the range of 2% to 4%.3

The small size of the adrenal gland, the benign nature of most adrenal tumors, and the difficulty of gaining access to the organ by open surgery, together with the improvement of cross-sectional imaging (CT and MRI scans) to define the lesion make the laparoscopic approach particularly suitable for adrenalectomy.2 Laparoscopic adrenalectomy was first reported by Gagner and coworkers in 1992,3 who performed three resections for benign tumors. Subsequently, laparoscopic adrenalectomy has been widely used and now is the gold standard for the treatment of most adrenal tumors.4

Herein, we report our initial experience with laparoscopic adrenalectomy to evaluate its surgical feasibility and what it offers in the field of adrenal tumors.

PATIENTS AND METHODS

From March 1996 to June 2004, 17 male and 26 female patients underwent laparoscopic adrenalectomy for various pathologies. Their ages ranged from 17 to 62 years (mean 29.4 ± 8.1 years). The estimated body mass index ranged from...
The indications for adrenalectomy included biochemically active adrenal masses (N = 14), nonfunctioning solid adrenal masses >5 cm (N = 15), solid adrenal masses with the possibility of nonadenomatous lesion (N = 8), and large adrenal cysts causing significant loin pain (N = 6).

Abdominal CT was the radiologic tool for diagnosis of the adrenal masses. Twenty-seven masses were on the right side and sixteen on the left. The estimated size of the mass ranged from 1.5 cm to 16 cm in largest diameter (mean 6.8 ± 3.2 cm). The largest solid mass was 12 cm in largest diameter, while the mass of 16 cm was an adrenal cyst. Hormonal assays, including serum catecholamines, aldosterone, or cortisol, were requested only when there was a clinical suspicion of a functioning adrenal mass.

The transperitoneal approach for laparoscopic adrenalectomy was used in all cases. The surgical technique was that described by Hamilton.5 Our primary target was early control of the main adrenal vein. This had two benefits: it avoided attacks of hypertension resulting from manipulation of the adrenal gland, and it facilitated complete mobilization of the gland, as the adrenal vein is the main structure anchoring the gland in its place. Exposure of the inferior vena cava (IVC) on the right side and the left renal vein on the left side was the approach for early control of the main adrenal vein. Because of the small size of the adrenal vessels, vascular Endoclips were sufficient for their control. After the dissection of the adrenal mass was completed, it was entrapped in an Endocatch bag II if small or in a Lapsac if large, then retrieved via an extended muscle-splitting port-site incision, leaving a tube drain (Fig. 1).

All patients were assessed regarding operative time, blood loss, intraoperative complications, and conversion to open surgery. The postoperative course was carefully reported, especially concerning the time of starting eating and ambulation, as well as any postoperative complications and the length of the hospital stay.

FIG. 1. Final appearance of incision after laparoscopic left adrenalectomy for large (8 × 10-cm) pheochromocytoma with tube drain coming out of a port site.

FIG. 2. Abdominal CT coronal cut showing large left-adrenal mass encroaching on renal hilum and stretching its vessels. L.R.A. = left renal artery; LT. K.I = left kidney.

RESULTS

The procedure was completed laparoscopically in all cases except three, an open-conversion rate of 6.9%. Conversion to open surgery was urgent in two cases because of avulsion of the right adrenal vein from the IVC during difficult dissection of the mass, leading to significant bleeding. These patients were explored via the thoracoabdominal approach, the bleeding was controlled, and the IVC was adequately repaired, after which, the mass was surgically removed. The definitive histopathology diagnosis of these masses was primary adrenocortical carcinoma and adrenal myelolipoma in one patient each. The conversion to open surgery in the third case was attributable to difficult dissection of the mass from the renal vessels, as the left-sided mass was large and displacing the left renal artery and vein, which necessitated abdominal exploration for safer dissection and separation of the mass (Fig. 2). The definitive histopathology diagnosis of this mass was pheochromocytoma.

