YAKEEN NEET 2.0

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EXCRETORY PRODUCTS AND ITS ELIMINATION

ZOOLOGY | **Lecture – 6**

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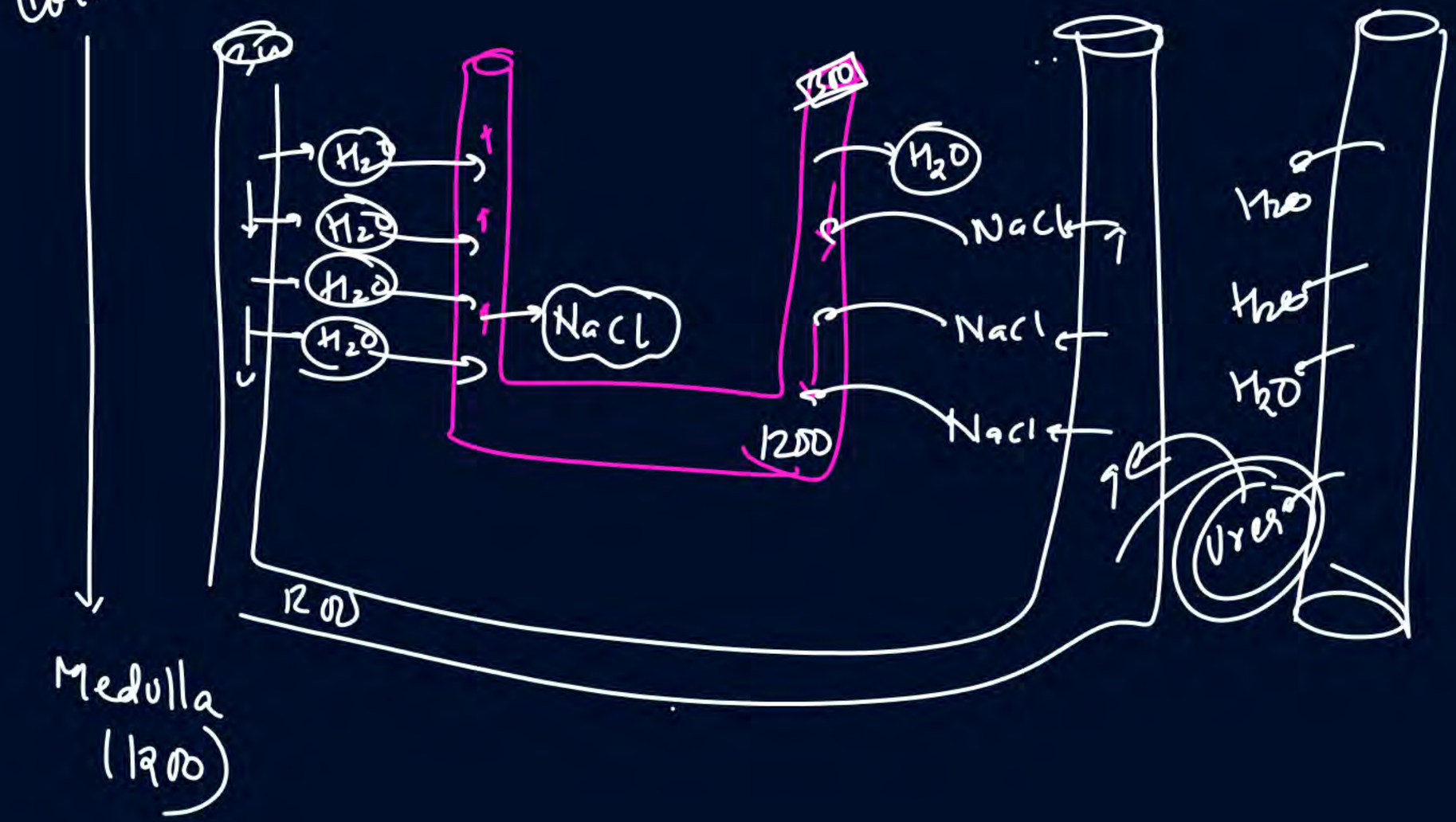
Topics to be covered

1. REGULATION OF KIDNEY FUNCTION, ROLE OF OTHER ORGANS IN EXCRETION , DISORDERS,
2.
3.
4.

MY TELEGRAM

#2 amephiexpress



Regulation of Kidney Function:

Basics

↑ GFR	↓ GFR
Blood volume ↑	Blood vol ↓
∴ H_2O ↑	∴ H_2O ↓
Blood Pressure ↑	Blood Press ↓
Osmolarity ↓	Osmolarity ↑

(1) By Hypothalamus:

✓ • Excessive Loss of Fluid (Dehydration) → Blood vol↓ / Blood H_2O↓ (↓ GFR, ↓ B.P) → Osmolarity ↑

Hypothalamus

→ Osmoreceptors

- Can detect the change in Blood volume / Pressure.
- Excessive loss of fluid from Body can activate these receptors.

