Open Transabdominal Adrenalectomy for Malignant Neoplasms

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10.1 Introduction

Open adrenalectomy has become an uncommon operation. Minimal-access surgery has markedly improved perioperative morbidity of simple adrenalectomy, with decreased pain and a shorter hospital stay. Long-term results are equivalent in terms of outcome, so the minimal access route is to be preferred. The diminution in incisional hernia, when done by the posterior dorsal, lateral, or transabdominal open approach, is of itself sufficient to justify the minimal access approach.

Unfortunately, such minimal access approaches are neither possible nor appropriate for established malignant adrenal cortical neoplasms. The classic presentation of malignant tumors, with fever, anemia, and weight loss, is now much less common, presumably because of earlier diagnosis. Occasionally, however, it is not easy to determine whether a lesion is benign or malignant [1]. Malignant adrenal tumors are usually large, with a median size of 14 cm [2, 3]. They often involve periadrenal lymph nodes and require lymph node dissection [4]. Feminization in a male or masculinization in a female should raise a high suspicion for malignancy, even in patients with relatively small tumors. Adherence to the kidney, if not involvement, is possible but uncommon. More challenging is the intravascular growth of such lesions, typically growing in the adrenal vein, either into the vena cava directly on the right or into the left renal vein and then the vena cava on the left. Appropriate open access then becomes mandatory for the safe performance of the procedure.

Primary resection of adjacent organs must be anticipated: on the left, usually the spleen and distal pancreas, for access or invasion, and the kidney, because of lymph node or venous involvement. On the right, the kidney, liver, or vena cava are at risk.

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Reoperative adrenal surgery for recurrence or persistence is a serious and most challenging problem [5]. At the time of reoperation, simple tissue planes are often lost, and though primary resection of the liver is uncommon, it may become necessary either because of invasion or because of the difficulty of mobilization in the presence of retrohepatic adherence. Rather than anatomical resection of the liver following hepatic inflow and outflow control, it is sometimes safer to revert to the more historic anterior transhepatic approach. At the time of recurrence, resection of adjacent organs is the norm and should be anticipated.

10.2 Surgical Technique

Multiple incisions are available for appropriate access for major adrenal excision. For simple or bilateral tumors, either a long midline incision or a bilateral or unilateral subcostal incision is preferred (Fig. 10.1a). Body habitus with a wide or narrow subcostal space can influence the approach. Our preferred approach is the unilateral subcostal approach, with extension to bilateral as needed, or extension of the unilateral subcostal incision up the midline to the xiphisternum. For extended resections in which mobilization of the liver will be important, a long lumbar incision or thoraco-abdominal incision is preferred on the right side (Fig. 10.1b). These approaches can also be used on the left side, especially if diaphragmatic adherence or invasion is suspected. On the left side, access to a left adrenal tumor can commence with a left subcostal incision with ready extension into the left chest if the lesion is large or access proves difficult (Fig. 10.1c).

Access to the right adrenal is illustrated (Fig. 10.2), where the transverse colon is reflected inferiorly, the duodenum is reflected to the patient's left, and the vena cava is clearly exposed. Although the right adrenal vein is shown to be accessible in the figure, it is often posterior and the tumor extends over the vena cava, so that access to the vein is at the end of the procedure rather than at the beginning. Textbooks commonly suggest that in functional tumors the

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adrenal vein should be ligated early in the procedure, but it is rarely possible to do so with large malignant tumors. Multiple parasitic arteries exist with concomitant adrenal venous tributaries. The vena cava is exposed directly from the anterior surface, and the renal vein is identified and dissected free. Important consideration must be given to the invariably present right accessory adrenal vein draining into the right renal vein. With large tumors, this can be a large vessel that can be a source of considerable hemorrhage if it is not carefully isolated, ligated, and divided. As opposed to benign adenomas, the periadrenal vessels draining into a phrenic venous plexus or directly to the liver are also a potential source of hemorrhage and require direct visual control.

