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Epidemio-clinical aspects of dysnatremia in polyvalent resuscitation at the CHU Antanambao Toliara

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Abstract

Dysnatremia is common in hospitalized patients. This study aims to determine the prevalence of dysnatremia in the intensive care unit of the university hospital center Antanambao Toliara and to determine the diagnoses of the pathologies encountered in intensive care. This is a prospective, descriptive and cross-sectional analytical study over a period of six months from May 01, 2020 to October 31, 2020 carried out in the multipurpose intensive care unit at the Antanambao Toliara University Hospital. We selected 78 cases (27,87%) of dysnatremia. The average age was 43,30 years with a male predominance (sex ratio = 1,36). The disorder of consciousness was the first reason for admission of patients with dysnatremia (70.51%), followed by dyspnea (38.46%), postoperative (38.46%), fever (30. 77%), agitation (28.21%), edema (20.51%), seizure (10.26%), gastrointestinal bleeding (8.97%) and jaundice (5 ,13%). According to the diseases, 48 (61.54%) patients had medical pathologies and 30 (38.46%) surgical pathologies. Fever, sub or extra-durable hemorrhage, severe head trauma, hyperosmolar coma, gastric ulce and eclampsia had a significant association with dysnatrémie with $p < 0,05$. In brief, dysnatremia can be life-threatening in patients. Its early diagnosis therefore makes it possible to optimize the management of patients.

Keywords: Dysnatremia; Natremia; Hyponatremia; Hypernatremia; Volemia; Osmolality.

1. Introduction

Dysnatremia corresponds to a disorder of sodium concentration [1]. Dysnatremia is the most frequently encountered hydroelectrolyte disorder in the hospital setting, particularly in the intensive care unit [2]. Our general objective is to determine the prevalence of dysnatremia in the intensive care unit of the university hospital center (CHU) Antanambao Toliara and to determine the diagnoses of the pathologies encountered in intensive care.

2. Material and methods

This is a prospective, descriptive and cross-sectional analytical study over a period of six months from May 01, 2020 to October 31, 2020 carried out in the multipurpose intensive care unit at the Antanambao Toliara University Hospital. All patients hospitalized in the multipurpose intensive care unit CHU Antanambao and having dysnatremia were included in the study. All patients who did not agree to complete the consent form were excluded. The data was transcribed on a collection sheet, from the medical observations and the medical files of the patients. The variables studied were age, gender, reasons for admission, history, dehydration, disease diagnosis and serum sodium results. Peripheral venous

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blood was collected in a dry tube before 8:30 a.m. and on an empty stomach. After centrifugation, serum sodium was measured on the MINDRAY BA-88A automaton by the colorimetric method between 20 to 25 °C, with a wavelength of 630 nm. Data were processed using Microsoft Word and Excel 2010 software. Epi info version 7.2.2.6 software was used for data processing and statistical analysis. A value of $p<0.05$ represented the significance of the statistical analyses. Free and informed consent was requested before each inclusion. The notion of volunteerism, anonymity and confidentiality was respected. For data collection, we had the agreement of the head of the multipurpose intensive care unit of the CHU Antanambao Toliara.

3. Results

During the study period, 280 patients were admitted to the intensive care unit at the Antanambao Toliara University Hospital, 82 had dysnatremia. Four patients were excluded. Seventy-eight were then selected. The prevalence of dysnatremia was 27.85% including 16.43% hyponatremia and 11.42% hypernatremia (Figure 1).

