MEDICAL-SURGICAL NURSING II · STUDY GUIDE

Exam 1 Study Guide

This guide covers the first two chapters. You will learn why missing insulin makes ketones while resistant insulin makes dehydration, how to read the numbers that define diabetes, and the order you treat the crises in: fluids, then potassium, then insulin, then dextrose. Then you will learn to read endocrine labs as pairs, and work through the thyroid, the calcium emergency, the adrenal glands and the pituitary water switch. Work one chapter at a time. Read the "what to know" paragraphs, study the tables, then try each worked case with the steps covered. Finish each chapter with its ten self-test items. The cram sheet at the end puts the numbers and rules in one place.

WHAT THIS GUIDE COVERS

- Chapter 1 · insulin and its three brakes, type 1 versus type 2, the diagnostic criteria, assessment and surveillance, insulin by onset, peak and duration, non-insulin agents by mechanism, inpatient targets, hypoglycemia and the rule of 15, DKA versus HHS, the fluids, potassium, insulin, dextrose sequence, chronic complications, foot care, sick-day rules, older adults and delegation.
- Chapter 2 · feedback loops and paired labs, hypothyroidism and myxedema coma, hyperthyroidism and thyroid storm, care after thyroidectomy, calcium and PTH, hypercalcemia and tetany, Cushing syndrome, adrenal insufficiency and crisis, pheochromocytoma, hyperaldosteronism, SIADH, diabetes insipidus and transsphenoidal surgery.

CHAPTER 1

Endocrine Disorders: Diabetes Mellitus

Read it in full: **Chapter 1 in the textbook**. Practice it in the lab: **Two Ways the Pancreas Fails** and **DKA, HHS and the Order You Treat Them In**.

What to know

Insulin is the storage signal. It does three jobs. It opens GLUT4 doors so glucose moves into muscle and fat. It tells the liver to stop making glucose. It keeps fat locked inside fat cells. Take

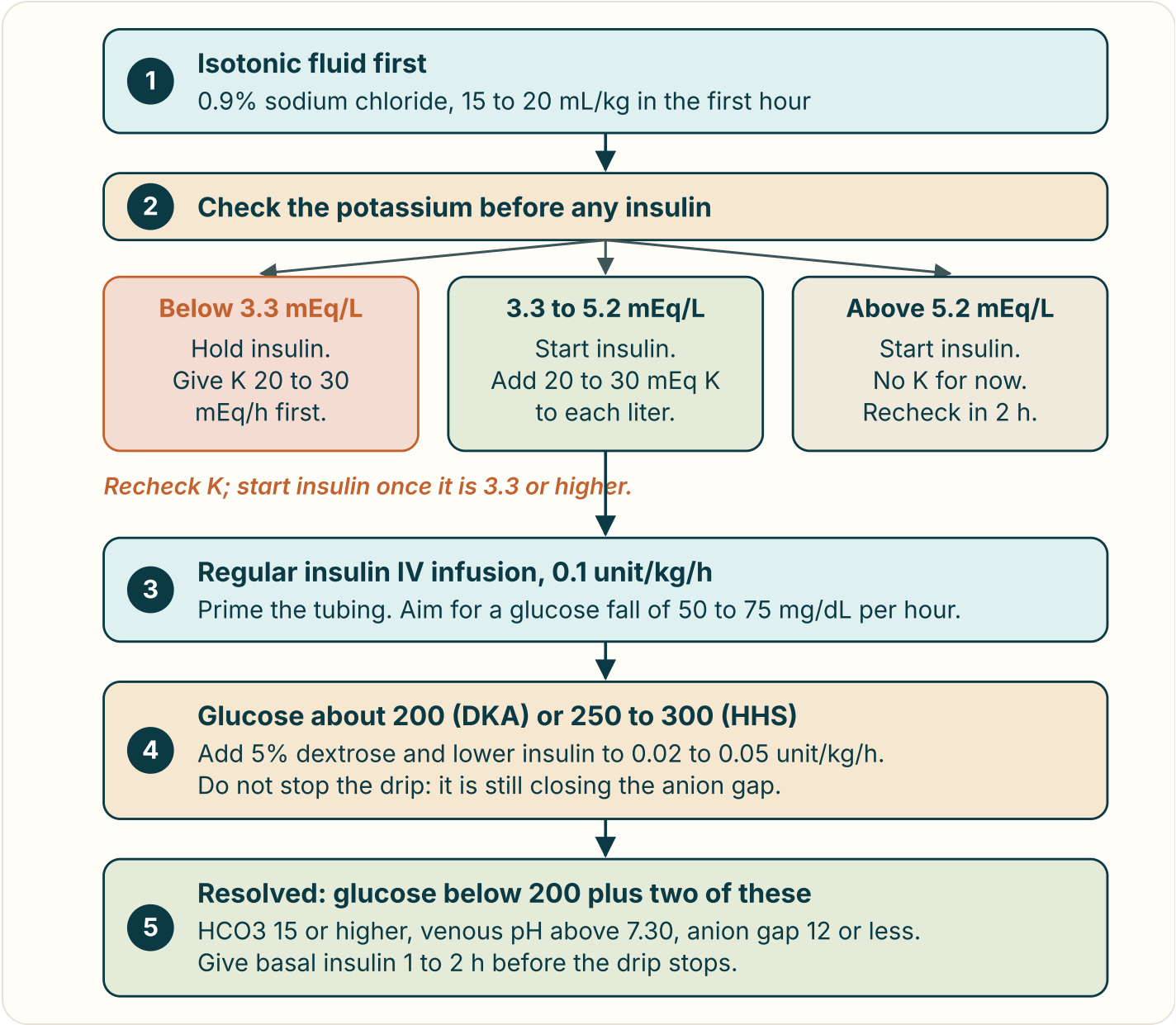
insulin away and all three brakes come off at once: glucose piles up in the blood, the liver makes more, and fat breaks down into fatty acids that the liver turns into **ketones**. Above a renal threshold of about 180 mg/dL, glucose spills into urine and drags water and electrolytes with it. That **osmotic diuresis** is why the patient has polyuria and polydipsia and is dry before anyone checks orthostatic vital signs.

