osmo receptor ← هي اللي بتحفزو (hypo volimea أو hyper osmolality) والتحور بتروح

hypothalamus وبتحفز الـ thirst center وبنفرز الـ ADH بروح بعمل water retention فبزيد

الـ volume أو بعمل dilution في حالة الـ hypernatrimia ... في حالة الـ hypovolemia

مش بس الـ thirst center اللي بتحفز بحيس كمان الـ perfusion

REGULATION OF SODIUM

للـ kidney قليل بزيد renin وبحول Angio 1 ← Angio 2 .... من الـ lung

بعمل vasoconstriction وبحفز إنتاج الـ aldosterone اللي بعمل

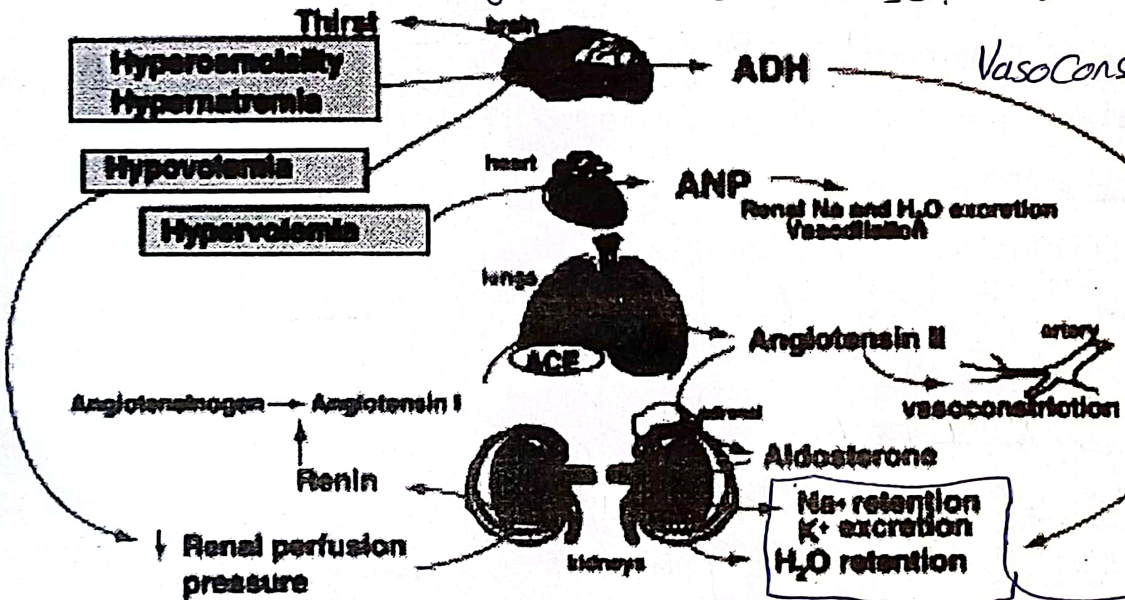

FIGURE 15-1. Responses to changes in blood osmolality and blood volume. ANP, atrial natriuretic peptide. The primary stimuli are shown in boxes (e.g., hypovolemia).

← إذا كان hypervolemia بنفرز ANP ← بزيد excretion الـ Na وبالتالي الـ water

ـه proximal tube ← هيبر فيها reabsorption .... الـ distal tube

له للتحفيز الـ aldosterone

aldosterone

CAUSES OF HYPERNATREMIA

- Excess water loss
  - Diabetes insipidus
  - Renal tubular disorder
  - Prolonged diarrhea
  - Profuse sweating
  - Severe burns
- Decreased water intake
  - Older persons
  - Infants
  - Mental impairment
- Increased intake or retention
  - Hyperaldosteronism
  - Sodium bicarbonate excess
  - Dialysis fluid excess

