

Pre-Procedure Intervention of Subclinical Hypothyroidism: Case Report

Anita Ratnasari Tantri^{1*}, Santi Syafril²

¹Department of Internal Medicine, Faculty of Medicine, Universitas Sumatera Utara, Medan

²Endocrinology and Metabolism Division, Department of Internal Medicine, Faculty of Medicine, Universitas Sumatera Utara, Medan

ABSTRACT

Background: Subclinical hypothyroidism (SH) is a very common disorder in the general population. In patients with known hypothyroidism or hypothyroidism who have been undergoing treatment, a TSH test should be included in the preoperative assessment to determine the adequacy of treatment and to ensure that thyroid therapy is optimized before surgery.

Case Presentation: A 39 years old woman complains about a weakness that has been 4 years interfering with activities. Shortness of breath if doing strenuous activities, walking long distances, and climbing stairs, and shortness of breath decreases after rest. Sore throat found since 1 week of hospitalization, and fever for 1 day. A lump in the neck is not found. Previously, the patient had been treated for 8 days in the Department of Cardiology and planned the installation of a temporary pacemaker due to bradycardia that persisted until cardiac arrest.

Conclusion: Subclinical hypothyroid patients undergoing pre-procedure intervention are predisposed to anemia, electrophysiologic disturbances, and hypotension, all of which can precipitate cardiovascular collapse. The goal of therapy in the perioperative patient with thyroid dysfunction centers around the attempt to normalize hormone levels before surgical intervention whenever possible and, when that is not feasible, to use other measures that will maximize hemodynamic stability and prevent decompensation.

Keywords: Hypothyroidism, Subclinical hypothyroidism, Intervention, Cardiovascular

ABSTRAK

Latar belakang: Hipotiroid subklinis (SH) merupakan kelainan yang sangat sering dijumpai. Pada pasien dengan hipotiroid yang sudah diketahui sebelumnya ataupun yang sedang akan melanjutkan terapi, tes TSH seharusnya di masukkan dalam pemeriksaan sebelum operasi supaya dapat mendapat terapi optimal sebelum operasi.

Presentasi kasus: Seorang wanita 39 tahun datang dengan keluhan lemas yang dirasakan selama 4 tahun ini yang mengganggu aktifitas. Mudah terasa capek jika melakukan aktifitas berat, jalan kaki dengan jarak jauh dan naik tangga, dan berkurang setelah istirahat. Benjolan di leher tidak dijumpai. Sebelumnya pasien dirawat 8 hari di departemen

*Corresponding author at: Department of Internal Medicine, Faculty of Medicine, Universitas Sumatera Utara, Medan

E-mail address: anitantri@yahoo.com

kardiologi dan rencana dipasang permanen pacemaker karena bradikardia sampai henti jantung.

Kesimpulan: *Pasien subklinis hipotiroid yang akan menjalani Tindakan intervensi sering berhubungan dengan anemia, gangguan EKG dan hipotensi yang menyebabkan henti jantung. Tujuan terapi pada pasien pre-operatif dengan gangguan tiroid mencoba membuat nilai hormon tiroid menjadi normal sebelum tindakan yang dapat meningkatkan kestabilan hemodinamik dan mencegah dekomposisi.*

Kata Kunci: *Hypothyroidism, Subclinical hypothyroidism, Intervention, Cardiovascular*