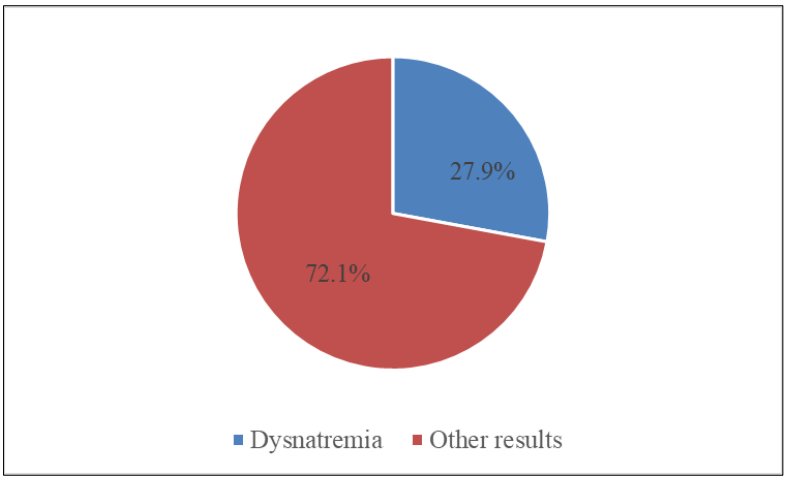

Figure 1 Prevalence of dysnatremia

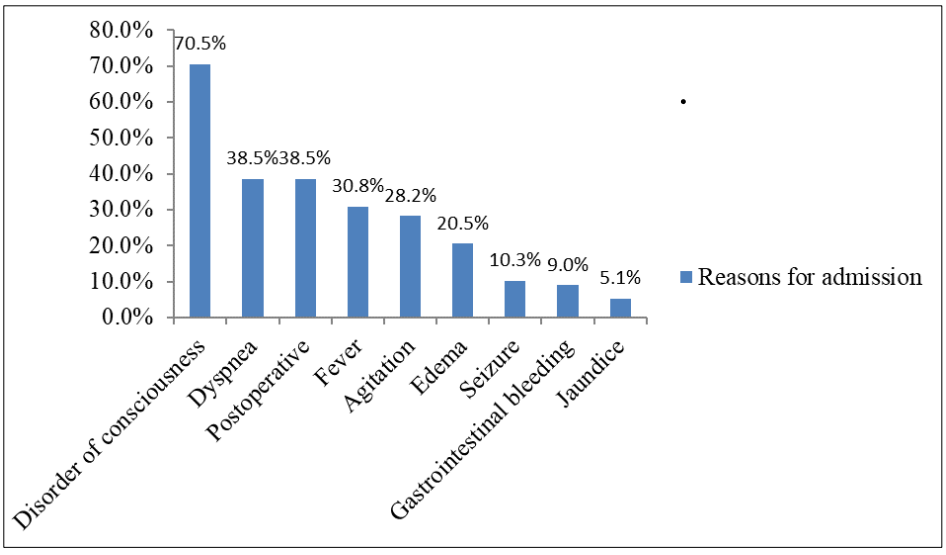

Figure 2 Reasons for admission

A male predominance was observed with a sex ratio of 1.36. The age of the patients is between 8 years to 76 years with the average age of 43.30 years. The age group between 16 and 26 years old was the most observed representing 24.36% of cases and 20.51% between the age group of 56 and 66 years old. The disorder of consciousness was the first reason for admission of patients with dysnatremia (70.51%), followed by dyspnea (38.46%), postoperative (38.46%), fever

(30. 77%), agitation (28.21%), edema (20.51%), seizure (10.26%), gastrointestinal bleeding (8.97%) and jaundice (5 ,13%) (Figure 2).

