ECHO Summary,16/AUG/2024 Session Title: Thyroid-Related Emergencies

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Chat questions
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Please note that thyroid emergencies do not have dedicated sections in the Uganda Clinical Guidelines.

Forms of Thyroid Emergencies and Their Epidemiology

- Thyroid storm - <2% of patients with hyperthyroidism[1]
- Decompensated hypothyroidism - rare - 0.22/million/year[2]

Risk Factors

- Thyroid storm/thyrotoxic crisis
    - Can occur in any patient with thyrotoxicosis including Graves' disease or other forms of hyperthyroidism (such as toxic multinodular goiter) - may be the initial presentation of a thyrotoxicosis
      Risk factors for hyperthyroidism include:
        - Age >35 (but elderly at higher risk)
        - Pregnancy
        - Type 1 diabetes mellitus (DM)
        - Radiation to the neck
        - Iatrogenic (i.e. overtreatment of hypothyroidism)
    - Thyrotoxic medications can tip these patients over the edge into thyroid storm (such as iodinated contrast dye and amiodarone)[3]
    - Maybe precipitated by:
        - Surgery and anesthesia induction - rare
        - Sepsis
        - Non-compliance to anti-thyroid medications
        - Diabetic Ketoacidosis
        - Vigorous palpation of an enlarged thyroid.
        - Toxemia of pregnancy and labor
- Decompensated hypothyroidism
    - Women are at 4X greater risk than men
        - Elderly women at the highest risk
    - Sepsis is the most common precipitating cause!
    - Risk factors for hypothyroidism include:
        - Northern climates/cold weather
        - Hashimoto's thyroiditis - autoimmune
        - Iatrogenic (i.e. excessive treatment for hyperthyroidism)
        - Thyroidectomy
        - Radiation to the head and neck
        - Thyrotoxic medications (such as amiodarone, lithium, beta-blockers, narcotics, diuretics)[4]

Clinical Presentation and Initial Approach

- **AIRWAY/BREATHING**: large goiters can obstruct/compress the airway.[3] Patients with thyrotoxicosis or myxedema coma may present with an altered level of consciousness and inability to protect the airway; in these cases, secure the airway early
    - For patients with myxedema coma, intubation is RISKY and should be performed by the most experienced clinician
        - Why?

        - Poor oxygen reserve → high risk for hypoxia → dysrhythmias → peri-intubation cardiac arrest
        - Myxedema coma can cause angioedema or tongue enlargement
        - Large goiters may narrow the airway passage and make intubation difficult can get in the way when intubating
- **CIRCULATION**: all patients with decompensated hyper- or hypothyroidism need continuous cardiac monitoring and large-bore IV access
    - Thyroid storm
        - These patients may be hypertensive, tachycardic (usually sinus), and may present with cardiac dysrhythmias (such as new-onset atrial fibrillation, which is the most common)
            - Place the patient on a cardiac monitor right away and plan for cardioversion
        - Cardiac stabilization should prioritize early initiation of anti-thyroid therapy[3]
    - Decompensated hypothyroidism
        - These patients may be hypotensive, bradycardic, and may present with heart blocks; be ready to pace if needed
        - Cardiac stabilization should prioritize early initiation of levothyroxine[4]
- **DISABILITY/EXPOSURE**:
    - Rule out hypoglycemia as a cause for altered mentation
    - Obtain a core temperature early (i.e. rectal, esophageal, bladder)
        - Thyroid storm
            - These patients may present with hyperthermia/hyperpyrexia, which should be addressed with external cooling and acetaminophen
                - AVOID NSAIDs - they can exacerbate hyperthyroidism[3]
        - Decompensated hypothyroidism
            - 90% of these patients may present with hypothermia, which should be addressed with non-invasive external warming measures first[4]
                - If external rewarming is not effective, you can move to invasive rewarming - you can learn more here (see “Rewarming the Patient with Pulses”): https://emcrit.org/ibcc/hypothermia/#general_resuscitative_measures
    - Look for signs of trauma that could have been a precipitating trigger for decompensated thyroid disease

Table 1. Key clinical features of **thyroid storm**. Modified from: Inman B. Thyroid Storm and Hyperthyroidism. In: Johnson W, Nordt S, Mattu A and Swadron S, eds. CorePendium. Burbank, CA: CorePendium, LLC. https://www.emrap.org/corependium/chapter/rec1SP9oNI2GZgKKF/Thyroid-Storm-and-Hyperthyroidism#h.9ixiqntened4. Updated October 7, 2023. Accessed August 21, 2024.

