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Anesthetic management of a patient with hyperthyroidism due to hydatidiform mole

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Abstract
Secondary hyperthyroidism can often complicate gestational trophoblastic disease, a malignant uterine cancer. We report here the perioperative management of hyperthyroidism due to hydatidiform mole. A 53-year-old woman underwent emergency surgery due to suspicion of hydatidiform mole. Tachycardiac atrial fibrillation was detected by electrocardiography at the preoperative examination. No abnormalities were found in blood count, coagulation, biochemical tests, chest radiographs, or respiratory function. General anesthesia with nitrous oxide, oxygen, and sevoflurane, combined with fentanyl and 1% mepivacaine, was administered intermittently from an epidural catheter. Intraoperative events included hypotension and tachycardia, although in general, tachycardia was prevented with antiarrhythmic agents and transfusion with a plasma expander and crystalloid fluid. Hyperthyroidism was highly suspected from the patient's clinical course and was confirmed by high levels of preoperative serum free triiodothyronine (T3) and thyroxine (T4). The patient became euthyroid within a few days after mole evacuation and did not require an antiarrhythmic agent after her return to the inpatient ward.

Key words Hyperthyroidism · Hydatidiform mole · Human chorionic gonadotropin

Introduction

The incidence of hydatidiform mole is 1.7 per 1000 births in Japan, while the death rate of hyperthyroidism associated with hydatidiform mole is unclear. A delay in surgical resection for trophoblastic disease can result in abnormally high levels of human chorionic gonadotropin (hCG), a hormone with thyroid-stimulating activity, which can lead to hyperthyroidism. Although previous studies reported high incidence rates of hyperthyroidism associated with hydatidiform mole [1,2], improvements in technology have reduced the incidence of this associated hyperthyroidism by making early diagnosis of hydatidiform mole possible. Life-threatening complications of hyperthyroidism, such as thyrotoxic crisis, can occur perioperatively. We report the anesthetic management of a patient with hydatidiform mole who underwent emergency surgery for trophoblastic disease complicated by unexplained rapid atrial fibrillation.

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Case report

A 53-year-old pregnant woman (height, 151 cm; weight, 52 kg) was admitted to the hospital due to complaints of prolonged vaginal bleeding. A blood test revealed abnormally high levels of hCG β-subunit (310 $ng \cdot ml^{-1}$; normal level <0.1 $ng \cdot ml^{-1}$). Pregnancy (tenth week) with hydatidiform mole was suspected from contrast-enhanced computed tomography (CT) images. Total abdominal hysterectomy and oophorectomy under general anesthesia were scheduled for the next day.

Laboratory data showed no abnormalities prior to anesthesia, although rapid atrial fibrillation was detected. Close examination by cardiac ultrasonography revealed no abnormalities in left ventricular function and no left atrial thrombus.

Preanesthetic medication was not administered. Preoperative blood pressure was 135/85 mmHg, heart rate was 120–140 bpm due to rapid atrial fibrillation, respiratory rate was 15 breaths per min, and peripheral oxygen saturation (Sp_{O_2}) was 98% on room air. An epidural catheter was inserted 5 cm from the T12-L1 level in the cephalad direction. Anesthesia was induced with 120 mg of propofol, 100 μg of fentanyl, and 6 mg of vecuronium, followed by tracheal intubation. Immediately after intubation, her heart rate increased to 170 bpm, and systolic blood pressure transiently decreased to the 70-mmHg

Table 1. Perioperative serum free T3, free T4, TSH, and β-hCG levels

Hormone	Normal range	1 Day before surgery	2 Days after surgery	5 Days after surgery	8 Days after surgery	12 Days after surgery	36 Days after surgery	120 Days after surgery
Free T3 ($pg \cdot ml^{-1}$)	2.60–3.77	5.02	3.69	3.41	3.28	2.96	3.26	3.50
Free T4 ($ng \cdot dl^{-1}$)	0.69–1.26	2.35	2.69	1.47	0.95	0.71	1.05	0.98
TSH ($\mu U \cdot ml^{-1}$)	0.373–3.68	0.09	0.014	0.031	0.078	0.296	1.066	1.195
β-hCG ($ng \cdot ml_{-}^{-1}$)	<0.1	310	85			6.9	0.8	0.1

T3, triiodothyronine; T4, thyroxine; TSH, thyroid-stimulating hormone; β-hCG, β-human chorionic gonadotropin

range. Sufficient depth of anesthesia was maintained with nitrous oxide, oxygen, and sevoflurane in order to prevent tachycardia; fentanyl was added appropriately; and 1% mepivacaine was administered intermittently from the epidural catheter. To avoid tachycardia and hypotension, transfusion with a plasma expander and crystalloid fluid was carried out, but no blood products were transfused. Phenylephrine was selected as the vasopressor to avoid tachycardia, and dopamine was infused continuously.

