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Prof. Dr. Youssef Hussein Anatomy - YouTube

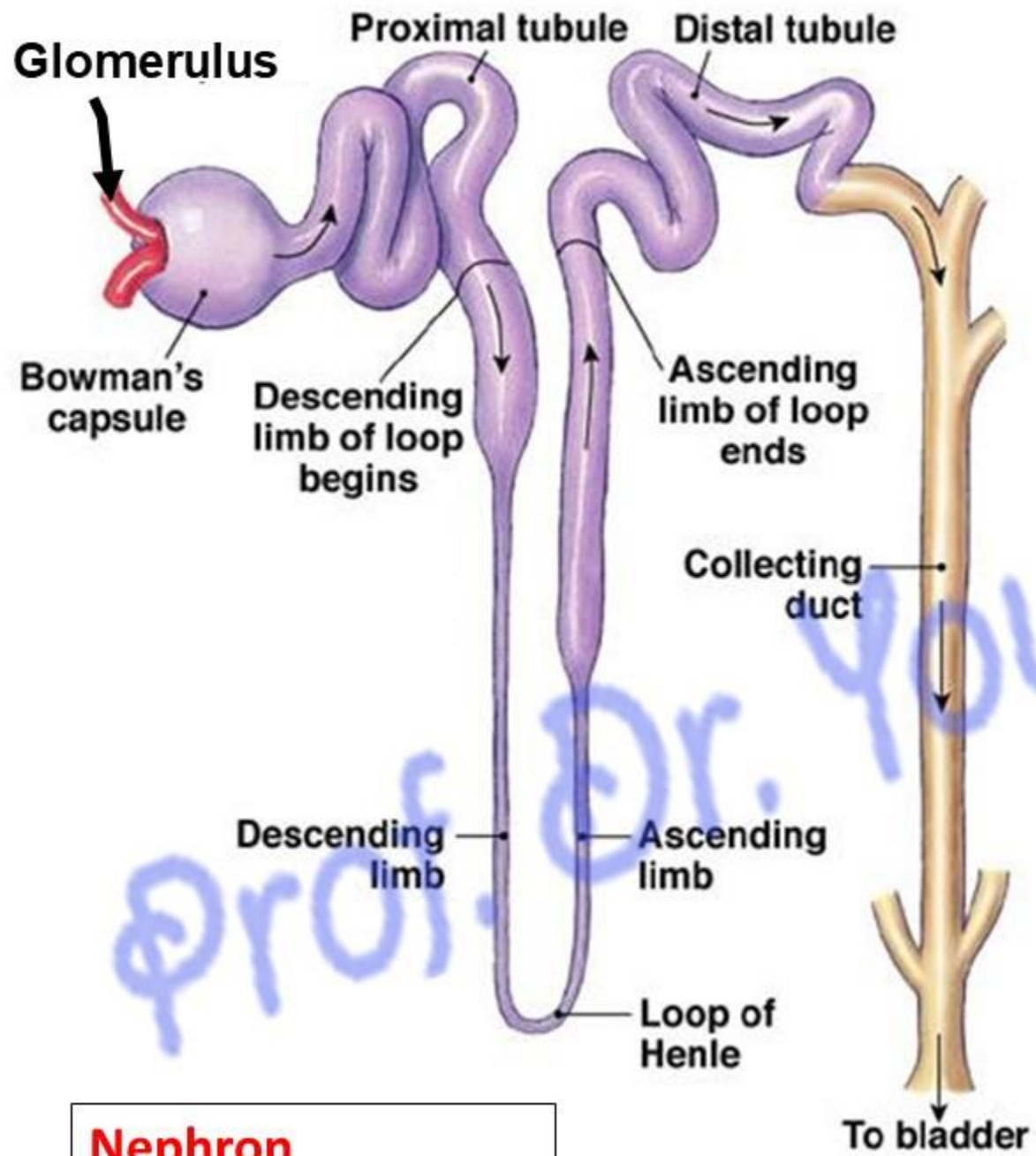
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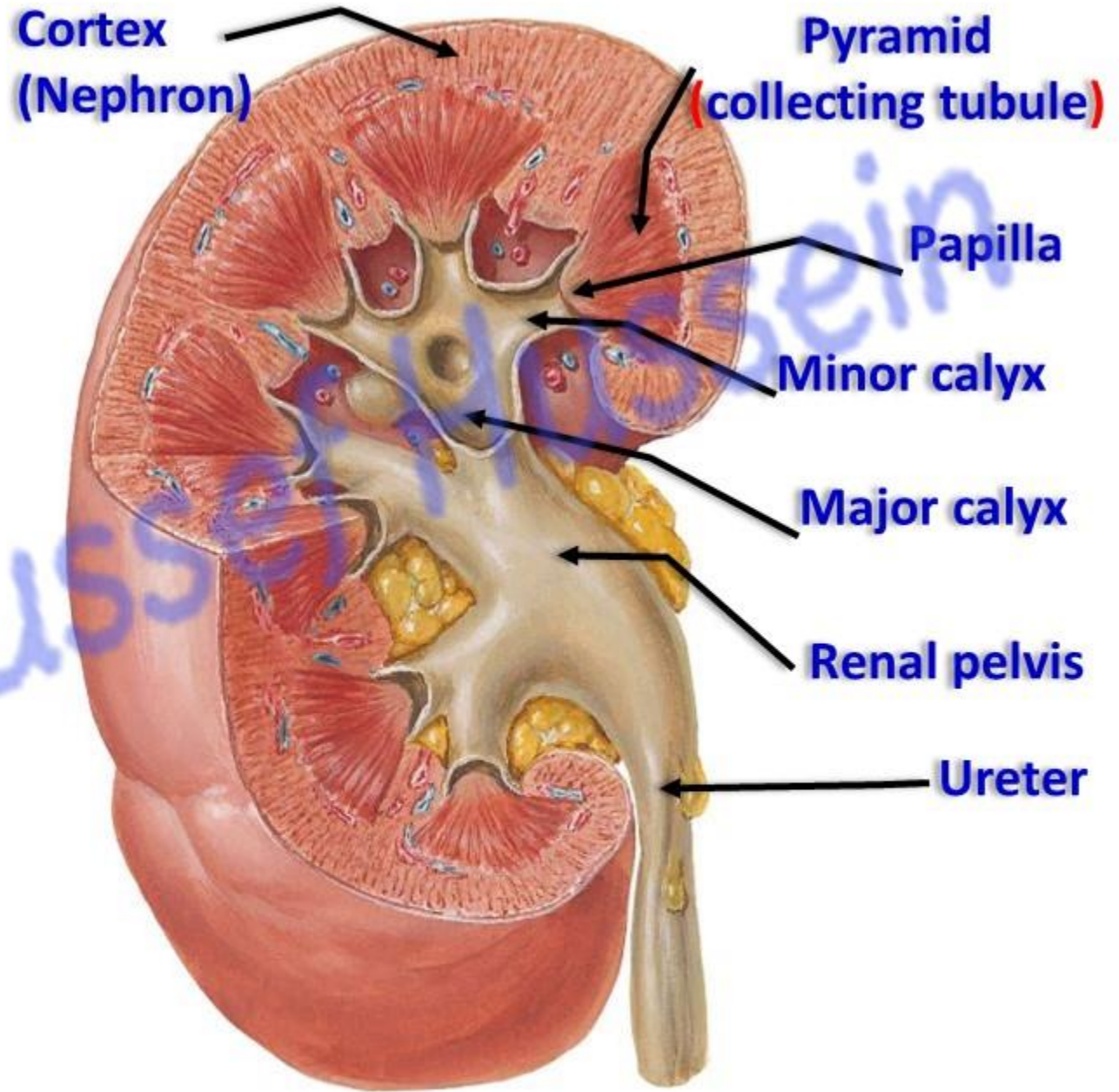
# Development of kidney and ureter

- The kidneys developed from the **intermediate mesoderm** (urogenital mesoderm).
- The kidneys pass into **3 successive stages** of development (overlap each other)

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**Nephron**



## The first stage {Pronephros}

- It develops from the **cranial part** of the **intermediate mesoderm**.
- It is divided into 7 or 8 mesodermal masses called **nephrotomes**.
- Each nephrotome gets a small cavity changing it into **nephrocele**.
- The nephroceles elongated and form the **pronephric tubules**.
- Each tubule has **dorsal** and **ventral** ends.

