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Lateral transperitoneal laparoscopic adrenalectomy

Abstract Several laparoscopic approaches to the adrenal gland have been described. The lateral transperitoneal approach has several distinct advantages when contrasted with other techniques for laparoscopic adrenalectomy (LA). We present our technique and results obtained in 50 consecutive transperitoneal LAs. We review 50 consecutive laparoscopic adrenalectomies (28 female, 19 male) performed from 1993 to 1998. S.J. Shichman or R.E. Sosa was either the primary surgeon or the first assistant for all cases. The lateral transperitoneal approach described below was used in all cases. Indications for adrenalectomy included Cushing's syndrome (13), aldosteronoma (15), pheochromocytoma (7), nonfunctioning adenoma (11), hyperplasia (2), and 1 case each of Carney's syndrome and metastasis to the adrenal gland. We performed 5 bilateral, 22 left, and 18 right laparoscopic adrenalectomies. The average time needed for bilateral adrenalectomy was 503 min (range 298–690 min); for left adrenalectomy, 227 min (range 121–337 min); and for right LA, 210 min (range 135–355 min). We demonstrated a yearly trend in lower operative times. The largest adrenal gland removed measured $13.8 \times 6.7 \times 3.5$ cm. Intraoperative blood loss was low. Only one patient received a blood transfusion. Conversion to open adrenalectomy was not required. Postoperative analgesic requirements were low. The average length of stay was 3.8 days for bilateral LA and 3 days for unilateral LA. Complications occurred in 5 patients (2 wound infections, 2 hematomas, and 1 pleural effusion). There was no mortality. Lateral transperitoneal adrenalectomy is a safe and efficient technique for the removal of functional and nonfunctional adrenal masses. This technique is associated with low morbidity, a minimal postoperative analgesic requirement, and a short hospital stay and, in our opinion, is more versatile than the retroperitoneal approach.

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Laparoscopic adrenalectomy is rapidly becoming the standard technique for the surgical removal of the adrenal gland. Gagner et al. [3] first reported laparoscopic adrenalectomy in 1992. Since then, many reports have confirmed the advantages of laparoscopic adrenalectomy over open surgery. Laparoscopy offers a shorter length of stay (LOS), a decrease in postoperative pain, a shorter time to return to the preoperative activity level, and improved cosmesis and reduces complications in the fragile Cushingoid patient [2, 4, 5, 9].

Various laparoscopic approaches to the adrenal gland have been described. Among these are the lateral transabdominal, anterior transabdominal, and lateral retroperitoneal and posterior retroperitoneal approaches [1, 3, 6, 8, 10, 13]. Each of these methods has specific advantages and disadvantages. Knowledge of the surgical anatomy and meticulous attention to dissection techniques and hemostasis are paramount for successful laparoscopic adrenalectomy with minimal morbidity.

We present the results we obtained in 50 consecutive laparoscopic adrenalectomies using the lateral transabdominal approach. We contrast our experience with that of other groups reporting on 20 or more laparoscopic adrenalectomies.

Subjects and methods

Between September 1993 and April 1998 we performed 50 lateral transperitoneal adrenalectomies (28 women, 19 men). In 40 cases

the adrenalectomy was unilateral and in 5 cases it was bilateral. Indications for surgery included Cushing's syndrome in 13 cases, aldosteronoma in 15, pheochromocytoma in 7, nonfunctioning adenoma in 11, hyperplasia in 2, Carney's syndrome in 1, and a metastatectomy for colon cancer in 1 patient.

Operative technique

All patients had a complete preoperative endocrine evaluation. Patients were placed on clear liquid diets and mechanical bowel preparation the day before surgery. General endotracheal anesthesia was used in all cases. A Foley catheter was employed to decompress the urinary bladder. Gastric decompression was achieved by an oral-gastric tube. Antiembolic stockings were used in all cases. Standard laparoscopy equipment was used. In addition to electrocautery shears, we utilized a 5- or 10-mm harmonic scalpel and medium and large hemoclips. A fan or paddle retractor was used to retract the liver or spleen. A 30° laparoscope was used for all cases.

