

CASE REPORT

Anesthetic Management for Urgent Caesarean Section in Patient with Uncontrolled Hyperthyroidism and Severe Mitral Regurgitation

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ABSTRACT

Background : The prevalence of hyperthyroidism in pregnancy approximately 0.05% to 3% and mostly caused by Graves' Disease (GD). The prevalence of Hyperthyroid Heart Disease (HHD) in pregnancy is 3.87%. Uncontrolled hyperthyroidism during pregnancy can increase maternal and fetal mortality. We report a case of a pregnant woman with uncontrolled hyperthyroidism and severe mitral regurgitation that underwent cesarean section with spinal anesthesia for delivery.

Case Illustration : A 33 years-old patient G4P1A2 visited the Obstetric-Gynecology outpatient clinic at our hospital at 23 weeks of gestation (WoG) due to uncontrolled hyperthyroidism caused by GD that diagnosed 3 years ago and shortness of breath. The echocardiography test obtained severe mitral regurgitation and left atrial dilatation with 58% LVEF. It was decided to maintain the pregnancy till the fetus is viable while still monitoring the patient's condition. At 32 WoG, the patient came to the ED due to shortness of breath, chest pain, and nausea. Fetal movement and fetal heart rate (FHR) were within normal limits. The patient was given a nasal cannula at 3 liters/minute, extra furosemide 20 mg, and fetal lung maturation with dexamethasone injection. The patient was prepared for termination by cesarean section. Spinal anesthesia was performed in a sitting position using a 27 G spinal needle. Inserted at L 3-4, using a low dose of heavy bupivacaine 0.5% 7.5 mg combined with 25 g fentanyl and 0.1 mg morphine intrathecally. C-section was successfully performed and hemodynamics during surgery was stable, resulting the delivery of a preterm baby who weighed 1.9 kg at birth and the baby was transferred to the NICU for further treatment.

Conclusion : Spinal anesthesia with low dose bupivacaine combined with opioids for cesarean section was revealed maternal and neonate safe.

Keywords: Cesarean Section; Hyperthyroidism; Heart Disease; Pregnancy; Spinal Anesthesia.

INTRODUCTION

Hyperthyroidism is an inappropriate high synthesis and secretion of thyroid hormone by the thyroid gland which can lead to thyrotoxicosis condition¹. Hyperthyroidism may result a great threat in pregnancy and may increase maternal and fetal mortality. The prevalence of hyperthyroidism in pregnancy is about 0.05% to 3% with most of these cases caused by Graves' Disease (GD). The prevalence of Hyperthyroid Heart Disease (HHD) in pregnancy is 3.87%². Cardiac Function is also influenced by thyroid hormones, an excessive amount of thyroid hormones can affect systemic hemodynamics and lead to high cardiac output, which is similar to pregnancy that cardiac output is increased by around 30%. These two conditions can make the heart work harder and can lead to heart failure and cardiomyopathy^{2,3}. Because of the complexity of thyroid illness and HHD in pregnancy the perioperative management of hyperthyroid and HHD in pregnancy is challenging. Poor control of hyperthyroidism is associated with pregnancy loss, prematurity, low birth weight, intrauterine growth restriction,

stillbirth, thyroid storm, and maternal heart problems^{2,4}. We report a case of a pregnant woman with uncontrolled hyperthyroidism who was found to have severe mitral regurgitation and underwent cesarean section with spinal anesthesia for delivery.

CASE ILLUSTRATION

A 33 years-old patient G4P1A2 visited the Obstetric-Gynecology outpatient clinic at our hospital at 23 weeks of gestation (WoG) due to uncontrolled hyperthyroidism and shortness of breath. The patient was diagnosed Graves' Disease (GD) 3 years ago with laboratory tests showed thyroid-stimulating-hormone (TSH) level <0.01 IU/ml (normal range : 0.3–4.1 IU/ml), free thyroxine (FT4) level 7.77 ng/dl (normal range : 0.78–2.0 ng/dl), and TSH receptor antibody (TRAb) level 69.1 IU/L (normal range : 0–14 IU/L). Previously, the patient was treated with propylthiouracil (PTU) 50 mg t.i.d, however, in the past 1 year the patient has not regularly taken the medicine. Her family history of similar symptoms or hyperthyroidism was denied.

