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Research Article

Factors Associated with Hydroelectrolytic Disorders in Chronic Kidney Disease in Departmental Teaching Hospital Borgou/Alibori (Benin).

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Abstract

Introduction: Chronic kidney disease (CKD) represents a real public health problem on a continental and global scale. The existence of hydroelectrolyte disorders in a patient suffering from CKD would constitute a risk factor for the progression of this condition.
Objective: To study the factors associated of frequent hydroelectrolyte disorders in chronic kidney disease patients at the Departmental Teaching Hospital Borgou/ Alibori (CHUD-B/A) form 2022 to 2023.
Methods: This was a cross-sectional study with descriptive and analytical aims with prospective collection of data from January 1, 2022 to October 31, 2023. It concerned patients with CKD followed in the nephrology department of the CHUD-B/A meeting the study inclusion criteria. The hydroelectrolyte disorders studied were hyponatremia, hypokalemia, hyperkalemia and hypocalcemia. Logistic regression made it possible to search for factors associated with each of the hydroelectrolyte disorders cited above.
Results: A total of 89 patients with CKD were included. Their average age was 53±14.37 years. The male gender was the most represented (64.62%). The subjects surveyed mainly had a monthly income greater than 88 dollars, or approximately 88 USD (64.62%). Hypocalcemia was the most common disorder with a prevalence of 78.12%.
Conclusion: Hydroelectrolytic disorders were present in more than half of patients with CKD and in most cases, the course of the disease was unfavorable. It is therefore necessary to put in place strategies to prevent the appearance of these disorders or slow their progression in order to limit the progression of CKD.

Keywords : CKD, hydroelectrolyte disorders, factors associated, Benin.

INTRODUCTION

Chronic kidney disease (CKD) is widespread in the general adult population. U.S. data estimate a prevalence of 13.1% among adults, increasing over time [1]. In Brazil, estimates of the disease's prevalence are not certain. A recent study examined the data available in the literature and found that prevalence varied according to the method used to define the disease; depending on demographic criteria, an estimated 3 to 6 million individuals have CKD [2]. In France, over 5% of the population suffers from chronic kidney disease (CKD), and this prevalence is increasing [2] . In Japan, in 2008, the prevalence of low glomerular filtration rate (strictly less than 60ml/min/1.73m^2) was estimated at 10% of the adult population [2].

In fact, at an advanced stage of renal function deterioration, there are disturbances in the metabolism of water and most electrolytes, notably sodium, potassium and chlorine. Studies have shown that patients with CKD also present hydroelectrolytic disorders such as dysnatremia [3] . In Mali, in 2022, a study was carried out to assess the epidemiological, clinical and etiological aspects of hydroelectrolytic disorders in patients hospitalized in the Internal Medicine Department of the CHU Point-G 1740 patients were hospitalized during the study period, of whom 200 developed hydroelectrolytic disorders, representing a frequency of 11.49%. Hyponatremia

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accounted for 69.5% of ionic disorders [4]. Hypokalemia ranged from 12- 18% in patients with CKD [6]. The associated factors are multiple and vary according to the type of hydroelectrolytic disorders or their evolution [5-7].

Thus, it is interesting to initiate the present work whose objective was to study the factors associated with the most frequently encountered hydroelectrolytic disorders, such as hyponatremia, hypocalcemia and dyskalemia, in chronic renal failure patients at CHUD-B/A from 2022 to 2023

METHODS

This was a cross-sectional study, conducted from January 1st , 2022 to May 31st, 2023, and involved patients with advanced chronic kidney disease followed up in the nephrology department of CHUD-B/A. All patients suffering from stage 3, 4 and 5 CKD, aged over 15, who had given informed consent, were included. Patients undergoing replacement therapy were not included. The census was exhaustive The dependent variable was the existence of at least one of the hydroelectrolytic disorders (hyponatremia, hypokalemia, hyperkalemia, hypocalcemia) in a patient with stage 3, 4 and 5 chronic kidney disease. These were dichotomous variables with "Yes" or "No" as modalities.

