

## Chapter 25

# Adrenalectomy

Riccardo Autorino, Marco De Sio, and Abhay Rane

**Abstract** Multiple series have demonstrated the benefits of laparoscopic adrenalectomy techniques when compared to open surgery. Laparoendoscopic single-site surgery (LESS) for adrenal gland has been effectively performed for a number of indications and a wide variety of approaches have been described. That said, there are still obvious technical difficulties associated with LESS and, in particular, LESS adrenalectomy is regarded as a highly challenging procedure. “Reduced port laparoscopic surgery” has been implemented as a way of moving forward towards the path of *scarless* surgery by overcoming the constraints of LESS. Herein we describe the techniques for reduced port laparoscopic adrenalectomy (RPLA), in both supine and prone position. As far as the approach is concerned, both transperitoneal and retroperitoneal techniques have demonstrated similar outcomes with appropriate patient selection criteria. The anterior transperitoneal route is used with the patient in supine position. This technique can present few advantages, including easy positioning of the patient on the operative table, clear evidence of anatomical landmarks, wider exposure of the adrenal gland, early ligation of the main adrenal vein before gland manipulation, the possibility to perform a bilateral procedure, easy immediate conversion to open in the case of major bleeding. Adrenalectomy with the patient in the prone position can also be used. Overall, RPLA represents a viable option in the surgical management of adrenal diseases. Its main feature is represented by the possibility of restoring the triangulation needed to optimize working angles while minimizing the scar associated with the procedure.

---

R. Autorino

Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH, USA

Second University of Naples, Naples, Italy

M. De Sio

Second University of Naples, Naples, Italy

A. Rane (✉)

Department of Urology, East Surrey Hospital, Redhill, Surrey, UK

e-mail: [a.rane@btinternet.com](mailto:a.rane@btinternet.com)

**Keywords** Adrenalectomy • Prone position • Reduced port laparoscopy • Supine position

## 25.1 Introduction

Since 1992 [1], laparoscopic adrenalectomy (LA) has been performed using different approaches, including the anterior [2] and lateral [3] transperitoneal approach, as well as via the lateral [4] and posterior [5] retroperitoneal approach. Multiple series have demonstrated the benefits of LA techniques, specifically the decreased requirements for analgesics, improved patient satisfaction, and shorter hospital stay and recovery time when compared to open surgery [6].

Over the last 5 years, a step towards *scarless* surgery has been made with the introduction and development of single-site or single-port laparoscopic techniques [7], comprehensively defined as laparoendoscopic single site surgery (LESS) [8, 9].

LESS adrenal surgery has been effectively performed for a number of indications and a wide variety of approaches (transperitoneal versus retroperitoneal, multichannel trocar versus multiple ports, trans- or extraumbilical) have been described [10]. That said, there are still obvious technical difficulties associated with LESS surgery and, in particular, LESS adrenalectomy is regarded as a highly challenging procedure [11].

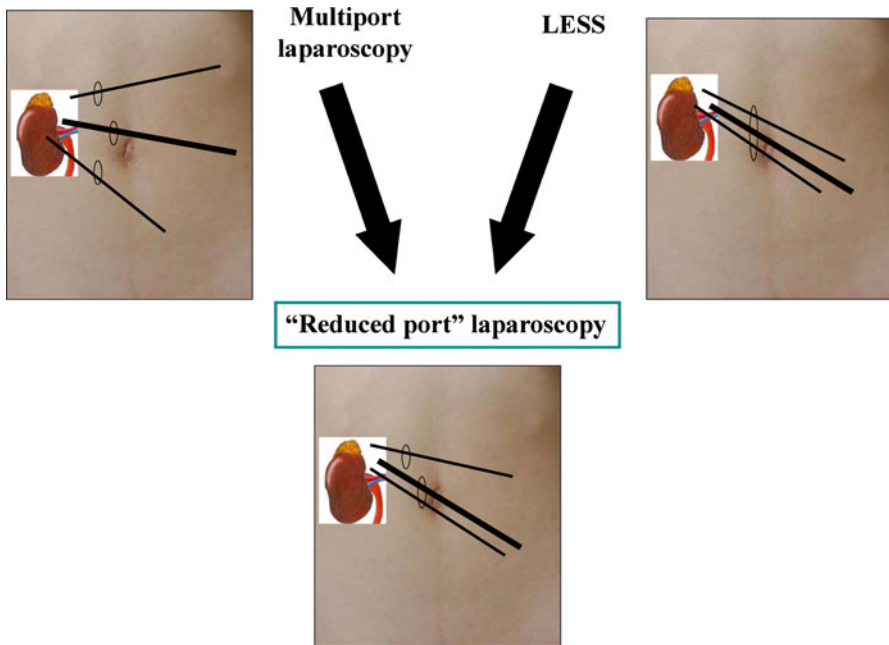
In general, laparoscopic surgery is done with one hand performing dissection and the other hand providing traction, thus making it necessary to coordinate bimanual motions. The difficulties encountered in LESS surgery mainly arise from the “sword fighting” of the instruments. Bent instruments can be used to minimize this “fighting”, but the angle of the bent instruments needs to be adjusted, and these maneuvers require quite a bit of time. Moreover, because the distance from the port to the tissue in the transumbilical approach is longer than in the conventional laparoscopic approach, the approach becomes more tangential in direction in LESS.