Intraoperative complications were encountered in 3 cases (6.9%), including the two cases of avulsion of the adrenal vein from the IVC. In the third case, there was accidental injury of the main right renal vein during right laparoscopic adrenalectomy, which was controlled by freehand laparoscopic suturing using 5-0 Prolene.

The estimated operative time ranged from 65 to 234 minutes with a mean of 128 ± 23 minutes. The intraoperative blood loss ranged from 50 to 220 mL with a mean of 60 ± 11.2 mL. There was no need for blood transfusion in any patient. Comparing the operative time and the blood loss with the side and the size of the mass, we found no statistically significant differences (Table 1).

There were no significant postoperative complications apart from one patient with Cushing’s syndrome, who suffered an adisonian crisis on the second postoperative day. This patient was managed in the intensive care unit by intravenous steroids and recovered within 1 week. All patients regained bowel motility and normal eating on the first postoperative day. All patients except those with conversion to open surgery ambulated on the
first postoperative day. Mild shoulder-tip pain was reported by 12 patients (27.9%), while abdominal subcutaneous emphysema was encountered in 5 patients (11.6%). Both were managed conservatively with no need for further intervention. There was no reported case of wound complication or prolonged ileus. Most of our patients (84%) were discharged home on the second postoperative day. The mean hospital stay was 2.6 ± 1.3 days (range 2–7 days). The definitive histopathology reports of the removed specimens are listed in Table 2.

**DISCUSSION**

Currently, laparoscopic adrenalectomy can be applied for various adrenal pathologies, including aldosteroma, pheochromocytoma, Cushing’s adenoma, and rare entities such as cyst or myelolipoma. A few reports on laparoscopic application for adrenal malignancy are also available. There is no debate about the necessity for adrenalectomy for functioning adrenal masses or for possibly malignant masses. On the other hand, the management of biochemically inert benign incidentally discovered adrenal masses is a matter of some controversy. The current recommendations for adrenalectomy in such cases are masses >5 cm, because of the possibility of their being malignant; patients younger than 50 years; and documented increase in the mass size on follow-up. In our series, we followed nearly the same indications for adrenalectomy, as our patients were harboring either functioning adrenal masses, tumors >5 cm, or symptomatic adrenal cysts.

Among our series, three cases of adrenal malignancy were encountered. One was a woman with history of radical mastectomy for breast cancer, who had a solitary well-defined adrenal mass 3 × 5 cm. Suspecting a solitary metastasis, we offered her laparoscopic adrenalectomy. In the other two cases, preoperative imaging showed well-defined large solid adrenal masses 6 cm and 8 cm in diameter with no signs of infiltration of the surrounding tissues or venous involvement. Adrenal masses suspected of being malignant are, in our opinion, better dealt with by open surgery. Patients with adrenal cysts presented with significant abdominal pain and gastric upset. The cysts ranged from 9 to 16 cm in diameter (mean 13.2 ± 2.1 cm). Laparoscopic excision of the cyst together with the remaining adrenal tissue was easier, as most of the adrenal tissue was replaced by the huge cyst, which would have made decortication or partial adrenalectomy very difficult.

Some retrospective studies compared the results of transperitoneal and retroperitoneal laparoscopic adrenalectomy and reported similar outcomes regarding the operative time, blood loss, analgesic requirement, hospital stay, and convalescence.

### Table 1. Operative Time and Blood Loss during Laparoscopic Adrenalectomy

<table>
<thead>
<tr>
<th>Mean operative time (min) ± SD</th>
<th>Mean blood loss (mL) ± SD</th>
</tr>
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<tbody>
<tr>
<td><strong>Side of mass</strong></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>131.2 ± 24.1</td>
</tr>
<tr>
<td>L</td>
<td>125.4 ± 17.5</td>
</tr>
<tr>
<td><em>P</em> value</td>
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</tr>
<tr>
<td><strong>Size of mass (cm)</strong></td>
<td></td>
</tr>
<tr>
<td>&gt;5</td>
<td>134.7 ± 21.1</td>
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<tr>
<td>&lt;5</td>
<td>121.6 ± 18.3</td>
</tr>
<tr>
<td><em>P</em> value</td>
<td>0.42</td>
</tr>
</tbody>
</table>

