Renal Function Tests

Renal function tests: are the groups of tests that are performed to assess the functions of kidney.

The renal function tests are of three types:

1) Examination of urine alone.
2) Examination of blood alone.
3) Examination of blood and urine.

Routine Examination of Urine

During the routine examination of urine, the following are determined:

i. Specific gravity: Normally it is 1.010 to 1.025. But, in some conditions like chronic nephritis, it is decreased.

ii. Presence of normal constituents of urine in abnormal quantity:

Normally, substances like water, salt, amino acids and creatinine are excreted in urine either in greater or lesser amount. But, if abnormally large amount is excreted, it suggests some abnormal functional status of kidney.

- If 4 to 5 liters of water is excreted consistently per day, it is suggestive of diabetes insipidus.
- Abnormally low amount of water excretion indicates nephritis.
- Abnormal amount of salts or nutritive substances like amino acids appear in urine during congenital tubular defects.
- Abnormal albumin excretion occurs in defective filtration.
- Abnormal amount of glucose is excreted in diabetes mellitus.

iii. Microscopic examination: This reveals the presence of red blood cells, pus cells, epithelial cells and crystals which suggests the renal pathology.

Examination of blood

The level of plasma proteins, urea, uric acid and creatinine are determined in blood. The blood level of these substances is altered in renal failure.

Examination of blood and urine

Plasma Clearance

Plasma clearance is defined as the amount of plasma that is cleared off a substance in a given unit of time. It is also known as renal clearance.

The determination of clearance value for certain substances helps in assessing the following renal functions:

1. Glomerular filtration rate
2. Renal plasma flow
3. Renal blood flow.

To determine the plasma clearance of a particular substance, measurement of the following factors is required:

1. Volume of urine excreted.
2. Concentration of the substance in urine.
3. The concentration of the substance in blood.

Micturition

Micturition is a process by which urine is voided from the urinary bladder. It is a reflex process. However, in grown up children and adults, it can be controlled voluntarily to some extent. The functional anatomy and nerve supply of urinary bladder are essential for the process of micturition.

Nerve supply to urinary bladder and sphincters

Urinary bladder and the internal sphincter are supplied by sympathetic and parasympathetic divisions of autonomic nervous system whereas; the external sphincter is supplied by the somatic nerve fibers.

Sympathetic nerve supply

The stimulation of sympathetic nerve causes relaxation of detrusor muscle and constriction of the internal sphincter. It results in filling of urinary bladder and so, the sympathetic nerve is called the ***nerve of filling***.

Parasympathetic nerve supply

The stimulation of pelvic (parasympathetic) nerve causes contraction of detrusor muscle and relaxation of the internal sphincter leading to emptying of urinary bladder. So, the parasympathetic nerve is called the ***nerve of emptying or nerve of micturition***.

Somatic nerve supply

The external sphincter is innervated by the somatic nerve called the pudendal nerve. It arises from second, third and fourth sacral segments of the spinal cord. It maintains the tonic contraction of the skeletal muscle fibers of the external sphincter and keeps the external sphincter constricted always. During micturition, this nerve is inhibited. It causes relaxation of external sphincter leading to voiding of urine. Thus, the pudendal nerve is ***responsible for voluntary control of micturition***.

Table: Functions of nerves supplying urinary bladder and sphincters

Nerve	On detrusor Muscle	On internal sphincter	On external sphincter	Function
Sympathetic nerve	Relaxation	Constriction	Not supplied	Filling of urinary bladder
Parasympathetic nerve	Contraction	Relaxation	Not supplied	Emptying of urinary bladder
Somatic nerve	Not supplied	Not supplied	Constriction	Voluntary control of micturition

Relation between renal disease & oral health

- Chronic kidney disease (CKD), the gradual and usually permanent reduction of the glomerular filtration rate (GFR) of the kidneys, leads to increases in serum creatinine and blood urea nitrogen (BUN) levels, resulting in uraemia. Uraemia develops and adversely affects every system of the body. An oral manifestation of chronic renal disease is common during the progression of uraemia.

- **Oral manifestations in uraemia:**
  - ♦ Enlarged (asymptomatic) salivary glands
  - ♦ Decreased salivary flow
  - ♦ Dry mouth
  - ♦ Odor of urea on breath
  - ♦ Metallic taste
  - ♦ Increased calculus formation
  - ♦ Enamel hypoplasia
  - ♦ Dark brown stains on crowns
  - ♦ Prolonged bleeding from gingiva
  - ♦ Candidal infections.