Thus, the concept of “reduced port laparoscopic surgery (RPLS)” has been implemented [12], and seen as a way of moving forward towards the path of *scarless* surgery by overcoming the constraints of LESS (Fig. 25.1). Several series have been reported in the field of general surgery [13, 14], whereas limited evidence is available in urology [15, 16].

Herein we describe the techniques for reduced port laparoscopic adrenalectomy (RPLA), in both supine and prone position.

## 25.2 Surgical Indications

As a general principle, all eligible laparoscopic surgery patients may be considered for LESS depending on surgeons’ own experience. The same criterion can be used for RPLS (Table 25.1). When starting out with a new technique, patient selection



**Fig. 25.1** Overcoming the challenges of LESS: the concept of RPLS

**Table 25.1** Indications to RPLS (adapted from [10])

Factor	Feature	Initial indication	Advanced indication
Adrenal mass	Size	<4 cm	Up to 10 cm
	Type	Nonfunctioning and functioning adenoma	Adrenal metastasis; pheochromocytoma; adrenocortical carcinoma
	Number	Single	Multiple (including bilateral)
	Stage <sup>a</sup>	Localized	Localized
Patient	BMI	Non-obese	Obese
	Previous surgery	No	Yes

<sup>a</sup>For malignant masses

criteria are expected to be stringent. Disease as well as patient features should be considered. With growing experience, indications can be expanded to include more challenging cases, which is likely to be facilitated by a RPLS versus a pure LESS approach. In general, there should be a low threshold for conversion to standard laparoscopy, or even open surgery if necessary.

As far as the approach is concerned, both transperitoneal and retroperitoneal techniques have demonstrated similar outcomes with appropriate patient selection criteria. Overall, patients with smaller tumors and previous abdominal operation seem to be more suitable for the retroperitoneal approaches for the prone approach.

On the other hand it can become more challenging to proceed with a retroperitoneal approach in patients with a high body mass index and thick posterior back soft tissue planes.

## **25.3 Technique**

### ***25.3.1 RPLA: Transperitoneal Approach in Supine Position***

The anterior transperitoneal route is used with the patient in supine position [17]. This technique can present few advantages, including easy positioning of the patient on the operative table, clear evidence of anatomical landmarks, wider exposure of the adrenal gland, early ligation of the main adrenal vein before gland manipulation, the possibility to perform a bilateral procedure, easy immediate conversion to open in the case of major bleeding.

A 2.5-cm vertical incision is made within the umbilical ring, through which a SILS™ port (Covidien, New Haven, CT, USA). In alternative, other commercially available multi-channel ports can be used, such as the Triport™ (Olympus, Tokyo, Japan) or standard trocars placed within the same skin incision but through different fascial incisions (in this case a 5-mm nonbladed trocar can be placed side-by-side with the camera trocar). Besides the umbilical site, a 3-mm or a 5-mm nonbladed trocar is then placed along the anterior axillary line. This access site is used for the left or the right hand depending on the site of the surgery. A variety of instruments can be used depending on surgeon's preference, including vessel-sealing devices such as Ligasure™ (Covidien) or Harmonic™ scalpel (Ethicon, Cincinnati, OH, USA).

