Characteristics of Graves’ Disease in Haemodialysis Patients

Karima Boubaker, Hayet Kaaroud, Hedi Ben Maiz, Adel Kheder

Abstract

Abnormal thyroid hormone production and metabolism are relatively common in chronic renal failure and in regular haemodialysis. Chronic kidney disease is associated with decreased thyroid hormone concentrations, especially triiodothyronine (T3), which are referred to as the euthyroid sick syndrome associated with increased severity of non-thyroidal illness and mortality in cats and dogs. Hyperthyroidism is a very unusual condition in patients undergoing regular haemodialysis. Graves’ disease is rare in these patients. To our knowledge, till now only 8 well documented cases of Graves’ disease have been reported in patients undergoing regular haemodialysis. The diagnosis of Graves’ disease must be evoked in presence or even in the absence of specific symptoms of the disease in haemodialysis patients. Diagnosis of hyperthyroidism may be difficult because of similar signs and symptoms as in uremia and manifestations are habitual. Indeed, hypertension, gynaecomastia, anaemia and hypercalemia can be seen in the two pathologies. Almost all patients undergoing regular haemodialysis received iodine 131 therapy for the treatment of Graves’ disease. This treatment is efficient and safe. Isolation of the patient is not recommended. The risk for dialysis staff is to be contaminated by an accidental ingestion of a biologic fluid from the patient. The usual protection barriers used during the haemodialysis session are sufficient.

Keywords: Hyperthyroidism; Graves’s disease; Renal failure; Haemodialysis; 131 iodine; Radiation protection

Introduction

Abnormal thyroid hormone production and metabolism are relatively common in chronic renal failure and in regular haemodialysis. These disorders rarely lead to hyperthyroidism. Niemczyk reported 18 cases of hyperthyroidism among patients undergoing regular haemodialysis [1]. In a more recent review, the incidence of hyperthyroidism is 1.14% in haemodialysis patients, similar to the incidence in healthy individuals (1.1%) [2]. Graves’ disease is the prevalent aetiology of hyperthyroidism. It is a very unusual condition and is difficult to identify in patients undergoing regular haemodialysis.

The Effect of Chronic Kidney Disease on Thyroid Function

Chronic kidney disease is associated with decreased thyroid hormone concentrations, which are referred to as the euthyroid sick syndrome. The decrease in thyroid hormones especially triiodothyronine (T3) is caused by changes in peripheral hormone metabolism due to a decreased extra thyroidal conversion of T4 to T3 and uptake of T4 and T3, impaired activity of nuclear receptors to T3 and post-receptor actions of T3, decrease thyroid hormone binding proteins production and affinity for thyroid hormones and decrease in TSH secretion [3]. The hypothalamic-pituitary axis is intact in patients with chronic kidney disease. Euthyroid sick syndrome is associated with increased severity of non-thyroidal illness and mortality in cats and dogs [4-6]. Differentiation between hypothyroidism and euthyroid kidney disease can be performed by evaluation of thyroidal 99mTcO uptake [7] or TSH stimulation [8].

Haemodialysis and Graves’ Disease

Although, the abnormal thyroid hormone production and metabolism are relatively common [9], hyperthyroidism is a very unusual condition in patients undergoing regular haemodialysis. Its incidence is 1.14%, similar to the incidence in healthy individuals [2]. Graves’ disease is the most common cause of hyperthyroidism. It is rare in patients undergoing regular haemodialysis. It is between five and ten times as common in females as in males. Diagnosis is usually made on the basis of symptoms, although thyroid hormone tests may be useful. Graves’
Hyperthyroidism in Graves’ disease is confirmed by elevated blood levels of thyroid hormones (free T3 and T4) and a suppressed TSH. Thus, when hyperthyroidism is confirmed, or when blood results are inconclusive, thyroid antibodies should be measured for the diagnosis of Graves’ disease. Graves’ thyrotoxicosis can be quite severe with FT4 serum levels 3 to 4 times above normal [29]. Diagnosis of hyperthyroidism may be difficult because of similar signs and symptoms as in uremia and manifestations are habitual. Indeed, anaemia and hypercalcemia can be seen in two pathologies. Anaemia is frequent in chronic renal failure. Hyperthyroidism is an unusual aetiology of anaemia with erythropoietin resistance [16, 30].

