CASE REPORT

Anaesthesia Management of Patient With Hyperthyroidism Underwent Laparoscopic Cholecystectomy Operation

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ABSTRACT

Background : Hyperthyroidism is a common endocrine disorder that can significantly impact perioperative management, particularly in patients undergoing major surgery. This case report discusses the anaesthetic management of a hyperthyroid patient undergoing laparoscopic cholecystectomy, emphasizing the challenges and strategies employed to optimize perioperative care.

Case Illustration : A 53-year-old male presented with progressive jaundice, weight loss, palpitations, and heat intolerance. Clinical evaluation revealed hyperthyroidism with a Wayne Index score of 21 and a Burch and Wartofsky score of 40, indicating an impending thyroid storm. Laboratory findings confirmed suppressed TSH levels and elevated free T4 levels. Additional comorbidities included atrial fibrillation with a normal ventricular response, first-degree atrioventricular block, and obstructive jaundice due to suspected choledocholithiasis. The patient was classified as ASA III and scheduled for laparoscopic cholecystectomy under general anaesthesia.

Preoperative optimization included the administration of thiamazole, beta-blockers, Lugol's solution, and corticosteroids to mitigate the risk of intraoperative thyroid storm. Anesthesia induction was performed using thiopental, fentanyl, and rocuronium, followed by endotracheal intubation and maintenance with inhalational agents. Intraoperatively, hemodynamic stability was maintained with meticulous fluid management and beta-blockade. The procedure was completed successfully with an estimated blood loss of 50 mL, and the patient was transferred to the ICU for postoperative monitoring.

Postoperatively, the patient experienced transient delirium and hemodynamic fluctuations, requiring continued sedation and ventilatory support. Thyroid function was closely monitored, and medical therapy was continued. The patient remained hemodynamically stable and was gradually weaned off mechanical ventilation.

Conclusion : Anaesthesia management in hyperthyroid patients undergoing surgery requires a multidisciplinary approach, with careful preoperative preparation to prevent thyroid storm, intraoperative hemodynamic control, and vigilant postoperative monitoring. This case highlights the importance of optimizing thyroid function and cardiovascular stability in hyperthyroid patients to improve surgical outcomes.

Keywords : Anaesthesia, Anaesthesia Management, Hyperthyroidism, Cholecystectomy, Laparoscopic Cholecystectomy

INTRODUCTION

Hyperthyroidism, a condition of increased thyroid hormone levels in the body, is one of the most significant thyroid disorders in Indonesia.[1] It is the most common metabolic disease after diabetes mellitus.[2] In 2007, the prevalence of hyperthyroidism in Indonesia was higher in women (14.7%) compared to men (12.8%) and had an overall prevalence of 6.9%, with a TSH level of <0.55 μIU/mL.[1] Hyperthyroidism itself can be caused by increased synthesis of thyroid hormones, excessive release of thyroid hormones, or endogenous and exogenous sources outside the thyroid gland.[3] Specifically, the term hyperthyroidism is used when the increased thyroid hormone levels result from excessive production and secretion from the thyroid gland. In contrast, if the increase in thyroid hormone levels is due to other causes, the term thyrotoxicosis is used.[4-8]

The clinical signs and symptoms of hyperthyroidism can vary depending on the patient's age, disease duration, hormone levels, and comorbid conditions. Generally, symptoms experienced by patients include palpitations, heat intolerance, excessive sweating, tremors, increased appetite, weight loss, fatigue, frequent bowel movements, anxiety, restlessness, menstrual disturbances (in female patients), and even arrhythmias and heart failure.[1,3,8] Clinical signs commonly observed include exophthalmos, neck swelling, tremors, palpitations, leg edema, and skin changes.[1,5] Supportive parameters used to diagnose hyperthyroidism include measurements of thyroid-stimulating hormone (TSH), thyroxine (T4), and triiodothyronine (T3).[5] In subclinical conditions, TSH levels are low, but T4 and T3 levels remain normal. In overt hyperthyroidism, TSH levels are low, while T4 and T3 levels, or both, exceed normal values.[5,9]

