Kidneys

The kidneys are paired, bean-shaped structures located in the retroperitoneal space directly beneath the sublumbar muscles.

The cranial pole of the right kidney lies in the renal fossa of the caudate liver lobe and is located more cranially than the left kidney.

The cranial pole of the left kidney lies lateral to the adrenal gland, which is closely associated with the cranial aspect of the left renal vessels.

The left kidney is generally more mobile than the right kidney.

The concave surface of the kidney is located along the medial aspect and is called the hilus.
The hilus is the location where the renal artery enters the kidney and the renal vein and ureter exit. Nerves and lymphatic vessels enter at the hilus as well.
The renal arteries arise directly off of the abdominal aorta. Although most kidneys are supplied by a single renal artery,
The renal vein returns blood back into the caudal vena cava. The left renal vein also receives blood from the left ovarian or testicular veins.
The kidney receives innervation from the sympathetic ganglion and parasympathetic sources.

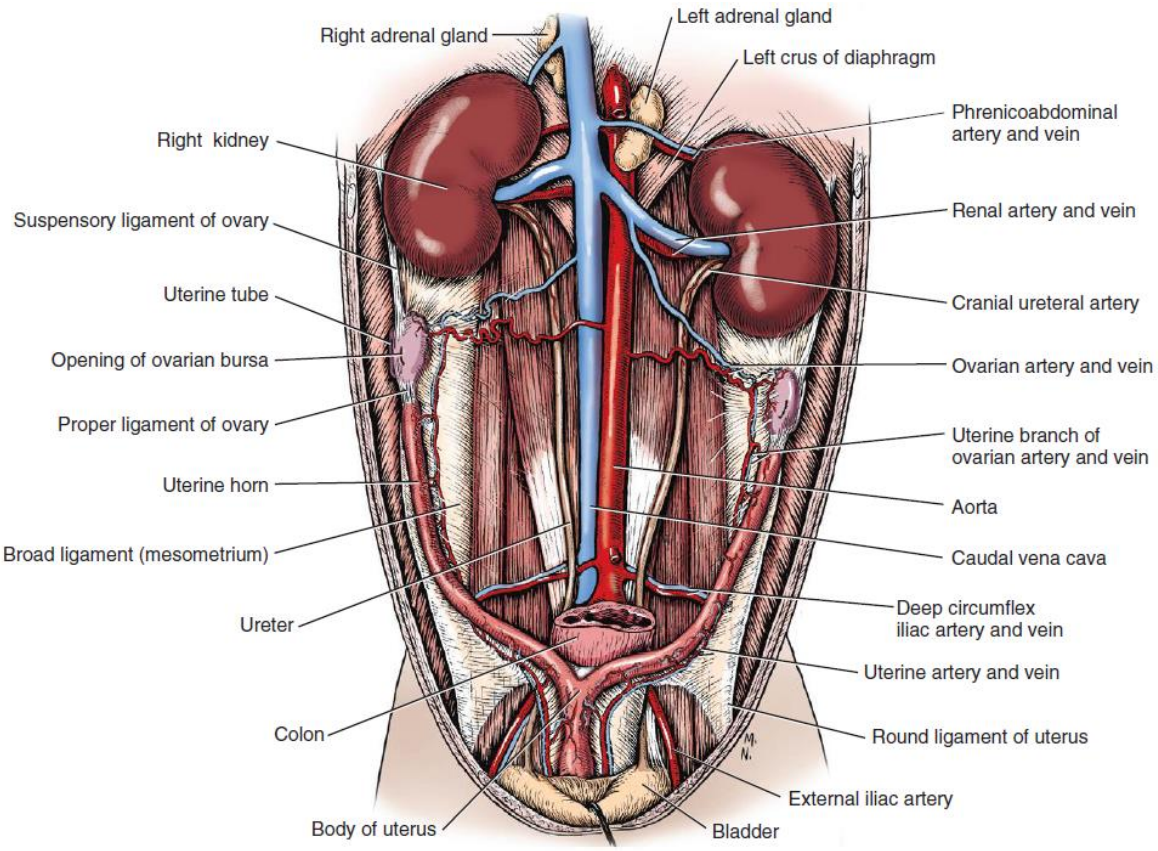


Figure 114-3 Female urogenital system in situ, ventral aspect. (From Evans HE, de Lahunta A: Miller's anatomy of the dog, ed 4, St Louis, 2013, Saunders/Elsevier.)