Chronic renal failure is a predisposing factor for the development of hypercalcaemia explained by a decrease in renal calcium excretion and due to a decrease in glomerular filtration rate [31, 32] or increase in fractional tubular calcium reabsorption Na/Ca exchange along the distal tubules T4-mediated [33]. Hypercalcaemia is encountered also in hyperthyroidism secondary to increase in bone turnover rates with elevated calcium entrance rate from the bone to the extracellular fluid space [34-36]. Serum 1, 25-(OH) 2D3 serum levels is normal to highnormal [33].

Characteristics of Treatment of Graves’ Disease in Haemodialysis Patients

Treatment of Graves’ disease is efficient and resolves cardiac symptoms of the disease [9, 14]. Treatment of Graves’ disease in these patients is initially antithyroid agent propylthiouracil [9, 15] and then iodine-131 therapy [15, 37]. The risk of the antithyroid agent propylthiouracil treatment is neutropenia. Iodine 131 therapy is prescribed for almost all patients undergoing regular haemodialysis, particularly for patients having thyroid carcinoma. Few well documented cases have been reported of patients treated with radioactive iodine for Graves’ disease. It is important to know pharmacokinetics and pharmacodynamic of this treatment in patients undergoing regular haemodialysis to get the radiation safety implications.

The usual dose of iodine therapy for thyroid carcinoma is reduced in haemodialysis patients compared to patients with normal renal function and varies from 25 to 100 Ci [38-40]. However, the daily dose for haemodialysed patients can be the same with patients having normal renal function since almost all the doses of treatment are eliminated by dialysis through diffusion because of the weak proteic liaison of the radioiodine [41]. The peak value is around the second day post administration [37]. More than 70% of the radioactivity is eliminated after the first haemodialysis session [38, 42]. The effective half-life is 6.5 days [37]. From the third day, the clearance of 131iodine was observed to be fairly constant and equated to 2.7% per day or 5.4% per dialysis session [37]. The biological half-life is 15 days [37]. The average
dose rate over the effective treatment duration is 8 mSv/hour at 1 meter distance and 2.6 mSv/hour at 2 meter distance from the patient [37]. There is no detectable contamination of the dialysis unit, disposables, and bed linen [37].

**Radiation Protection**

In order to keep below a level of dose constraint of 3 mSv and 1 mSv, the total allowable time spent at 1 m would be 15 hours and 5 hours per day, respectively [37]. These time limits are easy to respect. Isolation is not recommended because the patient radiation level is less than 20 mSv/hour at one meter [42].

There are no definite recommendations for the first session [42]. However, liquid and solid wastes contaminated by radioactivity must be collected [42]. Thus, it seems necessary to collect dialysate and solid wastes and to stock them in a room dedicated to radiation decay because initial discharge concentration rates into the waste water system are estimated at 200 MBq m/3 hours [37, 42].

The risk for dialysis staff is to be contaminated by an accidental ingestion of a biologic fluid from the patient [42]. The usual protection barriers used during the haemodialysis session are sufficient: mask, gloves, overgarments, cap [42]. There is no risk linked to external exposure to radiations. The maximal theoretical dose received by the staff during the session is 65 mSv, while annual maximal dose for public exposed to radiations is 1000 mSv [42].

**Conclusion**

The diagnosis of Graves’ disease must be evoked even in the absence of specific symptoms in haemodialysis patients. In front of clinical symptoms, the conventional treatment is efficient and inoffensive. Iodine 131 therapy is frequently necessary to collect dialysate and solid wastes and to stock them in a room dedicated to radiation decay because initial discharge concentration rates into the waste water system are estimated at 200 MBq m/3 hours [37, 42].

The risk for dialysis staff is to be contaminated by an accidental ingestion of a biologic fluid from the patient [42]. The usual protection barriers used during the haemodialysis session are sufficient: mask, gloves, overgarments, cap [42]. There is no risk linked to external exposure to radiations. The maximal theoretical dose received by the staff during the session is 65 mSv, while annual maximal dose for public exposed to radiations is 1000 mSv [42].

**Conflict of Interest**

None declared.

**References**


