Retroperitoneal Adrenalectomy: Open or Endoscopic?

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Abstract. Conventional adrenalectomy requires relatively large incisions. To assess the value of retroperitoneal endoscopic adrenalectomy, a case–control study was performed comparing the endoscopic technique to conventional posterior adrenalectomy. All patients had adrenal tumors less than 7 cm in diameter. Endoscopic retroperitoneal adrenalectomy required more operative time (90 vs. 60 minutes, $p < 0.0001$) than the open approach but was associated with less blood loss (20 vs. 125 ml, $p < 0.0001$). Endoscopic adrenalectomy caused less pain postoperatively ($p = 0.0005$) and was associated with fewer complications ($p = 0.035$). The hospital stay was shorter after endoscopic adrenalectomy than after open adrenalectomy ($p < 0.0001$). In conclusion, we advocate endoscopic retroperitoneal adrenalectomy in patients with small adrenal tumors.

The adrenal glands are located deep in the retroperitoneal space between the upper pole of the kidney and the diaphragm. Traditionally, small adrenal tumors were removed through the posterior approach, which involved resection of the eleventh of twelfth rib, or via a lumbotomy [1]. The morbidity associated with these conventional extraperitoneal approaches to the adrenal glands is considerable, including wound pain, neuralgia, wound infection, pulmonary infection, and atelectasis [2]. These complications are determined by the extent of the surgical trauma. Employing an endoscopic approach to adrenal pathology is thought to be associated with reduced surgical trauma. To test this assumption, a case–control study was done to analyze possible differences between open, posterior adrenalectomy and endoscopic retroperitoneal adrenalectomy.

Patients and Methods

The medical charts of all patients who underwent retroperitoneal endoscopic adrenalectomy at our institution were reviewed. The medical charts of 36 consecutive patients who had adrenalectomy through a dorsal approach at the University Hospital Dijkzigt between February 1988 and June 1994 were culled. Clinical

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characteristics, operative details, and postoperative courses were recorded. In patients with bilateral disease, the operative time and blood loss per side were separately documented. Pain medication was determined using the Medication Quantification Scale as described by Steedman et al. [3]. The Body mass index (BMI: quotient of body weight and square of body length, in meters) was determined for all patients.

Operative Procedures

Patients with Cushing syndrome were given corticosteroids intra- and postoperatively. The patients with pheochromocytomas had α- and β-adrenergic blockade and plasma expansion, when necessary, for at least 10 days prior to adrenalectomy. The hemodynamics in these patients were monitored intraoperatively by a Swan-Ganz catheter. Antibiotics or drains were not used routinely.

Open Adrenalectomy. The patient was placed in a prone position. After an incision extending from the tenth rib to the iliac crest, the sacrospinalis muscle was retracted medially, and either the eleventh or twelfth rib was resected. The adrenal gland was exposed by opening Gerota's fascia. After ligation of the adrenal arteries and the adrenal vein, the adrenal tumor was removed.

Endoscopic Retroperitoneal Adrenalectomy. The patient was placed in a lateral decubitus position. Through a 2-cm muscle-splitting incision in the midaxillary line just caudal to the tip of the eleventh rib, a dissecting balloon (Origin; Medsystems, Menlo Park, CA, USA) was introduced to create a retroperitoneal space. After replacing the balloon by a blunt-tipped trocar, carbon dioxide was insufflated to a maximal pressure of 12 mmHg, and the laparoscope was introduced. The second trocar was placed on the vertebral side of the first trocar. The peritoneal sac was mobilized medially to allow introduction of the third trocar on the medial side of the first trocar. The lateroconal fascia (extending from Gerota's fascia to the lateral peritoneum) was identified and opened to expose the adrenal gland [4]. If necessary, the right lobe of the liver was retracted for right adrenalectomy or the pancre-

Table 1. Clinical characteristics.

Characteristic	Endoscopic adrenalectomy	Open posterior adrenalectomy
No. of patients	42	30
Age (years)	45.0 (2.1)	43.5 (1.5)
Body mass index (kg/m^2)	26.2 (0.9)	26.8 (0.8)
Cushing's disease	5	5
Cushing's adenoma	11	11
Conn's adenoma	17	12
Pheochromocytoma	8	—
Incidentaloma	1	2
Side of lesion (right/left)	18/31	13/23
Diameter of adrenal tumor (cm)	3.0 (0.2)	3.0 (0.2)

Results are median (SE).

Table 2. Operative details and clinical course.

Operative factor	Endoscopic adrenalectomy	Open adrenalectomy	p
Operative time (min)	90.0 (5.1)	60.0 (4.3)	$< 10^{-4}$
Blood loss (ml)	20.0 (18.4)	125 (42.4)	$< 10^{-4}$
Postoperative analgesia	1.0 (1.6)	3.0 (4.3)	0.0005
Complications	3	8	0.035
Postoperative hospital stay (days)	4.0 (0.2)	7.0 (0.8)	$< 10^{-4}$

Results are median (SE).

atic tail for left adrenalectomy. Dissection was initiated laterally. Arterial branches were either coagulated or clipped and divided. The adrenal vein was clipped and divided during the final phase of dissection. All adrenal tumors were removed in a plastic bag (Endocatch; US Surgical, Norwalk, CT, USA).