Type 1 is autoimmune destruction of the beta cells. By the time glucose rises, 80 to 90 percent of them are gone. Autoantibodies such as GAD65 are present and **C-peptide** is low or absent. Onset is fast, about a third of new cases arrive in ketoacidosis, and insulin is needed from diagnosis for life. LADA is a slower autoimmune form in adults that is often mislabeled type 2. **Type 2** starts with insulin resistance; the pancreas makes extra insulin for years, then tires. Because some insulin is still present, fat breakdown stays mostly suppressed, so type 2 tends to decompensate into a hyperosmolar state rather than ketoacidosis. A type 2 patient under severe stress can still develop DKA, so check ketones when the picture fits.

Diabetes is diagnosed by any one of four tests: A1C 6.5% or higher, fasting plasma glucose 126 mg/dL or higher, a 2-hour OGTT value of 200 mg/dL or higher, or a random glucose of 200 mg/dL or higher with classic symptoms. Without symptoms, confirm an abnormal result with a repeat or a second test. Prediabetes is the band just below: A1C 5.7 to 6.4%, fasting 100 to 125, 2-hour 140 to 199. The A1C reflects about three months of glucose and is unreliable with hemoglobin disorders, recent transfusion, hemolysis, iron deficiency, pregnancy and advanced kidney disease.

Every insulin question is a timeline. Know the peak and you know when the patient will go low. Rapid-acting insulin goes in 0 to 15 minutes before eating, with the tray present. Regular is the only insulin given IV. NPH is cloudy and peaks at 4 to 12 hours. Glargine and detemir have no pronounced peak and are never mixed. When mixing NPH and regular, draw **clear before cloudy**. For the oral agents, mechanism tells you the hypoglycemia risk: sulfonylureas and meglitinides force insulin release and can cause lows on their own; metformin, DPP-4 inhibitors, GLP-1 agonists, SGLT2 inhibitors and pioglitazone generally do not unless combined with insulin or a secretagogue.

Between a glucose of 40 and a glucose of 400, treat the 40. For a conscious patient who can swallow, use the **rule of 15**. For an unresponsive patient, give IV dextrose or glucagon. DKA and HHS are both treated in one order: **isotonic fluid first, potassium before insulin, then a regular insulin drip, then dextrose** when the glucose reaches about 200 (DKA) or 250 to 300 (HHS) so the drip can keep closing the anion gap. The anion gap, not the glucose, tells you when DKA is over. Long term, the nurse prevents complications through surveillance, taking the socks off, sick-day rules and teaching the patient can really do at home.



Fluids, potassium, insulin, dextrose. The potassium check is a gate: insulin does not start until potassium is at least 3.3 mEq/L. The drip keeps running after dextrose is added, until the anion gap closes.

LOCK THESE IN

- No insulin means ketones and acidosis (DKA). Some insulin means no ketones but profound dehydration and hyperosmolarity (HHS).
- Diagnosis: A1C 6.5% or higher, fasting 126 or higher, 2-hour OGTT 200 or higher, or random 200 or higher with symptoms.
- Hypoglycemia: level 1 below 70, level 2 below 54, level 3 any value needing another person's help.
- Rule of 15: 15 g fast carbohydrate, recheck in 15 minutes, repeat until above 70, then a snack if the meal is more than an hour away.
- Crisis order: fluids, potassium (hold insulin if K is below 3.3), insulin 0.1 unit/kg/h, dextrose at about 200 mg/dL.
- Anion gap = Na minus (Cl plus HCO3). Effective osmolality = 2 x Na plus glucose/18. Above 320 fits HHS.
- NPO: hold prandial insulin, keep basal. Never stop insulin on a sick day.
- Inpatient target 140 to 180 mg/dL. Basal-bolus-correction beats sliding scale alone.

