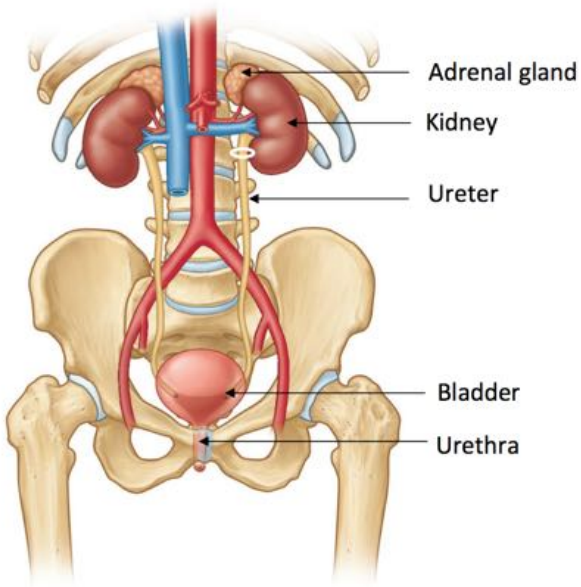
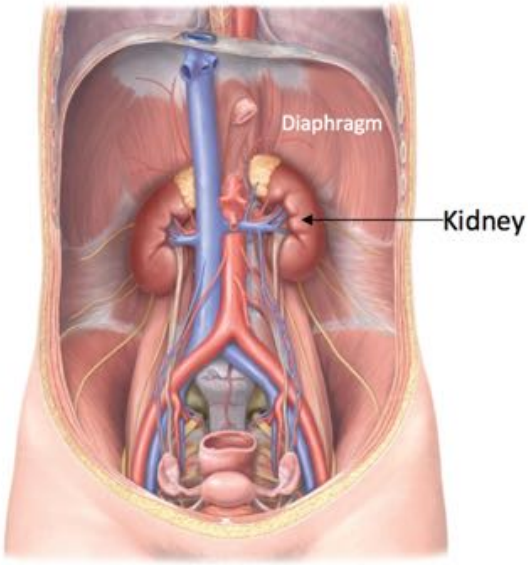
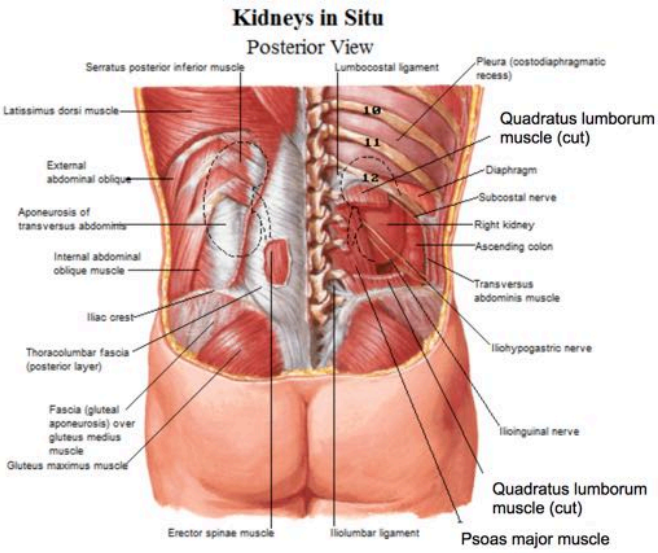
Lecture 56 – Kidney and Urinary System