Cardiovascular	● Chest pain ● Heart failure (possibly new-onset) ● Hypertension ● Tachycardia
Gastrointestinal	● Abdominal pain ● Hepatomegaly ● Jaundice ● Nausea, vomiting, diarrhea ● Unintentional weight loss
HEENT	● Diplopia ● Exophthalmos (i.e. bulging eyes) ● Goiter
Respiratory	● Dyspnea ● Orthopnea ● Pulmonary edema
Neurologic	● Altered mental status ○ Agitation ○ Anxiety ○ Coma/Stupor ○ Confusion ○ Delirium ○ Depression/apathy ● Apathetic thyroid storm* ● Cold intolerance ● Diaphoresis ● Fever ● Hyperreflexia ● Proximal muscle weakness ● Seizure ● Tremor

*Apathetic thyroid storm refers to an atypical presentation of thyroid storm that can occur in the elderly. These patients may present with depression, apathy, fatigue, and generalized weakness.

Table 2. Key clinical features of **decompensated hypothyroidism**. Modified from: Lovegrove S, Cimino-Fiallos N. Decompensated Hypothyroidism. In: Johnson W, Nordt S, Mattu A and Swadron S, eds. CorePendium. Burbank, CA: CorePendium, LLC. https://www.emrap.org/corependium/chapter/recq2Rb31DrFS9QWD/Decompensated-Hypothyroidism#h.xvpytfegah53. Updated October 6, 2023. Accessed August 21, 2024.

Cardiovascular	● Bradycardia ● Heart block/bundle branch block ● Hypotension
Dermatologic	● Dry skin ● Non-pitting edema ● Thin hair, or hair falling out
Gastrointestinal	● Constipation
Genitourinary	● Urinary retention
HEENT	● Angioedema ● Macroglossia (enlarged tongue) ● Goiter ● Voice changes
Respiratory	● Pleural effusions ● Respiratory failure
Neurologic	● Altered mental status* ○ Coma/stupor ○ Confusion ● Cold intolerance ● Hypothermia

*This is ALMOST ALWAYS present in myxedema coma

Diagnostics

- All patients with suspected thyroid-related emergency
  - Thyroid hormone panel - thyroid-stimulating hormone (TSH), T3, T4
    - Free T3 and T4 are helpful - total levels are not since most of the hormone is protein-bound![3]
  - ECG - to look for dysrhythmias and blocks
  - Coagulation profile
    - Thyroid storm can cause coagulopathy[3]
  - Complete blood count (CBC) - to look for anemia or leukocytosis (remember that sepsis is the most common inciting factor for decompensated hypothyroidism)
    - Leukocytosis with a left shift is EXPECTED in thyroid storm[3]
    - Leukocytosis and anemia are common in decompensated hypothyroidism[4]
  - Electrolyte panel - including calcium
    - Hypercalcemia is common in thyroid storm[3]
    - Hyponatremia, hyperkalemia, and hypoglycemia can occur due to associated adrenal insufficiency in decompensated hypothyroidism[4]
  - Kidney function testing - may show acute kidney injury
  - Liver function testing

        - Elevated alkaline phosphatase is common in thyroid storm[3]
    - Pregnancy testing in females of childbearing age
        - If pregnant, medication management differs for thyroid storm[3]
    - Rule out concomitant/precipitating infection - remember that thyroid storm can look JUST LIKE sepsis!
        - Blood cultures
        - Chest x-ray
        - HIV/malaria/TB testing
        - Urinalysis
- Thyroid storm
    - TSH should be low, free T3/4 high
    - The Burch-Wartovsky score can be useful for stratifying the likelihood of thyroid storm (https://mdcalc.com/calc/3816/burch-wartofsky-point-scale-bwps-thyrotoxicosis)
- Decompensated hypothyroidism
    - TSH should be high, free T3/4 low
    - Key additional labs to obtain
        - Creatine kinase (CK) - hypothyroidism can cause myopathy (muscle breakdown)
        - Venous blood gas
            - May show hypoxemia and respiratory acidosis from hypoventilation[4]

