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# Laparoscopic right and left adrenalectomies

## Surgical procedures

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**Abstract**
*Background:* Laparoscopic approach for adrenalectomy was recently described and the operative technique is not yet well defined.
*Methods:* Twenty-seven laparoscopic adrenalectomies were performed between 1992 and 1995. There were 18 women and nine men ranging in age from 31 to 70 years (mean, 50.8 years). The surgical procedure was a lateral decubitus transperitoneal flank approach in 26 patients, and a retroperitoneal approach in one. Twelve right and 15 left glands were removed. Adrenal diseases were primary aldosteronism in 20 patients, nonfunctional adenoma in four patients, Cushing adenoma in two, and an adrenal cyst in one. Median adrenal gland size was 2.0 cm (range 0.5–8 cm).
*Results:* Five patients were converted to laparotomy (18%)—for dissection problems in four and for an unrecognized gland in one. The median anesthesia time was 200 min and the median surgical time was 140 min. Operative morbidity was one adrenal vein injury sectioned close to the vena cava. The hemorrhage was controlled by laparoscopic suturing without conversion. This patient required a three-unit blood transfusion. No mortality occurred and postoperative morbidity was one minor chest infection. The median postoperative in-hospital stay was 4.6 days (range 2–8) for nonconverted patients.
*Conclusions:* Laparoscopic adrenal gland removal is safe and offers fast recovery and short in-hospital stay. Laparoscopic adrenalectomy combines the advantages of both the conventional anterior and posterior approach.

**Key words:** Adrenalectomy — Laparoscopy — Surgical technique

The laparoscopic approach for adrenalectomy was first described by Gagner et al. [4] and seems to offer several advantages when compared to conventional surgery. Nevertheless, the operative technique is not yet well defined, and a full evaluation of the method is required. After an initial attempt to perform laparoscopic adrenalectomy through an extraperitoneal route in 1992, we have performed 26 adrenalectomies since April 1994 using intraperitoneal access. We describe our experience with laparoscopic adrenal gland removal. We have endeavored to develop safe adrenal vascular control and gland dissection and have carefully documented length of operation and postoperative course.

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## Materials and methods

### *Patients*

From October 1992 to October 1995, we performed 27 laparoscopic adrenalectomies. These patients were selected excluding laparoscopy for pheochromocytoma or large tumors over 9 cm in diameter. There were 18 women and nine men with a mean age of 50.8 years (range 31–70). The pathological adrenal glands were located on the right side for 12 and on the left side for 15.

### *Methods*

All procedures were performed under general anesthesia with muscle relaxation and controlled ventilation. Patients were monitored carefully during surgery with special attention to oxygen saturation and end-tidal $CO_2$. A full lateral position on the left side for right adrenalectomy and on the right for the left dissection (Fig. 1) were used. The pneumoperitoneum was induced through a Veress needle inserted in the flank and $CO_2$ pressure was regulated at 12 mmHg for the whole procedure. A 10-mm port was inserted in the subcostal space in order to introduce a 10-mm 0° laparoscope to permit intraabdominal exploration. Three other 10-mm ports were inserted for introduction of atraumatic graspers, hook, retractors, instrument with peanut swab, and scissors (Fig. 1). A 0° or 30° angulated laparoscope was used during the adrenalectomy.

### *Right adrenalectomy*

The lateral decubitus allows downward migration of the bowel. The epigastric port receives a smooth retractor in order to retract the liver during