Patients were placed in the semilateral decubitus position, with the side of the lesion being elevated 45°. The umbilical region was placed over the break in the table; the kidney rest was elevated and the table, flexed. An axillary role was used to protect the dependent brachial plexus. The upper arm was secured using a neuro arm support. Patients were secured to the table using 3-inch cloth tape across the shoulders and hips. In this position, rolling of the table toward the side of the lesion achieves a near supine position for insertion of the umbilical Hasson trochar. Rolling of the table in the opposite direction places the patient in the full flank position used for the majority of the dissection.

Patients were prepared and draped from their nipple line to the lower abdomen and well across the midline, allowing for possible conversion to an open exposure. The Hasson trocar is inserted in the supraumbilical region. The peritoneal space is insufflated to 15 mmHG using CO_2. The abdominal cavity is explored with a 30° laparoscope.

Right adrenalectomy

Three additional trocars are utilized for a right adrenalectomy. All ports should measure 11 or 12 mm in diameter to allow insertion of the laparoscope, clip appliers, harmonic scalpel, and retractors. Two accessory ports are placed 2 cm below the costal margin at the midaxillary and anterior axillary lines. A third port is placed in the midclavicular line halfway between the costal margin and the umbilicus. Dissecting instruments are introduced via the two lateral trocars. The laparoscope and the retractor are inserted in the midclavicular and umbilical trocars, respectively.

The abdominal contents are initially explored to identify adhesions and other pathology. Adhesions, which compromise exposure, are lysed. Most cases do not require mobilization of the hepatic flexure and ascending colon. The triangular ligaments of the liver are incised to facilitate gentle retraction of the liver medially. For this purpose a paddle retractor is inserted through the umbilical port once adequate room has been established between the liver and the abdominal sidewall. The remainder of the triangular ligament and the anterior and posterior coronary ligaments are incised to release the right lobe of the liver from the diaphragm, exposing the bare area of the liver. The liver is mobilized until the vena cava is identified.

The posterior aspect of the right lobe of the liver may adhere to the anterior capsule of the adrenal gland and to the vena cava. In this situation the anterior wall of the vena cava is identified close to the renal hilum and duodenum. Dissection along the anterior wall veins of the vena cava in a cephalad direction releases the right lobe of the liver. The accessory hepatic veins must be identified and avoided. Meticulous dissection along the lateral vena cava allows identification of the right adrenal vein. Once the vein has been isolated, two or three hemoclips are applied on the caval side of the vein and one or two are applied on the adrenal side. Large hemoclips are frequently needed. The adrenal vein is sharply divided between the clips, releasing the medical aspect of the adrenal gland away from the vena cava.

The harmonic scalpel facilitates the dissection and homeostatic division of numerous arterial branches coming off the aorta. These middle arterial vessels feeding the adrenal gland are usually small, but there can be a large vessel requiring hemoclips for control. As dissection continues cephalad, toward the diaphragm, the inferior phrenic vessels can easily be identified. These vessels can easily be controlled with hemoclips or with the harmonic scalpel. The natural tendency is to continue the dissection along the lateral aspect of the gland, freeing it from the sidewall attachments. We do not recommend releasing the lateral attachments at this time. The lateral attachments hold the gland to allow identification and control of the inferior vascular pedicle arising the right renal hilum. Often a large inferior adrenal artery is identified and requires ligation with hemoclips. Care must be taken to avoid injury to the renal hilum. Once this inferior pedicle has been released the adrenal can easily be mobilized in a superior and lateral direction. The gland is retracted in an anterior and cephalad direction, away from the upper pole of the kidney, using a forceps to grasp Gerota's fascia overlying the adrenal gland. The harmonic scalpel or electrocautery shears are used to incise Gerota's fascia at the junction of the upper pole of the kidney and the adrenal gland. Small adrenal vessels coming from the perinephric fat and renal capsule are controlled using the harmonic scalpel. The gland is completely mobilized expect for the avascular lateral attachments, which are easily released. The paddle retractor is removed and a retrieval sack is inserted through the umbilical port. After the specimen has been entrapped in the sack it is placed on the kidney to allow inspection for hemostasis in the operative field. The paddle retractor is reinserted and the operative bed is irrigated and examined using low insufflation pressures to confirm adequate hemostasis. The specimen is then removed through the umbilical Hasson trocar site, which can easily be enlarged to accommodate large glands.