Elevation of the right lobe of the liver, with extensive mobilization if necessary, is important to gain access to the superior pole of a right adrenal tumor. Small hepatic venous tributaries draining into the vena cava are individually ligated and divided to allow safe mobilization of the right lobe of the liver. The right kidney is not electively sacrificed unless necessary for nodal dissection or (rarely) invasion. If it is clear that the kidney must be sacrificed because of superior pole invasion or to allow adequate lymph node dissection, then rotation of the kidney from the posterior aspect is helpful. With this maneuver, the posteriorly placed right renal artery can be ligated in continuity, allowing much safer and better controlled renal vein division.

The approach to the left adrenal vein often requires complete mobilization of the spleen and pancreas to gain adequate access (Fig. 10.3). Primary venous drainage on the left side is into the left renal vein. This vein often can be engorged and may contain tumor extending into it, often stopping as the vein travels in front of or behind the aorta. With large tumors, mobilization of the spleen and pancreas completely to the patient's right gives clear access to the tumor and the renal hilum. Small arterial branches from the phrenic vessels and the lateral side of the aorta must be individually ligated. With very large tumors, these vessels can be included with dissection of the soft tissues from the aorta with hemostatic clips. With all large malignant tumors, one should assume that parasitized vessels can occur on all surfaces of the tumor, and blunt dissection, as performed for small benign tumors, should not be attempted. On occasion, a hemostatic device such as a LigaSure™ (Covidien; Mansfield, MA) can be used in the posterior fat, but it is preferable to skeletonize the diaphragm under direct vision.

When tumor extends into the left renal vein through the adrenal vein, it is sometimes possible to preserve the left kidney if the left gonadal vein is not occluded or obstructed, by dividing the left renal vein just to the right of the left gonadal vein with a vascular stapler. The aorta is formally skeletonized. If pancreas invasion is expected or encountered, then the splenic artery is identified at its origin, ligated in continuity, and subsequently divided. All short gastric vessels are divided. With the splenic artery ligated, the portal vein can be dissected from above and below and the splenoportal junction can be clearly identified, isolated, and divided, either prior to or following pancreatic division.

The lymphatic drainage of the adrenal is illustrated for both the right and left side (Fig. 10.4). On the right side, the primary lymph node drainage areas are to the perinephric and renal vein sites, with small nodes extending to the hepatic vessels on both sides. Nodal disease can extend to the base of the common hepatic and splenic vessels and the celiac trunk. Although the value of extended node dissection is unproven, nodal metastases are common. Nodal dissection should be performed in continuity where possible and can proceed from medial to lateral, commencing on the right side at the base of the hepatic artery across the anterior vena cava, and extending posterior to the inferior vena cava and inferiorly to the renal vein. The renal artery can be

skeletonized superiorly. On the left side, the dissection continues along the left side of the aorta. The arterial supply to the left adrenal is often not a single vessel, but rather multiple, small arterial branches, which also occur from the phrenic artery superiorly.

The major challenge for open adrenalectomy for malignant tumor is vena cava involvement. Usually the caval involvement is above the right renal vein, which can be isolated. On occasions, the left renal vein will need to be isolated and controlled (Fig. 10.5). It is important to mobilize (and if necessary, ligate) the small hepatic veins draining directly into the vena cava below the main hepatic outflow tract. Isolation of the suprahepatic cava can be done either below or above the diaphragm. Often only temporary proximal occlusion is required of the suprahepatic cava. For more extensive invasion, more formal isolation is necessary. If tumor thrombus extends above the hepatic veins into the atrium, then hypothermic cardiac arrest with cranial perfusion is now the preferred approach. The importance of mobilization of the cava posteriorly cannot be overemphasized. Judicious use of a vein retractor on the right side is helpful, with clear identification of any lumbar veins draining into the posterior vena cava. On the left side, if tumor extends into the renal vein, it often stops at the right side of the aorta if the vein passes posteriorly. When the cava must be resected, the utilization of a vascular stapler superiorly has improved the safety of the procedure. If caval involvement is limited, a limited resection with a patch to the vena cava ensures caval continuity [6].

