RENAL SYSTEM - 3

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DISEASES OF RENAL TUBULES, INTERSTITIUM, PELVIS

- Renal tubules and the interstitium are closely related, and defects involving one tend to cause problems in the other.
- Regeneration of tubular epithelium can occur, if the basement membranes are preserved.
- The response of the kidney to injury is limited to hypertrophy of existing nephrons.
- Renal tubular epithelial cells suffer from degenerative changes similarly to many other cell types.
- These changes may be manifested as cellular swelling, hydropic degeneration, and/or fatty change.

- Various types of inclusion bodies are reported in renal tubular epithelial cells.
  - These include viral inclusions, inclusions of unknown origin, and inclusions from accumulation of material from the ultrafiltrate.
- Some conditions are characterized by thickening of the tubular basement membranes.
- In renal amyloidosis, amyloid is deposited in tubular basement membranes as well as in glomeruli.

TUBULOINTERSTITIAL DISEASES
- In most cases, conditions that cause tubular damage also cause changes in the interstitium,

- Also, conditions affecting the interstitium usually cause glomerular damage,
- hence it is possible for an interstitial problem to cause kidney failure, renal failure, and the nephrotic syndrome.

Non-suppurative Interstitial Nephritis
- An inflammatory condition involving primarily the interstitium of the kidney.
- The causes are not usually identified, especially in chronic cases, and they probably vary considerably.
- It may be acute or chronic and multifocal or generalized.
  - Acute cases are characterized by sudden onset and histologically there is oedema and accumulations of leukocytes in the interstitium and focal tubular necrosis.
In chronic cases, mononuclear cell infiltration and connective tissue proliferation in the interstitium are the dominant histopathologic features.

- Likely pathogens for non-suppurative interstitial nephritis include *Leptospira*, *canine adenovirus-I* in dogs and *Leptospira pomona* in cattle and swine.
- It has also been reported in
  - "white spotted kidney" of calves,
  - MCF in cattle,
  - theileriosis in cattle,
  - "lumpy-skin disease" in cattle,
  - Sheep pox in sheep
  - equine infectious anaemia in horses.

**Suppurative Interstitial Nephritis**

- Refers to a pyogenic inflammatory condition involving primarily the interstitium of the kidney.
- It is usually caused by pyogenic bacteria which may reach the kidney via haematogenous routes (usually resulting in embolic suppurative nephritis) or urogenous routes (usually resulting in pyelonephritis).
  - Embolic suppurative nephritis usually develops when bacteria are seeded into the kidney parenchyma, either during a bacteremia or in septic emboli.
  - The most common cause of embolic suppurative nephritis in horses is *Actinobacillus*.
- Typically, infection by Actinobacillus occurs primarily in neonates.
- It probably represents an umbilical infection and it is acquired either in uterus, during parturition, or shortly after birth.
- Abscesses, which sometimes are as much as 3mm in diameter, are found throughout the renal parenchyma.
- These are usually evident grossly and microscopically.
- The most common cause in adult cattle is probably *Corynebacterium pyogenes*. 
The characteristic interstitial inflammatory infiltrate is patchy in the cortex and streak-like in the medulla.

**Pyelonephritis**
- Inflammation of the renal pelvis and renal parenchyma characterized by the formation of a purulent exudate in those areas.
- It usually develops from an ascending infection and is usually accompanied by ureteritis and cystitis.
- The most common pathogens are *E. coli*, *staphylococci, streptococci, Enterobacter, Proteus, Pseudomonas, Corynebacterium renale, and Corynebacterium suis*.
- These bacteria are carried up the urinary tract, retrograde to the flow of urine.

- It only causes problems when the urine is septic.
- Reverse peristalsis may occur in the ureter when there is a cystitis.
- In the kidney, the medulla is more susceptible to ascending infections.
- This is probably due to its location as it relates to ascending infections, and to other factors including it relatively hypoxic state, hyper-tonicity, and its increased concentrations of ammonia.
- Pyelonephritis is usually bilateral but not necessarily symmetrical.
- Acute pyelonephritis is seen more commonly in sows and chronic pyelonephritis is most often reported in cows and dogs.

**Hydronephrosis**
- It does result in considerable damage to the renal parenchyma.
- It refers to dilatation of the renal pelvis and calyces with progressive atrophy of the renal parenchyma and cystic enlargement of the kidneys.
- It is caused by some form of urinary tract obstruction.
- Obstructing lesions may be complete or partial and they may be congenital or acquired.
- There are many possible acquired causes including urinary calculi, cystitis, prostatic enlargement, compression of the ureters by surrounding inflammatory or neoplastic tissue, displacement of the bladder, and acquired urethral strictures.
If the obstruction involves only one ureter, the hydronephrosis will be unilateral; however, if both ureters are involved, or if the bladder or the urethra is involved, the hydronephrosis will be bilateral.

It may not be symmetrical.

Complete or severe bilateral obstruction usually causes death, due to uraemia.

The pathogenesis involves persistence of glomerular filtration inspite of urinary tract obstruction.

If the obstruction persists, the kidney parenchyma will eventually undergo complete degeneration and necrosis and will be replaced by fibrous connective tissue, forming a cystic structure with a fibrous connective tissue wall.

Grossly

- there is progressive dilatation of the renal calyces and pelvis and blunting of the papillae or medullary crests.
- In severe cases, this may progress to form a large unilocular or multilocular cyst.

Histologically

- tubular dilatation is the most striking feature with damage occurring in the proximal regions of the nephron first.
- In severe cases, there is liquefactive necrosis in the medulla causing progressive reduction in the medullary parenchyma.