ABNORMALITIES OF THE KIDNEY

Renal Agenesis

Renal agenesis is often defined as the failure of one or both kidneys to develop.

Renal Ectopia

The metanephros originates near the bifurcation of the aorta. As the lumbrosacral region grows, the kidneys normally "ascend" from the pelvic region to the level of the thoracolumbar junction.

Fused Kidney

A fused single kidney results from convergence of the developing kidneys as they ascend. The fused kidney is often shaped more like a horseshoe rather than the more typical bean shape. Most fused kidneys function normally.

Renal Calculi

Accumulation of the calculi in the pelvic of the kidney.

Renal Neoplasia

Acquired Renal Cysts

Renal cysts are epithelial-lined, fluid-filled cavities. Acquired cysts can be secondary to chronic nephropathies or may be incidental findings in healthy dogs.

Perirenal Pseudocysts

A perirenal pseudocyst is a unilateral or bilateral fluid accumulation around the kidney; fluid is contained within a dense membrane of fibrous connective tissue that lacks an epithelial lining.

Renal Abscesses

abscess may develop within renal parenchyma or surrounding the kidney (perinephric bscessation).

Renal Trauma:

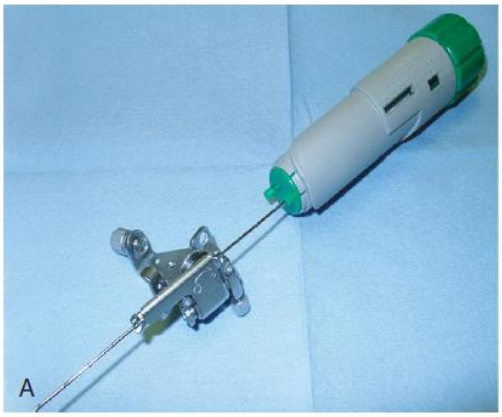
SURGICAL TECHNIQUES

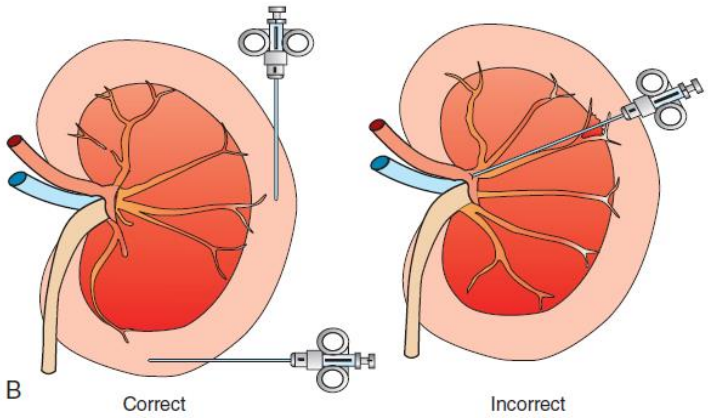
Renal Biopsy

Indications

Histopathologic evaluation of samples from diseased kidneys may be required to determine the underlying pathology causing renal dysfunction.

Indications for renal biopsy include evaluation of a patient with neoplasia; nephrotic syndromes; renal cortical disease, such as protein-losing glomerulopathy; or acute, progressive renal failure in which the underlying cause cannot be determined by less invasive methods.





Nephrotomy

Indications

Incision of renal parenchyma is performed to obtain tissue samples or to gain access to the renal pelvis for removal of nephroliths or other obstructive lesions.

Indications for nephrotomy include chronic infection, the presence of renal calculi, persistent hematuria of renal origin, or persistent hydronephrosis.

Renoliths are typically removed when they are associated with partial or complete obstruction and subsequent pelvic dilatation,

Surgical Technique

A nephrotomy is begun by releasing the kidney from its retroperitoneal attachments.
This provides better access for **temporary occlusion of the renal vessels**, giving the surgeon better control over intraoperative hemorrhage.

1- Use of hemostatic clamps or application of excessive pressure with vascular clamps can result in endothelial injury and promote vessel thrombosis.
2- The kidney is incised on the midline through the renal capsule
3- The renal parenchyma is then sharply incised, with the length of the parenchymal incision based on the amount of exposure required.

For removal of a small calculi, a smaller stab incision may allow adequate access for insertion of retrieval forceps into the renal pelvis.

For larger or more numerous calculi or for the removal of other mass lesions from the pelvis, the incision is extended from pole to pole (bisectional nephrotomy).
After access has been obtained, the renal pelvis and its recesses are gently explored to dislodge and remove any calculi or fragments.

