Endocrine Flags in Primary Care: *When It's Not Just Fatigue*

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Disclosures

I. None relevant to today's topic

Relationships With Financial Sponsors

SPEAKERS BUREAU/ HONORARIA:	**Diabetes/Obesity:** CPD Network Association, Eli Lilly, Novo Nordisk, Dexcom, Abbott (FreeStyle Libre)
GRANTS/RESEARCH SUPPORT/PATENTS:	**Diabetes/Obesity:** Novo Nordisk
CONSULTING FEES:	**Diabetes:** Abbott (FreeStyle Libre), Dexcom
OTHER:	Assistant Professor in Medicine (Dalhousie)

I will be using AI-generated images (not content)
Off-label recommendations will be clearly indicated

CPD = Continuing Professional Development; AI = artificial intelligence

№

Objectives

*Patient Oriented

At the conclusion of this activity, participants will be able to

I. Explore the presentation of **endocrine** causes of fatigue in adults and an *approach to initial **workup** [Medical Expert]
   - Focus: recognize **red flags**

II. Identify some **nuances** and possible **pitfalls** in endocrine interpretation and investigation [Medical Expert, Scholar]

III. List the criteria for involving **endocrinology** (and what to include in the referral) [Medical Expert, Communicator]

№ Slides incl. for your reference

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“I can’t explain it, but I’m so *tired* lately…”

I. Fatigue: Definition

What do patients describe?

“Fatigued”	“Running on empty”	“Wiped”
“Tired”	“Low battery”	“Faint”
“Exhausted”	“Brain fog”	“Overtired”
“Beat”	“Overwhelmed”	“Sapped”
”Lethargic”	“Tuckered out”	“Pooped”
“Weak”	“Worn out/down”	“Weary”
“Drained”	“Burned out”	“Spent”
“Listless”	“Bedraggled”	“Fagged out”
“Unwell”	“No/low energy”	“Zonked”
“Run down”	“Haggard”	“Done in”
“Zapped”	“Sleepy”	“Dead”

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I. Fatigue: Definition

Fatigue:

- Difficulty/inability to initiate activity
- Reduced capacity to maintain activity
- Difficulty with concentration, memory, emotional stability

Related, but different terms:

- Somnolence, malaise, lethargy, dyspnea, weakness (myasthenia), abulia, apathy

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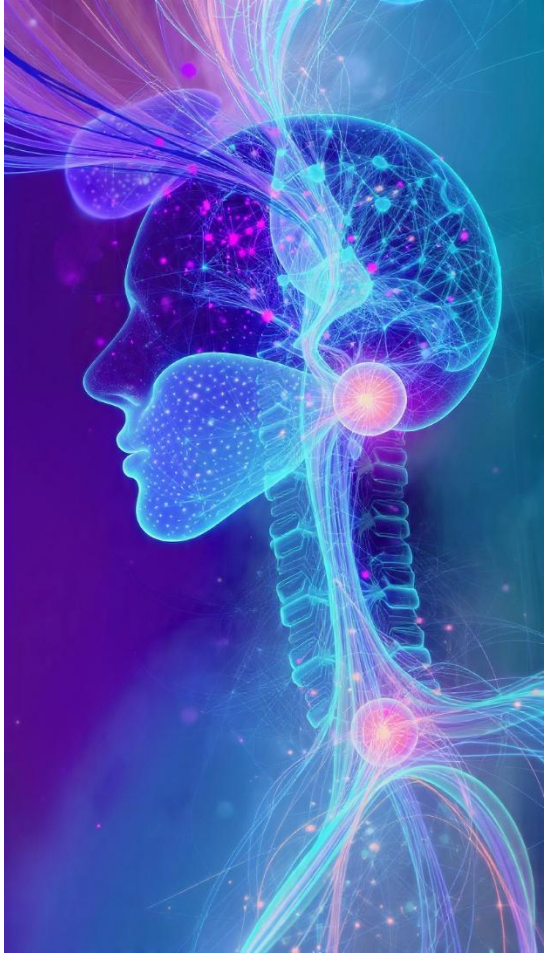
[1]Fosnocht et al. 2026

I. Fatigue: Etiology



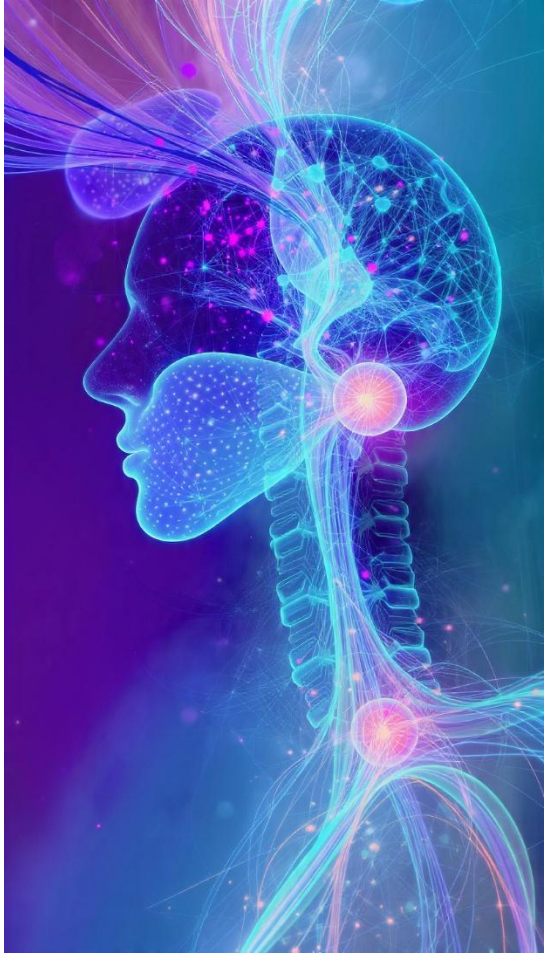
- Many things cause fatigue
- Few serious conditions cause fatigue in isolation
- Many endocrine abnormalities can cause fatigue, but do so with other symptom(s)
- Our job is to uncover serious symptoms i.e. "red flags" (localized findings)

Image generated using Microsoft Copilot, 2025

[1]Fosnocht et al. 2026

I. Fatigue: Etiology

- Some entities that do NOT exist:
  - “Endocrine Fatigue”
  - “Adrenal Fatigue”



- Patients inappropriately take supplements that claim to treat symptoms of these non-conditions

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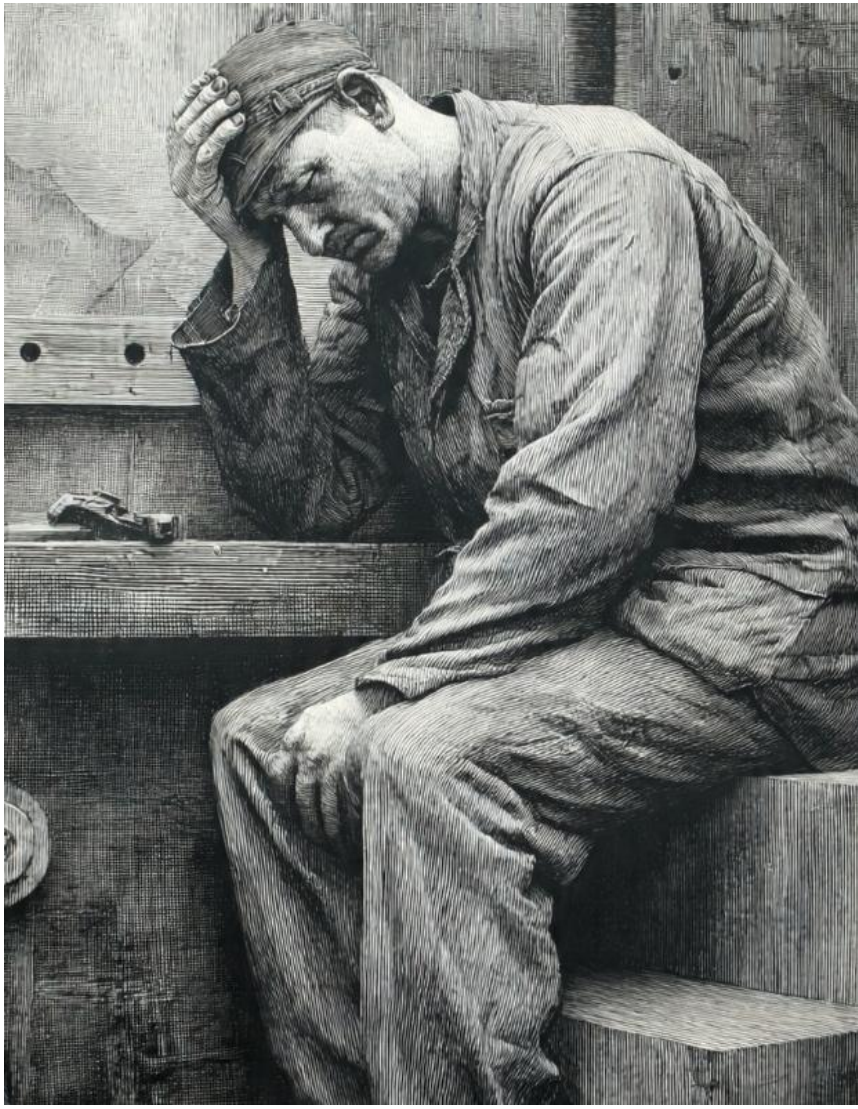
I. Fatigue: Etiology

Aging

1. Iron deficiency ~25%
2. Depression/anxiety ~10-15%
3. Obstructive sleep apnea ~15-30%
4. Hypothyroidism ~5-10%
5. Vitamin B12 deficiency ~5-20%
6. Diabetes mellitus ~10%
7. Vitamin D deficiency ~10-40%
8. Chronic infection/ post-viral ~10-30%
9. Heart disease ~5-10%
10. Fibromyalgia/ myalgic encephalomyelitis/ chronic fatigue syndrome ~2-5%



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“Could it be my *hormones*?”

I. Fatigue: Endo DDx – Anything?

Common
- Diabetes mellitus
- Hypothyroidism
- Menopause
- Metabolic syndrome
  - Insulin resistance
  - Polycystic ovarian syndrome
- Obesity

Less common
- Adrenal insufficiency
- Hyperaldosteronism
- Hyperparathyroidism (↑Ca)
- Hyperthyroidism
- Hypogonadism
- Hyponatremia
- *Vitamin D deficiency

Others
- Carcinoid syndrome
- Diabetes insipidus
- Growth hormone deficiency
- Hypercortisolism
- Hyperprolactinemia
- Hypoglycemia
- Hypoparathyroidism (↓Ca)
- Hypopituitarism
- Pheochromocytoma

[1]Fosnocht et al. 2026
Ca = calcemia

I. Fatigue: Endo DDx – Flags

Common

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Less common

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[1]Fosnocht et al. 2026
Ca = calcemia

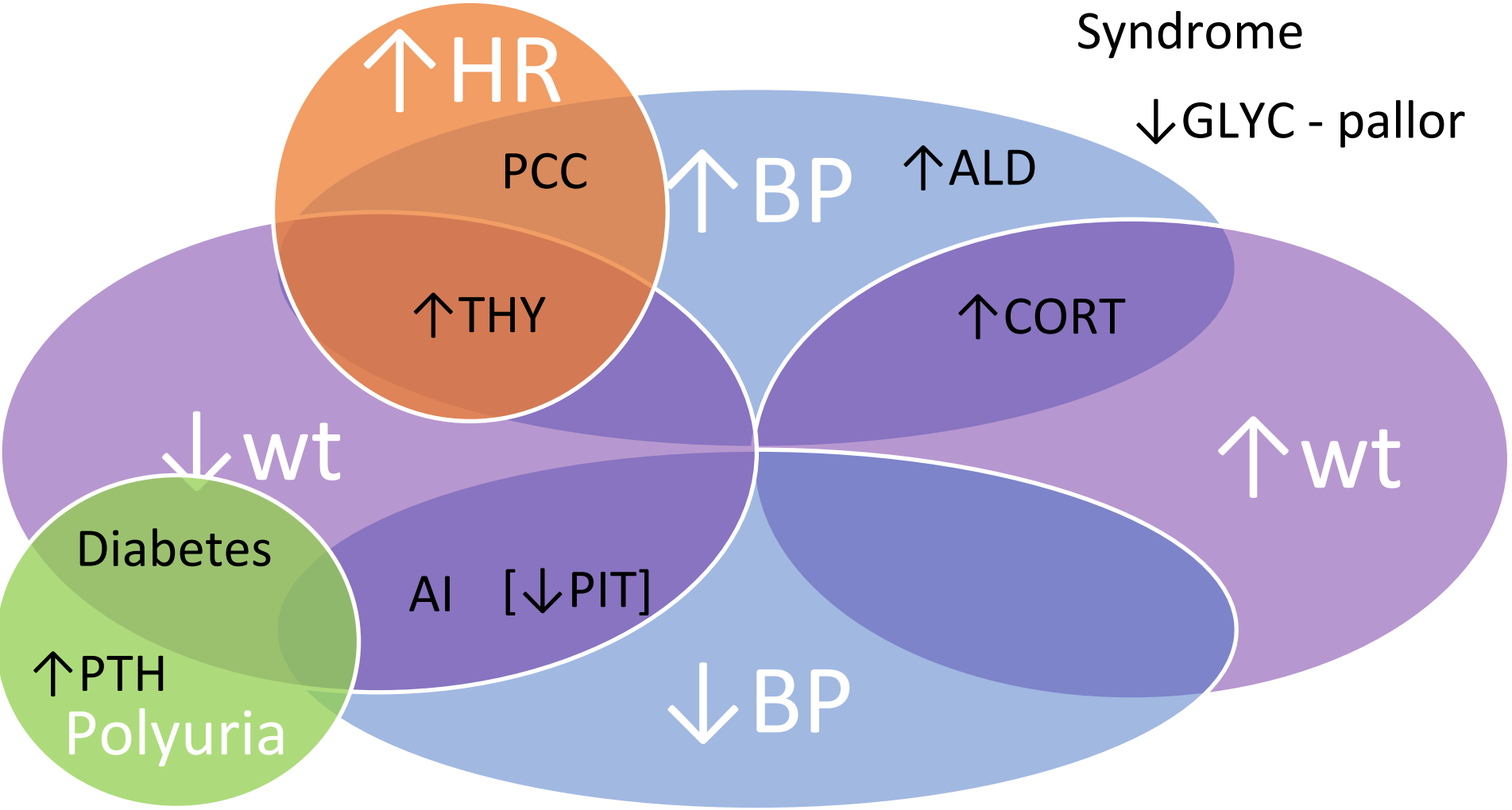
Cause	Key Symptom(s)	Key Sign(s)	Screening Test(s)	Other Test(s)
AI	Anorexia, abdominal pain, nausea/vomiting *salt craving	↓BP, ↓wt *orthostasis, *↑pigmentation	**8AM cortisol**	↓Na, *↑K, **ACTH** (ACTH stimulation)
Carcin-oid	**Flushing**, diarrhea, bronchospasm	Murmur, **telangiectasia**	**Urine 5-HIAA**	(Nuclear imaging)
Diabetes	**Polyuria/dipsia**, visual changes	↓wt	**A1C**, **glucose** (fasting, random), 75g OGTT	GAD antibodies, insulin/C-peptide
↑ALD	**↑BP**	↑BP (**resistant**)	30min seated **aldosterone/renin**	**↓K**, ↑Na (Saline suppression)
↑CORT	Bruising, **proximal weakness**, **facial plethora**, central obesity	↑BP, thin skin, **purple striae**, ↑wt, **dorsocervical/facial**	**1mg DST** 24h urine free cortisol	Late night salivary cortisol, **ACTH**, ↓DHEAS
↑PTH	**Polyuria/dipsia**, **nephrolithiasis**, fracture	None	Albumin, cCa, **↓PO4**	**PTH**, 25-vitamin D 24h urine Ca/Cr
↑THY	**Heat intolerance**, diarrhea, diaphoresis, palpitations	↑HR, ↑BP, ↓wt tremor, **ocular symptoms**, **goitre**	**TSH**	**Thyroid receptor antibody**
↓GLYC	***Whipple's triad**	Pallor	**Fasting glucose**	Insulin, C-peptide
↓PIT	Headache (+/- AI)	**↓peripheral vision**	Prolactin, **free T4**, FSH, LH, 8 AM cortisol	Insulin-like growth factor-1, **sellar MRI**
PCC	**Triad** (headache, diaphoresis, palpitations)	↑BP, ↑HR, orthostasis	24h urine fractionated **metanephrines /catecholamines**	**Serum** metanephrines /catecholamines (Abdominal imaging)

