

## Management of a hyperthyroid dental patient utilizing general anesthesia

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### Abstract

*A case is presented in which a hyperthyroid patient is treated in the operating room under general anesthesia. Preoperative, surgical and postoperative management is presented to demonstrate the multitude of factors to be considered in providing treatment for the hyperthyroid patient. The thyroid storm is a potentially fatal complication and is a risk to any thyrotoxic patient under stress. This case is significant in that it demonstrates the importance of understanding the medical conditions of our patients in order that we can provide safe and effective dental treatment.*

### Introduction

The hypermetabolic state of a hyperthyroid patient results in an increased risk during dental procedures requiring general anesthesia. The principles of managing these patients include obtaining an accurate medical history; coordination of care with the physician to bring the patient to an euthyroid state prior to surgery; monitoring of the patient's heart rate, blood pressure and core body temperature during the procedure; and insurance that an adequate airway is maintained throughout the procedure and in the immediate postoperative period. Thyroid storm is a potentially fatal complication which must be prevented or managed immediately upon recognition with a beta blocking agent and general supportive measures.

### Case Report

A 15-year-old well-nourished, well-developed, black female was referred from the Children's Hospital En-

docrine Clinic to the Division of Pediatric Dentistry for evaluation and treatment of severe caries and facial pain. A review of her medical history revealed that she was being treated for Graves disease, which had been diagnosed three years prior to this visit. She also had a history of mild bronchial asthma, sickle cell trait, mild scoliosis, and osteomas which had been removed from her frontal sinus 18 months and 6 months prior to this visit. The scoliosis had self-corrected and she had never been hospitalized for an asthmatic attack. Her current medications were propylthiouracil 150 mg. three times a day and aminophylline 250 mg. as needed for wheezing.

Panoramic and bite wing radiographs were obtained revealing multiple decayed and impacted teeth. The patient was extremely nervous and restless during the interview and radiographs. During the course of the clinical exam she began crying and resisting examination. As we were completing the intraoral examination she fell to the floor and began crying hysterically. At this time, we stopped our examination, engaged the patient in quiet conversation, and slowly overcame her fear by again explaining and demonstrating what we were doing and the instruments we were using. She returned to the dental chair and we were able to complete our examination without further incident. It was decided that due to the extent of the dental disease, the urgent need for treatment, the patient's medical status, and inability to cooperate, she would be best managed in the controlled environment of the operating room under general anesthesia.

Four days prior to the scheduled procedure, the patient was brought to the Endocrine Clinic to evaluate her current medical status, to determine her thyroid hormone levels, and to evaluate her readiness for surgery.

The patient was admitted the day before surgery. Her status at the time of admission was as follows:

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Height	156.8 cm	T3 RIA	253 (90-220 normal)
Weight	55.0 kg	Prothrombin time	11.6 (control 10.5)
Temp.	98.9	WBC	4.6 x 10 <sup>3</sup>
Respiration	24	Rbc	5.15 x 10 <sup>6</sup>
Pulse	90	Hgb	12.2 gm
B.P.	100/82	Hct	38.5%

Though the T<sub>3</sub> level was elevated, it was decided to proceed with surgery as this was the level at which the patient was normally maintained.

The patient was N.P.O. from midnight the night before the procedure. She received her normal doses of propylthiouracil the day before and the morning of surgery. One hour before the start of the procedure, she received 10 mg. of diazepam orally for sedation, along with her second daily dose of propylthiouracil, which would be due during the procedure.

The patient was brought to the operating room and placed in the supine position with a cooling mattress in place. An I.V. of 5% Dextrose in Isotonic saline (D-5W IMB) was started. Anesthesia was induced with thiopental 250 mg. and maintained with nitrous oxide, oxygen and halothane. The anesthesiologist constantly monitored heart rate, blood pressure, and esophageal core body temperature throughout the operation.

The procedure consisted of multiple two and three surface amalgam and composite restorations, one anterior root canal with apicoectomy, the extraction of nonrestorable teeth and the removal of three soft tissue impacted third molars. The procedure was well tolerated by the patient.

In the immediate postoperative period, the patient was closely monitored for airway obstruction, heart rate, temperature, and routine vital signs along with normal postsurgical supportive care. To insure close observation and immediate emergency treatment if needed, the patient remained in the recovery area until the following morning. Propranolol hydrochloride was available at bedside at all times. The patient's postoperative course was uneventful and she was discharged the following day. She was examined in the dental department ten days after surgery at which time she was cooperative but very apprehensive. No further pain or swelling was reported and the surgical areas were healing well. The patient was placed on a three month recall.