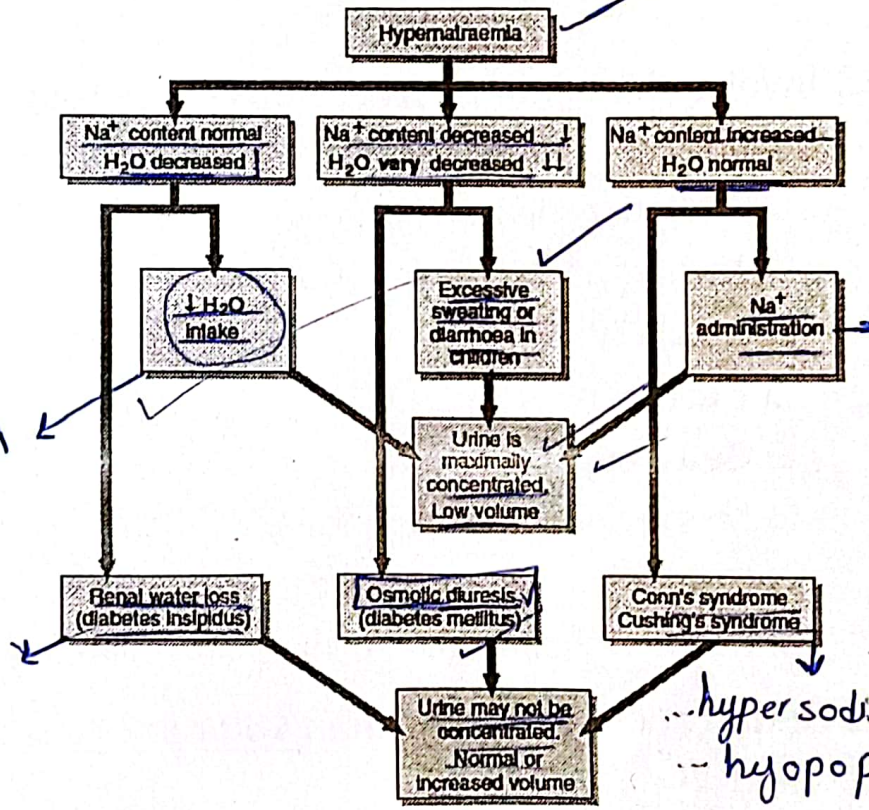

Fig 10.1 The causes of hypernatraemia.

sweat او diarrhoea عند في الكلية اذا الـ Urine اقل .. الـ water intake

concentrated

21

wine concentrated بسحب الماء فما بكون glucose ... diabetes

HYPERNATREMIA (150 MMOL/L) RELATED URINE OSMOLALITY

- Urine osmolality <300 mosm/kg
  - Diabetes insipidus (impaired secretion of ADH respond to ADH) or kidneys cannot
- Urine osmolality 300-700 mosm/kg
  - Partial defect in ADH release or response to ADH
  - Osmotic diuresis
- Urine osmolality >700 mosm/kg
  - Loss of thirst
  - Insensible loss of water (breathing, skin)
  - GI loss of hypotonic fluid
  - Excess intake of sodium

SYMPTOMS OF HYPERNATREMIA

- Involve the central nervous system (CNS) hyperosmolar state which include: as a resu of the
  - Altered mental status
  - Lethargy → تعب
  - Irritability
  - Restlessness.
  - Seizures
  - Muscle twitching, hyperreflexes → عضلة بتتحرك لحالها
  - Fever, nausea or vomiting
  - Difficult respiration, and increased thirst.
- Serum sodium of more than 160 mmol/L is associated with a mortality rate of 60-75%

TREATMENT OF HYPERNATREMIA

- Treatment is directed at correction of the underlying condition that caused the water depletion or sodium retention.

Normal Salaine , dextrose 5% إذا ما بتدر بشرب ماء ... بشرب العلاج

isotonic solution hypotonic

- The speed of correction depends on the rate with which the condition developed

- Hypernatremia must be corrected gradually because too rapid a correction of serious hypernatremia (>160 mmol/L) can induce cerebral edema and death. The maximal rate should be 0.5 mmol/L per hour

لهيك اكثر من هيك لانو الجسم بكون متعود إنو يكون concentrated وآجي اتفنترا فجأة ما بجيز Cerebral edema بجيز عندو

Edema

HYPONATREMIA

اعراض ← 150 ←

Normal ← 135 - 145

لـ أقل أعراض

- Hyponatremia is defined as a serum or plasma level <135 mmol/L.

لـ أقل معناها hypo

- Levels below 130 mmol/l are clinically significant.

- Hyponatremia can be assessed by the cause for the decrease or with the osmolality level.

← بدي أشوف شو المشكلة وأحلها

← إذا إنخفضت الـ osmolarity وإنخفض الـ sodium هي سبب

← وفي رح ينخفض الـ sodium من دون ما تنخفض الـ osmolarity

← في أشي اسمه اسوداريتفع بهاي الحالة

CAUSES OF HYPONATREMIA

- Increase sodium loss
  - Hypoadrenalism → water retention
  - Potassium deficiency (exchange in kidney) → as a response (Na ↓ aldosterone ↓)
  - Diuretic use (thiazide)
  - Ketonuria (sodium lost with ketones)
  - Salt losing nephropathy (with some renal tubular disorders) → urine loss
- **These factors will increase the conc. of Na in urine to >20 mmol/L** →
  - Prolong vomiting or diarrhea
  - Severe burns
- Increased water retention
  - Renal failure
  - Nephrotic syndrome
  - Hepatic cirrhosis → ↓albumin ↓ osmolarity, retention water
  - Congestive heart failure → كميات قليلة لـ urine

CAUSES OF HYPONATREMIA

- Water imbalance

- Excess water intake (polydipsia, increased thirst): may cause mild or severe hyponatremia if water intake was chronic. In a normal individual, excess intake will not affect Na levels.