### Table 2. Definitive Histopathologic Diagnoses of Adrenal Masses

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenocortical adenoma</td>
<td>13</td>
</tr>
<tr>
<td>Adrenomedullary hyperplasia</td>
<td>4</td>
</tr>
<tr>
<td>Pheochromocytoma</td>
<td>9</td>
</tr>
<tr>
<td>Suprarenal cyst</td>
<td>7</td>
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<tr>
<td>Malignancya</td>
<td>3</td>
</tr>
<tr>
<td>Myelolipoma</td>
<td>2</td>
</tr>
<tr>
<td>Ganglieneuroma</td>
<td>3</td>
</tr>
<tr>
<td>Oncocytoma</td>
<td>1</td>
</tr>
<tr>
<td>Cavernous hemangioma</td>
<td>1</td>
</tr>
</tbody>
</table>

*aOne case each of primary adrenocortical carcinoma, metastatic nodule from breast cancer, and primary adrenal leiomyosarcoma.

**FIG. 3.** Abdominal MRI coronal cut showing well-defined 6 × 5-cm right-adrenal mass that proved to be primary adrenocortical carcinoma.
Although the retroperitoneal approach carries the advantages of direct access to the adrenal gland, especially on the right side, because of the good surgical exposure of the retrocaval portion of the gland with less incidence of peritoneal contamination and intestinal injury, it has the drawbacks of inadequate working space, proximity of the few ports, and deficiency of anatomic landmarks, which makes orientation more difficult.9 Although the choice of the laparoscopic approach for adrenalectomy is primarily operator dependant, the only specific indication for the retroperitoneal approach is a history of transperitoneal surgery, and thus possible peritoneal adhesions, because of the higher risk of intestinal injury with the transperitoneal approach.10 We utilized the transperitoneal approach because of the large size of the adrenal masses (mean 6.8 cm), which makes retroperitoneal manipulation more difficult, and because we are more familiar with the transperitoneal approach.

Worldwide, the results of laparoscopic adrenalectomy have been largely consistent. In early series, the operative times were prolonged, but it quickly became clear that the operation was a safe and feasible procedure. Several large single-surgeon and single-institution studies demonstrated excellent results beyond the initial learning curve. Gagner and colleagues11 reported their experience with 100 consecutive cases of laparoscopic adrenalectomy with a mean operating time of 123 minutes and a mean hospital stay of 2.4 days. There were no deaths, 12 complications, and 3 conversions to open surgery. Suzuki and associates12 reported 24 complications among 75 consecutive patients (32%). Five patients (6.6%) were converted to open surgery. The operative time was 227 minutes on the left and 210 minutes on the right with minimal blood loss.12

In our patients, the mean operative time was 125 minutes, and the mean blood loss was 60 mL. This, together with the 6.9% incidences of intraoperative complications and of conversion to open surgery are compatible with what is reported in the literature.11,12 Two conversions to open surgery were among the initial 10 cases, while only one conversion was in-dicated in the ensuing 33 cases. All our patients showed excellent recovery with early ambulation and eating and short hospital stays (mean 2.6 days).

CONCLUSION

Laparoscopic adrenalectomy is surgically feasible and a safe procedure that could be applied for various pathological states. It carries the advantages of being minimally invasive, with low morbidity, early convalescence, and a short hospital stay. The procedure could be performed with minimal blood loss and acceptable operative times and complications. In this regard, it should be remembered that laparoscopic adrenalectomy remains a major surgical procedure, with the patient under general anesthesia and with a certain potential for conversion to open surgery and its attendant complications. Therefore, the availability of laparoscopy should never impact the generally accepted management decision algorithms for adrenal masses.

REFERENCES


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