According to the number of reasons for admission, 46.15% of patients had three reasons for admission and 33.33% had two. More than half of the patients (56.41%) had no toxic history. The most found toxic history was alcoholism and smoking which were respectively 20.51% and 19.23%. The decoction was observed in 15.36% of cases and alcohol-smoking in 11.54%. cases. In this study, 41.03% of patients were comatose on admission, 21.79% obtunded, 6.41% subconscious and 30.77% conscious. According to the diseases, 48 (61.54%) patients had medical pathologies and 30 (38.46%) surgical pathologies. Among the 61.54% medical cases, 34.61% had hyponatremia and 21.92% hypernatremia. Hyponatremia was observed during malaria (11.54%), renal failure (8.98%), stroke (5.13%), gastrointestinal bleeding following a gastric ulcer (3.85%), encephalopathy (2.56%), heart failure (1.28%) and alcoholic coma (1.28%). Among the surgical cases, 25.64% had hyponatremia and 12.82% hypernatremia. Hyponatremia was observed during cranial traumatisms and subdural or extradural hemorrhage (8.97%), laparotomy on digestive pathology (5.13%), gyneco-obstetrical surgery (5.13%), eclampsia (3.85%) and urological surgery (2.56%). Hypernatremia was observed during eclampsia (6.41%), genitourinary surgery (2.56%), laparotomy (2.56%) and gynecological surgery. obstetrics (1.28%). According to extracellular volume and hyponatremia, hypovolemia with hyponatremia was observed in 4 patients (5.12%). The pathologies associated with hypovolemia and hyponatremia were severe malaria (2.56%) and terminal renal failure (2.56%). Hypervolemia with hyponatremia was observed in 8 patients (10.26%) of whom 6.41% had renal failure and 3.85% heart failure. Most of the patients presented hyponatremia with normal extracellular volume (43.58%) among which 24.35% had medical pathologies and 19.23% surgical pathologies. According to extracellular volume and hypernatremia, seven patients (8.97%) had hypovolemia with hypernatremia, of which 4 patients (5.13%) had hyperosmolar coma and 3 (3.85%) renal failure. In addition, eight patients (10.26%) presented hypervolemia with hypernatremia, of which 7 patients (8.87%) had renal insufficiency. Hypernatremia with normal blood volume was the most frequent (21.79% corresponding to 17 patients). Among them, 14.10% (11 patients) had medical pathologies of which 1.28% had 3 or 4 associated pathologies and 6.41% had two. Similarly, 7.69% had surgical pathologies including 1.28% associated with end-stage renal failure. A statistically significant association between dysnatremia and fever, eclampsia, hyperosmolar coma, gastric ulcer, subdural or extradural hemorrhage and severe head trauma was observed (Table 1).

Table 1 Association between dysnatremia and some pathologies in intensive care polyvalente

Association	**p-value**
Dysnatremia and fever	0.02
Dysnatremia subdural or extradural hemorrhage	0.003
Dysnatremia and severe head trauma	0.001
Dysnatremia and eclampsia	0.04
Dysnatremia and hyperosmolar coma	0.001
Dysnatremia and gastric ulcer	0.009

4. Discussion

In this study, the prevalence of dysnatremia was 27.85%, i.e. 16.43% hyponatremia and 11.42% hypernatremia. A study by Hartgring, A. et al in Rotterdam reports that the prevalence of dysnatremia is between 6.9% and 17.7% [3]. Similarly, Funk G et al. found a prevalence of 17.7% hyponatremia and 6.9% hypernatremia in Austria [4]. Thus, dysnatremia is high in intensive care because patients have serious conditions causing hydroelectrolyte disturbances.

The average age of the patients was 43.30 years old and the extreme ages were 8 years old and 76 years old. The most affected age group is between 16 and 26 years old with 24.36% of cases. In a study conducted by Rabenjarison et al. in Antananarivo in 2015, the most affected age group was between 40 and 65 years old, i.e. 47.41%. The mean age of patients was 58 years with extremes of 17 and 89 years [5]. Thus, the average age in our study is lower than that of other studies. Indeed, the patients had severe pathologies and were mainly represented by young populations, especially children.

The male predominance in this study is the same as in other studies. Indeed, a study conducted by Rabenjarison at the CHU –Joseph Raseta Befelatanana in 2015 found a sex ratio of 1.38 [5]. Other studies have also shown this male

predominance [3, 6]. On the other hand, a female predominance was found in Houston, during a retrospective study by Huang concerning the association of dysnatremia and mortality in patients with chronic renal failure [7].

The reason for admission to intensive care in this study was represented by neurological disorders and post-surgical operations in the majority of cases. Two conditions can lead to postoperative hyponatremia such as inappropriate secretion of anti-diuretic hormone and positive water balance, qualified as electrolyte-free water because it contains neither sodium nor potassium [8]. The other studies carried out in Antananarivo by Rabenjarison F. et al and Andrianivoson H. also showed that patients with neurological disorders have dysnatremia in the majority of cases, respectively 71.55% and 53% of cases [3,5] .

