



Retroperitoneoscopic adrenalectomy: indications and technical considerations

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Abstract: Adrenal surgery has experienced vast advances over the past decade, including optimization of the laparoscopic technique. Currently, the transabdominal laparoscopic and retroperitoneoscopic procedures are two mainstay approaches to minimally invasive adrenalectomy. The latter approach is associated with decreased hospital stay and reductions in post-operative pain, allowing for smoother patient recovery when compared with transabdominal laparoscopic procedures. Despite the steep learning curve associated with this procedure, standardization of the posterior retroperitoneoscopic approach (PRA) has allowed for wider recognition and adoption within high-volume endocrine surgery centers and, as a result, this approach has become widely accepted in the field of endocrine surgery. This procedure is currently indicated in patients presenting with either functional or non-functional adrenal tumors. This can also be advantageous for cases requiring a bilateral adrenalectomy as the need for repositioning is eliminated. Notably, surgeons have successfully used this approach in the treatment of pheochromocytomas and metastatic disease in select patients. Contraindications to this approach include patients with BMI >40, cases with tumor sizes exceeding 7 cm, and cases where there is a high clinical suspicion of invasion into surrounding organs or malignancy. Steps to this approach have been summarized with an algorithmic approach, considering the differences in anatomic landmarks depending on the laterality of the tumor. Taken together, the ability to treat adrenal tumors regardless of functional status, option for bilateral mass resection, standardization of steps and direct access to the tumor all make the PRA an excellent option for minimally invasive adrenalectomies in the appropriate patient population.

Keywords: Retroperitoneoscopic adrenalectomy; minimally-invasive surgery

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Introduction

While a minimally invasive approach to adrenal surgery has become the preferred method, which particular method to choose remains at the discretion of the operating surgeon. Two surgical methods to minimally invasive adrenalectomy currently exist: transabdominal laparoscopic and posterior retroperitoneoscopic (1). These minimally invasive approaches have been widely adopted due to their shorter length of stay, decreased post-operative pain and earlier return to baseline activity (2). Laparoscopic adrenalectomy

was first described in 1992 in Japan, and the retroperitoneal approach was introduced shortly after, in 1995 (2). Since then, it has slowly been adopted by select, high-volume endocrine surgery centers. Pioneers of this technique have been able to standardize the approach to gain wider acceptance within the field of endocrine surgery.

Indications

The retroperitoneoscopic approach is indicated for

Table 1 Indications and contraindications for adrenalectomy approaches (11-14)

Items	Laparoscopic transabdominal approach	Posterior retroperitoneoscopic approach
Indications	Need to combine procedure with other abdominal operations (14)	Need for bilateral adrenalectomy (14)
	Hormonally active tumors (11)	Hormonally active neoplasms <7 cm (13)
	Obese patients (BMI >30) (12)	Nonfunctional neoplasms 4–7 cm (13)
Contraindications	Failure to tolerate pneumoperitoneum (14)	Inability to tolerate prone position (14)
	Suspected malignancy or high risk of malignancy (14)	Suspected malignancy or high risk of malignancy (13)
	Invasion into neighboring organs (14)	Invasion into neighboring organs (13)
	Inability to tolerate longer operative times and longer courses of anesthesia (14)	BMI >40 and tumors >7 cm (13)

biochemically functional or large, benign adrenal neoplasms (3,4). Adrenocortical carcinomas, or tumors which appear to be suspicious for carcinoma (based on imaging characteristics) can be approached laparoscopically if they are less than 6 cm (according to most authors recommendations) (3–6). If there is concern for invasion into surrounding structures during the operation, then conversion to an open approach is recommended. Of note, the retroperitoneoscopic approach is safer and faster than the transperitoneal approach for large pheochromocytomas (7). Studies also suggest that this approach is safe and feasible for patients with metastatic tumors isolated to the adrenal gland, and may be particularly favorable for patients with a high risk for significant intraperitoneal adhesions (8,9). Laparoscopic surgery continues to push the envelope and new literature demonstrates successful removal of metastatic tumors and pheochromocytomas.

