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Dysthyroidism in Chronic Hemodialysis Patients

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ABSTRACT

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Objective: The purpose of this study is to investigate the thyroid profile in HDC in order to determine prevalence and incidence, and to identify factors favouring each thyroid disorder.
Methods: This is a retrospective study spread over an 8-month period from January to August 2024, based on the exploitation of hospital records of adult patients on chronic hemodialysis. Biological results were collated from computerized data from the Biochemistry Laboratory.
Results: Nearly 36% of patients presented with anemia.Phosphocalcic disorders were dominated by hyperparathyroidism, mean calcemia 89.25 mg/l , mean phosphoremia 37.3 mg/l with high PAL . CRP varied between 0 and 60mg/l. TSH varied between 0.01 and 10.8 mIU/L. Hormone assays revealed hypothyroidism in 15 patients, representing an estimated prevalence of 25%. FT3 was low in 11 patients, with a mean of 1 ± 0.26 ng/l. 3 patients had both low FT3 and low FT4, with a mean FT4 of 0.5 ± 1 ng/l. 1 hemodialysis patient had a very high TSHus (TSHus = 11mUI/l).
Conclusion: Inflammatory syndrome, nutritional status, advanced age and long duration of hemodialysis are risk factors for dysthyroidism. Systematic screening for thyroid disorders in HDC patients should be carried out by means of biological tests (TSHus,T3L,T4L), and strict annual follow-up is essential.

KEYWORDS:
Dysthyroidism, chronic hemodialysis

INTRODUCTION

Chronic kidney disease (CKD) is a long-standing and progressive deterioration of kidney function. End-stage renal disease (ESRD) has always been considered incompatible with human survival. The advent of extrarenal purification techniques had given hope to uremic patients. Erythropoiesis-stimulating agents and injectable iron have greatly improved management and prolonged the survival of chronic hemodialysis patients.

Several complications have been reported in hemodialysis, most notably endocrine complications, with abnormal thyroid function in the forefront.

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Dysthyroidism in chronic hemodialysis patients (HDC) is represented by the euthyroid disease syndrome, defined by clinical euthyroidism associated with biological hypothyroidism.

FT3 is the biologically active hormone, and is often low in HDC, reflecting “low T3 syndrome” (1). This is a serious endocrine dysfunction, representing a powerful risk factor for cardiovascular morbidity and mortality (2).

The pathophysiology remains insufficiently elucidated; recent studies highlight the role of the inflammatory syndrome (3). Literature data are scarce. Neither consensus nor recommendations exist to clarify and facilitate the therapeutic management of thyroid disorders in dialysis patients. The aim of our work is to study the thyroid profile of HDC patients, in order to determine prevalence and incidence, and to identify the factors favouring each thyroid disorder.

MATERIALS AND METHODS

This is a retrospective study spread over an 8-month period from January to August 2024, based on the exploitation of the records of adult patients on chronic hemodialysis who consult the Nephrology Department of Ibn Rochd Hospital in Casablanca. Information was collected by consulting patients' hospital records. We analyzed epidemiological parameters (age, sex), cardiovascular risk factors (age > 50 years, diabetes, hypertension, overweight and smoking), nutritional and inflammatory status (weight, albuminemia, C-reactive protein (CRP); phosphocalcic balance (blood calcium, blood phosphorus, bone alkaline phosphatase, intact parathyroid hormone (PTH1-84)); anemia (hemoglobinemia, ferritinemia).

We collected clinical data in search of dysthyroid signs: hyperthyroidism or hypothyroidism (weight gain, asthenia, chilliness, bradycardia, digestive transit disorders (diarrhea, constipation), apathy, somnolence and signs of thyrotoxicosis). The reference values considered for thyroid hormones are: T3L = 1.7 - 3.7 ng/l; T4L = 0.7 - 1.5 ng/l; TSHus = 0.35 - 4.94 mUI/l. Determination of FT3, FT4 and TSHus parameters was performed using an immunometric technique: chemiluminescence on an Alinity AbottR used in the Biochemistry laboratory. Biological results were collected from the computer data of the Biochemistry Laboratory at Chu Ibn Rochd, Casablanca, using Kalisil software. All patients receiving treatment that might interfere with thyroid function (antithyroid drugs, lithium, amiodarone, rifampicin) were excluded. All the data collected in our statistical study were entered and organized in the form of a computer data sheet and analyzed by "EXCEL" software to be translated into sums, percentages and means plus or minus standard deviation for quantitative variables with normal distribution.

RESULTS

This study involved 60 chronic hemodialysis patients, aged between 30 and 80 years, with an average age of 49.68 years. There was a clear male predominance (38 males and 22 females). In our population, the duration of hemodialysis varied between 01 and 37 years, with an average of 22.9 years. More than half of our population had been on dialysis for less than 10 years, and the daily dialysis session lasted 4 hours. The initial nephropathy was undetermined in 45% of cases. The etiologies of chronic renal failure were dominated by diabetic nephropathy in 24% of cases, glomerular in 18% and tubulointerstitial in 12%. Analysis of biological parameters revealed hemoglobin levels ranging from 6 to 16 g/dl, with a mean of 10 g/dl, and mean ferritinemia of 200ng/l. Nearly 36% of patients were anemic (Hb<9 g/dl). Most patients were put on injectable or oral iron. Phosphocalcic disorders were dominated by hyperparathyroidism, with mean PTH 512 pg/ml, mean calcemia 89.25 mg/l, mean phosphoremia 37.3 mg/l and elevated PAL .

