

THE FLANK INCISION AND EXPOSURE OF THE KIDNEY

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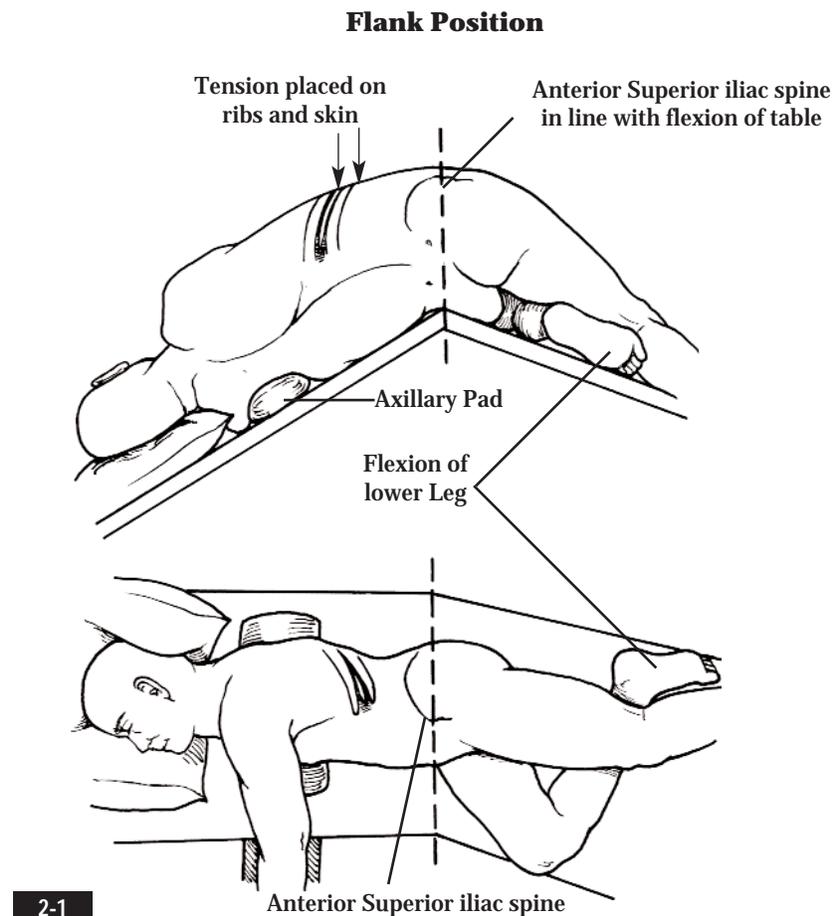
Good flank exposure of the kidney can be achieved by many surgical approaches. In general, the kidney lies higher than expected from the radiologic studies, with the left kidney slightly higher than the right kidney. Except for lower pole renal biopsy, most operations require good exposure of the renal pelvis and the renal pedicle and thus call for either a supra-twelfth-rib incision or a twelfth-rib rib resection. In the following discussion of these two approaches, important anatomic considerations for all flank exposures are highlighted.

FIG. 2-1. The flexion of the operating table should be in line with the anterior superior iliac spine of the pelvis. This spine is a constant landmark that the surgeon can palpate in both thin and obese patients.

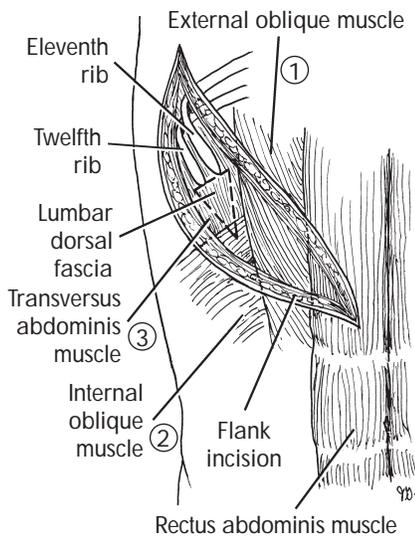
After the patient is positioned on the side, the kidney rest can be elevated and the operating table flexed. It is important to monitor the patient's vital signs because the vena cava can be compressed during this maneuver. We prefer that the patient is in a straight lateral position 90 degrees to the table as opposed to an angled position; the straight lateral position can be angled by simple rotation of the operating table from side to side. The surgeon should apply 5-inch-wide adhesive tape horizontally across at the level of the iliac spine and around the operating table to secure and maintain the patient in this flank position. The taping stabilizes patient position

perpendicular to the operating table and thus allows the operating table to be rolled from side to side for improved exposure of the anterior or posterior kidney.