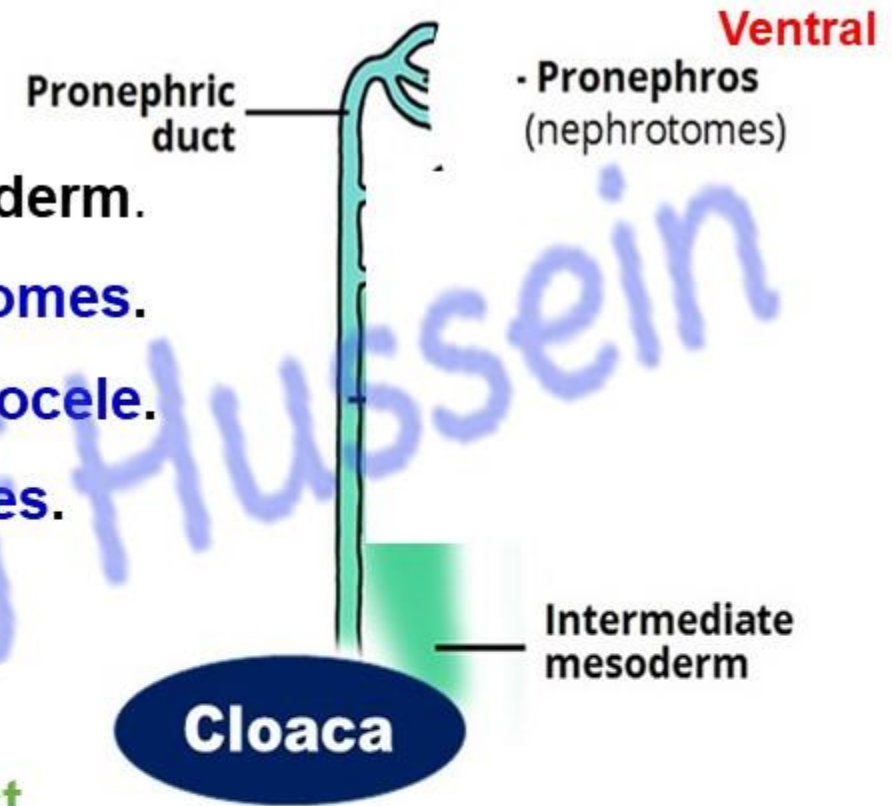
1) **Ventral** ends open into the **intraembryonic coelom**.

2) **Dorsal** ends join each other forming the **pronephric duct**.

- The pronephric duct elongates caudally and opens into the **cloaca**.
- **\*\* Function**, it has **no excretory** function (no glomeruli).
- **\*\* Fate of pronephros:**

- 1- The pronephric **tubules**: **disappear** completely

- 2- The pronephric **duct**: remain to be used as a **mesonephric duct**.

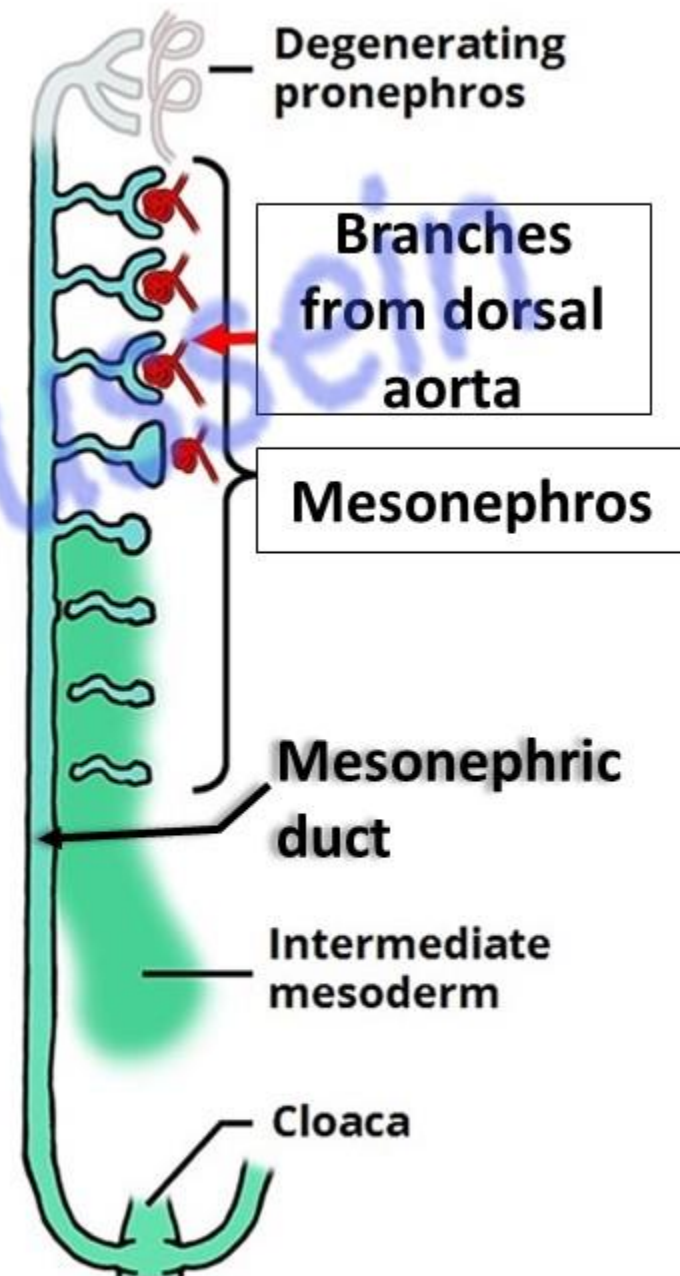


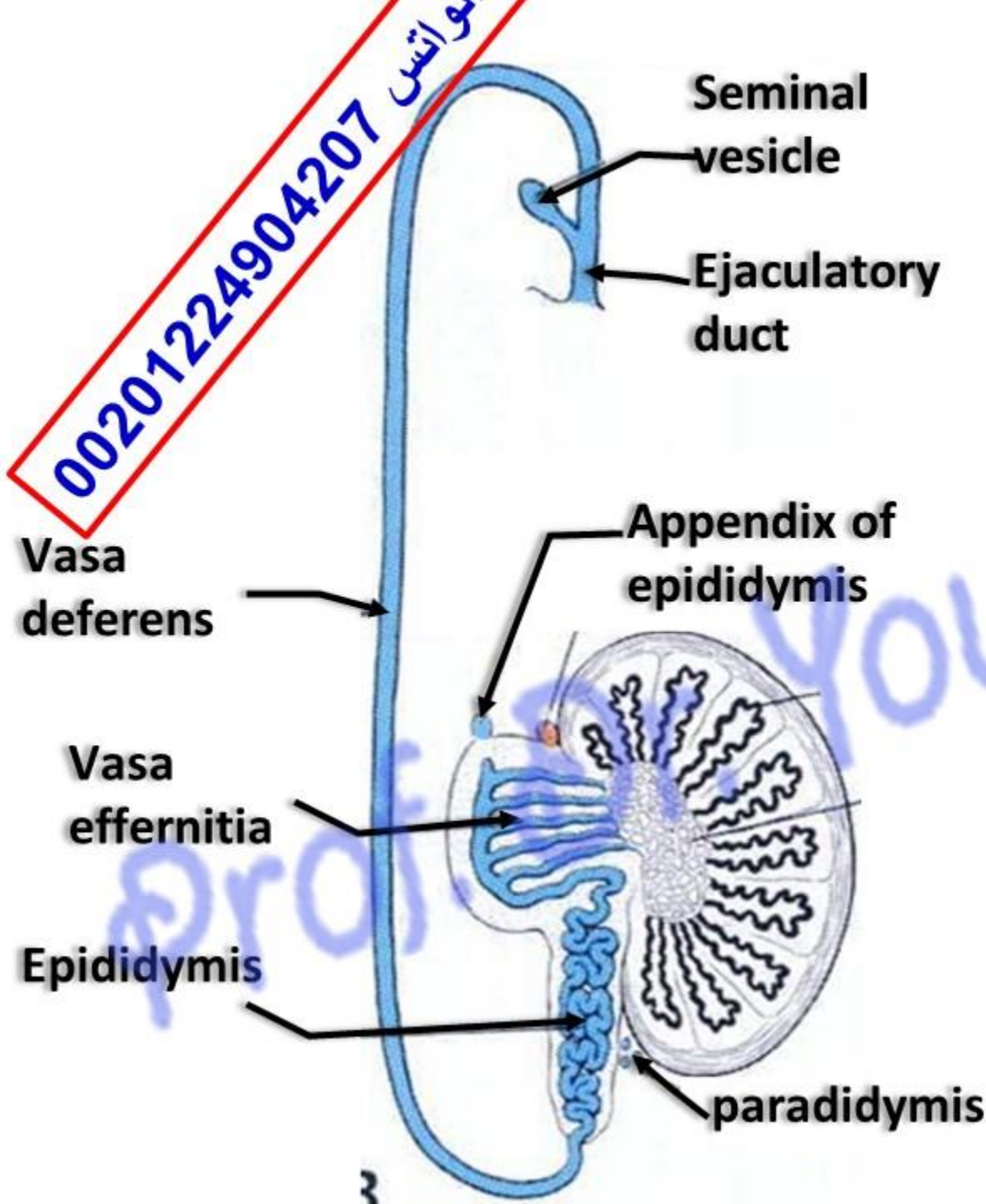
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- **Second stage**

