

甲狀腺風暴

Thyroid storm

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Thyroid storm (TS), or decompensated thyrotoxic crisis, is a life-threatening complication of severe thyrotoxicosis. The distinction between TS and compensated thyrotoxicosis is **clinical**, since thyroid function test abnormalities are similar in these two situations. In addition to typical manifestations of thyrotoxicosis, including palpitations, tremor, and nervousness, TS is accompanied by other clinical features, such as fever, acute altered mental status, diarrhea, vomiting, hepatitis, arrhythmia, and congestive heart failure. Mortality remains >10% even under best supportive care.

Besides lowering thyroid hormone levels, the systemic multiorgan involvement needs to be taken care of and treated. Fever should be treated with acetaminophen, as **aspirin** at high dosages can displace thyroid hormone from thyroxine-binding globulin, thus increasing fT4. Cooling blankets, alcohol sponging, and ice packs may be needed. Judicious intravenous fluids with dextrose help to replenish glycogen stores. Cardiac arrhythmias and congestive heart failure need aggressive treatment. If arrhythmias are present, **amiodarone** may be a preferred therapy, as its high iodine content and ability to block thyroid hormone release (Wolff-Chaikoff effect) and peripheral conversion are beneficial. Underlying precipitants should be identified and treated, and infection should be ruled out by a chest radiograph, urinalysis, and blood/urine cultures. Treatments for suppression of thyroid hormone synthesis include preventing T4 and T3 release from the thyroid, inhibition of peripheral conversion of T4 to T3, and blocking the action of thyroid hormone on target organs. Thionamides, *e.g.* **propylthiouracil (PTU)** and **methimazole** or **carbimazole**, inhibit thyroid hormone synthesis, may also have immunomodulatory effects. Because PTU inhibits peripheral conversion of T4 to T3 and methimazole does not, PTU has been favored for treatment of thyroid storm in the past. However, due to the longer half-life of methimazole or carbimazole, and the use of other agents in thyroid storm that prevent peripheral conversion of T4 to T3, many clinicians now prefer methimazole. Either high doses of methimazole or carbimazole, 20 to 30 mg every 6 hours, or PTU 200 to 400 mg every 4 to 6 hours orally or through the nasogastric tube should be started immediately until the patient's thyroid function and clinical condition is improving. High dose **iodine** inhibits iodine organification in the thyroid (Wolff-Chaikoff effect) and may be given as a **saturated solution of potassium iodide (SSKI)**, up to five drops every 6 hours, or **diluted Lugol's**

solution, up to eight c.c. every 6 to 8 hours. Iodine should be given only after anti-thyroid medication has been started at least one hour before. In patients allergic to thionamides or iodine, **lithium** may be given at a dose of 300 mg every 8 to 12 hours; lithium levels require close monitoring. When antiarrhythmic is indicated, **amiodarone**, which contains 37.3% iodine by weight, inhibits thyroid hormone release, and blocks conversion of T4 to T3, may be desirable. Peripheral conversion of T4 to T3 should be inhibited in TS and may be accomplished with PTU, as well as glucocorticoids, such as **hydrocortisone** 100 mg every 8 hours, or **dexamethasone** 4 mg every 12 hours. Steroid breakdown is accelerated in thyrotoxicosis, high doses of hydrocortisone should be given for several days prior to tapering, with potential benefit of treating the relative adrenal insufficiency in TS. β -Blockade antagonizes the effects of T3 on the heart and sympathetic nervous system. Non-selective **propranolol** inhibits T4 to T3 conversion, is given at oral doses of 10 to 40 mg every 4 to 6 hours with titration. Intravenous cardio-selective β -blockers **esmolol** may be considered due to its short half-life and ability to be rapidly titrated. Cardio-selective β -blockers, such as **atenolol**, **bisoprolol**, and **metoprolol** are recommended as the first-line agents to treat tachycardia in TS; while non-selective β -blocker **propranolol**, though not contraindicated, is not recommended for the treatment of tachycardia in TS with CHF because of potential increase in mortality. **Cholestyramine** reduces enterohepatic thyroid hormone absorption but may also interfere with absorption of several other medications. Treatments of last resort include **plasmapheresis** or emergency **thyroidectomy**, which is avoided if possible because of substantial perioperative mortality.