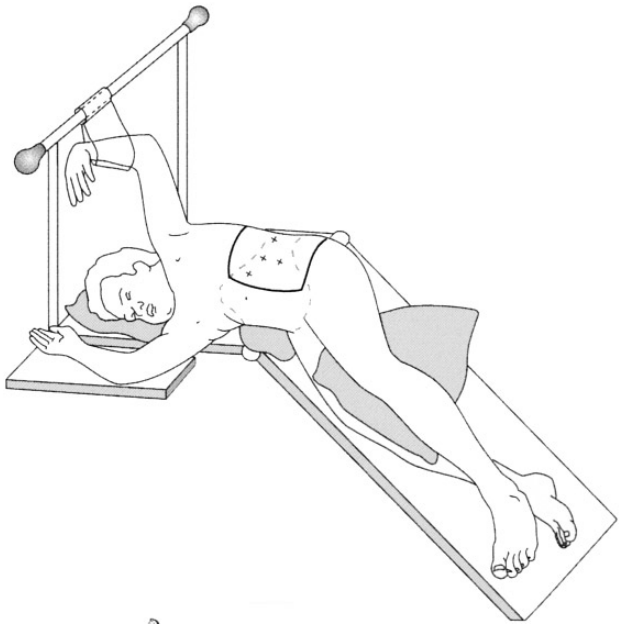

**Fig. 1.** Installation of the patient. Position of the patient in a full lateral position.

the whole procedure. The initial fundamental step of the procedure is sectioning, with hook or scissors, the peritoneum under the liver, extending to the hepatoparietal ligament and far to the right, allowing easy and tensionless upward mobilization of the liver (Fig. 2). Continuing on the left, the dissection exposes the vena cava. The adrenal gland can be easily identified posterior and inferior to the liver. The second step consists of continuing the dissection on the medial aspect of the gland toward the vena cava, using this structure as a landmark to find the main adrenal vein. Because of the strict left lateral position of the patient, the adrenal vein is well visualized and therefore easy to dissect. The vein is doubly clipped (Endoclip, Autosuture, Merlin Medical, France) and divided (Fig. 3), completing the most difficult stage of the dissection. During this dissection, accidental clip removal from the adrenal vein occurred in one patient. A 1-l blood loss occurred before the vena cava could be controlled by a laparoscopic vascular clamp. The defect was then sutured laparoscopically by a single intracorporeal suture (3/0 Prolene, Ethicon, UK) and a three-unit blood transfusion was administered. The third step is to look for an accessory adrenal vein joining a subhepatic vein 2–3 cm above the main adrenal vein. This accessory vein is present in 20% of cases. When present, it is dissected, ligated, and divided (Fig. 3). The fourth and last step of dissection is straightforward coagulation, clipping, and dividing of the three main adrenal arteries and accessory veins. Adrenalectomy is achieved by unhurried and meticulous dissection of the inferior, renal face of the gland with rigorous and progressive hemostasis in the perinephric fat (Fig. 3). This dissection is mostly made in perirenal fat and must be unhurried and meticulous. Atraumatic grasping and mobilization of the gland are difficult and require the use of specific smooth graspers. The freed gland is inserted into an extraction bag (Endocatch, Autosuture, Merlin Medical, France) and removed through a port site gently enlarged. Aspirative drainage is employed in every case for 1 or 2 days. Muscle and skin at the port sites are separately closed with absorbable sutures.

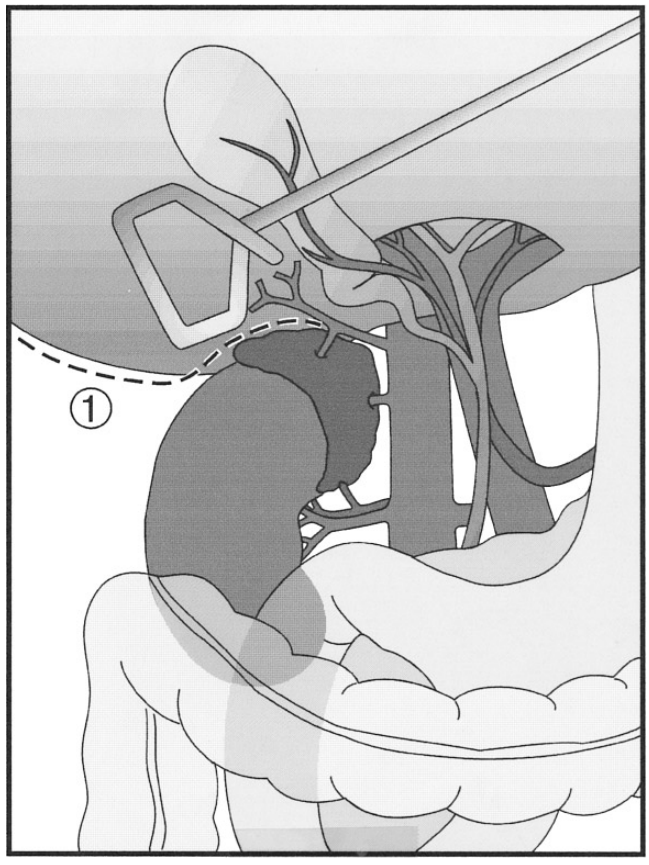


**Fig. 2.** Right adrenalectomy (*1*). First step: section of the peritoneum under the liver followed on the right side.

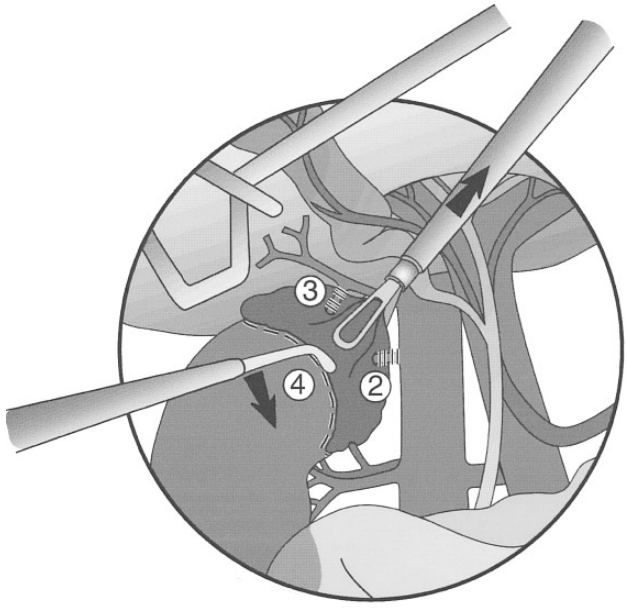


**Fig. 3.** Right adrenalectomy (*2*). Second step: section of the main adrenal vein; third step: research of an accessory adrenal vein; fourth step: dissection of the periglandular tissue.