- Hyponatremia was defined as a plasma sodium concentration below 135 mmol/L with hypoosmolality ' 280 mosmol/kg [8] . It was considered mild or severe if the natraemia was between]135-130 mmol /L] or < 130 mmol /L respectively
- Hypokalemia was defined as a plasma potassium concentration below 3.5 mmol/L[8] . It was considered mild, moderate and severe if kalemia was respectively between [3.0- 3.5 mmol /L [, [2.5 - 3.0 mmol /L [and < 2.5 mmol/L
- Hyperkalemia was defined as a plasma potassium concentration greater than 5.5 mmol/L[8] . Moderate and severe hyperkalemia was defined as kalemia between [6.0 - 6.5 mmol /L] and above 6.5 mmol /L respectively.
- Hypocalcemia was defined as a blood calcium level below 85 mg/L[8]. Moderate and severe hypocalcemia were defined as blood calcium levels between [70.0 - 80.0 mg /L] and below 70.0 mg /L respectively.

Independent sociodemographic, behavioral, clinical and paraclinical variables were studied.

Data collection, analysis and processing

Data were collected on the basis of an individual interview, a complete physical examination and a review of the individual medical records of the patients included. Qualitative variables were expressed as percentages, and quantitative variables as mean and standard deviation. Proportions were compared on a case-by-case basis using statistical tests such as Pearson's Chi-square test or Fisher's exact test. Logistic regression was used to search for associations between hydroelectrolytic disorders and between hydroelectrolytic disorders and independent variables in patients with chronic renal failure. The threshold of statistical significance was set at p=0.05. Explanatory variables were presented in terms of Odds-Ratio values and their 95% confidence intervals.

Ethical and deontological considerations

This study was conducted as part of a research project at the Faculty of Medicine, University of Parakou. Anonymity and confidentiality were respected

RESULTS

A total of 89 patients with advanced chronic kidney disease were included.

Socio-demographic and socio-economic data

The mean age of patients was 53± 14.37 years [extremes 18 and 82 years]. The most represented age group was 60 to 70, with a proportion of 30.3%. Males accounted for 64.0%, i.e. a sex ratio of 1.8. Of the 89 patients, 21.3% were shopkeepers, 36.0% had a monthly income of less than 52,000 CFA francs, 89.9% were married and 30.3% had a primary education.

Clinical data

Of the 89 patients, 78.7% had hypertension, 30.3% type II diabetes, 23.6% heart failure, 6.7% stroke and 1.1% hepatitis B virus.

In terms of lifestyle, among the 89 patients, 74.2% drank alcohol, 26.2% smoked, 12.3% abused herbal medicine and 86.2% did not exercise regularly. All patients regularly self-medicated; among them, 53.9% regularly took non-steroidal anti- inflammatory drugs.

On admission, asthenia and edema of the lower limbs were reported as functional signs by 61.8% and 49.4% of patients respectively. Exercise dyspnea, headache, fever, heart palpitations, vomiting, insomnia and somnolence were reported by 32.6%, 24.7%, 20.2%, 16.9%, 11.1% and 7.9% of patients respectively. Of the patients selected, 59.6% were in poor general condition on admission, 32.3% had pale conjunctival mucous membranes, and 96.6% were in a good state of consciousness. In 87.5% of cases, diuresis was preserved, 53.9% had edema of the lower limbs and 3.4% had dehydration folds. On examination, 21.3% of patients showed signs right heart failure, 20.2% hepatomegaly, 13.5% ascites, 12.4% crepitus rales and 7.9% signs of left heart failure.,

The chronic nephropathies recorded were vascular, glomerular, tubulointerstitial and polycystic respectively in 57.3%, 32.6%, 7.9% and 2.2% of cases.

Stages 3, 4 and 5 of chronic kidney disease were found in 23.6%, 20.2% and 56.2% respectively.

