Urinary System

The urinary and the genital organs are embryologically andanatomically connected. Both developed from a commonmesodermal-ridge along the caudal wall of abdominal cavity and the excretory ducts of both systems initially inter a commoncavity, the cloaca.

The urinary organs are:

1. Kidneys.
2. Ureters.
3. Bladder.
4. Urethra

Note: Kidney in the development of the embryo forms 3 types of kidneys:

1. Pronephrous:

Which degenerate (rudimentary) and, "not functional in the mammals.

2. Mesonephrous:

Degenerate most of it is tubules and persist only" 116 caudal from the stay in temporary function.

3. Metanephrous:

Which developed to the kidney in the adult.

The kidneys:

They are paired excretory organs which secrete the urine; they are red brown in color and are situated against the dorsal wall of the abdomen. They are regulating the water and salt concentration of the body and also remove foreign substances from the body, a large amount of blood flushes continuouslythrough kidneys. Their shape varies from bean shape to heart shape or heart of plan card (right kidney in horse). Only in bovine the kidney is lobulated.

The hilus: is the depression through

which pass artery, vein nerves, lymph vessels andureters and leads to the renal sinus which lodges the renal pelvis which is absent in bovine. In bovine the renal pelvis is absent so the ureter joins in the sinus and take over the role of the renal pelvis in, the other animals.

The renal pelvis receives the urine from the renal papillary ducts and transmits the urine to the ureters.

The kidney consists of external cortex and internal medulla.The cortex is reddish-brown in color and granular, while the medulla projects into the renal pelvis or calices with one ormore papilla.

The basic features of kidneys:

1) Two surfaces dorsal and ventral surfaces.

2) Two borders lateral and medial borders.

3) Two poles cranial and caudal poles.

Fixation:

The kidneys are held in position by:

1. The pressure of adjacent organs.

2. The renal fascia.

3. Hepatorenal ligament (right side).

4. Suspensory ligament of spleen (left side). Note: The right kidney is much more strongly attached than

the left kidney.

Types of kidneys:

The types of kidney according to the lobulation (renculi) are:

1. Lobulated kidney: the lobules are not fussed (developed separately); so, the cortex and medulla not fussed, and eachlobule connected with one calyx. Found in (wale, seal, polar bear and in the embryo of all mammals).

2. Simple kidneys: characterized by the fusion of the lobules(renculi). The fusion in different degree therefore theysubdivided in to:

A-Multipapillated furrowed kidney;The fusion is only in the middle of the lobules, and thecortex is not fussed (stay free). The surface of the kidney isfurrowed.We found in the kidney which the calyxes without pelvis(bovine).

B- Multipapillated smooth kidney:The cortex is fussed,therefore the surface is smooth. but thepapillae remain separated and connected with the samenumber of calyxes with renal pelvis(pig).

C-Unipapillated smooth kidney:Fusion of the papillae and

form one single large papillae andproject in the renal pelvis (sheep, goat, carnivores and horse).

The kidney of the horse:

1- **Right kidney**:It is heart shape, it is located ventral to the dorsal part of thelast 2-3 rids and the first lumber transverse process.The dorsal surface is convex and related to the diaphragm andthe ventral surface concave and relate to the liver, pancreas,cecum and right adrenal gland it has no peritoneal converting.The medialborder has renal pelvis, "the lateral border isrounded.The cranial pole is thick, rounded and lies in the renalimpression of the liver, while the caudal pole is thin aridnarrow.

2- **Left kidney**: is bean shaped, it is narrow and longerthan the right

one, it situated further caudally and locatedventral to the last rib.'The greater part of it is covered with peritoneum. Thecranial pole is related to the stomach, and the caudal pole islarger than cranial.

- **The kidney of ox:**

Are superficially divided into lobes by fissures. The lobes areabout **20**in number. The right kidney lies ventral to the last rib, while the left kidney when the rumen is full, it pushes, theleft kidney caudally and across the median plane, so that it is situated on the right side, caudal to the right kidney,Thekidneys are embedded in a large amount of fat termed adipose capsule. The weight is600-700 gm. The structure: the pelvis is absent in ox, so the ureter begins atthe junction of two wide thin-walled tubule the "majorcalices". Each major calyx gives off a number ofbranchesand these divided into several funnel-shaped "minorcalices" each of which embraces renal papillae.

