

Thyroid Emergencies in the Hospital Setting

Thyroid emergencies, including severe hypothyroidism, hyperthyroidism, myxedema coma, and thyrotoxicosis, are life-threatening conditions requiring rapid recognition and management in the hospital. This pamphlet provides students with a guide to recognize, diagnose, and treat these emergencies, including when to consult endocrinology, with clinical scenarios to apply the knowledge.

Clinical Presentation

Severe Hypothyroidism:

- o **Symptoms:** Fatigue, cold intolerance, weight gain, constipation, dry skin, hair loss, bradycardia, delayed reflexes; often insidious onset.
- o **Triggers:** Noncompliance with levothyroxine, recent thyroidectomy, amiodarone, lithium, or iodine exposure (e.g., contrast dye).
- o **Vitals/Exams:** Bradycardia (HR <60 bpm), hypothermia (<36°C), hypotension, periorbital edema, non-pitting edema (myxedema), hoarse voice.

Myxedema Coma:

- o **Definition:** End-stage severe hypothyroidism with multiorgan dysfunction; mortality 30-60% if untreated.
- o **Symptoms:** Altered mental status (confusion, coma), severe hypothermia, profound lethargy, respiratory depression (hypoventilation).
- o **Triggers:** Infection (e.g., pneumonia, UTI), stroke, trauma, surgery, cold exposure, sedatives (e.g., opioids, benzodiazepines).
- o **Vitals/Exams:** Hypothermia (<35°C), bradycardia, hypotension, hypoventilation (CO₂ retention), myxedema (non-pitting edema), delayed reflexes.

Severe Hyperthyroidism:

- o **Symptoms:** Weight loss, heat intolerance, palpitations, diarrhea, sweating, tremor, anxiety, insomnia, proximal muscle weakness.
- o **Triggers:** Noncompliance with antithyroid drugs, recent iodine exposure (e.g., contrast dye), thyroiditis, excess levothyroxine, amiodarone.
- o **Vitals/Exams:** Tachycardia (HR >100 bpm), fever, hypertension (widened pulse pressure), lid lag, exophthalmos (Graves' disease), goiter, fine tremor.

Thyrotoxicosis (Thyroid Storm):

- **Definition:** Life-threatening hyperthyroidism with systemic decompensation; mortality 10-30% if untreated.
- **Symptoms:** High fever ($>38.5^{\circ}\text{C}$), delirium, agitation, nausea/vomiting, jaundice (hepatic dysfunction), heart failure (high-output).
- **Triggers:** Infection, surgery, DKA, trauma, iodine load, abrupt cessation of antithyroid drugs, untreated Graves' disease.
- **Vitals/Exams:** Fever, tachycardia (HR 120-180 bpm), atrial fibrillation (20-40% of cases), widened pulse pressure, warm/moist skin, tremor.
- **Burch-Wartofsky Score:** Diagnostic tool for thyroid storm; score >45 highly suggestive (fever, CNS effects, GI symptoms, tachycardia, AF, precipitant history).

Diagnostic Testing and Expected Lab Results

Labs:

- **Thyroid Function Tests:**
 - **Severe Hypothyroidism/Myxedema Coma:** TSH markedly elevated (>20 mIU/L, often >50), free T4 low (<0.5 ng/dL), free T3 low (not always checked).
 - **Severe Hyperthyroidism/Thyroid Storm:** TSH suppressed (<0.01 mIU/L), free T4 elevated (>2.5 ng/dL), free T3 elevated (>6 pg/mL).
 - **CBC:** Anemia (hypothyroid: normocytic; hyperthyroid: anemia of chronic disease), leukocytosis (thyroid storm, infection trigger).
 - **CMP:** Hyponatremia (hypothyroid: SIADH-like; hyperthyroid: dehydration), elevated Cr (hypothyroid: reduced GFR), transaminitis (thyroid storm: hepatic dysfunction).
- **Other:**
 - **Hypothyroid:** Elevated CK (myopathy), hyperlipidemia (LDL increase), hypoglycemia (adrenal insufficiency overlap).
 - **Hyperthyroid:** Hypercalcemia (increased bone turnover), elevated alkaline phosphatase (bone/liver), hyperglycemia (insulin resistance).
 - **Adrenal Function:** Cortisol level (hypothyroid: rule out adrenal insufficiency; myxedema coma often has coexisting adrenal crisis).
 - **Inflammatory Markers:** ESR/CRP (elevated in thyroid storm, infection trigger).