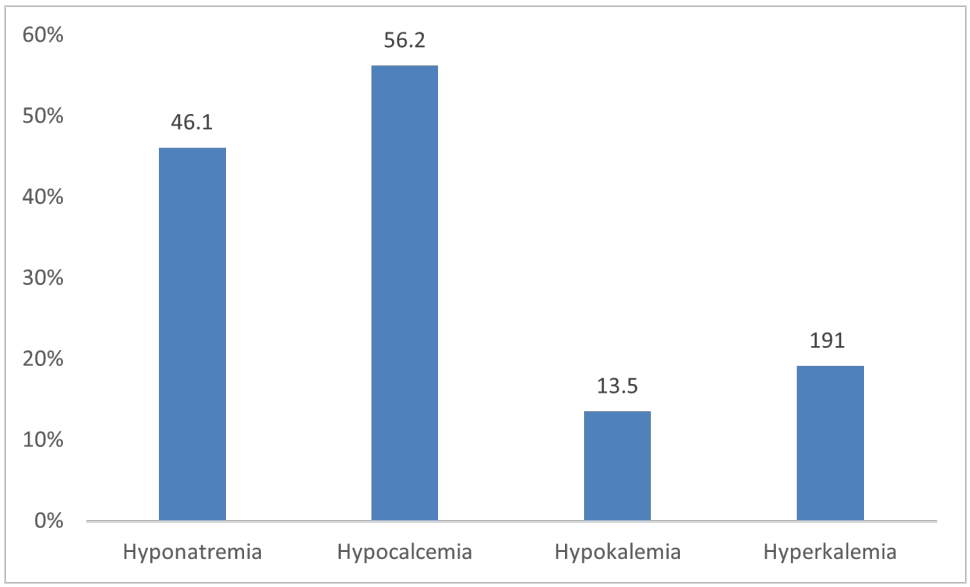
Frequency of hydroelectrolytic disorders

Of the 89 patients, 65 had at least one hydroelectrolytic disorder, giving an overall prevalence of hydroelectrolytic disorders of 73.0%.

Specific frequencies of fluid and electrolyte disorders

Of the 89 patients, 41 (46.1%) had hyponatremia, 12 (13.5%) hypokalemia, 17(19.1%) hyperkalemia and 50 (56.2%) hypocalcemia; this is illustrated in **Figure 1**.

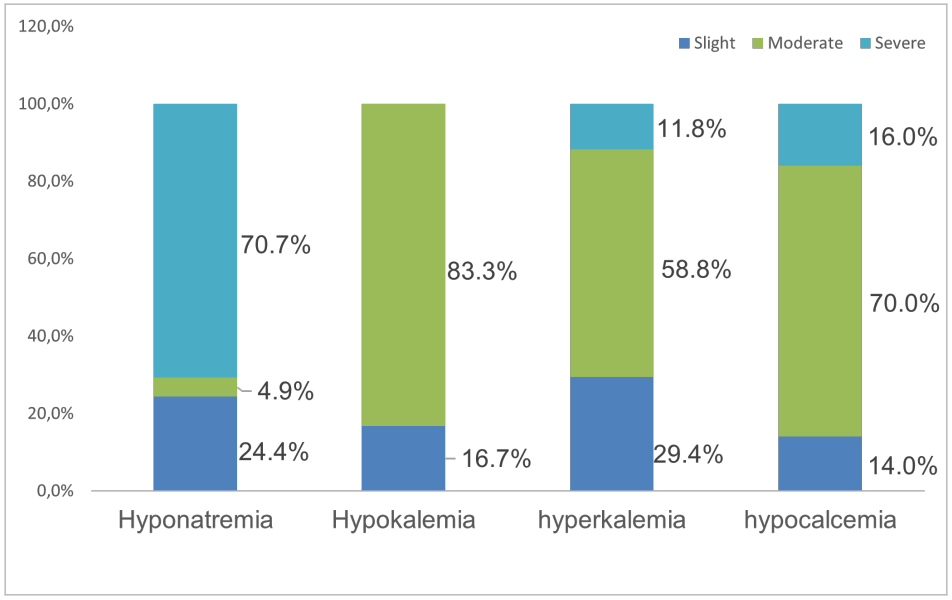
Figure 1. Distribution of hydroelectrolytic disorders in patients with chronic renal failure in the nephrology department of CHUD-B/A from 2022 to 2023.



