13 ELECTROLYTE DISORDERS (NA&K)

أسئلة نظام جديد

فاينال 60 | فاينال 59 | فاينال 57

1. **Enumerate lines of Management of hyperkalemia**
   1. **IV Calcium Gluconate** → (FIRST you protect the HAERT if there are toxic ECG changes
   2. **Intracellular shift of K+ :**
      a) **B2 agonist** (salbutamol – albuterol)
      b) **Correction of acidosis** → IV NAHCO3 (if pH < 7.2)
      c) **Insulin + Glucose**
   3. **Removal of K+ :**
      a) **Potassium-lowering resins** (potassium binders) or
      b) **Loop** diuretics or
      c) **Dialysis** (to remove K^+ rapidly in patients with kidney impairment)

أسئلة نظام قديم

1. **Define hyperkalemia**

◈ **Serum K^+ >5.5 mEq/L.**

MILD	5.5 – 6 mEq/L
MODERATE	6 – 7 mEq/L
SEVERE	>7 mEq/L

2. **What is expected ECG findings in hyperkalemia?**

T WAVES	**Peaked** (earliest)
P WAVES	**Small** or **absent**
PR INTERVAL	**Prolonged**
QRS COMPLEXES	**Wide** bizarre

e) Define hypokalemia and mention 4 causes

1. **Definition:**
   ↳ **Serum potassium level < 3.5** mEq/L.
2. **Causes:**

a) ↓↓ Intake : Diet Or Iv Fluif Deficint In Potassium

b) ↑↑ Intracellular Shift:
   ① Insulin.
   ② β2-Agonists.
   ③ Alkalosis.
   ④ Theophylline.
   ⑤ Hypokalemic periodic paralysis.

c) ↑↑ Loss:
   ➲ **Renal causes:**

DRUGS	① **Diuretics** (thiazides - loop diuretics - osmotic diuretics). **(COMMONEST CAUSE)** ② **Beta-2** adrenergic agonists. ③ **Glucocorticoids.** ④ **Catecholamines.**

	HYPERTENSIVE	NORMOTENSIVE
DISORDERS	① Malignant hypertension ② Renovascular hypertension ③ Renin-secreting tumors ④ Primary aldosteronism ⑤ Liddle syndrome ⑥ Congenital adrenal hyperplasia ⑦ Cushing's syndrome	① Renal tubular acidosis (type 1&2) ② Bartter syndrome ③ Gitelman syndrome ④ Hypomagnesemia

d) NON-Renal causes:

GIT LOSS	① Diarrhea ② Vomiting
SKIN LOSS	① Excessive heat ② Strenuous exercise

أسئلة اخرى

1. Define hyponatremia?

- **Hyponatremia** is defined as a serum sodium concentration **below 135 meq/L.**

2. Compare serum osmolality and sodium levels in various hyponatremic conditions?

Condition	Measured serum osmolality	Serum sodium by autoanalyzer	Serum sodium by direct electrode
Normal patient	Normal	Normal	Normal
Hypotonic hyponatremia	**Low**	Low	Low
Hyperglycemia / IV mannitol	**High**	Low	Low
Absorbed surgical irrigants	Normal	Low	Low
Pseudohyponatremia	**Normal**	Low	**Normal**

3. Define pseudohyponatremia?

- It is an **artefactually low sodium** measurement in the presence of high levels of **large molecules** (fat or protein) in the plasma.

4. List the causes of pseudohyponatremia?

- It is caused by a **decreased fractional water content** of plasma.
- Specific etiologies include **hyperlipidemia** and **hyperproteinemia.**