Left adrenalectomy

For removal of the left adrenal gland the patient is placed in the right semilateral decubitus position. After insertion of the umbilical Hasson trocar, two accessory trocars are inserted approximately 2 cm below the costal margin in the midaxillary and anterior axillary. A third accessory trocar can be inserted in the midclavicular line 3–4 cm cephalad to the umbilicus to allow the use of hemoclips or of a suction/irrigation device without removal of the operating instruments. If this third port is utilized, the laparoscope should be inserted through this site for optimal visualization of the operative field. All trocars should measure at least 11 mm in diameter to permit insertion of the various laparoscopic devices. Diagnostic laparoscopy is performed to identify and incise adhesions that limit exposure to the left upper quadrant. The surgeon should identify the spleen, the left lobe of the liver, the splenic flexure, the descending colon, and the underlying left kidney. The splenic flexure and spleen should be mobilized as a single unit off the kidney and abdominal sidewall. For this purpose, incision of the posterior peritoneum just lateral to the spleen is continued in a cephalad direction up to the level of the gastric fundus. All splenic attachments to Gerota's fascia, the abdominal sidewall, and the diaphragm are released. If adequately mobilized, the spleen will fall medially out of harm's way without retraction. The plane between the tail of the pancreas and Gerota's fascia should be developed and the pancreas, retracted with the spleen. If necessary, insertion of a paddle retractor allows gentle medial retraction of the spleen. The inferior phrenic vessels are identified, controlled using either clips or the harmonic scalpel, and transected.

As on the right side, dissection and release of the avascular lateral attachments of the adrenal gland should be avoided at this time. These should be left intact, facilitating dissection along the medial aspect of the gland. Instead, with the surgeon working from the top of the adrenal, the dissection is carried along the medial aspect, releasing small arterial branches coming from the aorta using either the harmonic scalpel or clips. After the release of all medial attachments the adrenal vein can usually be identified, controlled with clips, and divided. If the vein cannot be identified,

the superior lateral attachments are released by dissection along the lateral aspect of the gland. Gerota's fascia is entered and the renal capsule is identified. Gerota's fascia overlying the adrenal is grasped and the gland is retracted away from the renal hilum. This maneuver facilitates identification of the adrenal vein for ligation and transection. The remaining posterior attachments are easily released and the gland is placed in a retrieval sack and placed on the kidney. The operative field is irrigated and examined under low insufflation pressures to confirm adequate homeostasis. The gland is removed through the Hasson trocar site.

Patients are started on clear liquids immediately postoperatively and their diet is advanced as tolerated. Oral narcotics are started on the evening of surgery and Foley catheters are removed on the evening of surgery or on postoperative day 1.

Results

Transperitoneal adrenalectomy was successfully performed bilaterally in 5 patients and unilaterally in 40 patients (28 women and 19 men). In the bilateral cases the mean age was 54 years. The mean height was 64 (range 60–74) inches and the mean weight was 200 (124–366) pounds. The average operative time was 403 (298–690) min and the mean blood loss was 190 (100–350) cc. The average adrenal gland size was 8.1 cm (8 adrenals) and the average weight was 18.5 (5–32) g. There was no intraoperative complication. All patients tolerated clear liquids on the 1st postoperative day. The mean dose equivalent of narcotics was 2.8 given parenterally and 2.6 given orally (5 patients). The mean length of stay was 3.8 days.