## *Left adrenalectomy*

The key to success is to start the procedure by dissecting the splenorenal ligament as described initially by Gagner et al. (Fig. 4) [6]. The splenorenal ligament has to be dissected with coagulating scissors close to the diaphragm far enough to visualize the greater curvature of the stomach and permit a complete mobilization of the spleen, 2 cm of parietal ligament is left on the spleen to allow it to be grasped during mobilization. At the end of the parietal liberation, the spleen falls away from the operative field to the right with the tail of the pancreas. The spleen is not touched or manipulated any further. Recent experience in performing left adrenalectomy in the obese subject has shown that dissection of 5–8 cm of the splenic vein in the region of the tail of the pancreas greatly facilitates the exposure of the adrenal gland and is vasculature. At this time, the adrenal gland can be

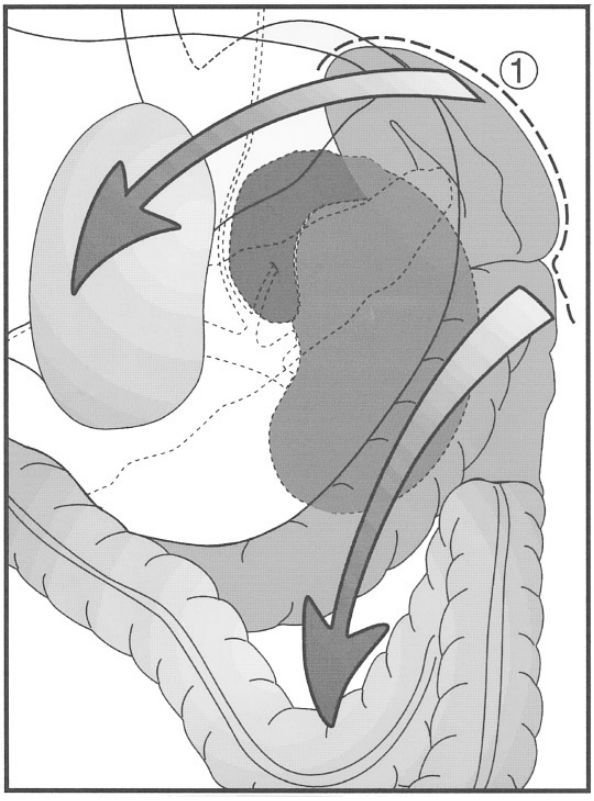


**Fig. 4.** Left adrenalectomy (*1*). First step: dissection of the splenorenal ligament.

identified at the upper pole of the kidney but has not been dissected. The next step is a progressive dissection allowing exposure of the renal vein which leads to the main and accessory adrenal veins (Fig. 5). An accessory vein is first ligated, clipped, and divided. This allows a complete dissection and division of the main adrenal vein close to the renal vein. The right side of the gland is dissected up to the diaphragm with ligation of the main adrenal arteries using clips, and the left and posterior faces of the gland are then freed by progressive dissection of the fat (Fig. 5). As on the right, the free gland is inserted into an extraction bag (Endocatch, Autosuture, Merlin Medical, France) and removed through a port site gently enlarged. The procedure is completed by aspirative drainage and careful port-site closure.

## Results

The indications for adrenalectomies were 20 Conn's adenoma, four clinically symptomatic nonfunctional adenomas, two Cushing adenomas, and one adrenal cyst of 7-cm diameter. Five laparoscopies were converted to laparotomy (18%), including the first three procedures, for dissection problems in four cases and for the inability to identify the gland on the left side in one patient. Median tumor size was 2.0 cm (range 0.5–8 cm). Bleeding was no more than 100 cc in 25 patients, and 300 cc in one. Hemorrhage of 1,000 cc occurred in the patient who suffered an adrenal vein tear and necessitated a three-unit blood transfusion. For the nonconverted adrenalectomies, the median anesthesia time was 200 min (range 90–290 min) and the medial surgical time 140 min (range 70–240 min). No mortality occurred. Postoperative morbidity consisted of a left pleural effusion and chest infection in the patient who had the longest operative surgical and anesthesia time. This complication responded satisfactorily to antibiotic treatment and physiotherapy, allowing hospital discharge after 6 days. The overall median hospital stay was 5.3 days (range 2–14) but only 4.6 days (range 2–8) for the nonconverted patients.

