33 Kidney

General Comments

The gross examination plays an important role in the evaluation of kidney specimens. Macroscopic features often provide important clues to the underlying pathologic process. For example, the accurate pathologic staging of renal neoplasms can usually be accomplished simply by noting relationships between the tumor and certain anatomic landmarks. As with other tissues, no kidney specimen should be dissected without prior knowledge of the patient's clinical history. This fundamental rule is especially important when handling kidney specimens in which the evaluation of glomerular disease relies on immunofluorescence and ultrastructural analysis. Thus, before processing even the smallest kidney biopsy, determine from the clinical history whether fresh tissue should be submitted for these special studies.

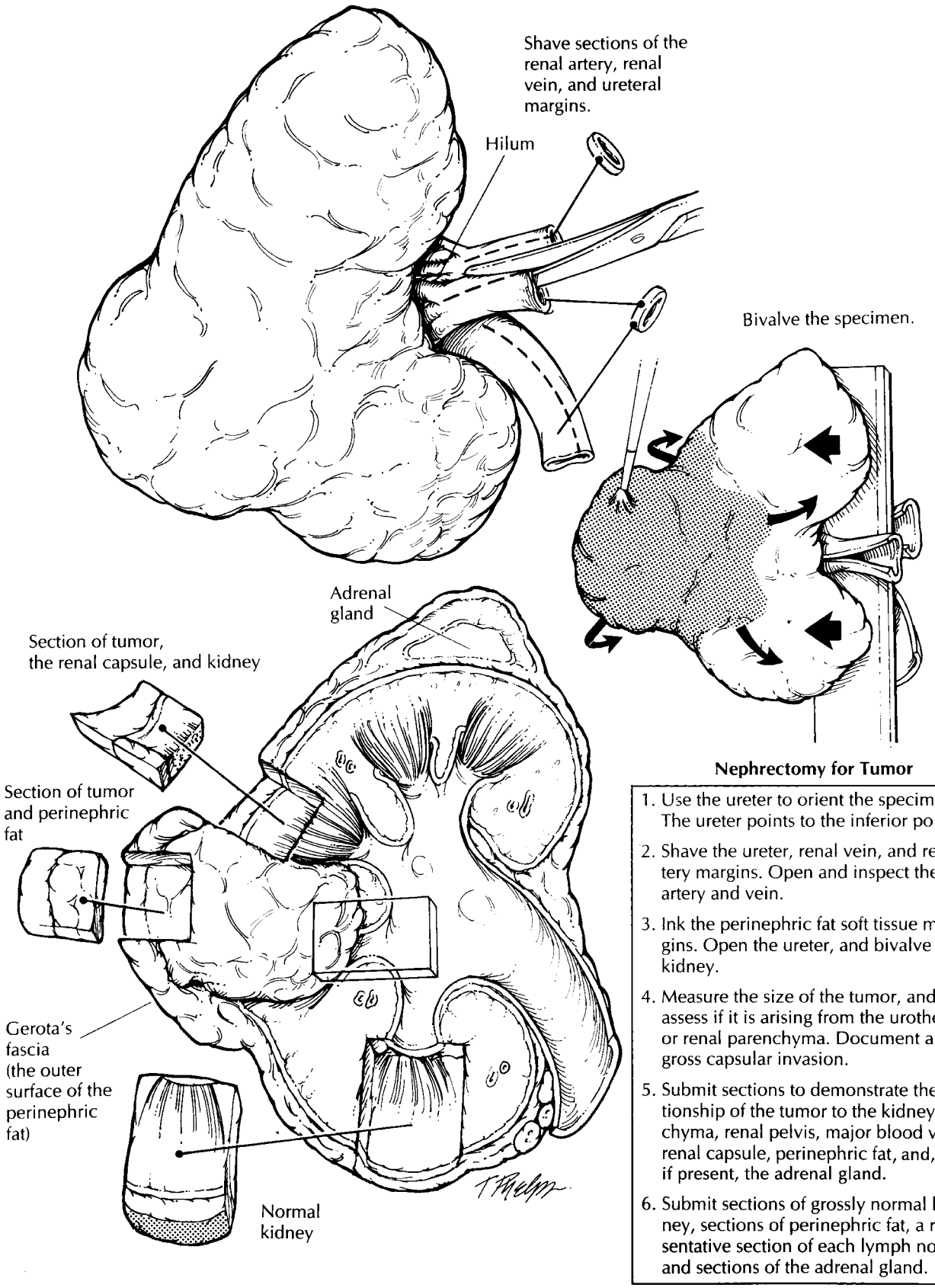
Biopsies

Electron microscopy and immunofluorescence studies are central to the diagnostic evaluation of kidney biopsies for non-neoplastic disease. Even small specimens must be properly oriented because glomeruli should be included in the tissue submitted for each of these tests. The goal of orienting kidney biopsies is to distinguish cortex from medulla. While this distinction is usually quite simple with the larger wedge biopsies, the identification of cortex and medulla in small-needle biopsies often requires the use of a magnifying lens or dissection microscope. Under magnification, the cortex can be recognized by its red sunburst pattern corresponding to the vascular tufts of the glomeruli. In contrast, the straight vessels of the medulla are seen as thin red streaks coursing through tan/white tissue. From the tips of the cortical end, freeze a 1-mm section for immunofluorescence, and submit an adjacent 1-mm section in glutaraldehyde for electron microscopy. If multiple cores are received, do the same for each core. If you cannot confidently identify an end with cortex, do not guess. Rather, submit 1-mm sections from both ends of the core. For larger wedge biopsies, freeze a full-thickness section of cortex for immunofluorescence, and submit 1-mm^3 cubes from the cortex in glutaraldehyde for electron microscopy. Submit the remainder of the tissue in fixative for routine histologic processing.

Nephrectomies for Neoplastic Disease

The purpose of evaluating kidneys resected for neoplasms is to determine the type of tumor, its extent, and the completeness of the resection. This can easily be achieved if you approach the nephrectomy as if it were made up of three individual compartments: the kidney, the renal hilum, and the perinephric fat. Describe each component of the kidney individually and systematically (Table 33-1).

First, weigh and measure the entire specimen. The renal capsule and the perinephric fat should not be stripped from the kidney until after their relationships to the tumor are established. Anatomically orient the specimen. The ureter will provide a useful landmark: the downward



Nephrectomy for Tumor

1. Use the ureter to orient the specimen. The ureter points to the inferior pole.
2. Shave the ureter, renal vein, and renal artery margins. Open and inspect the renal artery and vein.
3. Ink the perinephric fat soft tissue margins. Open the ureter, and bivalve the kidney.