Approaches to retroperitoneal adrenalectomy have expanded to include mini-laparoscopic and even single-port robotic-assisted adrenalectomies, which may circumvent the risk for venous hemorrhaging, a dangerous complication of the laparoscopic approach, and reduce narcotic use post-operatively (10). However, due to the increased cost and limited data on the outcomes of these procedures, posterior retroperitoneoscopic adrenalectomy remains a mainstay approach to treatment of adrenal tumors.

Relative contraindications to this particular approach include the following: extremely large tumors, malignant tumors with invasion into surrounding structures, or inadequate working space between the 12th rib and posterior superior iliac crest (PSIC). The patient's inability to tolerate general anesthesia or lay prone for the procedure pose as strict contraindications to the retroperitoneal approach (*Table 1*).

Retroperitoneal approaches can be performed laterally or posteriorly (*Figure 1*). The posterior retroperitoneoscopic approach (PRA) can be utilized in adrenal masses in which the patient's body habitus allows. The distance between the 12th rib and the iliac crest should be one handsbreadth. Ideally, a patient's BMI (body mass index) should be below 35, however, there is no precise cutoff for BMI. Relative contraindications to the approach include a BMI >40 and tumors >7 cm, as the patient's position can increase intra-abdominal pressure. Additionally, it is more difficult to convert to an open adrenalectomy in PRAs than in lateral retroperitoneoscopic approaches (10,15). Reasons for conversion to the transabdominal approach include patient size (BMI >45), which can cause compression of the retroperitoneum by abdominal organs when placing the patient in the prone position (15,16), and inability to tolerate high insufflation pressures.

PRA has several advantages over the lateral retroperitoneoscopic approach. This approach offers the unique ability to avoid repositioning patients in the case of a bilateral adrenalectomy. It also offers an undisturbed plane for the surgeon without the risk of encountering previous scar tissue in patients with prior abdominal surgical procedures. Furthermore, direct access to the retroperitoneoscopic space allows the surgeon to approach the adrenal without manipulation of the intestine, or mobilization of the colon. This reduces the risk of post-operative ileus, and markedly decreases the hospital length of stay with these procedures (2,3).