- **{Mesonephros} (WOLFFIAN)**

- The middle part of the **intermediate** mesoderm becomes segmented into 70-80 masses called **nephrotomes**.
- There is a small cavity transforming it to **nephrocele**.
- Each nephrocele elongates forming **S-shape mesonephric tubule**.
- Each tubule has ventral and dorsal ends.
  - **a- Dorsal end** of each mesonephric tubule **opens into mesonephric duct**.
  - **b- Ventral end** of each tubule enlarged and invaginated by a branch from **dorsal aorta** forming a **transient glomerulus**.
- **So; the mesonephros has an excretory function.**





## \*\* Fate (derivatives) of mesonephros

- By the end of the **5th week** of development shows the following changes:

- **In male embryo:**

### 1- Mesonephric tubules:

- **Cranial part** forms appendix of **Epididymis**.
- **Middle part** will form vasa efferentia.
- **Caudal part** forms **Paradiidymis**.

### 2- Mesonephric (Wolffian) duct:

- It forms epididymis, vas deferens, seminal vesicle and ejaculatory duct.
- Trigone of urinary bladder
- Ureteric bud

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## \*\* Fate (derivatives) of mesonephros

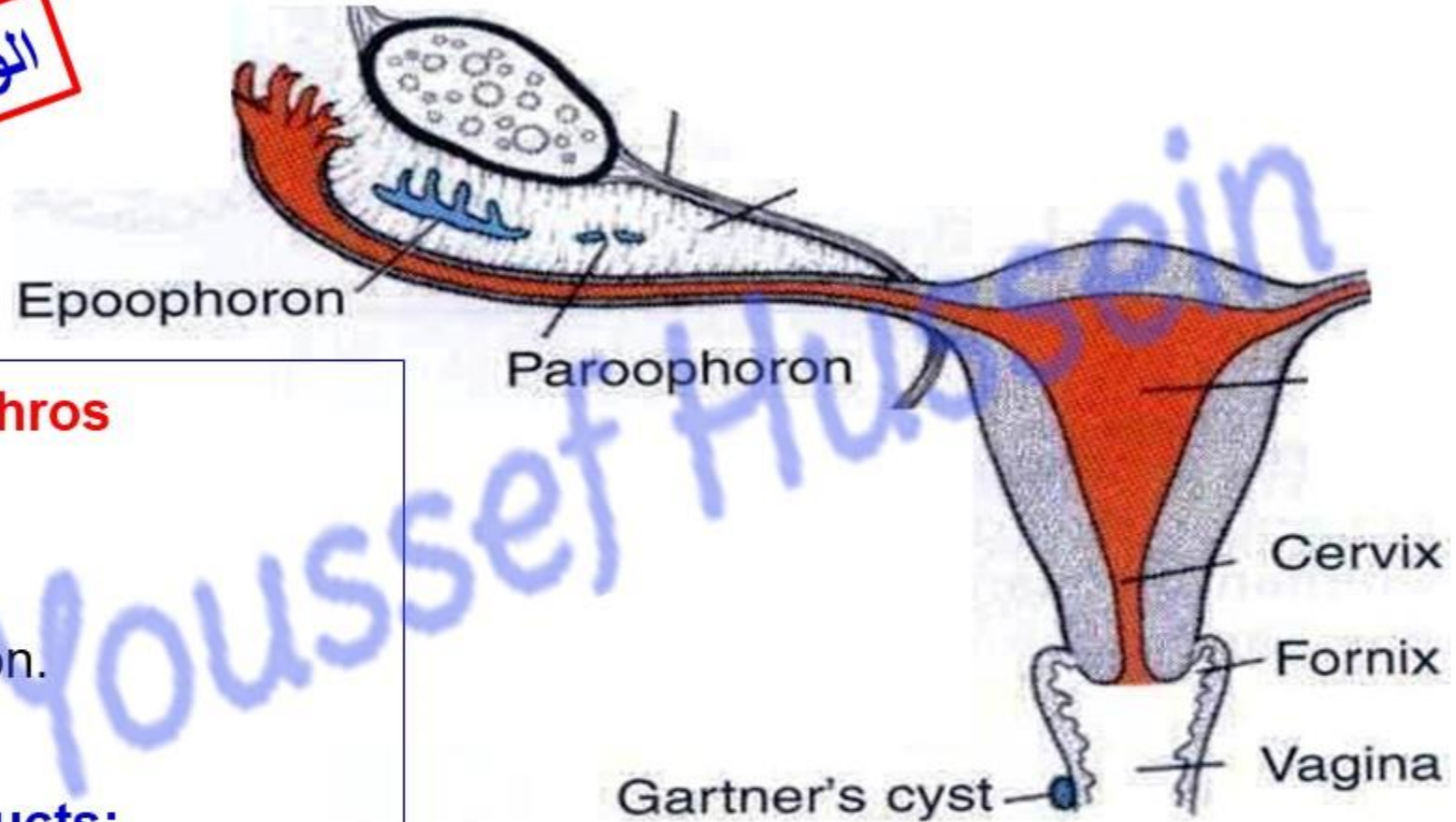
### - In female embryo:

#### 1- The mesonephric tubules:

- **Cranial part** forms the **Epoophoron**.
- **Caudal part** forms **Paroophoron**.

#### 2- The mesonephric (Wolffian) ducts:

- Gartner's cyst in the vaginal wall.
- Trigone of urinary bladder
- Ureteric bud



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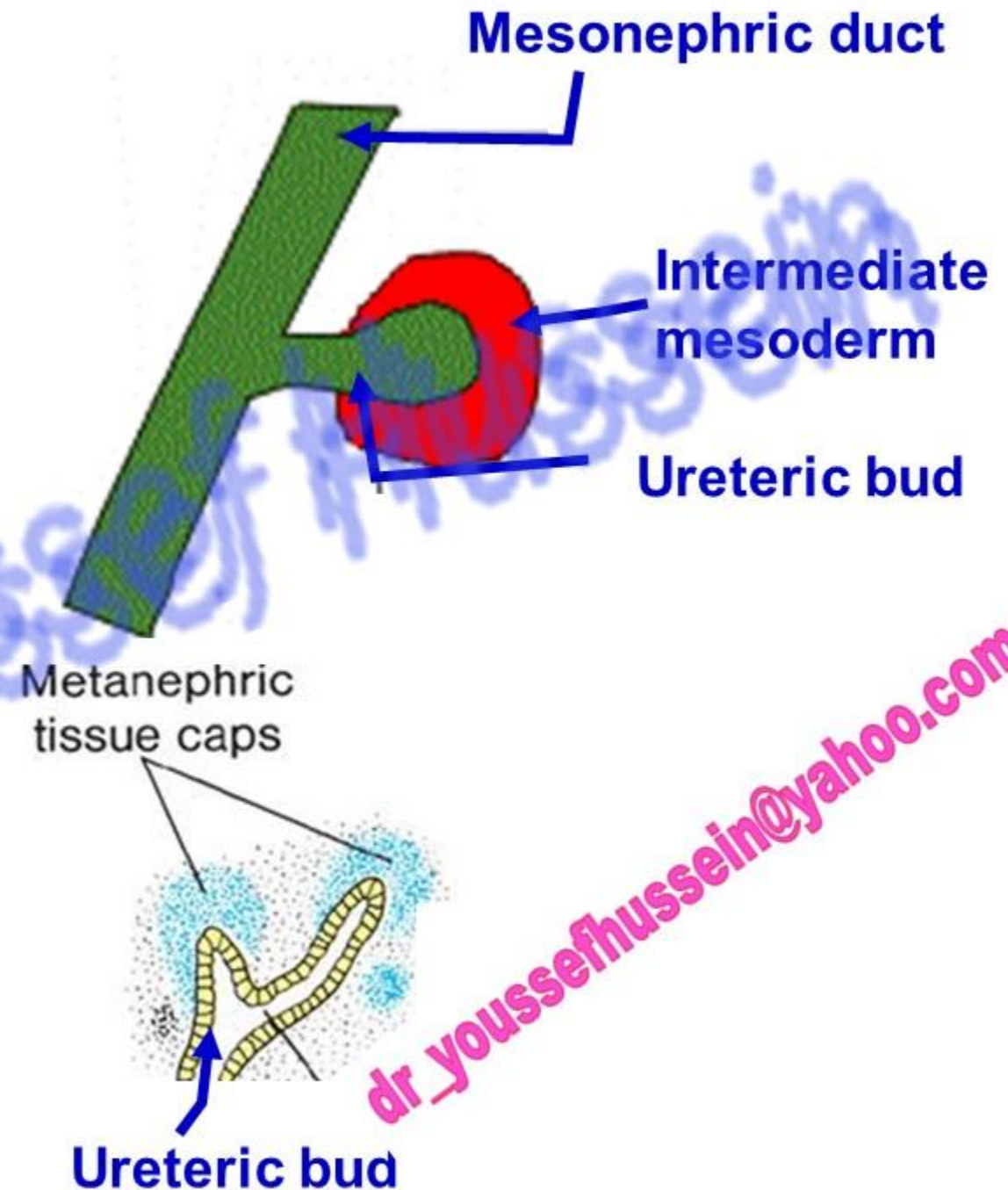
- **Third stage**

