

Retroperitoneoscopic Adrenalectomy for Pheochromocytoma: Comparison With Open Surgery

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ABSTRACT

Objectives: To evaluate the feasibility of the retroperitoneoscopic approach to adrenalectomy for pheochromocytoma and to compare it with the open retroperitoneal approach.

Methods: Twelve retroperitoneoscopic adrenalectomies for pheochromocytomas were performed in 10 patients at our center between January 1996 and January 2001. Two patients underwent simultaneous bilateral surgeries. These were retrospectively compared with open adrenalectomy for pheochromocytoma through the extraperitoneal flank approach in 6 patients with 7 adrenalectomies, conducted during the same period.

Results: Retroperitoneoscopic adrenalectomy could be successfully performed in 11 cases with 1 conversion to open surgery. Mean operative time was 151 minutes (range, 90 to 200 min). This was comparable to the time for the open surgery group, 169 minutes (range, 85 to 270 min). However, the mean blood loss of 140 mL (range, 30 to 300 mL), hospital stay of 4.4 days, and analgesia doses required (3.3) were significantly lower than those for the open surgery group (592 mL, 9.8 days, and 8.1 doses, respectively). No significant intraoperative hypertensive crises occurred in either group.

Conclusions: Retroperitoneoscopy is a safe and feasible option for adrenalectomy for pheochromocytoma. It requires shorter operative time, less postoperative analgesia, a shorter hospitalization, and blood loss is less. Although retroperitoneoscopy is widely practiced for other adrenal tumors, it should now also be considered for pheochromocytomas.

Key Words: Laparoscopy, Retroperitoneal space, Adrenal, Pheochromocytoma, Adrenalectomy.

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INTRODUCTION

Adrenalectomy for pheochromocytomas has been associated with the possibility of severe intraoperative hemodynamic instability. Attempts to minimize this include minimal tumor manipulation prior to ligation of the venous drainage. Laparoscopy has become a standard option for the management of adrenal tumors.^{1,2} In cases of pheochromocytomas, most surgeons prefer to use the transperitoneal approach, with the belief that it affords a better view and easier approach to the vessels. We performed adrenalectomies for pheochromocytomas in 12 patients by using the retroperitoneal laparoscopic approach and present the first study comparing this approach with retroperitoneal open surgery.

METHODS

Beginning January 1996, 12 retroperitoneoscopic adrenalectomies were performed for functioning pheochromocytomas in 10 patients at our center. Two patients underwent simultaneous bilateral adrenalectomies. During the same period, 7 open adrenalectomies by the extrapleural-extraperitoneal flank approach were performed for pheochromocytoma in 6 patients. The choice of procedure depended on the surgeon because 2 surgeons at our center do not practice laparoscopy. One patient had bilateral simultaneous surgeries. The patient and tumor characteristics are described in **Table 1**. Patients in the 2 groups were comparable in terms of age, sex, side of tumor, and size of tumor. All patients underwent either a preoperative computed tomography (CT) or magnetic resonance imaging (MRI) scan for tumor localization. Hypertension was controlled with a combination of alpha- and beta-adrenergic blockade prior to surgery.

Retroperitoneoscopy was performed using a standard technique described earlier.³ Three 10-mm ports were used in all cases with some requiring an additional 5-mm port to aid dissection. A combination of digital dissection and hydrostatic balloon distension was used for the creation of the retroperitoneal space, more cranially than is done for a nephrectomy. On occasions, the digital dissection may be sufficient without the need for balloon distension. On the left side, the renal hilum was directly approached to expose the renal vein. The adrenal vein

Table 1.
Patient Data

	Retroperitoneoscopy	Open Surgery	Significance (Wilcoxon Rank Sum Test)
Procedures	12	7	
Age Range (mean)	13–50 (34.3)	28–66 (37.8)	
Male:Female	3:7	4:2	
Right:Left	5:7	4:3	
Tumor Size, cm (mean)	2–7 (4.16)	4–10 (4.8)	
Operative Time, min (mean)	90–200 (151)	85–270 (169)	
Blood Loss, mL (mean)	30–300 (140)	350–1000 (592)	<i>P</i> <0.05
Hospital Stay, days (mean)	3–8 (4.4)	6–15 (9.8)	<i>P</i> <0.05
NSAID (Diclofenac sodium) doses	3.33	8.14	<i>P</i> <0.05
Conversions	1	-	
Major Complications	1	2	
Minor Complications	1	2	

was identified on its cranial surface and ligated before further manipulation of the gland. On the right side, the inferior vena cava was identified and traced up to the gland that was dissected primarily before ligating the short adrenal vein as it enters the vena cava. All specimens were retrieved intact by extending the primary port.