Technical considerations

PRA carries a steeper learning curve than the transabdominal

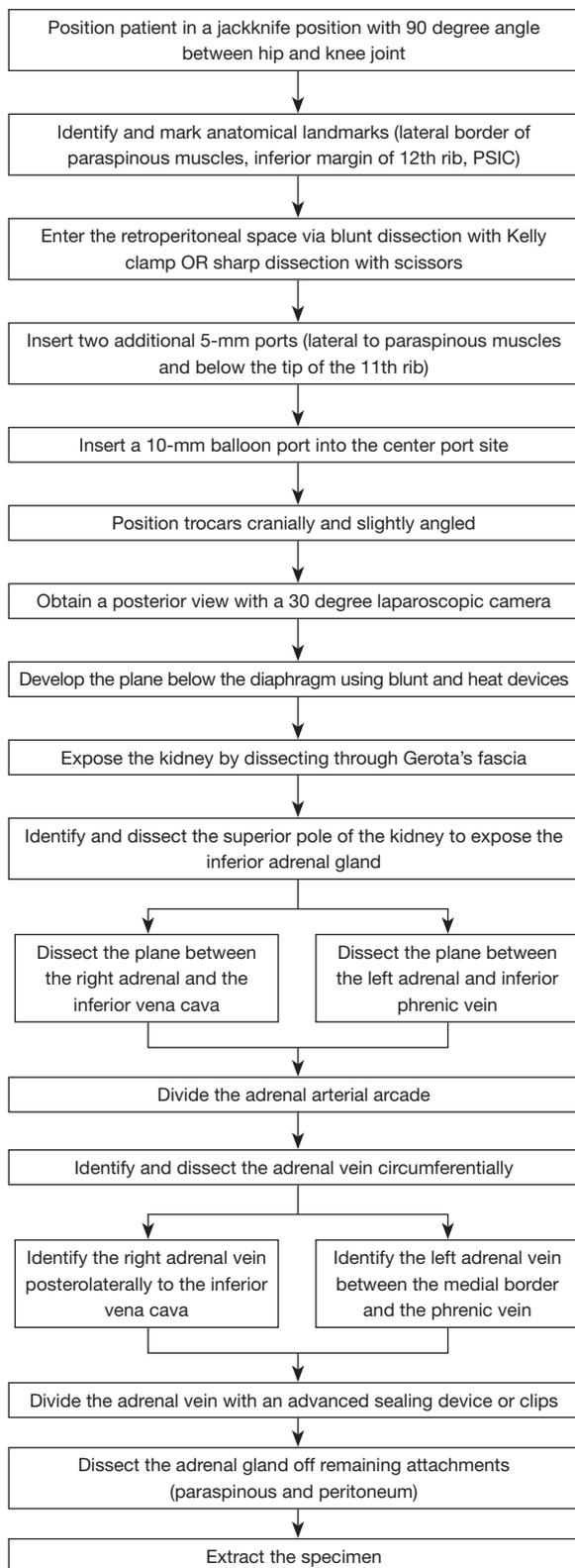


Figure 1 Algorithm for PRA. PSIC, posterior superior iliac crest; PRA, posterior retroperitoneoscopic approach.

laparoscopic approach. The retroperitoneal space can appear unfamiliar when approaching the adrenal gland posteriorly. The learning curve reported in the literature is on average 30 cases, if performed by an experienced laparoscopic surgeon (2).

Technical considerations rely heavily on patient positioning. Patients are positioned in a jackknife position with a 90-degree angle between the hip and knee joint. Due to the limited working space, the patient ideally is positioned in a way to maximize the distance from the iliac crest to the costovertebral angle.

Marking anatomical landmarks prior to incision can be helpful for operative planning. The authors recommend identifying the lateral border of the paraspinous muscles, the inferior margin of the 12th rib, as well as the PSIC. The first incision should be placed below the angle of the 12th rib, with allotment for three trocars across the back. The incision should allow your finger to help with blunt dissection and be able to fit a 10 mm trocar. Entrance into the retroperitoneal space is accomplished by blunt dissection with a Kelly clamp or sharp dissection with scissors. Once you have entered the retroperitoneal space, perform a finger sweep.

Two additional five mm ports should be placed under finger guidance just lateral to the paraspinous muscles and below the tip of the 11th rib. Once the 5 mm ports are inserted a ten mm balloon port is placed. The trocars are positioned cranially at a slight angle to allow for full motion of the instruments. We recommend using a 30-degree laparoscope. Creating the retroperitoneal space can be the most challenging task. A combination of blunt and heat device is recommended to develop the plane below the diaphragm. The fatty tissue encountered should be pushed down and Gerota's fascia should be opened to identify the kidney.

Our ideal angle to approach the dissection is to start at the superior pole of the kidney. One blunt open jawed grasper should be used to push down the kidney; approaching the superior pole of the kidney will allow the inferior aspect of the adrenal gland to come into view. The small arterial vessels feeding the adrenal gland can be divided using an electrocautery device. Dissection should continue in this plane, leaving the superior attachments to of the adrenal gland intact.

On the right side, when lifting the adrenal gland up, the inferior vena cava will come into view. The adrenal vein should be identified postero-laterally. On the left side, the adrenal vein can be identified in the space between

the medial aspect of the gland and the phrenic vein. This branch is normally medial to the upper pole of the kidney. Once the adrenal vein is isolated, it is recommended that it is circumferentially dissected and ligated using heat device or application of clips. The dissection is then continued medially, laterally and cranially; the adrenal vein stump can be used as the grasping handle. Once the entirety of the adrenal gland is dissected free it should be extracted in a specimen bag.