The echocardiography test obtained severe mitral regurgitation, left atrial dilatation with 58% Left

Ventricular Ejection Fraction (LVEF), without regional wall abnormality. It was decided to maintained the pregnancy till the fetus is viable while still controlling thyroid hormone level and monitoring patient's heart condition. The patient received thiamazole 10 mg daily, aspirin 80 mg s.i.d and pregnancy supplementation and advised to routinely control to obstetrics and gynecology clinic. After visiting our clinic, the patient underwent a series laboratory tests while taking thiamazole

10 mg daily (table 1), which was increased to 20 mg daily and added with propranolol 10 mg t.i.d after 25 WoG. However, despite the increase dosage, TFTs remained abnormal and the patient complained was deteriorated. Resulting in a second dose increase to 30 mg daily at 26 WoG. Afterwards, she maintained a FT4 level < 4.0 ng/dl (normal range 0.93 – 1.7), systolic blood pressure < 160 mmHg, heart rate (HR) < 100 bpm, at follow up examination.

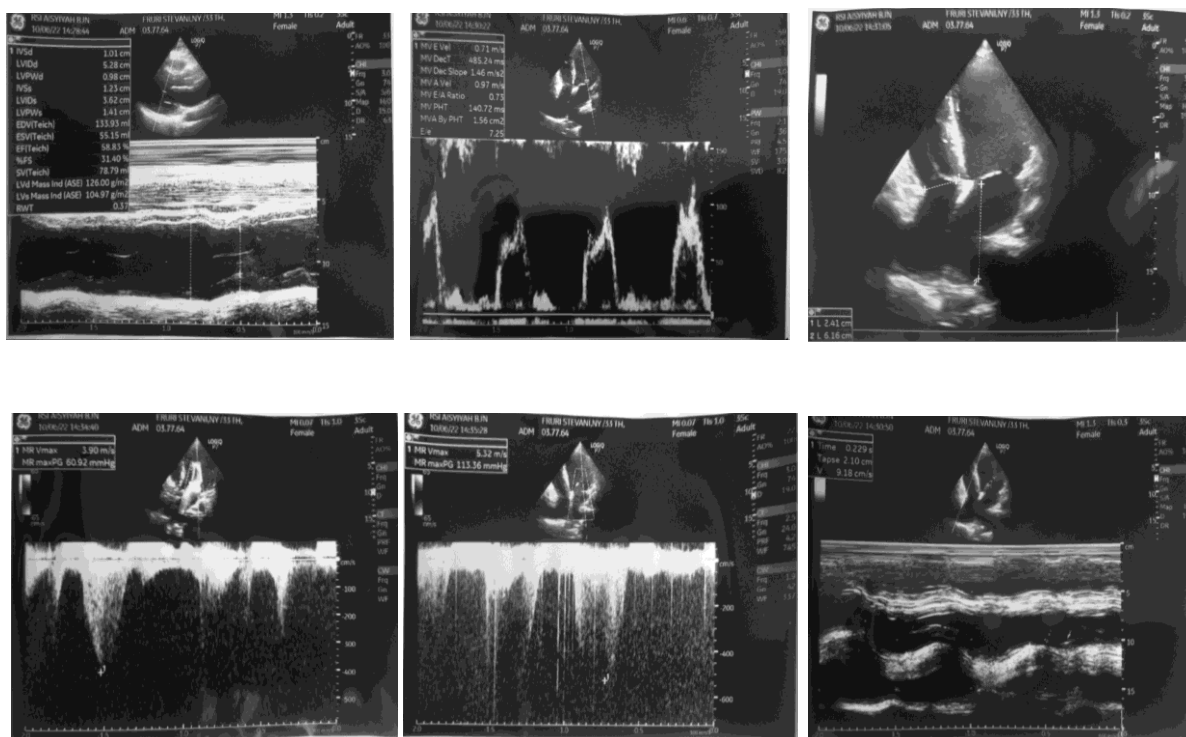


Figure 1. Echocardiography

- (a) Eccentric LVH; LA Dilatation, (b) Severe MR; (c) Mild AR; (d) Mild TR, (e) Diastolic Dysfunction (f) Normal LV Function (LVEF 58%) without regional wall abnormality

Tabel 1 . Anti-thyroid drug (ATD) management for this patient

Gestational Age	FT4	Progress Note
23 WoG	0.59 ng/dl	Thiamizole 10 mg
24 WoG	0.3 ng/dl	
25 WoG	2.19 ng/dl	Thiamizole dose was escalated from 10 mg to 20 mg, propranolol 10 mg t.i.d
26 WoG	>7.77 ng/dl	Thiamizole dose was escalated from 20 mg to 30 mg
27 WoG	7.1 ng/dl	
28 WoG	4.4 ng/dl	

At 32 WoG the patient came to emergency department due to shortness of breath, chest pain, and nausea. The blood pressure (BP) 119/78 mmHg, heart rate (HR) 112 beats/minutes, 36,2°C of temperature, respiratory rate (RR) 24-28 times/minutes with 93-95% saturation (SpO2) in room air condition. In physical examination obtained exophtalmus, crackles in both lungs, the TSH level < 0.05 IU/ml, FT4 level 33.54 ng/dl, otherwise within normal limits. Fetal movements and heart rate were within in normal limits. The patient was given 3 liters/minutes oxygenation with nasal cannulae, furosemide 20 mg extra, and fetal lung maturation with dexamethasone injection. And then the

patient is prepared for termination by caesarean section.