During the same period, 7 open surgical adrenalectomies for pheochromocytomas were performed in 6 patients with 1 bilateral surgery. All procedures were performed with the patient in the lateral decubitus position. A flank incision was used and the dissection kept in the retroperitoneum, outside the pleural cavity.

A retrospective analysis was performed of the various intra- and postoperative data, and the 2 procedures were compared using the Wilcoxon rank sum test for statistical significance.

RESULTS

Retroperitoneoscopic adrenalectomy was successfully performed in 11 cases with 1 conversion to open surgery (8.33%). In 2 cases, the procedure was successfully carried out bilaterally at the same sitting. The largest tumor resected was 7 centimeters in size. Comparative data for the 2 groups are given in **Table 1**.

No intraoperative complications or hypertensive crises occurred in either group. One patient undergoing retroperitoneoscopic adrenalectomy on the right gland developed a retroperitoneal collection and hemothorax that required intercostal drainage for 3 days. His subsequent recovery was uneventful. One patient developed fever that subsided within 2 days. Two patients undergoing open surgery developed severe chest infection with one requiring ventilator support for 4 days. Their subsequent recovery was uncomplicated. Two patients in the open surgery group also developed wound infection in the postoperative period.

In the retroperitoneoscopy group, 1 conversion to open surgery was required due to nonprogress of the dissection. The subsequent open surgery was uneventful and a 7-centimeter tumor was removed.

All patients undergoing retroperitoneoscopy were started on oral fluids the same evening and ambulated the next morning. Most were discharged by the fourth postoperative day.

All parameters assessed, ie, operative time, blood loss, hospital stay, and analgesia requirements, were lower in the retroperitoneoscopy group. No added morbidity occurred with the procedure.

DISCUSSION

Laparoscopy has become an established modality of treatment for a large number of urologic conditions. Between the 2 techniques of laparoscopy, retroperitoneoscopy has certain distinct advantages over the transperitoneal access.^{4,5} These relate primarily to the avoidance of the peritoneal cavity in the retroperitoneal approach. Retroperitoneoscopy does not require colonic mobilization or bowel handling and thus minimizes the chances of bowel injury and ileus. Suzuki et al⁵ had to abort their randomization into transperitoneal and retroperitoneal approaches for adrenalectomy in favor of the retroperitoneal approach because of a strong preference by the patients and referring physicians. Adrenalectomy is considered one of the more advanced laparoscopic procedures, requiring greater experience and technical skills.⁶ Among the various adrenal tumors amenable to laparoscopic excision, pheochromocytomas pose a specific challenge due to the associated hemodynamic effects of tumor manipulation and the need for early control of the draining veins. Gill^{2,7} found only 5 series consisting of 61 patients reporting exclusively on laparoscopic adrenalectomy for pheochromocytoma. Furthermore, they note that all these cases were performed transperitoneally. While most reports of retroperitoneoscopy for pheochromocytoma have been limited to occasional cases,^{1,2,8,10} Soulie et al's¹¹ experience of 9 cases is the first series reported. We have compared our experience of 12 retroperitoneoscopic procedures with 7 cases performed by open surgery, using the same retroperitoneal approach.

One of the basic tenets of surgery for pheochromocytoma is the early control of adrenal veins to prevent release of catecholamines into the circulation during tumor manipulation.¹² Retroperitoneoscopy is ideally suited for this approach because it allows direct access to the renal hilum and the adrenal vein, particularly on the left side, without approaching the adrenal gland itself. Even during open surgery, Nagesser et al¹³ found the retroperitoneal approach superior to the transabdominal one for tumors considered otherwise suitable for laparoscopy. Although directly approaching the vein may not be feasible on the right-sided gland, the tumor manipulation necessary to lift the gland and reach the vein from behind it is lower than that in open surgery. The magnification provided by the telescope makes the identification easier and subsequent dissection can be carried out without fear of hypertensive crises. Unlike a

nephrectomy, concerns regarding availability of space for dissection during retroperitoneoscopy are also lower for adrenalectomy because the adrenal is a smaller gland. Fernandez-Cruz et al¹⁴ have shown that the amount of catecholamines secreted during laparoscopic adrenalectomy is lower than that during open surgery and suggest that tumor manipulation is lower during laparoscopy. Sprung et al¹⁵ confirm that the hemodynamic changes that occur during laparoscopy for pheochromocytomas are similar to those occurring during open surgery. Janetschek,¹⁶ in a recent review of the role of laparoscopy for adrenalectomy, confirms that laparoscopy does not increase the risks specific to pheochromocytoma surgery.