**(The Metanephros, Permanent Kidney)**

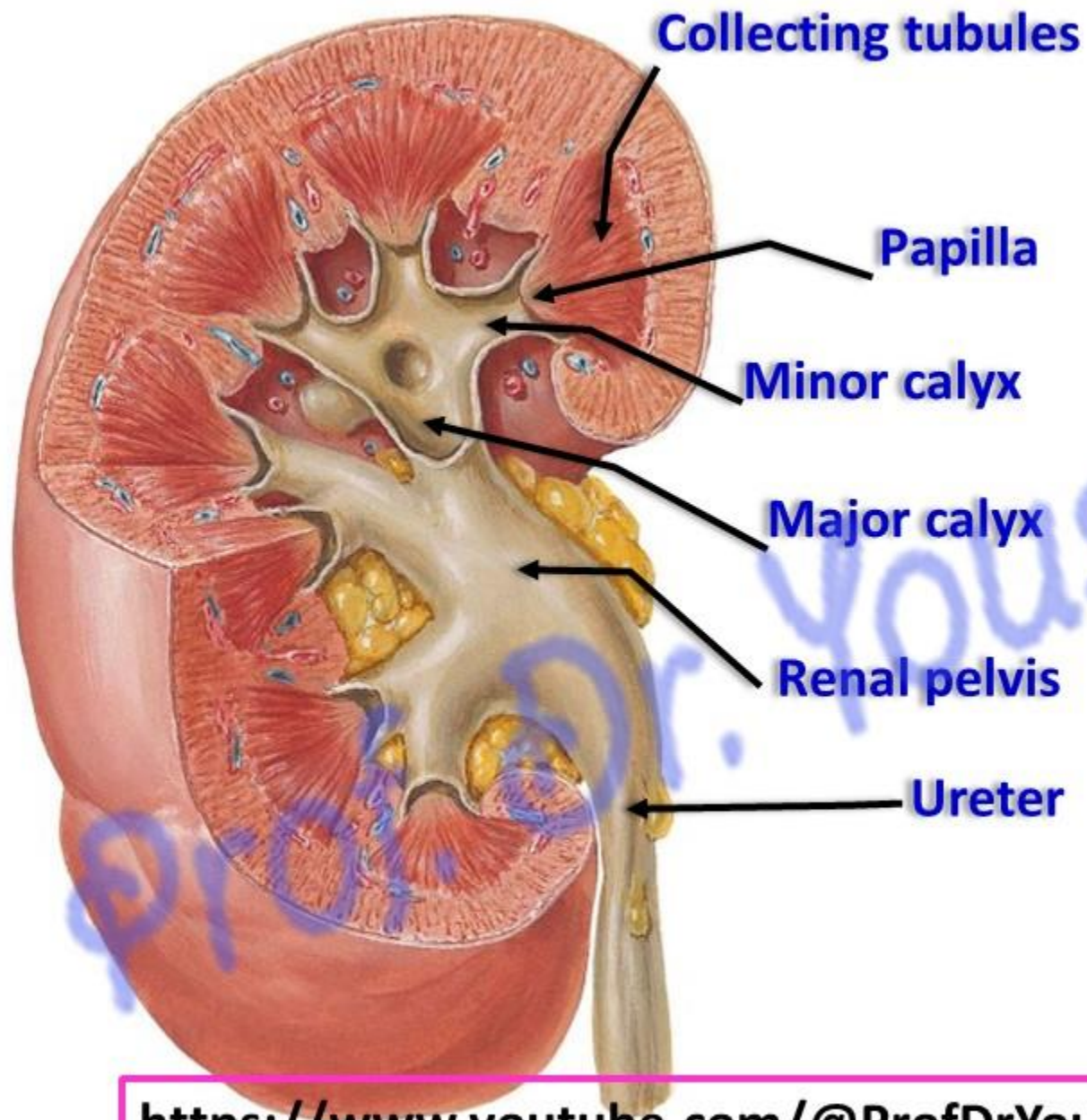
\* Before the disappearance of mesonephros (**by the 5th week**), the metanephros starts its development:

**a- Ureteric bud from mesonephric duct.**

**b) This bud grows upward and backward** till invading caudal part of **intermediate mesoderm** that called **metanephric cap or blastema** (**opposite the lower lumbar and sacral somites**).





