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Research Article

Evaluation of the Phosphocalcic Profile of Chronic Hemodialysis Patients in Chad - ③

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ABSTRACT

Introduction: Mineral-Bone Disorders associated with Chronic Kidney Disease (MBD-CKD) lead to life-threatening clinical complications in patients with chronic renal failure. Several studies had shown that serum concentrations of calcium, phosphorus and Parathyroid Hormone (iPTH) were controlled in only a few hemodialysis patients. In Chad, this study was initiated for the first time to evaluate the phosphocalcic profile of chronic hemodialysed patients of N'Djamena.

Methodology: This was a cross-sectional, descriptive, analytical study carried out over 6 months (February 15 to August 15, 2015) in the hemodialysis units of the General Hospital of National Reference and the Renaissance Hospital of N'Djamena. Were included all chronic hemodialysis patients for at least 6 months whose records included serum calcium, phosphatemia, vitamin D 25 OH and intact parathyroid hormone.

Results: Fifty-two (52) out of 90 files were selected. The sex ratio was 0.92. The average age was 50.04 years [18 and 84 years]. Diabetic nephropathy, nephroangiosclerosis and indeterminate nephropathy accounted for respectively 40.4% (n = 21), 23.1% (n = 12) and 32.7% (n = 17). The seniority in hemodialysis was 35.4 months [8 months - 204 months]. The average duration of hemodialysis sessions was 9.24 hours per week [8-10 hours]. Hypocalcaemia was noted in 23 patients (44.2%). Mean phosphatemia was 41.93 mg/l [11.56 - 110 mg/l]. It was noted that 30.8% of patients had normal phosphatemia. Hyperphosphatemia was observed in 22 patients, as 42.3%. In bivariate analysis, the association between phosphatemia and bone pain was statistically significant ($p = 0.031$). The average concentration of 25 (OH) D was 20.75 ng / ml [11.56 - 38.10 ng / ml]. Deficiency of 25 (OH) D was noted in 92.3% of patients. Secondary hyperparathyroidism (PTHi > 500 pg/ml) was observed in 14 patients, as 27%.

Conclusion: The prevalence of MBD-CKD was 57.5%. The compliance rate of the indicators compared to the recommendations KDIGO 2009 state of the order of 30.8% for phosphatemia; 48.1% for total serum calcium; 25% for the PTHi and 7.7% of the 25 (OH) vitamin D.

Keywords: MBD-CKD; Dialysis; N'Djamena; Chad

ABBREVIATIONS

MBD-CKD: Mineral Bone Disorders related to Chronic Kidney Disease; iPTH: Intact Parathyroid Hormone; BMI: Body Mass Index; Hypertension: High Blood Pressure; GHNR: General Hospital of National Reference; RH: Renaissance Hospital; ALP: Alkaline Phosphatase; CRP: C Reactive Protein

INTRODUCTION

Mineral Bone Disorders related to Chronic Kidney Disease (MBD-CKD) are defined by the international recommendations KDIGO (Kidney Disease Improving Global Outcomes) in 2009, as disturbances of phosphocalcic metabolism and their consequences on the skeleton (fragility by osteopenia) and on the soft tissues by metastatic calcifications in the joints, vessels and certain viscera, in particular heart and lung [1-3]. Several studies have shown that serum concentrations of calcium, phosphate and Intact Parathyroid Hormone (iPTH) were poorly controlled in chronic hemodialysis patients, thus exposing them to high morbidity and mortality [4]. Few studies have been conducted in Africa on these disorders. In Chad, this work is being undertaken for the first time. It aims to evaluate the epidemiological, clinical and paraclinical phosphocalcic profile of chronic hemodialysis patients in N'Djamena and then compare them with the KDIGO 2009 recommendations.

METHODOLOGY

This was a cross-sectional, descriptive, analytical study conducted over six months (February 15 to August 15, 2015) in the hemodialysis units of the National Reference General Hospital (GHNR) and Renaissance Hospital de the (RH) of N'Djamena. These are 2 referral and level 3 hospitals with 250 beds each, located in N'Djamena (capital of Chad). They are the only 2 hospitals in Chad with public hemodialysis units. The GHNR has 16 hemodialysis generators and the RH has 10 machines including a multifiltrate generator. Were included in the study all records of chronic hemodialysis patients for at least 6 months. All patients had benefited from phosphocalcic

assessment including calcemia, phosphatemia, vitamin D 25 OH and intact parathyroid hormone levels. Patients who had undergone hemodialysis for less than 6 months and / or had at least one calcemia and one phosphatemia were excluded from the study. The variables studied were epidemiological (sex, age, occupation, educational level, weight, height, BMI, field), clinical (bone pain, pathological fracture and pruritus) and paraclinical (calcemia, phosphatemia, vitamin D 25 OH, intact parathyroid hormone, blood count, total alkaline phosphatase, albuminemia, CRP).