Statistical Analysis

To compare the characteristics of the patients and the results of the three operative techniques, all data were recorded in a database. The median values and standard errors of the continuous variables were calculated. To analyze dichotomous variables, the Pearson chi-square test was performed. The Mann-Whitney U-test was used to analyze the continuous variables. Analysis of patients who underwent retroperitoneal endoscopic adrenalectomy but required conversion to open adrenalectomy was performed on the basis of the intention to treat. Statistical comparisons were made between the two techniques. A p value lower than 5% was interpreted as a statistically significant difference between two techniques.

Results

Analysis of age, BMI, side of the adrenal lesion, and the diameter of the adrenal tumor showed no significant differences between the two groups (Table 1). The diagnosis differed in the groups ($p = 0.01$). Posterior open adrenalectomy was not done in patients with pheochromocytomas. Seven patients who underwent endoscopic adrenalectomy had bilateral disease. Five patients had Cushing's disease resistant to pituitary surgery and irradiation. The other two patients with bilateral pheochromocytomas had multiple endocrine neoplasia type IIa (MEN-IIa) syndrome and von Recklinghausen's disease, respectively. All but one patient had bilateral endoscopic adrenalectomy during one surgical procedure. Bilateral disease was present in five patients who had undergone open posterior adrenalectomy. All had one-stage bilateral adrenalectomy for Cushing's disease.

Endoscopic adrenalectomy took 30 minutes longer than open posterior adrenalectomy (Table 2), and the blood loss was less for the endoscopic procedure. Two endoscopic adrenalectomies were converted to lumbotomy because of bleeding from the right adrenal vein in one patient and dense adhesions between the left adrenal gland and surrounding tissues in another patient. All conversions occurred in the first 15 patients. In the patients with

pheochromocytomas who had endoscopic removal of their adrenal tumors, peroperative systolic blood pressure did not exceed 180 mmHg. The pulse rate remained below 140 bpm. Cardiac arrhythmia was not encountered.

During endoscopic adrenalectomy tears of the peritoneum occurred in 18 patients. Retraction of the peritoneum sufficed to maintain an operative field. No attempt was made to repair these peritoneal tears.

Histologic examination of the incidentalomas showed an adrenal cyst, adenomyosis, nodular hyperplasia, and a hemorrhage in the adrenal gland. Microscopic examination of the other removed adrenal tumors revealed benign features in all but one patient.

This 58-year-old woman had undergone computed tomography (CT) of the abdomen 3 years before she was referred to our institution that showed a right adrenal tumor with a diameter of 6 cm. Hormonal activity of this tumor could not be demonstrated. Upon referral to our institution, elevated serum cortisol levels were recorded. Endoscopic adrenalectomy was performed without laceration of the tumor. Macroscopic examination revealed a tumor weighing 68 g with a diameter of 7 cm. Microscopic examination showed mitosis and necrosis but no capsular or vascular invasion. Mitotane was not given postoperatively. Six months after adrenal surgery, CT of the abdomen was unremarkable. Nine months after surgery, the patient developed lower back pain. Analysis showed bone metastases and a large tumor in the right upper abdominal quadrant. Port site metastases were not found. Irradiation of the osteolytic lesions was started, and mitotane was given.

Three patients developed a hematoma after endoscopic adrenalectomy. Ultrasonographically guided drainage was undertaken in one patient. In the other two patients the hematomas resolved spontaneously.

Postoperative complications were observed in eight patients after posterior open adrenalectomy. Wound infection occurred in three patients and a hematoma in two. Neuralgia, incisional hernia, and pulmonary embolism were each observed once. The hospital stay was 2 days shorter after endoscopic adrenalectomy than after open adrenalectomy.

Discussion

The transperitoneal approach is most commonly used for endoscopic adrenalectomy. Transperitoneal adrenalectomy can be done while the patient is in either the supine or lateral decubitus position [5, 6]. After initial experience with laparoscopic transperitoneal adrenalectomy, we changed to the endoscopic retroperitoneal approach because it required less dissection and retraction of structures surrounding the adrenal gland [7].