Severity of fluid and electrolyte disorders

Of the 41 patients with hyponatremia, 29 (70.7%) had severe form. In relation to the extracellular sector, dilution hyponatremia was found in 31 patients (75.6%). Of the 12 patients with hypokalemia, 10 (83.3%) had the moderate form. Of the 17 patients with hyperkalemia, 10 (58.8%) had the moderate form. Of the 50 patients with hypocalcemia, 35 (70.0%) had the moderate form. The following table shows the different disorders in terms of severity. **Figure 2** shows the different disorders in terms of severity. Hyponatremia, dilution hyponatremia and depletion hyponatremia were found in 75.6% and 24.4% of patients respectively.

Figure 2. Distribution of chronic renal failure patients with hydroelectrolytic disorders in the CHUD B/A nephrology department from 2022 to 2023, according to severity.



Identifying factors associated with hydroelectrolytic disorders

Univariate analysis showed that :

- The occurrence of hypocalcemia (p=0.01), age (p=0.002), economic level (p=0.004) and marital status (p=0.03) were significantly associated with the occurrence of hyponatremia.
- The occurrence of hyperkalemia (p=0.01), socio-professional status (p=0.04), economic level (p=0.01) and general state of health (p=0.02) were significantly associated with hypocalcemia. (**Table I**)

Table I. Factors associated with hyponatremia and hypocalcemia in patients with chronic renal failure in the nephrology department of CHUD-B/A from 2022 to 2023 (N=89) in univariate analysis.

	Presence of disorders		OR	(95% CI)]	p
	Yes (%)	No (%)			
Hyponatremia					
Hypocalcemia					
Yes	32.0	68.0	-	-	0.01
No	0.0	100.0			
Age (years)					
[18-38[	54.55	45.45	1	-	0.002
[38-58[	18.52	81.48	0.19	0.04-0.88	
>=58	18.52	81.48	0.19	0.04-0.88	
Economic level (dollars)					
=88	66.67	33.33	1	0.04-1.95	0.004
<88	35.29	64.71	0.27	0.01-0.55	
>88	14.29	85.71	0.08		
Marital status					
Single	57.14	42.86	5.11	1.00-25.98	0.03
Married	20.69	79.31	1	-	
Hypocalcemia					
Hyperkalemia					
Yes	100.0	0.0	-	-	0.01
No	78.8	29.2			
Profession					
Craftsman or blue- collar worker	90.00	10.00	1	-	0.04
Other	50.00	50.00	0.11	0.01-1.17	
Retailer	92.31	7.69	1.33	0.07-24.32	
Pupil or student	100.00	0.00	-	-	
Teacher	90.00	10.00	1	0.05-18.57	
Nurse	0.00	100.00	-	-	
Housekeeper	70.00	30.00	0.26	0.02-3.06	
Farmer or breeder	80.00	20.00	0.44	0.02-9.03	
Economic level (dollars)					
=88	83.33	16.67	1	-	0.01
<88	88.24	11.76	1.5	0.11-20.30	
>88	73.17	26.83	-	-	
Impaired general condition					
Yes	95.24	4.76	8.66	1.05-71.57	0.02
No	69.77	30.23	1	-	

The same applies to :

- Level of education (p=0.02) and consumption of non-steroidal anti- inflammatory drugs (p=0.01) were significantly associated with the occurrence of hypokalemia.
- The occurrence of hypocalcemia (p=0.01), age (p=0.02), economic level (p=0.04) and marital status (p=0.03) were significantly associated with hyperkalemia. (**Table II**)

Table II: Factors associated with dyskalemia in patients with chronic renal failure in the nephrology department of CHUD-B/A from 2022 to 2023 (N=89) in univariate analysis.