5. **List the clinical criteria for SIADH?**
   1. **Plasma osmolality < 270 mS/kg.**
   2. Inappropriate **urinary concentration** (urinary osmolality > 100 mS/kg).
   3. The patient must be **clinically euvolaemic.**
   4. **Elevated urinary sodium (> 40 mmol/L)** with normal salt and water intake.
   5. **Exclusion** of hypothyroidism and glucocorticoid deficiency.
6. **List the malignant causes of SIADH?**
   1. **Bronchogenic carcinoma** is a common cause.
   2. **Lymphoma** can lead to the condition.
   3. **Sarcoma** is another associated malignancy.
   4. Small cell carcinoma of the lung is particularly frequent.
   5. Less frequent tumors include **head and neck, duodenal, and pancreatic** cancers.
7. **List the drugs that can cause hyponatremia?**
   - Common medications include:
     1. **Diuretics**, particularly **thiazides.**
     2. **Non-steroidal anti-inflammatory drugs** (NSAIDs).
     3. **Desmopressin** (synthetic ADH analogue).
     4. **Antidepressants** such as **SSRIs** (fluoxetine) and **tricyclics** (amitriptyline).
     5. **Antiepileptic drugs** like **carbamazepine** and **lamotrigine.**
     6. **Chemotherapy agents** including **vincristine** and **cyclophosphamide.**
     7. **Nicotine** and **morphine.**
8. **Contrast the clinical manifestations of acute and chronic hyponatremia?**
   - **Acute Hyponatremia:**
     1. Symptoms are largely related to **CNS effects** due to water entry into brain cells.
     2. This causes **cerebral edema**, leading to malaise, headache, and nausea.
     3. Severe cases result in **seizures, coma, respiratory arrest,** and death.
   - **Chronic Hyponatremia:**
     1. Often **asymptomatic** even with serum Na < 120 mmol/L due to **cerebral adaptation.**
     2. Non-specific symptoms include **fatigue, dizziness, gait disturbances, and forgetfulness.**
     3. Patients may also experience **confusion, lethargy, and muscle cramps.**
9. **List the major risks and sequelae associated with hyponatremia?**
   1. **Acute hyponatremic encephalopathy** can cause permanent neurologic damage or death, especially in premenopausal females.
   2. **Osmotic demyelination (CPM)** can occur due to **overly rapid correction.**
   3. Other risks include **increased mortality, high morbidity,** and an **increased risk of falls.**

10. List the four goals of treating hyponatremia in hospitalized patients?

1. **Prevent further declines** in the serum sodium concentration.
2. **Decrease intracranial pressure** in patients at risk for brain herniation.
3. **Relieve symptoms** of the disorder.
4. **Avoid excessive correction** to prevent osmotic demyelination syndrome.

11. Explain the management of hyponatremia based on volemic status?

1. **Hypovolaemic hyponatraemia**: Requires **fluid and salt replacement** using **isotonic saline.**
2. **Hypervolaemic hyponatraemia**: Managed with **fluid loss** via **fluid restriction** and/or **diuretics.**
3. **Euvolaemic hyponatremia**: Focuses on treating the **underlying cause**, such as replacing thyroxine for hypothyroidism.

12. What are the correction rate guidelines for chronic hyponatremia?

- Correction should be **gradual,** at a rate no greater than **0.5 mmol/l/h.**
- The **maximum rate** of correction should be **8 mEq/L in any 24-hour period.**
- The primary aim of slow correction is to **avoid osmotic demyelination syndrome.**

13. List the problems associated with Tolvaptan use?

1. **Rapid correction** of hyponatremia may occur.
2. It carries a risk of **hepatic toxicity.**
3. The medication has a **high cost.**
4. It causes an **increase in thirst.**

14. Why is hypernatremia common in elderly patients?

1. Older adults often have **deficient free water intake.**
2. There is frequently **abnormal regulation of AVP** secretion.
3. There may be **decreased renal responsiveness** to AVP.
4. Elderly patients often have **free water losses** combined with **inadequate replacement.**

15. List the causes of unreplaced water loss leading to hypernatremia?

1. **Insensible and sweat losses.**
2. **Gastrointestinal losses.**
3. **Central or nephrogenic diabetes insipidus.**
4. **Osmotic diuresis** caused by glucose (diabetes mellitus), urea, or mannitol.
5. **Hypothalamic lesions** that impair thirst or osmoreceptor function.

16. What are the manifestations and sequelae of acute hypernatremia?

1. A rapid decrease in brain volume can cause **rupture of cerebral veins.**
2. This leads to **intracerebral and subarachnoid hemorrhages** and potential irreversible damage.
3. **Demyelinating brain lesions** may occur.
4. Initial symptoms include **lethargy, weakness, and irritability,** progressing to **twitching, seizures, and coma.**
5. Mortality is high, around **50%**, and increases with severity.

