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Case Study Paper

Increased Sodium Levels Associated with Ceftriaxone Administration: Case Report

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ABSTRACT

The development of hypernatremia in critically ill patients has multiple possible causes and is associated with worse clinical outcomes, including increased hospital stay and mortality. The differential diagnosis is very broad and includes alterations in volume status, renal, endocrine, paraneoplastic pathologies, and even the use of medications, among which are antibiotics. Below, we present a possible association between the development of hypernatremia and the use of ceftriaxone in a critically ill patient with severe pneumonia.

INTRODUCTION

Presentation of the case

A 73-year-old male patient was admitted to the intensive care unit due to severe community-acquired pneumonia with hemodynamic instability, septic encephalopathy and the need for invasive mechanical ventilation. Empirical antibiotic treatment was started with Ampicillin Sulbactam. Blood cultures were taken, finding growth of Streptococcus pneumoniae resistant to penicillin, for which reason, antibiotic therapy was redirected to ceftriaxone, receiving a dose of 4 grams per day by order of the institutional infectious disease committee. In the following 72 hours after starting antibiotic treatment, there was a progressive increase in serum sodium levels, reaching a maximum peak of 155.6 mEq/L. The patient was euvolemic, with diuresis in normal ranges with a maximum of 1cc/kg/hour, a cumulative positive water balance and no evidence of other cause of extrarenal fluid loss. No glycosuria was documented. It should be noted that he was not receiving parenteral nutrition or loop diuretics prior to antibiotic initiation. On the

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other hand, the patient presented an acute kidney injury with prerenal stage I pattern according to Kidney Disease Improving Global Outcomes (KDIGO) criteria, which resolved 48 hours after the start of antibiotic treatment. In order to correct the hydroelectrolytic disorder, the total body water deficit was calculated using the formula described by Adrogué-Madias, and intravenous replacement with 5% Dextrose in distilled water was started, without achieving a reduction in serum sodium levels. Since no other clear etiology of the electrolyte disorder was found, the possibility that it may have been associated with the administration of exogenous agents was considered, finding a temporal association with the initiation of ceftriaxone and the progressive increase in natremia. As a therapeutic trial, the suspension of this drug was considered after consulting the infectious disease department, taking into account hemodynamic stability and microbiological clearance in blood culture controls. When the medication was stoped, a daily reduction in sodium levels was achieved, reaching normal levels on the fourth day. Table 1 and graph 1 show the temporal behavior of serum sodium levels. The patient continued under critical care management for the next 10 days, without objective evidence of new episodes of hypernatremia or other hydroelectrolyte alteration, and was subsequently referred to a chronic care center.

DISCUSSION

Serum sodium disturbances are highly prevalent in critically ill patients and are associated with a significant increase in in-hospital mortality (1). In the setting of patients with community-acquired pneumonia, both hypo- and hypernatremia can occur, worsening the prognosis and clinical course, and increasing the length of hospital stay (2). Hypernatremia in the intensive care unit is multicausal, and in general terms it is associated with free water deficit, regardless of the etiology (3). A frequent cause of elevated serum sodium levels is medication. In this context, there are multiple studies and articles showing an association between the administration of antimicrobial therapy and the development of hypernatremia, mainly with fosfomycin (4-6). Beta-lactam antibiotics seem to be safer in terms of the risk of the development of sodium disorders, however, a case of probable association between the development of hypernatremia and the use of ampicillin sulbactam at very high doses for the treatment of Acinetobacter baumannii infection was recently published (7). Another work shows several types of electrolyte alterations associated with the use of therapy with aminoglycosides or colistin, including an increase in serum sodium, but no clear causal link was reached (8). It should be noted that medications and solutions other than antibiotics have stronger evidence of association with the development of hypernatremia, including 0.9% saline, proton pump inhibitors and loop diuretics (9). It should not be forgotten that the diagnostic approach to hypernatremia requires evaluating the volemia status, the existence of renal or gastrointestinal water loss, endocrinopathies, preneoplastic syndromes, among others; therefore, the pharmacological nexus, although important, is a diagnosis of exclusion that should be interpreted with caution, avoiding overlooking entities that may put the patient's life at risk(10). For this reason, in the initial approach to our patient we took into account the hydration status, the range of diuresis, excluding renal, neurohypophysis, thyroid and adrenal pathologies, without forgetting to mention other drugs that cause hypernatremia. Only after this stepwise approach was a possible causal association between the initiation of ceftriaxone and the development of hypernatremia considered.