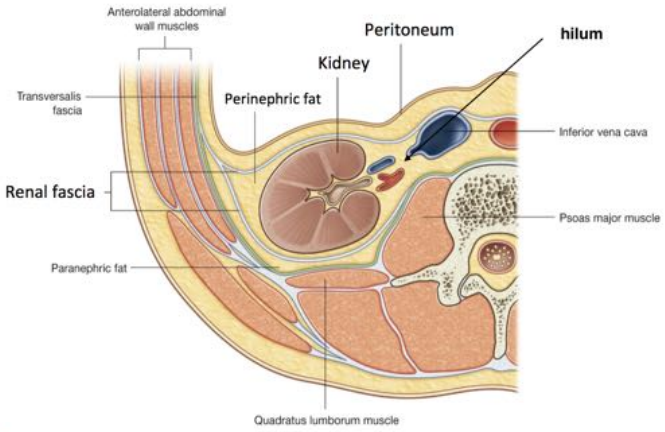


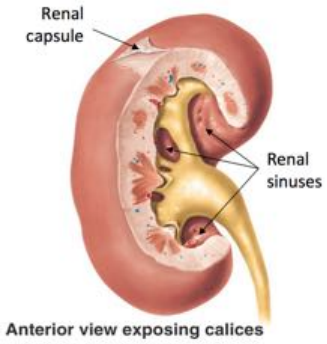


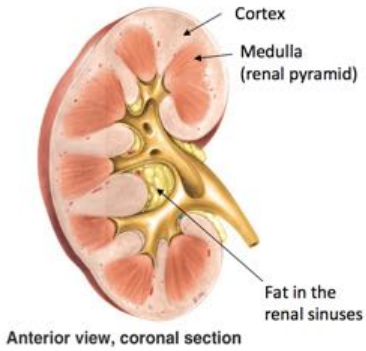
- The adrenal glands are located on the superomedial aspect of the kidney
- The right diagram shows a picture of the kidney with the abdominal walls and organs removed
- The kidneys are located posteriorly and are 10cm long, 5cm wide & 2.5cm thick (bean shaped)
- The kidneys are located outside the peritoneal cavity; it extends from T12-L3
- The kidney can move up and down along with the diaphragm as it contracts
- From the posterior aspect, the kidney is located behind the **quadratus lumborum muscle**; this muscle extends between the 12th rib and the iliac crest
- This is surgically significant, as cutting through this muscle to access the kidney is not the best way
- To operate on the kidney, it is best to cut anteriorly or laterally (flank approach) to avoid the peritoneal cavity (peritoneal cavity is prone to infection) and access the kidney through the **extraperitoneal** route



- The kidney is lined by **perinephric fat** which is then lined by **renal fascia**
- The kidney has a **hilum** located anteromedially to allow structures to enter and exit the kidney