- يزيد شرب الماء
- يزيد retention للحلة

Syndrome of inapropriad ADH

- SIADH causes an increase in water retention because of increased ADH production which is associated with pulmonary disease, malignancies, CNS disorders, infections.

- Pseudohyponatremia by measuring Na using indirect ISE (which dilutes sample prior to analysis), in a patient with hyperproteinemia or hyperlipidemia.

→ hyperLipidemia, hyperproteinemia

protein, lipid للجهاز المستخدم بتلصق فيه

وبعطوا القياس الصحيح

CLASSIFICATION OF HYPONATREMIA BY OSMOLALITY

- With low osmolality
  - Increased sodium loss
  - Increased water retention
- With normal osmolality increased nonsodium cations
  - Lithium excess
  - Increased -γ-globulins-cationic (multiple myeloma)
  - Severe hyperkalemia
  - Severe hypermagnesemia → هو ضوالنقص عشانة هيك بتكون Normal
  - Severe hypercalcemia, pseudohyponatremia
  - Hyperlipidemia
  - Hyperproteinemia
  - Pseudohyperkalemia as a result of in vitro hemolysis → لأنو الصوديوم مش ناقص
- With high osmolality
  - Hyperglycemia → osmo التأثير
  - Mannitol infusion → الو

... osmotic activity

SYMPTOMS OF HYPONATREMIA

- Symptoms depend on the serum **level.**
  - Between 125 and 130 mmol/l: **symptoms are gastrointestinal** ← Nasuea , Vomiting
  - Below 125 mmol/l: more severe **neuropsychiatric** seen including nausea and vomiting, muscular weakness, **headache,** lethargy, and ataxia.
  - More severe symptoms also include seizures, coma, and respiratory depression

← إذا إنخفض أكثر وأكثر

← لنصلح المشكلة مثلاً عند diuretic نعطيه edema ..

وبزيد الـ sodium intake

TREATMENT OF HYPONATREMIA

- Treatment is directed correction of the condition that caused either water loss or so loss in excess of water loss.
- Correcting severe hyponatremia too rapidly can cause cerebral myelinolysis while slowly can cause cerebral edema
- Appropriate management of fluid administration is critical. Fluid administration and monitoring is required during treatment of the underlying cause of the hyponatremia
- The measurement of urine osmolality is necessary to evaluate the cause of hypernatremia
- Chronic hyponatremia in an alert patient is indicative of hypothalamic disease

- هدف الـ rate البطيء ؛ الـ perfusion ع يعمل Cerebral edema

- rate عالي كتير الـ بتخرب meylin sheath

DETERMINATION OF SODIUM

- Sodium can be measured in serum, plasma, and urine.
- When plasma is used, lithium heparin, ammonium heparin, and lithium oxalate are suitable anticoagula
- Hemolysis does not cause significant change in serum or plasma values as a result of decreased level intracellular sodium. however, with marked hemolysis, levels may be decreased as a result of a dilution
- Whole blood samples may be used with some analyzers.
- The specimen of choice in urine sodium analyses is a 24-hour collection.
- Sweat is also suitable for analysis.

POTASSIUM

- Potassium is the major intracellular cation in the body with a concentration 20 times greater inside the cells than outside
- Many cellular functions requires that the body maintains a low ECF concentration of K. As a result, only 2% of the body's total potassium circulates in the plasma
- Function of potassium in the body include
  - Neuromuscular excitability
  - Contraction of the heart
  - ICF volume
  - Hydrogen ion concentration

POTASSIUM

- The potassium ion concentration has a major effect on skeletal and cardiac muscles. A lower than normal difference increases cell excitability leading to muscle weakness.
- Severe hypokalemia can cause muscle excitability which may lead to paralysis or fatal cardiac arrhythmia
- Hypokalemia decreases cell excitability resulting in an arrhythmia or paralysis
- the heart may cease to contract in extreme case of hypokalemia or hyperkalemia
- Potassium concentration affects hydrogen ion concentration in the blood. In hypokalemia, when potassium ion is lost from the blood, sodium and hydrogen ions move to into the cells. The hydrogen ion concentration decreases in ECF resulting to alkalosis