The surgical strategy follows a conventional transperitoneal adrenalectomy. Once the white line of Toldt's fascia is incised, the junction of the colonic mesentery and Gerota's fascia is identified. This plane is then dissected to the renal vein. The adrenal veins are identified, clipped with 5-mm Hem-O-Lok clips (Teleflex Medical, Research Triangle Park, NC, USA), and divided. A vessel-sealing device can be used to complete the adrenal dissection. The specimen is extracted by removing the 10-mm bag through the enlarged paraumbilical trocar site.

### ***25.3.2 RPLA: Retroperitoneal Approach in Prone Position***

Adrenalectomy with the patient in the prone position (and with moderately bent hip joints) has been detailed for both standard retroperitoneoscopy [18] and single-site retroperitoneoscopy [19]. The same principles are used for the RPLS technique. Regardless the technique, besides the number of access points, the procedure remains the same.

Initially, a 1.5 cm transverse incision just below the tip of the 12th rib is performed. After having prepared the subcutaneous and muscle layer by sharp and blunt dissection, the retroperitoneal space was easily accessible by digital perforation of the dorsolumbar fascia. A small cavity is prepared digitally for balloon dilatation with a special distension balloon trocar, which is insufflated under endoscopic control for a few minutes. After removing the distension trocar, a 5-mm standard trocar is introduced with internal finger guidance 4–5 cm laterally (medioaxillary line) to the initial incision site. Thus safe trocar placement is possible without visual control. Finally, a blunt trocar with an inflatable balloon and an adjustable sleeve is introduced into the initial incision site and blocked. Pneumoretroperitoneum is created by high (20 mmHg) CO<sub>2</sub> pressure. Retroperitoneoscopy is performed by a 10-mm 30° endoscope which is introduced into the port. The endoscope itself can eventually allow a step-by-step creation of the retroperitoneal space by disruption of the Gerota's fascia and by pushing the retroperitoneal fatty tissue bluntly downwards. Thereby, the area of the adrenal gland and the upper renal pole are exposed.

As the next step, a 5-mm bipolar scissor (LigaSure® (Covidien)) can be introduced through the lateral port so that following steps of dissection are completely performed in a single hand technique with the non-dominant hand holding the camera.

First of all, the upper pole of the kidney is mobilized. Dissection of the adrenal gland begins from lateral to medial on the backside of the peritoneum identifying the lower pole of the adrenal gland. On the right side, the adrenal arteries cross the vena cava medially posteriorly. These vessels are separated with a bipolar scissor. By lifting up the adrenal gland, the inferior vena cava is visualized posteriorly in its retroperitoneal cranial segment. The short suprarenal vein thus becomes clearly visible running postero-laterally. This vessel is followed for a length of 0.5–1 cm and divided by bipolar scissor. Eventually, clips can be used for the main adrenal vein. Preparation of the right adrenal gland is completed by lateral and cranial dissection. For the left-sided adrenalectomy, an extended mobilization of the upper pole of the kidney is essential as the lower pole of the adrenal gland lies in front of the kidney. Thereafter, the inferior part of the gland can be visualized and dissected. The typical main left adrenal vein joins the diaphragmatic vein between the upper pole of the kidney and the spine. After dissection of the adrenal vein with the bipolar scissor the gland is mobilized. In case of partial adrenalectomy, extent of dissection depends on the localization of the neoplasia. The parenchyma is divided with the bipolar scissor.

To prevent injury of the adrenal capsule an en-bloc resection of the gland with the surrounding fatty tissue must always be pursued. The completely mobilized tissue is placed in a retrieval bag, which is inserted directly through the skin incision and pulled through the initial sub-costal incision after removal of camera and its port. After specimen removal, the surgical field is checked for hemostasis.

An alternative option in the disposition of the ports is to remove the initially placed 10-mm port and place in the same site a 5-mm port and a 3.5-mm port inserted through the same incision. Then, a 3.3-mm 30° endoscope is used and the 5-mm port, which lies on the same axis of the camera mini-port, can be used for suction or counter-traction.

## 25.4 Conclusions

RPLA represents a viable option in the surgical management of adrenal diseases. Its main feature is represented by the possibility of restoring the triangulation needed to optimize working angles while minimizing the scar associated with the procedure. The technique can be regarded as a safe way to move towards the more challenging LESS, whose intrinsic limitations can translate into a steep learning curve. Further clinical research is warranted to define the role of both RPLS and LESS in the advancing field of minimally invasive adrenal surgery.