Treatment

- Stabilize the patient from an ABCDE standpoint
    - As necessary:
        - Secure the airway
        - Assist respirations
        - Provide IV fluids hypotension if patients *do not exhibit signs of volume overload* (i.e. peripheral edema, pulmonary edema)
            - *Do not administer vasopressors for myxedema coma patients unless blood pressure fails to improve with specific treatment*[4]
        - Reverse hypoglycemia and hypo/hyperthermia
        - Manage life-threatening traumatic injuries
- Start broad-spectrum antibiotics if you are suspicious of concomitant sepsis
- Thyroid storm
    - GIVE MEDICATIONS IN THIS ORDER
        1. **Beta-blockers** (unless contraindicated due to bronchospastic diseases like asthma or COPD) - combat the sympathomimetic effects of thyroid hormone
            a. Propranolol 0.5-1 mg IV bolus every 10min, titrate to heart rate <100 bpm **OR**

   b. Esmolol IV bolus 100-500 µg/kg over 1 min, followed by a continuous IV infusion: Initial rate, 25-100 µg/kg/min, subsequently, titrate in 25-50 µg/kg/min increments
2. **Anti-thyroid therapy** - reduces thyroid hormone production
   a. Propylthiouracil (PTU) 500 mg oral load, 250 mg orally every 4 hours **OR**
   b. Methimazole 40 mg oral load, 25 mg orally every 6 hours
   c. *Propylthyiouracil (PTU) is the drug of choice for 1st trimester pregnant patients; methimazole is the drug of choice for the 2nd and 3rd trimesters*
3. **Iodine** - inhibits thyroid hormone synthesis. Must be given **60 minutes** after anti-thyroid therapy or the patient's condition could worsen!
   a. Saturated solution of potassium iodide 5 drops orally every 6 hours **OR**
   b. Lugol's solution, 4-8 drops orally every 6-8 hours
4. **Hydrocortisone** 100 mg IV every 8 hours - prevents T4 → T3 conversion[3]

- Decompensated hypothyroidism
  - **Levothyroxine** (T4) 300-500 µg IV bolus **OR** liothyronine (T3) 25-50 µg IV bolus - replaces missing thyroid hormone
  - **Hydrocortisone** 100 mg IV - treats overlapping adrenal insufficiency[4]

Complications and Special Notes

- Patients with thyroid-related emergencies may develop heart failure
  - Thyroid storm
    - This is high-output heart failure
    - Afterload-reducing drugs such as nitrates should be avoided
    - The priority is controlling the heart rate with beta blockers (or calcium channel blockers if the patient has a contraindication), since this is usually the driving problem[3]
  - Decompensated hypothyroidism
    - Prioritize thyroid hormone therapy BEFORE vasopressors[4]
- Patients with thyroid-related emergencies may develop multi-organ failure (this is the most common cause of death in thyroid storm)
  - Be on the lookout for disseminated intravascular coagulation (DIC)[3]

Disposition

- All patients with thyroid storm and decompensated hypothyroidism should be admitted to a cardiac-monitored bed, preferably in the intensive care unit

Collaborating Partners

1. Ministry of Health of the Republic of Uganda

2. Seed Global Health
3. Techies Without Borders

References

1. Vennard K, Gilbert MP. Thyroid Storm and Complete Heart Block after Treatment with Radioactive Iodine. *Case Rep Endocrinol*. 2018;2018:8214169. doi:10.1155/2018/8214169
2. Murthy TA, Rangappa P, Jacob I, Janakiraman R, Rao K. Myxoedema coma in adults: Experience from a tertiary referral hospital intensive care unit. *Indian J Anaesth*. 2015;59(5):315-317. doi:10.4103/0019-5049.156889
3. Inman B. Thyroid Storm and Hyperthyroidism. In: *CorePendium*. CorePendium, LLC; 2023. Accessed August 21, 2024. https://www.emrap.org/corependium/chapter/rec1SP9oNI2GZgKKF/Thyroid-Storm-and-Hyperthyroidism
4. Lovegrove S, Cimino-Fiallos N. Decompensated Hypothyroidism. In: *CorePendium*. CorePendium, LLC; 2023. Accessed August 21, 2024. https://www.emrap.org/corependium/chapter/recq2Rb31DrFS9QWD/Decompensated-Hypothyroidism