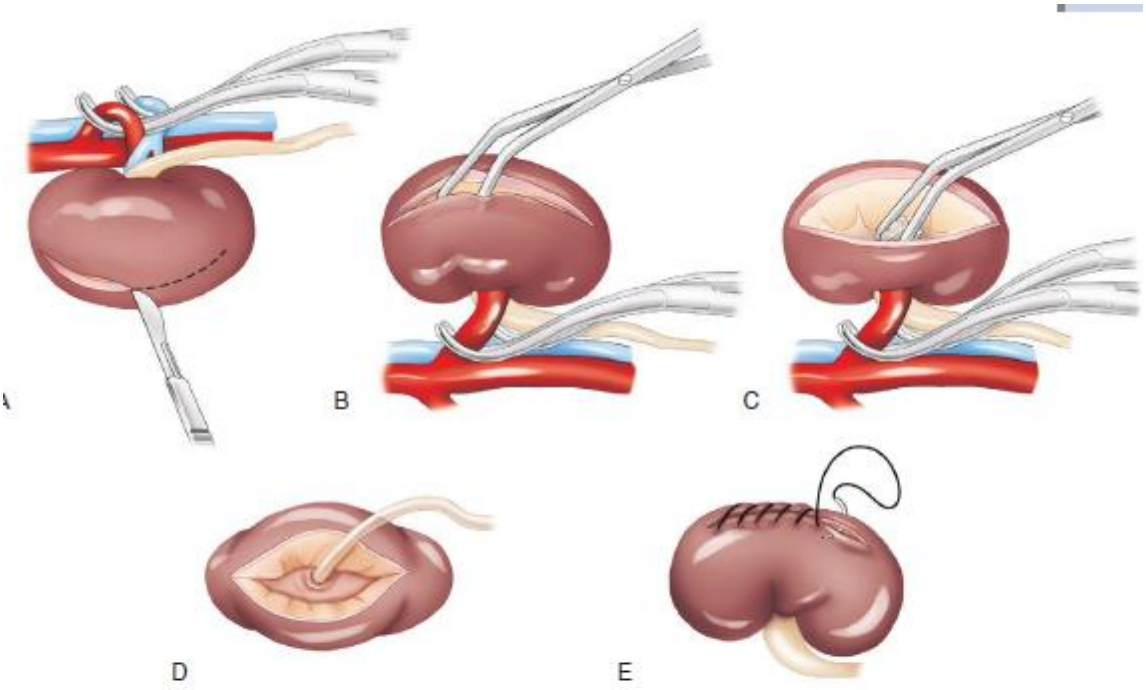


Figure 114-10 Nephrotomy. **A,** After vascular occlusion, the kidney is incised longitudinal through the capsule on midline of the convex surface. The cortex is cut for a bisectional nephrotomy or spread **(B)** for an intersegmental nephrotomy. **C,** The exposed calculus is grasped and removed. The pelvic recesses are explored and flushed, and a catheter **(D)** or suture is passed through the ureter to verify patency. **E,** The nephrotomy incision is closed by placing sutures through the renal capsule and superficial parenchyma. (**A–C** from Lanz OI, Waldron DR: Renal and ureteral surgery in dogs. Clin Tech Small Anim Pract 15:1–10, 2000. **D-E** from Stone EA: Canine nephrotomy. Compend Contin Educ Pract Vet 9:883, 1987.)

- The nephrotomy incision is closed Closure of the kidney can be accomplished with a variety of techniques.

- Direct compression across the incision for 1 to 5 minutes allows formation of a fibrin seal between the wound edges.
- The renal capsule is then closed with a continuous suture of a fine monofilament absorbable material.
- **Other options for closure include use of horizontal mattress sutures placed through the capsule and partial thickness into the renal cortex. Mattress sutures are tied with enough gentle pressure.**

After the kidney has been secured, sponge counts are reconciled, a general abdominal lavage is performed, and the abdomen is closed.

Partial Nephrectomy

Indications

Indications for partial nephrectomy are repair of substantial renal damage or resection of neoplasia.

Surgical Technique

- The blood vessel is closed by temporary pressure using the uncrushing forceps or by ligation.
- The surgical approach is usually through a ventral midline incision.
- The kidney is freed from its retroperitoneal attachments, and the vascular pedicle is temporarily occluded as described above for nephrotomy.
- The affected portion of the kidney is identified and removed with blunt dissection.
- If the collecting system is involved in the resection, it can be closed with 4-0 to 6-0 monofilament suture in a continuous pattern or left open (as with nephrotomy) before parenchymal closure is attempted.

