Emergency Laparotomy in Uncontrolled Thyrotoxic Patient with Preoperative Fulminant Hepatic Failure

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Acute stress of anesthesia and surgery can precipitate thyroid crisis postoperatively in uncontrolled thyrotoxic patients. Preexisted liver dysfunction may also be aggravated in the postoperative period. Uncontrolled thyrotoxic patient developed fulminant hepatic failure, and during the course she suffered acute panperitonitis due to upper gastrointestinal tract perforation and underwent emergency laparotomy. We describe our perioperative management of this patient.

Case Report

A 31-year-old female with a history of eleven years of Graves' disease was admitted with a complaint of general fatigue. Thyrotoxicosis was treated with antithyroid drugs when she was 20 years old, but she discontinued taking the drugs at the age of twenty-one. Ten days before the admission, the patient had symptoms of common cold and had taken some over-the-counter antipyretics. On admission, she was somnolent but oriented; height 155 cm, weight 42 kg, pulse 120 beats·min^{-1} in atrial fibrillation, blood pressure 174/32 mmHg and temperature 38.5°C. Prominent jaundice, diffuse goiter and a fine finger tremor were noted. Laboratory findings were; WBC 13,000 mm^{-3}, Hemoglobin 13.9 g·dl^{-1}, T.Bil 32.5 mg·dl^{-1}, D.Bil 21.9 mg·dl^{-1}, GOT 40 IU·l^{-1}, GPT 45 IU·l^{-1}, ChE 32 IU·l^{-1}, CK 163 IU·l^{-1}, CK-MB 73 IU·l^{-1}, NH_3 125 μg·dl^{-1}, glucose 187 mg·dl^{-1}, prothrombin time (PT) 24.1 sec (control; 12.1 sec), activated partial thromboplastin time (APTT) 35.6 sec (control; 32.1 sec), hepaplastin test 7% (normal range; 70–140%), free T_3 8.5 pg·ml^{-1} (normal; 2.7–5.9 pg·ml^{-1}), free T_4 5.1 ng·dl^{-1} (normal; 0.6–2.3 ng·dl^{-1}). Plain X-ray of chest and abdomen showed intraperitoneal free air. Diagnosis of acute panperitonitis due to possible upper gastrointestinal tract perforation was made. Emergency lapatoromy was deemed necessary as a life-saving measure.

Plasmapheresis was performed prior to the operation. Forty minutes after initiation of plasmapheresis, the patient complained of severe upper ab-

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dominal pain and 15 mg of pentazocine was administered i.m. by an internist. At the end of plasmapheresis, 20 mg of methimazole i.v. and 10 drops of Lugol's solution were given.

No preanesthetic medication was given. On arrival in the operating room, the patient was drowsy but responsive. Blood pressure was 170/80 mmHg and cardiac rhythm was atrial fibrillation with a rate of approximately 130 beats·min^{-1}. Electrocardiogram (ECG), body temperature, blood pressure (both non-invasive and direct radial arterial), pulse oximetry, rectal temperature, and urine output were monitored. Anesthesia was induced with 300 μg of fentanyl, 50 mg of thiopental and 8 mg of vecuronium, and the patient was intubated with a cuffed oro-tracheal tube. Anesthesia was maintained with isoflurane and nitrous oxide in 50% oxygen. Propranolol 0.6 mg was administered i.v. to control the ventricular response of atrial fibrillation. Perforated duodenal ulcer was sutured directly. Pathological finding of liver biopsy was later found to be compatible with that of fulminant hepatitis. Intraoperative course was stable with a blood pressure between 110/60–150/80 mmHg, a heart rate of 100–120 beats·min^{-1}, and temperature 36.5–37.0°C.

Plasmapheresis was performed for five consecutive days postoperatively. Sixty mg of methimazole was given i.v. daily. Tachyarrhythmia was controlled with digoxin 0.125 mg daily and a continuous infusion of propranolol at a rate of 1–2 mg·hour^{-1}. The patient was mechanically ventilated for eight days postoperatively. Sedation was provided with an i.v. infusion of flunitrazepam (6 mg·day^{-1}), buprenorphine (0.6 mg·day^{-1}), and haloperidol (15 mg·day^{-1}). Infusion of sedatives was discontinued on the morning of 7th postoperative day (POD). The patient awoke gradually and resumed spontaneous ventilation. She was weaned from artificial ventilation on the following day (8th POD) and was extubated. But two hours after extubation, she complained of dyspnea and produced copious amount of frothy sputum. She was immediately re-intubated. Hourly urine output decreased from 90 ml·hour^{-1} to 30 ml·hour^{-1} and a pulmonary artery catheter was introduced for evaluation of cardiovascular status. Her cardiovascular system was hyperdynamic with a cardiac index of 7.0 l·min^{-1}·m^{-2} and a pulmonary capillary wedge pressure of 11 mmHg. The patient was re-sedated, 20 mg of furosemide was given for diuresis and weaned from mechanical ventilation on 14th POD. The patient was discharged from ICU on 16th POD and moved to the medical ward.

