

# Laparoscopic Operative Technique for Adrenal Tumors

Maciej Otto, MD, PhD, Grzegorz Szostek, MD, PhD, Sławomir Nazarewski, MD, PhD,  
Tomasz Borkowski, MD, Witold Chudzinski, MD, PhD, Tadeusz Tolloczko, MD, PhD

## ABSTRACT

**Background and Objectives:** Laparoscopy has acquired an unquestionable position in surgical practice as a diagnostic and operative tool. Recently, the laparoscopic approach has become a valuable option for adrenalectomy. This paper reports, in detail, our experience of laparoscopic adrenalectomy performed for adrenal tumors.

**Methods:** We performed 12 laparoscopic adrenalectomies from October 29, 1997 to October 31, 1998. The technique of laparoscopic adrenalectomy is described thoroughly in all relevant details for either left or right-sided adrenal lesions.

**Results:** The presented technique of laparoscopic adrenalectomy in all 12 cases provided good and relatively simple exposure of the immediate operative area. All relevant vascular elements were safely controlled, adrenal tumors could be successfully removed, and adequate hemostasis was achieved. No intraoperative or postoperative complications were observed.

**Conclusions:** Laparoscopic adrenalectomy is a safe alternative to open surgery and is preferred for most patients because of shorter postoperative hospital stay and less postoperative discomfort.

**Key Words:** Laparoscopy, Adrenalectomy, Operative technique.

## INTRODUCTION

The introduction of laparoscopy has been a turning point in the field of surgery as it has allowed the development of new operative techniques and approaches. Historically, laparoscopic surgery was first performed by von Ott in St. Petersburg in 1901,<sup>1</sup> while in 1933, Fures was the first to establish pneumoperitoneum using carbon dioxide.<sup>2</sup>

Positive experience with laparoscopic cholecystectomy (ie, a radical reduction of patients' postoperative discomfort, good cosmetic results, shorter hospitalization, fast return to normal activity as well as minimal postoperative morbidity<sup>3-6</sup>), has encouraged the use of laparoscopy in other types of surgical procedures.

Since 1992, studies on laparoscopic adrenalectomies have been reported mainly, though not exclusively, by the Japanese centers<sup>7-10</sup> and Gagner,<sup>11-13</sup> and Fernandez-Cruz et al.<sup>14</sup> Several alternative techniques of laparoscopic adrenalectomy have been described. The classic transperitoneal approach<sup>7-14</sup> was subsequently modified by Gagner et al,<sup>15</sup> who advocated the transabdominal approach in the lateral decubitus position. In 1995, Mercan et al<sup>16</sup> proposed the retroperitoneal approach to the suprarenal gland. Today, laparoscopic adrenalectomy, whose feasibility was initially rarely documented, has become another approach for the surgical treatment of adrenal disease.<sup>13,14,17,18</sup> Reporting our experience with 12 laparoscopic adrenalectomies performed over a period of 12 months, we present the laparoscopic technique employed in our department for surgical removal of adrenal tumors.

## PATIENTS AND METHODS

From October 29, 1997, when the first laparoscopic adrenalectomy was performed, to October 31, 1998, 12 laparoscopic adrenalectomies were performed in the Department of Vascular and Transplantation Surgery, Medical University of Warsaw. In all patients, unilateral adrenal tumors, with diameters ranging from 1.8 cm to 8 cm, were diagnosed by ultrasound and CT scans of the abdominal cavity. In two cases, the tumors were located in the left adrenal gland and in ten cases in the right

Department of Vascular and Transplantation Surgery,  
The Medical University of Warsaw, Banacha 1a, 02-097 Warsaw, Poland (all authors)

Address reprint request to: Maciej Otto, MD, PhD, Department of Vascular and Transplantation Surgery, Banacha 1a, 02-097 Warsaw, Poland. Telephone: (+48-22) 823 02 91, Fax: (+48-22) 659 54 55.

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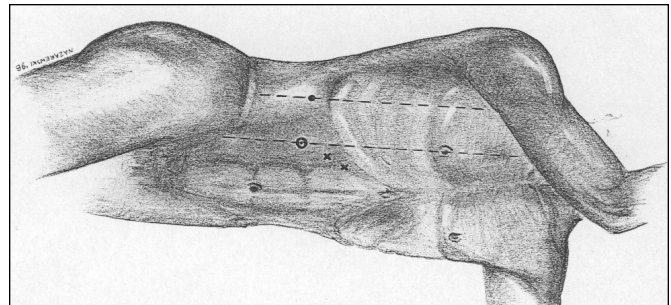
adrenal gland. Seven tumors were non-functional, while hyperaldosteronism was diagnosed by laboratory data in two patients and pheochromocytoma in three patients.