Although the anterior superior iliac spine is positioned at the flexion of the table, when the table is fully flexed, the final position of the body will cause the entire pelvis to be slightly below the apex of the flexion and the ribs to be slightly above, which creates tension in the area of the lower



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ribs and flank. The surgeon should palpate the region between the eleventh and twelfth ribs and between the ribs and the iliac spine when the operating table is adequately flexed to ensure that this tension has been maintained.

The lower leg is flexed to 90 degrees at the knee to prevent the body from rolling from side to side, but the upper leg is kept straight to maintain the tension of the incision site; pillows are placed between the legs as support.

An axillary pad is placed under the lower dependent arm to prevent any neural compression. The upper arm should be placed on an airplane rest for stabilization.

EXPOSURE

For any flank exposure of the kidney, the surgeon must release three components holding the ribs together:

- 1 Intercostal muscles
- 2 Diaphragmatic attachments to the ribs and retroperitoneum
- 3 Internal intercostal membrane holding the proximal ribs together

Supra-Twelfth-Rib Incision

FIG. 2-2. The surgeon makes the incision extending from the lateral

border of the rectus abdominis muscle to beyond the posterior axillary line. This incision is essentially slightly superior to the twelfth rib.¹ Anterior and medial to the rib, the external oblique (1), internal oblique (2), and transversus abdominis (3) muscles are sequentially divided.

Although it is not always possible, the surgeon should attempt to preserve the intercostal nerve to prevent the “frog belly” protrusion of the abdomen after surgery. The intercostal nerve can be freed from the muscles and can be pushed medially and laterally to the incision during the operation.

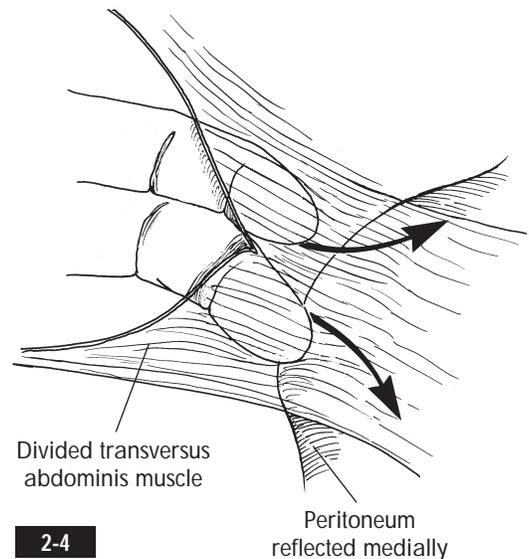
Once the internal oblique muscle is divided, the dense lumbar dorsal fascia, which lies anterior and medial to the tips of the eleventh and twelfth ribs, can be identified.

FIG. 2-3. By opening this fascial landmark, the surgeon can enter the retroperitoneal space and mobilize the peritoneum anteriorly.

FIG. 2-4. The surgeon inserts the left index and middle fingers and bluntly spreads the fingers beneath the transversus abdominis muscle to establish a dissection plane between the anterior peritoneum and the muscle. The transversus abdominis muscle is then divided to the lateral margin of the rectus fascia.