In a patient with a suprarenal infrahepatic tumor thrombus, tumor usually can be extracted with isolation of the cava and without caval resection. This procedure requires extensive mobilization with temporary occlusion of the inferior vena cava below the hepatic veins and above the renal veins (Fig. 10.6a). If the tumor extends to the outflow tract of the right and left hepatic veins, these must be clearly isolated with complete mobilization of the right lobe of the liver to the patient's left (Fig. 10.6b). In this situation and especially when the tumor extends more proximally into the atrium, hypothermic cardiac arrest with cranial perfusion is preferred. Caval resection can be performed above the renal vein with or without resection of the right kidney and isolation of the left renal vein (Fig. 10.6c). If necessary, the left renal vein can be divided with a vascular stapler to allow left renal vein drainage via the left gonadal vein. When thrombus exists in the proximal left renal vein, again division can often be accomplished without loss of the kidney, if the usually distended left adrenal vein enters the renal vein proximal to the gonadal vein (Fig. 10.6d).

Reconstruction of the resected vena cava is a matter of some debate. With minor thrombus, extraction with or without patch repair is the simplest technique [7]. With major, established suprarenal thrombus, simple ligation without reconstruction has been our commonest approach. With diligent attention to perioperative peripheral edema management, long-term results are excellent, with limited lower edema, probably owing to the prior establishment of vena caval collaterals.

Chemotherapy and radiotherapy have not been shown to be of significant benefit, so complete resection is the only potentially curative approach. Every effort should be made to achieve a complete resection at the first operation. Figure 10.7a demonstrates disease-specific survival stratified by completeness of first resection, and Fig. 10.7b shows disease-specific survival stratified by completeness of second resection [5].

Re-resection of recurrent disease should always be considered, given the lack of effective alternatives. Reoperation should be offered if a complete gross resection appears possible. Incomplete resection is rarely of value and should not be planned.

Figure 10.1

Incisions for appropriate access for major adrenal excision. (**a**) A long midline incision or a bilateral or unilateral subcostal incision is preferred for simple or bilateral tumors. (**b**) A long lumbar incision or thoraco-abdominal incision on the right side is preferred for extended resections with mobilization of the liver. (**c**) A left subcostal incision for access to a left adrenal tumor, with ready extension into the left chest for a large or difficult lesion

