

SECTION IX

Endocrinology

Diabetes – Type 2

Definition

Type 2 diabetes is a condition in which the body resists the effects of insulin, a hormone that regulates movements of glucose into cells, or the pancreas does not produce enough insulin to maintain normal glucose levels.

Causes^{10,11}

- Genetics
- Environmental factors (usually lifestyle related)

Risk Factors^{2,9,11}

- Aging (*insulin production decreases, insulin resistance increases*)
- Family history of diabetes (i.e., parents or siblings with diabetes)
- Overweight and obesity
- Smoking
- Physical inactivity
- Race/ethnicity (e.g., blacks, Hispanic-Americans, Native Americans, Asian-Americans, and Pacific Islanders)
- Previously identified impaired fasting glucose (IFG) or impaired glucose tolerance (IGT)
- Hypertension ($\geq 140/90$ mm Hg in adults)
- High-density lipoprotein (HDL) cholesterol ≤ 35 mg/dL (0.90 mmol/l) and/or a triglyceride level ≥ 250 mg/dL (2.82 mmol/l)

Signs & Symptoms^{3,10,11}

- Often asymptomatic or subtle symptoms in older adults and may be mistaken for a different chronic disease.
- Classic symptoms include polyuria, polydipsia, nocturia, and weight loss.

Tests^{1,3,4}

- HbA1c (or A1C), 2-hour plasma glucose (2-h PG) value following 75-g oral glucose tolerance test, or fasting plasma glucose (FPG)
- Consider HbA1c in older adults to avoid fasting.
- Criteria for diagnosis:
 - A1C \geq 6.5% (48 mmol/mol)
 - 2-h PG \geq 200 mg/dL (11.1 mmol/L)
 - FPG \geq 126 mg/dL (7.0 mmol/L)
 - Random plasma glucose \geq 200 mg/dL (11.1 mmol/L)
 - In individuals with symptoms of hyperglycemia or hyperglycemic crisis
- Per the American Diabetes Association (ADA), recommendation is for routine screening for all individuals > 45 years old.
- In asymptomatic adults age 40–70 years old who are overweight or obese or with sustained blood pressure > 135/80 mm Hg
 - If initial screening normal, consider repeating every 3 years.

Treatment & Management^{1,3,5,6,7,8,10,11,12}

- **Nonpharmacological and nursing interventions:**
 - Encourage lifestyle changes.
 - Nutrition (plant-based diet, calorie restriction, maintain optimal weight). Medical nutrition therapy is a covered benefit through Medicare for patients with diabetes.
 - Physical activity (consider barriers including safety and risk of hypoglycemia).
 - Sleep, behavioral support, and smoking cessation.
 - Hypoglycemia prevention through education of signs and symptoms is essential.
- **Pharmacological and other interventions:**
 - Metformin (Glucophage, Riomet, Fortamet, Glumetza)
 - Example: metformin 500 mg PO daily, initial dose (max of 2 g/day).

- Preferred first-line agent (in combination with lifestyle therapy).
- Avoid use in patients with an eGFR under 30 mL/minute; starting this drug with an eGFR between 30–45 mL/minute is not recommended.
- Discontinue medication prior to iodinated contrast imaging procedures if eGFR is between 30–60 mL/minute, in patients with liver disease, alcoholism, or heart failure. Re-evaluate renal function 48 hours after the procedure.
- Carries an unlikely risk for hypoglycemia; has gastrointestinal adverse effects (e.g., diarrhea, nausea, upset stomach).
- Sulfonylureas (e.g., glyburide [DiaBeta], glipizide [Glucotrol], glimepiride [Amaryl])
 - Example: glimepiride 1–2 mg PO daily (max 8 mg/day).
 - Risk of hypoglycemia, especially with glyburide (**Beers listed item**). Glimepiride carries a lower risk and may be the preferred sulfonylurea in older adults.
- Thiazolidinediones (e.g., pioglitazone [Actos], rosiglitazone [Avandia])
 - Example: pioglitazone 15 mg PO once daily (max: 45 mg/day).
 - Carries a high risk of hypoglycemia.
 - **Beers listed item.** May cause weight and worsen fluid retention (use with caution in older adults with heart failure, edema, or hepatic failure); carries an increased risk of fracture and bladder cancer.
- Glucagon-like peptide (GLP)-1 agonists (e.g., exenatide [Byetta], liraglutide [Victoza], dulaglutide [Trulicity])
 - Example: exenatide 5 mcg subcutaneous (SC) BID (initial dose); after a month, may increase to 10 mcg SC BID.
 - Avoid exenatide with creatinine clearance under 30.
 - Carries a lower risk of hypoglycemia, however is costly.
 - May cause gastrointestinal adverse effects.