↓

SIGNALS POST. PITUITARY (Neurohypophysis)

↓

Releases ADH / Vasopressin (Bloodvessel) → Vasoconstrictor → B.P ↑

↓

acts on latter part of the tubules

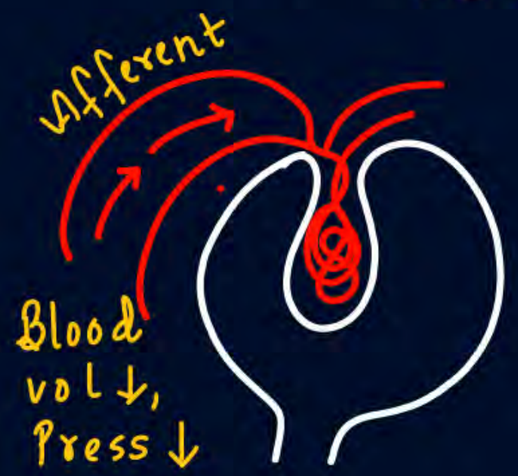
↓

DCT → H_2O reabsorb ← CD

→ Blood vol↑ (↑GFR)

② By JGA / RAAS : (Renin-Angiotensin-Aldosterone-System)

→ When ↓ GFR / Blood vol ↓ / Blood press. ↓ / Blood H_2O



↓

JG cells secrete

↓

RENIN (Hormone)

Angiotensinogen (By Liver)

converted

↓

Angiotensin-I

ACE (Angiotensin Converting Enzyme)

↓

Angiotensin-II

1) Vasoconstriction → Blood Press ↑ → ↑GFR

② Act on Adrenal Cortex → Secretes Aldosterone (Mineralocorticoid) → Act on Distal part of tubule (DCT) → Na^+ reabsorb, H_2O follows → Blood vol ↑, B.P ↑, GFR ↑

③ By ANF (Atrial Natriuretic factor)

- Produced By wall of Atria (Heart)
- When it operates: Blood vol ↑ / Blood H_2O ↑ / B.P ↑ / ↑ GFR
- It checks upon 'RAAS'
- ANF → inhibit 'RAAS'
  - → No Aldosterone → No Na^+ & H_2O reabsorption
    - → Na^+ out via Urine (Natriuretic factor)
- ANF cause VASODILATION → Blood Press ↓

16.5 Regulation of Kidney Function

The functioning of the kidneys is efficiently monitored and regulated by hormonal feedback mechanisms involving the hypothalamus, JGA and to a certain extent, the heart.

Osmoreceptors in the body are activated by changes in blood volume, body fluid volume and ionic concentration. An excessive loss of fluid from the body can activate these receptors which stimulate the hypothalamus to release antidiuretic hormone (ADH) or vasopressin from the neurohypophysis. ADH facilitates water reabsorption from latter parts of the tubule, thereby preventing diuresis. An increase in body fluid volume can switch off the osmoreceptors and suppress the ADH release to complete the feedback. ADH can also affect the kidney function by its constrictory effects on blood vessels. This causes an increase in blood pressure. An increase in blood pressure can increase the glomerular blood flow and thereby the GFR.

The JGA plays a complex regulatory role. A fall in glomerular blood flow/glomerular blood pressure/GFR can activate the JG cells to release **renin** which converts angiotensinogen in blood to angiotensin I and further to angiotensin II. Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thereby GFR. Angiotensin II also activates the adrenal cortex to release Aldosterone. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the tubule. This also leads to an increase in blood pressure and GFR. This complex mechanism is generally known as the **Renin-Angiotensin** mechanism.

An increase in blood flow to the atria of the heart can cause the release of **Atrial Natriuretic Factor** (ANF). ANF can cause vasodilation (dilation of blood vessels) and thereby decrease the blood pressure. ANF mechanism, therefore, acts as a check on the renin-angiotensin mechanism.

Role of other Organs in Excretion:

① Lungs: → CO_2 ✡ (200 ml/min)
→ Significant amt of H_2O vapour

② Liver: Largest gland: Secretes BILE
- → Bilirubin, Biliverdin] Bile pigments
- → Cholesterol
- → Vitamins
- → Drugs
- → Degraded Steroid hormone
- → via faecal matter

③ SKIN
- i) Sweat gland → SWEAT
  - Primary function: COOLING
  - Small of Urea, Lactic Acid, NaCl: Excreted
- ii) Oil/Sebaceous gland → SEBUM OIL
  - → protective covering on SKIN
  - → Waxes, Hydrocarbons & Sterols: Excrete.

Note · 'Saliva' also eliminates small amount of N_2 wastes (Urea).

16.7 Role of other Organs in Excretion

Other than the kidneys, lungs, liver and skin also help in the elimination of excretory wastes.

Our lungs remove large amounts of CO_2 (approximately 200mL/minute) and also significant quantities of water every day. Liver, the largest gland in our body, secretes bile-containing substances like bilirubin, biliverdin, cholesterol, degraded steroid hormones, vitamins and drugs. Most of these substances ultimately pass out along with digestive wastes.