AI = adrenal insufficiency; ACTH = adrenocorticotropic hormone; 5-HIAA = 5-hydroxyindoleacetic acid; OGTT = oral glucose tolerance test; GAD = glutamic acid decarboxylase, ↑ALD = hyperaldosteronism; ↑CORT = hypercortisolism; DST = dexamethasone suppression test; DHEAS = dehydroepiasterone sulfate; cCa = corrected calcium; ↑PTH = hyperparathyroidism; ↑THY = hyperthyroidism; PCC = pheochromocytoma; TSH = thyroid-stimulating hormone; ↓GLYC = hypoglycemia; ↓PIT = hypopituitarism; FSH = follicule-stimulating hormone; LH = luteinizing hormone;

I. Fatigue: Endo Differential

Carcinoid - flushing Syndrome

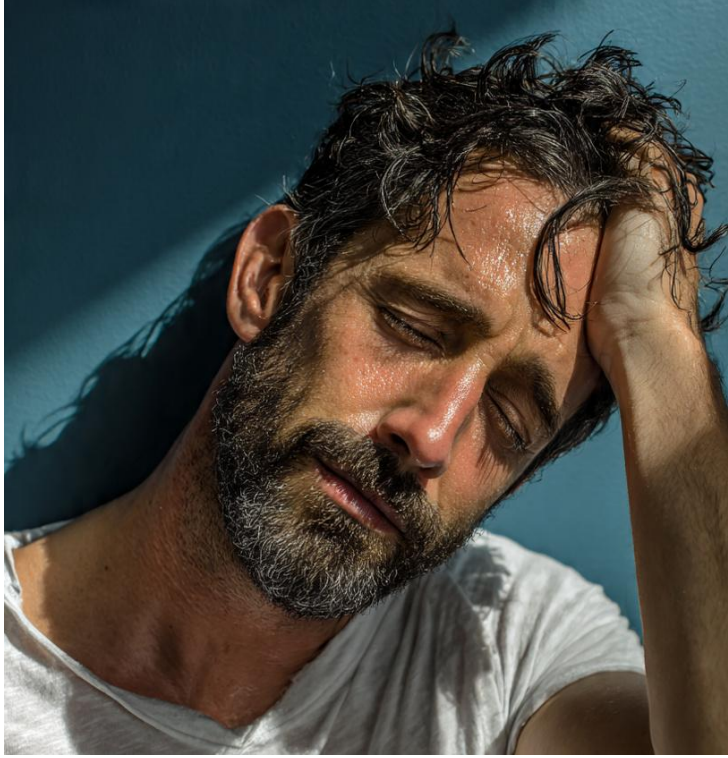
↓GLYC - pallor



AI = adrenal insufficiency; ↑ALD = hyperaldosteronism; ↑CORT = hypercortisolism ↑PTH = hyperparathyroidism; ↑THY = hyperthyroidism; ↓GLYC = hypoglycemia; ↓PIT = hypopituitarism;; PCC = pheochromocytoma

“But I haven’t been on a *cruise*…”

Case 1: AD 38M



- 3mo of fatigue, thirsty, ↓wt, anorexia, eating ++chips (salt craving), "like on a cruise"
- PHx: none
- Meds: none

"No cruise!"

- Exam: ↓wt, ↓BP, HR N, orthostatic drop, tanned, vitiligo
- Labs: K 5.2 ↑, Na 124 ↓

Next steps?

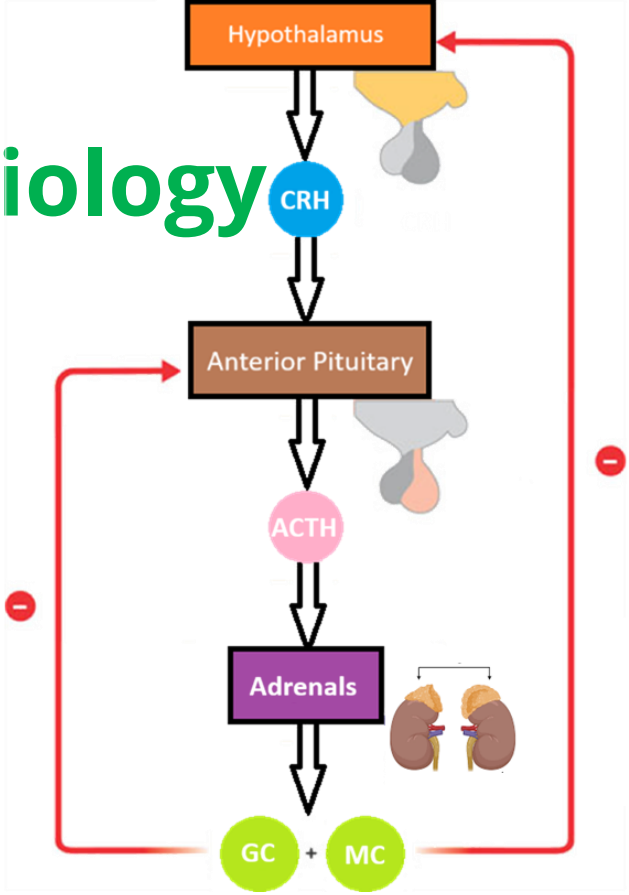
Image generated using Microsoft Copilot, 2025

PHx = past medical history

1. Adrenal Insufficiency: Etiology

Cortisol underproduction (i.e. hypocortisolism)

1. Primary: adrenal injury
   - Addison's: ↑ACTH, ↑CRH +/- ↑K, ↓Na, ↓glucose
2. Secondary: pituitary injury
   - See Hypopituitarism
     - *↓ACTH, ↑CRH +/- ↓Na
3. [Tertiary: hypothalamic injury]
   - Chronic GCs, opioids
     - ↓ACTH, ↓CRH, +/- ↓Na



[2]Nieman et al. 2026

ACTH = adrenocorticotropic hormone; CRH = corticotropin-releasing hormone; GC = glucocorticoids; MC = mineralocorticoids

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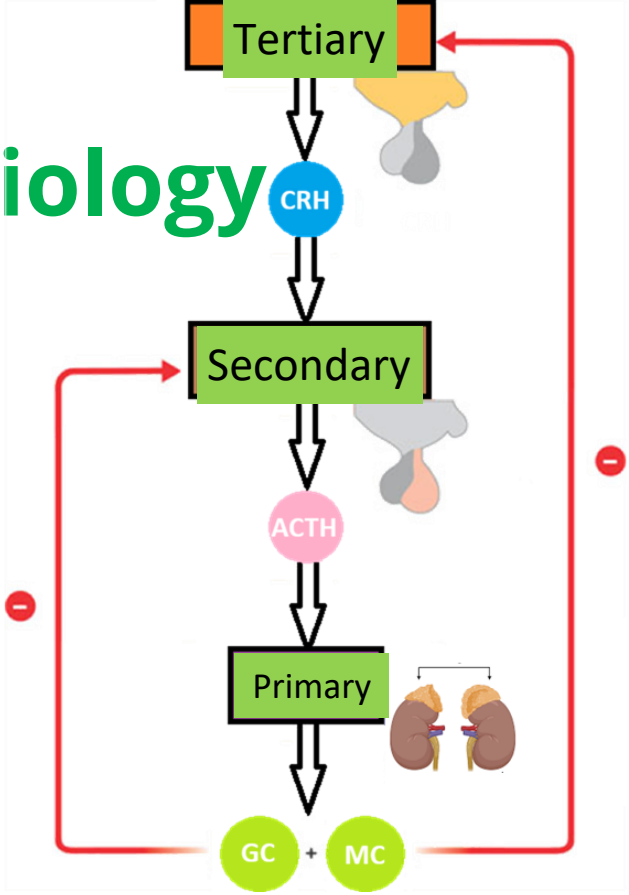

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ACTH = adrenocorticotropic hormone; CRH = corticotropin-releasing hormone; GC = glucocorticoids; MC = mineralocorticoids

1. Adrenal Insufficiency: Approach

1. Symptoms? Signs?
   - Anorexia, abdominal pain, nausea/vomiting, diarrhea, weakness, unintentional weight loss, hypotension, myalgia, arthralgia, oligo/amenorrhea, ↓Na
   - Primary: orthostasis, hyperpigmentation, salt craving, ↑K, ↓glucose
2. Offending agents?
   - Biotin, medications (steroids, opioids, immunotherapy, etomidate, antifungals, metyrapone, phenytoin, mitotane, barbiturates, megestrol, rifampin, anticoagulants, anticonvulsants, antiretrovirals)
3. Screening (after minimizing interference from 2.)
   - AM cortisol, ACTH, electrolytes, fasting glucose
   - hCG (♀ child-bearing)

[2]Nieman et al. 2026

ACTH = adrenocorticotropic hormone; hCG = beta-human chorionic gonadotropin

1. Adrenal Insufficiency: Nuance

*Pearl: screen 8AM cortisol

*Pearl: hold GCs before screening

- Screening: 8AM cortisol + ACTH
  - Random cortisol NOT helpful
    - >350-500 = normal (depends on assay)
    - <50: clearly adrenal insufficiency
    - 50-350: confirmation needed
  - No GCs for 48h (dexamethasone for 7d)

- Confirmation: ACTH stimulation (GIM/Endo)
  - Cosyntropin 250mcg IV, then cortisol at time = 30 min and 60 min
    - >350-500 = normal (depends on assay)

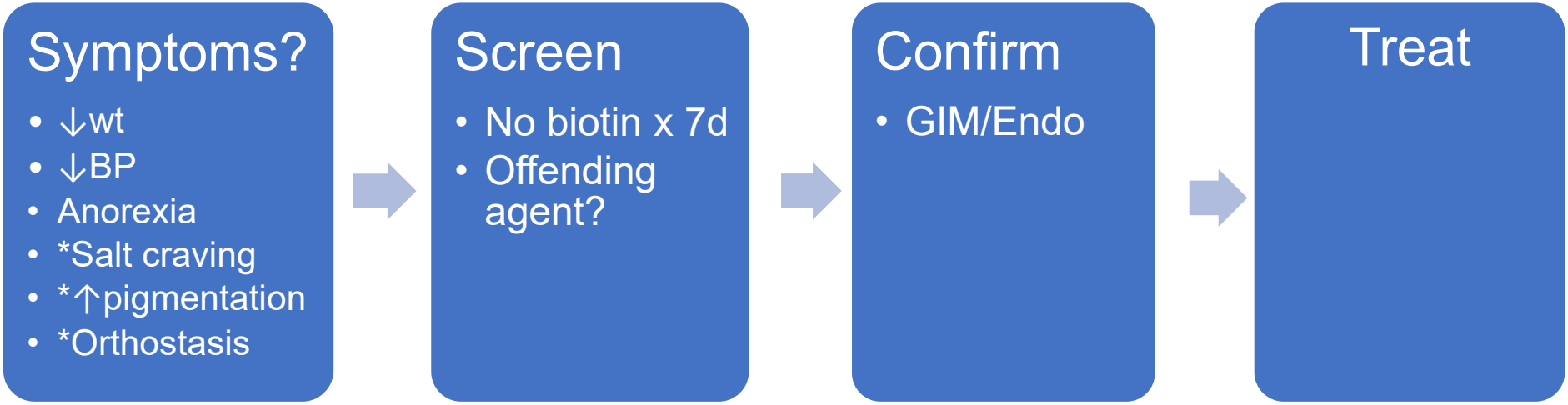
ACTH = adrenocorticotropic hormone; GC = glucocorticoids; GIM/Endo = general internal medicine/endocrinology

1. Adrenal Insufficiency: Treatment

1. Primary: glucocorticoid + mineralocorticoid
   - Hydrocortisone 10mg PO qAM + 5mg qPM + fludrocortisone 0.05mg PO qAM
   - Crisis: hydrocortisone injection kit

2. Secondary: glucocorticoid only
   - Hydrocortisone 10mg PO qAM + 5mg qPM

1. Adrenal Insufficiency: Summary



ACTH = adrenocorticotropic hormone; hCG = beta-human chorionic gonadotropin;
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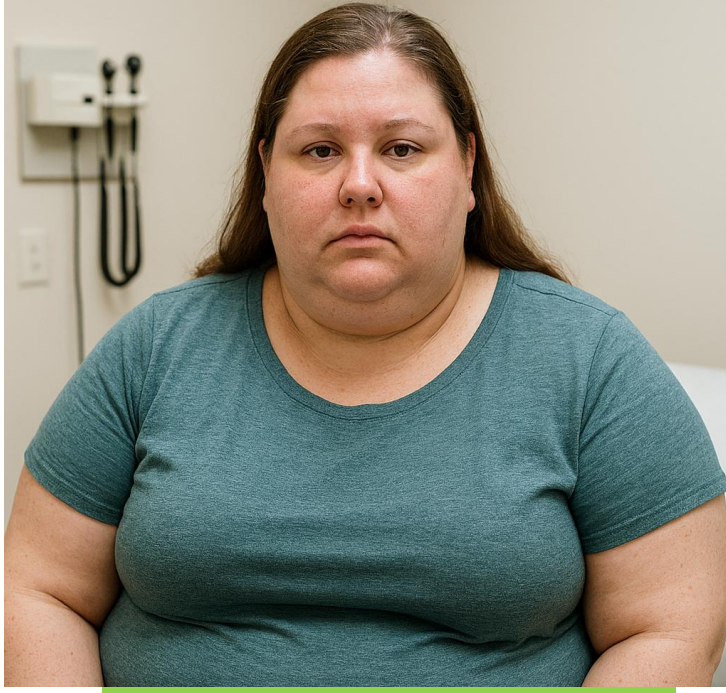
“I keep *gaining* weight”

Case 2: CS 43F



"Weight gain"

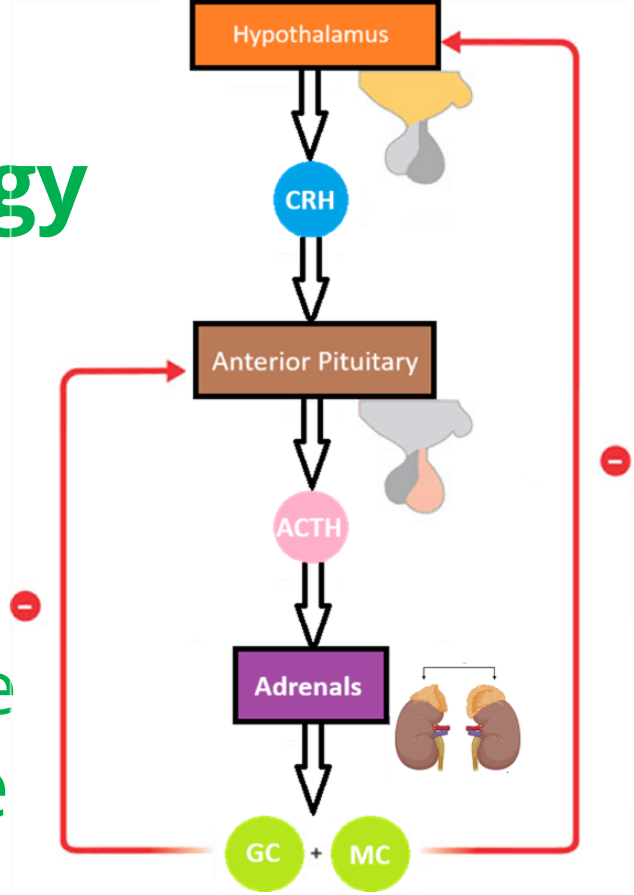
- 6mo of fatigue, ↑wt (50 pounds, mostly stomach/face), oligomenorrhea, hirsutism
- PHx: none
- Meds: none
- Exam: ↑wt (face/nape), ↑BP, HR N, facial plethora, proximal weakness, wide violaceous striae
- Labs: K N, Na N, fasting glucose 7.5 ↑, random cortisol 502

Next steps?