For the unilateral cases the mean age was 54 years. The average height was 66 (60–73) inches and the mean weight was 178 pounds. The mean operative time required for left cases was 227 (121–337) min and that needed for right cases was 210 (135–355) min. A decrease in operative time was demonstrated on a yearly basis (Fig. 1). Intraoperative blood loss averaged 142 (0–800) cc, and there was no intraoperative complication. The adrenal gland size averaged 7.1 cm (37 adrenals) and the average weight was 23.7 g (26 adrenals). A majority of patients began clear liquids on postoperative day 1 (32 on day 1, 8 on the day of surgery). An average of 4.8 doses of parenteral narcotic and 3.6 doses of oral narcotic were given postoperatively. One patient with Cushing's syndrome bled from a lateral trocar site and required a 2-unit blood transfusion postoperatively. One patient developed a retroperitoneal hematoma that caused pain but did not require transfusion. One patient developed a pleural effusion. Two patients developed superficial wound infections. The mean length of stay was 3 days.

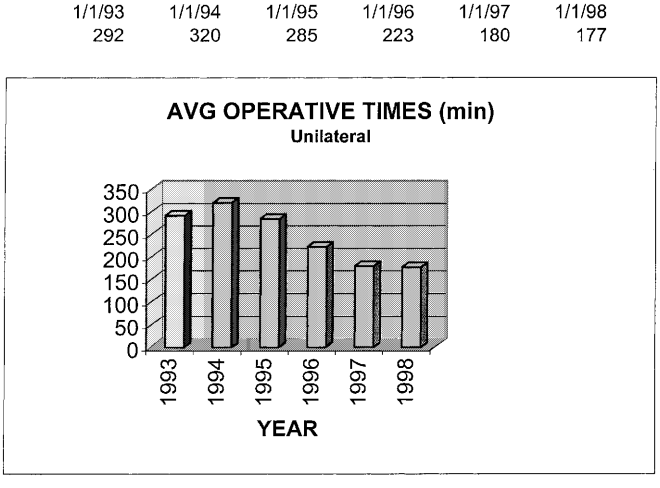

Fig. 1 Average operative times required for unilateral transperitoneal adrenalectomies performed between 1993 and 1998

Discussion

We consider laparoscopic adrenalectomy (LA) the procedure of choice for removal of the adrenal gland. Functional adrenal masses, including aldosteronomas, glucocorticoid- and androgen/estrogen-producing adenomas, and small- to moderate-sized solitary pheochromocytomas, are all amenable to LA (see Table 1). In addition, selected cases of bilateral adrenal hyperplasia can be treated with bilateral laparoscopic adrenalectomy [if ectopic adrenocorticotropic hormone (ACTH)-producing tumors cannot be located or pituitary tumor is unsuccessfully removed by transphenoidal hypophysectomy]. Nonfunctional tumors larger than 3 cm that demonstrate growth on serial imaging studies and tumors greater than 4–5 cm can be removed using LA. If radiologic characteristics of the tumor are strongly suggestive of malignancy, the experience and skill of the surgeon and the specific anatomy of the tumor vasculature and surrounding viscera must be considered in the process of deciding if the case can be approached laparoscopically. Recommendations regarding the maximal size of tumors that can be removed using a laparoscopic approach vary widely. As the size of the gland increases, the technical difficulties and operative risks increase. In addition, there is an increased risk of malignancy and the possibility of port-site seeding as described with carcinoma of the gallbladder and colon. Gagner et al. [4, 5] have reported the removal of a 14-cm adrenal mass. They use 15 cm as their size limit for a laparoscopic approach. Brunt et al. [1] advise caution in the consideration of laparoscopic removal of adrenal masses greater than 6 cm in size. We do not have an absolute cutoff in size for an adrenal mass that we will approach laparoscopically. The largest mass we removed measured 8 cm in diameter on preoperative imaging studies, though its length was actually 14 cm. Tumors of greater than 6 cm should be considered on an individual basis, taking into account the increase in the level of difficulty, the operative times, the limited exposure, aberrant retroperitoneal vasculature, and the potential risk of local invasion.