Received 05 July 2023 | Revised 24 July 2023 | Accepted 25 July 2023

1 Introduction

Subclinical hypothyroidism (SH) is a very common disorder in the general population, especially among middle-aged and elderly patients. It represents a state with increased values of thyroid stimulating hormone (TSH) and normal values of thyroxine (T4) and triiodothyronine (T3).[1] In most cases, patients with SH have no symptoms that would indicate this disorder, so diagnosis is made based on laboratory findings.[2] As the values of thyroid hormone are normal, an increased level of TSH represents a compensatory mechanism that stimulates the thyroid gland to produce sufficient amounts of thyroid hormones. The disorder can eventually progress to overt hypothyroidism (OH) which is characterized by increased values of TSH but reduced values of thyroid hormones.[3] Since SH is an asymptomatic disorder in which the values of thyroid hormones are normal, and it may be a prelude to a clinically manifest disease of the thyroid gland, the question is whether it should be treated. Routine preoperative thyroid function testing is not recommended for patients with no history of thyroid dysfunction. In such patients, it would be appropriate to check the thyrotropin (TSH) level if there is a reason to suspect thyroid disease based on symptoms such as unexplained weight changes, palpitations, tremors, or changes in bowel habits, skin, hair, or eyes that suggest thyroid dysfunction. Furthermore, when the physical examination or other investigation confirms the presence of exophthalmos, goiter, abnormal reflexes, hair or skin abnormalities, or tachycardia or bradycardia, a TSH test would be appropriately included in a preoperative evaluation. In patients with known hypothyroidism or hypothyroidism who have been undergoing treatment, a TSH test should be included in the preoperative assessment to determine the adequacy of treatment and to ensure that thyroid therapy is optimized before surgery.[4] This paper aims to summarize the available data on the influence of this disorder on the health of patients, as well as data on the effects of treatment to answer the question of whether SH with cardiovascular complications how be treated and what kind of treatment can be started.

2 Case Presentation

An initial M woman, age 39 years old, married, and a housewife. Main complaint: weakness has been 4 years to interfere with activities. Shortness of breath if doing strenuous activities, walking

long distances, and climbing stairs, and shortness of breath decreases after rest. Sore throat found since 1 week of hospitalization, feeling blocky, and fever for one day. A lump in the neck is not found. Often found pus-filled lumps in both armpits, decreased appetite, and difficulty defecation during hospitalization. Previously, the patient had been treated for 8 days in the Department of Cardiology and planned the installation of a temporary pacemaker due to bradycardia that persisted until cardiac arrest. A history of repeated abortion was found three times. History of medicine used: furosemide 40 mg, digoxin 0.25 mg, spironolactone 25 mg, and warfarin 2 mg.

She was alert, her blood pressure: normal; her temperature: was 36.5⁰C; her BMI: was underweight, and her heart rate: was 56 times permit. hematology routine and renal function: normal limit. Fasting blood sugar: 113 mg/dL and postprandial blood sugar: 93 mg/dL; HbA1C 6 %; albumin: 3.77 g/dL; HbsAg and Anti HCV: non-reactive. Thyroid function test: **TSH 32.1 (0.27-4.2) mIU/L; FT4 1.52 (0.93-1,7) ng/dL**; ANA test 17,7 (<20); CRP <0.7; LDL 134 mg/dL. Examination of ECG: rate 57 times/minute, irregular, normal axis, P -s, PR interval - s, QRS 0,08 s, T inverted in lead II, III, AVF, V4, V5, V6, LVH (-), RVH (-); the conclusion ECG was atrial fibrillation SVR + ischemia inferior lateral (Fig. 1). Echocardiography result from hospital before with conclusion Mitral stenosis moderate with EF: 34%.

Ro chest: cardiomegaly with lung edema and pericardial effusion (Fig. 2). Working diagnosis: Subclinical Hypothyroidism + Congestive heart failure + Post cardiac arrest. Treatment: IVFD NaCl 0,9% 10 micro drips/ minit; Furosemide injection: 40 mg/ 6 hours; ranitidine injection 50 mg/12 hours, spironolactone tablet 1x 25 mg; Digoxin tablet 1x 0.25 mg and planning angiography.