Our mean operative time is similar to that reported for retroperitoneoscopic adrenalectomies for pheochromocytoma by Soulie et al¹¹ and lower than that reported for the transperitoneal approach.² The operative time also compares favorably with that reported for retroperitoneoscopic adrenalectomy for tumors other than pheochromocytomas.^{9,17,18} Although this may be the result of increasing experience and intact specimen removal without spending time on morcellation, it may also be due to the direct access afforded by retroperitoneoscopy without the need for reflecting the colon in a transperitoneal approach. Our mean blood loss, hospital stay, and analgesia requirements are similar to those reported in the literature (**Table 2**). Retroperitoneoscopy allows direct access to the adrenal glands without the risks associated with a peritoneal transgression such as bowel injury. However, this does not mean that no risk to the abdominal viscera exists, because pancreatic injuries with left-sided adrenalectomies are possible.^{10,19,20}

Comparing the data with that for open surgery, lower blood loss, shorter hospital stay, and lower injectable analgesia requirements have been noted. This is consistent with the established advantages of laparoscopy. On the other hand, extensive dissection in the subdiaphragmatic region during open surgery requires strong retraction of the diaphragm. This is often associated with significant postoperative pulmonary complications similar to those seen in 2 of our cases. Direct visualization during laparoscopy precluded extensive retraction and allows better respiratory movements in the postoperative period. We noted 1 major complication in the laparoscopy group. The patient developed a hemothorax following an adrenalectomy for a large right-sided tumor.

Table 2.
Comparative Series

Author	Route*	Cases	Histology†	Operative Time (min)‡	Blood Loss (mL)‡	Analgesia	Complications	Convert	Hospital Stay (days) ‡
Tanaka ¹	TP-9 RP-1	10	Pheo	240	200	22% cases	-	1	8
Gill ⁷	RP	>10	PheoData Not Available.....					
Gasman ⁸	RP	23	Pheo-2 Others-21	97	Minimal	-	2	0	3.3
Baba ⁹	RP	26	Others	144	44	-	-	1	-
Soulie ¹¹	RP	52	Pheo-9 Others-43	135	60	2 days	17.2%	-	5.1
Ono ¹⁷	RP	5	Others	204	148	1 day	3 minor	0	8
Siperstein ¹⁸	RP	33	Others	176	32	-	0	0	1.4
Takeda ¹⁹	RP TP	11 27	Others	248 231	151 155	- -	6 minor 1 major	3 RP to TP	
Janetschek ²³	TP	19	Pheo	Uni-150 Bi-516	Uni-133 Bi-248	- -	4	0	Uni-4.9 Bi-5.3
Gagner ²⁴	TP	17	Pheo	Uni-230 Bi-380	- -	- -	4	0	Uni-8.4 Bi-8.3
Ono ²⁵	TP	5	Others	199	80	1 day	1 major	0	11
Pujol ²⁶	TP-26 RP-1	27	Pheo-6 Others-21	75-240	-	-	2	2	3
This series	RP	12	Pheo	151	140	3.3 doses	2	1	4.4

*TP = transperitoneal, RP = retroperitoneoscopic.

†Pheo = pheochromocytoma.

‡Uni = unilateral, Bi = bilateral.

Though diaphragmatic injury is not a common occurrence on the right side, this probably resulted from use of an electrocautery during the dissection. The collection was suspected in the early postoperative period, and an intercostal drain was placed for 3 days. Subsequent recovery was uneventful. We agree with Soulie et al¹¹ that such injuries can be minimized with the use of a bipolar electrocautery for dissection. Our complication rate of 8.3%, both major and minor, is lower than that reported by Suzuki²¹ for laparoscopic adrenalectomy. Our conversion rate of 8.3% is similar to their 6.7% though our series is much smaller.

Among the major issues related to the use of laparoscopy is the concern regarding cost effectiveness. We have already addressed this issue in an earlier publication.²²

Gill² has also reported a lower overall cost of laparoscopy compared with that of open surgery. We do not use any expensive disposable equipment during laparoscopy. All ports are reusable and the retroperitoneal space is created using a homemade balloon. We also do not use any vascular staples and rely instead on titanium clips, which are far less expensive. Though we have not carried out a cost audit of these cases, none of our patients has refused surgery due to the costs involved. This is despite the fact that our hospital requires patients to buy disposables not routinely used.

CONCLUSIONS

Retroperitoneoscopy is a feasible option for the management of adrenal pheochromocytomas. It is not associat-

ed with any additional morbidity, is less time consuming, and allows earlier patient mobilization and discharge. While retroperitoneoscopy is being widely accepted as a good option for other adrenal tumors, it should also be actively considered for pheochromocytomas. Retroperitoneoscopy is, however, a difficult technique to learn and should be performed only by experienced laparoscopic surgeons.

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