Imaging:

- **Chest X-ray:** Hypothyroid: Pleural effusion, cardiomegaly (pericardial effusion); Hyperthyroid: Pulmonary edema (heart failure in thyroid storm).
- **EKG:**
 - **Hypothyroid:** Bradycardia, low voltage, prolonged QT, T-wave flattening.
 - **Hyperthyroid:** Tachycardia, atrial fibrillation (AF with RVR), ST elevation (demand ischemia).
 - **Thyroid Ultrasound:** Not emergent; useful for chronic management (e.g., goiter, nodules in Graves' disease).

Other Tests:

- **Blood Cultures:** Rule out infection as a trigger (e.g., pneumonia in myxedema coma, sepsis in thyroid storm).
- **ABG:** Hypothyroid: CO₂ retention (hypoventilation); Hyperthyroid: Respiratory alkalosis (tachypnea in thyroid storm).

Diagnostic Testing Table

Test	Condition	Expected Results	Notes
TSH, Free T4	Hypothyroidism/Myxedema	TSH >20 mIU/L, Free T4 <0.5 ng/dL	Check cortisol (adrenal insufficiency overlap).
TSH, Free T4, Free T3	Hyperthyroidism/Storm	TSH <0.01 mIU/L, Free T4 >2.5 ng/dL	Free T3 often >6 pg/mL in storm.
EKG	Hypothyroidism	Bradycardia, low voltage	Prolonged QT increases torsades risk.
EKG	Hyperthyroidism	Tachycardia, AF with RVR	Check for ischemic changes in storm.

Treatment

General Principles:

- Stabilize the patient (e.g., airway, fluids, temperature control).
- Treat underlying triggers (e.g., infection, iodine exposure).
- Monitor closely (telemetry, frequent vitals, labs).

Severe Hypothyroidism:

- **Thyroid Hormone Replacement:**
 - Levothyroxine 100-200 mcg PO daily (start low if elderly or cardiac disease, e.g., 25-50 mcg PO daily).
 - **If unable to take PO:** Levothyroxine 50-100 mcg IV daily (50-70% of oral dose).
- **Supportive:**
 - Correct hyponatremia (3% saline 100 mL IV bolus if severe, <6 mEq/L/day correction).
 - Warm blankets for hypothermia.
 - Monitor for arrhythmia (bradycardia, prolonged QT → torsades risk).

Myxedema Coma:

- **Thyroid Hormone Replacement:**
 - Levothyroxine 200-400 mcg IV bolus (loading dose), then 100 mcg IV daily.
 - Liothyronine (T3) 5-20 mcg IV bolus, then 2.5-10 mcg IV q8h (optional, if severe; T3 acts faster but increases cardiac risk).
 - **Stress-Dose Steroids:** Hydrocortisone 100 mg IV q8h (rule out adrenal insufficiency; give before thyroid hormone to avoid precipitating adrenal crisis).
- **Supportive:**
 - ICU admission, mechanical ventilation (if hypoventilation, CO₂ retention).
 - Passive rewarming (warm blankets, avoid active rewarming → vasodilation, hypotension).
 - IV fluids (NS 500 mL bolus, then 100 mL/h; cautious, risk of heart failure).
 - Treat infection (e.g., ceftriaxone 1 g IV daily + azithromycin 500 mg IV daily for pneumonia).

Severe Hyperthyroidism:

- **Antithyroid Drugs:**
 - Methimazole 20-40 mg PO daily (preferred for non-storm); if unable to take PO, use rectal formulation.
 - Propylthiouracil (PTU) 200-400 mg PO q6-8h (alternative, especially in pregnancy; inhibits T4 to T3 conversion).
 - **Beta-Blockers:** Propranolol 10-40 mg PO q6h (rate control, symptom relief); if unable to take PO, 0.5-1 mg IV q4-6h.
- **Supportive:**
 - Correct hypercalcemia (NS 200 mL/h IV, calcitonin 4 units/kg SC q12h if Ca >14 mg/dL).