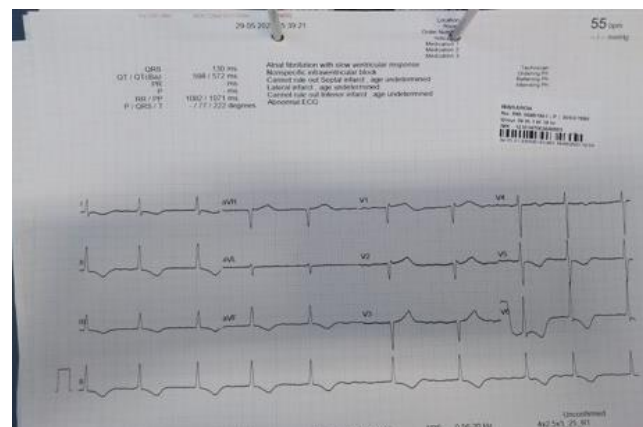


Figure 1 ECG



Figure 2 Ro Chest

3 Discussion

Thyroid hormones play a crucial role in homeostasis due to their effects on the cardiovascular, respiratory, renal, gastrointestinal, hematologic, and central nervous systems. Cardiovascular concerns are among the most relevant in perioperative situations. Patients with hypothyroidism are at increased risk of coronary events[5] possibly due to increased cholesterol levels,[6] prolonged half-life of multiple coagulation factors,[7] and anemia.[8] Nonspecific ST changes and low voltage on the electrocardiogram are observed and, less commonly, ventricular tachycardia has been described.[9] Hypothyroidism has been associated with a diminished cardiac output of 30% to 50%, with both slowing of the pulse and decreased contractility.[10] Furthermore, a deficiency of thyroid hormones causes an increase in peripheral vascular resistance resulting in increased cardiac afterload, leading to a decreased pulse pressure via an increase in diastolic pressure and a decrease in systolic blood pressure.[11] Even though catecholamine levels are increased in these patients, hypothyroid patients have a predisposition to develop hypotension under anesthesia, likely due to the downregulation of β -adrenergic receptors.[12] Paralytic ileus (colonic pseudo-obstruction) has been reported in association with bladder atony in the setting of hypothyroidism.[13] This is of increased concern considering that postoperative pain management regimens commonly use opioids which independently promote constipation.

3.1 Pre-procedure Intervention Considerations in Subclinical Hypothyroidism.

The pathophysiologic changes associated with hypothyroidism are generally reversible with the replacement of thyroid hormone. Thus, rather than face the risk of acute decompensation, it is preferable to postpone elective surgery or intervention until adequate treatment with thyroid hormone has achieved euthyroidism. A full replacement dose of levothyroxine is usually 1.6 $\mu\text{g}/\text{kg}/\text{day}$. However, in the elderly or those with known coronary artery disease, the initial dose is usually 25 μg daily, with a planned increase every 2 to 6 weeks until a euthyroid state is attained.

Once TSH values normalize, surgery or intervention can be performed. If the patient is too fast on the day of surgery, the patient may miss the dose of levothyroxine that day, as it has a long half-life of approximately 7 days. If oral medications cannot be given postoperatively, the dose may be missed for several days. However, if there is still no ability to administer the drug enterally after 5 days, intravenous (IV) levothyroxine should be administered at a dose between 60% and 80% of the oral dose.[14] In cases where surgery or intervention is not elective, the risk of the procedure must be weighed against the risks detailed above. Unfortunately, no large randomized studies are comparing surgical outcomes in hypothyroid versus euthyroid patients. In a prospective study comparing postoperative outcomes in patients with subclinical hypothyroidism, defined as an elevated thyroid-stimulating hormone with normal free thyroxine, to euthyroid patients undergoing coronary artery bypass grafting, no increase in major adverse cardiovascular events, wound problems, mediastinitis, leg infection, respiratory complications, delirium, or reoperation during the same hospitalization was noted. However, there was an increase in the rate of postoperative atrial fibrillation in the subclinical hypothyroidism group.[15] One retrospective study analyzed the outcome of anesthesia and surgery in 59 hypothyroid patients compared with 50 euthyroid patients. There were no differences in duration of surgery or anesthesia, lowest temperature, and blood pressure recorded during surgery, need for vasopressors, time to extubation, fluid and electrolyte imbalances, the incidence of arrhythmias, pulmonary or myocardial infarction, sepsis, need for postoperative respiratory assistance, bleeding complications, or time to hospital discharge. Analysis of subsets of patients divided based on their thyroxine levels (thyroxine level $< 1.0 \mu\text{g/dL}$, 1.0 to $<3.0 \mu\text{g/dL}$, and $\geq 3.0 \mu\text{g/dL}$) revealed no differences in outcomes. Because there were only 7 patients in the group with the lowest T4 concentration, the authors concluded that in mild to moderate hypothyroidism, there is no evidence to justify postponing surgery that is needed, but in severe hypothyroidism, there is insufficient evidence to make a recommendation.[16] The ubiquitous effects of thyroid hormone on multiple organ systems predispose patients with either hypothyroidism or hyperthyroidism to specific perioperative complications, some of which can be severe or even fatal. Thus, the goal of therapy in the perioperative patient should be to achieve a euthyroid state and when that is not feasible, to use other measures that will increase hemodynamic stability and prevent decompensation.[17]