- **Kidney of sheep and goat**:

Are bean-shaped and smooth the hilus is deeper in sheep than ingoat. There is a renal crest or common papillae formed by

thefusion of 12- 16 pyramids in sheep and10 in goat. Renal pelvis is present. The stellate veins in the area of hilus of the kidneysof sheep andgoat serve to distinguish these species from, the dog.

- **The kidneys of the dog:**

Bean-shaped, smooth they are retroperitoneal and located in thesub lumber region on either side of aorta and caudal vena, both kidneys are palpable through the abdominal wall.

- **The kidney of the pig:**

Smooth and bean-shaped the pelvis is funnel-shaped and divided in to two major calices which give off 8-12 short minor calices each one contains papillae.

- **Blood supply of the kidney:**

From the renal artery which come from the aorta, enter the hilus of the kidney and reach the intermediate zone and form anastomotic arches from the arteries branches pass in to the cortex and medulla.

Cortical branches have a radial course between the cortical lobules and give off short lateral branches.

- **Ureters:** The ureter is the narrow part of the excretory duct of the kidney.

It is conducting the urine in continuous trickle from the renal pelvis to the bladder.It begins at the renal pelvis and terminates at the bladder.

It is about 6-8 mm in diameter. It consists of:

1- **Abdominal. part***:* begins from the hilus of the kidney curves caudally, lateral to the caudal vena cava.

2- **Pelvic part:**passes caudally on the lateral wall of thepelvic cavity, it pierces the dorsal wall of the bladder nearit is neck. In male it enters the genital fold, while in female. it situated in the dorsal part of the' broad ligament of the uterus.

- **The urinary bladder:** Is an organ capable of great distention. It can store considerable

amount of urine, so its form and position differ according to the amount of the content. When it is' empty and contracted it is founding pelvis cavity, and it is wall is relatively thick. While when it is full it extends cranially to the abdominal cavity andthe wall is thin.(It is capacity in the horse is about **3**liters).

It consists of the following:

1- Apex: the cranial free end.

2- Body: the central main part.

3- Neck: the constricted portion which joins the urethra.

4- Dorsal and ventral surfaces: It is ventral surface related to the ventral wall of the pelviccavity, and the dorsal surface is related in male to the genitalfold and rectum, while in female it is related to the body ofuterus and the broad ligament and vagina.

In young animals is amass of scar tissue which is the remnant of the caudal part of the urachus, which is (the tube that connectthe primitive bladder with the allantoic sac in the fetus and it is included in the umbilical cord).

The wall of the bladder consists of covering peritoneummuscular coat and mucosal lining. There is a circular muscle at the neck of the bladder form **sphincter vesicae.**

The ureters join the bladder near the neck, they pass about 2-3 cm between the muscular and mucous coat before piercing thewall, this

form "a valve", that prevent the return of the urine from the bladder to the ureters.

Ureteral ostium: (left and right) the opening of each ureter in to the bladder, near the neck.

Fixation of the urinary bladder: 1. The median ligament (unpaired): it is ventral fold of peritoneum

which is fixed the bladder to the ventral wallof the pelvis and

abdomen.

2. Lateral ligament (paired): peritoneal folds attached the lateral

aspect of the urinary bladder to the lateral walls of the pelvis. Each

ligament envelops the round ligament (remnants of the left and right

umbilical arteries).

*** Urethra:**

It is musculomembranous tube through which the urine is

discharge from the bladder. The wall of urethra has the same basic layer as that the urinary bladder. In addition, it contains the striated urethralis 'muscle which allows some voluntary control of urination.

Both male and female urethra associated anatomically with the genital organs.

In female the urethra begins at the neck of the bladder and extends caudally along the floor of the pelvis and opens by the external urethral ostium in the floor of the genital tract at the junction of the vagina, and vestibule.

Male urethra: It is the long tube which extends from the bladder to glans ofpenis; it passes caudally on the floor of the pelvis, and divided into:

1- The pelvic part extends from the neck of the bladder, caudalto the prostate, the tube is dilated'. '
2- The pre-prostatic part, the short initial segment.
3- The prostatic part, the portion surrounded by, the prostategland.

4- Spongy part.

5- The portion of the urethra within the penis, passé between the two crura of the penis and run along the groove on theventral surface of the penis and covered by the corpusspongious penis and bulbospongious muscle. It opens in the external urethral orifice on the glans penis.

The urinary system in female horses

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