Image generated using Microsoft Copilot, 2026

PHx = past medical history

2. Hypercortisolism: Etiology



Cortisol overproduction

1. Primary: adrenal source
   - Adenoma
     - ↓ACTH, ↓CRH +/- ↑glucose
2. Secondary: pituitary source
   - Cushing disease
     - *↑ACTH, ↓CRH +/- ↑glucose
3. Other source
   - E.g. exogenous

[3]Nieman et al. 2016

ACTH = adrenocorticotropic hormone; CRH = corticotropin-releasing hormone; GC = glucocorticoids; MC = mineralocorticoids

2. Hypercortisolism: Etiology

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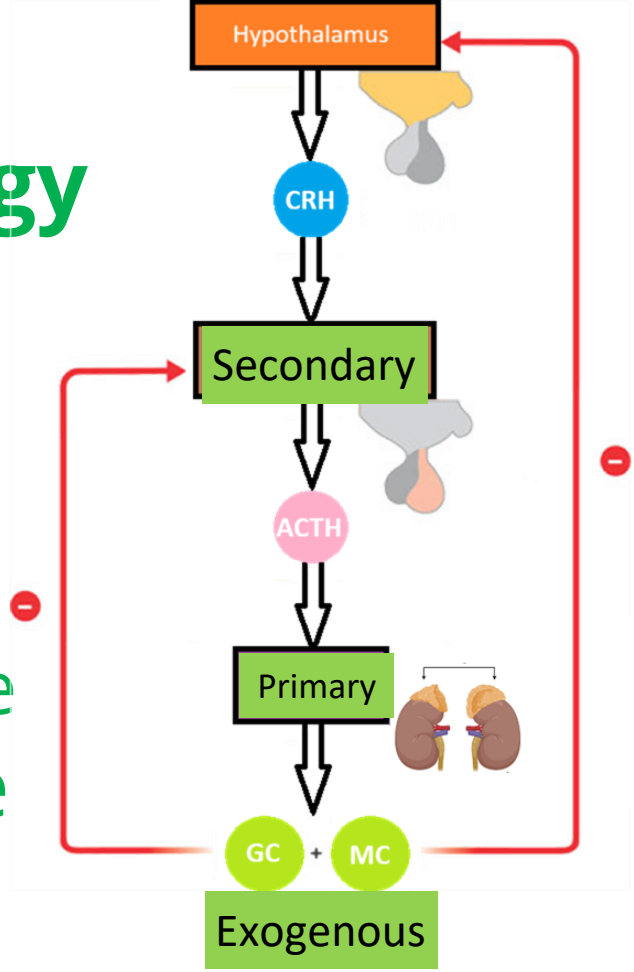


[3]Nieman et al. 2016

ACTH = adrenocorticotropic hormone; CRH = corticotropin-releasing hormone; GC = glucocorticoids; MC = mineralocorticoids

2. Hypercortisolism: Approach

1. Symptoms? Signs?
   - Fatigue, violaceous striae, facial plethora, easy bruising, proximal myopathy, unintentional weight gain (central, dorsocervical fat pad, facial fullness), fragility fracture, depression, hypertension, thin skin, peripheral edema, cognitive changes
   - Hyperandrogenism: oligo/amenorrhea, hirsutism, acne, deepening voice, androgenic alopecia, clitoromegaly
2. Offending agents?
   - Biotin, medications (steroids, estrogen, anticonvulsants, rifampin, pioglitazone, antifungals, antiretrovirals, fluoxetine, diltiazem, mitotane, fenofibrate)
3. Screening (after minimizing interference from 2.)
   - 1mg DST, ACTH, DHEAS, A1C, fasting glucose/lipids
   - hCG (♀ child-bearing), 24h UFC (estrogen)

[3]Nieman et al. 2016

DST = dexamethasone suppression test; ACTH = adrenocorticotropic hormone; DHEAS = dehydroepiasterone sulfate
hCG = beta-human chorionic gonadotropin; UFC = urine free cortisol

2. Hypercortisolism: Nuance

- Screening: 1mg DST 11PM + 8AM cortisol
  - Random cortisol NOT helpful
    - 8AM cortisol: <50 = normal
  - No other GCs for 48h
  - Estrogen use: false positives
- Confirmation:
  - 24h urine free cortisol (esp. estrogen)
  - 8mg DST 11PM + 8AM cortisol
  - 12AM salivary cortisol

*Pearl: screen 1mg DST (not random cortisol)

*Pearl: screen 24h UFC with estrogen

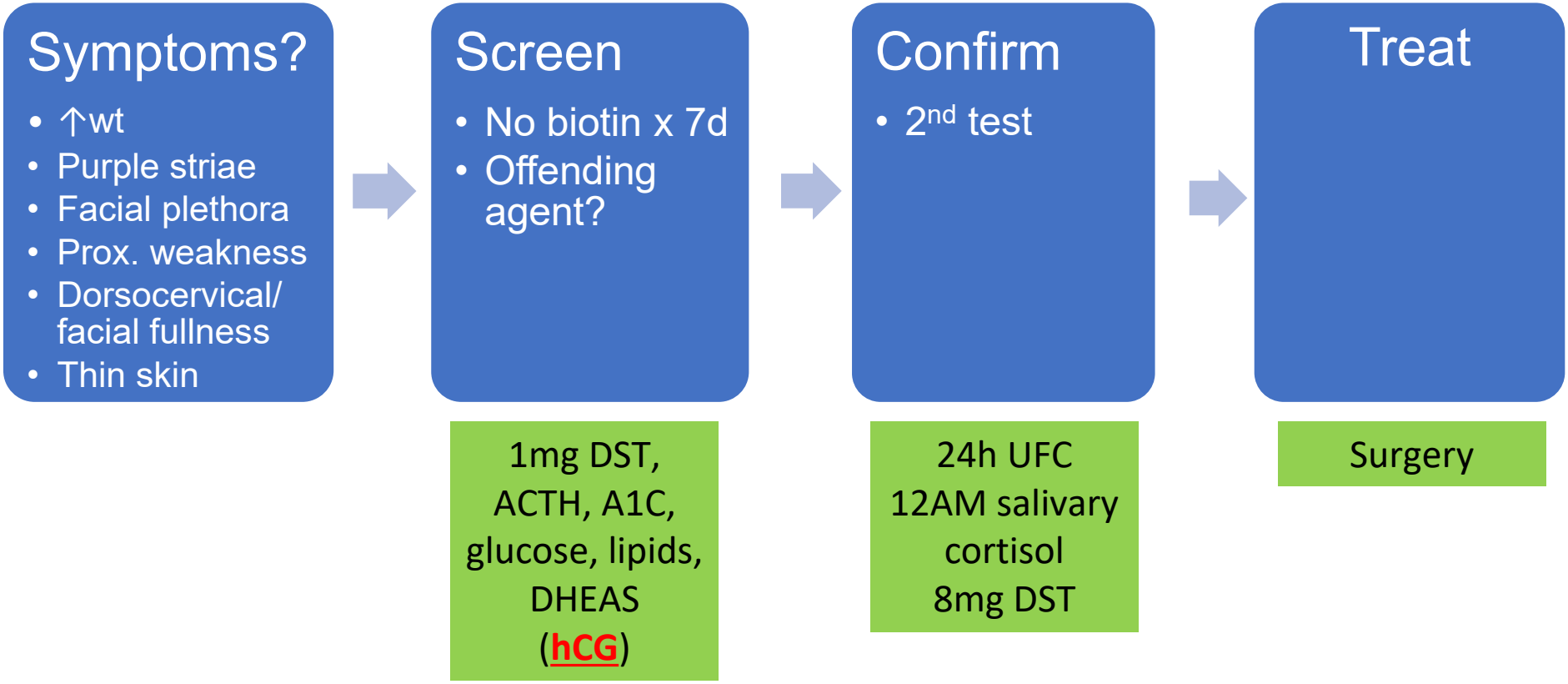
DST = dexamethasone suppression test; GCs = glucocorticoids

2. Hypercortisolism: Treatment

1. Surgery preferred

2. Medications 2nd-line

2. Hypercortisolism: Summary



DST = dexamethasone suppression test; ACTH = adrenocorticotropic hormone; DHEAS = dehydroepiasterone sulfate
hCG = beta-human chorionic gonadotropin; UFC = urine free cortisol;

"Why am I *peeing* so much? – I'm NOT pregnant!"

Case 3: DM 29F

- 6wk fatigue, polyuria, polydipsia, intermittent blurry vision

- PHx: hypothyroidism
- Meds: levothyroxine 50mcg

- Exam: ↓wt, BP N, HR N, mild dehydration, otherwise normal

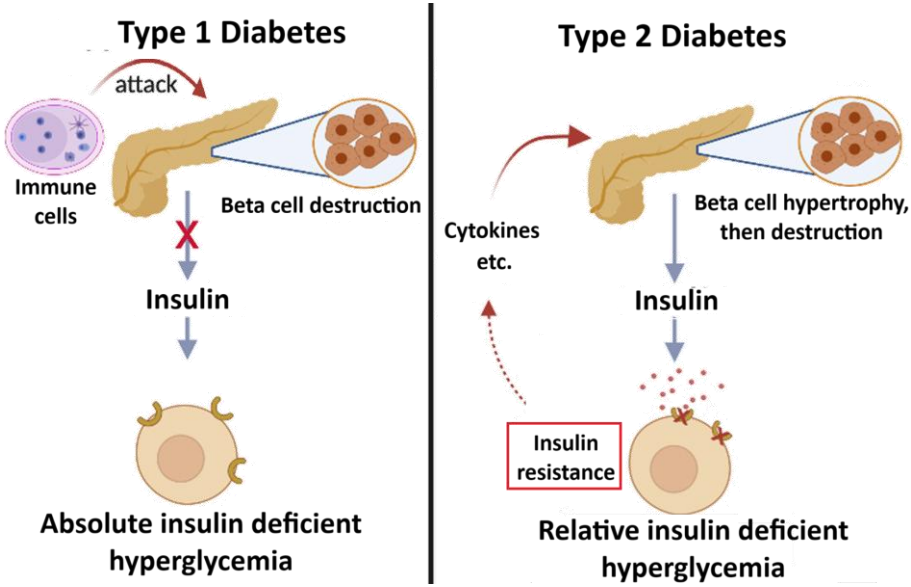
- TSH N, hCG N, fasting glucose 7.4↑ Next steps?

Image generated using Meta AI, 2024

PHx = past medical history; TSH = thyroid-stimulating hormone; hCG = beta-human chorionic gonadotropin

3. Diabetes: Etiology

1. Insulin deficiency
   - "Type 1" diabetes
     - Pancreatic antibodies (GAD)
2. Insulin resistance
   - Type 2 diabetes
     - Other comorbidities
3. Others
   - LADA, monogenic, meds



Deficiency ⟷ Resistance

[4]Inzucchi et al. 2026; [5]Punthakee et al. 2018
GAD = glutamic acid decarboxylase; LADA = latent autoimmune diabetes of adulthood

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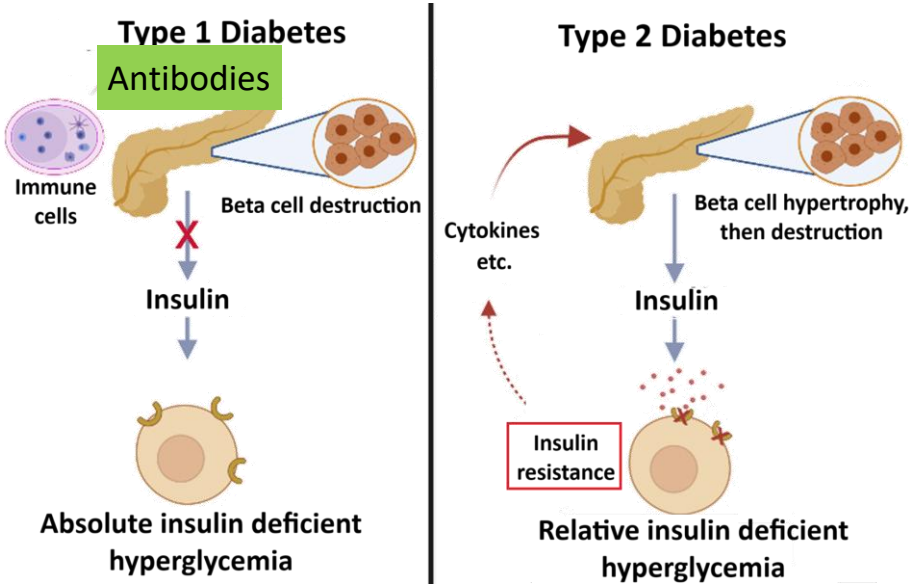
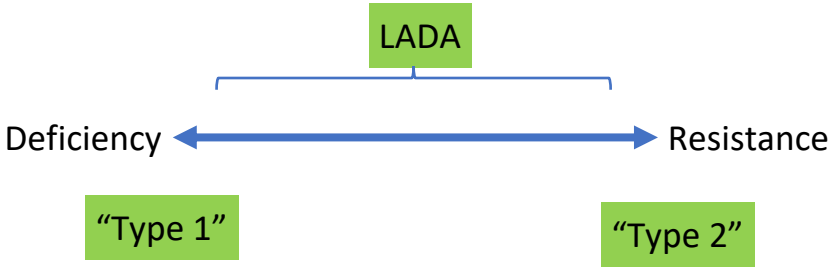




[4]Inzucchi et al. 2026; [5]Punthakee et al. 2018
GAD = glutamic acid decarboxylase; LADA = latent autoimmune diabetes of adulthood

3. Diabetes: Approach

1. Symptoms? Signs?
   - Polyuria, polydipsia, nocturia, visual changes, unintentional weight loss, oligo/amenorrhea, dehydration, hypertension, obesity, metabolic syndrome, microvascular complications
   - Type 1: autoimmune, age <30, low BMI, DKA
2. Offending agents?
   - Medications (steroids, levothyroxine, beta-agonists, thiazides, atypical antipsychotics, phenytoin, protease inhibitors, etc.)
3. Screening
   - A1C, fasting glucose/lipids, urine ACR
   - *Antibodies: GAD-65
   - hCG (♀ child-bearing)

[4]Inzucchi et al. 2026; [5]Punthakee et al. 2018
BMI = body mass index; DKA = diabetic ketoacidosis; ACR = albumin creatinine ratio;
GAD = glutamic acid decarboxylase; hCG = beta-human chorionic gonadotropin

3. Diabetes: Nuance

*Pearl: screen 8AM cortisol

- Screen: A1C ≥6.5, fasting glucose ≥7, random glucose ≥11
- Confirm: 75g OGTT ≥11

- Autoimmune? (see Diabetes Canada)
  - Antibodies: GAD-65
- Insulin needed? (*Asymptomatic)
  - Labs: fasting insulin, C-peptide level (<300)

[4]Inzucchi et al. 2026; [5]Punthakee et al. 2018
OGGT = oral glucose tolerance test; GAD = glutamic acid decarboxylase;

3. Diabetes: Treatment

1. Lifestyle
   - Referral to diabetes centre to review diagnosis/treatment

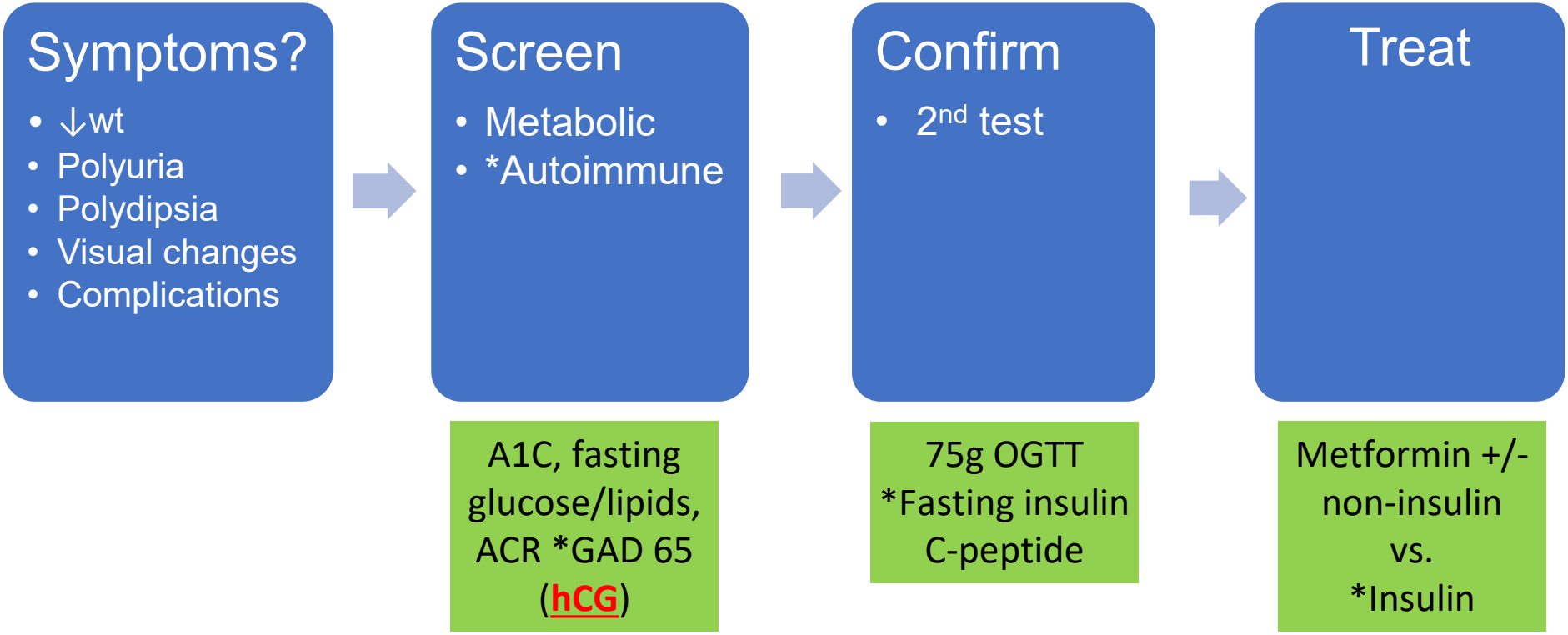
2. Metformin
   - Next "salient" feature
     - Obesity, CKD, CAD, CHF…

