

Open Adrenalectomy for Management of Suprarenal Masses

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Abstract

In an era when minimally invasive adrenalectomy is the gold standard treatment for majority of patients presenting with adrenal tumours, open adrenalectomy has become an operation that should be centralised in regional referral centers. Its main indication is represented by patients with large (>8 cm) pheochromocytomas and patients with cortical adrenal tumours suspected of malignancy either because of their size (>4–6 cm) or because of radiological appearance of local invasion. Based on local expertise some of these patients might benefit from multidisciplinary input from liver or transplant surgeons. This chapter will discuss the anatomical landmarks and will comment on different steps in the procedure for right- or left-sided procedure. It is outside the scope of this chapter to settle the ongoing debate about patient selection for laparoscopic or open adrenalectomy when the diagnosis of adrenocortical cancer is suspected preoperatively.

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Introduction

The sole surgical option for adrenalectomy was open adrenalectomy until the advent of laparoscopic adrenalectomy in the early 1990s. As a subspecialty of abdominal surgery, adrenal gland surgery first appeared at the close of the nineteenth century. Knowsley-Thornton reported successfully removing a big adrenal tumor in 1889, and in 1926, a pheochromocytoma was excised by Roux of Lausanne, Switzerland, and Charles Mayo of Rochester, Minnesota (1).

Cahill, an early proponent of adrenal surgery, initially favored the anterior technique (2). With its technical benefits of being extraperitoneal, extrapleural, and subdiaphragmatic, as well as its clinical advantages of being linked with minimal postoperative morbidity, the posterior technique was first

reported by Young (3). Because laparoscopic and retroperitoneoscopic adrenalectomy are now available to all patients who were previously considered to benefit from this treatment, the posterior approach is no longer used in modern surgical practice.

Open adrenalectomy's technical details are the subject of this chapter. Recent guidelines authored by the European Society of Endocrinology (4) summarize more detailed discussions on the evaluation and treatment of patients with adrenocortical cancer (ACC), while guidelines authored by the European Society of Endocrine Surgeons (ESES) and the European Network for Study of Adrenal Tumours (ENSAT) (5) discuss perioperative care. At the forthcoming European Society of Endocrine Surgeons meeting, which will take place later this year, topics pertaining to adrenal surgery training and the necessity to consolidate such procedures in facilities with a specified yearly workload will be discussed.

Indication for open adrenalectomy

It is necessary to be, stay, or become comfortable with open adrenalectomy, even if many surgical centers have embraced minimally invasive adrenalectomy techniques. Open surgery is the recommended course of treatment for patients with big adrenocortical tumors (>6-8 cm) or those who have a CT suspicion of locally invasive tumors and are predicted to have adrenocortical malignancy. Furthermore, if there is macroscopic evidence of cancer (invasion of neighboring structures, presence of regional lymphadenopathy, etc.) or if the surgeon is worried about fragmenting or spilling tumor tissue during the laparoscopic adrenalectomy, the procedure should be converted to an open operation. When complications arise during surgery that cannot be addressed using laparoscopy, such as uncontrolled bleeding, it may be essential to switch to an open operation.

It is recommended to perform an open procedure on any adrenal tumor that has spread to significant veins.

When the tumor's diameter is 8-10 cm or smaller, experienced surgeons may be able to approach the tumor laparoscopically; however, open adrenalectomy is usually required when the tumor's diameter is bigger.

Since laparoscopic or retroperitoneoscopic surgery is an option for individuals undergoing bilateral adrenalectomy, there is no need for an open approach [described in (6)].

Laparoscopic surgery can be performed even in patients who have had prior abdominal surgeries. Most of these individuals can be treated successfully with a laparoscopic technique, while a few could be better served by a retroperitoneoscopic approach (i.e., by eliminating the potential need to deal with adhesions following prior surgery).

Who should perform open adrenalectomy?

There is a severe lack of adrenal surgery available at the moment. In the UK, over 200 surgeons do adrenal surgeries; yet, just 34 of those surgeons operate more than 6 cases annually, and 189 of those

surgeons have a median of 1 adrenalectomy per year (7). It can be inferred that out of every five adrenalectomies, one is open and that most surgeons who perform this procedure perform one such case every few years, based on the 2017 report national audit kept by the British Association of Endocrine and Thyroid Surgeons, which recorded 331 open adrenalectomies and 1,555 laparoscopic adrenalectomies. This circumstance is completely unacceptable because it jeopardizes the treatment for the subset of individuals whose adrenal tumors are the most aggressive. The continuous endeavors to centralize adrenal surgery in the UK are driven by the urgent need for reform. In the vast majority of nations, things will probably work out the same way. If the 2019 European Society of Endocrine Surgeons meeting, which will center on volume-outcome correlations, comes out with recommendations for adrenal surgery centers of excellence, both patients and referring doctors will be able to make better decisions.

Perioperative management

Intraoperative flowtron pumping, postoperative anti-embolism stockings (TEDs), and subcutaneous low molecular weight heparin (Clexane, Daltaparin, Fragmin, as per local protocol) all contribute to deep vein thrombosis prophylaxis.