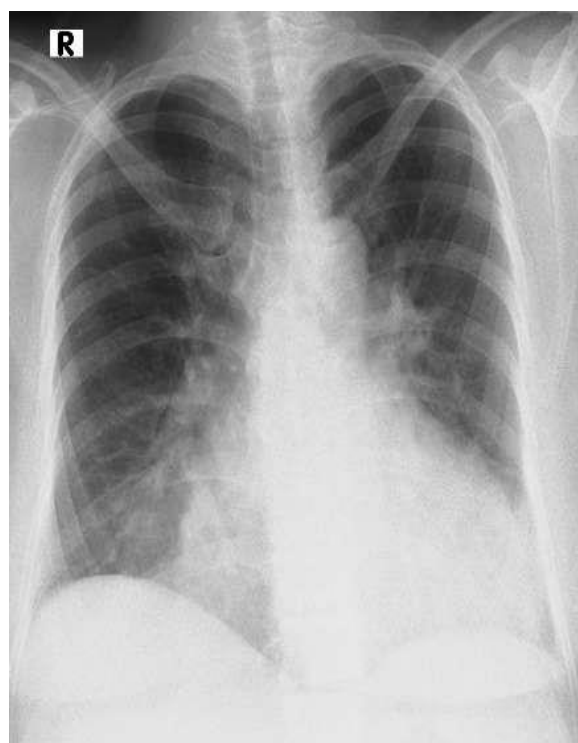


Figure 2. Chest X-Ray showed Cardiomegaly

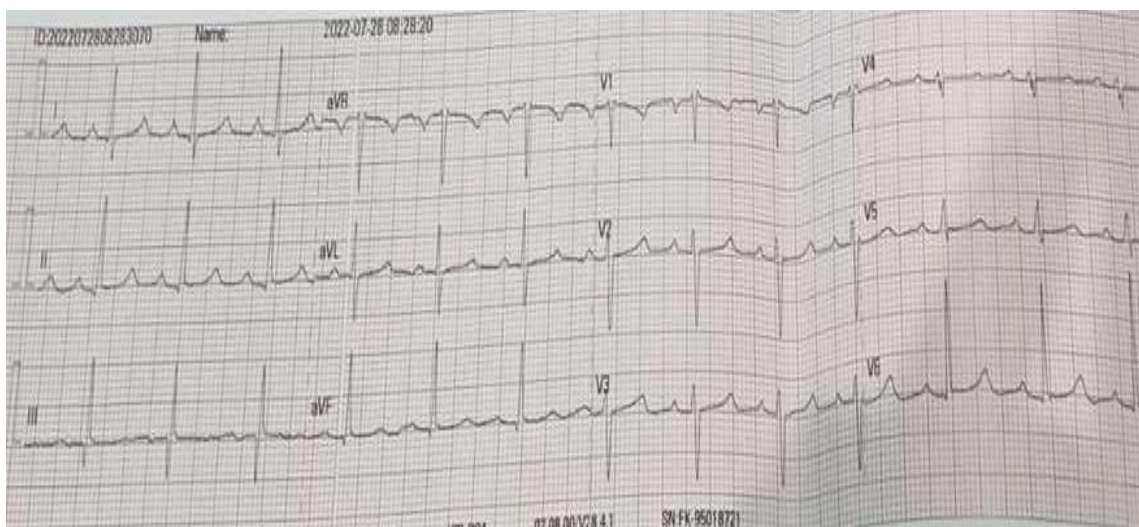


Figure 3. Perioperative Electrocardiogram

Subsequently, the patient was transferred to the operating room with prepared anti-thyroid drug. The patient perioperative condition was stable. Basic monitoring, including BP, HR, ECG, and pulse oximetry was applied. The initial vital signs were as follows: BP 136/78 mmHg, HR 96 beats/min, RR 18-20 times/minutes in a semifowler position, and SpO₂ 95-96% with 3 liters/minutes nasal cannulae oxygenation. After verifying the patient's information, spinal anesthesia was performed in sitting position using 27 G spinal needle insertion at L3-L4 level. Cerebrospinal fluid was checked, after which low dose heavy bupivacaine 0,5% 7.5 mg combination with fentanyl 25 µg and morphin 0.1 mg intrathecally. Approximately a few minutes later, a