3. Insulin
   - If symptomatic hyperglycemia
   - If fasting C-peptide <300)

*Pearl: symptomatic ↑glucose requires insulin

CKD = chronic kidney disease; CAD = coronary artery disease; CHF = congestive heart failure

3. Diabetes: Summary



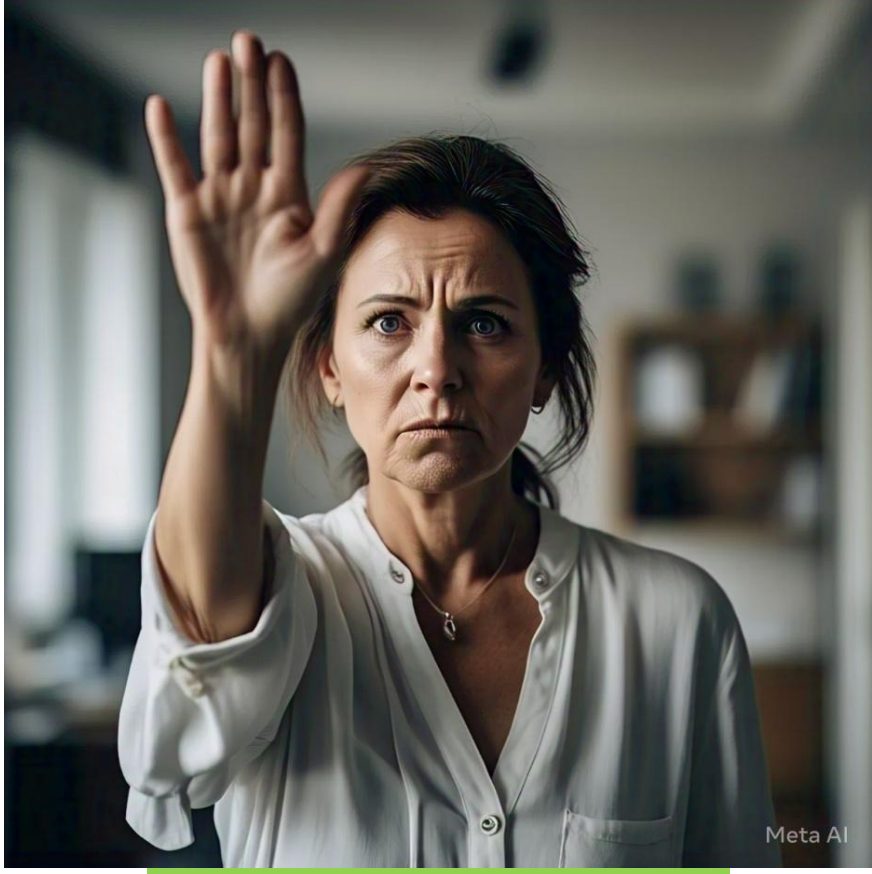
GAD = glutamic acid decarboxylase; hCG = beta-human chorionic gonadotropin; OGTT = oral glucose tolerance test

“Why am I shaking *after* I eat?”

Case 4: RH 57F

- 3mo of fatigue, “feeling off” after eating large meals
- PHx: prediabetes, GERD
- Meds: sucralfate
- Exam: wt stable, BP N, HR N, pale, otherwise normal
- Labs: ferritin N, fasting glucose 6.5 ↑, A1C 6.2 ↑

Next steps?



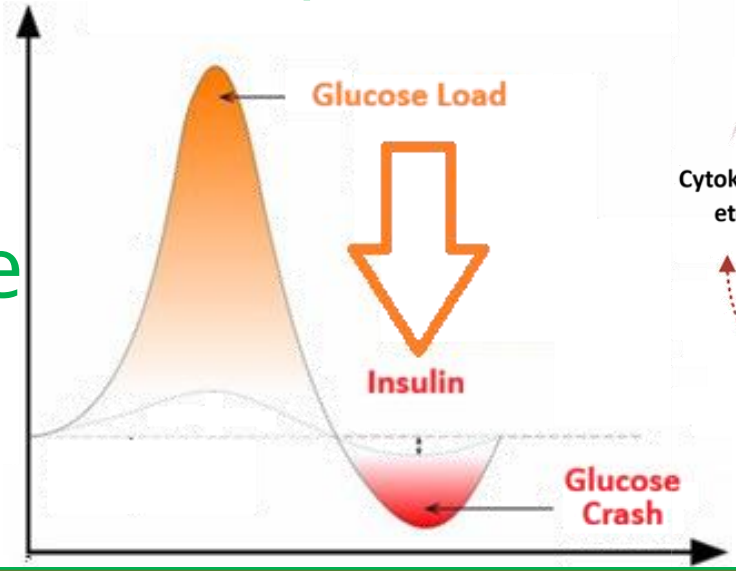
“Shaky meals”

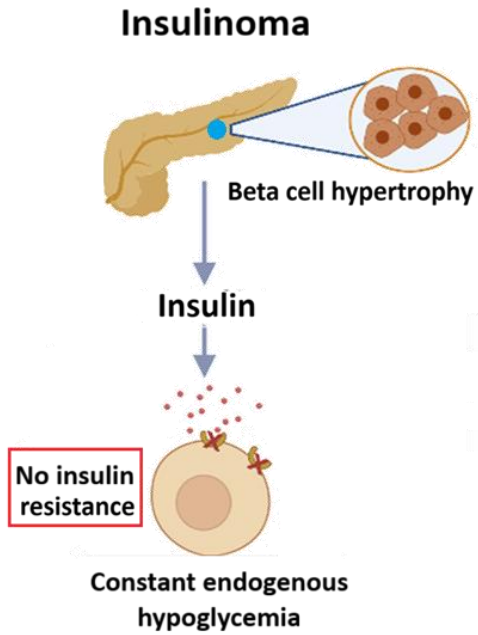
Image generated using Meta AI, 2025

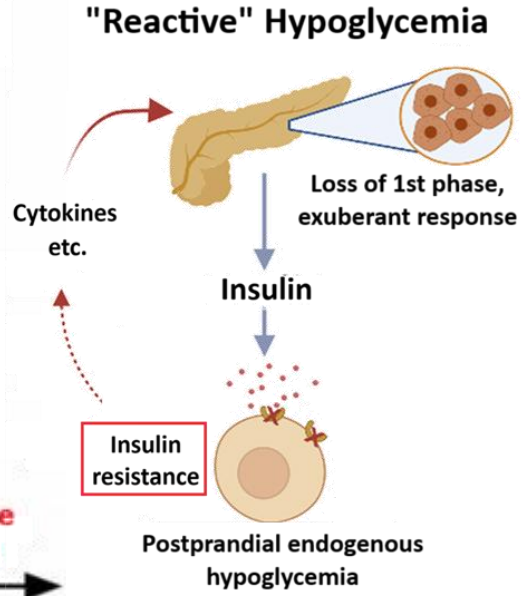
PHx = past medical history; GERD = gastroesophageal reflux disease

4. Hypoglycemia: Etiology

1. Insulin overproduction
   - Fasting: insulinoma
   - Postprandial: prediabetes ("reactive": loss of 1st-phase)
2. Others
   - AI
   - Liver disease
   - CKD
   - Alcohol







[6]Vella et al. 2026

AI = adrenal insufficiency; CKD = chronic kidney disease

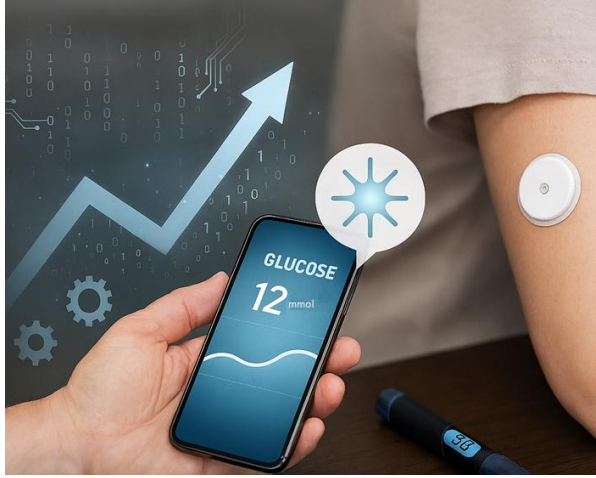
4. Hypoglycemia: Approach

1. Symptoms? Signs?
   - Tremor, palpitations, anxiety, diaphoresis, pallor, hunger, paresthesia, weakness, reduced LoC, dizziness, weight gain, timing (fasting vs. postprandial), *adrenal insufficiency, *diabetes, *liver disease
   - Whipple's triad: 1. Symptoms 2. Documented ↓glucose 3. Improvement with normalized glucose
2. Offending agents?
   - Biotin, medications (pentamidine, quinine, indomethacin, glucagon, lithium, ACEi, ARB, beta-agonists, levofloxacin, mifepristone, septra, heparin, 6-mercaptopurine, sucralfate)
3. Screening (after minimizing interference from 2.)
   - *Fasting glucose, insulin, C-peptide, ketones
   - Other causes: 8AM cortisol, liver/renal function

[6]Vella et al. 2026

LoC = level of consciousness; ACEi = angiotensin-converting enzyme inhibitors; ARB = aldosterone-receptor blocker

4. Hypoglycemia: Nuance



- Screening: replicate situation
  - Fasting: insulin, C-peptide, BHB
  - Postprandial: mixed meal (GIM/Endo)

- Confirmation:
  - Continuous glucose monitor
  - 72h fast (GIM/Endo): rarely needed

*Pearl: use CGM trial to document ↓glucose

Image generated using Meta AI, 2025

[6]Vella et al. 2026

BHB = beta-hydroxybutyrate; GIM/Endo = general internal medicine/endocrinology

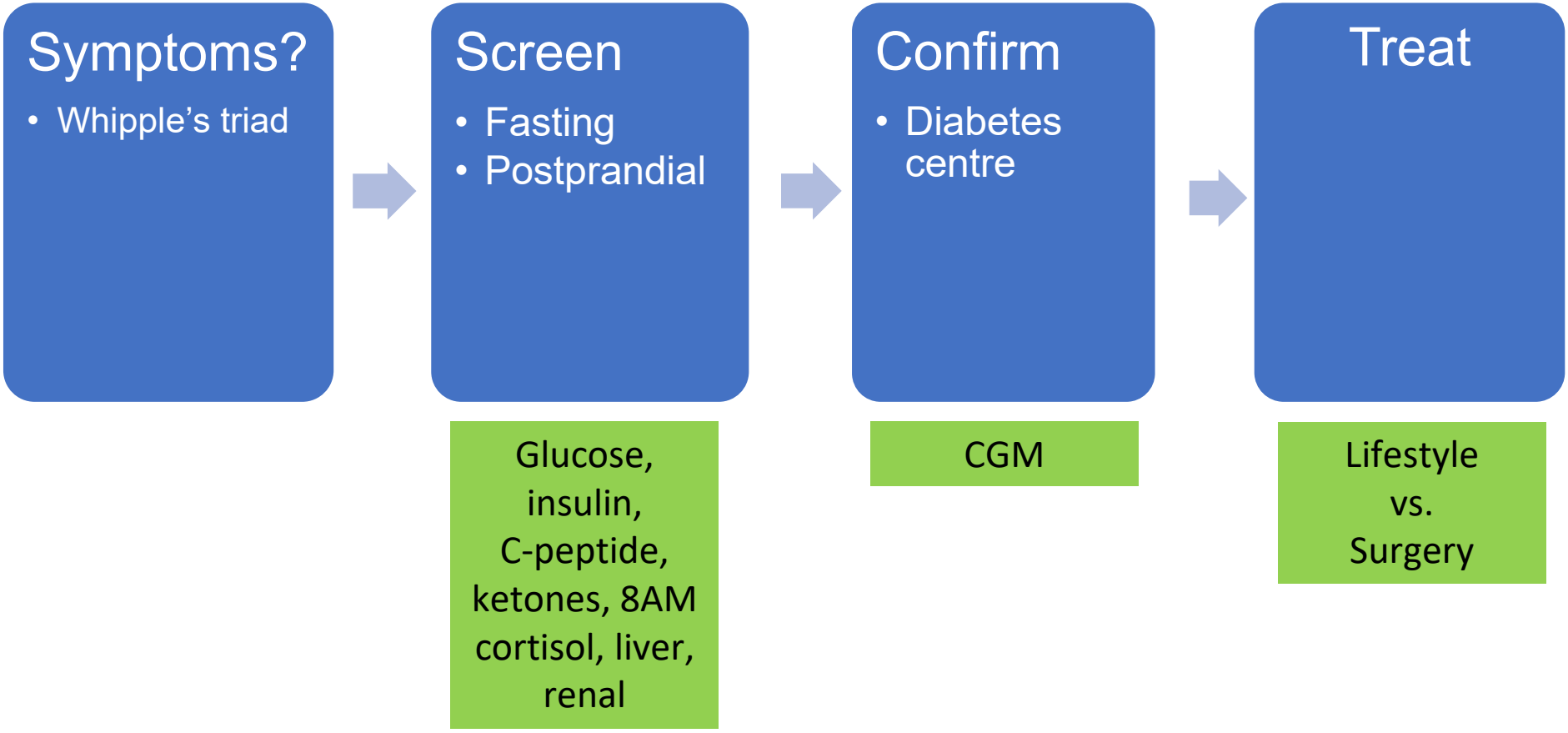
4. Hypoglycemia: Treatment

1. Lifestyle factors
   - Referral to diabetes centre to review prevention/treatment
     - Postprandial: smaller, frequent, lower carb, higher-protein meals

2. Medications 2nd-line (off-label)

3. *Insulinoma: surgery preferred

4. Hypoglycemia: Summary



CGM = continuous glucose monitor

“Could my *thyroid* be off?”

Case 5: GD 73M

- New diagnosis of atrial fibrillation and heart failure
- 3mo history of fatigue, dry eyes, tremor, "sweatiness"
- PHx: GERD, allergies, gout
- Meds: rabeprazole, cetirizine, allopurinol

- Exam: ↓wt, ↑BP, ↑HR, heart failure, goitre, proptosis
- TSH undetectable ↓, free T4 28.4

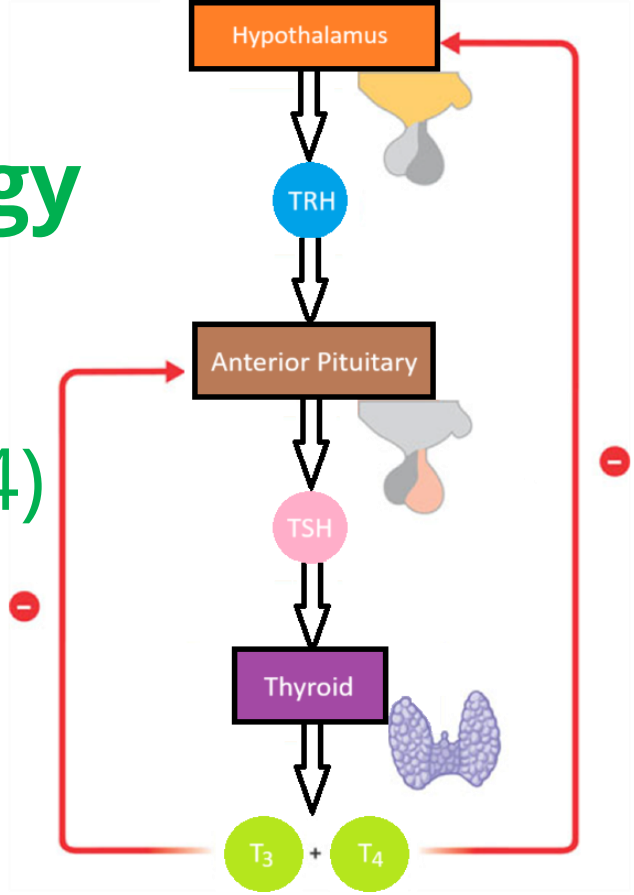
Next steps?