4. Measure the size of the tumor, and try to assess if it is arising from the urothelium or renal parenchyma. Document any gross capsular invasion.
5. Submit sections to demonstrate the relationship of the tumor to the kidney parenchyma, renal pelvis, major blood vessels, renal capsule, perinephric fat, and, if present, the adrenal gland.
6. Submit sections of grossly normal kidney, sections of perinephric fat, a representative section of each lymph node, and sections of the adrenal gland.

TABLE 33-1. Non-neoplastic components of nephrectomy specimen to be inspected and described.

Hilum	
Vessels	• Patency (e.g., atherosclerotic plaque, thrombosis)
Lymph nodes	• Number and size
Ureter	• Size (e.g., stenosis or dilatation)
	• Appearance of mucosa (e.g., red, purulent)
Kidney	
Capsular surface	• Contour (e.g., smooth, granular, coarsely scarred)
	• Character of capsule (e.g., strips with ease, scarred, adherent)
Cortex	• Thickness and color
Medulla	• Thickness and color
	• Shape of the pyramids
Collecting system	• Configuration (e.g., distortion, dilatation, stenosis)
	• Contents (e.g., stones)
	• Appearance of mucosa (e.g., red, purulent)
Perinephric fat	• Appearance
Adrenal gland	• Size and appearance

course of the ureter points to the inferior pole of the kidney. By knowing whether the kidney is from the right or left side, you can easily identify its anterior and posterior surfaces.

Begin the dissection at the kidney hilum. Identify the ureter, renal artery, and renal vein. Shave the margin from each, and then open each with a small pair of scissors to the point at which they enter the kidney. Look for the presence of vascular invasion, atherosclerosis, and thrombosis. Carefully inspect the mucosa and wall of the ureter. Is the ureter dilated or strictured? Are any masses present? Occasionally, lymph nodes will be present in the soft tissues of the hilum, and these should be individually measured and sampled. Other lymph node groups are usually submitted separately by the surgeon.

Next, ink the soft tissue margins and direct your attention to the dissection of the kidney itself. The objective of the initial section is to bivalve the kidney so that the relationship of the tumor to the kidney can be easily visualized. The plane of this initial section may vary depending on the location of the tumor, but in general it will be a sagittal cut that begins at the hilum and exits laterally through the perinephric fat. It may be helpful to insert probes into the calyces of the upper and lower poles of the kidney to guide the knife through the renal pelvis. Once the tumor is exposed, obtain fresh tissue for special studies such as electron microscopy, immunofluorescence, and cytogenetics, as is indicated. Describe the size, shape, color, and consistency of the tumor. Does the tumor appear to be centered in the cortex, medulla, or pelvis? Measure the distance of the tumor to the nearest margin, and note its relationship to the perinephric fat, renal pelvis, renal vein, ureter, and adrenal gland. Photograph the bivalved specimen. At this point you may choose to complete the dissection of the kidney in its fresh state, or you may want to submerge the specimen in formalin until it is well fixed.