sensory block up to the T6 level was confirmed and a C-section was successfully performed with no perioperative complications for the mother and neonate. Hemodynamics during surgery was stable, resulting in the delivery of a preterm baby who weighed 1.9 kg at birth and the baby was transferred to the NICU for further treatment. The patient was transferred to the Intensive Care Unit (ICU) for further observation, where she stayed for 1 day without complications, she was subsequently transferred to general ward. Meanwhile, thiamazole 20 mg daily, propranolol 10 mg t.i.d were administered. The patient was discharged 3 days after surgery without any perioperative complication.

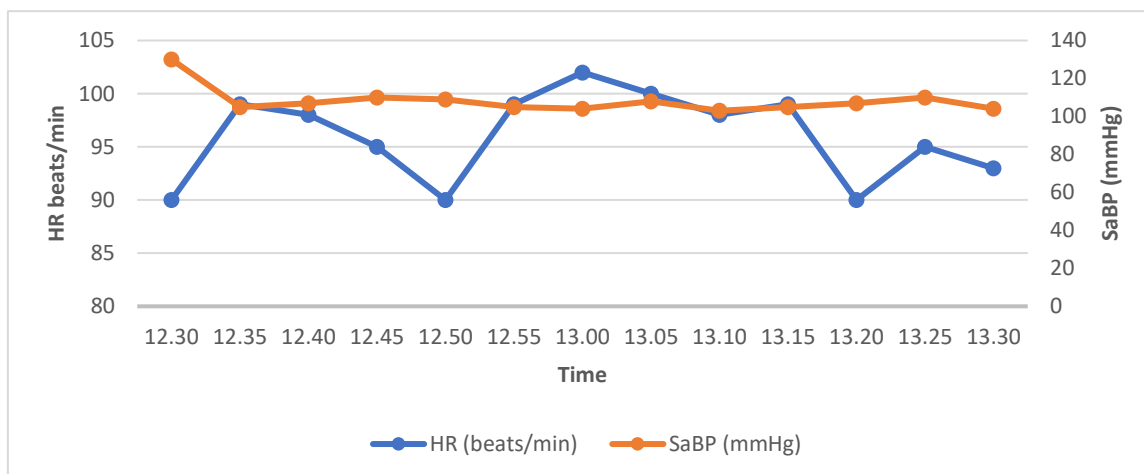


Figure 4. Perioperative systolic arterial blood pressure (sABP) and heart rate (HR). The patient's sABP and HR before and after intrathecal injection are shown. Note that the sABP remained stable, and even decreased following the intrathecal injection. HR remained relatively stable throughout the operation

DISCUSSION

Thyroid Hormone has several effect on the heart including arrhythmia, heart failure, valvular heart disease, and pulmonary hypertension³. In hemodynamics regulation, hyperthyroidism causes elevated preload, heart rate, cardiac output³. Untreated hyperthyroidism can lead to ventricular dilatation, persistent tachycardia, and eventual chronic heart failure⁵. Women with uncontrolled GD are 9.2 times more likely to have neonates with low birth weight compared to non-GD women. Mothers with uncontrolled GD are also 16.5 times more likely to undergo preterm delivery⁶. Study from Shan, et al shows

that during the 5-year study period there is 6 pregnant women that have hyperthyroid heart disease and the number of gestational weeks at delivery varied from 31 + 4 week to 39 + 4 week. Two patient had acute heart failure attacks in the second stage of labour, one had still birth and several heart attack even after delivery, two healthy preterm infants were born vaginally at 33 wk and 36 wk, these two patient did not present any heart failure symptoms during labour, and another patient choose caesarean delivery².

Factors considered to determine the anesthetic technique including maternal hemodynamic status, comorbidities, previous drug use, and

elective/emergency surgery^{7,8}. Here, the patient have uncontrolled hyperthyroidism and severe mitral regurgitation. The anesthetic management must take into consideration of the metabolic changes in the mother and the possibility perioperative thyroid storm and avoiding aggressively hemodynamic changes that can aggravates the work of heart^{4,9}. Heavy bupivacaine 0.5% 7.5 mg with adjuvant fentanyl 25 µg and morphin 0,1 mg using a 27-G needle was inserted in L3-4 intrathecally to the patient.