## References

1. Gagner M, Lacroix A, Bolté E (1992) Laparoscopic adrenalectomy in Cushing's syndrome and pheochromocytoma. *N Engl J Med* 327(14):1033
2. Rassweiler JJ, Henkel TO, Potempa DM, Coptcoat M, Alken P (1993) The technique of transperitoneal laparoscopic nephrectomy, adrenalectomy and nephroureterectomy. *Eur Urol* 23(4):425–430
3. Gagner M, Pomp A, Heniford BT, Pharand D, Lacroix A (1997) Laparoscopic adrenalectomy: lessons learned from 100 consecutive procedures. *Ann Surg* 226(3):238–246
4. Gasman D, Droupy S, Koutani A et al (1998) Laparoscopic adrenalectomy: the retroperitoneal approach. *J Urol* 159(6):1816–1820
5. Baba S, Miyajima A, Uchida A, Asanuma H, Miyakawa A, Murai M (1997) A posterior lumbar approach for retroperitoneoscopic adrenalectomy: assessment of surgical efficacy. *Urology* 50(1):19–24
6. Gumbs AA, Gagner M (2006) Laparoscopic adrenalectomy. *Best Pract Res Clin Endocrinol Metab* 20(3):483–499
7. Rané A, Rao P, Rao P (2008) Single-port-access nephrectomy and other laparoscopic urologic procedures using a novel laparoscopic port (R-port). *Urology* 72(2):260–263
8. Gill IS, Advincula AP, Aron M et al (2010) Consensus statement of the consortium for laparoendoscopic single-site surgery. *Surg Endosc* 24(4):762–768
9. Autorino R, Cadeddu JA, Desai MM et al (2011) Laparoendoscopic single-site and natural orifice transluminal endoscopic surgery in urology: a critical analysis of the literature. *Eur Urol* 59(1):26–45
10. Rane A, Cindolo L, Schips L, De Sio M, Autorino R (2012) Laparoendoscopic single site (LESS) adrenalectomy: technique and outcomes. *World J Urol* 30(5):597–604
11. Ishida M, Miyajima A, Takeda T, Hasegawa M, Kikuchi E, Oya M (2013) Technical difficulties of transumbilical laparoendoscopic single-site adrenalectomy: comparison with conventional laparoscopic adrenalectomy. *World J Urol* 31(1):199–203
12. Curcillo PG 2nd, Podolsky ER, King SA (2011) The road to reduced port surgery: from single big incisions to single small incisions, and beyond. *World J Surg* 35(7):1526–1531
13. Costedio MM, Aytac E, Gorgun E, Kiran RP, Remzi FH (2012) Reduced port versus conventional laparoscopic total proctocolectomy and ileal J pouch-anal anastomosis. *Surg Endosc* 26(12):3495–3499
14. Monclova JL, Targarona EM, Vidal P et al (2013) Single incision versus reduced port splenectomy—searching for the best alternative to conventional laparoscopic splenectomy. *Surg Endosc* 27(3):895–902
15. Cho HJ, Choi YS, Bae WJ et al (2012) Two-port laparoscopic donor nephrectomy with simple retraction technique. *Urology* 80(6):1379–1382

16. Sumino Y, Nakano D, Mori K, Nomura T, Sato F, Mimata H (2011) Left transperitoneal adrenalectomy with a laparoendoscopic single-site surgery combined technique: initial case reports. *Case Rep Med* 2011:651380
17. Lezoche E, Guerrieri M, Crosta F, Paganini A, D'Ambrosio G, Lezoche G, Campagnacci R (2008) Perioperative results of 214 laparoscopic adrenalectomies by anterior transperitoneal approach. *Surg Endosc* 22(2):522–526
18. Walz MK, Alesina PF, Wenger FA et al (2006) Posterior retroperitoneoscopic adrenalectomy—results of 560 procedures in 520 patients. *Surgery* 140(6):943–948
19. Walz MK, Alesina PF (2009) Single access retroperitoneoscopic adrenalectomy (SARA)—one step beyond in endocrine surgery. *Langenbecks Arch Surg* 394(3):447–450