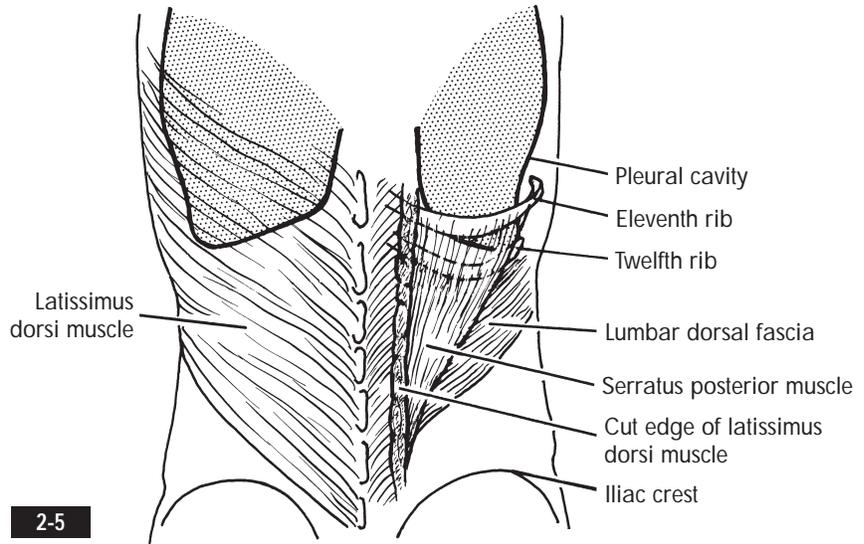
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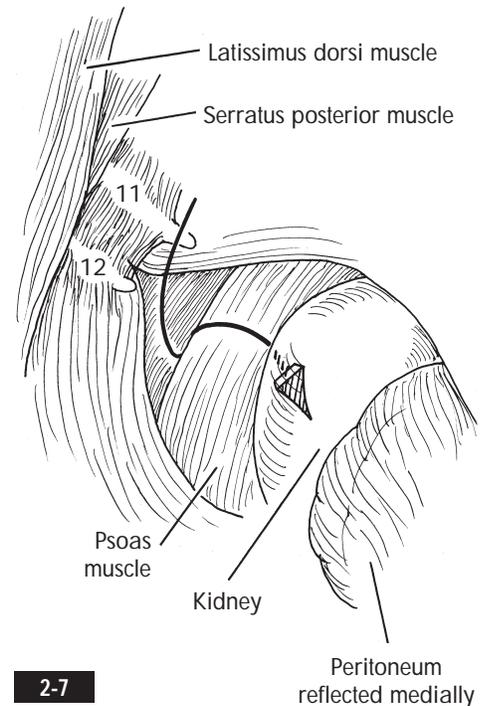
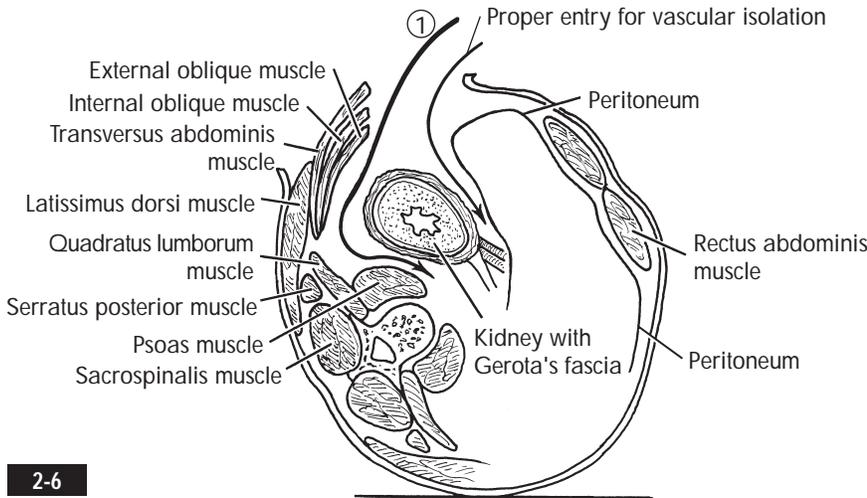
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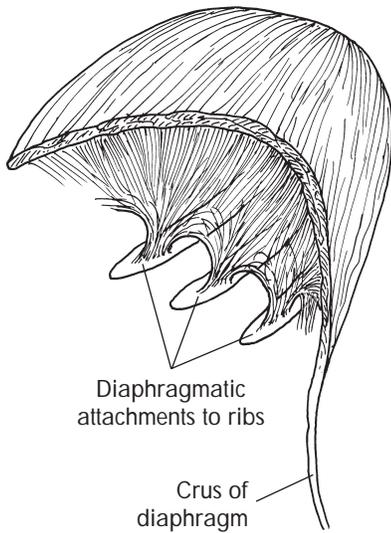
FIG. 2-5. The two large muscles, the latissimus dorsi and the serratus posterior, are partially divided to expose the posterior part of the ribs and the intercostal muscles. One common error is to fail to complete the posterior dissection despite an excellent anterior dissection.