Figure 10.1

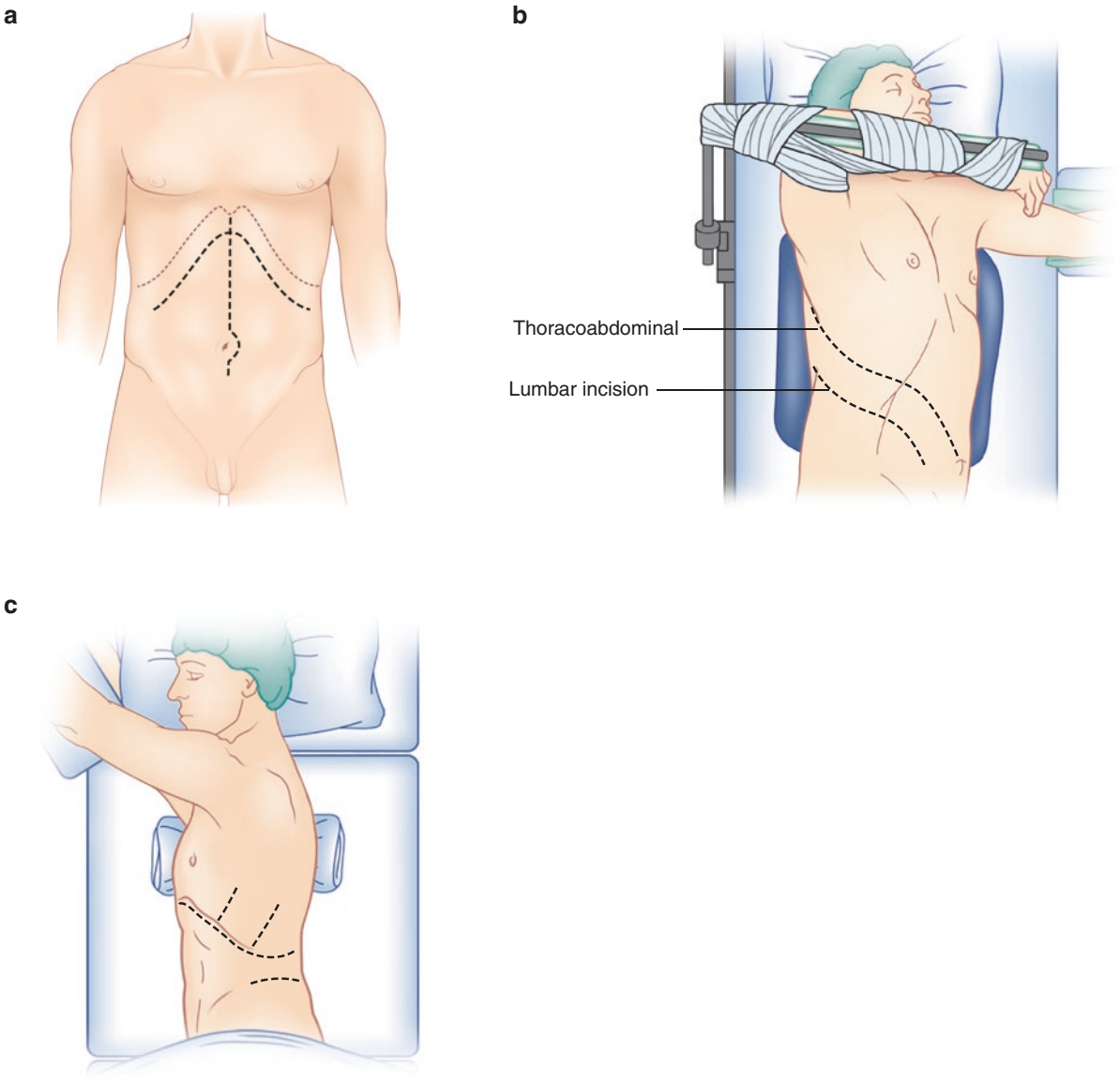


Figure 10.2

For access to the right adrenal, the transverse colon is reflected inferiorly, the duodenum is reflected to the patient's left, and the vena cava is clearly exposed

Figure 10.3

The approach to the left adrenal vein often requires complete mobilization of the spleen and pancreas to gain adequate access