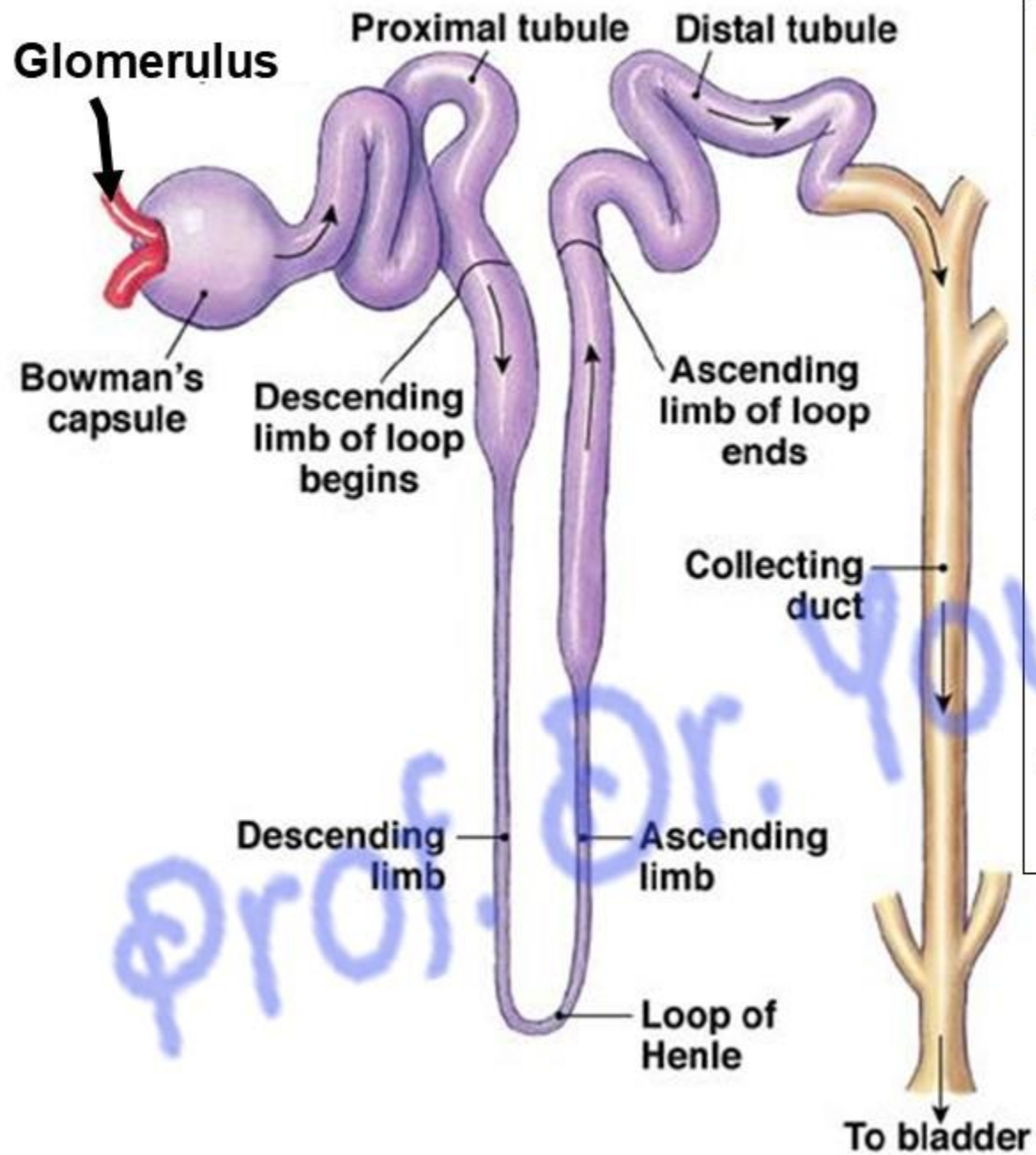


The ureteric bud gives  
**ureter**--- renal pelvis...  
**major calyces**----- minor  
**calyces** ----- **papillae** -----  
- **collecting tubules**

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## - Changes in the metanephric cap (**blastema**)

- \* **Dorsal end** lies in contact with **collecting tubule** but **without** canalization.
- \* **Ventral end** invaginated by branch from **internal iliac artery** forming glomerulus and Bowman's capsule.
- This tubule will elongate forming **proximal convoluted tubules**, **loop of Henle** and **distal convoluted tubule**.
- Later on **distal convoluted tubule** **will be canalized** with the collecting tubule.

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# Post-developmental changes of the kidneys

1. **Change in surface**; disappear of the fetal lobulation by the capsule.
  2. **Change in position**; ascend upward to the lumbar region.
  3. **Medial rotation 90 degree**, Hilum becomes medially after rotation.
  4. **Change in blood supply**;
    - a) In the **pelvis**, it is supplied from the **internal iliac artery**.
    - b) During its ascent, it is supplied by the **common iliac artery**.
    - c) At its normal position, it is supplied by the **abdominal aorta**.
- **Definitive nephrons secret urine in the 2<sup>nd</sup> half of pregnancy.**

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# Congenital anomalies of kidney and ureter

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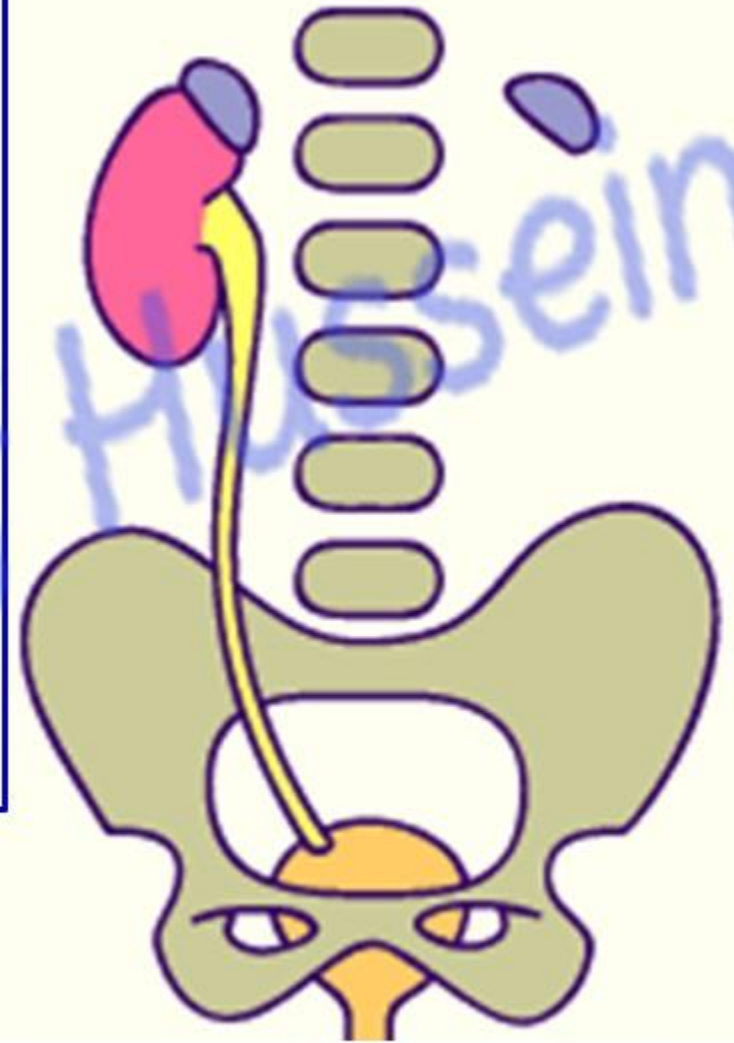
## ❖ Agenesis

### - Causes:

- 1- Failure of development of the **ureteric bud** (no ureter and kidney).
- 2- **Failure of contact** of the ureteric bud and intermediate mesoderm (ureter and no kidney).

### - It may be

- **Unilateral agenesis**, It may be not noticed until problems occur in the solitary kidney.
- **Bilateral agenesis** the amount of amniotic fluid decreased (oligohydramnios) and the fetus die within few days after birth



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- **Persistence fetal lobulation on external surface**

## ❖ **Abnormalities of surface**

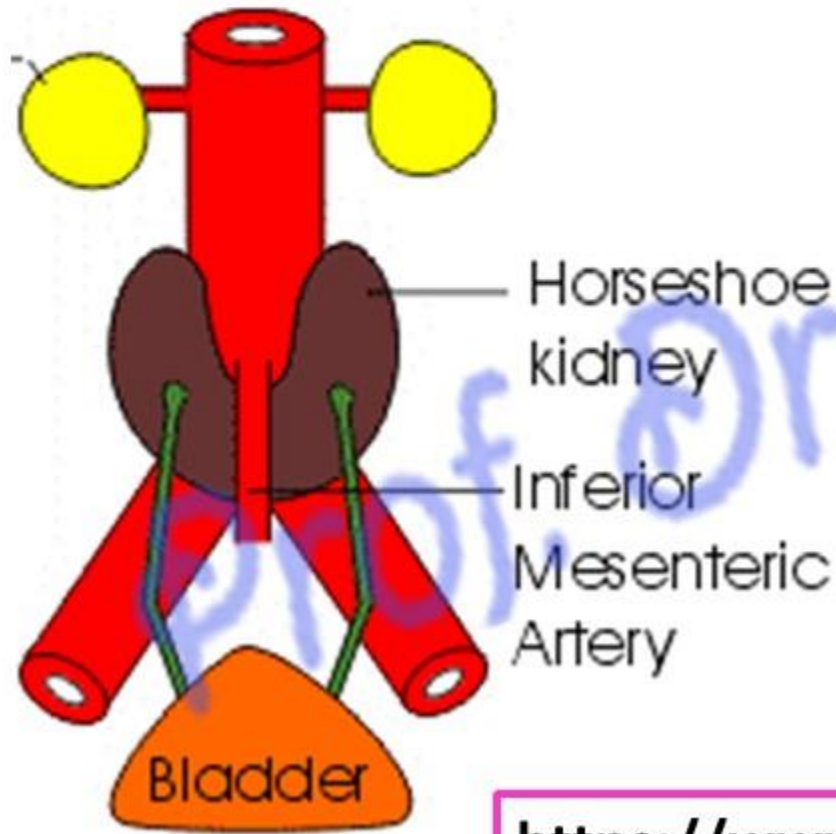
- **Polycystic kidney:** due to failure of canalization between distal convoluted tubules and collecting tubules.