The parenchymal defect is closed by passing overlapping mattress sutures through the capsule and parenchyma.

Mattress sutures are tightened to apply gentle compression,

arterial bleeders are coagulated or ligated

The renal capsule is sutured closed over the exposed tissues.

Complications

Complications commonly reported in humans after nephronsparing surgery include hemorrhage that requires blood transfusion, urine leakage, and urine fistula.

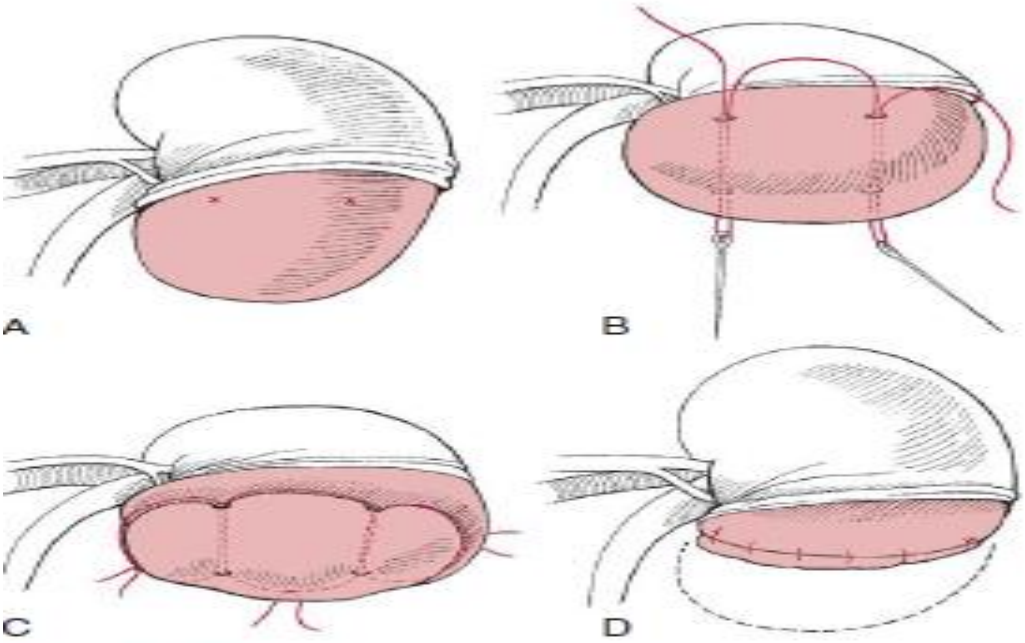


Figure 114-11 Partial nephrectomy. **A,** If possible, the capsule is peeled back from the area to be resected. **B,** Overlapping mattress sutures are passed through the parenchyma proximal to the proposed line of resection. **C-D,** The sutures are tightened to approximate the tissue, and the parenchyma is excised distal to the sutures. If possible, the capsule is reapposed over the resected parenchyma.

Nephrectomy and Nephroureterectomy

Indications

Indications for nephrectomy or nephroureterectomy include irreparable trauma, persistent infection, renomegaly, obstructive calculi with persistent hydronephrosis , renal or perirenal masses, and harvest for kidney donation.

Surgical Technique

The kidney is approached through a ventral midline incision. Adequate visualization is usually provided by extending the incision from the xiphoid two thirds of the distance to the pubis; in some situations, the incision should be extended to the pubis.

Self-retaining (e.g., Balfour) retractors are placed, and **the falciform ligament is torn off one side of the abdominal incision or torn from both sides**, ligated at its base, and resected. The abdomen is explored, and both kidneys are evaluated to ensure that the animal has two kidneys and that there are no gross abnormalities associated with the kidney that will remain after surgery.

1- After the kidney has been freed from its retroperitoneal space, the perirenal fat surrounding the renal hilus is separated to allow identification of the renal artery and vein.
2- The renal artery and vein are each dissected free from surrounding tissues, and at least two sutures are preplaced around each vessel.
3- Ligation is normally performed with a long-lasting absorbable suture (polyglyconate [Maxon] or polydioxanone) or a nonabsorbable suture material (nylon, polypropylene, or silk),
4- **The authors normally ligate the artery before the vein to prevent blood accumulation and increased pressure within the kidney and to provide the greatest degree of hemostasis**.
5- A moistened laparotomy sponge can be placed in the fossa to help staunch any other minor hemorrhage.
6- After the kidney has been freed and the renal vessels have been ligated, **the ureter** is easily dissected from its retroperitoneal position down to the bladder.
7- The ureter is ligated close to the bladder and transected.