Few absolute contraindications to LA exist. Invasive adrenalcortical carcinomas requiring enbloc resection of the kidney and perinephric fat, the spleen, the tail of the

Table 1 Indications (*Aldo* Aldosteronoma, *Pheo* pheochromocytoma, *Cush* Cushing's, *Nonfunc* nonfunctioning)

Reference	Aldo	Pheo	Cush adenoma	Nonfunc adenoma	Cush syndrome	Other
Transperitoneal:						
Gagner et al. [5]	21	25	13	20	8	10
Terachi et al. [12]	41	8	0	22	21	8
Rutherford et al. [11]	48	3	1	7	0	1
Guazzoni et al. [7]	10	7	3	0	0	0
Brunt et al. [1]	6	11	1	0	2	4
Our study	15	7	3	11	10	4
Retroperitoneal:						
Walz et al. [13]	5	7	7	4	3	1
Gasman et al. [6]	12	2	4	2	1	1

pancreas, the diaphragm, and the lymph nodes should be managed via an open approach. Pheochromocytomas, which demonstrate malignant behavior with multiple sites or metastatic nodes, should not be removed laparoscopically. However, our recent success with hand-assisted laparoscopic extirpative surgery for renal and ureteral pathology has caused us to reconsider this absolute limitation. Prior to magnetic resonance imaging (MRI) and metaiodobenzylguanidine (MIBG) nuclear scans, all pheochromocytomas were approached via a large anterior incision to provide adequate exposure for bilateral adrenal and peri-aortic exploration.

Relative contraindications include prior intraabdominal trauma or surgery, morbid obesity, uncorrectable coagulapathies, and large pheochromocytomas. Prior trauma and/or surgery involving the spleen, liver, kidney, or tail of the pancreas may preclude a safe laparoscopic procedure. Dense adhesions can limit the surgeon's ability to obtain adequate exposure, vascular control, and safe dissection and removal of the adrenal gland. Morbidly obesity can require high intraabdominal insufflation pressures to obtain an adequate pneumoperitoneum that may impede venous return. Large amounts of retroperitoneal fat further complicate the dissection. Instruments may not be long enough to dissect under the diaphragm in patients with thick abdominal walls. Coagulopathies need to be completely evaluated and corrected during the preoperative period. Reanticoagulation of the patient in the early postoperative course can result in a retroperitoneal hematoma.

Pheochromocytomas are associated with a higher incidence of complications requiring conversion to an open technique. These tumors tend to be larger than most functional cortical adenomas. Removal of pheochromocytomas requires minimal manipulation, movement, and traction of the adrenal gland to prevent intravascular surges of catecholamines and the associated hypertensive crisis and arrythmias. In Gagner et al.'s series of 97 LAs [5], 60% of the postoperative complications occurred in the removal of 25 pheochromocytomas. Intraoperative hypertension was documented in 56% of these 25 cases. Prinz [10] reported only two conversions to an open approach with two large right adrenal pheochromocytomas.

A variety of laparoscopic approaches have been described. Included in this list are lateral transperitoneal, anterior transperitoneal, lateral retroperitoneal, and posterior retroperitoneal accesses. The most popular technique thus far reported in the literature has been the lateral transperitoneal approach. All techniques require a thorough understanding of the retroperitoneal anatomy and the ability to appreciate the anatomy on a two-dimensional video monitor via a 30° laparoscope.