Image generated using Meta AI, 2024

PHx: past medical history; GERD: gastroesophageal reflux disease
TSH = thyroid-stimulating hormone; T4 = thyroxine

5. Hyperthyroidism: Etiology

1. Overproduction of thyroid hormones (free T3 > free T4)
   - Graves' disease: thyroid receptor antibody
   - Toxic nodule(s)
2. Release of stored thyroid hormones (free T4 > free T3)
   - Thyroiditis: TPO antibody
3. [Extrathyroidal source]



[7]Ross et al. 2025

TRH = thyrotropin-releasing hormone; TSH = thyroid-stimulating hormone; T4 = thyroxine; T3 = triiodothyronine
TPO = thyroid peroxidase

5. Hyperthyroidism: Etiology

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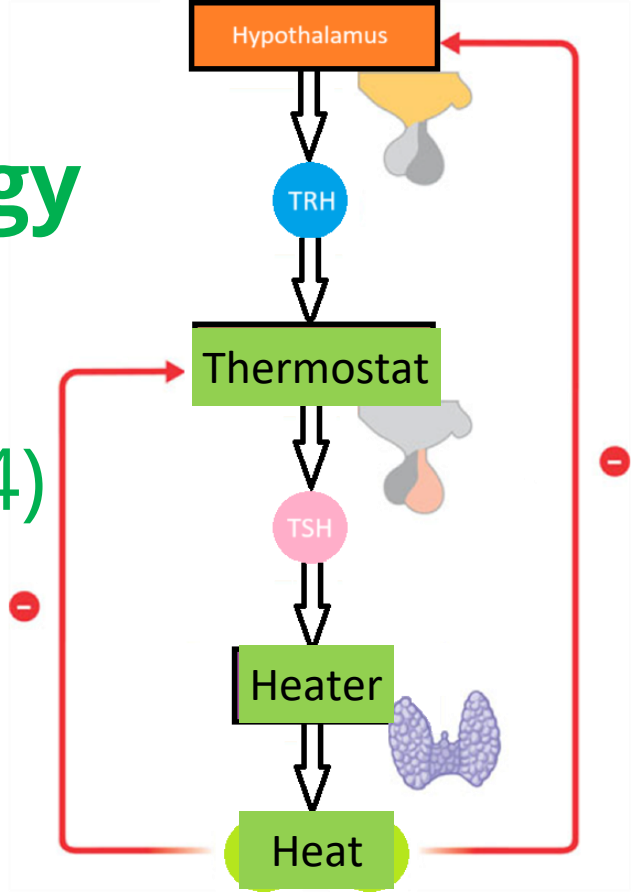


[7]Ross et al. 2025

TRH = thyrotropin-releasing hormone; TSH = thyroid-stimulating hormone; T4 = thyroxine; T3 = triiodothyronine
TPO = thyroid peroxidase

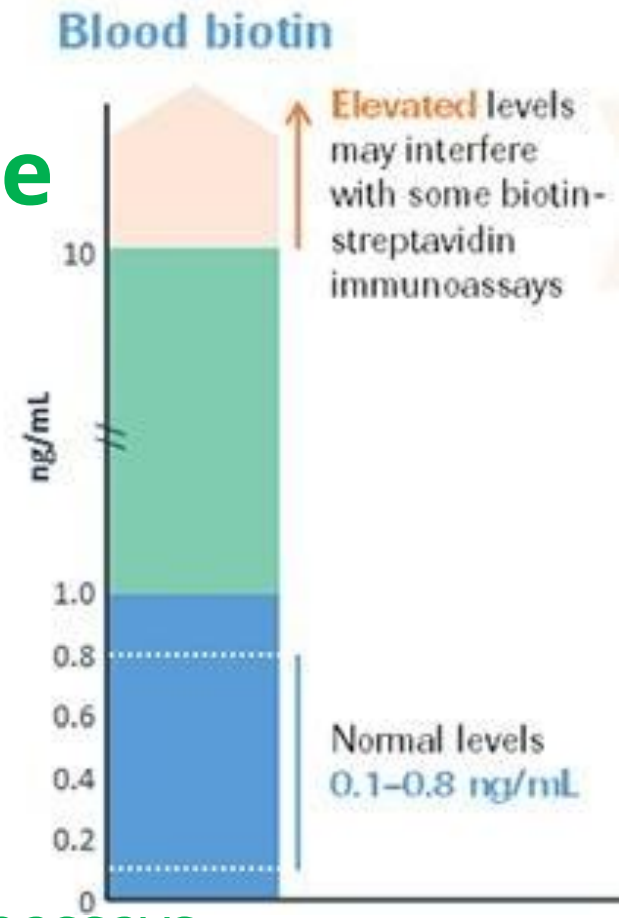
5. Hyperthyroidism: Approach

1. Symptoms?
   - Palpitations, tremor, diaphoresis, heat intolerance, diarrhea, polyphagia, unintentional weight loss, worsened anxiety, cognitive changes, congestive heart failure, weakness, oligo/amenorrhea, goitre
   - Ocular manifestations: proptosis, chemosis, blepharitis, diplopia
2. Offending agents?
   - Biotin, iodine, medications (steroids, levothyroxine, liothyronine, lithium, amiodarone, immunotherapy, cytokines, TKIs)
3. Screening (after minimizing interference from 2.)
   - Thyroid function studies: TSH, fT4, fT3
   - Antibodies: TPO, thyroid receptor antibodies (or thyroid-stimulating immunoglobulin)
   - CBC, CRP, ALT, bilirubin, hCG (♀ child-bearing)
4. Imaging: uptake (quantity) and scan (quality)→GIM/Endo

[7]Ross et al. 2025

TSH = thyroid-stimulating hormone; fT4 = free thyroxine; fT3 = free triiodothyronine; TPO = thyroid peroxidase antibody; CBC = complete blood count; CRP = C reactive protein; ALT = alanine aminotransferase; hCG = human chorionic gonadotropin; GIM/Endo = general internal medicine/endocrinology; TKIs = tyrosine kinase inhibitors

5. Hyperthyroidism: Nuance



- Vitamin B7 (water-soluble)
  - Many names: vitamin H, coenzyme R, factor S, factor W, vitamin Ba, protective factor X
- Biotin-streptavidin is one of nature's strongest non-covalent interactions
  - In vitro diagnostic tests take advantage of by immobilizing biotinylated capture antibodies
- Up to 85% of common immunochemistry analyzers used biotin-streptavidin immunoassays
- Immunoassay manufacturers and FDA have issued safety warnings about biotin interference
  - Reported levels of 1.0-1200ng/mL

[13]Pazirandehm & Burns 2021; [14]Rodrigo et al 2022; [15]Haddad, Giacherio, & Barkan 2019

5. Hyperthyroidism: Nuance

- Falsely low immunometric assays (e.g. TSH) ↓
- Falsely high competitive-binding assays (e.g. fT4, fT3, TRAB, TPO) ↑

Hormones

Test	Potential impact
Parathyroid Hormone (LAB108)	False decrease
Follicle Stimulating Hormone (LAB86)	
Luteinizing Hormone (LAB88)	
Adrenocorticotropic Hormone (LAB511)	
Prolactin (LAB531)	
Growth Hormone (LAB525)	
Insulin (LAB7389)	
C-Peptide (LAB521)	
Insulin-Like Growth Factor 1 (LAB8787)	
Anti-Mullerian Hormone (LAB7364)	
Cortisol (LAB61)	False increase
Estradiol (LAB523)	
Testosterone (LAB124)	
Progesterone (LAB529)	
Dehydroepiandrosterone Sulfate (LAB524)	

Nutritional Markers

Test	Potential impact
Ferritin (LAB68)	False decrease
Vitamin D, 25-Hydroxy (LAB535)	False increase
Vitamin B12 (LAB67)	
Vitamin B12, Reflexive (LAB882)	
Folate (LAB69)	

Other Proteins

Test	Potential impact
Immunoglobulin E (LAB74)	False decrease
Myoglobin (LAB105)	
Sex Hormone Binding Globulin (LAB4945)	

Pregnancy-Related Markers

Test	Potential impact
Pregnancy Screen, Qualitative (LAB1166)	False decrease
HCG – Pregnancy (LAB1148)	
HCG – Tumor Marker or Pregnancy (LAB142)	

fT4 = free thyroxine; fT3 = free triiodothyronine; TRAB = thyroid receptor antibody; TPO = thyroid peroxidase

Assays at The Moncton Hospital lab should not be susceptible to biotin interference

5. Hyperthyroidism: Nuance

Multivitamin	Hair & nail supplement	Experimental therapeutic regimen
30-60 mcg/day	5,000-10,000 mcg/day	>10,000 mcg/day
No recommended daily intake (RDI) exists, as deficiencies are rare	More than 125 times the suggested intake	Doctor-directed for specific patient populations

1 ASK your patients to report everything they are taking, including prescription and OTC medicines, vitamins and supplements, prior to a blood draw.

2 UNDERSTAND that many patients are not aware that they are taking high dose biotin because it is packaged as a supplement for hair, skin and nail beauty.

3 INFORM your patients about how to prepare for blood work. If they take high dose biotin, they will need to **wait** before a blood draw.

*Pearl: when in doubt, hold biotin for 7d

5. Hyperthyroidism: Treatment

- Symptoms: tremor, palpitations
  - Beta blockade: propranolol vs. other
- Subacute: pain
  - NSAIDs (naproxen 250-500 mg twice daily)
  - GCs (prednisone 20-40mg)

- Persistent, overt ↑THY: antithyroid medication
  - Methimazole: 10mg PO twice daily
  - (*Propylthiouracil: preferred during 1st trimester)

[7]Ross et al. 2025
NSAIDs = nonsteroidal anti-inflammatory drugs; GCs = glucocorticoids; ↑THY = hyperthyroidism

5. Hyperthyroidism: Summary

Symptoms?
- Palpitations or tremor?
- Neck pain or swelling?

Repeat labs
- 6-8wk
- No biotin x 7d
- Offending agent?

Abnormal exam?
- Goitre
- Nodule

Treatment

Persistent, overt hyperthyroidism

*Subclinical hyperthyroidism

Beta blockade if palpitations or heart rate >90

NSAIDS (+/- GCs)

fT4, fT3
TRAB, TPO
CBC, ALT, bilirubin, CRP
(**hCG**)

Thyroid ultrasound

Methimazole 10 PO daily

NSAIDs = nonsteroidal anti-inflammatory drugs; GCs = glucocorticoids
fT4 = free thyroxine; fT3 = free triiodothyronine; TRAB = thyroid receptor antibody; TPO = thyroid peroxidase antibody;
CBC = complete blood count; CRP = C reactive protein; ALT = alanine aminotransferase; hCG = human chorionic gonadotropin

“Why can’t we control my *blood pressure*?”

Case 6: HA 52M

- 15yr of hypertension ("never controlled"), 6mo of fatigue
- PHx: hypertension
- Meds: telmisartan 80mg, amlodipine 10mg, metoprolol 25mg BID, spironolactone 12.5mg

"BP control?"

- Exam: wt stable, ↑BP, HR N, otherwise normal
- Labs: K 3.2 ↓, Na N

Next steps?

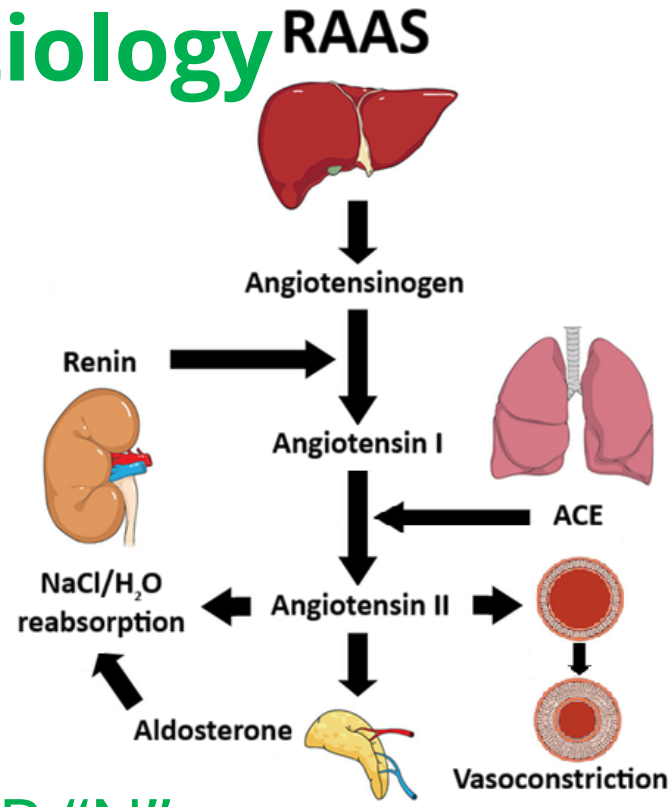
Image generated using Meta AI, 2025

PHx = past medical history

6. Hyperaldosteronism: Etiology

Aldosterone overproduction

1. Primary: adrenal source
   - Adenoma
     - ↓renin, ↑aldosterone, ↑ARR
2. Secondary: ↑BP vs. BP N
   - ↑renin, ↑ aldosterone, ARR "N"
3. Pseudohyperaldosteronism
   - ↓ renin, ↓aldosterone, ARR "N"



[8]Young et al. 2025

ARR = aldosterone renin ratio; RAAS = renin-angiotensin-aldosterone system; ACE = angiotensin-converting enzyme

6. Hyperaldosteronism: Etiology

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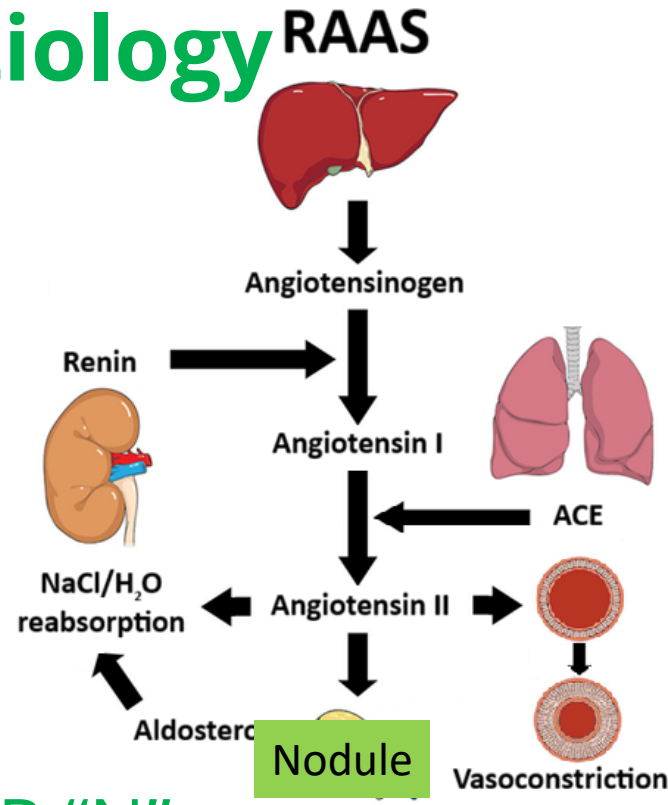


[8]Young et al. 2025

ARR = aldosterone renin ratio; RAAS = renin-angiotensin-aldosterone system; ACE = angiotensin-converting enzyme

6. Hyperaldosteronism: Approach

1. Symptoms? Signs?
   - ↑BP (resistant), ↓K (+/- diuretic use)
2. Offending agents?
   - Biotin, black licorice, medications (antifungals),
     - ↑BP: steroids, OCPs, NSAIDs, sympathomimetics, calcineurin inhibitors, antidepressants, atypical antipsychotics, TKIs, chemotherapy, MAOis
     - ↓K: insulin, beta-agonists, thiazides, loop diuretics, B12/folic acid, GSF, combined antipsychotics, laxatives, abiraterone
   - Spironolactone
3. Screening (after minimizing interference from 2.)
   - Seated 30 min aldosterone renin ratio, electrolytes

[8]Young et al. 2025

NSAIDs = nonsteroidal anti-inflammatory drugs; OCPs = oral contraceptive pills

TKIs = tyrosine kinase inhibitors; MAOis = monoamine oxidase inhibitors; GSF = granulocyte-stimulating factor

6. Hyperaldosteronism: Nuance

- Screening: aldosterone renin ratio
  - Seated 30 min
  - False positives/negatives
    - No spironolactone!
- Confirmation (GIM/Endo):
  - Oral salt load
  - Saline suppression
- [Localization: adrenal venous sampling]