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- Dipeptidyl peptidase 4 (DDP-4) inhibitors (e.g., linagliptin [Tradjenta], sitagliptin [Januvia], saxagliptin [Onglyza])
 - Example: sitagliptin 100 mg PO daily.
 - Dose adjustments may be necessary due to renal status (except linagliptin).
 - Carries a lower risk of hypoglycemia, however is costly.
- Sodium glucose cotransporter 2 (SGLT2) inhibitors (e.g., canagliflozin [Invokana], empagliflozin [Jardiance])
 - Example: empagliflozin 10 mg PO daily (max: 25 mg/day).
 - Low risk of hypoglycemia and drug–drug interactions; may have mild blood pressure (BP) lowering effect.
 - Can be costly; carries an increased risk of urinary tract infection (UTI).
- Insulin (e.g., fast acting: lispro [Humalog], aspart [Novolog]; long acting: glargine [Lantus], detemir [Levemir])
 - Rapid-acting insulin analogs are superior to regular (more predictable).
 - Long-acting insulin analogs are superior to neutral protamine Hagedorn (NPH) (reduce risk of hypoglycemia and provide a fairly flat response for about 24 hours).
 - Moderate to high risk of hypoglycemia and needs frequent monitoring.
 - High likelihood of weight gain and fluid retention.
 - **Beers listed item** (sliding scale insulin; rapid acting insulin).

*Note: Monotherapy is appropriate with an A1C of under 7.5%; dual or triple therapy is appropriate with an A1C \geq 7.5%, and insulin with other agents is appropriate in symptomatic individuals with an A1c above 9.0%.

The ADA and American Geriatric Society (AGS) recommend that glucose targets be individualized; AGS recommendations are shown below (ADA is slightly more stringent):

- A target HbA1C goal in older adults is 7.5%–8.0%.
- Normal HbA1C is <5.7%; prediabetes is considered HbA1C 5.7%–6.4%.

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- May consider goal of 7.0%–7.5% in healthier patients with few comorbidities
- In frail older adults with limited life expectancy or extensive comorbidities, an A1C goal of 8.0%–9.0% is appropriate.
- There is potential harm in lowering HbA1C to under 6.5% in older adults with type 2 diabetes.
- Monitoring
 - HbA1C frequency varies with control but can be done every 6–12 months, if stable.
 - HbA1c should be monitored every 3 months with medication changes.
 - Consider home glucose monitoring but must assess barriers including poor cognition, poor circulation, and financial issues.
- Screening for associated complications
 - Foot exam should be done at least annually.
 - Dilated eye exams every 1–3 years, depending on risk factors and symptoms.
 - Urine albumin to creatinine ratio (nephropathy) annually.
 - Monofilament testing (neuropathy) annually.
 - Blood pressure should be checked at every routine diabetes visit.
 - Lipid panel every 1–3 years (cardiovascular risk).
 - Screen for depression during the initial evaluation period (first 3 months); older adults with diabetes are at great risk for this.
- Dietitian referral (for individualized dietary plan)
- Endocrinology referral (if diabetes uncontrolled on multiple antidiabetic medications)

Beers listed items, as mentioned above, include: sliding scale insulin/rapid acting insulin, long duration sulfonylureas (chlorpropamide, glyburide) and thiazolidinediones (pioglitazone, rosiglitazone).

Differential Diagnosis^{9,10,11}

- Stroke or transient ischemic attack (TIA): Hypoglycemia can lead to a stroke-like presentation.
- Type 1 diabetes mellitus: Usually seen in young individuals (< age 35 years), whereas type 2 diabetes is more common in middle-aged or adult adults. Urine ketones usually present in those with type 1 diabetes (not typical for type 2 diabetes unless there is severe volume depletion).

CLINICAL PEARLS³

- Titrate medications slowly due to the risk of hypoglycemia in older adults.
- Older adults carry a higher risk of hypoglycemia due to decreased renal function, polypharmacy, and comorbidities. Most common symptoms include: confusion, delirium, dizziness, weakness, and falls.
- Consider poor eyesight, which may cause difficulty with giving injections in older adults.

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Hyperthyroidism

Definition

Hyperthyroidism is a form of thyrotoxicosis due to inappropriately high synthesis and secretion of thyroid hormone(s) by the thyroid.

Categories^{1,2,4,6}

Subclinical hyperthyroidism: subnormal thyroid-stimulating hormone (TSH) with normal T3 and T4.

Overt hyperthyroidism: subnormal TSH with elevated serum T3 and/or free T4.

Causes^{1,2,3,4,6}

- Grave's disease (most common cause in United States).
 - Autoimmune disorder in which thyrotropin receptor antibodies (TRAb) stimulate TSH receptor increasing thyroid hormone production and release.

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- May have spontaneous remission in up to 30% of patients.
- Toxic nodular goiter
 - Related to dietary iodine deficiency.
 - May actually be more common than Grave's disease in older patients, especially in regions with iron deficiency.
- Painless thyroiditis (also known as subacute lymphocytic thyroiditis)
 - Inflammation of thyroid tissue with release of thyroid hormones.
 - Associated with some medications (e.g., lithium, amiodarone [Cordarone, Nexterone, Pacerone], cytokines, or tyrosine kinase inhibitors).
- Subacute thyroiditis
 - Caused by viral infection (associated with fever, painful and firm thyroid, and elevated erythrocyte sedimentation rate [ESR] above 50).

