

Thyroid Disorders

Chapter 6

Perioperative Management of Thyroid Disease in Non-Thyroid Surgery

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1. Introduction

Thyroid disease is common. The prevalence is higher in women and with increased age. Most patients with thyroid disease are unaware of their illness [1,2]. Thus, a significant number of patients may have concomitant thyroid disease at the time of surgery. Most patients on treatment for thyroid disease do not need special consideration before surgery. But newly diagnosed or uncontrolled thyroid disease requires evaluation before proceeding with surgery.

Preoperative screening for thyroid disease

Routine Thyroid-Stimulating Hormone (TSH) testing in asymptomatic patients without a history of thyroid disease is not required. However, a TSH should be obtained in patients who have clinical findings suggestive of thyroid dysfunction as part of the preoperative evaluation [3,4].

Preoperative evaluation in patients with known thyroid disease

A thyroid function test (TFT) should be assessed in all patients with known thyroid disease with or without treatment. But it is not necessary if euthyroidism has been documented within 3-6 months, and there are no clinical findings suggestive of thyroid dysfunction [4]. In patients with large goiter, it is important to assess the risk of airway compromise. This may

include neck imaging and communication with the anesthetic team for the appropriate plan to secure the airway [5].

In this chapter, we divide the preoperative evaluation into hyperthyroidism and hypothyroidism.

Hyperthyroidism

Perioperative risks

Excess thyroid hormones effect all the body systems. This may affect the perioperative outcome. The most particular concern is cardiovascular complications. Patients with hyperthyroidism have a hyperdynamic circulatory state with increased cardiac output by 50% to 300%. This is due to vasodilatation, increased oxygen consumption, reduced peripheral vascular resistance, and alteration in the renin-angiotensin system. These may worsen myocardial ischemia or result in high-output heart failure [4]. Both overt and subclinical hyperthyroidism are at increased risk of atrial fibrillation [6,7]. Respiratory compromise may occur due to increased oxygen consumption and carbon dioxide production, muscle weakness, and reduced lung volume [8,9]. Although rare, the life-threatening thyroid storm represents the highest perioperative risk. It is characterized by tachycardia, hyperthermia, confusion, and cardiovascular collapse. Thyroid storm usually occurs intraoperative, or a few hours postoperative [4,5,10].

Perioperative management

We divide the patients according to severity to subclinical hypothyroidism (low TSH with normal thyroid hormones) and overt hyperthyroidism (low TSH and increased thyroid hormones).

Subclinical hyperthyroidism

Typically proceed to elective and urgent surgery [4,10].

Add beta-blockers like atenolol 25-50 mg daily to patients at risk, (older than 50 years old and younger with a history of cardiovascular disease).

Overt hyperthyroidism

Surgery can precipitate thyroid storm in untreated or poorly controlled hyperthyroidism. The management decision is dependent on the surgical urgency.

Elective surgery should be postponed pending adequate control (normal free T4 and T3) which usually takes a few weeks. Thionamides should be continued perioperatively. Beta-

blockers may be given perioperatively seven days before surgery if the time allows, otherwise short-acting beta blockers can be given intraoperatively when indicated [3].

Urgent surgery cannot be postponed, so preoperative treatment for overt hyperthyroidism should be initiated as soon as possible. Furthermore, a thorough evaluation for cardiac and pulmonary diseases, and any development of arrhythmia, cardiac ischemia, and heart failure [11]. This requires the use of invasive cardiovascular devices like an arterial line and pulmonary artery catheter when cardiopulmonary disease is present [3]. Careful postoperative monitoring is needed, due to the increased risk of prolonged intubation from high oxygen consumption and respiratory muscle fatigue.

The Perioperative preparation for urgent surgery will be accomplished with beta-blockers, thionamides, and or potassium iodide solution (SSKI).