Figure 10.2

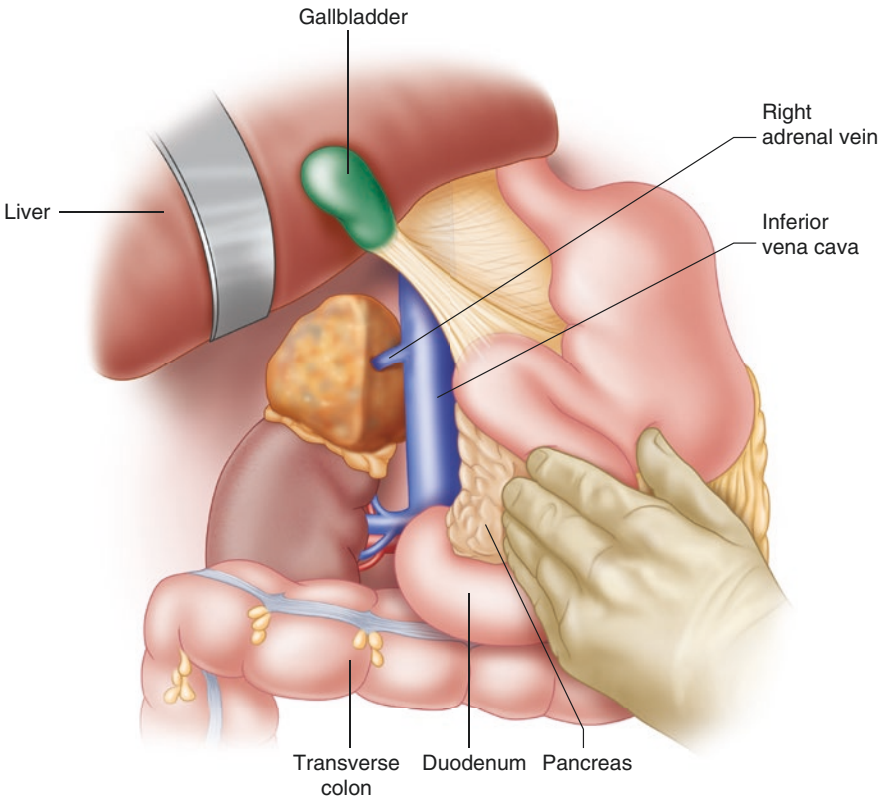


Figure 10.3

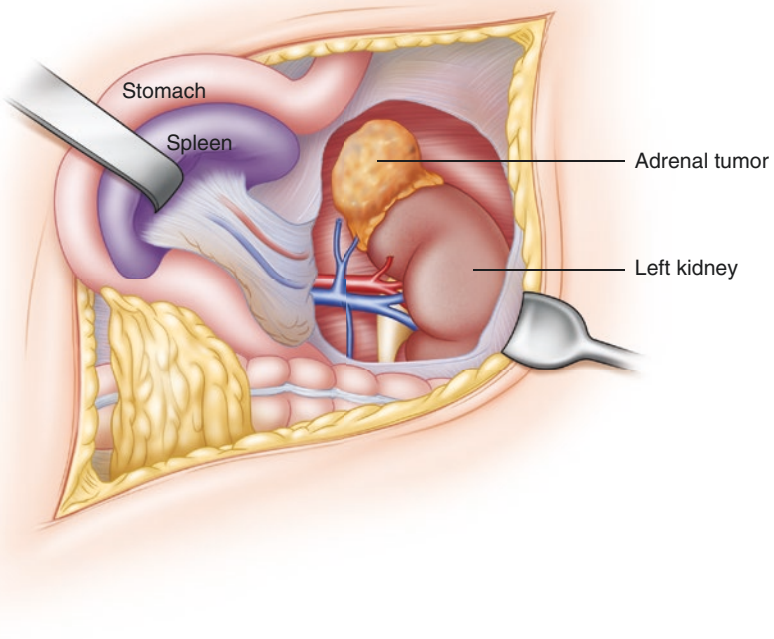


Figure 10.4

The lymphatic drainage of the adrenal, for both the right and left sides

Figure 10.5

Vena cava involvement is usually above the right renal vein, which can be isolated, but occasionally the left renal vein must be isolated and controlled. If the tumor extends close to the hepatic vein outflow, then suprahepatic caval control should be considered. T = tumor