	Presence of disorders		OR	(95% CI)]	p
	Yes (%)	No (%)			
Hypokalemia					
Education level					
Out of school	6,3	93,7	1	-	0,02
Primary	30,0	70,0	6,43	0,68-60,31	
Secondary	25,0	75,0	5	0,49-50,83	
University	15,4	84,6	2,73	0,22-34,01	
Non-steroidal anti-inflammatory drugs					
Yes	27,08	72,92	1	-	0,01
No	0,00	100,00	-	-	
Hyperkalemia					
Hypocalcemia					
Yes	32,0	68,0	-	-	0,01
No	0,0	100,0			
Age (years)					
[18-38[	54,55	45,45	1	-	0,002
[38-58[	18,52	81,48	0,19	0,04-0,88	
>=58	18,52	81,48	0,19	0,04-0,88	
Economic level (dollars)					
=88	66,67	33,33	1	0,04-1,95	0,004
<88	35,29	64,71	0,27	0,01-0,55	
>88	14,29	85,71	0,08		
Marital status					
Single	57,14	42,86	5,11	1,00-25,98	0,03
Married	20,69	79,31	1	-	

DISCUSSION

Comments and comparisons with results from other authors

Frequency of hydroelectrolytic disorders

In our study, of the 89 patients selected, 65 (73.0%) had at least one hydroelectrolytic disorder. This result was higher than those found by Diakité et al in Guinea in 2019, who found a frequency of 45.2% [9], Dembélé in Mali in 2021 reported a prevalence of 15.2% [10] and Kone et al found a prevalence of 11.5% [5]. Lahouimel et al found similar results, with 58% of hydroelectrolytic disorders in CKD patients [11]. This may be explained by the late admission of patients in the complications phase.

Factors associated with hydroelectrolytic disorders

A study of the factors associated with the onset of hydroelectrolytic disorders revealed that :

- The occurrence of hyponatremia was not related to patient age (p=0.83) or gender (p=0.59). These results concur with those of Kone et al [5] in Mali, who also found no association between age, sex and hyponatremia, with p=0.39 and p=0.15 respectively . On the other hand, Setondji [12] in Morocco did not find a significant association between sex and hyponatremia p=0.78, but did find a significant association between age and hyponatremia p=0.005 . Similarly, Djobsou [4] found no significant association between age, gender and hyponatremia, with p=0.371 and p=0.101 respectively .
- The occurrence of hypokalemia was statistically unrelated to age (p=0.83) or gender (p=0.36). It was significantly related to the use of anti-inflammatory drugs (p=0.004). These results are similar to those of Kone et al. [5] who found no association between age, sex and hypokalemia, with p=0.25 and p=0.44 respectively . Similarly, Djobsou [4] did not find a significant association between age, sex and hypokalaemia, with p=0.135 and p=0.068 respectively.
- The occurrence of hyperkalemia was significantly associated with age (between 18 and 38 years) with p= 0.004 and was not significantly associated with gender p=0.69. These results concur with those of Koné et al [5] concerning gender, who

found no association between gender and hyperkalemia p=0.44.

- The occurrence of hypocalcemia was not significantly related to age or gender, with p=0.13 and p=0.90 respectively. These results are like those of Kone et al,[5] who found no association between age, sex and hypocalcemia, with p=0.71 and p=0.48 respectively. Similarly, Djobsou [4] found no significant association between age, sex and hypocalcemia, with p=0.363 and p=0.391 respectively.

CONCLUSION

The frequency of hydroelectrolytic disorders in chronic renal failure was high. Several factors are involved. It is essential to detect them and intervene early to improve patient management.

Author Contributions

Conceptualization Séraphin Ahoui, Julien Attinon, Blaise Adelin Tchaou, Aimé Vinasse, Ingrid A. Makam Fokam. Validation and Formal Analysis Séraphin Ahoui, Julien Attinon, Blaise Adelin Tchaou, Aimé Vinasse, Ingrid A. Makam Fokam, Jacques Vigan. Investigation Aimé Vinasse, Ingrid A. Makam Fokam, Aubin M Melikan, Joseph Godonou. Writing-Original Draft Preparation Séraphin Ahoui, Julien Attinon, Joseph Godonou. Writing-Review and Editing Séraphin Ahoui, Julien Attinon, Blaise Adelin Tchaou. Supervision Jacques Vigan, Blaise Adelin Tchaou,

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Institutional Review Board Statement

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Conflicts of Interest

The authors declare no conflict of interest.

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