The inflammatory state study showed that CRP ranged from 0 to 60mg/l, with a mean of 11.6 mg/l. TSH ranged from 0.01 to 10.8 mIU/L, with a mean of 3.2±2.7mIU/L. Hormone assays revealed hypothyroidism in 15 patients, representing an estimated prevalence of 25%. FT3 was low in 11 patients, with a mean of 1 ± 0.26 ng/l. 3 patients had both low FT3 and low FT4, with a mean FT4 of 0.5 ± 1 ng/l. 1 hemodialysis patient had a very high TSHus (TSHus = 11mUI/l). In our study, we compared 2 groups of patients with and without hypothyroidism. The analysis showed that advanced age (> 50 years), inflammatory syndrome and prolonged duration of haemodialysis were risk factors associated with biological hypothyroidism in chronic haemodialysis patients.

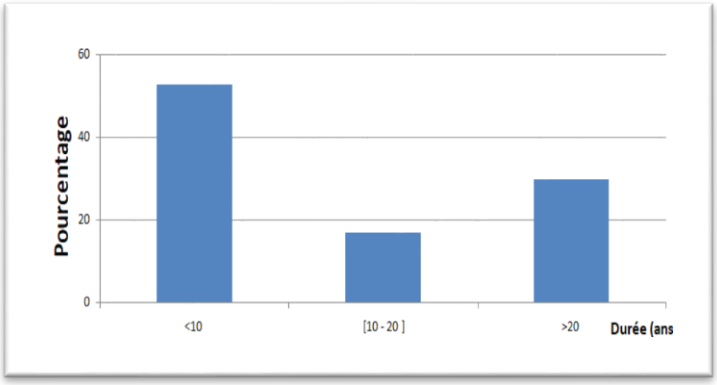

Figure 1: Distribution of patients by hemodialysis duration

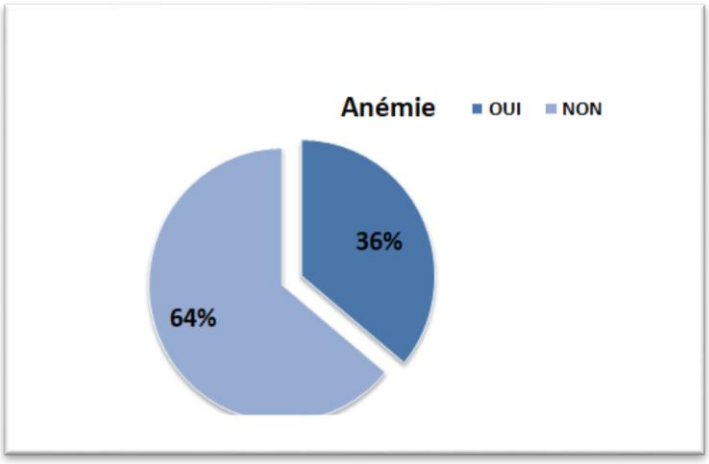

Figure 2: Distribution of workforce by presence of anemia

Table 1: Distribution of terminal renal disease by causative nephropathy

Numbers		Percentages
Undetermined	27	45
Diabetic	15	24
Glomerular	11	18
Chronic tubulointerstitial nephritis	7	12

Table 2: Biological parameter values for chronic hemodialysis patients

Parameters	Mean ± standard deviation
ferritinemia (ng/ml)	200 ± 180
PTH (pg/ml)	512 ± 423
Calcemia (mg/l)	89,25 ± 9
Phosphatemia (mg/l)	37,3 ± 10,7
PAL (UI/l)	280 ± 324
CRP (mg/l)	11,6 ± 9,6

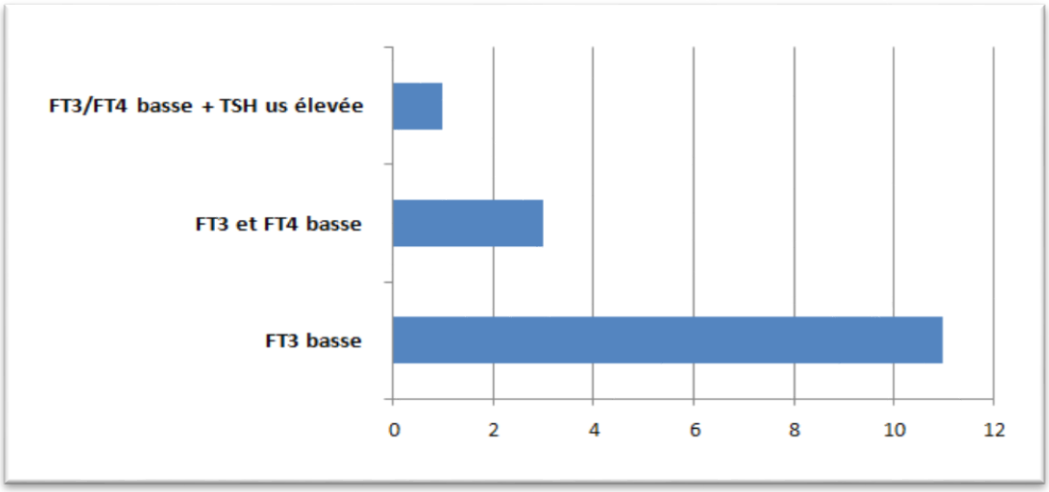

Figure 3: Degree of hypothyroidism in the 15 HDCs (patients with hypothyroidism)