In healthcare centers with limited diagnostic facilities, the Wayne index can help determine a diagnosis of hyperthyroidism. The Wayne index score is classified into three categories: a score of >19 indicates toxic hyperthyroidism, 11–19 is equivocal, and <11 is considered euthyroid/normal.[1,9,10]

CASE ILLUSTRATION

A 53-year-old male from Palembang came to the Emergency Department as a referral from an internal medicine specialist in Kayu Agung due to progressive jaundice for the past three weeks. He also experienced generalized itching, nausea, vomiting, loss of appetite, and weight loss of more than 15 kg within three weeks. His stool appeared pale yellow, and his urine was tea-colored. He had been hospitalized for two weeks at a local hospital and was diagnosed with hepatitis A. Over the past month, he frequently felt shortness of breath and palpitations, became easily fatigued, preferred cold environments due to frequent heat sensations and excessive sweating, and noticed his hands felt moist. He also perceived weight loss despite maintaining a normal appetite. A small lump was present on the right side of his neck, which did not interfere with eating, cause voice changes, or induce pain. He had no history of hypertension, diabetes mellitus, asthma, allergies, hyperthyroidism, chemotherapy, or surgery.

On the primary survey, the airway was clear, and breathing and circulation were stable. The respiratory rate was 24 breaths per minute, with oxygen saturation at 99% on room air. The blood pressure was 148/78 mmHg, and the heart rate ranged from 90 to 109 beats per minute, with a noted pulse deficit. The patient was fully conscious (E4M6V5) and well-oriented.

On physical examination, the conjunctiva was not anemic, but scleral icterus was present. A palpable mass was found in the cervical region. Pulmonary examination was within normal limits. Cardiac examination revealed a pulse deficit, with a heart rate of 90-100 beats per minute, but no additional murmurs or gallop sounds were detected. Abdominal examination revealed a palpable mass in the umbilical region, approximately 10 cm in diameter, with well-defined edges and an irregular surface. Bowel sounds were present. The extremities were warm, with minimal pretibial edema. The scoring for hyperthyroidism was performed on this patient. The Wayne Index score for this patient was 21 and Burch and Wartofsky Score for this patient was 40.

Laboratory tests showed abnormalities in hemoglobin (10 g/dL), total bilirubin (37.64 mg/dL), direct bilirubin (24.68 mg/dL), indirect bilirubin (12.96 mg/dL), albumin (2.9 g/dL), and potassium (3.3 mEq/L). Thyroid function tests revealed elevated free T4 (49.07, normal range 0.01–19.05) and suppressed TSH (0.0008, normal range 0.35–4.94), suggesting hyperthyroidism.

Electrocardiography (ECG) on April 30, 2024, showed atrial fibrillation (AF) with a normal ventricular response at a rate of 90–100 beats per minute. An ECG performed on April 29, 2024, showed first-degree atrioventricular (AV) block and T-wave inversion in leads II, III, aVF, and V1–V3. A chest X-ray revealed cardiomegaly.

Echocardiography showed left ventricular (LV) dilation with left ventricular hypertrophy, global normokinetic wall motion, and a left ventricular ejection fraction (LVEF) of 61%. Diastolic dysfunction grade 2 was present, along with severe mitral regurgitation (MR) toward the lateral wall and mild tricuspid regurgitation (TR). Right ventricular (RV) function was normal.

The Internal Medicine – Cardiology Subdepartment assessed the patient with obstructive jaundice suspected to be due to choledocholithiasis, microcytic hypochromic anemia, mild hypokalemia, and hypoalbuminemia. The recommended management included packed red blood cell (PRBC) transfusion, nebivolol 2×5 mg orally, atorvastatin 1×20 mg orally, and bisoprolol 1×2.5 mg orally.