FIGS. 2-6 AND 2-7. The surgeon uses a sponge stick bluntly and gently to sweep the posterior Gerota's fascia medially off the psoas and quadratus lumborum muscles (1 in Fig. 2-6). The kidney and peritoneum are rolled medially by this maneuver, exposing the posterior surface of the kidney and its pedicle in Gerota's fascial compartment.



Entry into Retroperitoneum



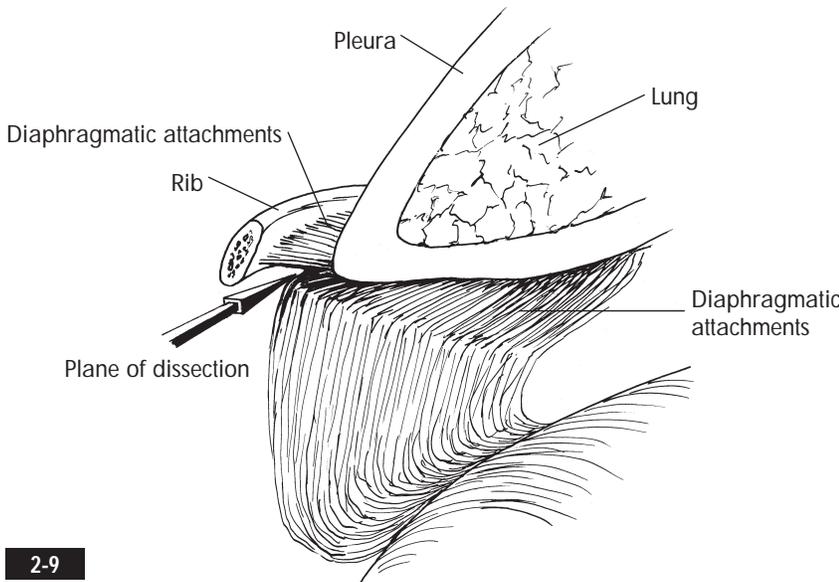


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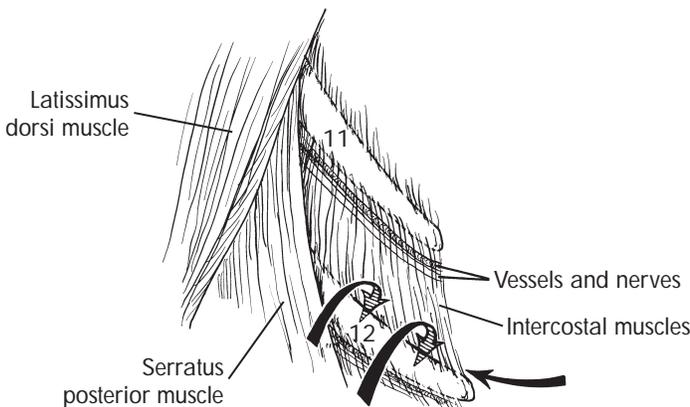
Diaphragmatic Attachments

FIGS. 2-8 AND 2-9. With outward traction of the free end of the twelfth rib, the surgeon uses the right index finger and gently pushes proximally against the inner aspect of the twelfth rib, thereby separating strands of the diaphragmatic muscles from the rib. This maneuver exposes the inner aspect of the rib completely and gives the surgeon a clear view of the diaphragmatic muscles' attachments to the rib and retroperitoneum. These diaphragmatic attachments are then divided.

Using the index finger, the surgeon must apply pressure against the rib rather than on diaphragmatic muscles or the adjacent pleura. This maneuver, in essence, separates the pleura from the rib.



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Intercostal Attachments

FIG. 2-10. With the same traction applied outward and downward on the distal tip of the twelfth rib, the intercostal muscles are now gently divided from the superior margin of the rib, beginning at the distal tip of the rib and extending to the proximal region, avoiding injury to the pleura.