Technical considerations when attempting the PRA approach include using high-pressure CO₂ insufflation (our preferred pressure is 25 mmHg). The retroperitoneal space can tolerate these higher insufflation pressures without causing any cardiovascular changes to the patient. This not only creates additional space, which is needed due to the limited working space in this approach, but also tamponades minor bleeding from small arterioles. Prior to closing, the pressure should be decreased and an additional check for hemostasis should be performed. The higher pressure used can also cause subcutaneous emphysema of the neck and chest. This tends to be asymptomatic and should not alter hospital length of stay.

Potential complications of this approach include pneumothorax during placement of trocars or diaphragm dissection. Additionally, violation of the peritoneal cavity can lead to damage to the spleen or tail of the pancreas on the left or the liver on the right.

The retroperitoneoscopic approach is a valuable approach to adrenal surgery. Despite its challenging learning curve, the standardization of steps and direct access to the tumor make it an excellent option for minimally invasive surgeons.

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Footnote

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References

1. Kwak J, Lee KE. Minimally Invasive Adrenal Surgery. *Endocrinol Metab (Seoul)* 2020;35:774-83.
2. Alesina PF. Retroperitoneal adrenalectomy—learning curve, practical tips and tricks, what limits its wider uptake. *Gland Surg* 2019;8:S36-40.
3. Constantinides VA, Christakis I, Touska P, et al. Systematic review and meta-analysis of retroperitoneoscopic versus laparoscopic adrenalectomy. *Br J Surg* 2012;99:1639-48.
4. Goitein D, Mintz Y, Gross D, et al. Laparoscopic adrenalectomy: ascending the learning curve. *Surg Endosc* 2004;18:771-3.
5. Gagner M, Lacroix A, Bolté E. Laparoscopic adrenalectomy in Cushing's syndrome and pheochromocytoma. *N Engl J Med* 1992;327:1033.
6. Mercan S, Seven R, Ozarmagan S, et al. Endoscopic retroperitoneal adrenalectomy. *Surgery* 1995;118:1071-5; discussion 1075-6.
7. Shiraishi K, Kitahara S, Ito H, et al. Transperitoneal versus retroperitoneal laparoscopic adrenalectomy for large pheochromocytoma: Comparative outcomes. *Int J Urol* 2019;26:212-6.
8. Goto T, Inoue T, Kobayashi T, et al. Feasibility of laparoscopic adrenalectomy for metastatic adrenal tumors in selected patients: a retrospective multicenter study of Japanese populations. *Int J Clin Oncol* 2020;25:126-34.
9. Dickson PV, Jimenez C, Chisholm GB, et al. Posterior retroperitoneoscopic adrenalectomy: a contemporary American experience. *J Am Coll Surg* 2011;212:659-65;

- discussion 665-7.
10. Zino S, O'Dwyer P, Watson C. Mini-laparoscopic trans-abdominal adrenalectomy: A novel technique. *Eur J Surg Oncol* 2017;43:2389.
 11. Brunt LM, Moley JF, Doherty GM, et al. Outcomes analysis in patients undergoing laparoscopic adrenalectomy for hormonally active adrenal tumors. *Surgery* 2001;130:629-34; discussion 634-5.
 12. Epelboym I, Digesu CS, Johnston MG, et al. Expanding the indications for laparoscopic retroperitoneal adrenalectomy: experience with 81 resections. *J Surg Res* 2014;187:496-501.
 13. Walz MK, Alesina PF, Wenger FA, et al. Posterior retroperitoneoscopic adrenalectomy--results of 560 procedures in 520 patients. *Surgery* 2006;140:943-8; discussion 948-50.
 14. Madani A, Lee JA. Surgical Approaches to the Adrenal Gland. *Surg Clin North Am* 2019;99:773-91.
 15. Arghami A, Dy BM, Bingener J, et al. Single-port robotic-assisted adrenalectomy: feasibility, safety, and cost-effectiveness. *JSLs* 2015;19:e2014.00218.
 16. Oh JY, Chung HS, Yu SH, et al. Comparison of surgical outcomes between lateral and posterior approaches for retroperitoneal laparoscopic adrenalectomy: A single surgeon's experience. *Investig Clin Urol* 2020;61:180-7.

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