*Pearl: no spironolactone before ARR

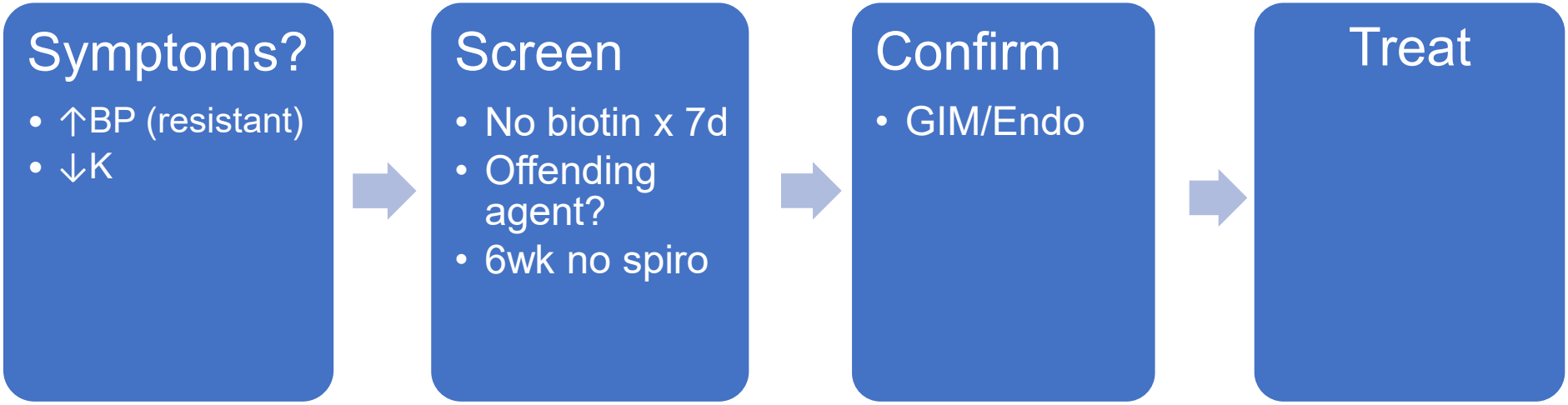
GIM/Endo = general internal medicine/endocrinology; ARR = aldosterone renin ratio

6. Hyperaldosteronism: Treatment

1. Surgery preferred

2. Aldosterone-blocker 2nd-line
   - E.g. spironolactone

6. Hyperaldosteronism: Summary



hCG = beta-human chorionic gonadotropin; GIM/Endo = general internal medicine/endocrinology

“I can feel it in my *bones*”

Case 7: PH 69F

- 6mo of fatigue, polyuria, kidney stones, bony pain
- PHx: breast cancer, fibromyalgia
- Meds: letrozole
- Exam: wt stable, BP N, HR N, normal
- Labs: Ca 2.75 ↑, Cr 110, eGFR 52 ↓

"Bone ache"

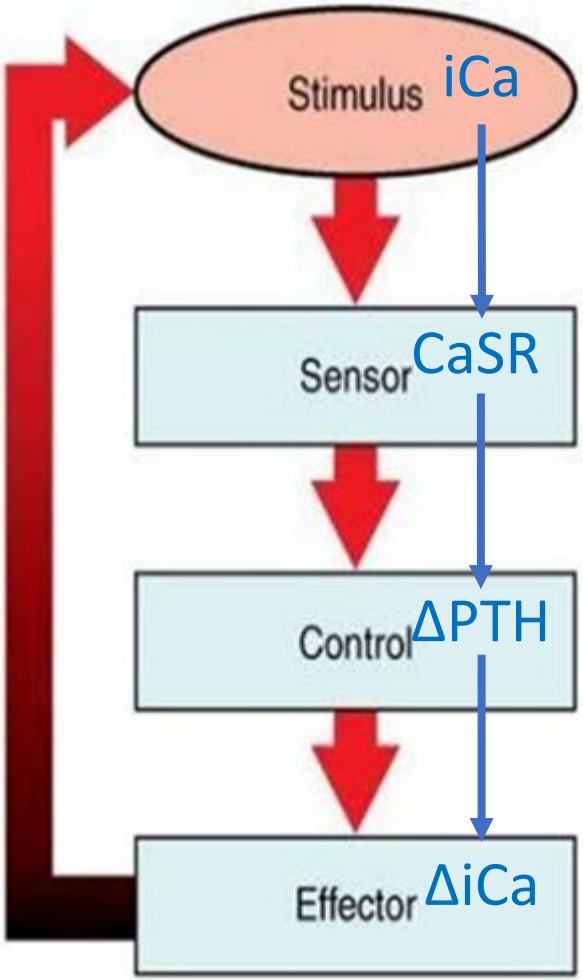
Next steps?

Image generated using Meta AI, 2024

PHx = past medical history

7. Hyperparathyroidism: Etiology

1. Primary: parathyroid source
   - Adenoma
     - ↑cCa, *↑PTH, ↓PO4
2. Secondary: appropriate
   - ↓Vitamin D, celiac, CKD
     - cCa N (or ↓), ↑PTH
3. Tertiary: parathyroid source
   - Advanced CKD
     - ↑cCa, ↑PTH



[9]Fuleihan et al. 2026

cCa = corrected calcium; ↑PTH = hyperparathyroidism; CKD = chronic kidney disease; iCa = ionized calcium; CaSR = calcium-sensing receptor

7. Hyperparathyroidism: Approach

1. Symptoms? Signs?
   - Bone pain, anorexia, nausea/vomiting, constipation, lethargy, weakness, polyuria, polydipsia, depression, arthralgia, cognitive changes, nephrolithiasis, fragility fracture
2. Offending agents?
   - Biotin, medications (calcium, thiazides, lithium, teriparatide, vitamin A, theophylline, tamoxifen, TPN)
3. Screening (after minimizing interference from 2.)
   - Calcium, albumin, magnesium, PO4, PTH, hCG (♀ child-bearing)
   - Complications: BMD (distal radius), abdominal imaging, 24h urine calcium/creatinine

[9]Fuleihan et al. 2026

TPN = total parenteral nutrition; hCG = beta-human chorionic gonadotropin; BMD = bone mineral density

7. Hyperparathyroidism: Nuance

- Screening: cCa (Ca + ALB), PTH
  - Correct up or down
  - ↓PO4 (PTH – "Phosphate Trashing Hormone")
- Complications:
  - Serum Ca/Cr + 24h urine Ca/Cr
  - BMD (incl. "distal radius")
  - Imaging (nephrocalcinosis/lithiasis)

Corrected Ca (cCa): ↑serum [Ca] by 0.2 mmol/L for every ↓ of 10 g/L (below 40 g/L) in serum [ALB]
(or ↑ 0.02 for every ↓ 1 g/L)

*Pearl: use corrected Ca

Corrected Ca (cCa): ↓ serum [Ca] by 0.2 mmol/L for every ↑ of 10 g/L (above 40 g/L) in serum [ALB]
(or ↓ 0.02 for every ↑ 1 g/L)

[9]Fuleihan et al. 2026
ALB = albumin; BMD = bone mineral density

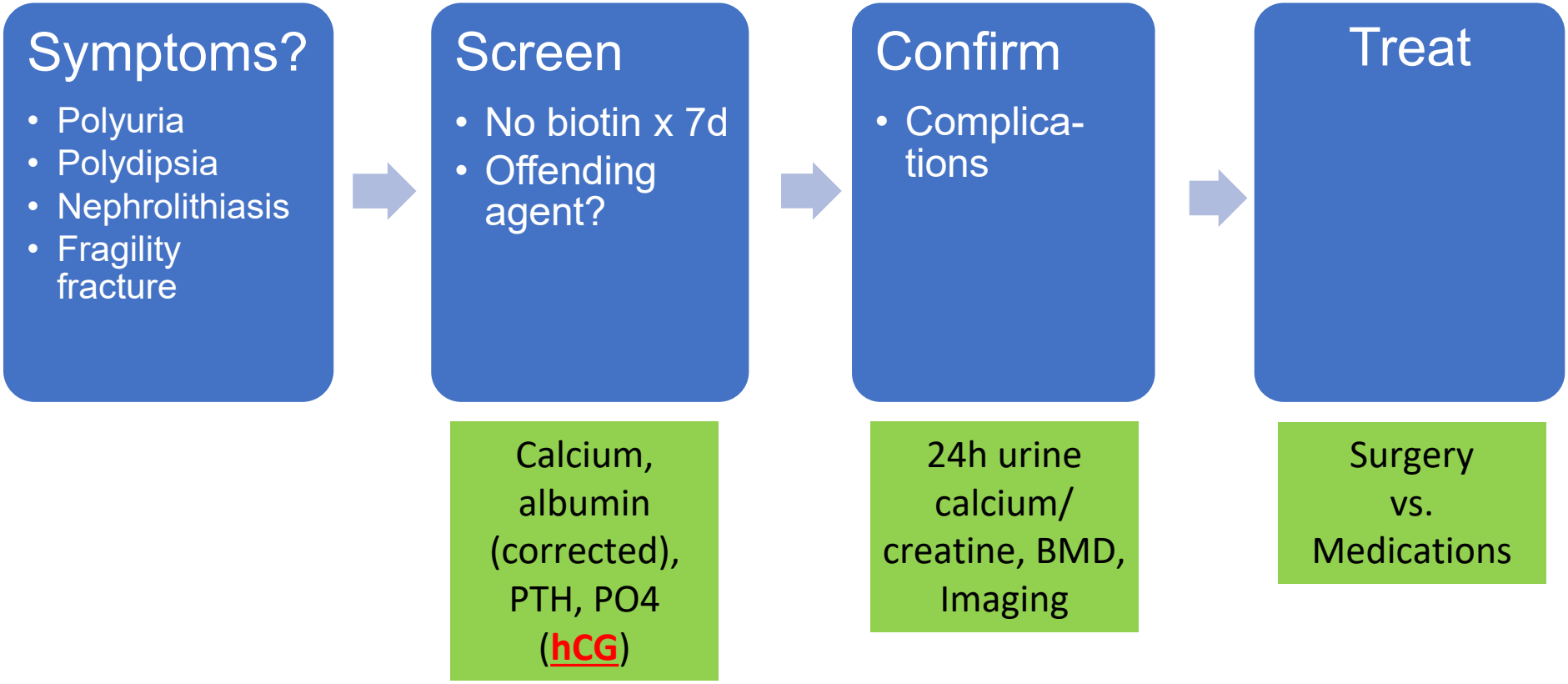
7. Hyperparathyroidism: Treatment

1. Surgery preferred
   - Symptomatic
   - Asymptomatic
     - <50 y, osteoporosis/fragility fracture, [Ca] >0.25 ULN, 24h uCa >10 ♂ (>6.5 ♀), CrCl <60, nephrolithiasis/calcinosis

2. Medications 2nd-line
   - Osteoporosis/penia: bisphosphonates
   - Very ↑Ca: cinacalcet

ULN = upper limit of normal; uCa = urine calcium; CrCl = creatinine clearance

7. Hyperparathyroidism: Summary



hCG = beta-human chorionic gonadotropin; BMD = bone mineral density

“Clumsy me, *bumping* into things”

Case 8: PA 61M

- 6mo of fatigue, headaches, “brain fog”, erectile dysfunction, reduced libido, minor MVC
- PHx: depression, obesity
- Meds: bupropion, citalopram
- Exam: wt stable, BP N, ↓HR, ↓reflexes visual field deficit, dry skin, no orthostasis
- Labs: TSH N, total testosterone 5.5 ↓

“Clumsy”

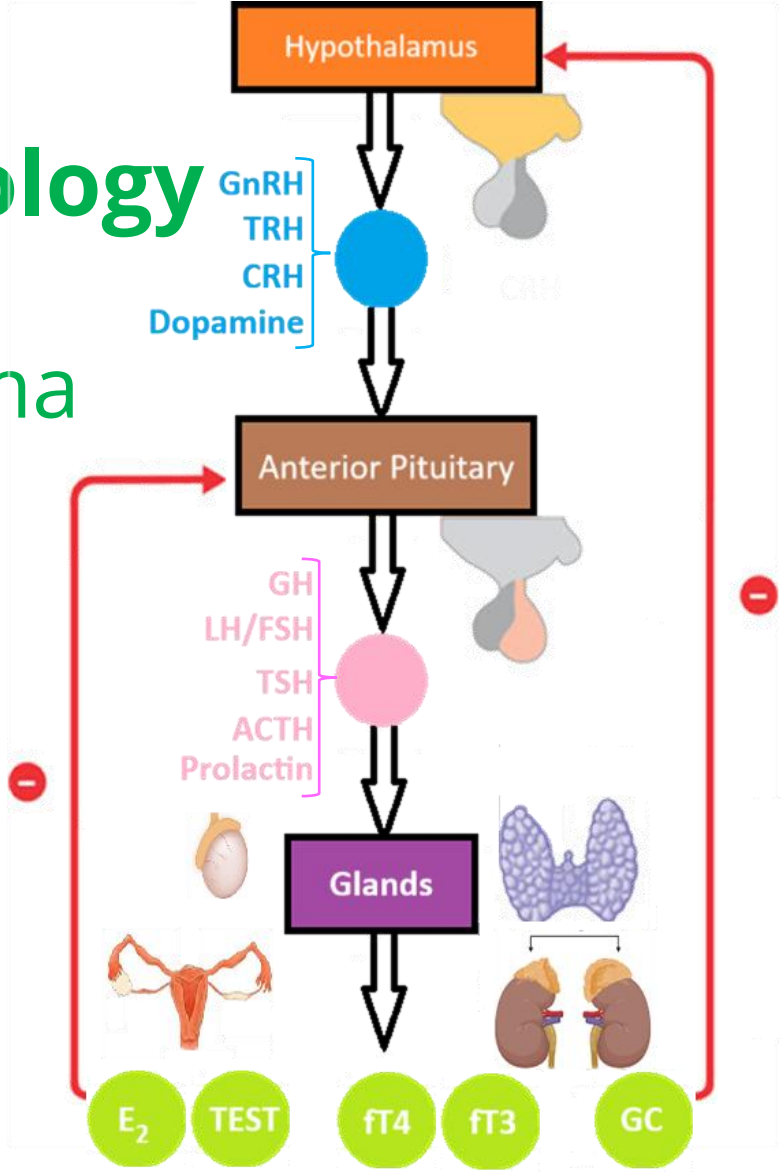
Next steps?

Image generated using Meta AI, 2025

MVC = motor vehicle collision; PHx = past medical history; TSH = thyroid-stimulating hormone

8. Hypopituitarism: Etiology

1. Nonfunctioning adenoma
   - Most common
2. Functioning adenoma
   - Prolactinoma most common
   - Cushing's disease next
   - Rare: GnRHoma, TSHoma
3. Non-pituitary mass



[10]Snyder et al. 2026

GnRH = gonadotropin-releasing hormone; TRH = thyrotropin-releasing hormone; CRH = corticotropin-releasing hormone
GH = growth hormone; LH = luteinizing hormone; FSH = follicle-stimulating hormone; ACTH = adrenocorticotropic hormone;
E2 = estradiol; TEST = testosterone; fT4 = free thyroxine; fT3 = free triiodothyronine; GC = glucocorticoids

8. Hypopituitarism: Etiology

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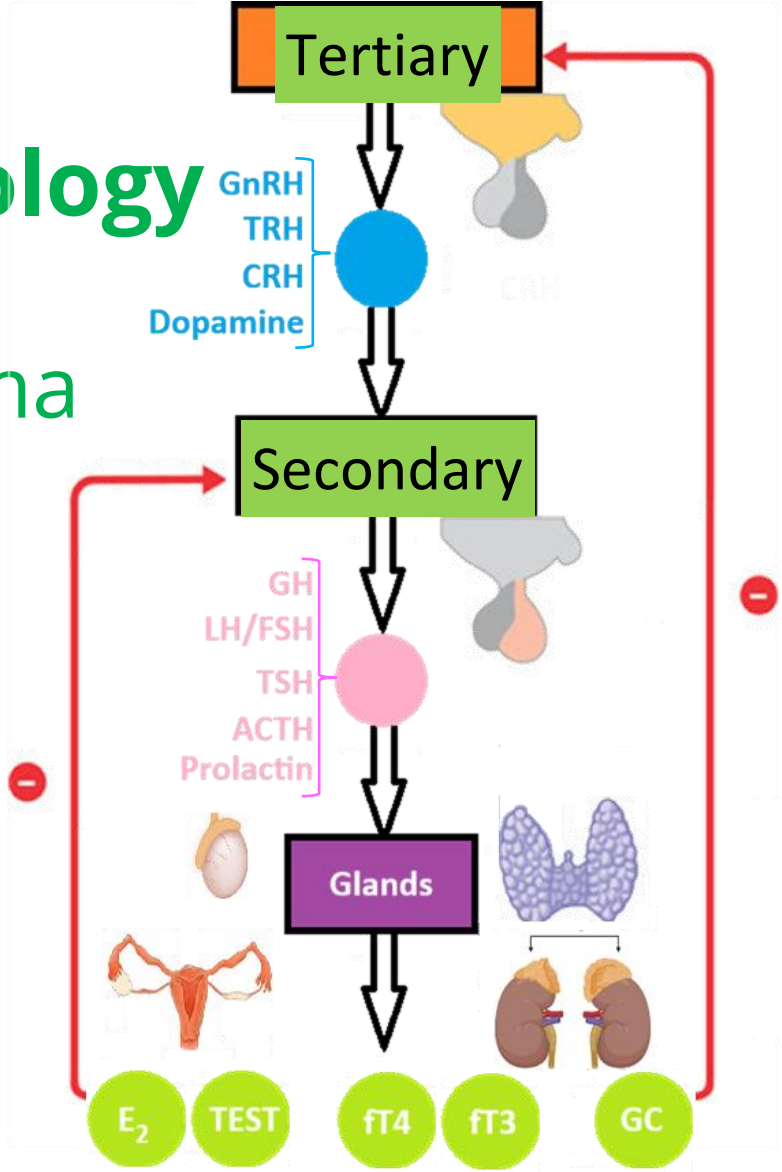