Employing the endoscopic retroperitoneal approach resulted in a reduction of operating time of more than 1 hour. Many have claimed that the retroperitoneal approach is not preferable in minimally invasive adrenal surgery because the retroperitoneal space does not provide sufficient landmarks. Himpens has described various retroperitoneal landmarks that aid the surgeon's orientation [4]. For endoscopic retroperitoneal surgery, it is important to recognize the lateroconal fascia. This structure covers the space that contains the adrenal gland. Endoscopic ultrasonography has been advocated by Duh et al. to localize the adrenal tumor [8]. In our opinion, this device is rarely necessary when the anatomic landmarks are respected. Although the right adrenal gland is readily accessible when the transperitoneal approach is used, exposure of the left adrenal gland can be cumbersome because it requires mobilization of the spleen, the splenic flexure of the colon, or the pancreatic tail. The advantage of the endoscopic retroperitoneal approach is that mobilization of other organs is unnecessary because the adrenal gland is approached in its proper anatomic plane. A disadvantage of endoscopic retroperitoneal adrenalectomy is the limited maneuvering space for the endoscopic instruments, particularly in patients with prominent iliac crests. Therefore the maximal lateral decubitus position is required for successful endoscopic retroperitoneal adrenalectomy. Alternatively, the patient can be placed in prone position as advocated by Mercan et al. [9]. The prone position allows bilateral adrenalectomy without turning the patient. We prefer the lateral decubitus position because lumbotomy can be done easily when conversion of the endoscopic procedure is necessary.

Traditional dogma for surgical treatment of pheochromocytoma is early ligation of the adrenal vein and exploration of the contralateral adrenal gland and paraaortic region. In this study, there were no major hemodynamic alterations during endoscopic removal of pheochromocytomas despite the fact that the adrenal vein was clipped at the end of adrenal dissection. Preoperative α- and β-blockade and minimal manipulation appear essential to prevent peroperative hypertensive crisis. Fernández-Cruz et al. showed clearly that laparoscopic dissection of pheochromocytomas was associated with less increase of serum catecholamine levels than conventional open removal of pheochromocytomas [10]. Use of the endoscopic technique precludes thorough exploration of the paraaortic region and the contralateral adrenal gland. However, this exploration has become futile, as scintigraphy with ^{131}I-m-iodobenzylguanidine (MIBG), CT scanning, and magnetic resonance imaging (MRI) of the abdomen localize pheochromocytomas precisely and differentiate between unilateral and bilateral disease [11, 12].

The size limits of adrenal tumors for endoscopic removal is still debated. We consider only adrenal tumors with diameters less than 6 cm for endoscopic retroperitoneal removal because the risk that an adrenal tumor of this size is malignant is 1 in 10,000 [13, 14]. In this study, CT scans underestimated the size of the tumor in the patient with adrenal cancer. Whether open adrenalectomy could have prevented recurrence of disease in this patient remains questionable.

Comparison of open posterior adrenalectomy and endoscopic retroperitoneal adrenalectomy showed that the endoscopic technique is preferable except for operating time. Heintz et al. reported a median operating time of 180 minutes for endoscopic retroperitoneal adrenalectomy [15], and Walz et al. recorded a median operating time of 124 minutes [16]. As shown in this study, the operating time can be reduced to 90 minutes after some experience.

In conclusion, we advocate endoscopic retroperitoneal adrenalectomy in patients with adrenal tumors with diameters less than 6 cm.

Résumé

La surrénalectomie par voie traditionnelle nécessite des incisions relativement longues. Pour évaluer la surrénalectomie rétropéritonéale vidéolaparoscopique, nous avons réalisé une étude comparant ces deux voies d'abord, traditionnelle et laparoscopique). Le diamétre de toutes les tumeurs ne dépassait pas 7 cm. La surrénalectomie laparoscopique a duré plus longtemps (90 vs. 60 min, p < 0.0001) par rapport à la technique traditionnelle mais les pertes sanguines étaient moins importantes (20 vs. 125 mL, p < 0.0001). Les patients opérés par laparoscopie avaient moins de douleur postopératoire (p = 0.0005) et avaient moins de complications postopératoires (p = 0.035). La durée d'hospitalisation était plus courte après résection laparoscopique par rapport à la voie traditionnelle (p < 0.0001). En conclusion, nous préconisons la surrénalectomie laparoscopique rétropéritonéale chez le patient ayant une tumeur surrénale de petite (< 7 cm) taille.

Resumen

La adrenalectomía convencional requiere la realización de incisiones relativamente amplias. Con el propósito de definir el valor de la adrenalectomía endoscópica retroperitoneal, se emprendió un estudio de casos controlados para comparar la técnica endoscópica con la adrenalectomía convencional por abordaje abierto posterior. Todos los pacientes de esta serie tenían tumores adrenales de menos de 7 cm de diámetro. La adrenalectomía endoscópica retroperitoneal requirió un mayor tiempo operatorio (90 vs 60 min, p < 0.0001) que la operación por el abordaje abierto, pero resultó en menor pérdida de sangre (20 mL vs. 125 mL, p < 0.0001), causó menos dolor postoperatorio (p = 0.0005), se acompañó de menos complicaciones (p = 0.035) y la hospitalización fue más breve (p < 0.0001). En conclusión, nosotros preconizamos la adrenalectomía endoscópica retroperitoneal en pacientes con tumores pequeños de la glándula suprarrenal.

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