Key terms and comparisons: insulin by timeline

Insulin	Onset	Peak	Duration	Nursing timing
Rapid: lispro, aspart, glulisine	10 to 30 min	30 min to 3 h	3 to 5 h	Give 0 to 15 min before eating; tray present
Short: regular	30 min to 1 h	2 to 4 h	5 to 8 h	30 min before the meal; the only insulin given IV
Intermediate: NPH	1 to 2 h	4 to 12 h	12 to 18 h	Cloudy; roll gently; classic nocturnal low window
Long: glargine U-100, detemir	2 to 4 h (detemir 1 to 3 h)	No pronounced peak	Up to 24 h	Same time daily; never mix
Ultra-long: degludec, glargine U-300	About 1 to 6 h	No peak	Beyond 24 h (degludec beyond 42 h)	Steady state takes 3 to 4 days

Key terms and comparisons: DKA versus HHS

Feature	DKA	HHS
Typical patient	Type 1 (type 2 under severe stress), often younger	Type 2, often older, limited access to water
Onset	Hours to 1 to 2 days	Days to weeks
Glucose	Usually above 250 (near normal in euglycemic DKA)	Usually above 600, often above 1000
pH and bicarbonate	pH below 7.30; HCO3 below 18	pH above 7.30; HCO3 above 18
Ketones and anion gap	Beta-hydroxybutyrate 3.0 mmol/L or higher; gap above 10 to 12	Absent or small; gap normal or mildly up
Effective osmolality	Variable, often below 320	Above 320 mOsm/kg
Fluid deficit	About 6 L	About 9 to 12 L
Clues	Kussmaul breathing, fruity breath, abdominal pain, vomiting	Profound dehydration, altered mentation, focal deficits, seizures
Mortality	About 1 to 5%	About 5 to 20%

Worked cases

WORKED CASE 1 · READING A DKA PANEL

Mr. Delacroix, 26, with type 1 diabetes, has vomited for a day and ran out of insulin. Labs: sodium 132 mEq/L, chloride 96, bicarbonate 10, glucose 520 mg/dL, potassium 3.0 mEq/L, pH 7.14, beta-hydroxybutyrate 5.2 mmol/L.

STEP 1 · CALCULATE THE ANION GAP

132 minus (96 plus 10) = 26 mEq/L. That is well above 10 to 12, so ketoacids are piling up.

STEP 2 · CALCULATE EFFECTIVE OSMOLALITY

2 x 132 = 264, plus 520/18 = 28.9, total about 293 mOsm/kg. That is below 320, which fits DKA rather than HHS.

STEP 3 · CORRECT THE SODIUM

Add 1.6 for every 100 mg/dL of glucose above 100: (520 minus 100)/100 x 1.6 = 6.7. Corrected sodium is about 138.7, which is normal, so after the first resuscitation the fluid is usually switched to 0.45% sodium chloride.

STEP 4 · CHECK THE POTASSIUM GATE

Potassium is 3.0, below 3.3. Insulin would push potassium into cells and could cause a lethal rhythm. Hold the insulin, give fluid and potassium (about 20 to 30 mEq/h with urine output confirmed and the monitor on).

RULE

Fluids first, potassium before insulin. A normal serum potassium on arrival hides a large total-body deficit.

WORKED CASE 2 · SETTING UP THE INSULIN DRIP

After potassium rises to 3.8, the provider orders regular insulin at 0.1 unit/kg/h for Mr. Delacroix, who weighs 80 kg. Pharmacy sends 100 units of regular insulin in 100 mL (1 unit/mL). This is a worked calculation example only.

STEP 1 · FIND THE DOSE

0.1 unit/kg/h x 80 kg = 8 units/h.

STEP 2 · CONVERT TO A PUMP RATE

At 1 unit/mL, 8 units/h = 8 mL/h.

STEP 3 · PRIME THE TUBING

Run insulin solution through the tubing before connecting it, because insulin sticks to plastic.

STEP 4 · SET THE TARGET FALL

Aim for a glucose fall of 50 to 75 mg/dL per hour, with hourly fingersticks. A faster fall risks cerebral edema.

STEP 5 · PLAN FOR 200 MG/DL

When glucose reaches about 200, add 5% dextrose and reduce the drip to 0.02 to 0.05 unit/kg/h: 1.6 to 4 units/h for 80 kg. Do not stop it.

RULE

Give the subcutaneous basal dose 1 to 2 hours before stopping the drip. IV regular insulin lasts only minutes.

WORKED CASE 3 · WHO IS RESOLVED

Later, Mr. Delacroix has glucose 190 mg/dL, sodium 138, chloride 106, bicarbonate 17, venous pH 7.33. The resident asks if the drip can come off.

STEP 1 · CALCULATE THE GAP

138 minus (106 plus 17) = 15 mEq/L, still above 12.

STEP 2 · APPLY THE CRITERIA

Resolved means glucose below 200 plus two of: bicarbonate 15 or higher, venous pH above 7.30, gap 12 or less. He meets glucose, bicarbonate and pH.

STEP 3 · DECIDE AND PLAN THE OVERLAP

By criteria he meets resolution, but the gap is still closing, so confirm with the provider and give basal insulin 1 to 2 hours before the drip stops.

RULE

The anion gap and these criteria, not the glucose alone, tell you the ketoacidosis is over.

WORKED CASE 4 · THE CONFUSED OLDER ADULT

Mrs. Halloran, 82, with type 2 diabetes, comes from a care home confused and very dry. Sodium 148 mEq/L, glucose 1080 mg/dL, pH 7.36, bicarbonate 22, ketones negative.

STEP 1 · CALCULATE OSMOLALITY

2 x 148 = 296, plus 1080/18 = 60, total 356 mOsm/kg, above 320.

STEP 2 · NAME THE CRISIS

Extreme glucose, high osmolality, no acidosis and no ketones: HHS.

STEP 3 · ACT IN ORDER

Airway and neuro check, large-bore access, isotonic fluid resuscitation (deficit about 9 to 12 L), cardiac monitoring, then insulin at lower doses.

