

THYROID STORM

See also Hyperthyroidism (Pregnant), Thyroid Storm (Peds)

Background

1. Definition

- Acute, life-threatening state produced by excessive quantities of endogenous or exogenous thyroid hormone
- Pronounced hyperthyroidism

2. Resource

- American Thyroid Association: www.thyroid.org

Pathophysiology

1. Pathology

- Infection, trauma, surgery, or radioiodine treatment precipitates severe thyrotoxicosis in pts. with untreated or partially treated hyperthyroidism
- Physiology uncertain
 - Possible stress-related increase in free thyroid hormone from decreased binding proteins

2. Incidence/prevalence

- 1-2% of pts. with hyperthyroidism
- Occurs in < 10% of patients hospitalized with thyrotoxicosis

3. Risk factors

- Untreated or partially treated Graves' dz or multinodular goiter, solitary toxic adenoma
- Stress: infection, trauma, surgery (thyroid & non-thyroid), DKA, radiation, parturition, MI, pulmonary embolism
- Iodine (amiodarone, radiocontrast material), pseudoephedrine or salicylate use, discontinuation of any thyroid meds
- Low socio-economic status¹
- Young women highest prevalence

4. Morbidity/mortality

- Mortality: Up to 30% if untreated

Diagnostics

1. History

- A clinical diagnosis
 - Labs are used to confirm/investigate precipitating factors
- Signs and symptoms
 - Fever, heat intolerance, hyperhidrosis, marked anxiety/agitation, confusion, psychosis, weakness, muscle wasting, palpitations, hepatic failure, diarrhea, nausea, vomiting, palpitations, dyspnea, chest pain, oligomenorrhea, hair loss, weight loss,
- May lead to CNS depression, coma, pulmonary edema
- Elderly pts.
 - Tachycardia, CHF, change in mental status, weight loss, weakness, syncope

2. Physical exam

- Fever (104-106°F),

- Tachycardia (>140 beats/min)
 - jaundice, spider angiomas, dermal myxedema (Grave's), warm skin
 - Lid lag, lid retraction, proptosis, ophthalmoplegia,
 - Goiter, neck tenderness, thyroid nodule,
 - Gynecomastia,
 - Bruit, pericardial rub, evidence CHF, pericardial rub
 - Weakness, muscle wasting, tremor, hyperreflexia
 - Altered mental status (eg, psychosis, coma, seizures)
 - Other signs of precipitating factors (eg, infection, trauma)
3. Diagnostic testing
- Laboratory tests
 - TSH (low),
 - Thyroid values not significantly different from uncomplicated hyperthyroidism
 - If TSH normal, no further testing
 - If TSH abnormal: Check T4 and resin uptake ratio (RU), calculate free thyroid index (FTI): T4 X RU
 - To rule out other serious conditions (eg sepsis)
 - CBC w/diff, BMP, calcium, LFTs, cardiac enzymes, blood and urine cultures, urine tox
 - Imaging
 - EKG (sinus tach, a fib), CXR
 - Thyroid sono with Doppler: assess vascularity, gland size, nodules
 - Nuclear MRI with radioactive iodine uptake: urgent evaluation only
4. Diagnostic Criteria
- General Information
 - Point system based on dysfunction of various body systems
 - Scoring
 - > or = 45 points: highly suggestive of thyroid storm
 - 25-45 points: supports diagnosis of thyroid storm
 - < 25 points: thyroid storm unlikely
 - Categories
 - Thermoregulatory dysfunction
 - Temperature
 - 99-99.9°F: 5 points
 - 100-100.9°F: 10 points
 - 101-101.9°F: 15 points
 - 102-102.9°F: 20 points
 - 103-103.9°F: 25 points
 - > or = 104°F: 30 points
 - Cardiovascular dysfunction
 - Tachycardia
 - 90-109: 5 points
 - 110-119: 10 points
 - 120-129: 15 points
 - 130-139: 20 points
 - > or = 140: 25 points
 - Congestive heart failure
 - Absent: 0 point

- Mild: 5 points
 - Pedal edema
- Moderate: 10 points
 - Bibasilar rales
- Severe: 15 points
 - Pulmonary edema
- Afib
 - Absent= 0 points
 - Present= 10 points
- Precipitating event
 - Negative: 0 points
 - Positive: 10 points
- Central nervous system effects
 - Absent: 0 point
 - Mild: 10 points
 - Agitation
 - Moderate: 20 points
 - Delirium, psychosis, extreme lethargy
 - Severe: 30 points
 - Seizure, coma
- Gastrointestinal/hepatic dysfunction
 - Absent: 0 point
 - Moderate: 10 points
 - Diarrhea, nausea, vomiting, abdominal pain
 - Severe: 20 points
 - Unexplained jaundice

Differential Diagnoses

1. Psychiatric illness
2. Alcohol or drug withdrawal
3. Pheochromocytoma
4. Metastatic neoplasm
5. Infectious disease

Therapeutics

See also hyperthyroidism: general

1. Treat any underlying disorder (eg, infection)
2. Order of medications important: thionamide (PTU, methimazole) before iodine to avoid stimulation of new thyroid hormone production
3. Medications (higher and more frequent doses needed)
 - Adrenergic control
 - Propranolol: 1 mg/min IV until heart rate slows
 - Concurrent propranolol: 60-80 mg PO or per NG q 4 hr
 - Contraindicated in asthma, caution in CHF
 - Esmolol: 250-500 mcg/kg load, 50-100 mcg/kg/min; titrate to heart rate
 - Thyroid control
 - Inhibit thyroid hormone synthesis
 - Propylthiouracil: 200 mg PO or per NG q 4 hr (blocks peripheral conversion T4 to T3)

- Methimazole: 20-30 mg PO or per NG q 6-12 hr tapering to 5-15 mg qD
- Inhibit conversion T4 to T3 (give 1 hr after propylthiouracil or methimazole)
 - Iopanoic acid: 0.5-1 mg PO qD (not available in the United States)
 - Sodium iodide: 0.5-1 g IV q 12 hr
 - Potassium iodide: 5 gtt PO q 8 hr
 - Lugol's solution: 10 gtt PO q 8 hr
- Hydrocortisone: 100 mg IV q 8 hr
 - Blocks T4 to T3 conversion, adrenal support, controls Graves' dz
 - Avoid in non-life threatening hyperthyroidism

4. Supportive therapy

- ICU monitoring & care
- Acetaminophen: 325-650 mg PO/PR q 4 hr for fever
 - Avoid aspirin (increases free T4 and T3)
- Treatment of precipitating factors
 - Antibiotics if infection suspected
- Treatment for CHF or afib
 - Higher doses of meds often needed
- Volume resuscitation
- Diuresis for CHF

Follow-Up

1. Evaluation of precipitating factors
2. Adjustment of thyroid meds

Prognosis

1. Good if recognized and treated immediately

Prevention

1. Elimination of precipitating factors
2. Management of hyperthyroidism and thyrotoxicosis

References

1. Sherman, SI, Simonson, L, Ladenson, PW. Clinical and socioeconomic predispositions to complicated thyrotoxicosis: a predictable and preventable syndrome? *Am J Med* 1996; 101:192.

Author: Laurence Biro, MD, Trillium Health Care, ON, CA

Editor: Kara Cadwallader, MD, Rural FMR of Idaho, ID