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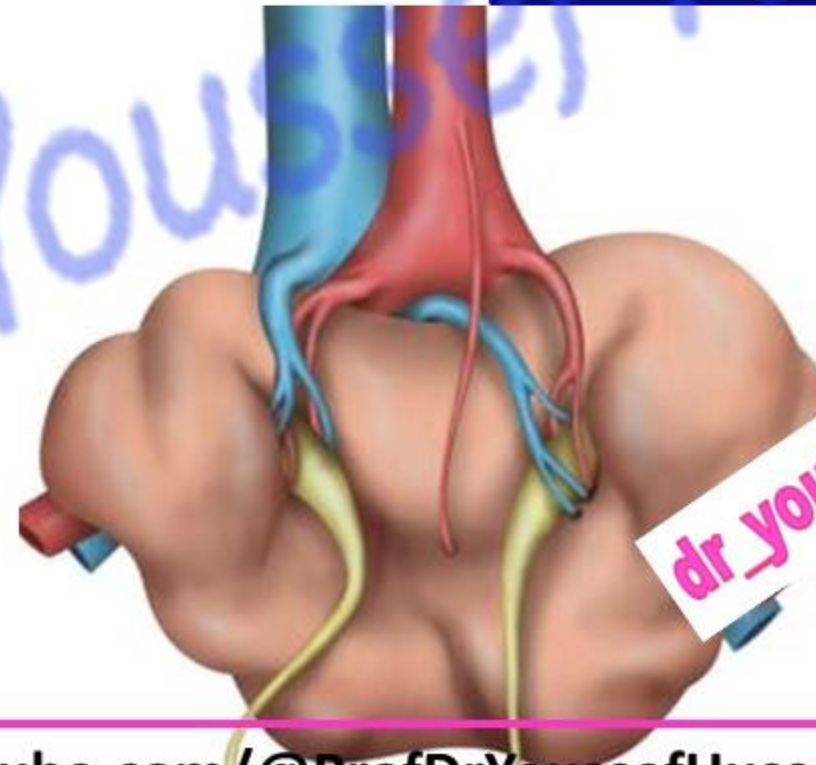
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- **Horseshoe kidney** due to fusion of the lower poles of both kidneys.
  - It lies in **lower abdominal cavity** because its ascent is prevented by **inferior mesenteric artery**.

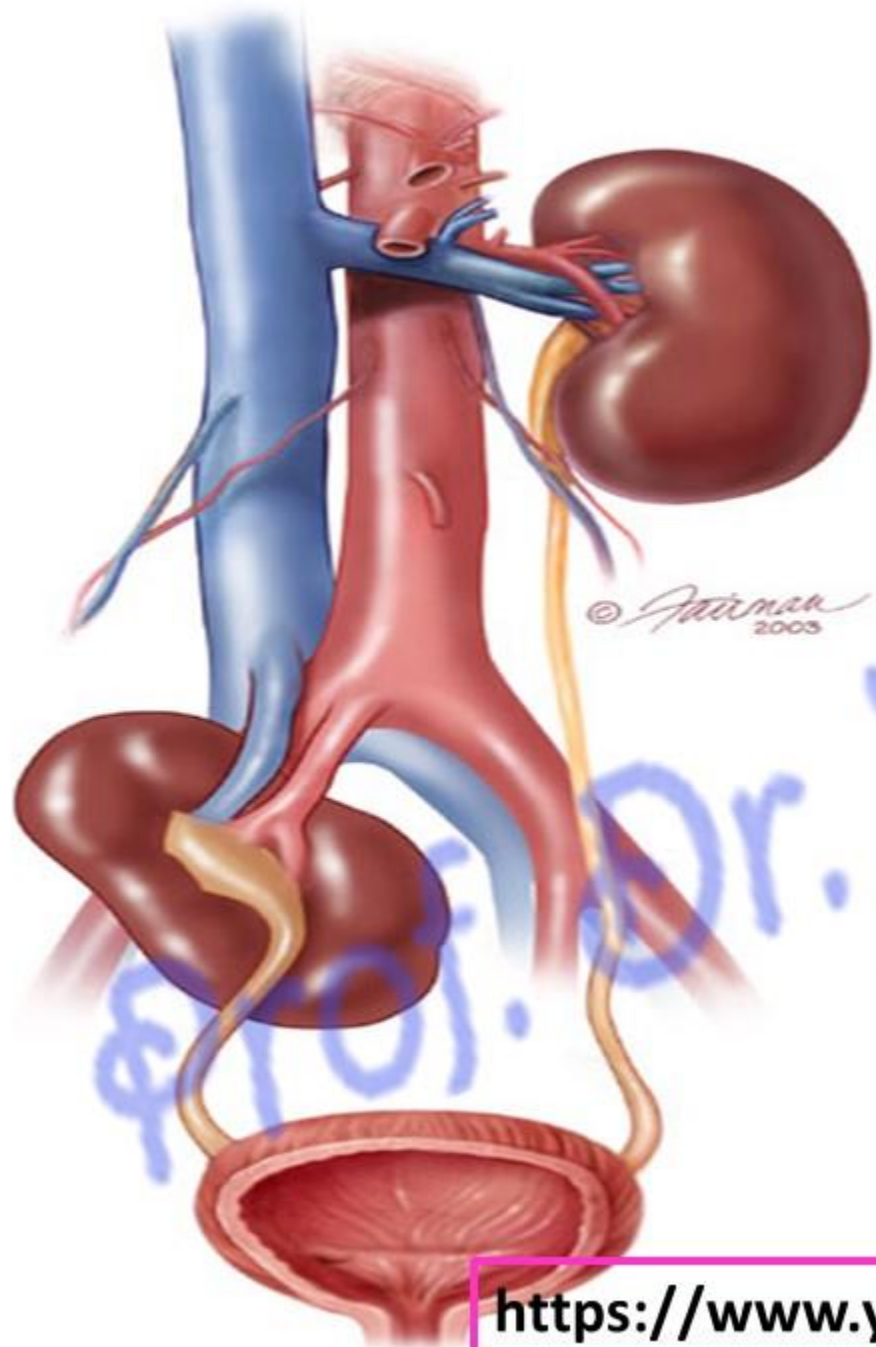


## ❖ Abnormalities of shape

- **Rosette (cake) shaped kidney:**
  - due to fusion of both upper and lower poles of two kidneys.
  - They remain in the **pelvis**.



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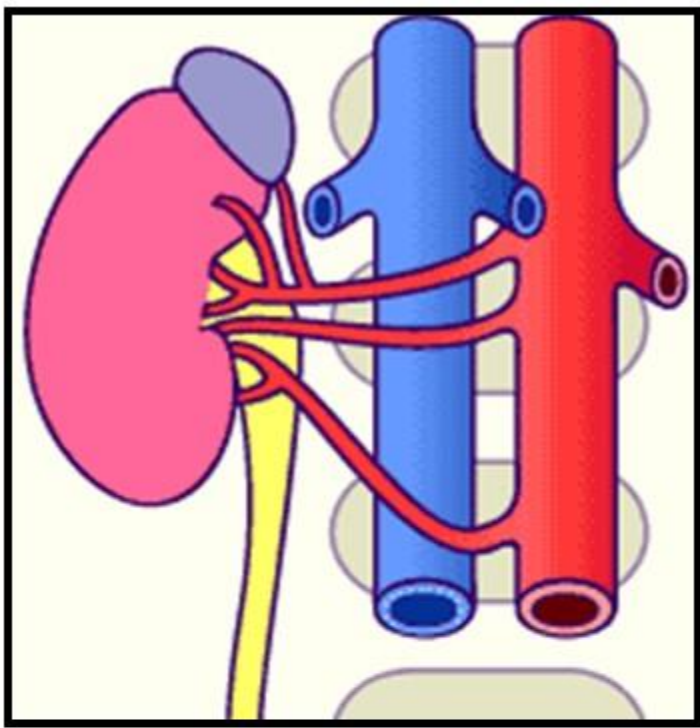
## ❖ Abnormalities of the position

- a. **Pelvic kidney:** failure of the ascent of one or both kidneys to their normal positions.
- b. **Incomplete ascent:** it ascends but not reaches its terminal position.
- c. **Ectopic kidney** due to abnormal ascent.
- d. **Mobile (floating) kidney:** Not fixated to posterior abdominal wall. The kidney is movable with changes of body position. This lead to **torsion** of renal artery or ureter (**Dietl's disease**)