STEP 4 · FIND THE CAUSE

Look for infection first: urine, chest film, cultures. Watch her lungs for overload as fluid runs.

TRAPS PEOPLE FALL INTO

- **Starting insulin before checking potassium.** If potassium is below 3.3 mEq/L, insulin waits. Replace potassium first.
- **Stopping the drip when glucose hits 200.** Add dextrose and lower the rate. The drip keeps running until the gap closes.
- **Giving rapid-acting insulin before the tray arrives.** If the meal may not come, the dose does not go in. NPO means hold prandial, keep basal.
- **Soaking a diabetic patient's feet.** Soaking macerates skin and can scald a foot that cannot feel heat. Wash in lukewarm water tested with a thermometer or elbow.

- **Trusting a normal glucose on an SGLT2 inhibitor.** Euglycemic DKA happens. Check ketones and a gas when the patient is nauseated and breathing fast.

Chapter 1 self-test · ten items

1. A 30-year-old has a random plasma glucose of 260 mg/dL with polyuria, polydipsia and weight loss. What is needed to diagnose diabetes?

A. A 2-hour oral glucose tolerance test within the next week
B. A repeat random glucose on a different day to confirm the value
C. None, since symptoms plus a random 200 or more is diagnostic
D. An A1C of 6.5% or higher before any diagnosis can be made

C. None, since symptoms plus a random 200 or more is diagnostic A random glucose of 200 mg/dL or more with classic symptoms needs no confirmation. Confirmation is for asymptomatic patients.

2. Which finding best separates type 1 diabetes from type 2 in a lean adult whose oral agents failed quickly?

A. A family history of type 2 diabetes in a parent
B. Low C-peptide with positive GAD65 antibodies
C. An A1C above 9% at the time of diagnosis
D. High fasting insulin with acanthosis nigricans

B. Low C-peptide with positive GAD65 antibodies Low C-peptide shows the body is not making insulin, and autoantibodies point to autoimmune disease such as LADA.

3. A patient received NPH insulin at 0730. When is hypoglycemia most likely?

A. From late morning through the afternoon and evening
B. Within 15 minutes, before breakfast is finished
C. Only in the early morning hours of the next day
D. At no particular time, since NPH has no peak

A. From late morning through the afternoon and evening NPH peaks 4 to 12 hours after the dose, so the risk window runs from late morning into the evening.

4. A conscious patient can swallow and has a glucose of 58 mg/dL. Which treatment is best first?

A. A peanut butter sandwich and a glass of whole milk
B. A chocolate bar, then recheck the glucose in one hour
C. Glucagon 1 mg intramuscularly, then turn to the side
D. Four ounces of regular juice, then recheck in 15 minutes

D. Four ounces of regular juice, then recheck in 15 minutes The rule of 15 uses fast carbohydrate. Fat in chocolate or peanut butter slows the rise. Glucagon is for patients who cannot swallow.

5. A patient in DKA has a potassium of 3.0 mEq/L. Insulin is ordered at 0.1 unit/kg/h. What should the nurse do?

A. Give sodium bicarbonate first to shift potassium back
B. Start the insulin and add potassium to the next liter
C. Hold the insulin and clarify while potassium is replaced
D. Start the insulin at half the ordered rate for safety

C. Hold the insulin and clarify while potassium is replaced Below 3.3 mEq/L, insulin waits. It would drive potassium into cells and risk arrhythmia and respiratory muscle weakness.

6. During a DKA insulin drip, glucose falls to 195 mg/dL and the anion gap is 18. What is next?

A. Add 5% dextrose and reduce, but continue, the insulin
B. Stop the insulin drip and start the basal dose
C. Continue the same insulin rate with saline only
D. Give a bolus of rapid-acting insulin under the skin

A. Add 5% dextrose and reduce, but continue, the insulin The drip must keep running to close the gap. Dextrose is what makes continuing it safe.

7. Which lab pattern fits HHS rather than DKA?

A. Glucose 210, pH 7.21, gap 22, on empagliflozin
B. Glucose 900, pH 7.38, osmolality 345, ketones absent
C. Glucose 320, pH 7.28, bicarbonate 14, fruity breath
D. Glucose 480, pH 7.12, bicarbonate 9, ketones large

B. Glucose 900, pH 7.38, osmolality 345, ketones absent HHS has very high glucose and osmolality above 320 without acidosis or ketones.

8. A patient with heart failure starts pioglitazone and gains 4 lb in two days with ankle edema. What is the best action?

A. Ask the assistant to recheck the weight tomorrow
B. Give the dose with the evening meal instead
C. Teach a low-sodium diet and recheck in a week
D. Hold the dose and notify the provider

D. Hold the dose and notify the provider Thiazolidinediones cause fluid retention and can worsen heart failure. A rapid gain with edema is reported.

9. Which task may the RN delegate to assistive personnel on a diabetes unit?

A. Obtaining a fingerstick glucose on a stable patient
B. Teaching insulin injection to a new patient
C. Evaluating if a low glucose episode resolved
D. Assessing a new ulcer on the patient's heel

A. Obtaining a fingerstick glucose on a stable patient Point-of-care glucose on a stable patient can be delegated with training. Teaching, evaluation and assessment stay with the RN.