DISCUSSION

There is a close relationship between the thyroid and the kidney. Thyroid hormones are essential for growth and renal development. The kidney is both necessary for thyroid hormone metabolism and elimination, and a target of thyroid hormone action. Dysthyroidism leads to significant changes in tubular and glomerular function, often clinically significant and reversible with hormone replacement. Any thyroid dysfunction is likely to result in vascular disturbances to the glomerulus, tubular function and water balance (4 ,5 ,6). On the other hand, impaired renal function in various renal pathologies, particularly chronic renal failure, affects both the hypothalamic-pituitary axis and peripheral thyroid hormone metabolism (5,7,8).

The pathophysiology of dysthyroidism in end-stage renal disease may be due to dysfunction of the hypothalamic-pituitary axis. According to some authors, this is explained by a direct action of pro-inflammatory cytokines at pituitary level, while others believe that there is an increase in type 2 deiodase activity in hypothalamic glial cells, leading to an increase in local T3 production. (9,10,11,12).

The widely accepted hypothesis is that 5'-deiodase type 1, one of the enzymes responsible for the extra-thyroidal conversion of T4 to T3, is reduced during chronic renal failure (9,5,13).

In chronic renal failure, abnormally elevated uremic toxins such as urea, creatinine, indols and phenols, metabolic acidosis and certain drugs, notably furosemide and heparin-based per-dialytic anticoagulation, can interfere with and inhibit binding and transport proteins, resulting in decreased thyroid hormone concentration (5,14,15,16).

The malnutrition-inflammation complex is a major problem in chronic renal failure. Studies have shown an association between markers of inflammation and thyroid dysfunction. IL-1, IL-6 and TNF profoundly affected thyroid function. A reduction in plasma FT3 (the biologically active thyroid hormone) is the earliest thyroid dysfunction in CDH, followed by a fall in FT4 (3,17,18). Low FT3 is often associated with a chronic inflammatory state, is independently associated with high cardiovascular mortality (2,3,19,20,21), and is a predictor of hemodialysis mortality (22,23).

The most common thyroid disorder in chronic hemodialysis patients is “euthyroid disease syndrome”(5,24). It includes a reduced plasma T3 concentration, whether or not associated with a reduced T4 concentration, with no elevation of TSH(12,25), or an elevation of more than 5 mIU /L but not more than 20 mIU /L(5). T3 reduction alone or “low T3 syndrome” is more frequently observed in haemodialysis patients with clinical euthyroidism (7,6,24).

In our Moroccan population of chronic hemodialysis patients, the prevalence of euthyroid disease syndrome is poorly known, given the small number of studies carried out. The study carried out in Rabat in March 2007 estimates the prevalence of this condition at 28%, of which low T3 syndrome accounts for almost half (13%).

In our series, the frequency was 25% (15 patients), with 18% (11 patients) having isolated low T3 (normal T4).

The syndrome of euthyroid disease, in particular the reduced T3 level, is closely associated with long dialysis duration and markers of inflammation (5,26). The results of our work are clearly in line with those of the literature, particularly recent studies such as that by Zoccali et al. (27), with advanced age and inflammatory syndrome as common risk factors.

The therapeutic management of low T3 syndrome is widely debated. Some authors defend hormonal substitution with triiodothyronine and/or tetraiodothyronine, while others consider it an adaptation of the organism to the various modifications undergone during chronic renal failure(5,28) and insist on treatment of acidosis and inflammatory states (28). Studies have shown that the best treatment remains renal transplantation(7).

CONCLUSION

Endocrine disorders in dialysis patients are poorly understood. Euthyroid disease syndrome, as described in the literature, is the most common thyroid disorder. Inflammatory syndrome, nutritional status, advanced age and long duration of hemodialysis are the risk factors associated with dysthyroidism. Hormone replacement is defended, as this endocrine dysfunction represents a powerful risk factor for cardiovascular morbidity and mortality. Strict clinical and biological monitoring is essential. Systematic screening for thyroid disorders in HDC patients is required, with a biological evaluation (TSHus , T3L , T4L), and strict annual surveillance.

Annex

Model farm sheet :

- Age

- Gender

- Cardiovascular risk factors

- Clinical signs of dysthyroidism

- Duration of hemodialysis

- Etiologies of chronic renal failure

- Biological tests :

Albuminemia	CRP
Calcemia	Phosphatemia
Ferritinemia	Hemoglobin
Alkaline phosphatase (PAL)	
Parathormone	

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