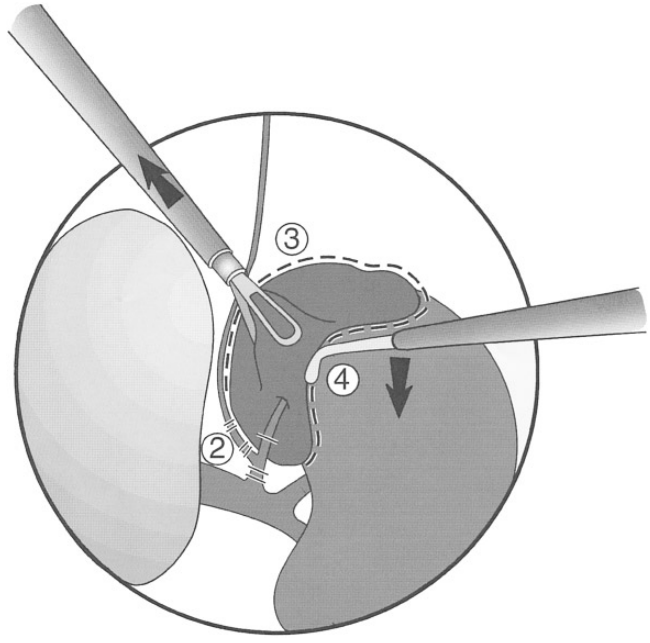


**Fig. 5.** Left adrenalectomy (*2*). Second step: section of the adrenal vein; third step: dissection of the right side of the gland; fourth step: dissection of the periglandular tissue.

## Discussion

Our initial attempt to perform laparoscopic adrenalectomy through retroperitoneal access failed. This approach provides a small operative field, limited exposure of the gland [7], and difficulties with mobilization of the instruments. Heintz and Junginger reported an operative time ranging from 290 to 330 min and intraoperative bleeding was often encountered [7]. In the present series employing a transperitoneal approach the median operative duration for adrenal gland removal was 140 min, comparable to that of 129 min described by Proye et al. for the conventional posterior approach [12]. After the description of the transperitoneal approach by Gagner et al. in 1992, we decided to employ this method exclusively [5]. The transperitoneal approach is very adequate. It offers a wide operative field; it allows appropriate mobilization of the instruments and easy control of the blood vessels [9]. The visual magnification through the laparoscope permits excellent control of all the small vessels surrounding the adrenal gland and also ensures the complete removal of the gland [11].

On the right side, the flank approach renders the control of the vessels and dissection of the adrenal gland easy, in contrast to the difficult dissection required when employing a decubitus approach [1, 3, 7]. In case of sudden bleeding such as that observed in one patient in our series, the lateral approach permits adequate control of the vascular defect. Sufficient room must be maintained in the operative field for additional trocar insertion and clamp application. Lateral bleeding from the vena cava following adrenal vein damage

can be managed by laparoscopic suture, identical in principle to the technique which might be employed if using an open approach to adrenalectomy.

On the left side, the transperitoneal flank approach avoids spleen retraction and the risk of splenic injury, in contrast to the conventional open approach. The retrosplenic route to the adrenal also avoids pancreatic dissection [10], and in the case of pheochromocytoma, early ligation of the adrenal vein before gland mobilization is possible [2, 8].

Serious complications can also be avoided when quick conversion is performed in case of dissection problems. The high conversion rate in our series (18%) was accompanied by a low overall blood loss and need for transfusion. We believe that serious complications can be avoided by readily converting to an open procedure when dissection or access problems are encountered. This explains why three of the five conversions in our series were our initial patients, no conversion occurring in our last 14 patients. Other reports have described lower conversion rates but higher morbidity [14, 15]. In this preliminary experience, we have chosen to select patients presenting with small tumors. Indeed, a small Conn's adenoma would appear to provide the ideal indication for laparoscopic adrenalectomy. The laparoscopic technique should not be recommended for malignant lesions and tumors larger than 8–9 cm [9, 13].

Advantages of the laparoscopic approach compared with the conventional posterior approach have yet to be defined. Minimal access adrenalectomy undoubtedly offers optical magnification, and probably shorter hospital stay and lower postoperative pain. These criteria and benefits, which have been fully evaluated for cholecystectomy, will, in the case of adrenalectomy, require prospective studies with a larger number of patients. Endocrine surgeons are enthusiastically embracing this new technique. Although we have shown in the present study that laparoscopy is safe for adrenal gland removal, conversion should be readily carried out when necessary and not be considered a failure of the method. Laparoscopic adrenalectomy demands careful, meticulous technique by a surgical team trained and skilled in laparoscopic procedures.

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