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E2 = estradiol; TEST = testosterone; fT4 = free thyroxine; fT3 = free triiodothyronine; GC = glucocorticoids

8. Hypopituitarism: Approach

1. Symptoms? Signs?
   - Galactorrhea, polyuria, polydipsia, skin tags, changes to ring/shoe/gat size, *hypothyroidism, *adrenal insufficiency, *hypogonadism
   - Mass effect: new/persistent headache, peripheral vision changes
2. Offending agents?
   - Biotin, cannabis, medications (steroids, opioids, immunotherapy, chemotherapy, radiation)
3. Screening (after minimizing interference from 2.)
   - Prolactin, FSH, LH, E2/testosterone, fT4, 8AM cortisol, insulin-like growth factor-1, creatinine, eGFR, hCG (♀ child-bearing)
4. Imaging: sellar MRI (NOT CT head)

[10]Snyder et al. 2026
LH = luteinizing hormone; FSH = follicle-stimulating hormone;
E2 = estradiol; fT4 = free thyroxine; hCG = beta-human chorionic gonadotropin;

8. Hypopituitarism: Nuance

*Pearl: fT4 to screen for central hypothyroidism

- Can present as hyperfunctioning, hypofunctioning, or both
- Screen for other deficiencies

(Go):	GH	IGF-1
(Look For)	LH/FSH	E2/testosterone
(The)	TSH	TSH AND fT4
(Adenoma)	ACTH	8AM cortisol
(Please)	Prolactin	8AM, fasting prolactin

*Pearl: order of ↓pituitary affected

[10]Snyder et al. 2026

GH = growth hormone; IGF-1 = insulin-like growth factor-1; LH = luteinizing hormone; FSH = follicle-stimulating hormone; E2 = estradiol; fT4 = free thyroxine; ACTH = adrenocorticotropic hormone

8. Hypopituitarism: Nuance

*Pearl: exclude physiologic ↑PRL

- (Go): GH – IGF-1
  - Do NOT order GH
- (Look For): LH/FSH – fasting, 8AM testosterone
  - Need low level x 2 to diagnose hypogonadism
- (The): TSH – free T4 (write "exception")
  - TSH can be inappropriately N despite ↓fT4
- (Adenoma): ACTH – 8AM cortisol (i.e. Case 1)
- (Please): prolactin – fasting, no sexual/physical activity for 48h, no biotin/marijuana for 7d
  - Minimize physiologic causes of ↑PRL

[10]Snyder et al. 2026

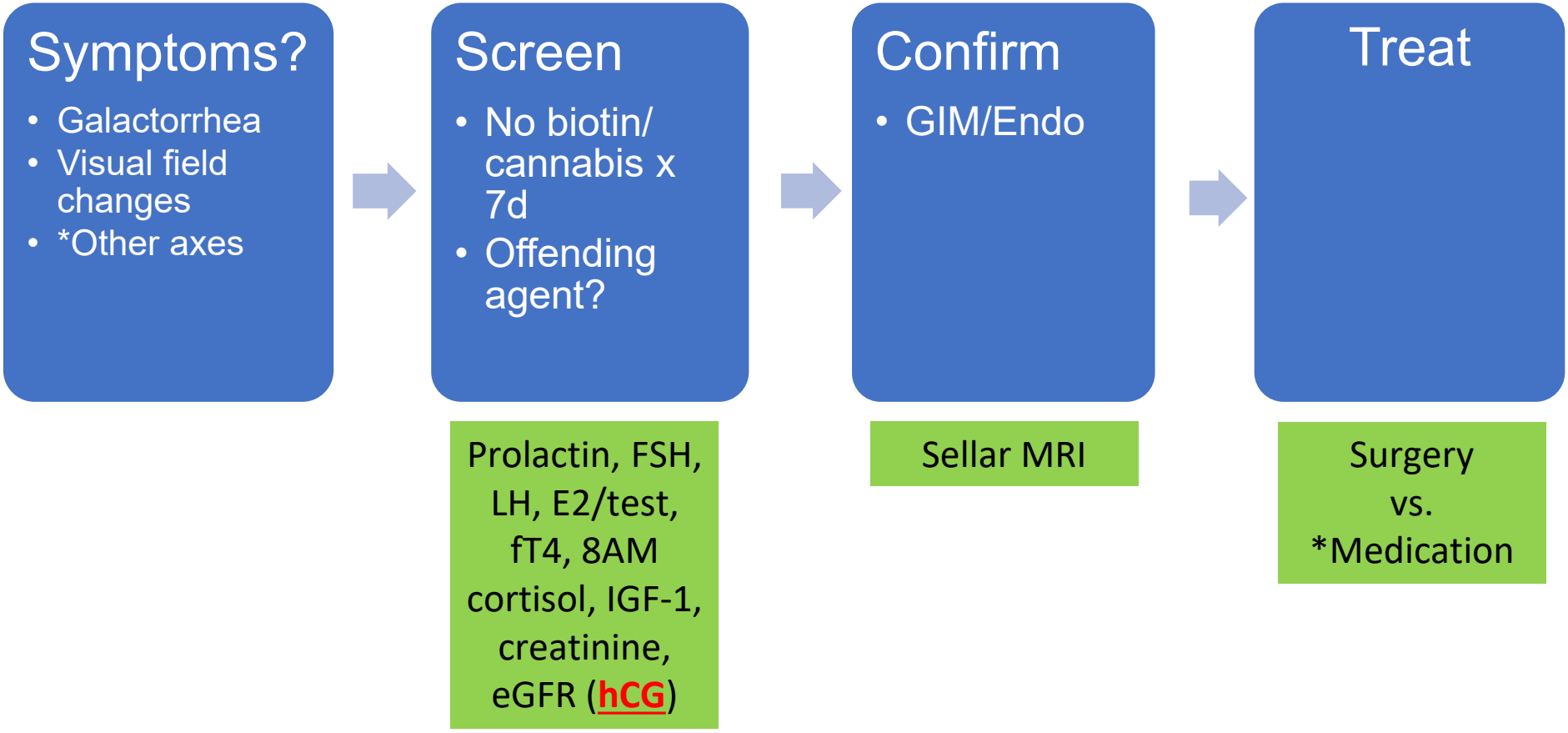
GH = growth hormone; IGF-1 = insulin-like growth factor-1; LH = luteinizing hormone; FSH = follicle-stimulating hormone; T4 = thyroxine; ACTH = adrenocorticotropic hormone

8. Hypopituitarism: Treatment

1. Surgery preferred

2. Medications 2nd-line
   - *Prolactinoma: 1st-line
     - Dopamine agonists

8. Hypopituitarism: Summary



NSAIDs = nonsteroidal anti-inflammatory drugs; GCs = glucocorticoids
IGF-1 = insulin-like growth factor-1; LH = luteinizing hormone; FSH = follicle-stimulating hormone; E2 = estradiol;
fT4 = free thyroxine; hCG = beta-human chorionic gonadotropin; GIM/Endo = general internal medicine/endocrinology

"I'm *anxious* all of a sudden"

Case 9: PCC 27F

- 3mo of fatigue, anxiety, palpitations, headache, diaphoresis
- PHx: none
- Meds: ashwanganda
- Exam: wt stable, BP N, HR N, normal
- 2nd visit: pallor, ↑BP, ↑HR, orthostasis, diaphoretic
- Labs: TSH N, 8AM cortisol 410, ferritin N

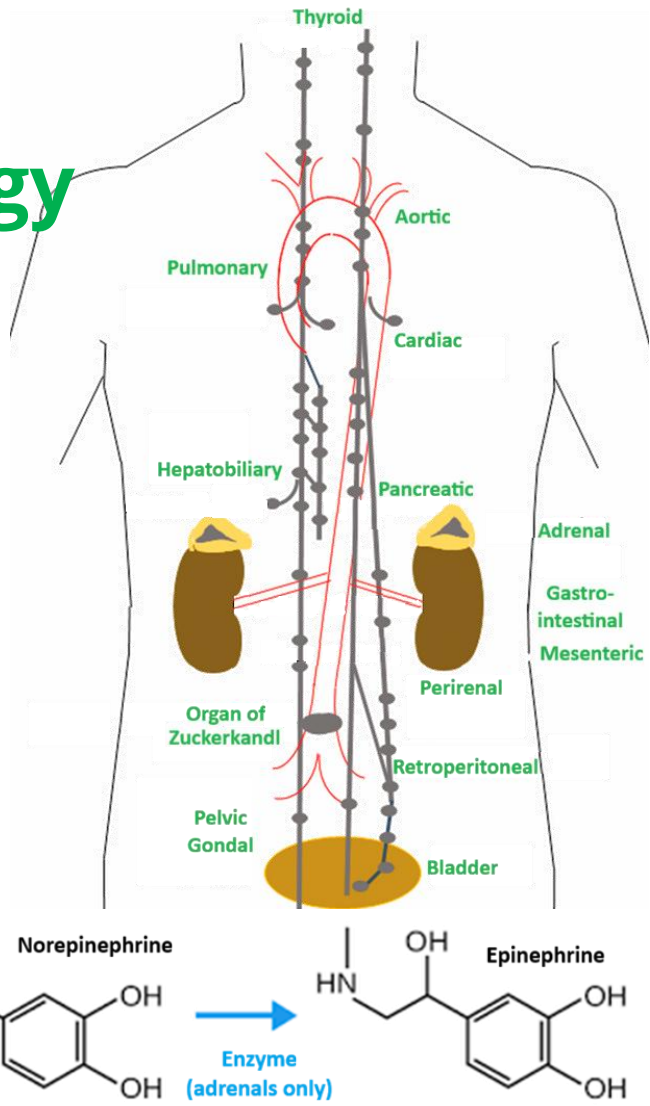
Next steps?

Image generated using Microsoft Copilot, 2025

PHx = past medical history; TSH = thyroid-stimulating hormone

9. Pheochromocytoma: Etiology

1. Pheochromocytoma:
   - Adrenal
     - ↑epinephrine, ↑norepinephrine
2. Paraganglioma:
   - Sympathetic chain
     - Epinephrine N, ↑norepinephrine
3. Other

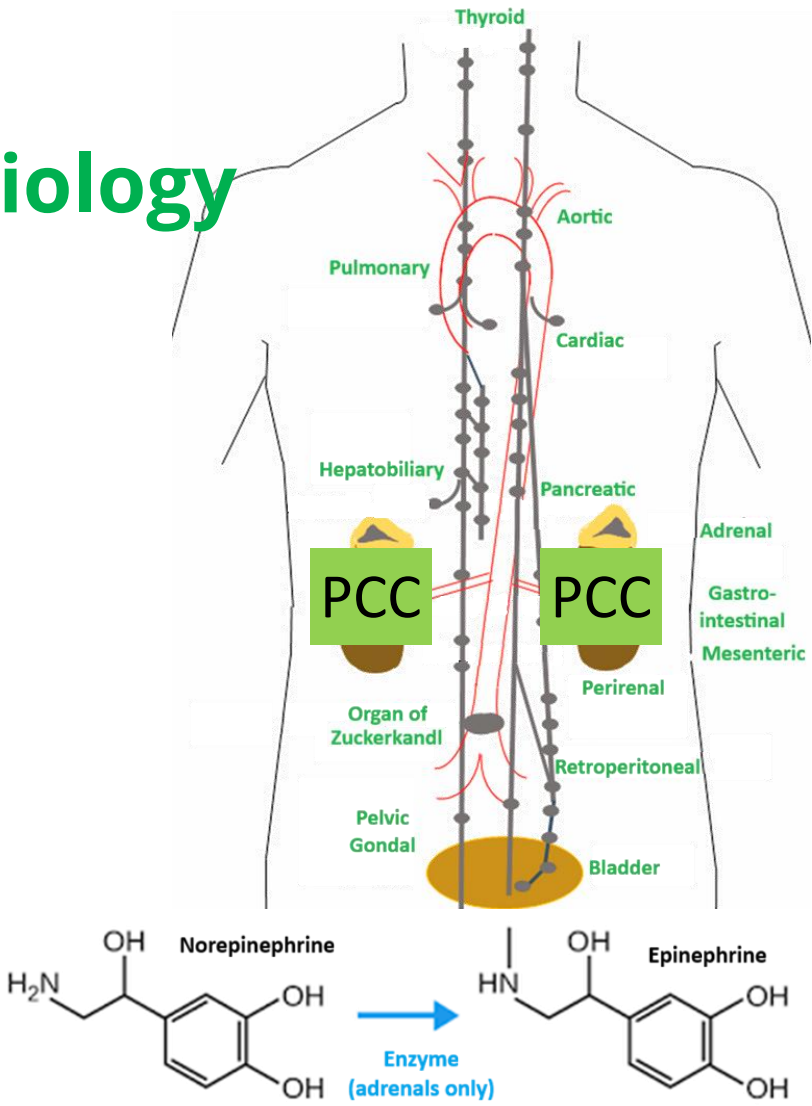


[11]Young et al. 2026
PCC = pheochromocytoma

*Pearl: para does not elevate epinephrine

9. Pheochromocytoma: Etiology

1. Pheochromocytoma:
   - Adrenal
     - ↑epinephrine, ↑norepinephrine
2. Paraganglioma:
   - Sympathetic chain
     - Epinephrine N, ↑norepinephrine
3. Other



[11]Young et al. 2026
PCC = pheochromocytoma

*Pearl: para does not elevate epinephrine

№

9. Pheochromocytoma: Approach

1. Symptoms? Signs?
   - Episodic triad (headache, palpitations, diaphoresis), tremor, diaphoresis, pallor, weakness, anxiety, orthostasis, presyncope, visual changes, polyuria, polydipsia, cognitive changes, *hypertension
2. Offending agents?
   - Biotin, ashwanganda, medications – palpitations (anticholinergics, vasodilators, sympathomimetics), diaphoresis (antidepressants, cholinergics, aromatase/ADT, beta blockers, CCBs, triptans, interferon, opioids, donepezil, niacin)
3. Screening (after minimizing interference from 2.)
   - 24h urine catecholamines, fractionated metanephrines, creatinine
   - Other: TSH, FSH/LH/E2, hCG (♀ child-bearing)
4. Imaging: unenhanced abdominal CT reporting “Hounsfield units”

[11]Young et al. 2026

ADT = androgen deprivation therapy; CCBs = calcium channel blockers; E2 = estradiol
hCG = human chorionic gonadotropin;

9. Pheochromocytoma: Nuance

- Screening: 24h urine catecholamines + fractionated metanephrines
  - False positives

- [Localization: abdominal imaging +/- others]
  - If HU < 10, then it's not a pheo…