3.2 Recommendations Pre-procedure Intervention For Subclinical Hypothyroidism

Although mild, moderate, and severe hypothyroidism are somewhat subject to interpretation and vary between studies, and the number of studies is quite limited, the following conclusions are reasonable based on the literature. Although pre-procedure intervention considerations are best postponed until a euthyroid state is achieved, patients require urgent management if they have mild or moderate hypothyroidism. Levothyroxine should be started pre-procedure and there should be increased awareness of the possibility of minor postoperative complications such as those mentioned above. In general, the classification of “severely hypothyroid” includes those

patients with myxedema coma or severe complications such as altered mentation, pericardial effusions or heart failure, or very low levels of thyroxine ($<1 \mu\text{g/dL}$). Based on the lack of outcomes data and an understanding of the risks outlined above, nonemergent surgery should be postponed until hypothyroidism has been treated. If emergent surgery is required, thyroid hormone levels should be normalized as rapidly as possible, using IV levothyroxine in a loading dose of 200 to 500 μg followed by 50 to 100 μg IV daily.[18] Simultaneous administration of IV liothyronine should be considered if there is suspicion of myxedema coma. If there is any suspicion of concurrent adrenal insufficiency, glucocorticoids should be administered in stress doses before or together with thyroid hormone. Patients who require cardiac revascularization comprise the only subset of patients who may not benefit from preoperative replacement of thyroid hormone. Although one may intuit from the above discussion that preoperative optimization of thyroid hormone status would benefit all patients, in cardiac patients with angina, there is a real possibility of worsening cardiac ischemia by replacing thyroid hormone and consequently increasing myocardial oxygen demand. As retrospective and prospective studies of cardiac patients undergoing cardiac surgery or catheterization found no increase in the rate of adverse events in those patients whose hypothyroidism had not been treated, it is reasonable to proceed with the revascularization procedure before repleting thyroid hormone.[19], [20]

4 Conclusion

Although subclinical hypothyroidism represents opposite ends of a disease spectrum, the ubiquitous effects of thyroid hormone deficiency throughout multiple organ systems predispose patients with either condition to specific pre-procedure complications, some of which can be severe or even fatal. Apart from the dreaded complication of myxedema coma which involves the central nervous system, subclinical hypothyroid patients undergoing pre-procedure intervention are predisposed to anemia, electrophysiologic disturbances, and hypotension, all of which can precipitate cardiovascular collapse. Similarly grave is the complications of thyrotoxicosis which may trigger arrhythmias, fever, gastrointestinal disturbances, and even progress to the mental status changes and cardiovascular decompensation associated with the calamitous state of thyroid storm. Thus, the goal of therapy in the perioperative patient with thyroid dysfunction centers around the attempt to normalize hormone levels before surgical intervention whenever possible and, when that is not feasible, to use other measures that will maximize hemodynamic stability and prevent decompensation.

REFERENCES.

- [1]. Canaris GJ, Manowitz NR, Mayor G, Ridgway EC. The Colorado Thyroid Disease Prevalence Study. *Arch Intern Med.* 2000 Feb 28;160(4):526.
- [2]. Hak AE, Pols HAP, Visser TJ, Drexhage HA, Hofman A, Witteman JCM. Subclinical Hypothyroidism Is an Independent Risk Factor for Atherosclerosis and Myocardial Infarction in Elderly Women: The Rotterdam Study. *Ann Intern Med.* 2000 Feb 15;132(4):270.