Individuals with pheochromocytomas or non-secreting cortical tumors may not need antibiotic prophylaxis, although this is still the standard practice for individuals with Cushing syndrome. Preoperative immunization should be explored for patients if splenectomy is expected during the procedure. Another option is to begin penicillin V post-splenectomy prophylaxis as soon as possible after surgery and finish the immunization three to four weeks later.

Patients diagnosed with Cushing syndrome should receive intravenous steroids during surgery, specifically 100 mg of hydrocortisone during induction.

Based on local experience and availability, adrenergic blockade is decided for the majority of patients with pheochromocytomas.

Where on the table

The patient is positioned supine in our clinic, with a wedge applied to the side that is being operated on. Referrals from individuals might lead to the conclusion that lateral decubitus is more severe.

The author believes that a bilateral subcostal incision, also called a "roof top," with the option of a midline vertical extension, is the best choice of incision. When there is radiological evidence of diaphragmatic invasion or when accessing the upper pole of big tumors is difficult, a thoracoabdominal incision may be used, according to certain reports.

Surgical technique for right open adrenalectomy for ACC

Operating on the colonic hepatic flexure begins with a comprehensive examination of the abdominal cavity followed by dividing the gastrocolic ligament and the peritoneal reflection over the ascending

colon. Kocherization of the duodenum is necessary to gain complete access to the inferior vena cava (IVC).

✦ Getting the liver working. By severing the falciform ligament and the lateral triangular ligament, the liver's "mobility" is enhanced, which improves the subsequent tumor dissection. In our technique, the Thompson retractor is fastened at this stage to allow for easier access and the lifting of the ribs.

Getting the correct kidney to work. This procedure involves opening the Gerota fascia towards the upper pole of the right kidney and mobilizing the perinephric fat upwards so that it becomes part of the surgical specimen. It is used for tiny adrenal tumors that can be readily removed from the kidney. It is recommended to remove bigger adrenal tumors that touch on renal vessels all at once, along with the right kidney, if possible. Here, the lower pole of the kidney is used as a starting point for the lateral to medial dissection of the retroperitoneal area. We find, bind, and divide the right ureter. Prior to their draining into the inferior vena cava (IVC), the appropriate gonadal vessels must be located and safeguarded. A division and tying of the renal arteries is done. If clamping the IVC is anticipated later in the treatment, a sling should be passed around it and the left renal vein.

✦ Getting the liver working. Preoperative CT scans showing invasion of the inferior vena cava (IVC) or tumors heavily adhering to the IVC making safe demonstration of the right adrenal vein impossible need subdiaphragmatic IVC management. In order to gain access to the suprahepatic inferior vena cava (IVC), the liver must be totally mobilized off the diaphragm and the left triangle ligament must be separated. If necessary, the IVC can be prepped for clamping by carefully dissecting at the diaphragm's crus. When this occurs, slinging the left renal vein and gaining control of the distal inferior vena cava (IVC) are standard procedures.

❖ Taking the IVC apart. The dissection moves closer to the infrarenal IVC that was revealed previously, with the goal of making a "groove" that connects the tumor to the IVC. Ligation or division of the tiny veins draining the caudate lobe of the liver into the inferior vena cava (IVC) allows for additional upward mobilization of the liver, hence it is important to be careful near these veins.

❖ Surgical removal of the liver's right lobe. Finding a dissection plane that can mobilize the tumor without breaking its capsule is an important consideration. A liver surgeon can help execute a restricted right hepatectomy in conjunction with the tumor if the tumor has invaded the liver directly. This highlights the significance of centralized centers with suitable interdisciplinary competence and the necessity for meticulous preoperative multidisciplinary input.

Methods for doing left open adrenalectomy surgical procedures for ACC

The left colon is being mobilized. Splitting the gastrocolic ligament and the peritoneal reflection along the descending colon mobilizes the splenic flexure. This causes the left colon to move distally and towards the midline until the Treitz angle, the fourth portion of the duodenum, becomes visible.

Controlling splenic processes. During a simultaneous splenectomy, the splenic artery can be simply and safely removed if it is seen to be surrounded or displaced by the tumor on preoperative CT images. This not only facilitates access to the subcostal area, but it also helps separate the upper pole of a large adrenal tumor away from the diaphragm, which could be challenging without spleen removal earlier in the procedure.

If the splenic artery can be located near the top of the pancreas during the initial dissection, it will be possible to limit the primary arterial splenic input and potentially reduce blood loss during the en bloc resection that follows. Within the gastrosplenic ligament, the anastomotic vessels that run along the great curvature of the stomach are carefully preserved as the gastrosplenic arteries are split individually. No ACC instances reported by the ESES working group have involved direct invasion of the stomach by the adrenal tumor.

Release of the left kidney. Beginning at the kidney's base, a lateral to medial dissection of the retroperitoneal area is performed. The ureter on the left side is marked, bound, and segmented. After locating and tying off the gonadal arteries, divide them distally from where they empty into the left renal vein. Due to its potential containment of regional lymph nodes, the soft tissue along the IVC is mobilized en bloc.