- Monitor for AF (rate control with beta-blockers).

Thyrotoxicosis (Thyroid Storm):

- **Antithyroid Drugs:**
 - PTU 500-1000 mg PO loading dose, then 250 mg PO q4h (preferred in storm; inhibits T4 to T3 conversion).
 - Methimazole 60-80 mg PO daily (alternative, if PTU unavailable).
 - **Iodine (Blocks Thyroid Hormone Release):** Start 1 hour after antithyroid drug (to prevent worsening storm):
 - Potassium iodide (SSKI) 5 drops PO q6h or Lugol's iodine 8-10 drops PO q6h.
 - **Beta-Blockers:** Propranolol 60-80 mg PO q4-6h or 1-2 mg IV q4h (target HR <100 bpm); esmolol 50-100 mcg/kg/min IV infusion (if unstable, titratable).
 - **Steroids:** Hydrocortisone 100 mg IV q8h or dexamethasone 2 mg IV q6h (reduces T4 to T3 conversion, supports adrenals).
- **Supportive:**
 - ICU admission, cooling measures (acetaminophen 650 mg PO q6h, cooling blankets; avoid aspirin → displaces T4 from binding proteins).
 - IV fluids (NS 1 L bolus, then 150-200 mL/h; cautious in heart failure).
 - Treat precipitant (e.g., antibiotics for infection, insulin for DKA).
 - **If AF with RVR:** Rate control (propranolol); avoid amiodarone (iodine content worsens storm).

Treatment Guidelines Table

Condition	Treatment Agent/Dose	Notes
Severe Hypothyroidism	Thyroid Hormone - Levothyroxine 100-200 mcg PO daily	Start low (25-50 mcg) if cardiac risk.
Myxedema Coma	Thyroid Hormone + Steroids -Levothyroxine 200-400 mcg IV bolus -Hydrocortisone 100 mg IV q8h	ICU admission, passive rewarming.
Severe Hyperthyroidism	Antithyroid Drug + Beta-Blocker -Methimazole 20-40 mg PO daily -Propranolol 10-40 mg PO q6h	Monitor for AF, hypercalcemia.
Thyroid Storm	Antithyroid + Iodine + Beta-Blocker -PTU 500-1000 mg PO load -SSKI 5 drops PO q6h -Propranolol 1-2 mg IV q4h	Cooling, ICU, avoid amiodarone.

Endocrine Consults

Indications:

- o **Diagnostic Uncertainty:** Atypical presentation (e.g., normal TSH with severe symptoms, possible pituitary cause).
- o **Severe Cases:** Myxedema coma or thyroid storm (life-threatening, need ICU-level care and endocrine expertise).
- o **Refractory Symptoms:** Persistent tachycardia, fever, or mental status changes despite initial therapy.
- o **Comorbidities:** Coexisting adrenal insufficiency (hypothyroid), pregnancy (hyperthyroid), or need for long-term management (e.g., post-storm ablation).
- o **Therapy Guidance:** Need for iodine therapy, T3 use in myxedema, or management of complications (e.g., heart failure in thyroid storm).

Timing:

- o **Urgent:** Myxedema coma, thyroid storm, or severe cases with multiorgan dysfunction (e.g., respiratory failure, AF with RVR).
- o **Routine:** Stable severe hypo/hyperthyroidism for long-term management (e.g., methimazole dosing, thyroidectomy planning).

Key Pearls

- **Myxedema Coma:** Suspect in hypothyroid patients with altered mental status, hypothermia; treat with IV levothyroxine + hydrocortisone (adrenal support).
- **Thyroid Storm:** Use Burch-Wartofsky score (>45 suggestive); PTU first, then iodine (1 hour later), beta-blockers, steroids; avoid amiodarone.
- **Hypothyroidism:** Check cortisol before thyroid hormone (adrenal crisis risk); prolonged QT on EKG → torsades risk.
- **Hyperthyroidism:** Beta-blockers (propranolol) for symptom relief; monitor for AF, heart failure in storm.
- **Infection:** Common trigger for both myxedema coma and thyroid storm; always investigate (blood cultures, CXR).
- **ICU:** Admit myxedema coma and thyroid storm patients for close monitoring (telemetry, respiratory support).
- **Endocrine Consult:** Urgent for myxedema coma and thyroid storm; routine for stable cases needing long-term planning.