10. A patient with a 3 a.m. glucose of 52 mg/dL has a fasting glucose of 230. What is the likely cause?

A. Missed dose, so a correction dose is needed now
B. Dawn phenomenon, so basal insulin should increase
C. Steroid surge, so midday insulin should increase
D. Somogyi effect, so evening insulin should be reduced

D. Somogyi effect, so evening insulin should be reduced A low 3 a.m. glucose followed by a morning high is rebound (Somogyi). Adding insulin would make it worse.

CHAPTER 2

Endocrine Disorders: Thyroid, Parathyroid, Adrenal and Pituitary

Read it in full: **Chapter 2 in the textbook**. Practice it in the lab: **The Axis Decoder: Read the Pair, Find the Lesion** and **The Calcium Bench: Correct It, Pair It With PTH, Read the QT**.

What to know

Endocrine labs are read as **pairs**. The pituitary sends a trophic hormone (TSH, ACTH) to a target gland, the gland answers with its hormone (thyroxine, cortisol), and that hormone tells the pituitary to quiet down. If the target gland fails, its hormone is low and the trophic hormone is

high: **primary** disease. If the pituitary fails, both are low or the trophic hormone is inappropriately normal: **secondary** (central) disease. A low free T4 with a normal TSH is a pituitary problem, and that patient may lack ACTH too, so glucocorticoid comes before levothyroxine.

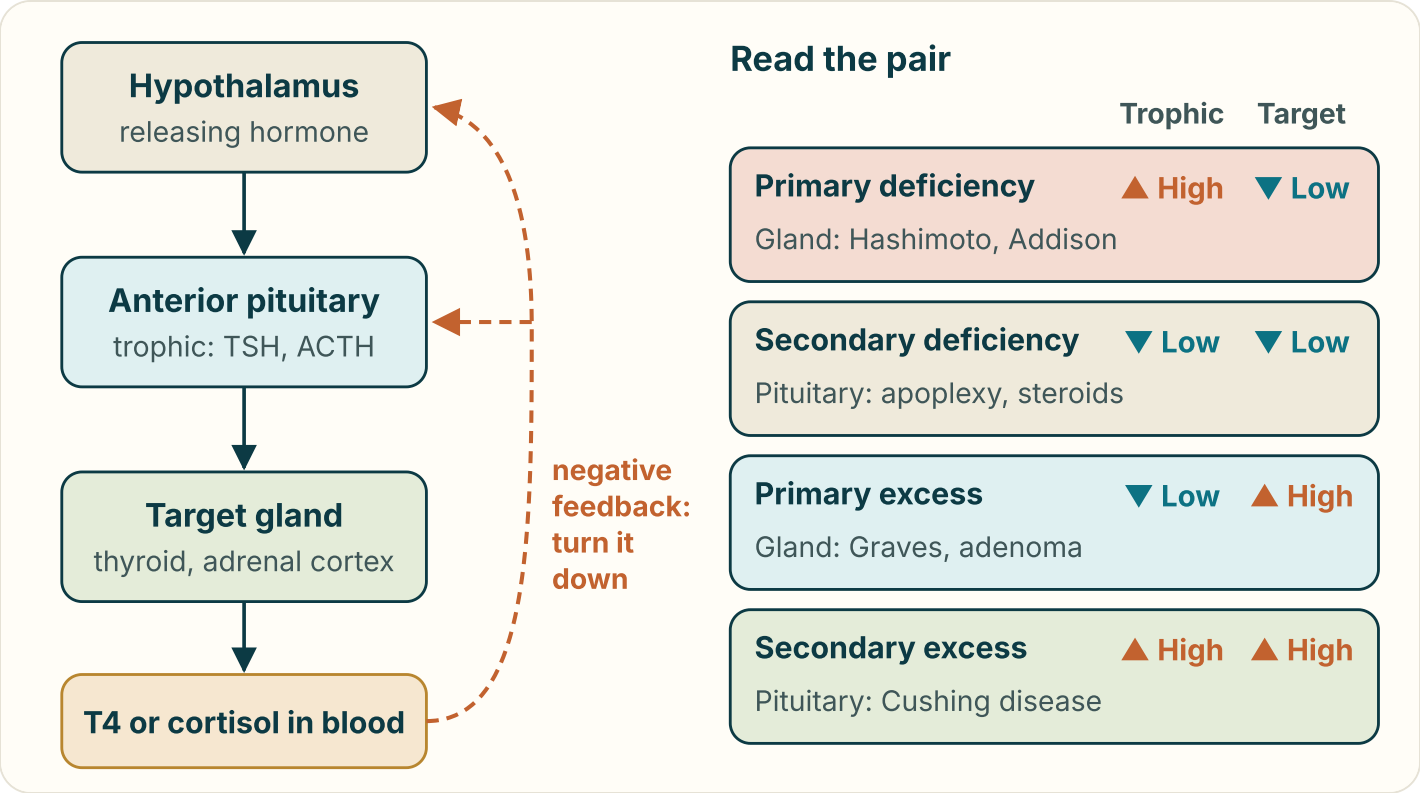
Hypothyroidism slows everything: cold intolerance, constipation, bradycardia, weight gain, coarse skin, slow reflex relaxation, non-pitting puffiness (myxedema). TSH is high and free T4 low. Levothyroxine is taken on an empty stomach 30 to 60 minutes before breakfast, separated by 4 hours from calcium, iron and antacids, and started at 12.5 to 25 mcg in older adults or anyone with coronary disease. Recheck TSH in 6 to 8 weeks. **Myxedema coma** kills by hypoventilation: protect the airway, avoid sedatives, rewarm passively, give IV hydrocortisone before or with IV levothyroxine.