The patient's intraoperative blood pressure was 90–120 mmHg and her heart rate was 80–110 bpm. The surgery was completed without complications. The duration of the surgery was 1 h and 15 min; duration of anesthesia was 2 h and 20 min, total blood loss was 230 g, urine output was 700 ml, and total infusion volume was 3200 ml. The tracheal tube was removed without any agents for the reversal of muscle relaxants and the patient recovered promptly after the withdrawal of nitrous oxide and sevoflurane. At extubation, her heart rate increased to 180 bpm, but systolic blood pressure remained stable at 110–130 mmHg. As heart failure was also suspected, we conducted cardiac ultrasonography, but no abnormalities in wall motion or cardiac chamber size were observed. Verapamil 5 mg, procainamide 200 mg, and digoxin 0.25 mg were used to decrease the heart rate; response to these medications, however, was poor. We refrained from administering a β-blocker, given the lack of problems with urine flow and the stable blood pressure. She maintained a systolic blood pressure in the 120-mmHg range and showed atrial fibrillation with a heart rate of 80–100 bpm.

Because hyperthyroidism was highly suspected from the patient's clinical course, we assessed thyroid function by measuring preoperative serum hormone levels. Hyperthyroidism was confirmed with levels of 5.02 pg/ml for free triiodothyronine (T3), 2.35 ng/dl for free thyroxine (T4), and 0.09 μU/ml for thyroid-stimulating hormone (TSH). Levels of free T3 and T4 rapidly decreased after surgery. Free T3 normalized the day after the surgery, free T4 normalized 8 days postoperatively, and TSH normalized 36 days postoperatively. Levels of hCG β-subunit decreased steadily and were normalized 120 days postoperatively (Table 1).

Atrial fibrillation was detected by postoperative electrocardiography, but no oral medication was administered. The patient did not present with subjective symptoms (e.g., palpitation), given her stable heart rate in the 70-to 80-bpm range, and no abnormalities were detected by cardiac ultrasonography.

Discussion

The first report of hyperthyroidism due to hydatidiform mole was in 1955 [3]. Since then, there have been similar reports of trophoblastic tumors. In the present patient, the hyperthyroidism was likely induced by hCG [4] released by the tumor. The release of hCG is dramatically increased in trophoblastic diseases, including hydatidiform moles. The hCG molecule consists of α and β subunits; the α-subunit is identical to TSH and the β-subunit has a similar structure to TSH. Because hCG and TSH receptors are similar, hCG can act directly on TSH receptors in the thyroid [5,6]. This results in an increased level of thyroid hormone and decreased TSH levels.

The most important aspect of the perioperative management of hyperthyroidism is the prevention of thyrotoxic crisis. In patients with hyperthyroidism, surgery is generally performed after the administration of preoperative medication to normalize thyroid function. However, surgical resection is indicated for hyperthyroidism due to hydatidiform mole, given that tumor removal leads to rapid resolution of the symptoms, as was seen with the present patient [7,8]. Individuals with hydatidiform mole who have not been diagnosed with hyperthyroidism are at higher risk of thyroid crisis during emergency surgery, which can be fatal during the perioperative period, due to a delay in preventive treatment [9].

Only few reports exist on the anesthetic management of patients with hydatidiform mole complicated by hyperthyroidism. However, a case associated with thyrotoxic crisis after surgery [9], a case in which spinal anesthesia was selected rather than general anesthesia [10], and a case in which total intravenous anesthesia combined with a β-blocker was employed

for anesthetic management [11] have been reported previously.

Crucial to anesthesia management is the perioperative control of sympathetic stimulation secondary to hyperthyroidism. Balanced anesthesia with a combination of inhalation anesthetic or intravenous anesthetic with an opioid, nitrous oxide, muscle relaxant, and epidural anesthesia is desirable to secure sufficient analgesia and sedation. For inhalation anesthetics, sevoflurane should be used rather than isoflurane, as sevoflurane augments the sympathetic response to surgical stimulation to a lesser degree than isoflurane [12]. Notably, because both sevoflurane and isoflurane augment the sympathetic response [13], it is best to use small amounts of these agents. Another option is the continuous infusion of propofol, which suppresses the sympathomimetic effect to an even greater degree [14]. To treat tachycardia, it is important to maintain circulating blood volume with sufficient fluid and blood infusion, and also to correct electrolyte imbalance. Hyperthyroidism was not diagnosed preoperatively in our patient. Nevertheless, perioperative hemodynamics were kept stable by the adequate control of sympathetic nervous system activation together with surgical stimulation through balanced and epidural anesthesia. In this patient, we were unable to control tachycardia at the time of intubation and extubation.

Although we did not take this approach, the continuous intravenous infusion of a short-acting β-blocker is very effective as an antiarrhythmic agent to suppress tachycardia associated with hyperthyroidism [11,15]. Furthermore, as cortisol can inhibit the conversion of T4 to T3 [16], its use may be another option in the event of emergency surgery.

In the present patient, hemodynamics stabilized quickly after tumor removal. However, as a previously reported case of hydatidiform mole associated with hyperthyroidism involved a patient who developed thyrotoxic crisis [9], perioperative management should be continued with meticulous attention to the patient's hemodynamics and respiratory condition.

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