CONCLUSION

Serum sodium elevation is considered a frequent manifestation in critically ill patients, with

significant clinical outcomes and requiring timely management. This case report suggests a possible association between the use of ceftriaxone and the development of hypernatremia, and its subsequent resolution once the use of this pharmacological agent was suspended, highlighting the importance of a timely diagnosis with a multifactorial approach to dysnatremia, and considering antimicrobial therapies as potential etiologies of this hydroelectrolytic disorder once the most frequent and clinically relevant etiologies have been ruled out in intensive care unit patients.

REFERENCES

1. Grim CCA, Termorshuizen F, Bosman RJ, Cremer OL, Meinders AJ, Nijsten MWN, et al. Association Between an Increase in Serum Sodium and In-Hospital Mortality in Critically Ill Patients*. Crit Care Med. Dec 2021;49(12):2070-9.
2. Chia TM, O'Neill H, Sohail HM, Nagi D. The impact of hyponatraemia and hypernatremia on severity and clinical outcomes of acute acquired pneumonia. Ir Med J. 2024;117(1):899.
3. Chand R, Chand R, Goldfarb DS. Hypernatremia in the intensive care unit. Curr Opin Nephrol Hypertens. Mar 2022;31(2):199-204.
4. Kollu K, Bas A, Gok F, Kizilarslanoglu MC. Effect of fosfomycin-induced hypernatremia on patients' hospital stay length and survival. Ir J Med Sci 1971-Oct 2024;193(5):2453-9.
5. Scavone C, Mascolo A, Bernardi FF, Aiezza ML, Saturnino P, Morra G, et al. Hypernatremia During Intravenous Treatment With Fosfomycin: A Retrospective Medical Record Review Study and an Analysis of Spontaneous Reports in the EudraVigilance Database. Front Pharmacol. Mar 29, 2022;13:844122.
6. Chen TT, Chang YF, Wu YC. Clinical Use of Intravenous Phosphomycin in Critical Care Patients in Taiwan. Pathogens. 2023;12(6):1-11.
7. Polo Díaz J, Blanco Pertuz P, Carbonell Riquett L, Muñoz Verbel D, Almanza Hurtado A, Dueñas Castell C, et al. The enigma of hypernatremia: Ampicillin/sulbactam as an unexpected cause-A case report. Acta Colomb Cuid Intensivo. July 2024;24(3):264- 7.
8. Scoglio M, Bronz G, Rinoldi PO, Faré PB, Betti C, Bianchetti MG, et al. Electrolyte and Acid-Base Disorders Triggered by Aminoglycoside or Colistin Therapy: A Systematic Review. Antibiotics. Feb 1, 2021;10(2):140.
9. Ayhan YE, İlerler EE, Sosyal D, Bektay MY, Karakurt S, Daşkaya H, et al. Assessment of drug-induced electrolyte disorders in intensive care units: a multicenter observational study. Front Med. June 4, 2024;11:1343483.
10. Yun G, Baek SH, Kim S. Evaluation and management of hypernatremia in adults: clinical perspectives. Korean J Intern Med. May 1, 2023;38(3):290-302.

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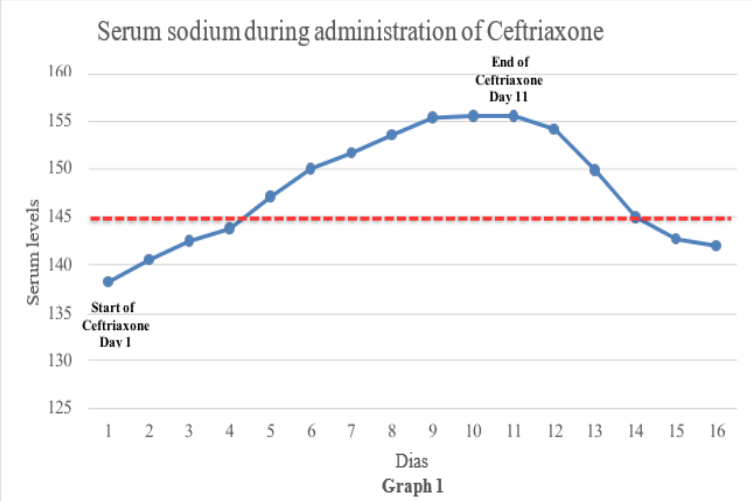
Table 1. Serum sodium levels

Dias	Serum sodium (Meq/L)
1	138.2
2	140.5
3	142.5
4	143.8

5	147.1
6	150.1
7	151.7
8	153.6
9	155.4
10	155.6
11	155.6
12	154.2
13	149.9
14	145
15	142.7
16	142



Graph 1