Hyperthyroidism speeds everything: tachycardia, atrial fibrillation, heat intolerance, tremor, weight loss. Graves disease adds goiter and exophthalmos. Methimazole is preferred for most adults (warn about agranulocytosis: sore throat or fever means a same-day CBC). PTU is used in the first trimester and in storm. Radioactive iodine is contraindicated in pregnancy and breastfeeding. In **thyroid storm** the order is beta blocker, then thionamide, then iodine at least 1 hour later, then hydrocortisone, with cooling and acetaminophen, never aspirin. After thyroidectomy watch three things: airway (hematoma), voice (recurrent laryngeal nerve) and calcium (24 to 72 hours).

PTH raises calcium and lowers phosphate. Total calcium is about 8.5 to 10.5 mg/dL; correct for low albumin by adding 0.8 for each 1 g/dL below 4.0. **Hypercalcemia** gives stones, bones, groans and moans, weakness, a short QT and digoxin sensitivity; treat with isotonic saline first, then calcitonin and a bisphosphonate, and furosemide only once volume is replete. **Hypocalcemia** gives tingling, cramps, Chvostek and Trousseau signs, laryngospasm, seizures and a long QT; treat with IV calcium gluconate on a monitor and check magnesium.

Cushing syndrome (too much cortisol) is a slow disease of thin skin, bruising, high glucose, low potassium, bone loss and hidden infection; the most common cause is prescribed steroids. **Adrenal insufficiency** is fast: hypotension, low sodium, high potassium, low glucose. Adrenal crisis gets hydrocortisone 100 mg IV and isotonic saline right away, before any test. Pheochromocytoma needs **alpha blockade before beta blockade**. In the posterior pituitary,

SIADH holds water (low sodium, concentrated urine, specific gravity above 1.030) and **diabetes insipidus** dumps it (high sodium, dilute urine, specific gravity below 1.005). Raise chronic low sodium by no more than about 8 mEq/L in 24 hours.



Always read the pair. If the target gland fails, the pituitary shouts louder, so the two hormones move in opposite directions. If the pituitary fails, both are low.

LOCK THESE IN

- Primary: trophic hormone and target hormone move in opposite directions. Secondary: both low.
- Levothyroxine: empty stomach, separate from calcium and iron by 4 hours, start low in elders and heart disease, recheck TSH in 6 to 8 weeks.
- Thyroid storm order: beta blocker, thionamide (PTU), iodine at least 1 hour later, hydrocortisone. No aspirin.
- After thyroidectomy: airway, voice, calcium. Neck tightness is an emergency; trach tray at the bedside.
- Calcium and QT go opposite ways. Low calcium: long QT, tetany, laryngospasm, IV calcium gluconate, check magnesium.
- Adrenal crisis: hydrocortisone 100 mg IV plus saline now. Never stop steroids; double or triple the dose on sick days.
- Pheochromocytoma: alpha blocker 10 to 14 days before beta blocker. No deep abdominal palpation.
- SIADH: low sodium, concentrated urine, fluid restriction, correct no faster than about 8 mEq/L in 24 hours. DI: high sodium, dilute urine, desmopressin for central.

Key terms and comparisons: reading the pair

Pattern	Trophic hormone	Target hormone	Lesion	Example
Primary deficiency	High	Low	Target gland	Hashimoto hypothyroidism; Addison disease
Secondary deficiency	Low or normal	Low	Pituitary or hypothalamus	Pituitary apoplexy; long-term steroids
Primary excess	Suppressed	High	Target gland	Graves disease; adrenal adenoma
Secondary excess	High or normal	High	Pituitary or ectopic tumor	Cushing disease; ectopic ACTH

Key terms and comparisons: normal values and opposite emergencies

Item	Value or finding
TSH and free T4	TSH about 0.4 to 4.0 mIU/L; free T4 about 0.8 to 1.8 ng/dL
Calcium	Total 8.5 to 10.5 mg/dL; ionized 4.5 to 5.6 mg/dL; phosphate 2.5 to 4.5; magnesium 1.8 to 2.4; PTH about 10 to 65 pg/mL
Corrected calcium	Measured calcium plus 0.8 for each 1 g/dL albumin below 4.0
Hyper vs hypocalcemia	High: weakness, short QT, constipation. Low: tingling, tetany, long QT, laryngospasm
Cosyntropin test	Peak cortisol below about 18 mcg/dL confirms adrenal insufficiency
Dexamethasone 1 mg test	8 am cortisol above 1.8 mcg/dL fails to suppress (screens positive for Cushing)
SIADH	Na below 135, serum osm below 275, urine osm above 100 (usually 300), urine Na above 30 to 40, SG above 1.030
Diabetes insipidus	Urine above 3 L/day, SG below 1.005, urine osm below 300, Na above 145, serum osm above 295

Worked cases

WORKED CASE 1 · READING A THYROID PAIR

Mrs. Abernathy, 61, is tired and cold. Her free T4 is 0.4 ng/dL and her TSH is 0.8 mIU/L. The provider has written levothyroxine 25 mcg daily.