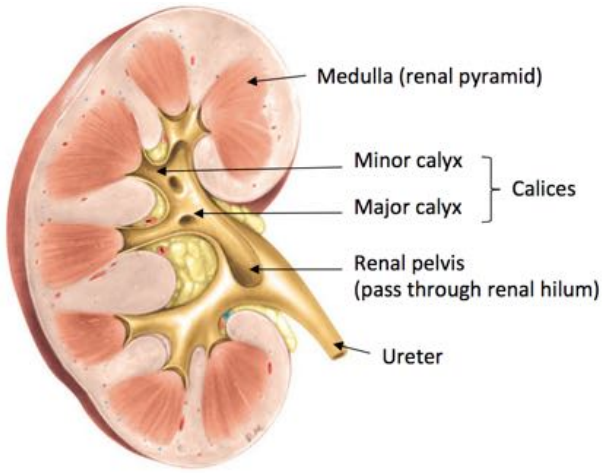




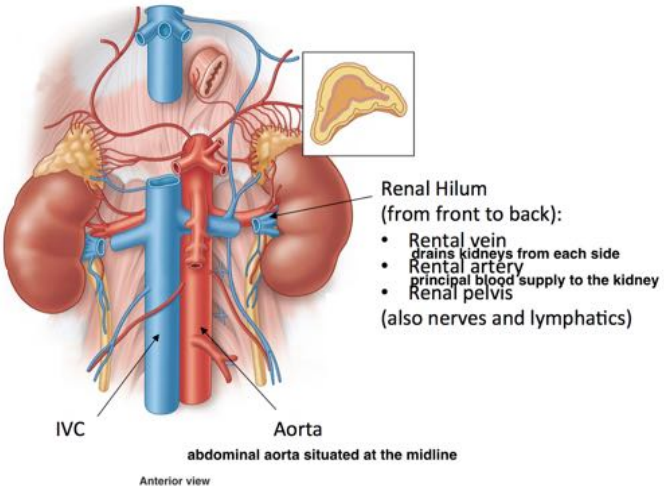


The kidney is lined by the **renal capsule**. The space within the kidney is known as the **renal sinuses** which are usually filled with **perinephric fat**. The **medulla** has its base faced towards the surface while its apex projects towards a tube structure from which urine is secreted. Each medulla is separated by **cortex**. Urine is secreted from the medulla.

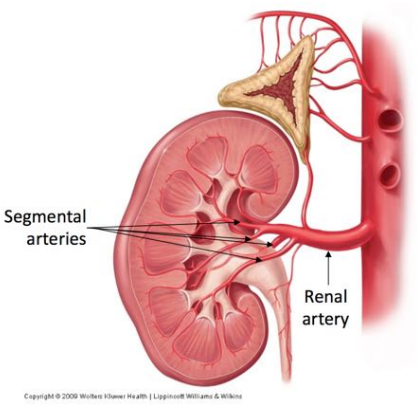
Medulla secretes into the **minor calyx**. 2 or 3 of these form the **major calyx**. 2 or 3 of these form the **renal pelvis**. The renal pelvis is the superior dilated part of the ureter

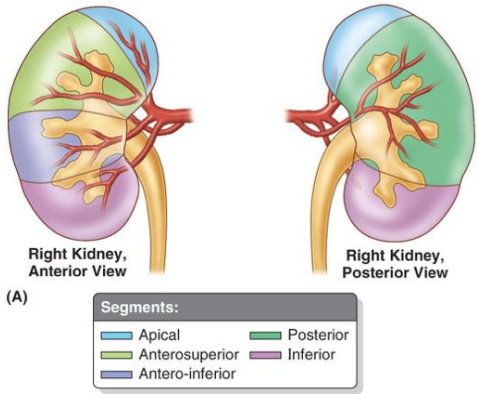


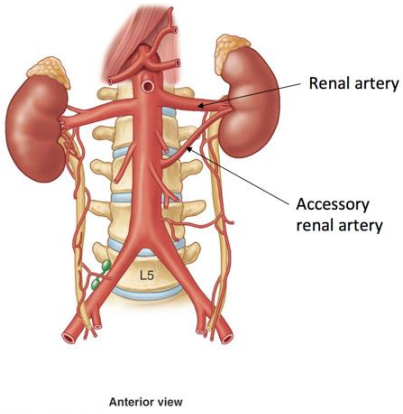
- The renal hilum from front (anterior) to back (posterior): **renal vein, renal artery & renal pelvis**
- Nerves are harder to see
- Renal vein drains kidney from each side; left renal vein has longer course to travel
- IVC is located on the right of the abdominal aorta