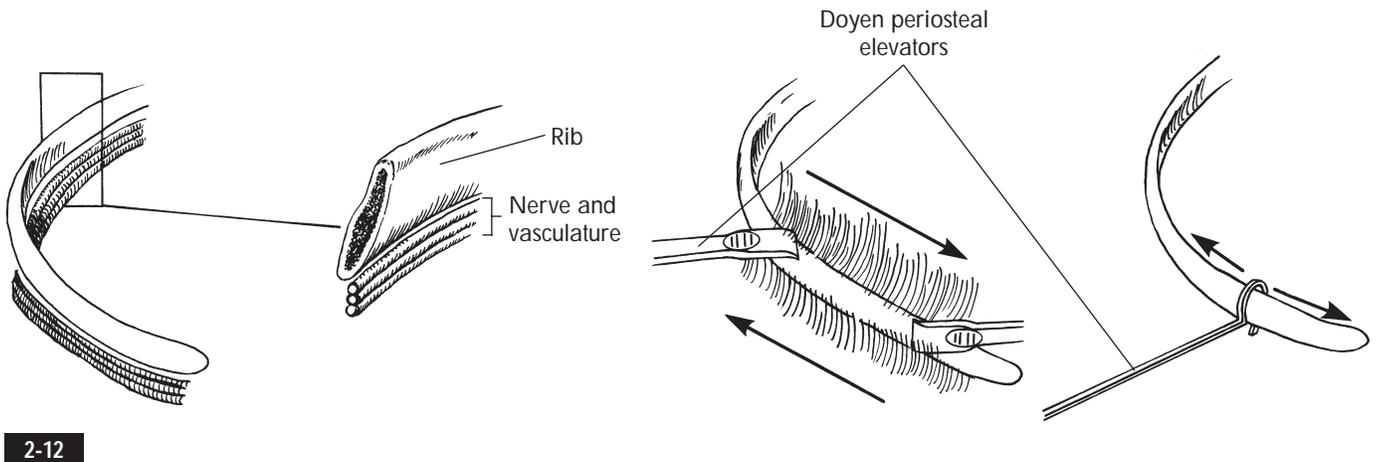
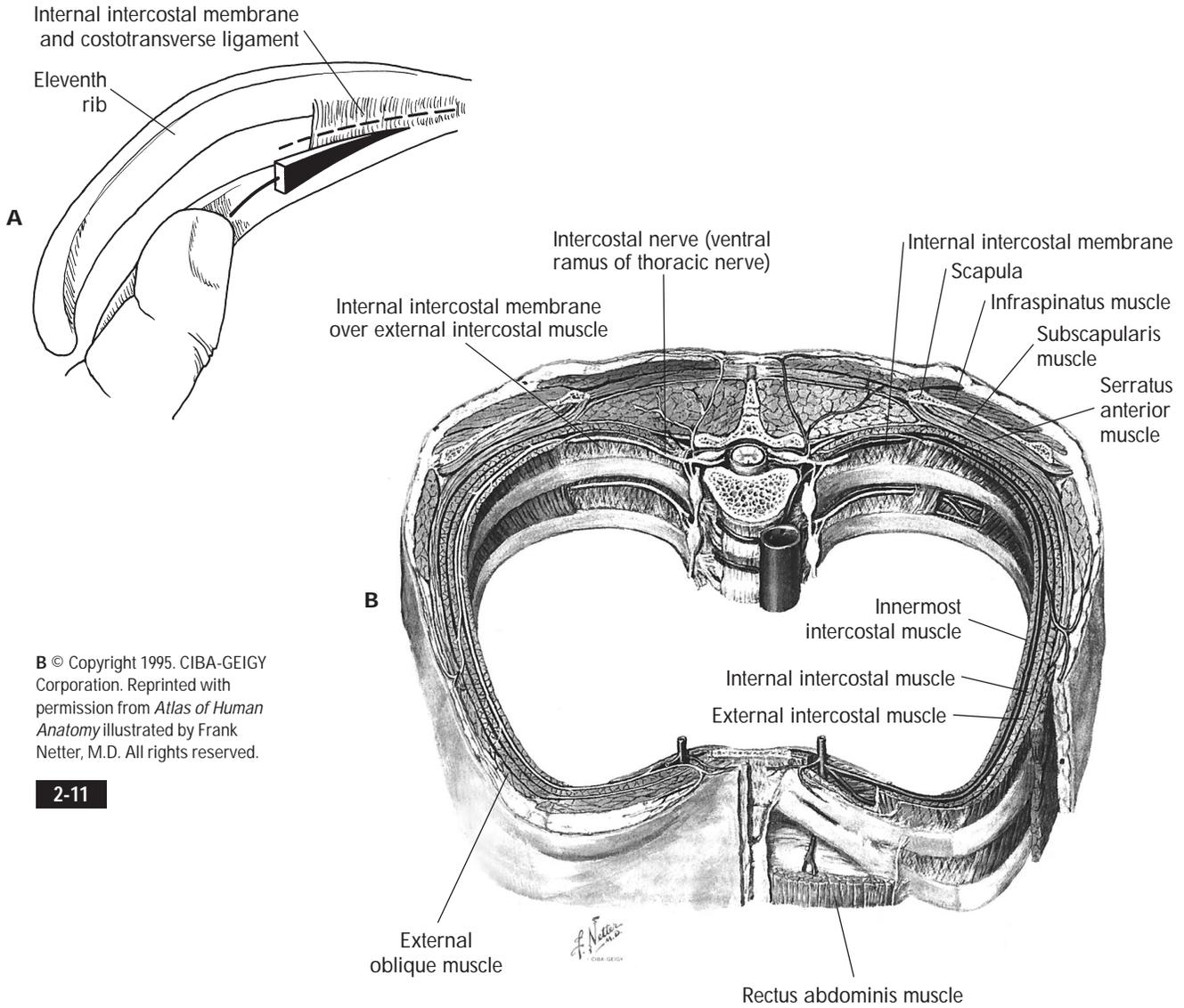
The surgeon can divide the muscle directly above the rib without injury to the vasculature and nerves, which are located immediately below the rib.