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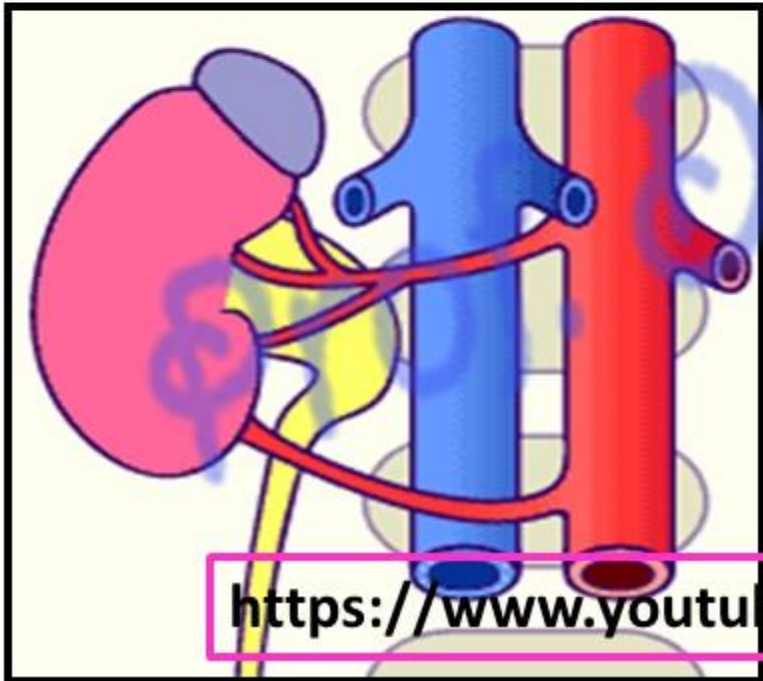




- **Abnormalities of blood supply:**

**A- Aberrant renal artery:** a **persistent** artery during its ascent (enter through hilum).

**B- Accessory renal artery:** additional artery enters the kidney at its **lower pole**.



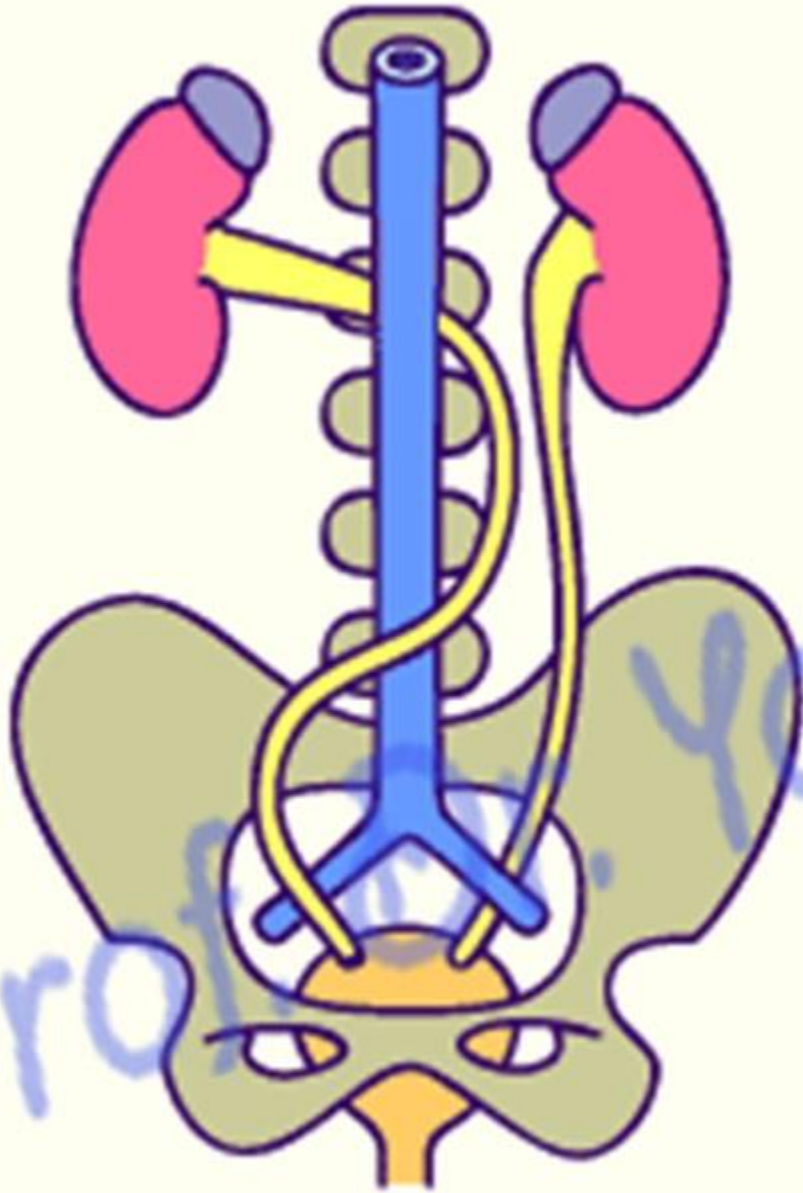
- **Lateral rotation of the kidney:**

As a result, the **hilum** is directed **laterally** and the ureter and **renal vessels** pass in front of the kidney.

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- **Postcaval ureter:** passes behind inferior vena cava leading to obstruction of the ureter.

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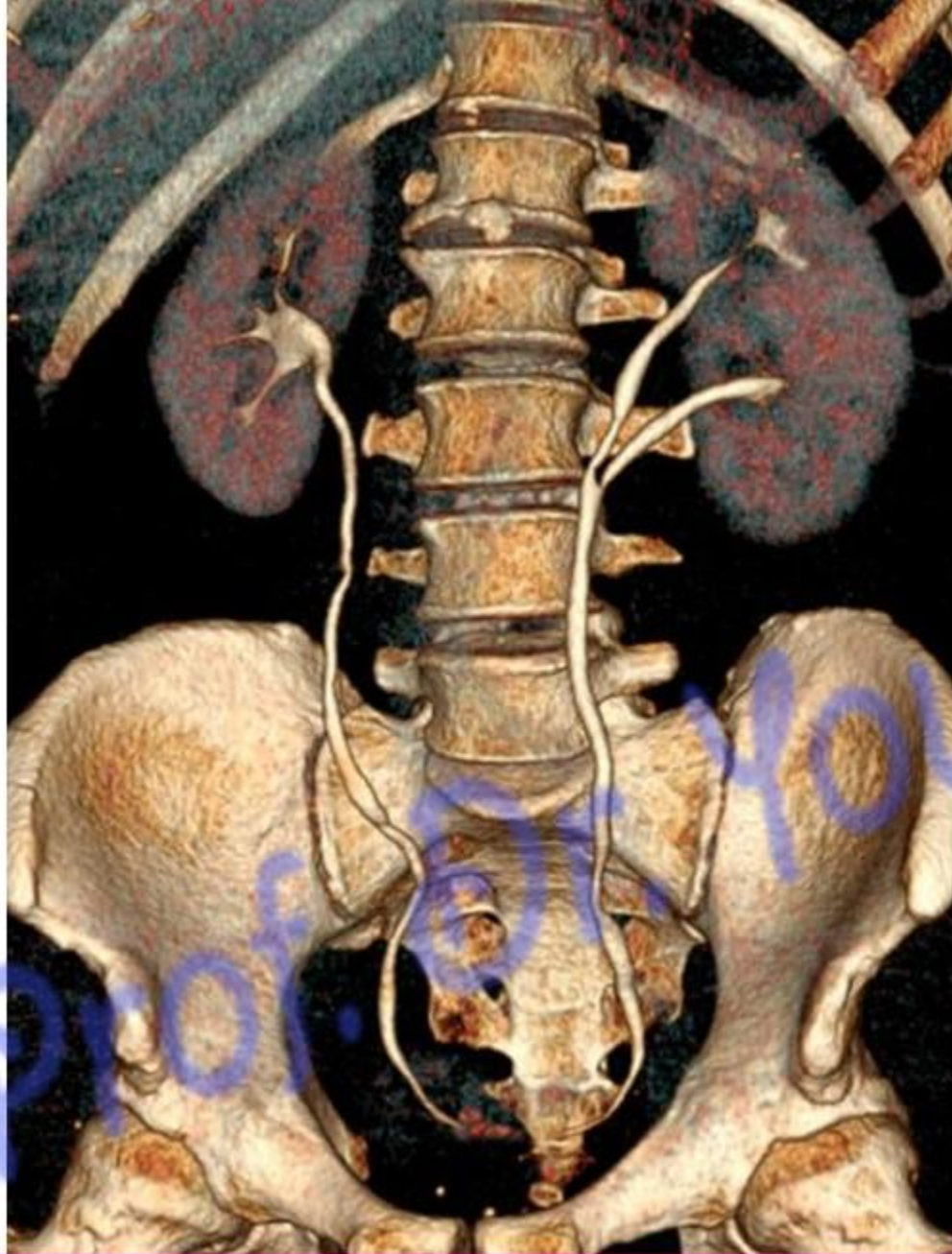
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- **Unilateral double kidneys with one ureter.**
  - caused by **complete division** of the **distal end** of the **ureteric bud before contact** to intermediate mesoderm



