Normal kidney is a bean-shaped organ located in the lumbar retroperitoneal space opposite vertebrae T-12 to L-13. Adult kidney 12 (L) x 6 (W) x 2.5 (T) cm. Average weight 125-170 g (M) and 115-155 g (F).
Percutaneous Kidney Biopsy

- The majority lie on their abdomen with a firm pillow under the person’s body to support the abdomen and help to push the kidneys up.
- In transplant cases on their back because the kidney is transplanted in the front lower part of the abd to one side of the bladder.
- Using imaging techniques the needle is inserted to remove the kidney tissue.
The use of biopsy pad is not recommended for kidney biopsies as the foam material may cause artefactual holes.
RENAL BIOPSY PROCESSING

NEEDLE CORE BIOPSY

Light Microscopy

Electron Microscopy

Immunofluorescence

Light Microscopy Stains
Renal stain panel

Cut at 2 microns
5 unstained slides (#10-14)
kept for possible additional stains/immunohistochemistry.

IMMUNOFLOURESCENCE

Antibody Stain Panel:

- IgG
- IgM
- IgA
- C3
- C1q
- Albumin
- Kappa
- Lambda

Transplant Kidneys

- Combined CD3 (T-cell marker) with PAS stain
- CD20 (B-cell marker) occasionally
- C4d in immunofluorescence
Electron Microscopy Processing

- Glutaraldehyde-based fixation
- Heavy Metal Staining:
  - Osmium
  - Uranyl Acetate
- Dehydration
- Clearing (with propylene oxide)
- Resin Infiltration

Thick Sectioning:
- 0.5-2 micron sections cut on a glass knife on an ultramicrotome.

Thin sections:
- 30-100 nanometers
- Sectioned on a diamond knife onto a water bath.

Ultramicrotomy
Ultrathin sections are picked up from the water bath and placed onto copper mesh grids with 200 openings. The sections are then stained:
- Uranyl Acetate
- Lead Citrate

- Stained grid loaded in specimen arm
- Introduced into the electron microscope
- Pumped under vacuum
During the fetal development the kidneys originally develop in the pelvis and migrate superiorly by gradual retroperitoneal ascent.
Cortex, granular brown, 70%, 1.0 cm
- Continuous and undivided
- Portions of the cortex, the columns of Bertin, have no renal capsular investment
  - Important in renal neoplasia

Medulla, striated, outer 37% and inner (papilla) 3%
- Discontinuous with individual pyramids

Main Divisions

Main Divisions...

Renal collecting system
- Calyces
  - Minor (most proximal) and major
  - Enveloped by the renal sinus fat
- Sac-like renal pelvis
  - Partially enveloped by the renal sinus fat
- Ureter
Main Divisions ...

- **Renal Sinus**
  - Fat-containing component housed within the confines of the kidney that also invests the calyceal and pelvic portion of the collecting system

- **Renal Hilum**
  - Medial concave surface with a 3-cm slit-like space
  - Ureter, branches of renal arteries and veins, nerves and lymphatics

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**Fig. 26-4. Review of kidney structure.**
Nephrons

- 400,000 - 800,000
  - Number influenced by renal developmental factors such as preterm labor, short stature...
  - Less in older age due to age-related obsolescence

Nephron Component

- Renal Coruscle
- Tubular portion of the nephrons
Renal Corpuscle

- Bowman Capsule
- Glomerular tuft
- Endothelial cell
- Mesangial cell
- Mesangial Matrix
- GBM
- Urinary Space
- Juxtaglomerular Apparatus

Tubular portion of the Nephrons

- Proximal Tubule
- Loop of Henle
- Distal Tubule
- Connecting Tubule
- Collecting Duct
The organization unit of metanephrosis is the renal lobe.

- 10:14, according to the papillary count.
- Medullary pyramid and surrounding cortical mantle
Gross Anatomy in Pediatric Age

- The newborn kidney has a shorter, more rounded configuration.
- Less fat in renal sinus.
- Prominent lobation of the surface.

Normal cut surface of fetal kidney (25 week’s gestation)
Kidney, Gross Features

- The convex outer surface is invested by a capsule composed of a thin fibroblastic layer that is difficult to dissect from the underlying nephrons and an outer thicker collagenous layer easily stripped by blunt dissection. The renal capsule is covered by fat which in turn surrounded by a condensation of retroperitoneal connective tissue, the peripheral fascia of Gerota which can be in direct contact with the renal capsule anteriorly, where the perirenal fat is scant.

Histology

- Renal cortex, granular appearance due to gloms and tubules
- Medulla, darker with 8-18 pyramids with their base at the corticomedullary junction and the apex at the sinus.

Histology

- Full complement of nephrons between the 32nd and 36th weeks of gestation.
  - Subsequent growth with elongation and maturation of nephrons.
- The glomeruli in the outer cortex of newborn are crowded together.
  - The older, more mature glomeruli deeper in the cortex are more widely separated.
  - Tubular elongation separate gloms from one another and also from the lobar surface.
Kidney Development
- As the developing kidney grows, new several corpuscles are added near the capsule while those found deeper in the cortex formed earlier are more mature.

Histology...
- Glomerular development spans a 6-7 month period of fetal life with a progressive spectrum organized with the mature ones in the deeper part of the cortex.
- Sclerotic gloms in infants 1-2% of total gloms, up to 10% in some cases.
- Fetal kidneys can show gloms outside the confines of the parenchyma such as renal sinus or within the capsule.
Relative Frequency of Pediatric renal malignancies
- Wilms tumor (nonanaplastic) 80%
- Wilms tumor (anaplastic) 5%
- Mesoblastic nephroma 5%
- Clear cell sarcoma 4%
- Rhabdoid tumor 2%
- Miscellaneous 4%
  › Neuroblastoma, PNET, synovial sarcoma, RCC, angiomyolipoma, lymphoma, other.

Macroscopic Extent of Tumor
- Primary tumor cannot be assessed
- No evidence of primary tumor
- Tumor limited to kidney
- Tumor extension into perinephric tissues
- Tumor extension into endothoracic
- Tumor extension beyond Gerota’s fascia
- Tumor extension into major renal vein or its segmental (muscle containing) branches, inferior vena cava
- Tumor extension into pelviccaliceal system
  › Major calyx
  › Minor calyx
- Tumor extension into adrenal gland
  › Direct Invasion (T4)
  › Noncontiguous (M1)
- Tumor extension into other organ(s) structure(s)

Macroscopic extent of tumor
- Renal sinus fat involvement is an under-recognized phenomenon.
- An important pathway of tumor spread
- Renal sinus fat involvement predicts a more aggressive outcome than peripheral perinephric fat invasion.
- The adrenal gland involvement should be classified as contiguous or separate (noncontiguous) nodule (metastatic).
Specimen Type

- Standard radical nephrectomy consists of entire kidney with a variable length of ureter.
  - Adrenal gland is usually removed en bloc.
  - Entire perirenal fat to the level of Gerota Fascia
  - Variable length of hilar major renal vessels.
  - Regional lymphadenectomy is not generally performed (sometimes sampled separately).
Poorly circumscribed bulky, soft, pale and relatively uniform tumor with satellite lesions.