The lateral transabdominal approach is used most commonly. This approach has distinct advantages. Most advanced laparoscopic surgeons have extensive experience in identifying, dissecting, and mobilizing intraabdominal viscera. Numerous landmarks are easily identified. With the patient in the full lateral position, gravity helps retract the medially mobilized spleen or liver, allowing for wide exposure of the adrenal gland. This generous exposure enables dissection of large tumors and is particularly helpful in the removal of pheochromocytomas, allowing the surgeon to perform minimal manipulation and retraction of the adrenal gland before ligation of the adrenal vein. This technique is easier to learn than the retroperitoneal techniques. Moreover, the transperitoneal approach also allows access to other organ systems. In one of our patients we performed a cholecystectomy in addition to adrenalectomy using the lateral transperitoneal approach. Disadvantages of this approach include dissection difficulties in patients with intraabdominal adhesions. Bilateral transabdominal adrenalectomies require time-consuming repositioning, repreparation and redraping of the patient. We perform all of our adrenalectomies, including all unilateral and bilateral cases in this series, with this approach.

The anterior transabdominal approach is the most infrequently described approach in the literature. Lee and Chung's [8] preferred true anterior approach places the patient in the supine position with the legs abducted and a sandbag under the lumbar spine. Exposure of the adrenal gland using the anterior approach is difficult and offers limited working space. As compared with the lateral transperitoneal and retroperitoneal approaches, it requires additional trocars for insertion of multiple retractors. The surgeon works against gravity, having to

Table 2 Results published from series involving >20 cases (*No. proc.* Number of procedures, *Op* operative, *Insuff* insufficient)

Reference	No. proc.	Complication rate (%)	Open (%) conversion	Hospital stay (days)	Op time avg (min)	Op range (min)
Transperitoneal:						
Gagner et al. [5]	97	12	3	3	123	80–360
Terachi et al. [12]	100	15	3	7.2	240	110–480
Rutherford et al. [11]	60	3	NR	NR	128	59–315
Guazzoni et al. [7]	20	5	0	3.4	170	100–375
Brunt et al. [1]	24	17	NR	3.2	183	120–265
Our study (total)	50	10				
(unlilateral)	40	12.5	0	3	R-210/L-227	121–355
(bilateral)	10	0	0	3.8	503	298–690
Retroperitoneal:						
Walz et al. [13]	30	8	17	NR	124	45–225
Gasman et al. [6]	23	9	0	3.3	Insuff only 97	45–160

retract adjacent organs rather than releasing them from their attachments and letting them fall away as occurs with the lateral transperitoneal approach. Another problem with this approach is that the adrenal bed is in the most dependent position when the patient is supine. This positions allows the collection of blood, lymphatic fluid, and irrigant, which can obscure the operative field and lengthen the operative time. Advantages of this approach include clear anatomic landmarks and the ability of the surgeon to perform bilateral adrenalectomies without repositioning the patient.

Retroperitoneoscopy is an alternate technique for removal of small benign adrenal lesions. This approach mimics the treatment of small adrenal lesions by open posterior approaches before the era of laparoscopy. Gasman et al. [6] recently reported their experience in using the lateral retroperitoneal approach to perform 23 adrenalectomies. Patients were placed in the lateral decubitus position and the retroperitoneal working space was created by digital dissection and further developed by insufflation without the use of balloon dissectors. After identification of the psoas muscle the kidney is pushed forward and the renal pedicle is identified. On the left side the adrenal vein is ligated and transected. On the right side the vena cava is identified, allowing identification, ligation, and transection of the adrenal vein. The adrenal gland is then retracted in a caudal direction and freed from the upper diaphragmatic attachments. Finally, the adrenal gland is separated from the lower attachments to the upper pole of the kidney and peritoneum. Reported operative times range from 45 to 160 min, with the average being 97 min. However, reported times include only the insufflation time. Our series and most reported series report the operative time from the first incision to the placement of the dressings. The mean diameter of the excised glands ranged from 26 mm to 4 cm. Contraindications to retroperitoneal laparoscopy included adrenal glands measuring ≥ 5 cm or previous lumbar incisions. The authors state that this approach is less traumatic than a transperitoneal approach, though the morbidity rates were similar to those reported in the transperitoneal studies (See Table 2).

