Reviewer's report

Title: Undercorrection of hypernatremia is frequent and associated to mortality.

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Reviewer: Gregor Lindner

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Batatille and coworkers performed a retrospective study to characterize patients with severe hypernatremia and to identify risk factors for mortality with a focus on speed of correction. Although the study aim is not especially new, the study is well conducted and the authors present many interesting facts (importance of correction speed, many patients inadequately treated, inadequate fluid choice, …). Thus, the study is of value for the scientific community as well as for physicians caring for patients with hypernatremia.

In general, the research question is adequately addressed, and the methods are sound and so are the data. However, I have some concerns outlined below:

Major:

- Introduction: “In most cases, treatment of hypernatremia is started at ED, but so far only one publication has studied characteristics, symptoms, treatments, and outcomes of severe hypernatremic patients at ED (1).” – This is not correct. The study by Arampatzis and coworkers (Am J Med 2012) included patients presenting to the ED solely.

- Introduction: “Unless shock or hypotension is present, isotonic or hypertonic solutes are not recommended.” – Indeed experts recommend to first replace fluid losses in dehydrated/hypovolemic patients by use of isotonic or slightly hypertonic fluids (e.g. lactated Ringer’s). See the review by Lindner and Funk in J Crit Care. 2013 Apr;28(2):216.e11-20

- Introduction: “To avoid over- or under-treatment, at risk for neurological complications (cerebral edema, seizing, or coma), management of intravenous fluid must be rationalized. Mathematic calculation of water deficit based on sodium and water distribution in the intra- and extracellular spaces have been proposed. They require two clinical data: measured natremia and patient’s weight. For example, Adrogue and Madias’s formula enables to calculate natremia variation after perfusion of one liter of solute according to the type of solute, initial natremia and total body water volume: Attended natremia = ([Na] of solute – initial natremia) / (Total body water volume - 1) (3, 8, 9). Most formulas consider human body as a closed system and do not integrate undergoing losses of water. Furthermore, total body water volume required for calculation is extrapolated from weight regardless of percentage body fat variability. For authors, their inappropriate use is at risk of hypernatremia under-correction or worsening (10).” – These formulae have been studied in the past and were found to be too imprecise in the individual patients with deviations > 10 mmol/L (Lindner
et al. NDT 2008) – you should include these findings when making this statement due to the potential danger of the formulae.

- Introduction: “While hypernatremia acquired during the hospitalization is a mortality risk factor (14), it is not clear if hypernatremia at admission evaluation increases mortality (2, 15).” – In fact the large study by Funk and coworkers on about 150,000 patients clearly showed that even mild hypernatremia is an independent predictor of mortality (see your own citation No 13)

- Methods: Why were only patients with Na > 150 mmol/L included? – In order to bring more light into the chimera of hypernatremia it would be helpful to study the group with Na 145-150 mmol/L too since only little data is available.

- Methods: “Optimal correction rate of hypernatremia was defined in accordance with the literature as a decreasing rate between 0.5 to 1 mmol/L/h (3-6).” – It should be added: …with a maximum of 12 mmol/L/day. – Although many experts feel more comfortable with a daily maximum of 10 mmol/L.

- General: The manuscript should undergo language editing by a native speaker.

Minor:

- Abstract: “…an associated extracellular dehydration were associated to death.” – Should be …associated WITH death.

- Abstract: “…22% of patients without hypotension who received an isotonic solutes or weren't perfused.” – The sentence is not clear – please clarify.

- Discussion: Header for discussion section is missing

- Table 1: There is a fault in the number of patients (Total 85; died 19; survived 59) – 10 patients are missing...

- Table 4: “Arampatzis et al. published two studies in the same year. Patients of the second study with hypernatremia definition > 150 mmol/L were a subgroup of the former larger study with an unclassical hypernatremia definition.” – The definition of hypernatremia in the second study (> or equaling 150 mmol/L is a common definition for hypernatremia in many studies on hypernatremia). The first study used the reference range of serum sodium in the local laboratory. Thus, I would not call it unconventional.

**Level of interest:** An article of importance in its field

**Quality of written English:** Needs some language corrections before being published

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

'I declare that I have no competing interests'