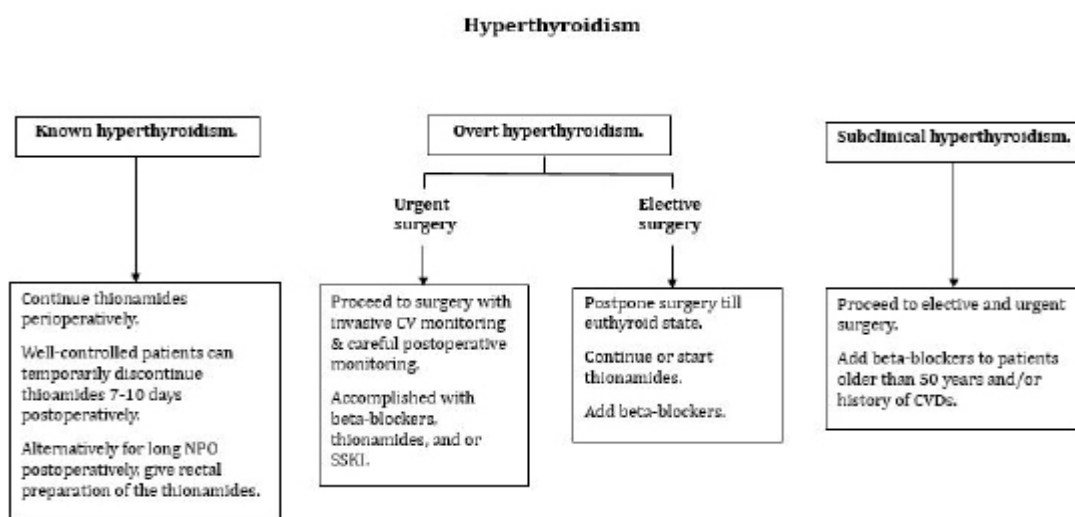


Figure 1: Summary for the perioperative management of hyperthyroidism in non-thyroid surgery. (Abbreviations: NPO, non per oral; SSKI, potassium iodide solution; CV, cardiovascular; CVDs, cardiovascular diseases).

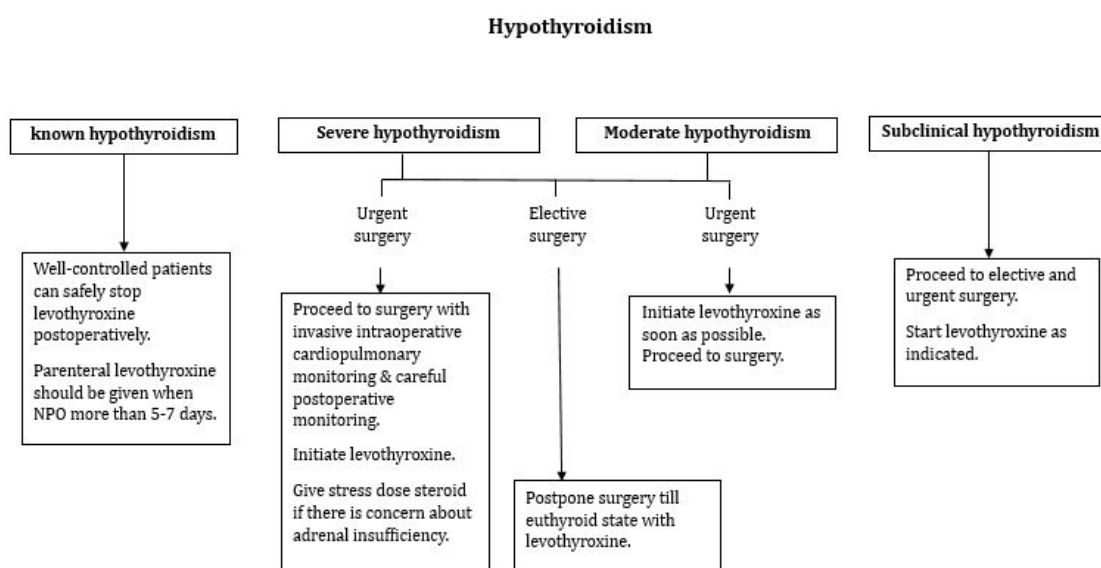


Figure 2: Summary for the perioperative management of hypothyroidism in non-thyroid surgery. (Abbreviations: NPO, none per oral).

Beta-blockers

Atenolol is usually started in a dose (25-50 mg per day) orally and titrated as needed to achieve a heart rate of 80 beats per minute [12]. Propranolol intravenously in a dose (0.5 to 1 mg over 10 minutes followed by 1-2 mg over 10 minutes every few hours) can be used to control fever, hypertension, and tachycardia intraoperatively [13]. Propranolol has the added benefit of the reduced conversion of T4 to T3. Alternatively, an intravenous esmolol drip allows rapid control of heart rate because it is short-acting. When beta-blockers are contraindicated like in patients with asthma, selective beta blockers like atenolol, metoprolol, and esmolol are preferred. Alternatively, calcium channel blockers may be used.

Thionamides

Carbimazole, methimazole, and propylthiouracil should be initiated as soon as possible with the aim to control hyperthyroidism in the postoperative period. Except in the first trimester, Carbimazole and methimazole are preferred to propylthiouracil to their longer half-life and less hepatotoxicity. Postoperatively, patients who cannot take thionamides orally will need rectal administration of the medications [14].

Iodine

When there urgent need to control severe hyperthyroidism in patients with Graves' disease, SSKI one to five drops three times daily at least one hour after thionamides are administered [15]. In addition to stress-dose glucocorticoid (hydrocortisone 100 mg every eight hours the day of surgery and gradually taper down over the next three days. SSKI should not be used in toxic adenoma/multinodular goiter without effective thionamides administration orally or rectally as it will exacerbate hyperthyroidism.

In patients who are intolerant to thionamides, beta-blockers should be used alone to control symptoms of hyperthyroidism in patients with toxic adenoma/multinodular goiter. While beta-blockers in combination with SSKI can be used to control hyperthyroidism in patients with Graves' disease.

Known hyperthyroidism

In case of preexisting hyperthyroidism on treatment, patients should continue their treatments perioperatively. In patients who may be unable to take their oral medications for a few days postoperatively, they can take rectal preparation of their medications. However, in patients with well-controlled thyroid function tests on long-term treatment, there is usually a lag of 7-10 days in the recurrence of hyperthyroidism after the temporary discontinuation of the treatments [5,14].