FIG. 2-11. The surgeon's right index finger pushes gently against the most proximal inner aspect of the twelfth rib until the junction of the vertebral body is felt. The surgeon can now palpate the internal intercostal membrane and eleventh rib above. The intercostal membrane is a thin, dense band of tissue holding the two ribs together. Only this dense membrane is divided; the tissue deeper to this membrane is left intact. When dividing this membrane, the surgeon can feel the release of tension. The Finocchetto retractor with two dry laparotomy pads can be placed on either side of the ribs and opened slowly for full exposure of the kidney.

This same exposure can be applied to the eleventh rib if necessary.

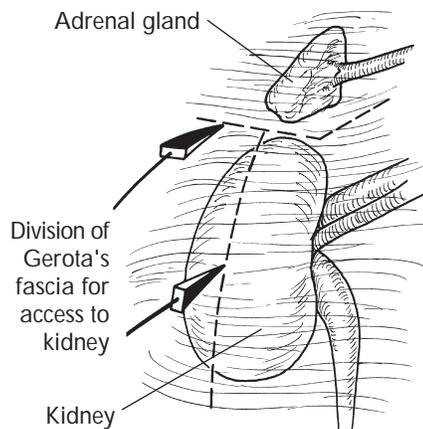
Twelfth-Rib Rib Resection

FIG. 2-12. Using periosteal elevators such as Doyen periosteal elevators, the surgeon first cleans and frees the rib from its intercostal attachments with periosteal elevators in opposing directions as illustrated. The Doyen elevators curl around the bony rib and essentially release the periosteum and its diaphragmatic attachments.



Since the rib is resected at its proximal end with rongeurs, there is no need to divide the intercostal membrane as is performed in the supra-twelfth-rib incision.

After the rib is resected, the surgeon uses blunt dissection to reestablish the plane between the quadratus lumborum and psoas muscles on one side and the posterior Gerota's fascia and kidney on the other side as described previously.



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SIMPLE NEPHRECTOMY AND RECONSTRUCTIVE RENAL SURGERY

FIG. 2-13. The surgeon divides the most lateral posterior aspect of the Gerota's fascia to expose the lateral surface of the kidney.

Dissection between the Gerota's fascia and the kidney medially on both sides provides excellent exposure of the kidney, renal pelvis, and renal pedicle.

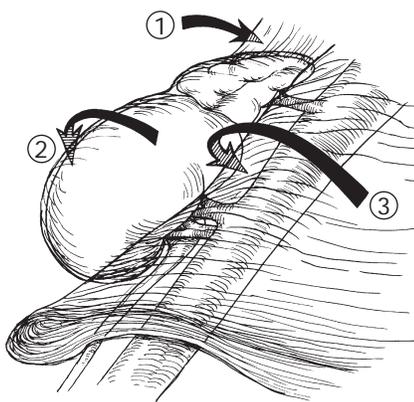
RADICAL NEPHRECTOMY IN FLANK POSITION FOR SMALL RENAL CANCERS IN LOWER HALF OF KIDNEY

FIG. 2-14. The dissection preserves the integrity of the Gerota's fascia and includes the adrenal gland (1).