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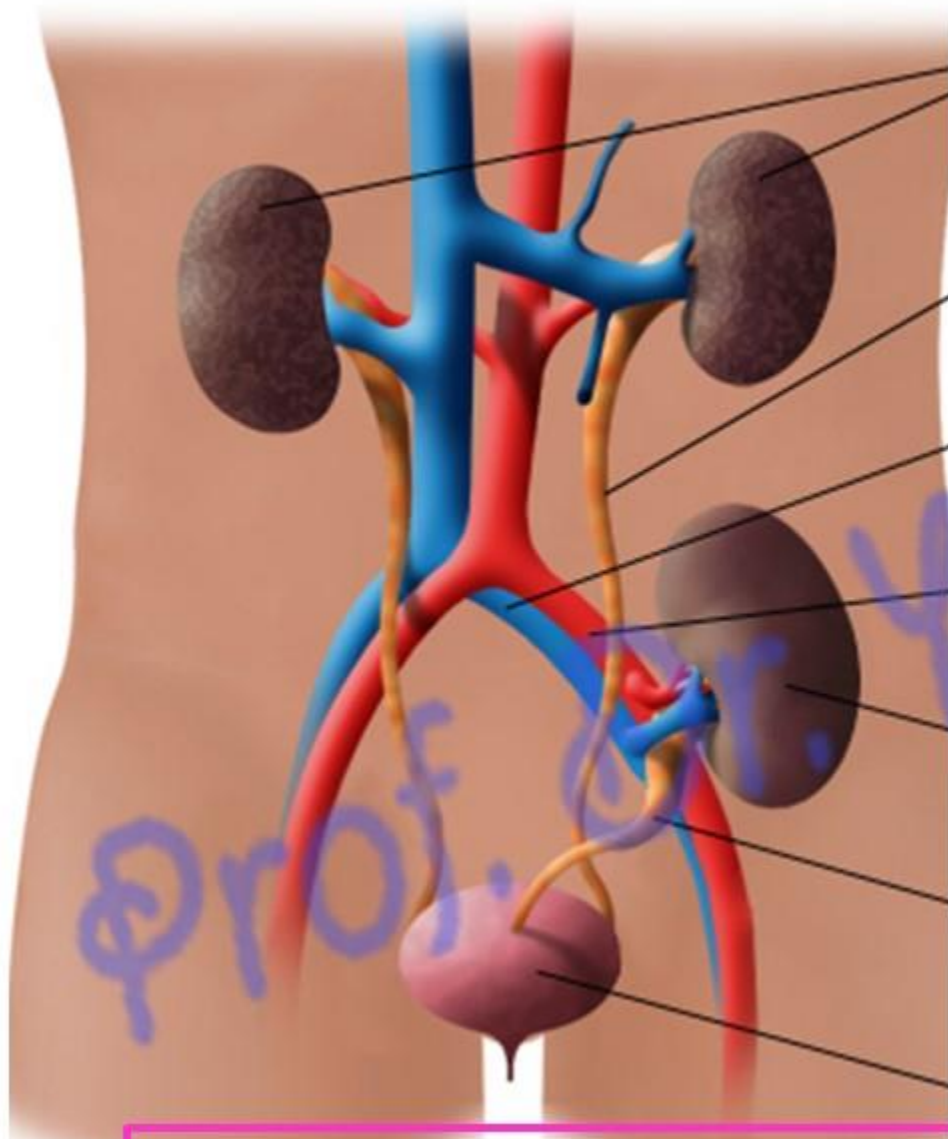


- **Bifid ureter with one kidney:** complete division of the **distal end of** ureteric bud **after contact** to intermediate mesoderm
- In such case the renal pelvis is doubled.

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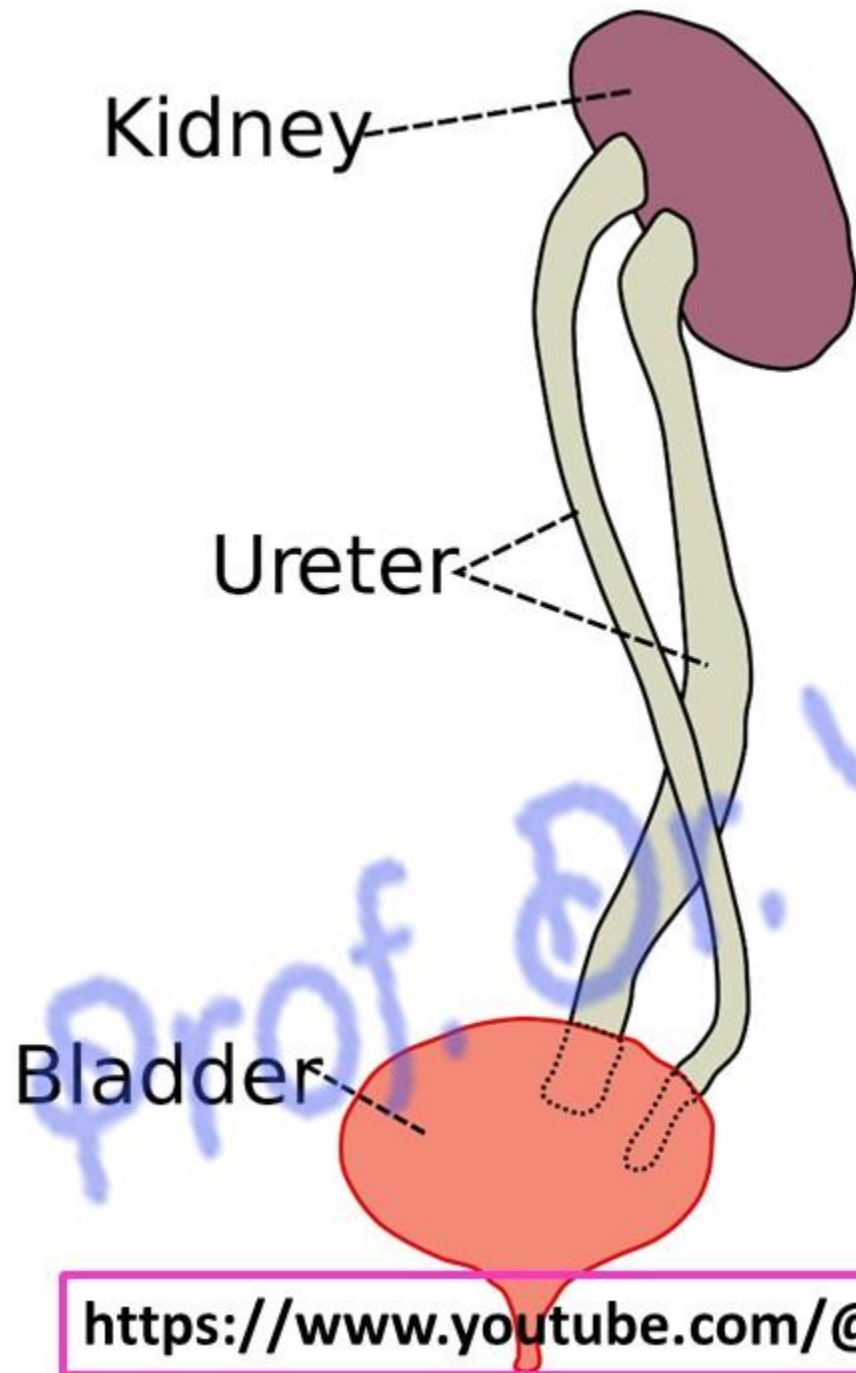


- **Unilateral double kidneys** and **double ureters**
  - due to early **complete division** of ureteric bud **before contact** to intermediate mesoderm

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**Double ureters with Single kidney:** Complete division of the ureteric bud **after contact** to intermediate mesoderm

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Thank You

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