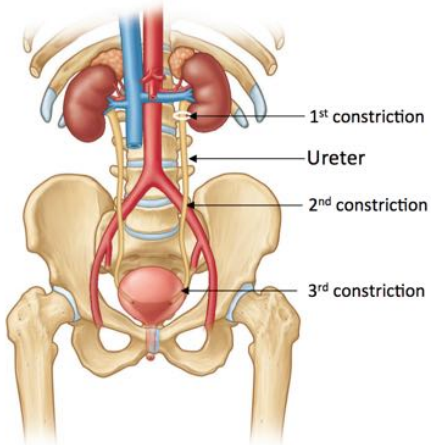


- Renal arteries divide into **segmental arteries** which supply separate compartments of the kidney (known as renal segments)
- Each **renal segment** has an independent blood supply and are surgically resectable; each renal segment is functionally independant
- This acts a protective mechanism to ensure vital function is maintained
- An **accessory renal artery** also exists: this is due to the kidney's initial development at the lower pelvis – the kidney then changes its position due to different growth rate compared to the abdominal wall; during its initial development, the accessory renal artery was the principal blood supply of the kidney
- The accessory artery, along with the renal artery, must be tied off during surgery to prevent peritoneal bleeding
- The **ureter** extends from the abdomen down to the pelvis and is ~25cm long; it is essentially a muscular tube with 3 narrow (constriction) points the help squeeze urine through:
  - ❖ 1st constriction is at the **renal pelvis** and is known as the **uretopelvic junction**
  - ❖ 2nd constriction is at the **pelvic brim**; the ureter tips over the pelvic brim as it enters the pelvis – the bony edge compresses the ureter laterally
  - ❖ 3rd constriction occurs at the terminal portion of the ureter as it traverses the bladder wall obliquely – the bladder muscles act as a functional sphincter to prevent the backflow of urine
- Kidney stones most often block constriction sites in the ureter

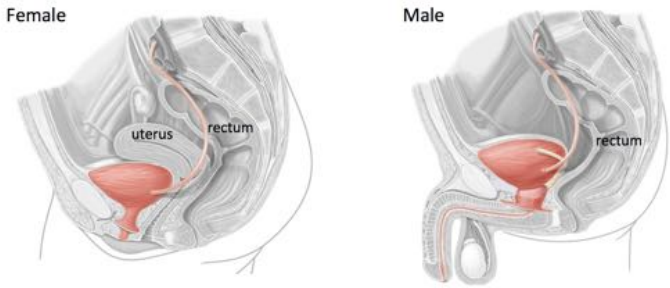






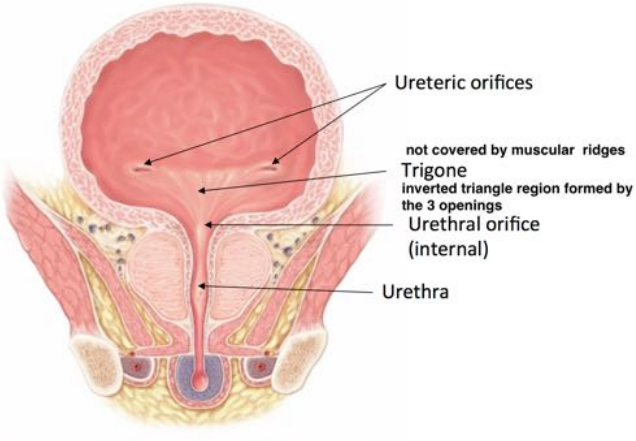


- Bladder sits behind the pubic bone for both males and females
- The uterus sits behind the bladder for females
- The bladder is a hollow viscus with strong muscular walls