Concerning the definition of the operational variables by KDIGO 2009:

- Normal serum calcium is defined as 88 to 104 mg/l. A serum calcium lower than 88 mg/l defines hypocalcaemia. Calcemia greater than 104 mg/l defines hypercalcemia.
- Phosphatemia is normal between 25 and 45 mg/l. Hyperphosphatemia is defined as more than 45 mg/l and hypophosphatemia is less than 25 mg/l.
- The PTHi is normal between 120 and 540 pg/l. Hypoparathyroidism is PTHi less than 120 pg/l while hyperparathyroidism is PTHi greater than 540 pg/l.
- Native Vitamin D is normal when its level is above 30 ng/l. Deficiency and / or insufficiency, are noted if rate is lower than 30 ng/l.

The data were collected on a survey sheet, analyzed by SPSS software (Statistics Package for Social Sciences) 17.0. The results were presented in percentage and average form. The value of p is considered significant if it is < 0.05.

RESULTS

Fifty-two (52) out of 90 files were selected. There were 27 women (51.9%) and 25 men (48.1%), as a sex ratio of 0.92. The average age was 50.04 years with extremes of 18 years and 84 years. The age range between 40-59 years was 50% of cases. Housewives and civil servants

accounted respectively for 32.2% and 28.7%. Diabetic nephropathy, nephroangiosclerosis and indeterminate nephropathy accounted respectively for 40.4% (n = 21), 23.1% (n = 12) and 32.7% (n = 17). The seniority in hemodialysis was 35.4 months [8 months - 204 months]. Average duration of hemodialysis sessions was 9.24 hours per week [8-10 hours]. Average Body Mass Index (BMI) was 22.95 kg/m² [17.31 - 30.81 kg/m²]. It was normal in 41 patients (79%). There were 6% of obese patients and 15% of overweight patients. Bone pain was present in 32.7% of cases. Pathological fractures and pruritus were noted respectively in 4% and 13.5% of patients. Mean hemoglobin was 8.49 g/dl [4.2 and 12.6 g/dl]. Anemia was severe (less than 8 g/dl) in 30 patients, as 57.7%. CRP was greater than 6 mg/l in 28.4% of patients. The mean albumin level was 35.07 g/l [12.20 - 70.00 g/l]. It was normal in 50% of cases (40 and 50 g/l). Hypoalbuminemia was noted in 48.1%. Mean serum calcium was 87.48 mg/l [38.8 - 110.45 mg/l]. It was normal in 48.1%. Hypocalcaemia was noted in 23 patients (44.2%). Mean phosphatemia was 41.93 mg/l [11.56 - 110 mg/l]. It was noted that 30.8% of patients had normal phosphatemia. Hyperphosphatemia was observed in 22 patients, as 42.3%. In bivariate analysis, the association between phosphatemia and bone pain was statistically significant ($p = 0.031$). The average concentration of 25 (OH) D was 20.75 ng/ml [11.56 - 38.10 ng/ml]. Deficiency of 25 (OH) D was noted in 92.3% of patients. Fifty percent of patients had mild vitamin D deficiency. The mean concentration of intact parathyroid hormone was 588.84 µg/ml [10.50 - 1455.10 µg/ml]. It was noted that 11.5% of patients had normal PTHi levels. Secondary hyperparathyroidism was observed in 14 patients (27%). Total alkaline phosphatase was not measured in any patient. There were 30.4% of patients who received calcium carbonate as phosphate buffers and 31.1% oral calcium to correct hypocalcaemia with an average dosage of 1.5 g/d. The combination Calcium-Vitamin D native was noted in 7.7% of patients. No parathyroidectomy was performed. There were no significant associations between other clinical and paraclinical variables.

DISCUSSION

The compliance of the indicators with the KDIGO recommendations 2009 status of the order of 30.8% for phosphatemia, 48.1% for total serum calcium, 25% for iPTH and 7.7% of 25 (OH) vitamin D. The average age of patients in our series was comparable to that found in Senegal in 2015 by Mahamat Abderraman et al. [5] and in Morocco in 2013, by Benabdellah et al. [6]. It was lower than the results of Pelletier et al. [7] who noted an age of 62 years. This discordance between African countries and Western countries is explained by life expectancy, greater access to care and the quality of care in Europe [8,9]. Hypertension and diabetes were the leading causes of chronic renal failure in our study. These results were similar to those found in Senegal in 2015, which accounted for 51% of vascular causes [5]. Seventeen patients (32.7%) had bone pain and 15.3% (n = 7) had pruritus. Our results were close to those observed by Ibrahim in Bamako: bone pain 31.5% and pruritus 13.6%. In contrast, Benabdellah et al. [6] in Morocco reported a different outcome with more joint pain and pruritus with 67.4% and 15.6% respectively. The association of bone pain and hyperphosphatemia was significant ($p = 0.031$). For hemodialysis, the dialysate concentration was fixed in the 2 dialysis centers at 1.5 mmol/l. Comparatively, Mahamat Abderraman et al. [5] in Senegal in 2015 and Laradi et al. [8] in France in 2011 reported that 28.1% in Senegal and 36.4% in France of chronic hemodialysis patients were treated with calcium bicarbonate as a phosphate binder