The sweat and sebaceous glands in the skin can eliminate certain substances through their secretions. Sweat produced by the sweat glands is a watery fluid containing NaCl, small amounts of urea, lactic acid, etc. Though the primary function of sweat is to facilitate a cooling effect on the body surface, it also helps in the removal of some of the wastes mentioned above. Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum. This secretion provides a protective oily covering for the skin. Do you know that small amounts of nitrogenous wastes could be eliminated through saliva too?

Disorders:

1) **Renal Calculi**: (KIDNEY-STONES)
   - ↳ Insoluble mass of Crystallised salts (eg: Calcium oxalate) in Kidney.

2) **Glomerulonephritis**: Inflammation in Glomerulus / filteration membrane.
   - Glomerulus
   - inflammation

3) **Uremia**:

Malfunctioning of KIDNEY: Urea not eliminated in Urine

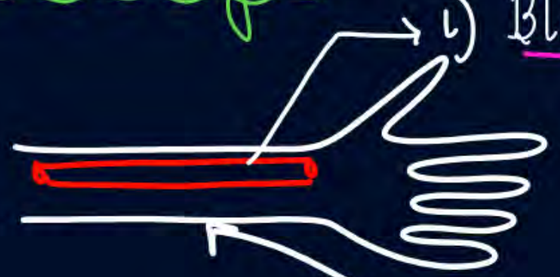
↓

'UREA' accumulate in Blood (Kidney damage)

↓

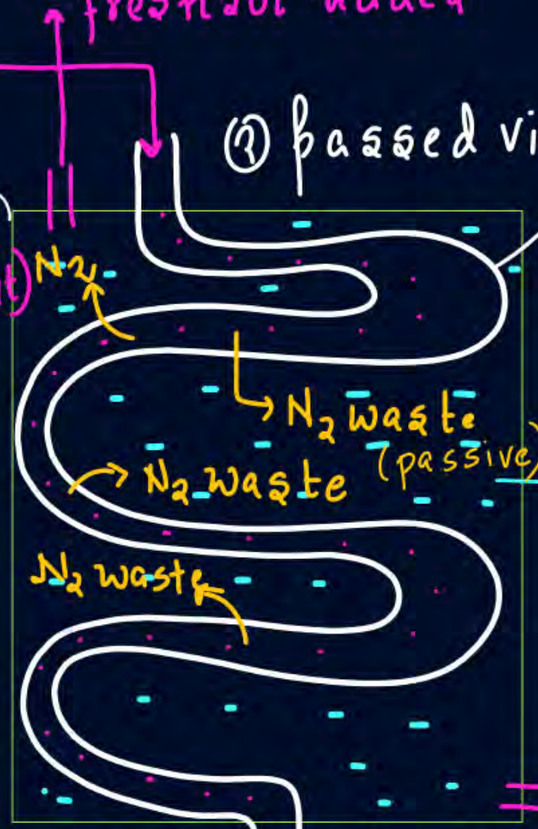
Haemodialysis is performed.

Haemodialysis



1) Blood is taken out from a convinient artery (N_2 waste)

(Heparin (anti coagulant) added



2) passed via this → dialysing tube (Cellophane) (porus, Semipermia-ble)

* Dialysing fluid / solution

Composition is Similar to Blood plasma except N_2 waste

used soln removed

Artificial KIDNEY

3) Purified Blood (No N_2 waste)

4) Coagulant add (antiheparin)

5) Returned to Body via convinient vein (Radial vein)

④ Acute Renal failure: immediate Kidney fail

KIDNEY-FAILURE

↓

Only soln is 'Kidney transplantation'

↓

'Closest Relative'

↳ Max. tissue matching (Donar)

• Blood gp matching

• for transplantation,

patients: 'Immunosuppressants' (eg: Cortisol)

↓

to stop unwanted immune responses.

16.8 Disorders of the Excretory System

Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called **uremia**, which is highly harmful and may lead to kidney failure. In such patients, urea can be removed by a process called **hemodialysis**. During the process of haemodialysis, the blood drained from a convenient artery is pumped into a dialysing unit called **artificial kidney**. Blood drained from a convenient artery is pumped into a dialysing unit after adding an anticoagulant like heparin. The unit contains a coiled cellophane tube surrounded by a fluid (dialysing fluid) having the same

composition as that of plasma except the nitrogenous wastes. The porous cellophane membrance of the tube allows the passage of molecules based on concentration gradient. As nitrogenous wastes are absent in the dialysing fluid, these substances freely move out, thereby clearing the blood. The cleared blood is pumped back to the body through a vein after adding anti-heparin to it. This method is a boon for thousands of uremic patients all over the world.

Kidney transplantation is the ultimate method in the correction of acute **renal failures** (kidney failure). A functioning kidney is used in transplantation from a donor, preferably a close relative, to minimise its chances of rejection by the immune system of the host. Modern clinical procedures have increased the success rate of such a complicated technique.

Renal calculi: Stone or insoluble mass of crystallised salts (oxalates, etc.) formed within the kidney.

Glomerulonephritis: Inflammation of glomeruli of kidney.

Homework

- REVISE CLAASNOTES / ZOOLOGY MED EASY

THANK YOU