The Internal Medicine – Endocrinology Subdepartment diagnosed obstructive jaundice due to distal common bile duct obstruction, suspected Grave's disease, atrial fibrillation with rapid ventricular response (AF RVR) with a CHA_2DS_2-VASc score of 0, thyroid heart disease, microcytic hypochromic anemia, mild hypokalemia, hypoalbuminemia, and dyslipidemia. They recommended PRBC transfusion, delaying surgery, and initiating thiamazole 1×20 mg. If surgery was necessary, preoperative preparation included lugolization (8 drops of Lugol's solution in 200 cc of water every 8 hours) and intravenous hydrocortisone 200 mg every 8 hours.

Our assessment was obstructive jaundice due to distal common bile duct obstruction with impending thyroid storm in hyperthyroidism, AF NVR, first-degree AV block, differential diagnosis of sinus arrhythmia, mild anemia (10 g/dL), mild hypokalemia (3.3 mEq/L), and hypoalbuminemia (2.9 g/dL). The planned procedure was laparoscopic cholecystectomy. The patient's physical status was classified as ASA III, and general anesthesia with endotracheal intubation was planned.

After obtaining consent for surgery and the anesthetic procedure, the patient was admitted to the operating theatre. One day before surgery, preoperative preparation included lugolization. General anesthesia was induced using thiopental 500 mg, fentanyl 100 µg, and rocuronium 20 mg. The patient was intubated with a 7.5 mm endotracheal tube. The surgical procedure lasted 1 hour, during which a cholecystectomy was performed, and common bile duct (CBD) stones were identified intraoperatively. No signs of intraoperative shock were observed. Fluid management included 500 cc of crystalloid, with an estimated blood loss of 50 ml and urine output of 150 ml.

Postoperatively, the patient remained intubated and was admitted to the Intensive Care Unit (ICU) for further monitoring. Neurologically, the patient was delirious postoperatively (DPO), with pupils isocoric (3/3 mm) and reactive to light. Hemodynamic parameters were stable, with a blood pressure of 113/71 mmHg and a heart rate of 108 beats per minute, without vasopressor support. The patient was maintained on a synchronized intermittent mandatory ventilation (SIMV) mode with a respiratory rate of 12 breaths per minute, pressure support of 10 cmH_2O, FiO_2 50%, PEEP 5 cmH_2O, and a tidal volume of 300 ml. SpO_2 remained at 100%. Nasogastric tube (NGT) placement showed residual gastric content, and urinary output was adequate.

Current postoperative therapy included intravenous ceftriaxone 1 g every 12 hours, omeprazole 40 mg every 24 hours, nebivolol 2×5 mg orally, bisoprolol 1×2.5 mg orally, atorvastatin 1×20 mg orally, and continued lugolization with 6 drops in 250 cc of water every 6 hours for 5 days. On postoperative day 1 (May 14, 2024), thiamazole 1×20 mg was initiated orally. Continuous intravenous dexmedetomidine and fentanyl infusions were administered for sedation. The patient remained under close observation in the ICU, with continued ventilatory support, serial laboratory monitoring, and ongoing medical therapy.

DISCUSSION

A 53-year-old male patient was diagnosed with obstructive jaundice due to distal CBD obstruction with impending thyroid storm in hyperthyroidism, AF NVR, first-degree AV block, sinus arrhythmia, mild anemia (Hb 10 g/dL), mild hypokalemia (K 3.3 mEq/L), and hypoalbuminemia (2.9 g/dL). The patient was scheduled for a laparoscopic cholecystectomy. Upon vital sign examination, the patient was compos mentis, with grade I hypertension, an irregular pulse ranging from 90-110 bpm, slightly increased respiratory rate, oxygen saturation of 99% on room air, and afebrile temperature. Physical examination revealed small bilateral nodules (2 cm × 2 cm × 2 cm) that moved with swallowing. Cardiac examination showed a systolic murmur over the mitral area, pulse deficit, irregular palpable pulse, and irregular heart rate ranging from 90-110 bpm. Minimal pitting edema was present in both legs, but no lung crackles were detected. Hyperthyroidism assessment using the Wayne index scored 23, indicative of hyperthyroidism, which was supported by thyroid function tests. The Burch and Wartofsky scoring system classified the patient as being in an impending thyroid storm state, with a score of 55.

