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Assessing the Nutritional Status of Hemodialysis Patients in Sub-Saharan Africa: Experience of Two Hemodialysis Centers in Niger

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Abstract

Introduction: Patients with end-stage chronic renal failure (ESKD) have a significant impairment in their nutritional status. Our study is aiming at evaluating the nutritional status based on clinical and biological parameters. **Patient and method**: This is a prospective, cross-sectional, descriptive and analytical study carried out in two departments of nephrology/dialysis in Niger from 1 December 2014 to 31 March 2015. The assessment of nutritional status relied on the Body Mass Index (BMI), albuminemia, serum phosphate, hemoglobin, CRP, urea, creatinine levels. **Results:** Sixty-five patients were involved in the study. The mean age was 44.35 ± 13 years with a sex ratio of 2.09 in favor of men and an average dialysis duration of 43.47 ± 36.55 months. The mean BMI was 21.60 ± 4.47 kg/m^2. Undernutrition was noted in 19 patients (29.23%), hypoalbuminemia was found in 13 patients, C-reactive protein (CRP) level was high in 11 patients. In comparative analysis according to the BMI, several parameters were significantly related to undernutrition: hypo-albuminemia, hyperphosphatemia, high CRP, hyperazotemia, anorexia, MUAC, comorbidities, central venous catheter. **Conclusion:** The prognostic value of undernutrition in chronic hemodialysis patients fosters early recognition and management of all nutritional disturbances in these patients. Assessment and monitoring of nutritional status in chronic hemodialysis require the simultaneous determination of several markers in order to weight the limits of each of the criteria taken in isolation.

Keywords

Nutrition, Hemodialysis, Niger

1. Introduction

Patients with chronic end-stage renal disease often show signs of protein-energy malnutrition in relation to an imbalance between inadequate nutritional intakes, catabolism and increased needs. Many causes contribute to its development, first of all anorexia and various comorbidities that are added to the various dietary restrictions laid down.

Despite regular dialysis, nutritional imbalances are often reported due to inflammation, infections, metabolic acidosis, as well as gastroparesis in diabetic patients [1], and oxidative stress related to uremia, but also to the technique of dialysis. These factors can lead to additional complications, sources of morbidity and mortality in dialysis.

Protein-energy malnutrition has been reported in 20% to 50% of patients treated with hemodialysis in several studies. Since early 1980s, malnutrition has emerged as a determinant of survival in this population. Its frequency varies according to the method of evaluation. In West Africa, very few studies have been published on this subject. In Senegal, a cross-sectional study of 142 cases in three hemodialysis centers in Dakar showed a prevalence of undernutrition of 43.2% [2].

In Niger no previous studies have been done so far. So our purpose in this multicenter study was to find out the nutritional status of the Nigerian dialysis population.

2. Materials and Methods

This was a prospective, cross-sectional, descriptive and analytical study carried out during the period 1 December 2014 to 31 March 2015 in the nephrology/dialysis departments of the national hospitals of Zinder and Lamordé.

We included in this study all chronic hemodialysis patients for at least three months, who gave informed consent.

Clinical and paraclinic sociodemographic data were collected from an individual survey form.

Patients were classified according to the WHO classification for nutritional status and were considered to be undernourished, with a BMI of all patients less than 18.5 Kg/m^2. The BMI can be used to assess a person's fat and determine their body size. The result of the BMI remains valid only for 18 to 65-year-old.

The data were entered, monitored and analyzed using the EPI Info version 3.5.1 software. First, a descriptive analysis of the quantitative data was carried out, the results were presented as mean, ±SD (standard deviation), and quantitative data in the form of percentages. Secondly, in order to determine the predictive factors of undernutrition, we divided the patients into 2 groups: group 1 (the undernourished) and group 2 (the not undernourished). The two groups were compared using the student and chi-square

tests and Fisher's exact test. The differences were considered significant at $p < 0.05$).

3. Results

We collated data concerning 65 patients, 44 men and 21 women, with a male/female ratio of 2.09. The mean age of the patients was 44.35 ± 13.00 years, with a median age of 44 years and extremes of 19 years and 73 years. The average age of women was 45.52 ± 14.36 years with extremes from 19 years to 73 years. In men, the age varied from 20 years to 72 years with an average of 43.79 ± 12.43 years.