Discussion

There are reports of concomitant liver dysfunction in thyrotoxic patients[1]. Those are usually autoimmune hepatitis and the principal change of laboratory findings are moderate increase of hepatic enzymes. In our patient, however, change of hepatic enzymes were minimal and severe jaundice with depressed protein-synthetic function was the prominent finding. Therefore, we considered that acute liver failure in this patient was different from an autoimmune-type hepatitis in thyrotoxic patients.

In order to control thyrotoxic symptoms, we used intravenous propranolol. This patient's ECG upon admission showed atrial fibrillation with a rapid ventricular response and ST depression, T wave inversion in precordial leads. Preoperative CK and CK-MB values were both moderately increased. Because of this patient's age and sex, existence of significant coronary artery disease in this patient was unlikely and the ECG change might reflect thyrotoxic cardiomyopathy. Pa-

tients with fulminant hepatic failure are prone to develop hypoglycemia, due to diminished hepatic glycogen reserves and impaired gluconeogenesis. Frequent blood glucose measurement is necessary because beta-blockers may potentiate the action of insulin and also mask the clinical manifestation of hypoglycemia.

Antithyroid drugs such as methimazole and propylthiouracil are the standards for preoperative management for thyrotoxic patients undergoing elective thyroidectomy. Both drugs are removed from plasma by plasmapheresis, so we administered methimazole i.v. at the end of plasmapheresis. Propylthiouracil has the advantage of being able to inhibit the peripheral conversion from T_4 to more physiologically active T_3[2]. But as this patient had an acute abdomen and propylthiouracil was not available in an injectable form, so methimazole was administered instead.

The effectiveness of plasmapheresis as a treatment of thyrotoxicosis, especially patients with ophthalmopathy, is already reported[3,4]. Plasmapheresis has also been used successfully to remove thyroid hormones and thyroid binding globulin in thyroid storm[5,6].

Thyrotoxic patients are usually given heavy premedication to reduce their anxiety and sympathetic nervous system hyperactivity[7]. On the other hand, use of central nervous system depressants are relatively contraindicated in patients with acute liver failure and obtunded consciousness. Depressed level of consciousness in this patient may have delayed the diagnosis of upper GI tract perforation.

As for intraoperative management, it was important to avoid drugs that could stimulate sympathetic nervous system and also drugs that could lower hepatic blood flow. Combination of fentanyl and low-dose isoflurane worked well from the standpoint of hemodynamic indices. Percentage of isoflurane metabolized in the body is the lowest among three available anesthetic vapors and it seems to be the drug of choice for patients with preoperative liver dysfunction. Inhalational anesthetics may show hepatotoxicity in triiodothyronine pre-treated animals[8]. Although its clinical implication is not clear, we should keep in mind the possible increased organ toxicity of inhalational anesthetic in thyrotoxic patients. Pancuronium was avoided because of its sympathomimetic activity. Although vecuronium is metabolized in the liver and excreted mainly in the bile, we were not concerned with its prolonged effect[9], because this patient was considered to require postoperative mechanical ventilation. As for intraoperative monitoring, end-tidal CO_2 monitoring is particularly useful because intraoperative thyroid storm can sometimes mimic malignant hyperthermia[10]. In the patients with possible cardiac dysfunction, invasive monitoring of ventricular filling pressures are necessary but requires meticulous attention when inserting central venous or pulmonary artey catheters because of concomitant coagulopathy.

During postoperative ventilation, this patient was sedated with continuous infusion of flunitrazeapm, buprenorphine and haloperidol. Thiobarbiturates have intrinsic antithyroid activity and theoretically, it might be the better sedative in thyrotoxic patient[7].

The patient developed pulmonary edema after extubation and required re-intubation. She was not yet euthyroid, and acute increase in heart rate after extubation might have decreased diastolic cardiac filling and have caused left ventricular dysfunction. The patient was successfully weaned from artificial ventilation on 14th POD, after her hyperdynamic cardiovascular status was controlled with propranolol.

The administration of beta-blockers requires careful hemodynamic monitoring in thyrotoxic patients because it may sometimes precipitate overt cardiac failure[11,12]. In the presence of continuous beta-blockade, we advocate the use of pulmonary artery catheter as a measure to evaluate cardiovascular status.

Other therapeutic measures for thyrotoxicosis and hepatic failure were mostly of supportive ones. Critical patients are prone to develop stress-induced gastric ulcer and prophylactic administration of histamine H_2-blocker is recommended. Cimetidine has been stated that it significantly decreases total hepatic blood flow and inhibits hepatic clearance of several drugs, such as propranolol[13,14]. Propranolol is extensively metabolized in the liver and in the presence of severe hepatic dysfunction and cimetidine, steady-state plasma concentration may reach very high level after usual dosage. Therefore famotidine was administered instead of cimetidine in the ICU.

In conclusion, we described our management of patient who underwent emergency laparotomy complicated with uncontrolled thyrotoxicosis and hepatic failure. Preoperative plasmapheresis might have had some beneficial effect for rapidly decreasing elevated thyroid hormones.

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