Preoperative

Elective surgery in hyperthyroid patients should be postponed until the patient reaches a euthyroid state with medical therapy, ensuring normal T3 and T4 levels and the absence of resting tachycardia. However, this patient presented with abdominal pain rated 6-7 on the VAS

scale and severe hyperbilirubinemia (total bilirubin 37.64 mg/dL). A cohort study by Han et al. conducted in Seoul reported that patients with extreme or grade 4 hyperbilirubinemia (≥30 mg/dL) had a 12-fold increased mortality risk compared to those with grade 1 hyperbilirubinemia. Therefore, urgent management for extreme hyperbilirubinemia should be considered in this patient.[11]

Additionally, the patient had suspected thyroid-related heart disease, characterized by atrial fibrillation with a normal ventricular response and severe mitral regurgitation. Preoperative cardiac risk assessment was necessary to evaluate intraoperative and postoperative risks and prognosis. Patients with active cardiac conditions or significant heart disease require preoperative cardiac risk evaluation. According to ACC/AHA guidelines, elderly patients with heart disease but good activity tolerance have lower surgical risk compared to those with dyspnea or limited physical activity. Activity tolerance can be assessed using the METs score, estimating the energy required for various activities.[12]

In this case, the patient was able to perform light activities such as walking to the bathroom and climbing stairs, with a METs score >4. The ACC/AHA preoperative evaluation guidelines for non-cardiac surgery classify patients with moderate clinical predictors, including compensated congestive heart failure and minor predictors such as abnormal ECG findings (AF NVR and first-degree AV block). Patients with a METs score of 4 have a mild-to-moderate risk when undergoing non-cardiac surgery.[12]

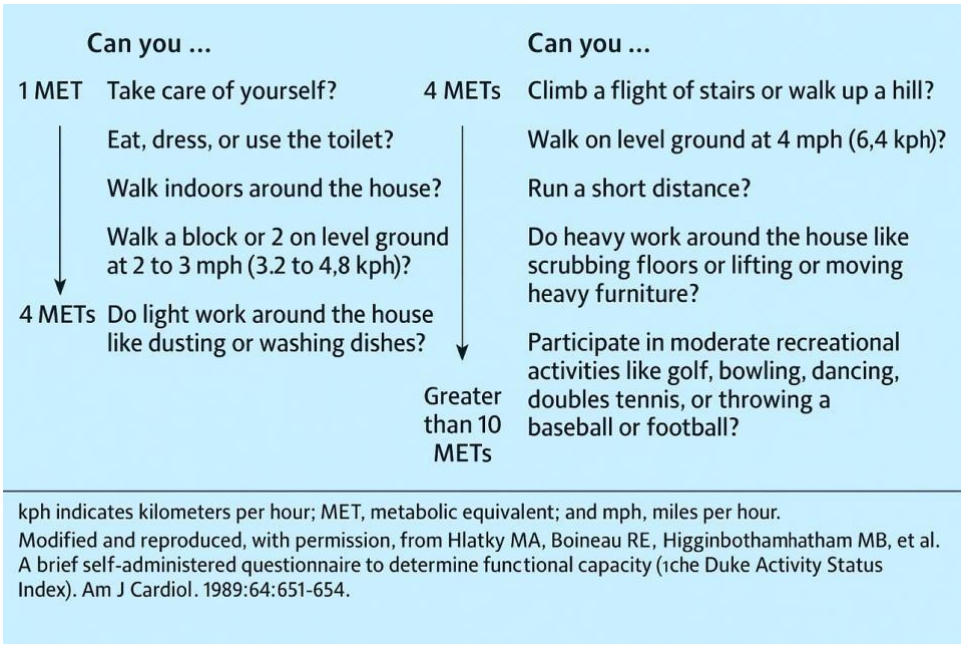

Figure 1. Estimated Energy Requirements[12]