Hypothyroidism

Perioperative risks

The perioperative risk is dependent on the severity of untreated hypothyroidism [16]. However, the definition of the severity of hypothyroidism is vague and can vary based on different studies [17,18]. Severe hypothyroidism includes patients with very low thyroxine levels (for example free T4 less than 0.5 ng/dL), and clinical manifestations of chronic severe disease like myxedema coma, altered mentation, pericardial effusion, or heart failure. Moderate hypothyroidism includes patients with elevated TSH and low free T4 without clinical manifestations of severe disease. Mild hypothyroidism includes patients with subclinical hypothyroidism with elevated TSH and normal free T4. Perioperative complications are most often seen in patients with severe hypothyroidism. Potential cardiovascular complications include reduced cardiac output, hypotension, ischemia, bradycardia, arrhythmias, and prolonged QT interval resulting in ventricular tachycardia and torsades de pointes [18]. Respiratory complications include reduced hypoxic and hypercapnic respiratory drive, muscle weakness, and sleep apnea [4]. Besides macroglossia and laryngeal myxedema can result in difficult airway intubation, patients may have reduced responsiveness to anesthetic agents [5,16]. Surgery can precipitate myxedema coma which is a rare but life-threatening condition that is characterized by altered mental status, hypothermia, bradycardia, hypotension, and electrolyte derangements [4]. Postoperatively, patients are at increased risk for ileus, coagulopathy, and delayed wound healing [4,16,19,20].

Given the perioperative complications and severity of hypothyroidism, there are few observational studies evaluating the surgical outcomes in patients with hypothyroidism. Mild (subclinical hypothyroidism) does not associate with a significantly increased risk of postoperative complications as compared to euthyroid patients undergoing coronary artery bypass grafting [21]. Several studies have evaluated the safety of general anesthesia in patients with moderate overt hypothyroidism [17,22,23]. Fewer adverse effects have been reported, but in hypothyroid patients, there were higher frequencies for ileus, hypotension, hyponatremia, neuropsychiatric complications, less fever with infection, and increased sensitivity to anesthesia and narcotics. These complications may be more pronounced in severe hypothyroidism as described by older case studies including cardiovascular collapse [24,25]. Furthermore, myxedema coma had been described as a postoperative complication in untreated severe hypothyroidism [26-28].

Perioperative management

As a result of the paucity of studies regarding the perioperative management of hypothyroidism, our management strategy is based on expert opinion and observational studies that assessed the surgical outcome in patients with hypothyroidism. These strategies depend on the

severity of hypothyroidism and the surgical urgency.

Subclinical hypothyroidism

Do not postpone surgery, and levothyroxine treatment is indicated according to what is recommended without surgery.

Moderate hypothyroidism

Elective surgery should be postponed till the achievement of the euthyroid state with the initiation of levothyroxine.

It is suggested to proceed to urgent surgery without delay. Keep in mind, some minor perioperative complications may develop. For this reason, levothyroxine should be initiated as soon as possible in a dose of (1.6 µg/kg per day) or in a lower dose (25 to 50 µg per day) in old patients and those with cardiovascular diseases [29].

Severe hypothyroidism

Elective surgery should be postponed till the effective treatment of hypothyroidism levothyroxine.

While it is suggested to proceed to the urgent or emergent surgery, hormonal replacement therapy should be initiated immediately with intravenous levothyroxine (loading dose 200-300 µg followed by 50 µg per day) [4]. When there is a concern about presenting myxedema or precipitating myxedema, intravenous liothyronine should be administered simultaneously (loading dose 5-20 µg followed by 2.5-10 µg every eight hours). Lower doses of thyroid hormones may be given to elderly patients, patients with cardiac diseases, or undergoing urgent cardiac revascularization surgery [4,10]. Addison's disease may co-exist with the primary Hashimoto's hypothyroidism. Secondary (central) hypothyroidism may be associated with secondary adrenal insufficiency. For this reason and when there is enough time before surgery, testing for the presence of adrenal insufficiency is recommended using a cosyntropin stimulation test. Otherwise, when there is a concern about adrenal insufficiency, a stress dose steroid should be given during surgery [4,10]. As patients with severe hypothyroidism are at high risk for perioperative complications including cardiac and respiratory adverse events, invasive intraoperative monitoring with the use of an arterial line should be considered in the presence of cardiopulmonary disease. In the postoperative period, close follow-up is required to look for electrolytes disturbances especially serum sodium, ileus, neuropsychiatric symptoms, and any infection without fever.

Known hypothyroidism

Patients with known hypothyroidism on thyroxine replacement can safely stop their

thyroxine a few days postoperatively till oral intake is restarted. Levothyroxine's half-life is seven days. Thus, if oral intake cannot be permitted in five to seven days, intravenous or intramuscular levothyroxine should be initiated (60-80 % of the current oral dose) [4,10,16,19,20].

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