In the posterior retroperitoneal approach the patient is placed on the operating table in the prone position and the table is flexed, creating the semi-jackknife position. A balloon dissector is inserted 2 cm lateral and inferior to the tip of the 12th rib. After the retroperitoneal space has been dilated, two to three additional trocars are inserted. The kidney is identified and retracted in a caudal direction, enlarging the retroperitoneal space and facilitating identification and dissection of the adrenal gland. The superior aspect of the gland is released, and the inferior phrenic vessels are ligated and divided. The remaining exposure and dissection of the gland as well as the technique used to control the adrenal vasculature are similar to those described for the lateral transabdominal approach. In this technique, retraction of the liver or spleen is not required. The posterior approach does not require repositioning of the patient who needs a bilateral adrenalectomy.

Retroperitoneal approaches avoid adhesions from prior abdominal surgery, potentially reducing operative times and complication rates by eliminating the need for adhesiolysis. Disadvantages of the retroperitoneal approach include a small working space, which limits the size of the gland that can safely be removed. The small space also limits instrument placement, and crossing of instruments can easily occur. Balloon dilation can inadvertently place direct pressure on the adrenal gland and, in the case of a pheochromocytoma, cause catastrophic release of catecholamines. Identification of landmarks is limited, and dissection in obese patients with large amounts of retroperitoneal fat can be quite difficult. Other concerns include the increased risk of hypercapnea secondary to subcutaneous emphysema.

Currently, only two series have been reported that involve >20 retroperitoneal adrenalectomies. Walz et al. [13] have reported on 30 procedures in 25 patients, whereas Gasman et al. [6] have reported on 23 adrenalectomies in 22 patients. Operative times required for the retroperitoneal approach parallel those needed for the transperitoneal technique. Open conversion rates were significantly higher in Walz et al.'s report [13] as reflected by 5 procedures (17%) that required conversion to an open approach. Complication rates reported for the ret-

roperitoneal approach were similar to those noted for the transperitoneal series. Walz et al. [13] did not report the LOS, whereas Gasman et al. [6] reported results similar to those obtained in the transperitoneal series. Complication rates noted for the retroperitoneal approach were 8–9%, which compared favorably with those recorded for the two largest transperitoneal series (12–15%). Our complication rate was 8%, and all of these complications occurred in the beginning of our series.

The adrenal gland's unique location in the retroperitoneum makes it amenable to a variety of transperitoneal and retroperitoneal approaches. We performed 50 consecutive LAs for a variety of indications via the lateral transperitoneal approach. We believe that the lateral transperitoneal technique offers distinct advantages to the laparoscopist, including improved visibility of familiar anatomic landmarks, easy access to other organ systems, the use of gravity to work in the surgeon's favor to retract the spleen and liver, a wide exposure that allows the removal of large adrenal lesions, and a position that allows the natural application of new innovations such as the hand-assisted technique.

In conclusion, as the twenty-first century approaches, as physicians and surgeons we must search for the least invasive surgery that has the lowest complication rate and does not compromise patient care. Laparoscopy is a natural extension of this evolution in medicine. The adrenal gland is ideal for laparoscopic removal, and a variety of approaches have been described. A distinct advantage exists for LA over the traditional open adrenalectomy in terms of decreasing LOS, postoperative analgesic requirement, return to the preoperative activity level, and improved cosmesis. We favor the lateral transperitoneal approach and believe that the majority of adrenal pathologies can be safely removed in a timely manner with this technique. In addition, on the basis of our recent experience with the hand-assisted technique, we believe that the open adrenalectomy may one day become obsolete.

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