## OPERATIVE TECHNIQUE

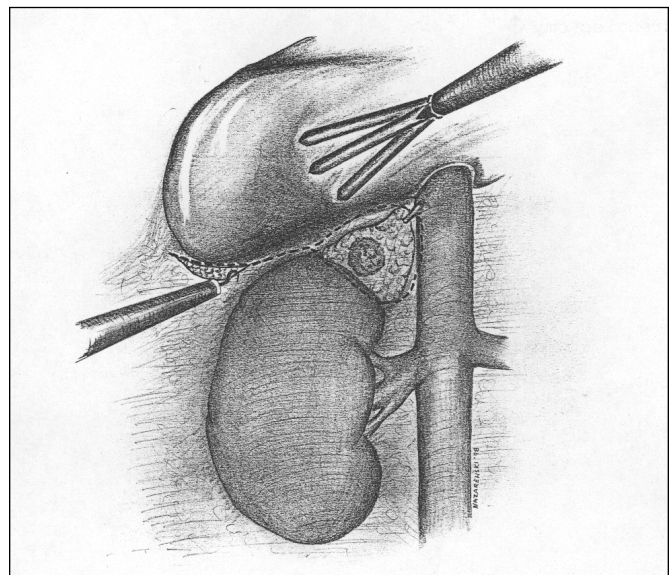
We used a transperitoneal lateral approach with the patient in a lateral decubitus position, rotated 60°. After the patient was rotated, four ports were placed (**Figure 1**) at a distance of 5-10 cm from the costal arch. The first 10/12-mm trocar used for videoendoscopic control was routinely inserted through a minilaparotomy incision between the midclavicular and anterior axillary line, depending on the patient's habitus and shape of the thorax, always laterally to the edge of the rectus abdominis muscle. The remaining three trocars were typically inserted under direct vision after establishing a CO<sub>2</sub> pneumoperitoneum with the abdomen inflated to the pressure of 12-14 mm Hg. Two 10-mm trocars were used to insert a laparoscopic hook, a clip applicator and other surgical instruments, and one 5-mm trocar was used for auxiliary instruments.

### Right Laparoscopic Adrenalectomy

After routine diagnostic inspection of the peritoneal cavity, the immediate operative area was exposed by elevating the right hepatic lobe and transection of the triangular ligament (**Figure 2**). Through the translucent parietal peritoneum, the adrenal gland could be seen, which was easily identified because of its characteristic color, shape and location. Next, the retroperitoneal space was opened, and the exposure and dissection of the adrenal gland with the involving tumor was begun using a laparoscopic hook at a low coagulation power, which allowed the maintenance of hemostasis. A small, round flap of the posterior parietal peritoneum was left on the anterior aspect of the adrenal gland to provide a stable and safe support for the instruments and to prevent 'crushing' of the adrenal gland, which might lead to intraoperative bleeding (**Figure 2**). After mobilization of the adrenal gland inferiorly and partially at its posterior aspect, the adrenal gland was dissected medially to visualize the inferior vena cava and to identify the suprarenal vein (**Figure 3**). The suprarenal vein was secured in a typical manner with three clips. After dissection of the suprarenal vein, the adrenal gland with its lesion was completely mobilized. In rare cases, additional clips were necessary to achieve tissue hemostasis during dissection of the adrenal gland, mainly owing to its charac-

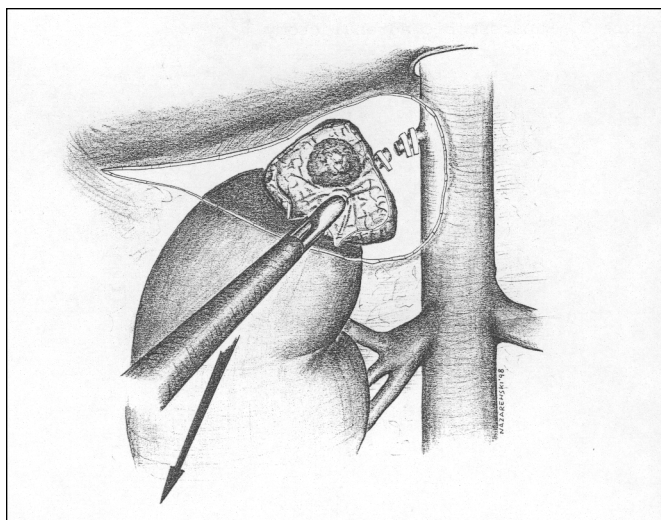


**Figure 1.** Location of trocars. o=10-12 mm (insufflation, videoendoscopic control, removal of the resected gland); x=10 mm (operating instruments, laparoscopic hook), ●=5 mm (auxiliary instruments).