The surgeon separates the posterior Gerota's fascia from the psoas muscle (2).

The surgeon then identifies the upper ureter and places a vessel loop for traction. Often the gonadal vein is next to the ureter and can be divided on the right side.

The most difficult maneuver of the operation is to separate the posterior peritoneum from the anterior Gerota's fascia (3). The assistant holds the peritoneum up while the surgeon uses the fingers to gently tease a dissection plane between the two. The reflection of the posterior peritoneum can often be seen and used as a guide. As the surgeon gently uses the



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fingers to separate the two layers, first the renal vein and then the renal pelvis can be identified medially.

With the patient in the full flank position for right-side dissection to expose the kidney, the surgeon will not see the duodenum as clearly as when the patient is in the supine position (Kocher maneuver, see p. 12). As the separation of the peritoneum and the Gerota's fascia is completed, the duodenum will be just anterior to the vena cava.

FIG. 2-15. From the anterior aspect of the kidney, the surgeon can usually identify all venous structures, renal vein, adrenal vein, gonadal vein, and lumbar vein.

At times it may be necessary to free the entire posterior Gerota's fascia from the posterior muscles to isolate the renal artery located slightly inferior to and behind the renal vein.

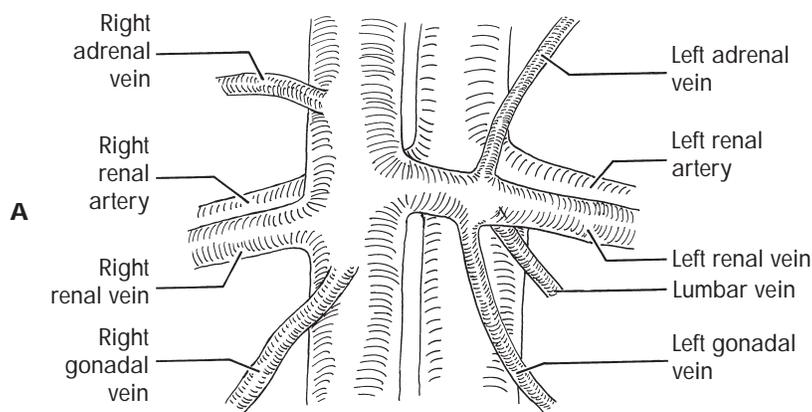
The renal artery is always ligated and/or divided *before* the renal vein is. Two ties (0 silk) are placed proximally and one distally.

Superiorly, the surgeon follows the Gerota's fascia and proceeds beyond the adrenal gland. While cautiously using gentle downward traction with the left index and middle fingers on either side of the adrenal gland, the surgeon can clip and divide the attachments superiorly with the right hand. If the adrenal vein has not been identified yet, it will usually lie on the medial aspect of the adrenal gland (for right-sided nephrectomy).

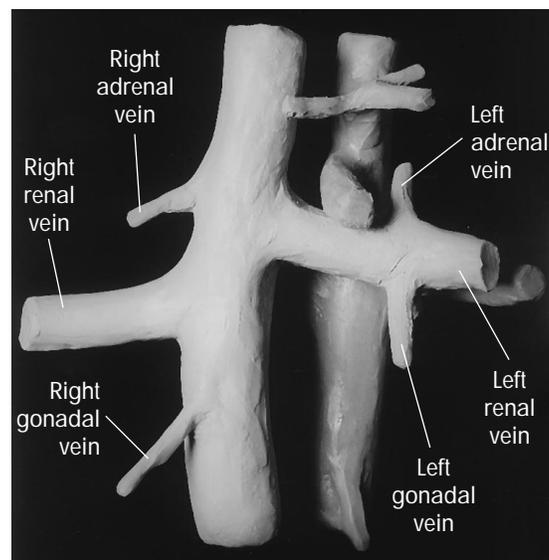
RENAL AND ADRENAL VASCULATURE

On the *right side*, the adrenal, renal, and gonadal veins branch directly from the vena cava, whereas on the *left side*, the adrenal, accessory lumbar, and gonadal vessels join the renal vein.

On the *right side*, the adrenal



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vein can be injured during a radical nephrectomy for large upper pole cancer as previously discussed (see p. 12).