- [3]. Diekman T, Lansberg PJ, Kastelein JJ, Wiersinga WM. Prevalence and correction of hypothyroidism in a large cohort of patients referred for dyslipidemia. *Arch Intern Med.* 1995 Jul 24;155(14):1490–5.
- [4]. Palace MR. Perioperative Management of Thyroid Dysfunction. *Health Serv Insights.* 2017 Jan 1;10:117863291668967.
- [5]. Hak AE, Pols HAP, Visser TJ, Drexhage HA, Hofman A, Witteman JCM. Subclinical Hypothyroidism Is an Independent Risk Factor for Atherosclerosis and Myocardial Infarction in Elderly Women: The Rotterdam Study. *Ann Intern Med.* 2000 Feb 15;132(4):270.
- [6]. Diekman T, Lansberg PJ, Kastelein JJ, Wiersinga WM. Prevalence and correction of hypothyroidism in a large cohort of patients referred for dyslipidemia. *Arch Intern Med.* 1995 Jul 24;155(14):1490–5.
- [7]. Loeliger EA, Van Der Esch B, Mattern MJ, Hemker HC. The Biological Disappearance Rate Of Prothrombin, Factors Vii, Ix, And X From Plasma In Hypothyroidism, Hyperthyroidism, And During Fever. *Thromb Diath Haemorrh.* 1964 Jan 1;10:267–77.
- [8]. Axelrod AR, Berman L. The bone marrow in hyperthyroidism and hypothyroidism. *Blood.* 1951 May;6(5):436–53.
- [9]. Fredlund BO, Olsson SB. Long QT Interval and Ventricular Tachycardia of “Torsade de Pointe” Type in Hypothyroidism. *Acta Med Scand.* 2009 Apr 24;213(3):231–5.
- [10]. Anthonisen BP, Holst E, Chr. Thomsen AA. Determination of Cardiac Output and Other Hemodynamic Data in Patients with Hyper- and Hypothyroidism, Using Dye Dilution Technique. *Scand J Clin Lab Invest.* 1960 Jan 13;12(4):472–80.
- [11]. Stathatos N, Wartofsky L. Perioperative management of patients with hypothyroidism. *Endocrinol Metab Clin North Am.* 2003 Jun;32(2):503–18.
- [12]. Bilezikian JP, Loeb JN. The Influence of Hyperthyroidism and Hypothyroidism on α and β -Adrenergic Receptor Systems and Adrenergic Responsiveness*. *Endocr Rev.* 1983 Oct;4(4):378–88.
- [13]. Rodrigo C, Gamakaranage CS, Epa DS, Gnanathanan A, Rajapakse S. Hypothyroidism causing paralytic ileus and acute kidney injury - a case report. *Thyroid Res.* 2011;4(1):7.
- [14]. Stathatos N, Wartofsky L. Perioperative management of patients with hypothyroidism. *Endocrinol Metab Clin North Am.* 2003 Jun;32(2):503–18.
- [15]. Park YJ, Yoon JW, Kim K Il, Lee YJ, Kim KW, Choi SH, et al. Subclinical Hypothyroidism Might Increase the Risk of Transient Atrial Fibrillation After Coronary Artery Bypass Grafting. *Ann Thorac Surg.* 2009 Jun;87(6):1846–52.
- [16]. Weinberg AD, Brennan MD, Gorman CA, Marsh HM, O’Fallon WM. The outcome of anesthesia and surgery in hypothyroid patients. *Arch Intern Med.* 1983 May;143(5):893–7.
- [17]. Malhotra B, Bhadada S. Perioperative management for non-thyroidal surgery in thyroid dysfunction. *Indian J Endocrinol Metab.* 2022;26(5):428.
- [18]. Bennett-Guerrero E, Kramer DC, Schwinn DA. Effect of Chronic and Acute Thyroid Hormone Reduction on Perioperative Outcome. *Anesth Analg.* 1997 Jul;85(1):30–6.
- [19]. Myerowitz PD, Kamienski RW, Swanson DK, Chopra PS, Berkoff HA, Kroncke GM, et al. Diagnosis and management of the hypothyroid patient with chest pain. *J Thorac Cardiovasc Surg.* 1983 Jul;86(1):57–60.
- [20]. Drucker DJ, Burrow GN. Cardiovascular surgery in the hypothyroid patient. *Arch Intern Med.* 1985 Sep;145(9):1585–7.