with an average dose respectively of 2.7 g/day and 1.16 g/day ; 11.9% [5] and 22.7% [8] by Sevelamer with an average dosage respectively of 1850 mg/day and 1600 mg/day. The phosphate binder in our study was calcium bicarbonate given its availability and affordability at a rate of 30.4%. Our study's calcemia was consistent with KDIGO in 48.1% against 63.7% in Senegal [5] and 62.7% in France [8]. It was noted that 44.2% of patients had hypocalcaemia. Our results showed that normal serum calcium and normal phosphatemia were lower than those found in the literature. This could be explained by under dialysis (number of hours per week < 12 weeks) but also by the lack of use of the therapeutic native vitamin D. Hypophosphatemia associated with hypoalbuminemia may be the cause of the precarious nutritional status of patients in our study exposing them to excess mortality. Hyperphosphatemia (42.3%) and hyperparathyroidism (27%) were higher than those recorded in Senegal [5] respectively with 30.8% and 42.6%. This high rate would explain the presence of bone pain in one-third of patients in our series, especially since the association between hyperphosphatemia and bone pain was statistically significant. Only 23 patients had benefited from iPTH assay. Of these, 11.5% had iPTH rate in KDIGO standards. It was well below those recorded in Senegal, France and Morocco with respectively 24.3% [5]; 41.1% [8] and 68.2% [6]. There was 27% of hyperparathyroidism. This rate of hyperparathyroidism would be even higher if all patients had iPTH test confirming the high proportion of hyperphosphatemia (42.3%). The KDIGO compliance rate of vitamin 25OH vitamin D was 7.7% of the patients who did the dosage (n = 15). It is lower than the results obtained in Senegal [5] and France [8] with respectively 22.5% and 30%. Nearly 95% of patients had vitamin D deficiency. This could explain the inflammatory status (28.4% of patients with high CRP), malnutrition. These results are explained by the low prescription of vitamin D native and active supplementation in CKD patients and the high price of its laboratory dosage. Since patients with vitamin D deficiency have a higher mortality rate [10], systematic supplementation with vitamin D would be desirable. This has been demonstrated in several studies that have reported improved survival in hemodialysis patients who have received active vitamin D [11,12]. They are consistent with world literature. Recent results from a cohort of hemodialysis patients in United States of America had revealed that 78% of them had vitamin D deficiency [13]. In contrast, the association between vitamin D deficiency and bone pain was not significant in our study. The comparison between our results and those of the other studies is summarized in table 1.

CONCLUSION

This first work on mineralo-bone complications in chronic hemodialysis patients in Chad took place in the 2 largest hospitals in N'Djamena which have hemodialysis units. The prevalence of MBD - CKD was 57.7%. The compliance rate of the indicators studied compared to the KDIGO 2009 recommendations was 30.8% for phosphatemia; 48.1% for total serum calcium; 25% for the PTHi and 7.7% of the 25 (OH) vitamin D. Our KDIGO-compliant results are lower than those found in the literature. We must improve the quality of care by achieving optimal dialysis with close monitoring of our patients to improve their quality of life. However, our study had many limitations. This is the weakness of the sample but also the lack of dosage of certain parameters (iPTH, vitamin D and total alkaline phosphatase) that could not be determined in all patients. This work can be improved for the study of vascular calcification by the realization of the abdomen without preparation and echocardiography.

**Table 1: Comparison between our study and the other works.**

| Phosphocalcic parameters | KDIGO(2009) Standards | Our study | Senegal [5] | Maroc [6] | France [8] |
|----------------------------------|-----------------------|-----------|-------------|-----------|------------|
| Average phosphatemia (mg/l) | 23-46 | 41.9 | 39 | 36.2 | 46.5 |
| KDIGO Compliance | | 30.8% | 60.9% | 61% | 45.5% |
| Average calcium level (mg/l) | 84-104 | 87.4 | 93 | 82 | 86 |
| KDIGO Compliance | | 48.1% | 63.9% | 71.2% | 63.6 |
| Mean PTHi (pg/ml) | 150-500 | 588.8 | 514 | 508 | 337.3 |
| KDIGO Compliance | | 11.5% | 21.3% | 43.1% | 68.2% |
| Average 25(OH) Vitamin D (ng/ml) | 30-60 | 20.7 | 31 | 34.7 | 24.1 |
| KDIGO Compliance | | 7.7% | 22.5% | | 30% |
| Average total ALP (UI/l) | 40-130 | Not dosed | 186 | 321.4 | |
| KDIGO Compliance | | | 17.8% | | |

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