Early detection of thyroid storm should be known due to possibility rapid deterioration within hours. General anesthesia frequently selected as the method for the patient with uncontrolled hyperthyroidism because it provides adequate sedation and minimal fluctuations of haemodynamics parameter. However, when performing general anesthesia, the endotracheal tube may caused irritation that can stimulates neural and resultantly increases HR and BP. Alternatives method that may be suitable is neuraxial anesthesia since it can be lower HR and BP through sympathetic block, decreases side effects cause by histamin secretion in response to neuromuscular blocking agent

admission, and provide adequate post operative pain control. Considering that surgeries and severe emotional stress are known precipitating events of thyrotoxic storm, shortening the time required for anesthesia and surgery was thought to be important to prevent such a catastrophic event⁴.

Spinal anesthesia is still the first choice for caesarean section due to its deep sensory block as well as fewer side effect to the mother and the fetus.⁽¹⁰⁾ Spinal anesthesia with hyperbaric bupivacaine is the most commonly used anesthetic technique for elective caesarean section and urgent or emergency scenarios due to its simplicity and ease of performance, low cost and quick installation of anesthesia, providing adequate analgesia and muscle relaxation for surgery. However, when used alone, higher dose are required to obtain satisfactory result, and consequently, major adverse events will be raise, such as arterial hypotension and fetal distress^{11,14}. A sudden decrease in preload and afterload due to spinal technique can aggravates the patient condition, so in some literature this technique is contraindicated in patient with heart disease. There are several ways to reduce incidence of post-spinal

anesthesia hypotension such as preloading/coloadng fluids, uterine displacement, use of vasoconstrictor, and the use of low dose bupivacaine technique⁷.

Spinal anesthesia works by inhibiting voltage gated sodium channels on the spinal chord which will affect the motor and sensory impulses of afferent and efferent fibers. This level of blocks depend on the technique, agent and the dosage used. Intrathecal opioids selectively produce an analgesic effect through interaction with opioid receptors and thus can minimize the dosage and supraspinal effects of local anesthetics. The main location of the opioid receptors is in the dorsal horn of the spinal cord, that is in the substantia grisea of the substantia gelatinosa. This is the basis of the anatomy of selective analgesia by intrathecal opioids^{7,12}.

Hydrophilic opioids such as morphine provide excellent selective spinal analgesia because of small volume of distribution and slow clearance from the spinal cord. However, slow spinal cord penetration and prolonged duration in cerebrospinal fluid (CSF) caused by hydrophilicity also results in slow onset, prolonged duration of action, and risk of delayed respiratory depression from

rostral spread in CSF. Lipophilic opioids have a more favorable clinical profile of fast onset, modest duration, and little risk of delayed respiratory depression. Fentanyl is the most commonly used spinal lipophilic opioids¹³. The combination, therefore, is expected to have the advantage of a prompt onset of analgesia and a long action.

Low-dose bupivacaine (< 8 mg) is expected to have minimal effects on hemodynamics of the mother and fetus. The addition of opioids could reduce the dose requirements of local anesthetics and prevent hemodynamic fluctuations and increase the effects of intraoperative and postoperative analgesia. The association of low dose bupivacaine with fentanyl, a lipophilic opioid has been proposed to improve quality of blockade, prolong duration of analgesia and reduce intraoperative nausea and vomiting. Several dose of fentanyl (from 2.5 – 50 mcg) have been described in the literature, and the 25 mcg dose was frequently used in the studies^{7,11,14}.

Low dose hyperbaric bupivacaine combined with fentanyl and morphine provide the adequate block with minimal systemic side effects and preventing hypotension during spinal anesthesia. Study from Isngadi, et al stated that low

doses of hyperbaric bupivacaine combined with fentanyl 50 µg produced adequate blocks with minimal systemic side effects and no vasopressor needed to be used^{7,14-16}. Another study from Semra, et al revealed that the addition of 0.1 mg morphine and 12.5 µg fentanyl to hyperbaric bupivacaine produces good quality of intraoperative and postoperative analgesia¹³.

CONCLUSION

Uncontrolled hyperthyroidism and severe mitral regurgitation in pregnancy is very challenging to perioperative health care provider. Spinal anesthesia with low dose bupivacaine combined with opioid for caesarean section was revealed maternal and neonates safe. This technique is preferable due to its sympathetic block, non-tocolytic effect, and good post-operative analgesia which beneficial to avoid stimulates of thyroid storm.

CONFLICT OF INTEREST

The Authors declare that they have no conflict of interest.

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