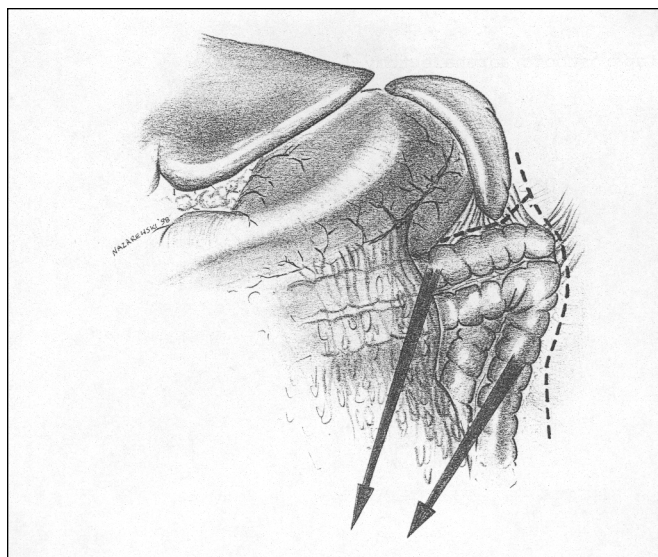


**Figure 2.** The right triangular ligament is divided and the hepatic lobe is elevated. Transection of the posterior parietal peritoneum is sufficient to expose the retroperitoneal space, and safe dissection of the adrenal gland together with its tumor can be safely dissected.

teristic arterial blood supply. Exposure of the operative area was maintained by abundant irrigation with saline and laparoscopic suction. Once the adrenal gland was totally excised and hemostasis maintained, the gland with its tumor was removed in a plastic laparoscopic bag through the 10/12-mm port. In this way, the so-called 'oncological cleanliness' was preserved, and the removed tissue was prevented from crushing and fragmentation.



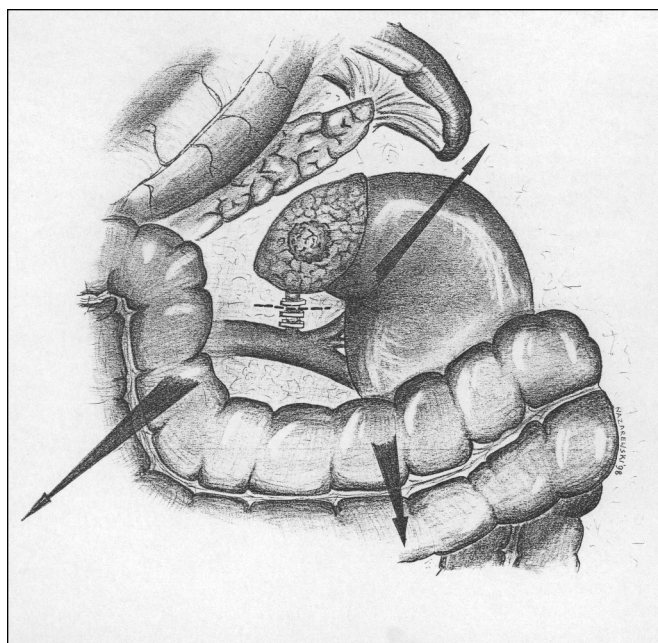
**Figure 3.** The suprarenal vein clipped after exposure of the inferior vena cava.



**Figure 4.** Transection of the posterior parietal peritoneum to adequately expose the left retroperitoneal space.

### Left Laparoscopic Adrenalectomy

In this procedure, the patient's position and placement of ports are similar to a right laparoscopic adrenalectomy. The immediate operative area, ie, the retroperitoneal space, is exposed by mobilization of the splenic flexure of the colon. Dissection of the phrenocolic ligament and splenic attachments allowed the retraction of the colon downward and to the right to expose the retroperitoneal space (**Figure 4**). After the identification of the kidney, spleen, lower edge of the pancreas and posterior wall of the stomach, the operation was continued in the quadrilateral area bounded inferiorly by the retracted colon (**Figure 5**). The dissection within the retroperitoneal adipose tissue began with the incision of Gerote's fascia to expose a 'clean' fibrous capsule of the kidney. The left adrenal gland with its tumor could be expected to be found medially. Technically, laparoscopic excision of the left adrenal gland is more difficult than a right adrenalectomy because the pancreas may be mistaken for the left adrenal gland. Such intraoperative error may be avoided by observing the rule that if a structure that is being dissected just looks like the adrenal, it certainly is not this gland. The adrenal gland must be unmistakably identified by its characteristic color and appearance. Proper identification is also ensured by appropriate sequence of dissecting and exposing of relevant anatom-