Figure 10.4

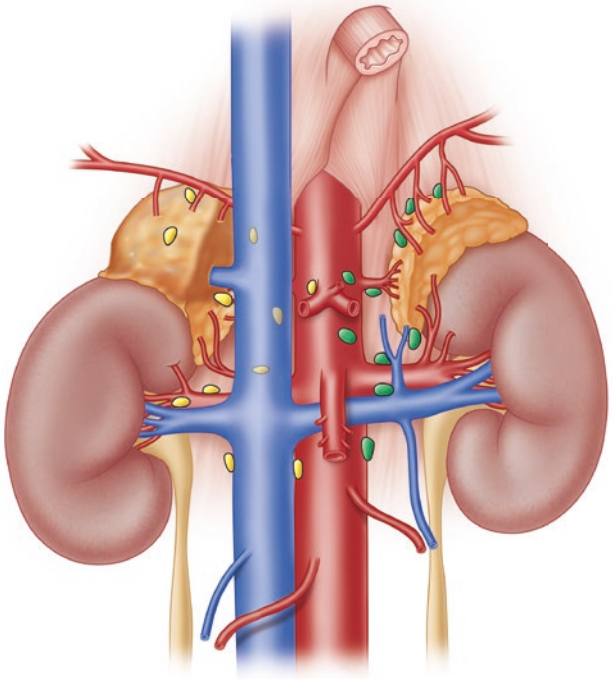


Figure 10.5

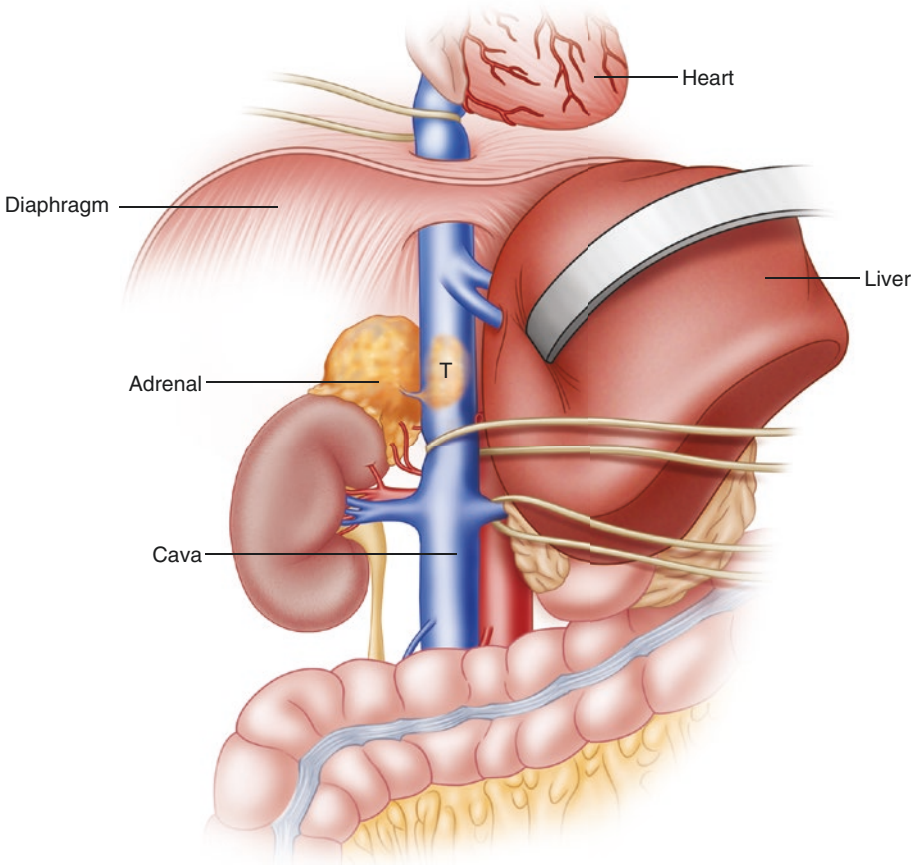


Figure 10.6

Suprarenal infrahepatic tumor thrombus. (**a**) Extraction of the tumor with isolation of the cava and without caval resection requires extensive mobilization with temporary occlusion of the inferior vena cava below the hepatic veins and above the renal veins. (**b**) If the tumor extends to the outflow tract of the right and left hepatic veins, these must be clearly isolated with complete mobilization of the right lobe of the liver to the patient's left. (**c**) En bloc caval and tumor resection with or without the right kidney is necessary (i.e., adrenal vein intact). Caval resection can be performed above the renal vein with or without resection of the right kidney and isolation of the left renal vein. If tumor extends below the right renal vein, then the right kidney must be removed en bloc. (**d**) If thrombus exists in the proximal left renal vein, division often can be accomplished without loss of the kidney if the usually distended left adrenal vein enters the renal vein proximal to the gonadal vein

