Urinary System

Selective reabsorption

Tubular reabsorption is known as selective reabsorption because the tubular cells reabsorb only the substances necessary for the body. Essential substances such as glucose, amino acids and vitamins are completely reabsorbed from renal tubule. Whereas the unwanted substances like metabolic waste products are excreted through urine.

Mechanism of reabsorption

The basic transport mechanisms involved in tubular reabsorption are of two types:

1. Active Reabsorption

Active reabsorption is the movement of molecules against the electrochemical gradient. It needs liberation of energy which is derived ATP. By using Nat, K+ ATP pumps. The substances reabsorbed actively from the renal tubule are sodium, calcium, potassium, phosphates, sulfates, bicarbonates, glucose, amino acids, ascorbic acid, uric acid and ketone bodies.

2. Passive Reabsorption

Passive reabsorption is the movement of molecules along the electrochemical gradient. This process does not need energy. The

substances reabsorbed by passively are chloride, urea and water. By using:

- Na+ symporters (glucose, amino acid, etc.).
- Na+ antiporters (H).
- Ion channels.
- Osmosis.

Regulation of tubular reabsorption

Tubular reabsorption is regulated by three factors:

1. Glomerulotubular Balance

It is the balance between the filtration and reabsorption of solutes and water in kidney. This process helps in the constant reabsorption of solute particularly sodium and water from renal tubule.

Mechanism of Glomerulotubular Balance

Glomerulotubular balance occurs because of osmotic pressure in the peritubular capillaries. When GFR increases, more amount of plasma proteins accumulate in the glomerulus. Consequently, the osmotic pressure increases in the blood, by the time it reaches efferent arteriole and peritubular capillaries. The elevated osmotic pressure in the peritubular capillaries increases reabsorption of sodium and water from the tubule into the capillary blood.

2. Hormonal Factors

The hormones which regulate GFR are: Aldosterone, Angiotensin II, Antidiuretic hormone, Parathormone and Calcitonin.

3. Nervous Factor

Activation of sympathetic nervous system increases the tubular reabsorption (particularly of sodium) from renal tubules. It also increases the tubular reabsorption indirectly by stimulating secretion of renin from juxtaglomerular cell. Renin causes formation of angiotensin II which increases the sodium reabsorption.

3. Tubular secretion

Tubular secretion is the process by which the substances are transported from blood into renal tubules. It is also called tubular excretion

Substances secreted in different segments of renal tubules

1. Potassium is secreted actively by sodium-potassium pump in proximal and distal convoluted tubules and collecting ducts.

2. Ammonia is secreted in the proximal convoluted tubule.

3. Hydrogen ions are secreted in the proximal and distal convoluted tubules. Maximum hydrogen ion secretion occurs in proximal tubule.

* Thus, urine is formed in the nephron by the processes of glomerular filtration, selective reabsorption and tubular secretion.

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

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.

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 uremia or azotaemia. Uremia develops and adversely affects every system of the body Oral manifestations of chronic renal disease is common during the progression of uremia.

Oral manifestations in uremia:

1. Enlarged (asymptomatic) salivary glands
2. Decreased salivary flow
3. Dry mouth
4. Odor of urea on breath
5. Metallic taste
6. Increased calculus formation
7. Low caries rate
8. Enamel hypoplasia
9. Dark brown stains on crowns
10. Bleeding from gingiva
11. Prolonged bleeding

12. Candidal infections

13. Tooth erosion (secondary to regurgitation associated with dialysis)

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.