Radiographic manifestations

- ♦ Demineralization of bone
- ♦ Giant cell lesions, “brown tumors”
- ♦ Socket sclerosis
- ♦ Pulpal narrowing and calcification
- ♦ Tooth mobility
- ♦ Arterial and oral calcifications.
- ♦ Loss of bony trabeculation
- ♦ Ground-glass appearance
- ♦ Loss of lamina dura

Dental problems with renal disease

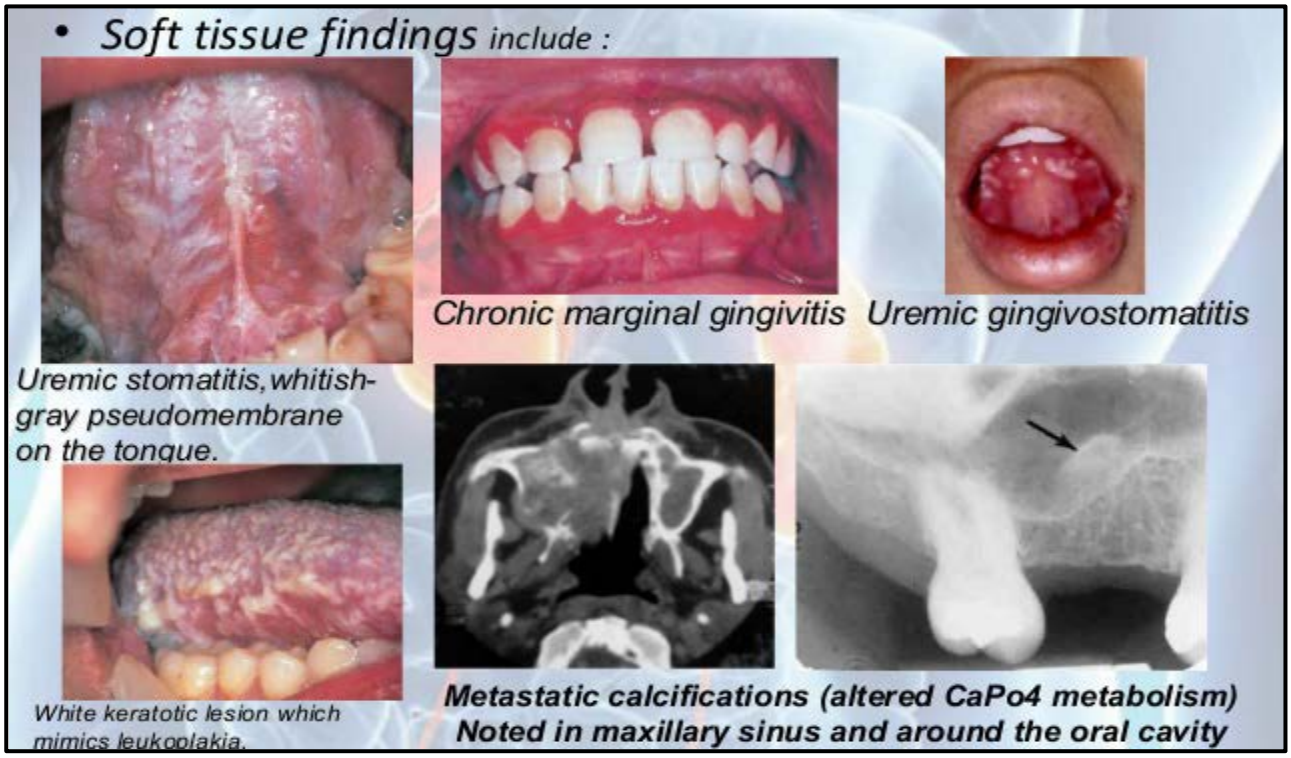
- Uraemic patients have more dental problems than healthy controls in oral mucosa, teeth, salivary glands and jaw bones, problems that seem to develop before dialysis.

- Xerostomia, uraemic stomatitis, periodontal disease and maxillary and mandibular radiographic alterations can be observed in patients with chronic renal failure.

- Periodontal diseases are highly prevalent among patients with chronic renal failure, specifically gingivitis, excessive plaque formation and poor oral hygiene in uraemic patients; however, there are previous reports that periodontal diseases and other dental problems, such as loss of teeth, periapical lesions and mucosal lesions, are contradictory findings.

- Other studies have confirmed that periodontal health is poor in haemodialysis patients and that it correlates with markers of malnutrition and inflammation.


• hard tissue findings include :
Retarted growth resulting in malocclusion
Hypoplasia – characteristic
Incremental defect
Tetracycline
staining
Ground glass appearance
Loss of lamina dura
Large bony lesions
Uremic osteodystrophy of bones


• Soft tissue findings include :
Chronic marginal gingivitis
Uremic gingivostomatitis
Uremic stomatitis, whitish-
gray pseudomembrane
on the tongue.
White keratotic lesion which
mimics leukoplakia.
Metastatic calcifications (altered CaPo4 metabolism)
Noted in maxillary sinus and around the oral cavity