Figure 10.6

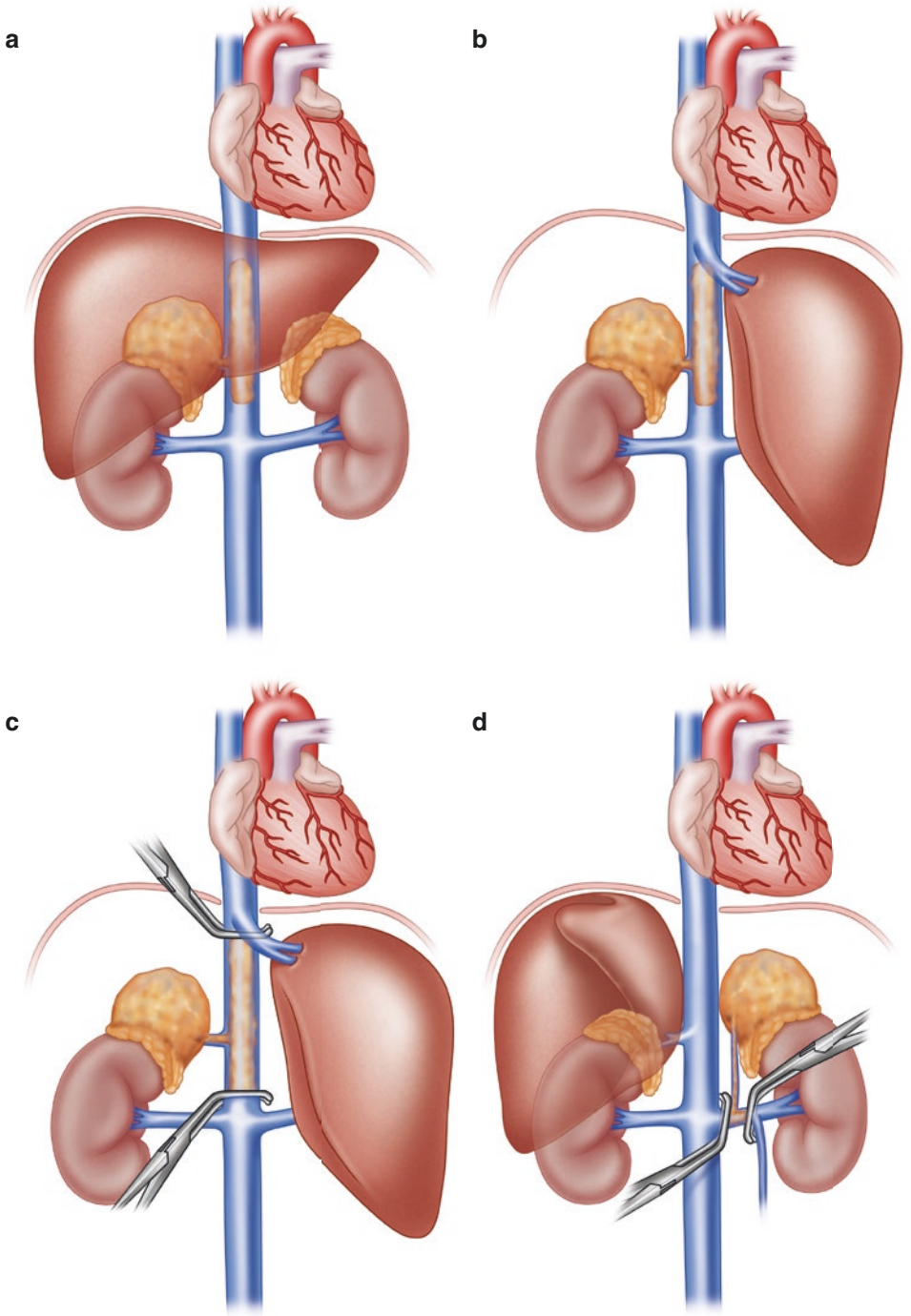
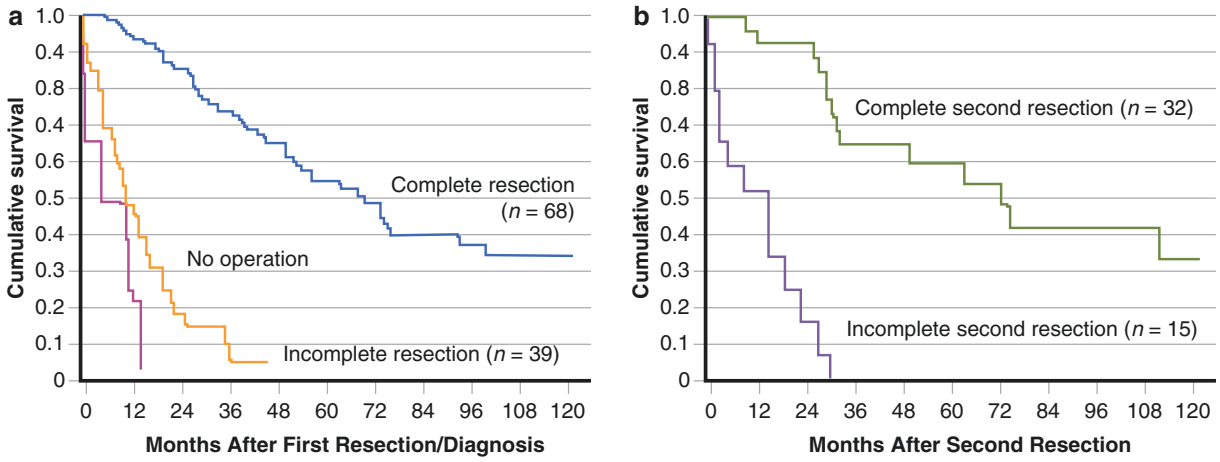