## Discussion

The thyroid gland secretes two biologically active hormones L-Thyroxin (T-4) and L-Triiodothyronine (T-3) which are the most important metabolic regulators of the body, and which have widespread effects on organ, cellular, subcellular, and enzymatic processes.<sup>1,2</sup> Graves disease or hyperthyroidism is a hyper-

metabolic disorder resulting from excessive secretion of thyroid hormone. Synonyms include: diffuse or nodular toxic goiter, Plumer's or Parry's disease, exophthalmus goiter, and thyrotoxicosis. Graves disease is the most common form of hyperthyroidism and consists of a classic triad of diffuse thyroid hyperplasia, hyperthyroidism and ophthalmopathy. The disease affects females four times more often than males, and most often arises between the ages of 20-40 years.<sup>3</sup>

**T**he clinical signs and symptoms of hyperthyroidism may include nervousness, tension, inability to relax, purposeless activity, and crying spells. Sweating is continuous, the skin warm and the patient is unable to tolerate heat. There is increased blood volume, erythrocyte mass and peripheral blood flow in order to satisfy the increased tissue requirements for oxygen. The heart rate, volume output, coronary blood flow, oxygen consumption, peripheral blood flow and plasma volume all increase, while the cardiac efficiency and peripheral vascular resistance decrease. The systolic blood pressure increases and the diastolic decreases. The patient may lose weight despite increased caloric intake and experience fatigue along with muscle weakness. The thyroid gland is enlarged with bruits present, eyelids may be retracted and exophthalmus present. Nausea and vomiting may be present along with hyperdefecation due to exaggerated peristalsis and increased smooth muscle tone.<sup>3,4,5</sup> While not all of these symptoms will be present in all patients, the occurrence of a number of them in a single patient should alert the dentist to proceed carefully and be aware of the possibility of Grave's disease.

The altered metabolic and physiologic state of the hyperthyroid patient can result in potentially serious complications during surgery and in the immediate postoperative period. These patients should be brought as close as possible to an euthyroid state prior to surgery by antithyroid medication. In spite of adequate preparation, the complications may still arise and should be considered, prepared for, and managed when necessary.

Most of the serious complications during anesthesia for the hyperthyroid patient are likely to be circulatory in nature. The increased cardiac output, tachycardia, systolic hypertension, red blood cell mass and volume, all contribute to increased cardiac work. Under anesthesia and during surgery this may lead to arrhythmias and pulmonary edema from which the

heart may be unable to recover due to its already elevated work load.<sup>6,7</sup>

The elevated oxygen consumption coupled with short bouts of inadequate alveolar ventilation can result in a rapid fall in oxygen tension and elevation in carbon dioxide tension, leading to respiratory acidosis. An adequate airway and pulmonary ventilation with oxygen must be maintained without interruption throughout the procedure and in the immediate post-operative period.<sup>6,7</sup>

The hypermetabolic state of the patient leads to increased heat production, sweating, and heat loss. Atropine is to be avoided, as it inhibits heat loss, as are thick surgical drapes, unless a cooling mattress is used. Adequate I.V. fluids and electrolytes must be provided to allow for perspiration and increased urine output. Constant monitoring of the patient's core body temperature is essential.<sup>6,7</sup>

The exophthalmus present in these patients requires that an extra effort be made to cover the eyes to prevent injury from debris and aerosol during the procedure.

Many hyperthyroid patients will be taking propylthiouracil to inhibit the synthesis of excessive thyroid hormone. Because this drug may cause agranulocytosis, hypoprothrombinemia, and bleeding, prothrombin time should be determined before any surgical procedure.<sup>8</sup>

In the immediate postoperative period, along with routine postsurgical care, it is important that the patient has an adequate airway and adequate oxygenation of the tissues.

The thyroid crisis, or storm, though rare today except in the undiagnosed hyperthyroid patient, must be considered due to its potentially fatal nature.<sup>9</sup> The crisis may follow severe infection, stress, or other illness in untreated or inadequately treated hyperthyroid patients. The thyroid crisis is a life threatening (25-50% end in death), fulminating exacerbation associated with marked tachycardia above 140/min., high fever up to 107°, and vascular collapse. The onset may be sudden, starting with high fever, tachycardia, and/or atrial fibrillation, drenching sweats, extreme hyperkinesia verging on hysteria, marked tremors, vomiting and diarrhea leading to dehydration, coma and death, if untreated.<sup>7,9,10</sup>

Treatment consists of general supportive measures including replacement of fluids, glucose, and electrolytes; efforts to reduce the secretion and production of thyroid hormones with high doses of propylthiouracil (600-1000 mg.) or methimazol (60-100 mg.), along

with medication to diminish the metabolic effects of thyroid hormones. This can be accomplished by agents which deplete the catecholamines or by beta-adrenergic blockers. Propranolol hydrochloride, a beta-adrenergic block agent, is the drug of choice. It controls the cardiac and psychomotor manifestations of thyrotoxicosis within 2 to 10 minutes when given I.V. at a rate of 1 mg. per minute until the crisis is controlled. The total dose is to 10 mg. The propranolol hydrochloride has no effect on thyroid hormone production or the course of ophthalmopathy.

## Conclusion

The thyroid storm carries a high mortality rate and is a risk to any thyrotoxic patient under stress. Therefore, the best treatment is to prevent the occurrence by bringing all thyrotoxic patients to an euthyroid state prior to surgery. The survival of a thyroid storm depends on early treatment after recognition as well as alleviation of the underlying illness.<sup>9</sup>

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