The local area is gently lavaged with warm saline, and the abdomen is closed routinely.

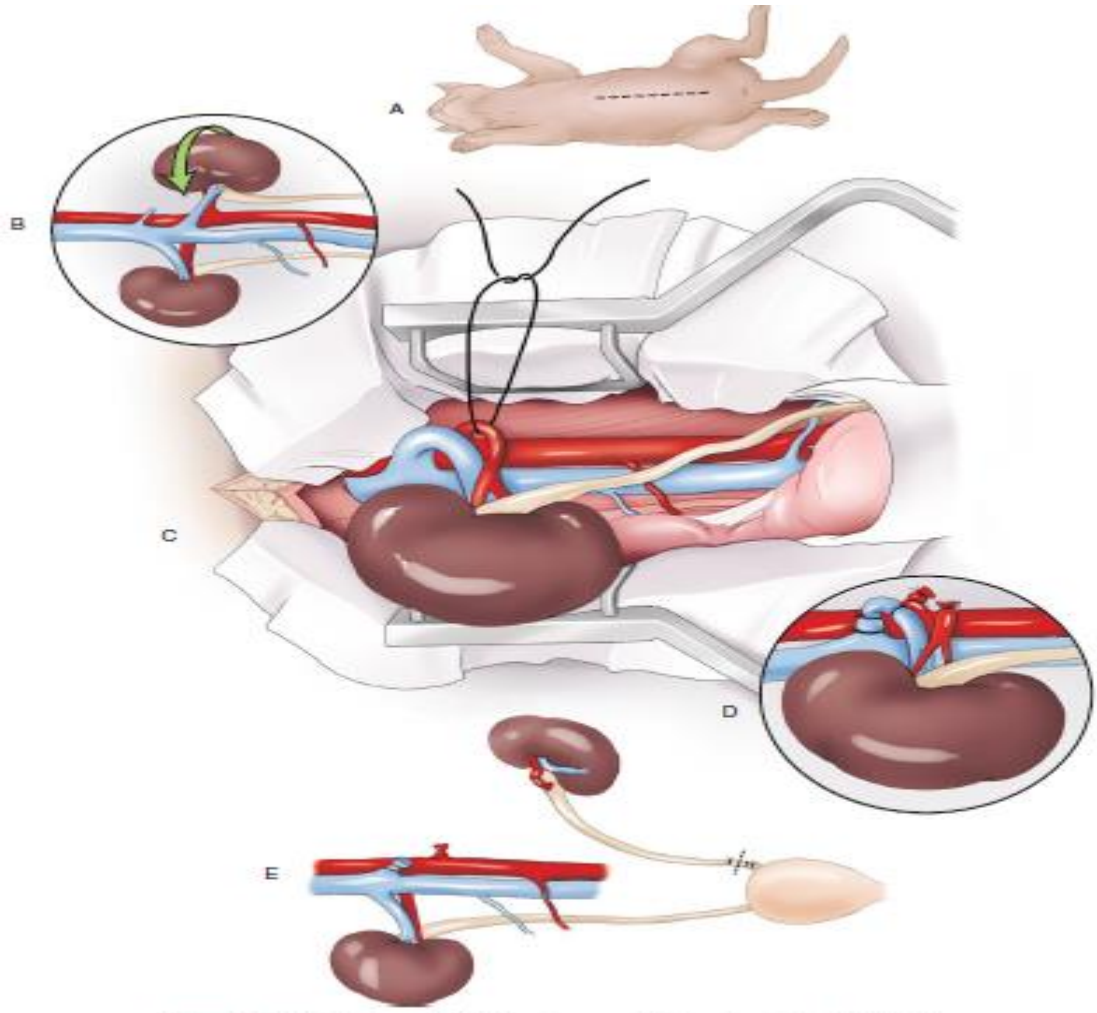


Figure 114-13 Nephrectomy. A, The kidney is approached through a ventral midline incision. B, The kidney is freed from its retroperitoneal attachments. Ventromedial rotation exposes the vessels. C, Sutures are preplaced around the renal artery and vein. In intact animals, flow to and from gonadal vessels should be spared. D, Vessels are triple ligated before transection. E, The ureter is double ligated close to the bladder and transected. (From Lanz OI, Waldron DR: Renal and ureteral surgery in dogs. Clin Tech Small Anim Pract 15:1–10, 2000.)