STEP 1 · READ THE TARGET HORMONE

Free T4 0.4 is below the 0.8 to 1.8 range, so she is hypothyroid.

STEP 2 · READ THE TROPHIC HORMONE

A failing thyroid would drive TSH high. A TSH of 0.8 is inappropriately normal, so the pituitary is not responding: secondary (central) hypothyroidism.

STEP 3 · THINK ABOUT THE OTHER AXES

A pituitary that cannot make TSH often cannot make ACTH. Thyroid hormone speeds cortisol clearance and could tip her into adrenal crisis.

STEP 4 · ACT

Before the first levothyroxine dose, clarify with the provider whether her cortisol has been checked and glucocorticoid started first.

RULE

Always ask for the partner hormone. Glucocorticoid before levothyroxine in central disease.

WORKED CASE 2 · TINGLING ON DAY ONE

Ms. Varga had a total thyroidectomy yesterday. At hour 22 she reports tingling around her mouth. Total calcium is 7.6 mg/dL and albumin 2.0 g/dL.

STEP 1 · CORRECT THE CALCIUM

7.6 plus 0.8 x (4.0 minus 2.0) = 7.6 plus 1.6 = 9.2 mg/dL. Corrected, the total looks normal.

STEP 2 · DO NOT STOP THERE

Her symptoms fit true hypocalcemia from parathyroid injury, which peaks at 24 to 72 hours. Request an ionized calcium, which is the active fraction, plus magnesium.

STEP 3 · ASSESS

Check Chvostek and Trousseau signs, reflexes, any stridor, and place her on a cardiac monitor for a long QT.

STEP 4 · PREPARE

Have IV calcium gluconate ready (1 to 2 g diluted, over 10 to 20 minutes, with monitoring) and report to the provider now.

RULE

Perioral tingling after neck surgery is the first rung of a ladder that ends in laryngospasm.

WORKED CASE 3 · SIADH OR DI

Two patients after neurosurgery. Patient A: sodium 122 mEq/L, urine specific gravity 1.032, weight up 2 kg, no edema. Patient B: urine output 320 mL in the last hour, specific gravity 1.002, sodium 149 mEq/L, asking for ice water.

STEP 1 · SORT PATIENT A

Low sodium with concentrated urine and weight gain without edema: SIADH. Restrict fluid to 800 to 1000 mL a day, seizure precautions, neuro checks.

STEP 2 · SET THE SAFE LIMIT FOR A

Raise sodium by no more than about 8 mEq/L in 24 hours: from 122 to no higher than 130 by this time tomorrow.

STEP 3 · SORT PATIENT B

Huge dilute output with high sodium and thirst: central diabetes insipidus. Report output above 200 to 250 mL/h for two hours, keep water at the bedside, expect desmopressin.

RULE

Specific gravity plus serum sodium tells you which water problem you have in two minutes.

TRAPS PEOPLE FALL INTO

- **Giving iodine first in thyroid storm.** Iodine before a thionamide hands the gland raw material. Thionamide first, iodine at least an hour later.
- **Giving aspirin for the fever of storm.** Salicylates free up more thyroid hormone. Use acetaminophen and cooling.
- **Giving furosemide to a dry hypercalcemic patient.** Volume comes first. A loop diuretic belongs only after repletion and only for overload.
- **Starting a beta blocker first for pheochromocytoma.** Unopposed alpha vasoconstriction causes a hypertensive crisis. Alpha blockade comes first.
- **Correcting chronic low sodium quickly.** Faster than about 8 mEq/L in 24 hours risks osmotic demyelination, which is often permanent.

Chapter 2 self-test · ten items

1. A patient has a TSH of 18 mIU/L and a free T4 of 0.4 ng/dL. Where is the problem?

A. In the adrenal gland, a cortisol deficiency
B. In the pituitary, a secondary deficiency
C. In the thyroid gland itself, a primary deficiency
D. In the hypothalamus, a tertiary deficiency

C. In the thyroid gland itself, a primary deficiency A low target hormone with a high trophic hormone means the gland has failed and the pituitary is shouting.

2. A 79-year-old with coronary disease is newly hypothyroid. Which levothyroxine plan is expected?

A. Give the dose with breakfast and calcium
B. Start 12.5 to 25 mcg daily and titrate slowly
C. Start the full weight-based dose right away
D. Start 100 mcg and halve it if chest pain occurs

B. Start 12.5 to 25 mcg daily and titrate slowly Full doses can trigger angina or arrhythmia in older adults and heart disease. Start low and go slow.

3. In thyroid storm, which order of drugs is correct?

A. PTU, then aspirin for the fever, then iodine, then propranolol
B. Hydrocortisone, then iodine, then PTU an hour later, then propranolol
C. Iodine, then PTU, then propranolol an hour later, then hydrocortisone
D. Propranolol, then PTU, then iodine an hour later, then hydrocortisone

D. Propranolol, then PTU, then iodine an hour later, then hydrocortisone Beta blocker first for the heart, then the thionamide, then iodine at least one hour later, then steroid.

4. A patient on methimazole calls with a sore throat and fever. What should the nurse advise?

A. Stop the drug and get a CBC with differential today
B. Double the dose because the thyroid is flaring
C. Take acetaminophen and call if it lasts a week
D. Gargle with salt water and continue the drug

A. Stop the drug and get a CBC with differential today Sore throat, mouth ulcers or fever can signal agranulocytosis, the warning toxicity of thionamides.