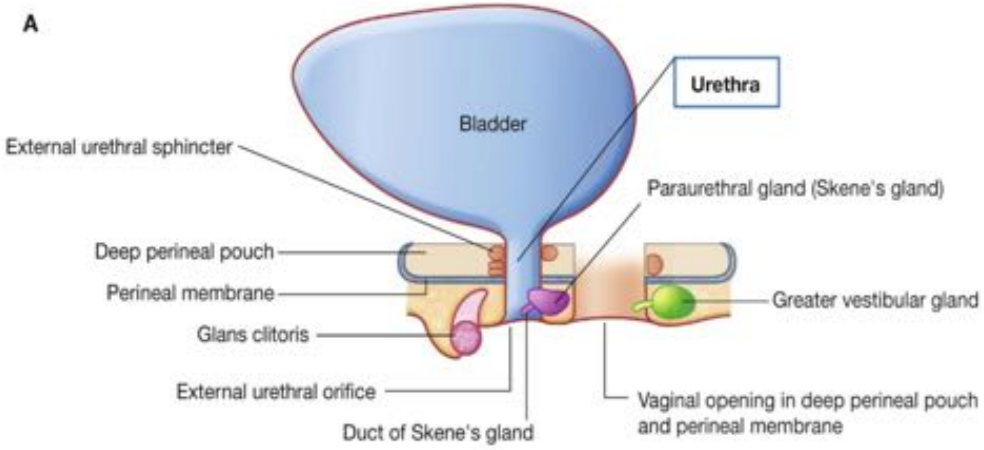


- It is positioned most anterior of the pelvic viscera
- It is pyramidal-shaped with the apex located anteriorly and the base located posteriorly
- The top part of the bladder can extend beyond pelvis when full; the bladder neck is fixed posteriorly by a ligament known as the **pubovesical ligament**

- The kidney has two openings at the top **(ureteric orifices)** where the ureter enters
- It then has an opening of the bladder inferiorly to the urethra via **urethral orifices**

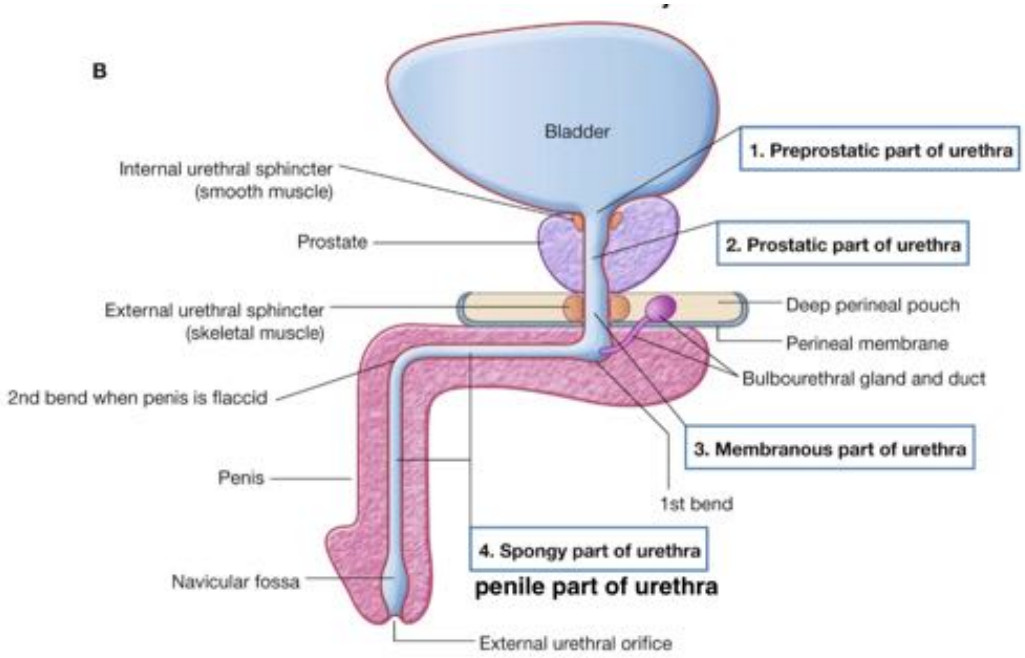


Urethra in Females



- Short (~4cm long)
- Passes through the pelvic floor and perineal membrane
- Traverse pelvic floor and reaches the exterior environment
- Clinically, a short urethra is good for traversing a catheter, however female urinary system more prone to infection due to shorter course of invasive microbes

Urethra in Males



- Long (~20cm long)
- Divided into 4 parts:
  1. **Preprostatic part of urethra:** very short and leads into prostate
  2. **Prostatic part of urethra:** surrounded by prostatic gland; during aging, prostate can undergo benign hypertrophy to compress the urethra, making it harder for individuals to push out urine (often requiring abdominal muscles)
  3. **Membranous part of urethra:** leads into the 1st bend of the urethra
  4. **Spongy part of uretha:** urethra of the penis
- Has 2 bends along its course
- Harder to traverse a catheter due to longer urethra and bends
- Men are less prone to urinary tract infections as bacteria find it harder to invade