Management of the pancreatic. When there is a significant tumor on the left side of the adrenal gland, the pancreas is "stretched" over it, making a distal pancreatectomy a potentially safer cancer treatment option. Since the ACC almost never invades the pancreas directly, this is usually preventable. Distal pancreatectomy is performed by creating a tunnel under the pancreas to the left of the inferior mesenteric vein and transecting the pancreas with a linear stapler when it is determined that it would be beneficial to do so. It is common practice to stitch the resection line. Given the prevalence of pancreatic leaks as postoperative complications, a Robinson drain is typically left adjacent to the pancreatic bed.

Role of lymphadenectomy

Radical adrenalectomy does not yet officially include lymph node dissection (LND). If en bloc resection of the ACC is performed to encompass the kidney, perinephric fat, and Gerota's fascia, it is believed that many of the lymph nodes that drain the adrenal gland, including those in the renal hilum, para-aortic, and paracaval regions, will be included.

It appears that surgeons are not formally performing regional lymphadenectomy or that pathologists are not appropriately assessing or reporting the lymph node involvement in ACC, given the vast range of reported cases (ranging from 5% to 75%). The fact that almost a third of ACC patients underwent a formal lymphadenectomy alongside tumor excision reflects the variability in surgical treatment, as seen in major American and French datasets. Furthermore, according to the ESES-ENSAT working group, lymph nodes were either intentionally dissected (n=11), "likely excised en bloc" (n=5), or "not seen/not dissected" (n=21) in their practice. According to the authors' observations, it is extremely

difficult to visually identify these lymph nodes, and postoperative chyle leak is a common complication following en-bloc excision of the soft tissue around the major veins. According to our personal data, which is not published, we tried using indocyanine green to detect peria renal lymph nodes, following a procedure that was first used for colonic resection. However, we did not see any compelling uptake of the dye in the local lymph nodes.

'The panel proposes that routine locoregional lymphadenectomy should be performed with adrenalectomy for highly suspected or verified ACC,' according to the European Society of Endocrinology's recently released guidelines. The nodes around the kidneys and the peria renal area should be part of it. Prior to surgery, it is important to remove any lymph nodes that appear swollen or suspicious. in (4).

In order to determine the extra morbidity and benefits (staging) of lymphadenectomy for ACC and to answer the question of its practicality, a prospective multicenter cohort research would be very helpful.

Complete removal of all internal organs

Patients with stage II ACC who underwent radical adrenalectomy alone (n=16) or nephron-adrenalectomy (n=25) were compared in a retrospective analysis for their oncological outcomes. According to the results, nephrectomy does not improve the oncological outcome (8). Only 30% of patients undergoing simultaneous nephrectomy in a multicenter European trial on ACC surgery had pathological invasion of the kidney. On the other hand, total lymphadenectomy of the renal hilum is possible with combined nephrectomy, and the risk of tumor capsular rupture is lower. In the event that neighboring organs are believed to be invading, the ESE guidelines advise resecting them all at once. Included in this category are the following organs and structures: spleen, left renal vein or inferior vena cava, stomach, kidney, right liver, colon, diaphragm, and spleen. 'Good surgical practice' is the consensus, yet there is no evidence to compare results. According to the panel, standard ipsilateral kidney resection is not necessary unless there is direct renal invasion. in (4).

The presence of a venous tumor thrombus during ACC surgery

Roughly 25% of cases with ACC progress to the adrenal vein, renal vein, or intravascular vein. Intravenous tumor thrombus is the most common type of venous involvement, although direct vascular invasion is also possible. Cardiopulmonary bypass or intravenous cross-clamping may be necessary during thrombectomy, depending on the size of the thrombus at the higher level. During the resection, it is important to do a flush maneuver, full thrombectomy, and, on occasion, vascular cuff or prosthetic IVC replacement. If an intravenous catheter (IVC) or renal vein invasion is detected, a venous resection should be performed since a large series found a 3-year overall survival rate of 25-29 percent (9). Based on multidisciplinary input from endocrine surgeons, liver surgeons, cardiac/vascular surgeons, and others, the ESE recommendations suggest that individualized treatment

decisions for these individuals are necessary. It is important to wait for assessment at a regional center with sufficient knowledge before classifying these individuals as "unresectable." in (4).

In this environment, the importance of input from other disciplines cannot be overstated. It is imperative to refrain from operating when large tumors are seen surrounding portal veins or when there is significant vascular involvement.

Postoperative care

Continuation of DVT prevention and early mobilization occurs during the admission. You can start taking your medication orally again in the first day after surgery.

Steroid replacement: individuals with Cushing syndrome should take 100 mg of hydrocortisone intravenously once daily or every three days until their diet is back on track, and then they can switch to oral steroids, such as 20-20-10 mg of hydrocortisone daily, with the goal of reducing the dosage by 5 mg every three to five days. For long-term steroid replacement monitoring, the endocrinology team's involvement is crucial.

Even though minimally invasive adrenalectomy has replaced open adrenalectomy as the treatment of choice for most adrenal tumors, the former should be performed only at regional referral facilities. Most surgeons should send these patients to reputable centers that have expertise caring for patients with this condition because of the technical difficulties of the procedure and the necessity for interdisciplinary input both before and after the operation.

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