

# Sodium balance

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- Inorganic salts are in solution, as in the extracellular or intracellular fluids of the body dissociate into ions.
- Ions are of two kinds: **(1) cations**, which are electropositive; and **(2) anions**, which are electronegative: **collectively these are the electrolytes.**
- The **chemical concentrations**, **reactivity** and **osmotic power** described as millimoles per litre (mmol/litre).

➤ **The cations include** sodium, potassium, calcium and magnesium

➤ **the anions include** chloride, phosphate, bicarbonate and sulphate.

➤ **The distribution of the salts** within the fluid compartments of the body:

1. Controls the passage of water through the cell walls and
2. Maintains acid—base equilibrium.

# Sodium balance

- Sodium is the principal cation content of the extracellular fluid.
- The total body sodium amounts approximately 5000 mmol, of which **44** per cent is in the extracellular fluid, **9** per cent in the intracellular fluid and the remaining **47** per cent in bone.
- The sodium housed in bone merits special notice: a little more than half of it is **osmotically inactive** and requires acid for its solution; the remainder is **water soluble and exchangeable**.

➤ Thus, there is a **large storehouse of sodium** ready to compensate abnormal loss from the body.

➤ **daily intake of sodium** average 1 mmol/kg sodium chloride or 500 ml of isotonic 0.9 per cent saline solution. An equivalent amount is excreted daily, mainly in the urine and some in the faeces.

## Control by adrenal corticoids

the most powerful conservator of sodium being **aldosterone**.

# The sodium excretion shut down of trauma due to increased adrenocortical activity

- Following trauma/surgery there is a **variable period of reduced excretion of sodium**.
- For this reason it may be inadvisable to administer large quantities of isotonic (0.9 per cent) saline solution after an operation.
- The period of sodium excretion shut down can last for up to 48 hours and is due to increased adrenocortical activity.



# Sodium depletion (hyponatraemia)

## Causes

- **obstruction of the small intestine**, with its rapid loss of gastric, biliary, pancreatic and intestinal secretions by antiperistalsis and ejection, whether by vomiting or aspiration.
- Duodenal, total biliary, pancreatic and high intestinal external **fistulae** also are all bringing about early and profound hyponatraemia.

- **Severe diarrhoea** due to dysentery, cholera, ulcerative colitis or pseudomembranous colitis will cause hyponatraemia with acidosis.
- **Adrenocortical insufficiency:** The finding of hyponatraemia with elevated potassium would suggest adrenocortical insufficiency.
- Hyponatraemia is also seen in **SIADH**.

- **Gastric aspiration combined with allowing the patient to drink** as he or she pleases and promptly aspirating the fluid swallowed. The act of drinking excites the flow of gastric juice, and this is also aspirated. During this form of therapy, should the patient be receiving intravenous dextrose solution to maintain fluid balance, he or she will soon become a victim of hyponatraemia.

## ***Clinical features***

- **Clinical features of hyponatraemia with salt and water depletion are due to extracellular dehydration.**
- **Eyes are sunken**
- **Face is drawn.**
- **In infants the anterior fontanelle is depressed.**
- **The tongue is coated and dry**; in advanced cases it is brown in colour.

- **The skin is dry and often wrinkled**, making the patient look older than his or her years.
- **The subcutaneous tissue feels lax.**
- **Peripheral veins are contracted and contain dark blood.**
- **Unlike the dehydration** produced by loss of water only, in water and salt depletion thirst is not particularly in evidence.
- **The arterial blood pressure** is likely to be below normal.
- **The urine** is scanty, dark in colour, of a high specific gravity

➤ **Increase hematocrit (PCV)** However, haemoconcentrations can be masked by preexisting anaemia.

➤ **Normal or slightly reduced serum sodium**

➤ **Low urinary output and low urinary sodium.**

## Postoperative hyponatraemia

- Hyponatraemia with a normal or increased extracellular fluid volume arises as a result of too prolonged administration of a sodium-free solution.

## Postoperative Sodium excess (hyponatremia)

- This is likely to arise if a patient is given an excessive amount of 0.9 per cent saline solution intravenously during the early postoperative period when, as has been described, some degree of sodium retention is to be expected. The result is an overloading of the circulation with salt and its accompanying water.



## ***Clinical feature* of excessive amount of saline solution given intravenously during the early postoperative period**

- Slight **puffiness** of the face is the only early sign.
- The patient makes no complaint.
- **Pitting oedema** should be sought, especially in the sacral region, but for pitting oedema to be present at least 4.5litres of excess fluid must have accumulated in the tissue spaces.
- The patient's **weight increases**.

➤ **In infancy (infants are very susceptible) :**

1. Increased tension in the anterior fontanelle
2. Increased weight, an increase in the number of urinations and oedema.

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