17. Why are healthy older people more prone to hyperkalemia?

1. The **transtubular potassium gradient** is diminished in older people.
2. **Aldosterone and renin levels fall** with age.
3. The **aldosterone response** to elevated potassium is **blunted.**
4. Renal tubules are **less sensitive to aldosterone.**
5. There is a higher prevalence of **diabetes, hypertension,** and **polypharmacy.**

18. List the causes of increased potassium release from cells?

1. **Pseudohyperkalemia.**
2. **Metabolic acidosis.**
3. **Insulin deficiency,** hyperglycemia, and hyperosmolality.
4. **Increased tissue catabolism.**
5. Drugs such as **beta blockers** and **digitalis overdose.**
6. **Exercise** and hyperkalemic periodic paralysis.
7. **Red cell transfusion** and **succinylcholine.**

19. List the causes of reduced aldosterone production?

1. **Hyporeninemic hypoaldosteronism** associated with kidney disease or NSAIDs.
2. Drugs such as **ACE inhibitors, ARBs,** and **direct renin inhibitors.**
3. **Chronic heparin therapy,** which impairs synthesis.
4. **Primary adrenal insufficiency.**
5. **Inherited disorders** like Gordon's syndrome.

20. List the causes of aldosterone resistance?

1. **Potassium-sparing diuretics** (spironolactone, amiloride).
2. Antibiotics like **trimethoprim** and **pentamidine.**
3. **Pseudohypoaldosteronism type 1.**
4. **Voltage defects** or obstructive uropathy.
5. Conditions like **SLE** and **sickle cell disease.**

21. List the clinical and ECG manifestations of hyperkalemia?

- **Clinical: Muscle weakness or paralysis,** cardiac conduction abnormalities, and **arrhythmias.**
- **ECG Abnormalities by Severity:**
  1. **Mild (5.5-6.5 mEq/L): Peaked T waves** and prolonged PR segment.
  2. **Moderate (6.5-8.0 mEq/L): Loss of P wave,** prolonged QRS, and ST-segment elevation.
  3. **Severe (> 8.0 mEq/L): Sine wave,** progressive QRS widening, **ventricular fibrillation,** and **asystole.**

22. Describe the management strategies for hyperkalemia?

1. **Antagonism of membrane actions**: Use **calcium** to stabilize the heart.
2. **Shifting potassium into cells:**
   - **Insulin and glucose.**
   - **Sodium bicarbonate** (if metabolic acidosis is present).
   - **Beta-2-adrenergic agonists.**
3. **Removal from the body:**
   - **Loop or thiazide diuretics.**
   - **Cation exchange resins.**
   - **Dialysis** (hemodialysis) if the case is severe.

23. List the causes of hypokalemia?

1. **Decreased intake.**
2. **Increased entry into cells** (alkalosis, insulin excess, beta agonists, hypothermia).
3. **GI losses** (vomiting, diarrhea, laxative abuse).
4. **Urinary losses** (diuretics, renal tubular acidosis, amphotericin B, salt-wasting nephropathies).
5. **Sweat losses.**
6. **Dialysis or plasmapheresis.**

24. List the clinical manifestations of hypokalemia?

1. **Neuromuscular: Severe muscle weakness**, rhabdomyolysis, and **respiratory failure.**
2. **Gastrointestinal: Ileus**, anorexia, nausea, and vomiting.
3. **Cardiovascular: Arrhythmias**, palpitations, hypotension, and ECG abnormalities.
4. **Metabolic: Glucose intolerance** and hyperglycemia.

25. List the kidney structural and functional changes caused by prolonged hypokalemia?

1. Impaired concentrating ability.
2. Increased ammonia production.
3. Increased bicarbonate reabsorption.
4. Altered sodium reabsorption.
5. Hypokalemic nephropathy.
6. Elevation in blood pressure.
7. Decreased phosphate reabsorption.

26. Describe the management of hypokalemia?

1. Provide **K supplements** via oral or IV routes.
2. Administer **K-sparing diuretics.**
3. **Treat the underlying cause.**
4. Correct associated **hypomagnesemia.**
5. Frequently monitor serum K levels.
6. For redistributive hypokalemia, treat the **cause only** to avoid rebound hyperkalemia.