NCLEX-RN • NEXT GEN PHARMACOLOGY • 2026

Thyroid Replacement *Medications*

High-yield rapid-review infographic. Levothyroxine (T4), Liothyronine (T3), and combination therapies — built for NGN clinical judgment and medication-safety priority questions.

ENDOCRINE SYSTEM | CLASS: Thyroid Hormone Replacement | Pregnancy Cat: A | LIFETIME THERAPY

1 DRUG OVERVIEW
Why we give it

- **Primary hypothyroidism** (most common indication)
- **Hashimoto's thyroiditis** — autoimmune destruction of thyroid
- **Post-thyroidectomy** hormone replacement
- **Congenital hypothyroidism** (cretinism in infants)
- **Myxedema coma** → IV levothyroxine (endocrine emergency)
- **TSH suppression** after thyroid cancer / goiter
- **Secondary / tertiary** hypothyroidism (pituitary/hypothalamic)
- **Pregnancy** — often requires **25–50% dose increase**

2

MECHANISM OF ACTION

How it works

Synthetic **T4 (levothyroxine)** → converted in peripheral tissues to active **T3 (liothyronine)**
→ binds nuclear receptors → ↑ gene transcription of metabolic enzymes
→ ↑ **Basal Metabolic Rate** • ↑ O_2 consumption • ↑ protein synthesis
→ ↑ **Cardiac output** • ↑ HR • ↑ body temperature • ↑ GI motility
→ Replaces hormone the failing thyroid cannot produce

3

THERAPEUTIC EFFECTS

What tells you it's working

- **TSH returns to normal** (0.4–4.0 mU/L) — **primary goal**
- ↑ Energy, ↓ fatigue, improved mood
- Weight returns toward baseline (modest ↓)
- Warmer skin, resolution of cold intolerance
- HR normalizes (resolution of bradycardia)
- Regular bowel pattern (no more constipation)
- Hair regrowth, skin moisturizes
- **Full effect: 6–8 weeks** after dose change

4

SIDE EFFECTS & ADVERSE REACTIONS

Recognize toxicity early

Common (Mild → Mimic Hyperthyroid)

- Headache, insomnia, nervousness
- Tremors, irritability
- Heat intolerance, sweating
- Diarrhea, ↓ appetite, weight loss
- Hair loss (temporary, first few months)
- Menstrual irregularities

Serious LIFE-THREATENING

- **Tachycardia, palpitations, chest pain**
- **Angina → MI** (↑ cardiac O_2 demand)
- **Atrial fibrillation** — esp. elderly
- **Thyroid storm / thyrotoxicosis** — fever, tachycardia, altered mental status
- **Adrenal crisis** if given before steroids in adrenal insufficiency
- Osteoporosis (chronic over-replacement)

5

PRIORITY NURSING CONSIDERATIONS

Assess • Monitor • Hold • Notify

📊 Monitor

- **Apical pulse × 1 full min BEFORE dose**
- BP, temperature, weight
- **TSH, Free T4** (6–8 wks after dose change)
- Signs of hyper/hypothyroidism
- Cardiac status (esp. elderly, CAD)

✋ HOLD & Notify Provider

- **HR > 100 bpm** or new chest pain
- New palpitations or dysrhythmia
- Suspected thyroid storm
- Acute MI or unstable CAD

🚫 Contraindications

- **Untreated adrenal insufficiency** → adrenal crisis
- Acute MI, thyrotoxicosis
- Hypersensitivity to components

⚠️ Key Drug Interactions

- **Warfarin** → ↑ anticoagulant effect (bleeding)
- **Insulin / oral hypoglycemics** → may need ↑ dose
- **Digoxin** → ↓ digoxin effect
- **Ca^{2+}, iron, antacids, PPIs** → ↓ absorption (separate 4 hrs)
- **Cholestyramine** → ↓ absorption (separate 4–6 hrs)
- **Estrogen** → ↑ TBG, may need ↑ dose

LABS & DIAGNOSTICS

6 The TSH Inverse Rule

LAB	NORMAL RANGE	WHAT ABNORMAL MEANS
TSH ⭐ most important	0.4 – 4.0 mU/L	**↑ TSH** = under-replaced → **↑ dose** **↓ TSH** = over-replaced → **↓ dose**
Free T4	0.8 – 2.0 ng/dL	↓ = hypothyroid / under-dosed • ↑ = overdose
Total T3	80 – 200 ng/dL	Rarely used alone; supports diagnosis
When to check	6–8 weeks after starting / dose change → then every 6–12 months once stable	

🔑 **Remember:** TSH and thyroid hormone are **INVERSELY** related. Think feedback loop — low hormone = pituitary screams (↑ TSH).