In this study, 20.51% and 19.23% of the patients were alcoholic and chronic smokers. Chronic alcoholism is most often associated with electrolyte disturbances. According to the literature, alcohol is a factor favoring the secretion of anti-diuretic hormone. Thus, there is a correlation between chronic alcohol intake and dysnatremia [9]. Similarly, chronic smoking is associated with serious illnesses, hence its high prevalence in hospitals. These serious illnesses are also linked to dysnatremia [10]. In addition, 15.36% of patients consume traditional decoctions. However, there are no studies yet to demonstrate the relationship between this toxic habit and dysnatremia. Nevertheless, its effects on renal function by intoxication or excess dose could be responsible for dysnatremia [11].

In this study, 48 (61.54%) patients had a medical pathology and 30 (38.46%) a surgical pathology. The distribution of surgical cases and medical cases found in our study is comparable with that of the studies carried out in the United States by Nicolini and in France by Claisse [12,13].

Kidney failure accounted for 30.77% of pathologies. In Imai's study, kidney failure increases the risk of hyponatremia. Since the regulation of the water-electrolyte balance and the acid-base balance are ensured by the kidneys, renal dysfunction therefore leads to an electrolyte disorder including dysnatremia [14].

Encephalopathy accounted for 16.67% of pathologies. It may be responsible for dysnatremia. Conversely, severe dysnatremia can also cause encephalopathy [15]. In our study, we found a statistically significant association between dysnatremia and cerebral involvement, in particular intra- and extradural hemorrhage (p=0.003) and severe head trauma (p=0.001).

Severe malaria accounted for 16.67% of pathologies. Complications of malaria can cause dysnatremia because these complications affect the kidneys, lungs, brain, liver… [10, 11].

A statistically significant association was found between eclampsia and dysnatremia (p=0.04). In general, dysnatremia during pregnancy is mild and asymptomatic and does not require correction. In our study, it is mainly associated with hypernatremia with high extracellular volume following the presence of edema often generalized in eclampsia. According to the literature, severe dysnatremia is one of the less specific signs of pre-eclampsia and eclampsia, but its appearance reveals the seriousness of its pathologies [16].

Clinical examination allowed us to distinguish hypervolemia (characterized by peripheral edema, ascites, pleural effusion) and hypovolemia (characterized by orthostatic hypotension, tachycardia and signs of dehydration) [1,2] .

Dysnatremia with normal blood volume was found in 75.37% of our patients, i.e. 42.30% hyponatremia and 23.07% hypernatremia. These data are similar to the literature which showed that normal blood volume predominates in dysnatremia. When dysnatremia is mild or moderate, clinical signs are often absent. And in the intensive care unit, the reasons for admission were not often the symptoms of dysnatremia [17].

Regarding the causes of hyponatremia, approximately one-third are due to inappropriate antidiuretic hormone secretion, and one-third are associated with extracellular hypovolemia. Two other causes are common, such as inflationary hyponatremia associated with extracellular hypervolemia (due to congestive heart failure) and hyponatremia associated with diuretics (7%) [12]. The mechanisms of hyponatremia are often multifactorial, involving impaired renal water excretion, antidiuretic hormone secretion induced by hypovolemia, pain, opioids, and hypotonic fluid infusion [18].

Unlike hyponatremia where plasma osmolarity can be variable, all hypernatremia are associated with hyperosmolarity and a deficit in free water. In intensive care, 40 to 60% of hypernatremic patients had a positive water and sodium balance with the intake of large quantities of isotonic saline solutions. The other half of the patients showed a decrease in intracellular volume with insensible losses linked to fever, digestive or renal losses (osmotic diuresis linked to

hyperglycaemia or mannitol infusions). Diabetes insipidus seems to be a cause of hypernatremia in intensive care apart from certain very specific situations such as head trauma or neurosurgery [12]. A retrospective study of 130 cases of hypernatremia, carried out in the intensive care unit in the Netherlands, identified that sepsis, renal insufficiency, hypokalaemia, hypoalbuminemia, and the administration of bicarbonate and mannitol constituted risk factors for hypernatremia. 60% of patients had a negative water balance during hypernatremia. This study concluded that in hypernatremia, there is more salt and less water [19].

5. Conclusion

Dysnatremia is a common metabolic disorder in intensive care. It can be life-threatening for patients. Its etiologies are numerous.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The Author declare no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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