HYPERNATREMIA

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DEFINITION

- Serum Na >145mmol/L
- Severe Hypernatremia - Na>152mmol/L

CAUSE

- Free water loss
- Decreased water Intake
- Sodium overload : Rarely

FREE WATER LOSS

- Gastrointestinal losses
  - severe diarrhoea/prolonged vomiting

- Osmotic diuresis/renal losses
  - recovery from renal failure
  - poorly controlled diabetes mellitus
  - use of intravenous mannitol or loop diuretics
  - Recovery from obstructive uropathy
  - Diabetes Insipidus

FREE WATER LOSS

- Insensible or sweat losses
  - exercise, fever, heat exposure, burns
  - are unlikely to cause severe hypernatraemia, but can contribute to worsening of hypernatraemia

- During peritoneal dialysis

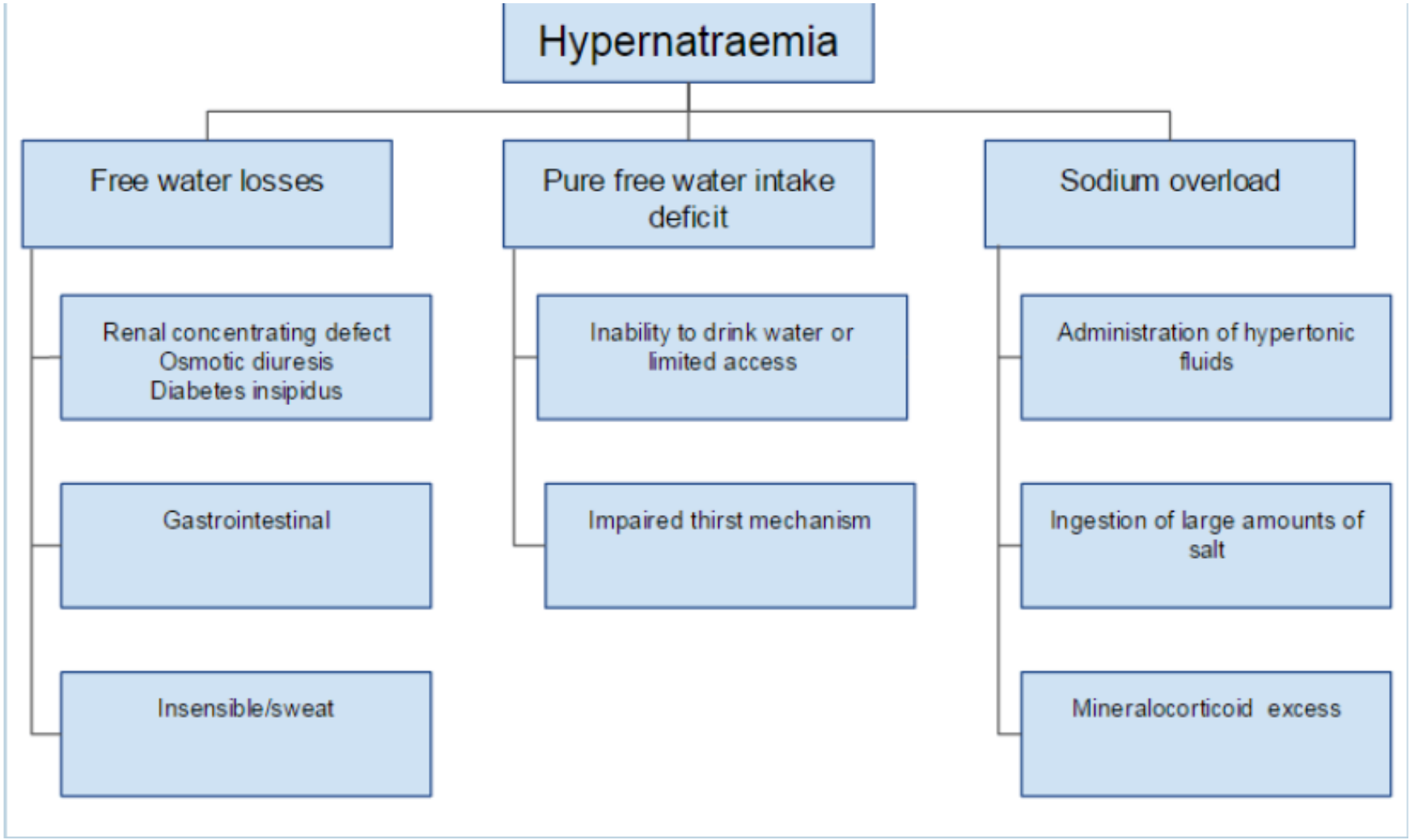
INADEQUATE FREE WATER INTAKE

- Impaired thirst mechanism
  - Brain tumor
  - Hypothalamic lesion

- Inability to drink water or limited access to water
  - Elderly patients with Dementia