Laparoscopic surgery increases preload and afterload while decreasing cardiac output (CO). These changes are influenced by intraoperative patient positioning, intravascular fluid volume status, and underlying cardiovascular conditions such as congestive heart failure, ischemic heart disease, valvular heart disease, congenital heart disease, pulmonary disease, and obesity.[12,13]

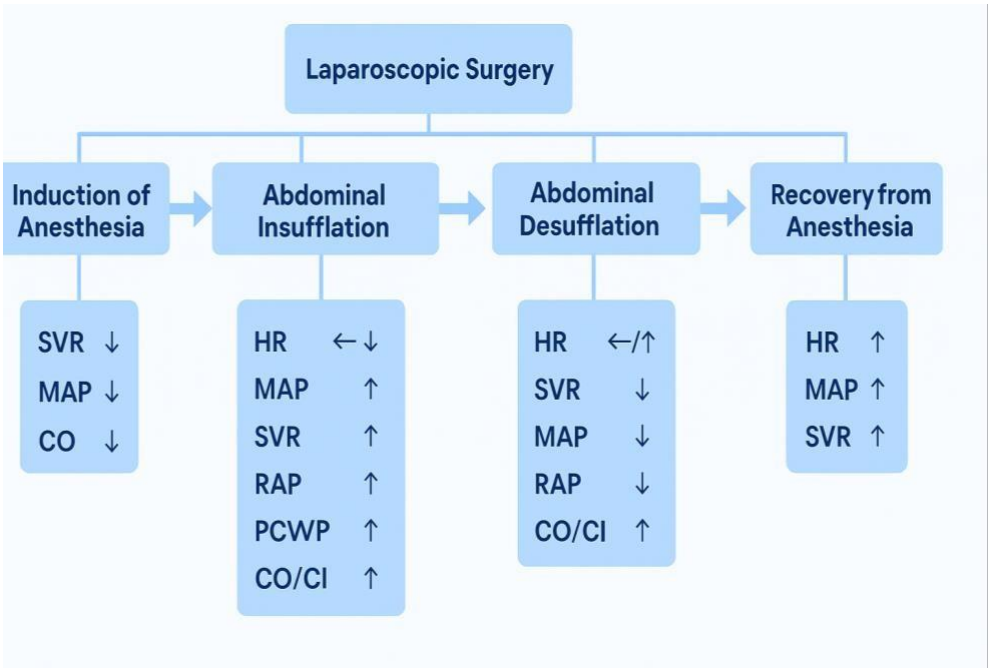

Figure 2. Phases of Laparoscopic Surgery[13]

Anesthetic management for this patient was classified as ASA physical status III. General anesthesia is recommended for laparoscopic surgery to achieve complete muscle relaxation and prevent diaphragmatic irritation caused by gas insufflation and surgical manipulation. Tracheal intubation with positive-pressure ventilation is typically required to mitigate regurgitation risk due to increased intra-abdominal pressure, prevent hypercapnia, and manage the relatively high peak inspiratory pressure associated with pneumoperitoneum. Neuromuscular blockade is necessary during surgery to reduce insufflation pressure, enhance surgical visualization, and prevent unexpected patient movement. Additionally, a nasogastric tube is recommended for decompression to minimize the risk of visceral perforation during trocar insertion and optimize visualization.[14]

Intraoperative

During the initiation of surgery, the patient was in a stable condition. An intravenous (IV) line was secured, and monitoring was established. General anesthesia was induced using thiopental (500 mg), fentanyl (100 mcg), and rocuronium (20 mg). After the administration of these agents, the patient lost consciousness and achieved muscle relaxation. Intubation was performed using a 7.5 Endotracheal Tube (ETT) to ensure a patent airway and facilitate mechanical ventilation.