FIG. 2-16. On the *left side*, the location and vasculature of the adrenal gland is more accessible and easier to expose. The most common venous injury involves the accessory lumbar vein draining into the renal vein from a posterior position. Because this vein is located directly behind the renal vein, the surgeon may miss it before dividing the renal pedicle vein (see p. 20).

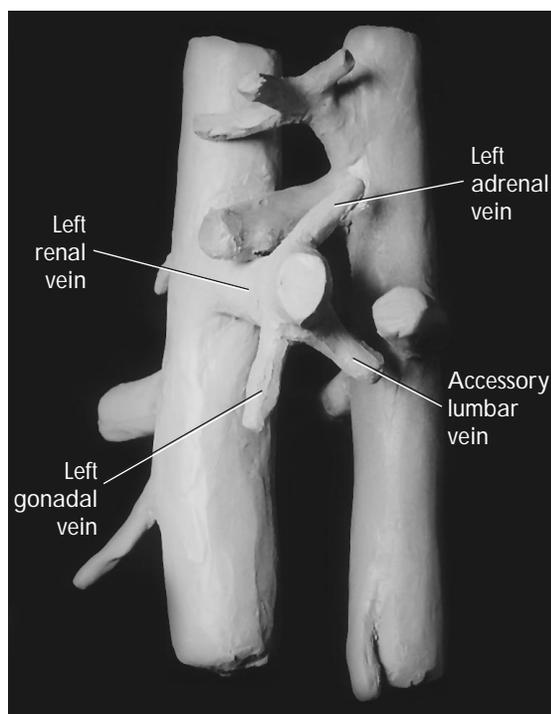
PLEUROTOMY

Inadvertent pleurotomy is common with flank incisions. The simplest method to correct this problem is to insert a chest tube (see p. 23).

For a small opening, a red rubber catheter can be placed within the pleural cavity, and the opening can be closed with a stitch (2-0 chromic).

After the surgery is completed and the wound is reapproximated around this catheter, the proximal end of the red rubber catheter is placed to an underwater seal such as a medicine cup filled with water.

The anesthesiologist can expand the lung by inflation and can push the air within the cavity out through the red rubber catheter.



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The surgeon gradually moves the catheter out while watching for air bubbles to be expelled.

When no further air bubbles come out through the catheter, the surgeon pulls the catheter out.

In most cases, the postoperative chest radiograph shows a small residual defect of 10% pneumothorax. This small defect does not require treatment but needs only monitoring with serial radiographs.

KEY POINTS

- The patient is positioned with the anterior iliac crest in line with the flexion of the table.
- The retroperitoneum space is established first.
- The intercostal muscles, diaphragmatic attachments, and intercostal membrane (for supra-twelfth-rib incision) are released.
- Note that above the twelfth rib the pleura can be easily swept off, whereas the pleura is more adherent to the ribs above the eleventh rib.
- The Gerota's fascia is divided to expose the kidney and renal pedicle for reconstructive renal surgery.
- The posterior peritoneum and anterior Gerota's fascia are separated to expose the renal pedicle for a cancer operation.
- The right adrenal vein is carefully dissected out for right-sided tumors. For left-sided tumors, the surgeon must watch for the lumbar vein draining into the renal vein from a posterior position.

POTENTIAL PROBLEMS

- *Pleurotomy*: Perform postoperative closure with the tip of a red rubber catheter in the pleural cavity and the open end to an underwater seal to blow out the air in the pleural cavity *or* place chest tube
- *Intercostal vasculature and nerve injury*: Achieve hemostasis by electrocoagulation → perform stitch ligation of vasculature not including the nerve
- *Inadvertent opening of the posterior peritoneum*: Perform immediate closure because this defect may be forgotten subsequently
- *Torn adrenal vein on right side*: Apply hand compression on the vena cava → apply curved Satinsky vascular clamp on a cuff of the vena cava before repairs if necessary (see p. 59)
- *Excessive manipulation of left-sided dissection leading to splenic injury with hemorrhage suspected based on sudden drop in blood pressure*: Perform peritoneotomy → explore spleen to see if preservation is possible → if not, perform splenectomy (see p. 28)

REFERENCE

- 1 Turner-Warwick RT: The supracostal approach to the renal area, *Br J Urol* 37:671, 1965.