**Figure 5.** Anatomical conditions for safe clipping of the suprarenal vein.

ical structures. Exposure of the left renal vein and the left suprarenal vein that it gives off is of primary importance, followed by dissection of the adrenal gland with its tumor. It is also possible to expose the renal capsule first, proceeding medially from its apex to identify and separate the adrenal gland from the perirenal fat to expose the suprarenal vein. Such an approach seems much easier when the tumor involving the adrenal gland is not too small. When left laparoscopic adrenalectomy is to be performed, the tumor should not be less than 2 cm in diameter. The suprarenal vein was secured typically with three clips (**Figure 5**). With hemostasis maintained, the tissue was removed in a plastic laparoscopic bag through a minilaparotomy incision. Routinely, no drains were left in the abdominal cavity.<sup>19</sup>

## RESULTS

In all 12 cases, the technique of laparoscopic adrenalectomy described above proved to be a safe and efficient method for adrenal lesions involving either the right or the left gland. It provided good and relatively simple exposure of the immediate operative area, ie, the retroperitoneal space. All relevant vascular structures could be easily visualized, and hemostasis was maintained in all 12 patients. There were no intraoperative complications, and, in all cases, the postoperative course was uneventful.

## DISCUSSION

A transperitoneal lateral approach for laparoscopic adrenalectomy is safe and allows good visualization of the adrenal gland together with its tumor involvement.<sup>9,10,13,19</sup> In the transabdominal method, the adrenal region is exposed by mobilizing either the liver or the spleen. The inferior vena cava and the left renal vein are the most important landmarks for further dissection and orientation.<sup>20</sup> The outcome and duration of the procedure depend to a large extent on the surgeon's technical experience gained during other laparoscopic procedures, such as cholecystectomy, as well as the experience with techniques of open adrenalectomy.<sup>7,10,13,17,18</sup> However, the lateral decubitus approach is the procedure of choice in most cases.<sup>21</sup>

As left adrenalectomy performed using the transabdominal approach is technically more demanding due to the anatomical position of the left adrenal gland, the

retroperitoneal approach may be a feasible alternative. Although the number of trocars required to visualize the immediate operative area differs with the two approaches — four to six trocars are needed with the transabdominal approach and only three trocars with the retroperitoneoscopic method — both orientation in the operative area<sup>22</sup> and removal of larger tumors are more difficult with the retroperitoneal approach. With this approach, safe dissection in the retroperitoneal space and anatomical identification on the left side are possible with the exposure of Gerota's fascia. The left adrenal gland is then found by opening Gerota's fascia onto the superior pole of the kidney and dissecting medially and parallel to the ventromedial surface of the kidney.<sup>23</sup> Both approaches — transperitoneal and retroperitoneal — seem safe and efficient for laparoscopic adrenalectomy, while the retroperitoneal method may be considered the method of choice in patients with a previous history of abdominal surgery.<sup>24</sup>

The advisability of creating pneumoperitoneum with carbon dioxide is still a matter of dispute not only in laparoscopic procedures as such, but when the adrenal tumors are hormonally active, as in Cushing's syndrome and pheochromocytoma.<sup>7,9,13</sup> Studies by Col,<sup>25</sup> Fernandez-Cruz,<sup>24</sup> and Mobius et al,<sup>26</sup> however, did not confirm these reservations.

Advances in the identification of endocrine causes of arterial hypertension have had a considerable impact on the surgery of the adrenals<sup>7,13,17,18</sup> as they allow proper diagnosis and precise localization of the tumor. In many cases, the extent of the operation may be limited by performing unilateral adrenalectomy using a lateral approach along the 11th rib<sup>27</sup> or laparoscopic adrenalectomy.<sup>7,9,10,13,14,17,18</sup>

## CONCLUSIONS

Laparoscopic adrenalectomy is a safe operative method, with shorter hospital stay and less postoperative discomfort to the patient. Our experience suggests that laparoscopic adrenalectomy may be a method recommended for planned removal of the adrenal gland in cases of its involvement with tumor.

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