SODIUM OVERLOAD

- Administration of large volume of Hypertonic solution
- Excessive intake of salt
- Mineralocorticoid excess
  - Cushing's
  - Primary hyperaldosteronism


Hypernatraemia
Free water losses
Pure free water intake deficit
Sodium overload
Renal concentrating defect
Osmotic diuresis
Diabetes insipidus
Gastrointestinal
Insensible/sweat
Inability to drink water or limited access
Impaired thirst mechanism
Administration of hypertonic fluids
Ingestion of large amounts of salt
Mineralocorticoid excess

EDELMAN'S EQUATION

- Electrolyte free water excretion

- UNa + UK < Pna
  - electrolyte-free water excretion is positive, a process that will tend to raise the serum sodium concentration

- UNa + UK > Pna
  - electrolyte-free water excretion is negative, a process that will tend to lower the serum sodium concentration

    - where UNa = urine concentration of sodium; UK = urine concentration of potassium; PNa = plasma concentration of sodium.

- People with normal renal function who receive large amounts of saline can concentrate their urine to excrete the sodium load that they have been given and, therefore, have very little electrolyte-free water excretion.

- However, patients with the inability to concentrate their urine, as is the case in patients with kidney dysfunction or diabetes insipidus, have the inability to excrete the extra sodium load and may develop hypernatraemia

ACUTE HYPERNATRAEMIA

- Onset in **<48 hours**
- Higher osmolality in the extracellular space causes water to move out of brain cells causing the brain to shrink.
- This shrinkage can lead to neurological consequences, including lethargy, weakness, and irritability.
- If **severe**, adverse manifestations can include **intracranial haemorrhage**, **seizures**, **stupor**, **coma**, and **death**

CHRONIC HYPERNATREMIA

- onset over ≥48 hours
- Brain cells can adapt to the chronic hyperosmolality by increasing intracellular osmolality.
- Hence lesser damage

DRUGS CAUSING DIABETES INSIPIDUS

- Lithium
- Pencillins
- Aminoglycosides
- Cisplatin
- Amphotericin B
- Vinblastine
- Phenytoin
- Vitamin A and D

OTHER DRUGS CAUSING HYPERNATREMIA

- Loop diuretics:
  - cause an increase in free water excretion.

- Intravenous Mannitol
  - Osmotic diuresis

- Laxatives

DIAGNOSTIC TESTS

- Serum Na

- Urine osmolality :
  - <150 mmol/kg: diabetes insipidus
  - 200-500 mmol/kg: renal concentrating defect
  - >500 mmol/kg:pure volume depletion

- **Serum osmolality**

- **Electrolytre free water excretion**

- **Serum vasopressin**
  - **Decreased in central Diabetes Insipidus**
- **Desmopressin challenge test**
  - **Differentiates between Peripheral and central Diabetes Insipidus**
- **Serum Argenine Vasopressin levels (AVP)**
  - **Differentiates between Peripheral and central Diabetes Insipidus**
- **MRI or CT brain**
  - **To look for brain lesion**

TREATMENT STRATERGY

- Calculating the free water deficit
- Determining a suitable serum sodium correction rate
- Estimating ongoing free water losses (if applicable)
- Designing a suitable fluid repletion program that takes into account the estimated free water deficit the desired serum sodium correction rate, and any ongoing free water losses

- *Free water deficit formula.*

- *TBW (total body water) = patient body weight (kg) x 0.5 (women/older men) or 0.6 (young men or children) or 0.4 (dehydrated patients). Na*

$$free\ water\ deficit\ (L) = TBW \times \frac{actual\ serum\ Na - ideal\ serum\ Na}{ideal\ serum\ Na}$$