Figure 10.7

Disease-specific survival in patients undergoing resection for adrenocortical carcinoma. (**a**) Survival stratified by completeness of first resection. (**b**) Survival stratified by completeness of second resection (From Schulick and Brennan [5]; with permission)

Figure 10.7


a
Cumulative survival
1.0
0.4
0.8
0.4
0.6
0.5
0.4
0.3
0.2
0.1
0
Complete resection
(n = 68)
No operation
Incomplete resection (n = 39)
0 12 24 36 48 60 72 84 96 108 120
Months After First Resection/Diagnosis
b
Cumulative survival
1.0
0.4
0.8
0.4
0.6
0.5
0.4
0.3
0.2
0.1
0
Complete second resection (n = 32)
Incomplete second resection (n = 15)
0 12 24 36 48 60 72 84 96 108 120
Months After Second Resection

10.3 Results and Conclusions

Open adrenalectomy is currently mandatory for large, malignant adrenal tumors. The approach is similar to other cancer operations. Complete local resection with skeletonization of major vessels and encompassing nodal dissection should be performed whenever possible. Complete resection of the primary tumor is essential to offer any possibility of long-term survival. Surgeons should be aware of the common problem of intravenous vascular extension by tumor thrombus. With conventional imaging, recognition of this extension, with isolation and resection of major vessels, is feasible and safe. The most challenging cases are those that have been explored but did not undergo resection, usually on account of intraoperative hemorrhage. As with most tumor surgery, the first operation is the easiest and the most likely to have a favorable impact on long-term survival. Once tissue planes have been dissected, they are lost, and adherence to surrounding structures becomes inevitable. Poorly placed or aggressive biopsy at the time of an initial, abandoned resection often leads to multifocal or disseminated persistence or recurrence. At any reoperation, resection of adjacent viscera can be the expected norm.

Overall 5-year survival for patients with resected adrenocortical cancer is 30–40%. Patients presenting with early-stage disease (I & II) have a 5- year survival of 60%, but those with stage III/IV have a dismal 5-year survival below 10%. Complete resection of the primary tumor is essential to offer any possibility of long-term survival. It is important to emphasize that re-resection of local and systemic recurrence can be associated with 5-year survival of 50% and should be considered in most patients with recurrence.

References

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