In our series, 47.69% had a liberal function, we noted a history of hypertension and diabetes in 90.8% and 4.6% respectively. Initial nephropathy was dominated by nephroangiosclerosis in 62%, and was not determined in 26% of cases. The mean duration of dialysis was 43.47 ± 36.55 months. Most of the patients had arteriovenous fistula (FAV) placed, only 4.62% received a central venous catheter (CVC). The mid-upper arm circumference (MUAC) of the patients in our series was 26.50 ± 4.09cm and the extremes were 20 cm and 37 cm.

Eighteen patients (27.7%) had anorexia, the mean albumin levels were 42.28 ± 5.73 g/l with extremes of 51.90 g/l and 26.40 g/l. Mean phosphoric acid was 3.91 ± 1.50 mg/dl. The average CRP of our patients was 9.79 ± 13.44 mg/l and the mean hemoglobin level of the patients was 8 g/dl. The average urea rate of our patients was 0.89 ± 0.35 g/l and the mean serum creatinine level was 106.32 ± 44.219 g/dl.

In our series, we carried out a comparative study, and the BMI was considered as a common criterion to distribute the study population in 2 groups.

The prevalence of undernutrition was 29.30%, *i.e.* 19 patients in the undernutrition group. We tried to find out the link between undernutrition and certain clinical parameters. There is a statistically significant relationship between undernutrition and anorexia ($p = 0.0001$), MUAC ($p = 0.0003$), vascular access ($p = 0.03$) and comorbidities ($p = 0.04$).There is no connection with age and duration of dialysis.

Biologically, the levels of albumin ($p = 0.03$), phosphorus ($p = 0.03$), CRP ($p = 0.04$) and urea ($p = 0.001$) were also associated with undernutrition. On the other hand, we did not observe any significant relationship between undernutrition and parameters such as hemoglobin and serum creatinine.

4. Discussion

The general objective of this work was to contribute to evaluating the nutritional status of chronic hemodialysis in Niger. The specific objectives should enable us to specify the prevalence of undernutrition in this population and to determine the predictive factors of undernutrition in chronic hemodialysis. In our series, the overall average age was 44.35 ± 13 years with extremes of 19 years and 73 years. Our result is closer to those of Camara *et al.* [3] and Es-sebbani [4] who obtained respectively 45.64 ± 17 years and 48, 43 ± 17.7 years.

In our series, the sex ratio was substantially equal to 2, close to the result of Camara *et al.* [3] who found a sex ratio of 1.8.

High blood pressure (hypertension) was present in 90.8% of our patients. Our result was more important than that of Es-sebbani [4] who got 22%. This high proportion of hypertensive patients can be explained by the fact that high blood pressure is a major cause of chronic renal insufficiency (CRI). Moreover, hypertension might result from CKD: patients admitted in nephrology/dialysis departments are most often at the end stage. During CKD, there is early onset form of high blood pressure, often preceding renal failure, especially during glomerular, vascular nephropathies and polycystic kidney disease [5].

The mean duration of hemodialysis in our series was 43.47 ± 36.55 months. Es-sebbani [4] and Ondele in Senegal [2] came out with an average duration of hemodialysis of 76.12 ± 43 months and 86.57 ± 31.10 months, respectively. This difference is probably due to the time spent in providing care within these facilities.

BMI is the main evaluated parameter in all patients. The BMI averaged 21.60 ± 4.47 kg/m². Thus, El Ati [6] had an average BMI of 22.17 ± 0.6 kg/m², however a lower prevalence than ours (16%) with a BMI lower than 18.5 kg/m².

The mid-upper arm circumference (MUAC) in our series was 26.50 ± 4.09 cm. Camara *et al*. [3], obtained an MUAC of 22.62 ± 3 cm. Anorexia was present in 27.69% of hemodialysis patients. Ondele *et al*. [2] got 24.8%. This could be explained by several factors: the restricted diet in liquid, sodium, phosphorus, potassium, and especially, inadequate dialysis dose.