The outer surface of the fat represents Gerota's fascia. Ink this surface where it overlies the tumor, and submit perpendicular sections to show the relationship of the tumor to the soft tissue margin. Then carefully peel back the perinephric fat from the kidney, examine the capsular surface, and look for tumor extension through the renal capsule. Keep in mind that when renal tumors invade through the capsule, they tend to bulge from the surface of the kidney. Note any bulges, and document any disruption of the normal contour of the kidney surface by submitting sections that include the tumor, the adjacent non-neoplastic kidney, and the overlaying capsule. Make additional sections through the tumor and surrounding kidney. Look for any satellite tumors.

Submit at least four sections of tumor (or more if necessary) to demonstrate the relationship of the tumor to the kidney parenchyma, renal pelvis, major blood vessels, renal capsule, and perinephric fat. Because some renal neoplasms are multifocal, section through the remainder of the kidney, looking for smaller tumors. Do not forget to describe the cortex,

medulla, and collecting system of the non-neoplastic kidney. Also, submit one or two sections of the non-neoplastic kidney for histology. Finally, dissect the fibrofatty tissue enveloping the kidney, and submit one or two sections of the fat to assess infiltration by tumor.

Nephrectomy specimens often will include the adrenal gland. Be sure to look for it in the superior perinephric fat; if it is present, weigh it, measure it, and submit a section. Keep in mind that the lymph nodes will be found in the soft tissues at the kidney hilum. A misdirected search for lymph nodes in the perinephric fat outside of the hilum will be a waste of your time.

Important Issues to Address in Your Surgical Pathology Report on Nephrectomies for Tumor

- What procedure was performed, and what structures/organs are present?
- Is a neoplasm present?
- Where is the tumor located?
- How large is the tumor?
- Does the tumor invade the renal capsule, Gerota's fascia, major veins, or the adrenal gland?
- What are the histologic type and grade of the neoplasm?
- What is the status of each of the margins (ureter, renal vein, soft tissue)?
- Are metastases identified? Record the number of nodes involved and the number examined.
- Does the non-neoplastic portion of the kidney show any pathology?

Partial Nephrectomies

Occasionally, you may receive a partial nephrectomy—that is, a tumor removed with only a small portion of surrounding renal parenchyma. Take the same approach as you would for a total nephrectomy, only remember to sample the renal parenchymal margins. Ink these margins, and submit perpendicular sections to demonstrate the distance of the tumor's edge to the margin. Given the much more limited extent of these resections, you will often not be able to assess the relationship of the tumor to the perinephric fat, renal vein, ureter, or other important structures.

Nephrectomies for Non-neoplastic Disease

Dissection of the nephrectomy specimen is essentially the same for neoplastic and non-neoplastic diseases. Before beginning the dissection, try to establish from the patient's clinical history whether fresh cortical tissue should be taken for immunofluorescence studies or electron microscopy. Evaluate the kidney, the hilum, and the perinephric fat as three separate compartments, using the guidelines of dissection given earlier. When the specimen shows some modification (e.g., the absence of a perinephric soft tissue compartment), simply alter the dissection accordingly. Some pathologists may prefer to evaluate the texture of the cortical surface by stripping the capsule from the fresh specimen, and this can be done before the kidney is sectioned and fixed.

If calculi are identified during the dissection, submit some for chemical analysis if indicated. Because the macroscopic findings often provide crucial clues to the pathologic process involving the kidney, describe each component of the kidney individually and systematically (see Table 33-1).

Cystic Kidneys

Sometimes kidneys are resected for congenital or acquired non-neoplastic cystic disease. Even for massively enlarged and distorted kidneys, the dissection should follow the same guidelines given above, only remember to pay particular attention to the following points: (1) Probe the ureters before opening them to check for patency. (2) Note the location of the cysts in terms of their relationship to the cortex and medulla. (3) Document the size and contents of the cysts. (4) Last, because cystic kidneys can harbor unsuspected neoplasms, thoroughly section and inspect the kidney. Submit sections of any suspicious areas, including solid foci, cysts with thickened walls, and cysts with a papillary lining.