5. Four hours after thyroidectomy, a patient says her neck feels tight and you hear stridor. What is first?

A. Give the ordered IV pain medicine and reassess in 30 minutes
B. Ask the assistant to recheck her vital signs and report back
C. Stay, raise the head of bed and call for help with the trach tray
D. Loosen the dressing a little and recheck her neck in 15 minutes

C. Stay, raise the head of bed and call for help with the trach tray Neck tightness with stridor is an expanding hematoma or airway edema until proven otherwise. Airway first; never leave.

6. Which finding is most specific for hypocalcemia?

A. A shortened QT interval seen on the continuous cardiac monitor
B. Facial twitch when the cheek is tapped in front of the ear
C. Constipation with decreased deep tendon reflexes in both legs
D. Carpal spasm after a cuff is held above systolic for 3 minutes

D. Carpal spasm after a cuff is held above systolic for 3 minutes Trousseau sign is more specific than Chvostek. A short QT and constipation fit high calcium.

7. A patient with calcium 14.8 mg/dL is confused. What is the first intervention?

A. Isotonic saline at about 200 to 300 mL per hour
B. IV calcium gluconate infused over 10 minutes
C. A low-calcium diet with strict fall precautions
D. Furosemide 40 mg IV push given right away

A. Isotonic saline at about 200 to 300 mL per hour These patients are dry from polyuria and vomiting. Saline first; a loop diuretic only after volume is restored.

8. A patient with Addison disease is vomiting with a pressure of 76/42. What does the nurse expect first?

A. Fluid restriction and a daily weight
B. Hydrocortisone 100 mg IV and isotonic saline
C. A cosyntropin test before any steroid is given
D. Fludrocortisone by mouth and a salty snack

B. Hydrocortisone 100 mg IV and isotonic saline Adrenal crisis is treated at once. Do not delay steroids for a test in a shocked patient.

9. Which pair of findings separates primary from secondary adrenal insufficiency?

A. Hypotension and fatigue present only in primary disease
B. Low glucose and low sodium present only in secondary disease
C. Weight gain and edema present only in primary disease
D. Hyperpigmentation and a high potassium in primary disease

D. Hyperpigmentation and a high potassium in primary disease In primary disease ACTH is high (pigment) and aldosterone is gone (high potassium). Secondary keeps aldosterone.

10. On day one after transsphenoidal surgery, which visitor action should the nurse stop?

A. Raising the head of the bed to 30 degrees
B. Reading quietly at the bedside with the patient
C. Offering the patient a drink through a straw
D. Helping the patient sip water from a cup

C. Offering the patient a drink through a straw Straws, nose blowing and straining raise pressure on the sellar repair and risk a CSF leak.

ONE PAGE

Cram sheet

One page of numbers and orders for both chapters. Cover the right column and say each rule out loud.

Diabetes

Item	Rule or value
Diagnosis	A1C 6.5% or higher; fasting 126 or higher; 2-hour OGTT 200 or higher; random 200 or higher with symptoms
Prediabetes	A1C 5.7 to 6.4%; fasting 100 to 125; 2-hour 140 to 199
Targets	Most adults A1C below 7%; premeal 80 to 130; peak below 180; inpatient 140 to 180; time in range above 70%
Hypoglycemia	Below 70 level 1; below 54 level 2; rule of 15; D50 25 to 50 mL IV or glucagon 1 mg IM/SC or 3 mg intranasal
Crisis order	Fluids (15 to 20 mL/kg first hour), K (hold insulin below 3.3), regular insulin 0.1 unit/kg/h, D5 at about 200 (DKA) or 250 to 300 (HHS)
Formulas	Gap = Na minus (Cl plus HCO3); osm = 2 x Na plus glucose/18; corrected Na adds 1.6 per 100 glucose above 100
DKA resolved	Glucose below 200 plus two of: HCO3 15 or higher, pH above 7.30, gap 12 or less
Mixing	Air into NPH, air into regular, draw regular first: clear before cloudy
Sick day	Never stop insulin; glucose and ketones every 3 to 4 hours; call for vomiting beyond 4 hours or ketones with glucose above 240
Feet	Inspect daily, no soaking, no barefoot, monofilament yearly

Thyroid, calcium, adrenal and pituitary

Item	Rule or value
Pairs	Primary: opposite directions. Secondary: both low
Myxedema coma	Airway, passive rewarming, hydrocortisone before or with IV levothyroxine
Thyroid storm	Beta blocker, PTU, iodine 1 hour later, hydrocortisone; no aspirin
After thyroidectomy	Airway, voice, calcium at 24 to 72 hours; trach tray, suction, oxygen at bedside
Calcium	High: saline, calcitonin, bisphosphonate. Low: calcium gluconate, magnesium, monitor
Adrenal crisis	Hydrocortisone 100 mg IV, saline (D5NS if low glucose), monitor potassium
Pheochromocytoma	Alpha blocker 10 to 14 days before beta blocker
SIADH	Fluid restriction 800 to 1000 mL; 3% saline if seizing; raise Na no more than about 8 in 24 h
DI	Report output above 200 to 250 mL/h for 2 hours; desmopressin for central; thiazide for nephrogenic
Triphasic response	DI days 1 to 3, SIADH days 5 to 10, then possible permanent DI

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