ADMINISTRATION & SAFETY

7 Timing is everything

- **PO** preferred — same time every day
- **EMPTY STOMACH:** 30–60 min BEFORE breakfast, full glass of water
- Alternative: bedtime, ≥3 hrs after last meal
- **Start LOW, go SLOW** — esp. elderly / cardiac (start 25–50 mcg)
- **IV** form reserved for **myxedema coma**
- **Separate 4 hrs** from: calcium, iron, antacids, PPIs
- **Avoid near dose:** coffee (60 min), soy, high-fiber foods, walnuts
- **DO NOT switch brands** without TSH recheck (bioequivalence varies)
- **LIFETIME therapy** — never stop abruptly
- Store in light-resistant container

8

PATIENT EDUCATION

What they MUST know

- **This is a LIFETIME medication** — never stop without provider
- Take **same time every morning** on empty stomach
- Wait 30–60 min before eating, coffee, or other meds
- Don't double dose if missed — take when remembered same day
- Wear **medical alert bracelet**
- Expect full effect in **6–8 weeks**; hair loss is temporary
- **Report immediately:** chest pain, palpitations, rapid HR, unusual sweating, tremors, heat intolerance
- **Report:** fatigue, weight gain, cold intolerance, constipation (under-dosed)
- Get **annual TSH** even when feeling well
- **Pregnancy:** notify provider immediately — dose usually ↑ 25–50%
- Don't switch generic ↔ brand without telling provider

9

NCLEX TEST TRAPS ⚠

Where students lose points

- **Trap #1:** Thinking **low TSH = low thyroid**. It's **INVERSE** → low TSH = OVER-replaced.
- **Trap #2:** Giving with breakfast, coffee, or milk → slashes absorption up to 50%.
- **Trap #3:** Giving calcium, iron, or antacids within 4 hrs → binds and inactivates drug.
- **Trap #4:** Starting full adult dose in elderly → can trigger **MI or A-fib**.
- **Trap #5:** Stopping when symptoms improve — this is **LIFETIME** therapy.
- **Trap #6:** Side effects look like **hyperthyroidism** (tachycardia, weight loss, heat intolerance) because you're replacing hormone — not "drug side effects," it's **overdose**.
- **Trap #7:** Missing **thyroid storm**: fever + severe tachycardia + altered mental status = emergency.
- **Trap #8:** Giving levothyroxine BEFORE steroids in adrenal insufficiency → **adrenal crisis**.
- **Trap #9:** Switching brand ↔ generic without rechecking TSH.
- **Trap #10 (priority):** Not checking **HR/apical pulse** before administration.

10

MEMORY BOOSTERS

Stick it to your brain

🧬 "SYNTHROID" — administration & safety

- **S**ame time each day
- **Y**ears of therapy (lifetime)
- **N**ever stop abruptly
- **T**SH monitored (6–8 wks)
- **H**R checked before dose
- **R**eport chest pain
- **O**n empty stomach
- **I**nteractions are many
- **D**ecreased absorption with food/calcium/iron

🔁 TSH Inverse Rule

- **HIGH TSH** = LOW thyroid → need **MORE** medication
- **LOW TSH** = HIGH thyroid → need **LESS** medication
- *"TIRED = MORE, WIRED = LESS"*

⚖️ T4 vs T3 quick recall

- **T4 (levothyroxine)** = "4 life" — long-acting, preferred
- **T3 (liothyronine)** = "3× stronger" — short-acting, used for **myxedema coma**
- "Low & Slow" — start low, titrate slowly in elderly & cardiac pts

FINAL SECTION — MANDATORY

Clinical Judgment Snapshot

#1 PRIORITY RISK

Cardiac complications — angina, MI, atrial fibrillation, and thyroid storm. Greatest danger in elderly and patients with coronary artery disease. Excess hormone ↑ cardiac O_2 demand beyond what diseased coronaries can supply.

WHAT HARMS THE PATIENT FIRST?

Tachycardia → progresses to angina → MI or A-fib in susceptible patients. Watch for early overdose signs: HR > 100, palpitations, chest pain, tremors, heat intolerance.

FIRST NURSING ACTION IN A SCENARIO

Assess apical pulse for a full minute BEFORE administration. If HR > 100 bpm or patient reports chest pain/palpitations → **HOLD the dose** and notify provider. Document findings.

NGN CLINICAL JUDGMENT PEARL

If the scenario shows **adrenal insufficiency + hypothyroidism**: give **HYDROCORTISONE FIRST**, then levothyroxine. Reversing the order → **adrenal crisis (fatal)**.

BONUS — MOST TESTED DRUGS IN THIS CLASS

Know the differences

DRUG (GENERIC / BRAND)	FORM	HALF-LIFE	KEY USE / NOTES
Levothyroxine Synthroid, Levoxyl, Euthyrox, Tirosint	Synthetic **T4**	~7 days	**PREFERRED first-line.** Once-daily dosing. Consistent potency. All long-term replacement.
Liothyronine Cytomel, Triostat	Synthetic **T3**	~2.5 days	**Rapid onset.** Reserved for **myxedema coma** (IV) or when fast effect needed. ↑ cardiac risk.
Liotrix Thyrolar	T4 + T3 combo (4:1)	Mixed	Rarely used. No proven benefit over levothyroxine alone.
Desiccated Thyroid Armour Thyroid, Nature-Throid	Natural (porcine)	Variable	**Not preferred** — inconsistent potency. Some patients request it; monitor TSH closely.

🎯 **Key distinction: T4 = chronic replacement** (patient, slow, steady). **T3 = acute crisis** (fast, potent, risky). Never give T3 to a stable elderly outpatient — you'll stress their heart.