THERAPEUTIC APPROACHES IN HYPERKALEMIA

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Abstract: *The imbalances of kalium are considered medical emergencies and therapy is initiated most often in the emergency departments. Patients should be evaluated quickly in hyperkalemia by an interdisciplinary team that will assess the state of the patient's toxicity, try to identify the immediate cause, to remove, and then to correct electrolyte imbalance. Complications such as: ionic imbalance has often vital risk, leading to the defibrillator and / or dialysis. Knowing the clinical picture you may step in long before their installation. The article presents therapeutic approaches and treatment algorithms for patients at different stages of severity of the hyperkalemia.*

Cuvinte cheie: *hiperpotasemie, terapie, algoritm terapeutic*

Rezumat: *Dezechilibrele potasemiei sunt considerate urgențe medicale, iar terapia se inițiaza cel mai adesea în compartimentele de urgență. Pacienții aflați în hiperpotasemie trebuie evaluați rapid de către o echipă interdisciplinară, care va determina starea de toxicitate în care se află pacientul, va încerca să identifice cauza determinantă, să o îndepărteze, iar apoi să corecteze dezechilibrul electrolitic. Complicațiile acestor dezechilibre ionice prezintă de multe ori risc vital, ajungându-se la defibrilare şi/ sau dializă. Cunoscând tabloul clinic se poate interveni mult înainte de instalarea lor. Articolul prezintă abordările terapeutice şi un algoritm de tratament pentru pacienții aflați în diferite faze de severitate ale hiperpotasemiei*

SCIENTIFIC ARTICLE OF THEORETICAL PREDOMINANCE

Hyperkalaemia is considered a medical emergency, and therapy follow five main points, namely:

1. **Evaluation of toxicity caused by hyperkalaemia**:
   - Making an ECG to assess cardiotoxicity (1)
   - a stabilization of myocardial cell membrane to prevent lethal cardiac arrhythmias (and win time to introduce and increase intracellular potassium removal)
     - § Calcium chloride IV
     - § IV calcium gluconate

§ Arrhythmias caused by hyperkalaemia, are difficult to treat with defibrillation, epinephrine or antiartimic medication without lowering the kalium blood level. (2)

2. **Identify and eliminate the source of hyperkalemia**
   - § Stopping an oral and parenteral supplementation of potassium
   - § Restriction of potassium salts
   - § Patient examination and change the diet with a low-potassium diet
   - § Children diagnosed with Addison's disease or adrenal disease, requiring additional mineralocorticoid. If indicated, attempt to intravascular volume expansion (3)
3. **Intracellular penetration of potassium**:
   - § Administration of glucose and insulin by IV are very effective in increasing potassium acquisition. Although glucose stimulates insulin secretion, glucose administration alone is not effective in this clinical situation. Onset of action is approximately 20-30 minutes and duration is variable between 2-6 hours. Thus, continuous infusion of glucose and insulin is effective for long-lasting effect and glucose determination is made every 2 hours.
   - § Correcting a metabolic acidosis with sodium bicarbonate is a less effective therapeutic modality and results less predictable, because of the varied effects of metabolic acidosis on the kalium level. Is recommended in cases of severe metabolic acidosis.
   - § The beta-adrenergic agonists, used as nebulizer (albuterol) have variable efficacy. Recommended dose is 10 mg in hyperkalemia, substantially higher than recommended for therapy of bronchospasm and require the presence of a specialist the Pneumology. This therapy is very effective but much higher alkalizing agents in patients with kidney disease. The parenteral administration is also very effective in these cases. Sometimes there have been reports of intolerance expressed by tachycardia or chest discomfort after taking beta-agonists in hyperkalemia. (5) (6)
4. **Increase the total elimination of potassium from the body** by: (7)
   - § an increase in renal excretion is easily performed in patients with preserved renal function, by parenteral administration of salts associated with

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loop diuretics (furosemide).

- § Discontinue potassium-sparing diuretics, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and other drugs that inhibit renal potassium excretion.
- § Monitor volume status and aim to maintain euvolemia.
- § Renal excretion may be increased by administering an aldosterone analogue, for example 9-alpha fluorohidrocortizon acetate (Florinef). Florinef is especially effective in patients with hyporeninemia or hypoaldosteronism.
- § Gastrointestinal excretion can be increased by the use of cation exchange resins such as Kayexalate. Kayexalate can be administered orally or rectally as a retention enema. Because the major site of action for this drug is the colon, rectal administration is preferred for hyperkalemic emergencies. The onset of action occurs within 2 hours and is long lasting. The serum potassium level can be decreased by 2 mEq/L with a single enema. Kayexalate administered orally also is quite effective if it is suspended in 70% sorbitol.
- § Emergency dialysis is a final recourse for patients who are experiencing potentially lethal hyperkalemia that is unresponsive to more conservative measures or for patients who have complete renal failure. Initiation of dialysis often can take several hours; therefore, even if dialysis is contemplated, initiate the other modalities of therapy first
- § A peritoneal dialysis is not as effective in removing potassium and hemodialysis. Success rate is similar peritoneal dialysis potassium removal with sodium polystyrene sulfonate (Kayexalate).
- § A continuous arteriovenous haemofiltration dialysis (CAVHD) or veno-venous haemofiltration continuous dialysis (CVVHD) are effective in eliminating potassium, similar to peritoneal dialysis or Kayexalate. These methods are suitable for long-term elimination of potassium in the body, but in case of severe hyperkalaemia, acute unresponsive to usual medications, hemodialysis remains the choice of choice. (10)