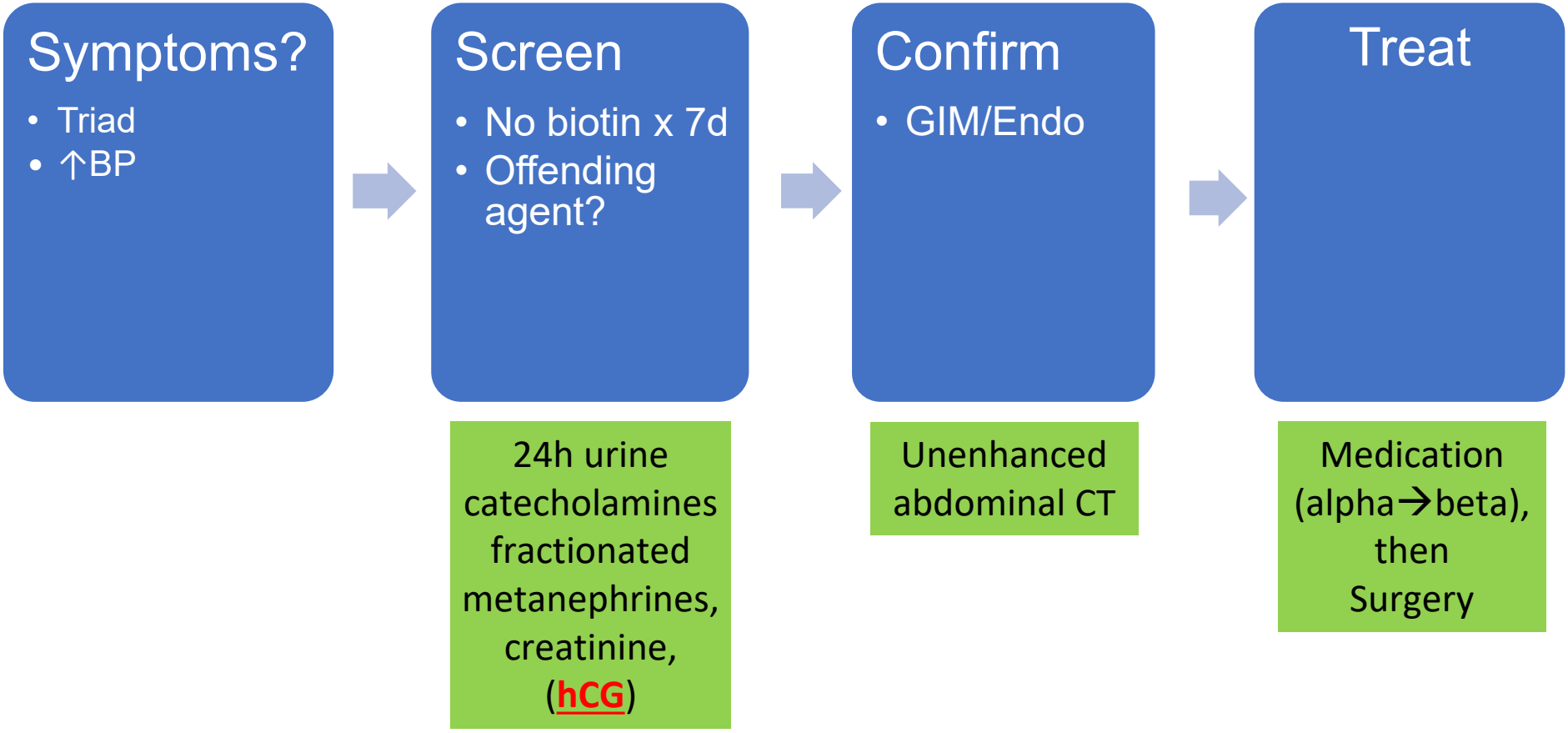
[11]Young et al. 2026
HU = Hounsfield units

9. Pheochromocytoma: Treatment

1. Surgery preferred

2. Medications required beforehand
   - Alpha blockade, then beta blockade

9. Pheochromocytoma: Summary



hCG = human chorionic gonadotropin; GIM/Endo = general internal medicine/endocrinology

“I feel like I’m *blushing* all the time”

Case 10: CS 82M

- 6mo of fatigue, "flushing", diarrhea, wheezing
- PHx: hypertension, dyslipidemia, type 2 diabetes, obesity
- Meds: metformin 1000mg BID, semaglutide 1.0 mg, ramipril 10mg, spironolactone 25mg, rosuvastatin 10mg
- Exam: wt stable, BP N, HR N, facial plethora, new systolic ejection murmur, chest telangiectasia
- Labs: TSH N, liver tests N, testosterone N

"Blushing"

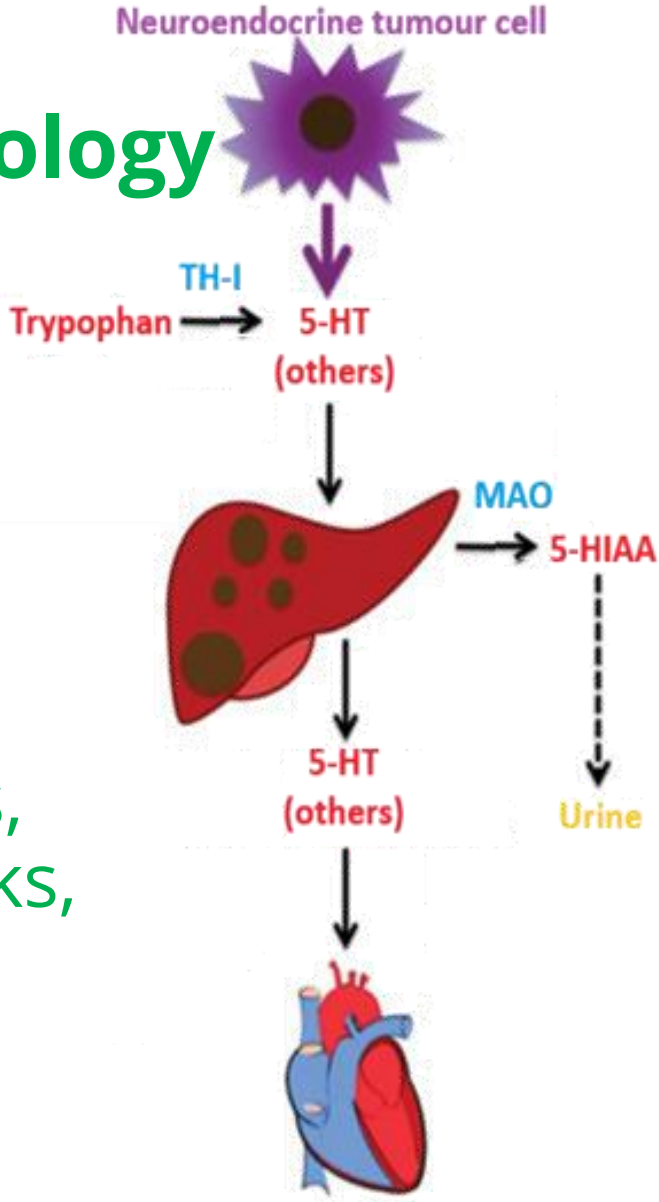
Next steps?

Image generated using Meta AI, 2025

PHx = past medical history

10. Carcinoid Syndrome: Etiology

- Neuroendocrine tumor
  - Serotonin excess
    - ↑5-HIAA (urine)
- Flushing:
  - Menopause, emotional stress, anaphylaxis, alcohol/hot drinks, POTS, liver disease, *↑THY, medications



[12]Strosberg et al. 2026

5-HIAA = 5-hydroxyindoleacetic acid; 5-HT = serotonin; ↑THY = hyperthyroidism
TH-I = tryptophan hydroxylase; MAO = monoamine oxidase

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10. Carcinoid Syndrome: Approach

1. Symptoms? Signs?
   - Flushing, diarrhea, abdominal pain, telangiectasia, bronchoconstriction, cyanosis, pellagra, heart murmur
2. Offending agents?
   - Biotin, tryptophan foods, medications (acetaminophen, phenobarbital, ephedrine, methamphetamine, nicotine, phentolamine, caffeine, fluorouracil, mesalamine)
3. Screening (after minimizing interference from 2.)
   - Urine 5-HIAA
   - Other: TSH, FSH/LH/E2, hCG (♀ child-bearing), Echocardiogram (if new murmur)

[12]Strosberg et al. 2026

5-HIAA = 5-hydroxyindoleacetic acid; E2 = estradiol; hCG = human chorionic gonadotropin;

10. Carcinoid Syndrome: Nuance

- Screening: urinary 5-HIAA
  - NOT serotonin, serum 5-HIAA
  - False positives:
    - Tryptophan foods, caffeine, nicotine, OTC medications
      - Restrict diet for 3d before testing

*Pearl: exclude exogenous causes of ↑5-HIAA

- [Localization: imaging]

[12]Strosberg et al. 2026

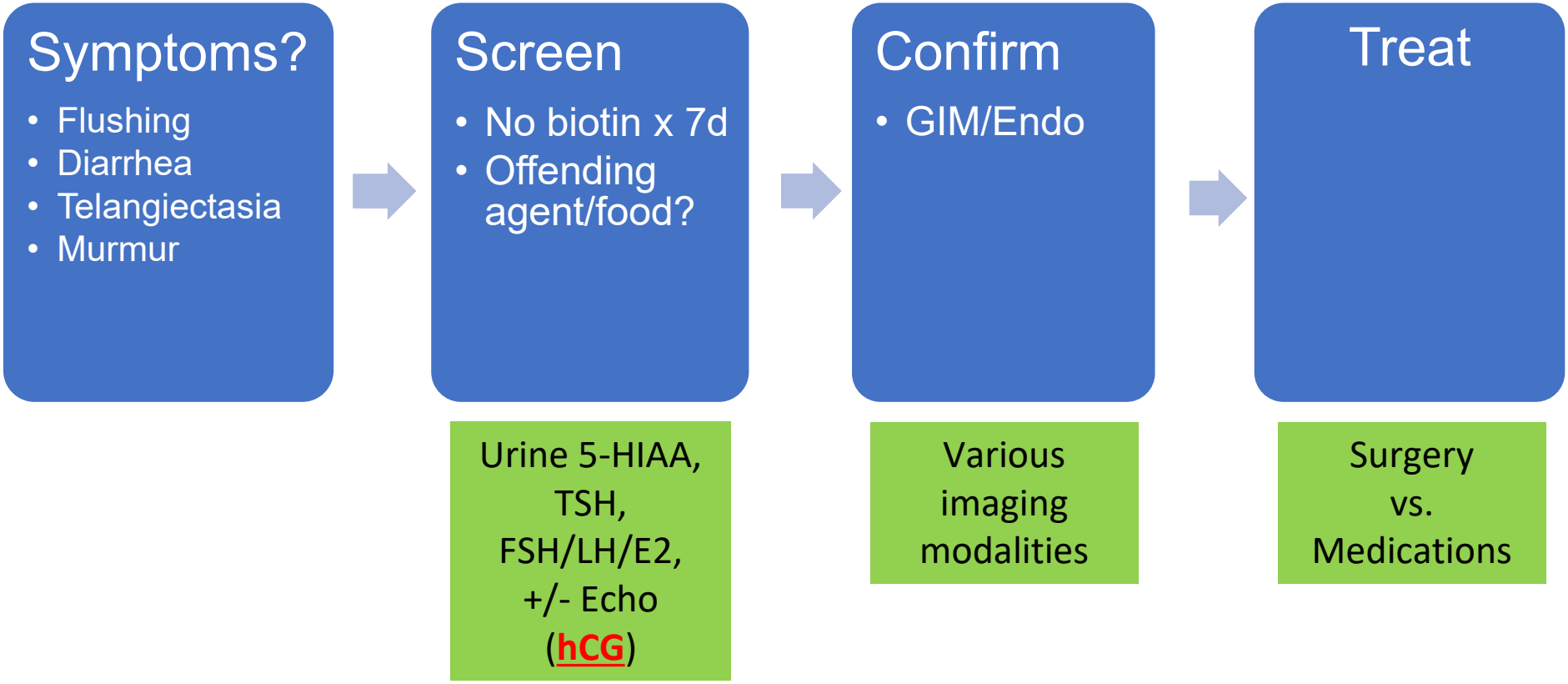
5-HIAA = 5-hydroxyindoleacetic acid; OTC = over-the-counter

10. Carcinoid Syndrome: Treatment

1. Surgery preferred

2. Medications 2nd-line

10. Carcinoid Syndrome: Summary



5-HIAA = 5-hydroxyindoleacetic acid; E2 = estradiol; hCG = human chorionic gonadotropin; GIM/Endo = general internal medicine/endocrinology

III. When to Call Endocrinology

- Red flag + abnormal workup
- If you need help ordering the right test
- If you need help interpreting the test
- When something does not make sense…
  - Referral checklists included below

- Common causes of fatigue: referral NOT required: ↓THY, type 2 diabetes, ↓ vitamin D

"I want to see a specialist"

↓THY = primary hypothyroidism

III. Checklist Template

- ❑ Clear clinical question
- ❑ Symptoms of issue
- ❑ Supplements containing biotin
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (7d no biotin):

- ❑ Imaging:

Take Away Points

- When faced with fatigue, identify red flags
- Initial workup for fatigue should be guided by symptoms/findings
  - Not all testing is useful
- Be mindful of common nuances of endocrine testing
  - Try to eliminate interferences before screening
- Refer to Endocrinology for less common causes (if red flag AND abnormal result)

Questions?
Thoughts?

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16. Bowen, R., Benavides, R., Colón-Franco, J. M., Katzman, B. M., Muthukumar, A., Sadrzadeh, H., ... & Tran, N. (2019). Best practices in mitigating the risk of biotin interference with laboratory testing. *Clinical biochemistry*, *74*, 1-11.

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III. Adrenal Insufficiency Checklist

- ❑ Clear clinical question
- ❑ Symptoms of adrenal insufficiency
- ❑ Supplements containing biotin
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (7d no biotin, 48h no GCs): 8 AM cortisol, ACTH, electrolytes, fasting glucose, creatinine, eGFR, ALT, bilirubin, albumin, TSH, free T4, FSH, LH, E2/total testosterone, 21-hydroxylase antibodies, hCG (if ♀)

III. Hypercortisolism Checklist

- ❑ Clear clinical question
- ❑ Symptoms of cortisol excess
- ❑ Supplements containing biotin
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (7d no biotin, 48h no GCs): 8AM cortisol (following 1mg dexamethasone at 11PM evening before), ACTH, 24h urine free cortsiol/creatinine, A1C, fasting glucose/lipids, creatinine, eGFR, ALT, TSH, 25-vitamin D, vitamin B12, urate, hCG (if ♀)

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III. Diabetes Checklist

- ❑ Clear clinical question
- ❑ Symptoms of hyperglycemia
- ❑ Supplements containing biotin
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Refer to diabetes centre for review
- ❑ Dilated eye exam (if type 2 diabetes)
- ❑ Labs (7d no biotin): A1C, fasting glucose/lipids, creatinine, eGFR, urine ACR, ALT (if type 2 diabetes), TSH (if type 1 diabetes), hCG (if ♀), +/- GAD

III. Hypoglycemia Checklist

- ❑ Clear clinical question
- ❑ Whipple's triad?
- ❑ Supplements containing biotin
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Refer to diabetes centre for 2wk CGM trial
- ❑ Labs (7d no biotin): *fasting glucose, insulin, C-peptide, BHB, TSH, creatinine, eGFR, ALT, bilirubin, INR, 8 AM cortisol

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III. Hyperthyroidism Checklist

- ❑ Clear clinical question
- ❑ Symptoms of hyperthyroidism
- ❑ Supplements containing biotin, iodine
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (7d no biotin): TSH, free T4, free T3, antibodies (thyroid receptor antibody AND anti-TPO), CBC, ALT, bilirubin, CRP, hCG (if ♀)
- ❑ Thyroid ultrasound (only if abnormal exam)

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III. Hyperaldosteronism Checklist

- ❑ Clear clinical question
- ❑ Resistant hypertension or hypokalemia
- ❑ Supplements containing biotin, sodium, potassium, black licorice
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (7d no biotin), 6wk no spironolactone): seated 30 min aldosterone renin ratio, electrolytes, creatinine, eGFR, hCG (if ♀)

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III. Hypercalcemia Checklist

- ❑ Clear clinical question
- ❑ Symptoms of hypercalcemia
- ❑ Supplements containing biotin, calcium, vitamin D
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (7d no biotin): calcium, albumin, PTH, magnesium, phosphate, creatinine, eGFR, ALP, 25-vitamin D collected concurrently with 24h urine calcium and creatinine, hCG (if ♀)
- ❑ BMD: include distal radius

III. Pituitary Mass Checklist

- ❑ Clear clinical question
- ❑ Symptoms of hormone excess/deficiency or mass effect
- ❑ Supplements containing biotin
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (fasting, 7d no biotin/cannabis, 48h no physical/sexual activity): prolactin, FSH, LH, E2/testosterone, free T4, 8AM cortisol, insulin-like growth factor-1, creatinine, eGFR, hCG (if ♀)
- ❑ Sellar MRI: esp. if 2 abnormal axes

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III. Pheochromocytoma Checklist

- ❑ Clear clinical question
- ❑ Symptoms of catecholamine excess
- ❑ Supplements containing biotin
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (7d no biotin): TSH, creatinine, eGFR, 24h urine (catecholamines/fractionated metanephrines, creatinine), hCG (if ♀)
- ❑ Abdominal CT (unenhanced)

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III. Carcinoid Checklist

- ❑ Clear clinical question
- ❑ Symptoms of carcinoid syndrome
- ❑ Supplements containing biotin
- ❑ Updated medication list, including drug allergies, medications tried for this issue
- ❑ Labs (7d no biotin, 3d foods): urine 5-HIAA, TSH, FSH/LH/E2, hCG (if ♀)
- ❑ Echocardiogram (if new murmur)