The mean albumin level was 42.28 ± 5.73 g/l. Es-sebbani [4] and Ondele [2] came out with 40 ± 6.57 g/l and 41.70 ± 4.82 g/l respectively. The mean phosphorus level was 3.91 ± 1.50 mg/dl. Es-sebbani [4] found 4.4 ± 1.4 mg/dl. The average CRP of the patients was 9.79 ± 13.44 mg/l. Es-sebbani [4] obtained an average CRP of 13.13 ± 13 mg/l. In several series, CRP remains high in hemodialysis patients. Different factors contribute to the establishment of a chronic inflammatory state in the patient with CKD [6]: They can be secondary to the kidney disease itself, particularly oxidative stress due to the decrease in antioxidant defenses secondary to CKD, and the accumulation of molecules of the advanced glycation end-products (AGE) type. The inflammatory phenomena induced by hemodialysis treatment may be linked to the interaction between the blood and the dialysis membrane or to the quality of water used for performing dialysis. Infectious problems are common in hemodialysis, as are complications of the vascular access, joint problems, all of which can induce microinflammatory states. Therefore, the causes of chronic inflammation are multiple, entangled, but not necessarily accessible to a univocal treatment in chronic kidney disease. Chronic inflammation has a major nutritional impact: it is associated with anorexia and a decrease in protein synthesis. It is also a catabolic factor, in particular by the *ubiquitin-proteasome* pathway [7].

The mean hemoglobin in our study was 8.39 ± 1.68 g/dl. Es-sebbani [4] found a rate substantially equal to 10 g/l. This is consistent with the fact that not all patients receive treatment with erythropoietin.

The prevalence of undernutrition in our series was 29.23% for a BMI lower than 18.5 kg/m². Our results are more significant than those of Hassoum in Morocco [8] and El

Ati [6] who found a prevalence of 26% and 14.21% respectively for a BMI lower than 18.5 kg/m².

Old age and duration of dialysis were found to be correlated with undernutrition in several studies [9], but were not significant in our series. On the other hand, vascular access procedure using a central venous catheter was correlated with undernutrition ($p = 0.03$). This result is consistent with the literature [7]. In our series, comorbidities were also correlated with undernutrition. Our results were identical to the findings by Es-sebbani in Morocco [4]. Anorexia and MUAC were also correlated with undernutrition. Ondele [2] also found a relation between undernutrition and anorexia. Anorexia in CKD is attributed to many factors [10], such as frequent hospitalizations, multiple drug treatments, comorbidities, depression, poverty and uremic toxins.

In our series, hypo-albuminemia, hyperphosphatemia, hyperazolemia and a high rate of CRP were positively correlated with undernutrition. This result is identical to the results of Es-sebbani [4] who found a correlation between hypo-albuminemia and undernutrition. For Ondele [2], hypo-albuminemia and a high CRP level correlated with undernutrition. This result corresponds to the data in the literature: albumin is an indicator of visceral proteins. Its normal plasma concentrations are about 42 ± 3 g/l, and remain high 38 g/l even in the very old subjects. Given prolonged half-lives (22 days), decreased plasma albumin concentrations (less than 35 g/l) indicate prolonged severe malnutrition [11]. Malnutrition is the leading cause of hypo-albuminemia in CKD. The level of albumin may be low in apparently well-fed hemodialysis patients, and then gradually decreases according to the degree of malnutrition [12].

Hyperphosphatemia and hyperazolemia were also correlated with undernutrition in our series. Our result could probably be explained by inadequate and not enough dialysis (Sessions were less than 12 hours on a weekly basis).

5. Conclusion

The purpose of our preliminary study was to evaluate the nutritional status and predictive factors of malnutrition in chronic hemodialysis in Niger. Thus, at the end of the study, it appears that protein-energy malnutrition remains frequent in our hemodialysis patients, and its prevalence was 29.23%. Hypoalbuminemia, hyperphosphatemia, hyperazolemia, high CRP, anorexia and MUAC below normal were correlated with this type of undernutrition.

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