5. The final step in the medical management of hyperkalemia is to **determine the cause of hyperkalemia** in order to prevent future episodes. This should include examination of the following:
   - § Sources of potassium intake
   - § Causes of decreased renal excretion
   - § Causes for impaired cellular uptake

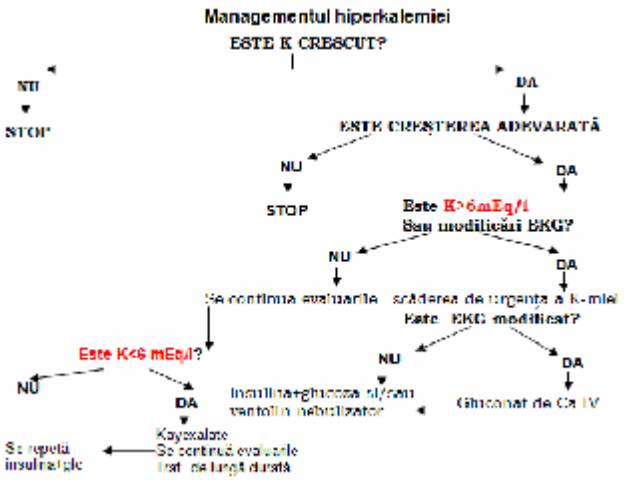
Diet

A low-potassium diet with 2 g of potassium is recommended to minimize potassium intake

Medication

Hyperkalaemia therapy requires collaboration of several medical specialties, depending on the disease causing

- § pediatric anesthesiologist and neonatologist - role in the therapy of severe hyperkalemia, life-threatening (hyperkalaemia with ECG changes)
- § nephrologists - Hyperkalaemia associated with renal disease
- § Hematology / Oncology - Hyperkalemia resulting from tumor lysis syndrome



- § Social work - if unintentional ingestion or poisoning in children
- § Nutritionist - in patients who hyperkalaemia caused by kidney disease that requires close control of sodium and potassium intake.
- § endocrinologist - Patients with mineralocorticoid dysfunction or congenital adrenal hipolazie (11)

BIBLIOGRAPHY

1. Mattu A, Brady WJ, Robinson DA. Electrocardiographic manifestations of hyperkalemia. Am J Emerg Med. Oct 2000;18(6):721-9.
2. Lieh-Lai, M, Asi - Bautista, M, Ling - McGeorge, K. Hyperkalemia. In: Pediatric Acute Care Handbook. Philadelphia, PA: Lippincott, Williams, & Wilkins; 1995.
3. Finberg L, Kravath R, Hellerstein S. Potassium. In: Water and Electrolytes in Pediatrics: Physiology, Pathophysiology, and Treatment. Philadelphia, PA: WB Saunders; 1993:70-1.
4. Behrman R, Kliegman R, Jenson H. Nelson Textbook of Pediatrics. 17th Ed. Philadelphia, PA: WB Saunders; 2004
5. Allon M, Dunlay R, Copkney C. Nebulized albuterol for acute hyperkalemia in patients on hemodialysis. Ann Intern Med. Mar 15 1989;110(6):426-9.
6. Khanna A, White WB. The management of hyperkalemia in patients with cardiovascular disease. Am J Med. Mar 2009;122(3):215-21.
7. San-Cristobal P, de los Heros P, Ponce-Coria J, et al. WNK kinases, renal ion transport and hypertension. Am J Nephrol. 2008;28(5):860-70.
8. Marino PL. Potassium. In: The ICU Book. Baltimore: Williams & Wilkins; 1998.
9. Kokko, JP, Tannen RL. Potassium disorders. In: Fluids and Electrolytes. Philadelphia, PA: WB Saunders; 1990:195-300.
10. Weiner ID, Wingo CS. Hyperkalemia: a potential silent killer. J Am Soc Nephrol. Aug 1998;9(8):1535-43.
11. Clinical guidelines: Potassium in pre-dialysis patients. Caring for Australasians with Renal Impairment - Disease Specific Society. 2005 Dec. 6 pages. NGC:006168