Thiopental is a barbiturate with a rapid onset and short duration of action. Its use for induction was appropriate, as it quickly induces general anesthesia. Fentanyl, a fast-acting opioid with a moderate duration (30–60 minutes), was suitable for pain management during induction and the early phase of surgery. For a procedure lasting one hour, additional boluses or a continuous infusion of fentanyl might be necessary to maintain analgesia. Rocuronium, a neuromuscular blocking agent with a rapid onset and moderate duration (30–60 minutes), was sufficient for

intubation and muscle relaxation throughout the procedure. A single dose of rocuronium was likely adequate for a one-hour surgery, but neuromuscular monitoring was essential to ensure continued paralysis throughout the procedure.[15-17]

Given the patient's history of hyperthyroidism and risk of thyroid storm, close intraoperative monitoring of blood pressure, heart rate, and body temperature was crucial. A beta-blocker such as bisoprolol was administered intraoperatively to control tachycardia and blood pressure.[18]

Intraoperative findings in this patient undergoing laparotomy and cholecystectomy for common bile duct (CBD) stones confirmed the presence of stones in the CBD. Intraoperative management included the administration of 500 cc of crystalloid fluids, with minimal blood loss (approximately 50 mL) and a urine output of 150 mL, indicating adequate renal function. The patient had a Burch and Wartofsky score of 55, indicative of severe thyroid storm, which was managed with beta-blockers (bisoprolol), antithyroid medication (thiamazole), and glucocorticoids to control the acute hyperthyroid effects. Continuous monitoring of vital signs and hemodynamic status was maintained throughout the surgery, and general anesthesia was sustained with inhaled anesthetics and additional analgesics as required.

The effects of pneumoperitoneum during laparoscopy can have significant adverse impacts, particularly on the cardiovascular system. Increased intra-abdominal pressure displaces the diaphragm cephalad, reducing lung compliance and increasing peak inspiratory pressure. A slow initial insufflation rate at the beginning of the procedure can help minimize these effects. High insufflation pressures (>25 cm H_2O or 18 mmHg) tend to collapse major abdominal veins, particularly the inferior vena cava, thereby impairing venous return and reducing preload and cardiac output in some patients. Hypercapnia stimulates the sympathetic nervous system, increasing blood pressure, heart rate, and the risk of arrhythmias. Therefore, intra-abdominal pressure should be maintained as low as possible to mitigate these risks.[13,14]

Postoperative Findings

The postoperative results indicated the onset of hemodynamic surges. The patient was in a DPO (day post-operation) state, with isocoric pupils (3/3 mm) and a positive light reflex. Blood pressure was 154/91 mmHg, and heart rate ranged from 108–120 bpm, irregular, with atrial fibrillation (AF) rhythm, without inotropic support. The patient was on SIMV ventilation with PS 10, FiO_2 50%, PEEP 5, tidal volume of 300 mL, respiratory rate of 14 breaths per minute, and oxygen saturation of 100%. The postoperative body temperature was 36.9°C. Additionally, the patient had a nasogastric tube (NGT) with positive residual and positive urine output, indicating adequate gastrointestinal and renal function.

Due to the postoperative hemodynamic surge, sedation was administered, and mechanical ventilation was maintained to reduce oxidative and metabolic stress on the patient. The patient was managed in the ICU for postoperative care.

CONCLUSION

Holistically, this case reflects a comprehensive approach to managing a patient diagnosed with CBD stones accompanied by thyroid storm in hyperthyroidism. Laparoscopic cholecystectomy under general anesthesia was chosen as the operative approach, with adequate intraoperative

fluid management. Intraoperative findings included the presence of stones in the CBD, while postoperative outcomes demonstrated good cardiorespiratory stability.

The high Burch and Wartofsky score highlighted the severity of the thyroid storm. Appropriate pharmacological therapy was administered to manage the patient's condition, including antibiotics, antihypertensive medications, statins, and antithyroid agents. The ongoing management plan includes monitoring the patient's consciousness and hemodynamics, maintaining ventilator settings, and conducting comprehensive laboratory assessments to evaluate therapeutic response.

Overall, the management of this patient reflects a multidisciplinary approach involving specialists from various fields to achieve optimal outcomes and ensure patient safety and well-being.

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