References

- **UpToDate:** "Myxedema Coma: Diagnosis and Management" (2025).
- **NEJM:** "Thyroid Storm: A Review of Diagnosis and Treatment" (2024).
- **Endocrine Society:** "Management of Thyroid Dysfunction in the Hospital Setting" (2023).
- **J Clin Endocrinol Metab:** "Critical Care Management of Thyroid Emergencies" (2024).

Clinical Scenarios

Case 1: A 60-Year-Old Female with Confusion

- **Presentation:** A 60-year-old female with a history of hypothyroidism (noncompliant with levothyroxine) presents with confusion, lethargy, and hypothermia for 2 days.
- **Exam:** Temp 34°C, HR 50 bpm, BP 90/60 mmHg, hypoventilation, periorbital edema, delayed reflexes.
- **Labs:** TSH 75 mIU/L, free T4 0.3 ng/dL, cortisol 5 mcg/dL (low), Na 128 mEq/L, CK 800 U/L.
- **Diagnosis:** Myxedema Coma → Altered mental status, hypothermia, bradycardia, high TSH, low free T4.
- **Management:** ICU admission. Start levothyroxine 300 mcg IV bolus, then 100 mcg IV daily. Hydrocortisone 100 mg IV q8h (adrenal support). Passive rewarming with blankets. IV fluids (NS 500 mL bolus, then 100 mL/h). Treat infection (ceftriaxone 1 g IV daily, azithromycin 500 mg IV daily for suspected pneumonia). Urgent endocrine consult. Monitor telemetry (bradycardia, prolonged QT), respiratory status, and Na correction.

Case 2: A 35-Year-Old Female with Fever and Palpitations

- **Presentation:** A 35-year-old female with Graves' disease (stopped methimazole 2 weeks ago) presents with fever, agitation, and palpitations for 1 day.
- **Exam:** Temp 39°C, HR 150 bpm, BP 160/80 mmHg, fine tremor, exophthalmos, goiter. Burch-Wartofsky score: 50.
- **EKG:** Atrial fibrillation with RVR (HR 150 bpm).
- **Labs:** TSH <0.01 mIU/L, free T4 3.5 ng/dL, free T3 8 pg/mL, ALT 90 U/L, Ca 11 mg/dL.
- **Diagnosis:** Thyroid Storm → Fever, tachycardia, AF, high Burch-Wartofsky score, suppressed TSH, elevated T4/T3.

- **Management:** ICU admission. Start PTU 600 mg PO loading dose, then 250 mg PO q4h. SSKI 5 drops PO q6h (1 hour after PTU). Propranolol 1 mg IV q4h (target HR <100 bpm). Dexamethasone 2 mg IV q6h. Cooling blankets, acetaminophen 650 mg PO q6h. IV fluids (NS 1 L bolus, then 200 mL/h). Urgent endocrine consult. Monitor telemetry (AF, tachycardia), mental status, and liver function.

Case 3: A 50-Year-Old Male with Fatigue and Weight Gain

- **Presentation:** A 50-year-old male with a history of thyroidectomy presents with fatigue, weight gain, and cold intolerance for 3 months (noncompliant with levothyroxine). **Exam:** HR 55 bpm, BP 110/70 mmHg, dry skin, delayed reflexes.
- **Labs:** TSH 30 mIU/L, free T4 0.6 ng/dL, Na 132 mEq/L, LDL 180 mg/dL.
- **EKG:** Bradycardia, low voltage.
- **Diagnosis:** Severe Hypothyroidism → Fatigue, bradycardia, high TSH, low free T4, no coma.
- **Management:** Start levothyroxine 100 mcg PO daily. Correct hyponatremia (NS 100 mL/h IV, monitor Na). Monitor EKG (prolonged QT risk). Routine endocrine consult for long-term management (e.g., levothyroxine dose adjustment). Educate on medication adherence.

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