Risk Factors¹

- Autoimmune disease
- Some medications
- Viral infections

Signs & Symptoms^{1,2,3,4,6}

- Fatigue and weakness
- Weight loss
- Exophthalmos (*specific to Graves disease*)
- Osteoporosis
- Palpitations
- Atrial fibrillation or sinus tachycardia
- Embolic events
- Proximal muscular weakness
- Tremor
- Neuropsychiatric symptoms (e.g., anxiety)
- Poor concentration

Tests^{1,3,7}

- Serum TSH (initial screening test in hyperthyroidism), and free T4
 - TSH will be subnormal; in overt disease will be less than 0.01 mU/L.
 - Free T4 will be elevated in overt hyperthyroidism and normal in subclinical.
- Serum T3 (*not used much in clinical practice*)
 - Will be elevated in overt hyperthyroidism and normal in subclinical.
- Serum thyrotropin receptor antibody (TRAb)
 - Will be elevated in Grave's disease.
 - Should be ordered if unable to determine diagnosis clinically (e.g., lack of symmetrically enlarged thyroid, recent onset of orbitopathy, and moderate to severe hypothyroidism).
 - May be best first test to determine etiology.
- Serum calcium, magnesium, liver enzymes, complete blood count (CBC)
 - Not uncommon to find hyper- or hypocalcemia, hypomagnesemia, increased liver enzymes, anemia, and/or decreased neutrophils in hyperthyroidism.
- Radioactive iodine uptake (RAIU)
 - Will be elevated in Grave's disease and toxic nodular goiter.
 - Near zero indicates subacute thyroiditis, factitious ingestion of thyroid hormone, or recent excess iodine intake.
 - Ordered if third-generation TRAb not available.
- Ultrasonography with color flow Doppler
 - Can distinguish thyroid hyperactivity (increased flow) from destructive thyroiditis.

Treatment & Management^{1,3,5,6,7,8}

- **Nonpharmacological and nursing interventions:**
 - In those with thyroiditis, support measures are adequate treatment.

- Monitor for weight changes.
 - Common to have a weight loss due to increased basal metabolic rate (BMP).
- Encourage patient to eat a balanced diet and to eat small meals, frequently throughout the day.
 - This approach will increase caloric intake and conserve energy.
- **Pharmacological and other interventions:**
 - If able, discontinue drugs associated with hyperthyroidism (benefit is not immediate in stopping amiodarone; half-life is about 100 days).
 - Beta-adrenergic receptor blockage (e.g., propranolol [Inderal], atenolol [Tenormin], metoprolol [Lopressor])
 - Example: atenolol 25–100mg PO once to twice daily.
 - Increased compliance due to convenience of dosing
 - Recommended in all patients with symptomatic hyperthyroidism, especially elderly and patients with resting heart rate of 90 or coexistent cardiovascular disease.
 - Caution use in these agents in patients with heart failure, chronic obstructive pulmonary disease, or diabetes mellitus.
 - Antithyroid drugs (e.g., methimazole [Tapazole], propylthiouracil)
 - Example: methimazole 10–30 mg daily; TSH should be tested every 4 weeks until euthyroidism is achieved.
 - This is the preferred antithyroid drug due to longer half-life and few adverse effects.
 - Consult with endocrinologist for appropriate prescribing and monitoring.
 - Used in patients with mild thyrotoxicosis or small goiters; are used to prep older adults for surgery and radioactive iodine treatment.
 - Monitor for gastrointestinal effects, arthralgias, agranulocytosis, and pancytopenia.
 - Dietitian consultation/referral
 - To assist in determining the patient's caloric needs.

- Endocrinology referral
 - Help decide which treatment options are most appropriate.
 - Patients with overt Grave's hyperthyroidism are treated with radioactive iodine therapy, antithyroid drugs, or thyroidectomy.
 - Surgery is recommended in patients with large toxic nodular goiter.

Beers listed items, as mentioned above, include: testosterone (avoid unless hypogonadism confirmed and with clinical symptoms).

Differential Diagnosis^{5,7}

- Anxiety or depression: Severe cases of hyperthyroidism may cause anxiety, rapid speech, insomnia, and/or psychosis along with subnormal TSH and elevated levels of T4 or T3. Individuals with anxiety and/or depression will have normal thyroid levels.
- Malignancy: Will also have weight loss, fatigue, and higher risk of embolic events.

CLINICAL PEARLS^{1,2,6,8}

- Low threshold to refer to endocrinologist for treatment options of hyperthyroidism but beta blockers are useful in most forms.
- Untreated thyroid disease can lead to cardiac issues (e.g., atrial fibrillation, heart failure), along with bone mass loss and thyroid storm.

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Hypogonadism

Definition

Hypogonadism is a clinical syndrome due to failure of testes to produce testosterone leading to decreased spermatozoa production and decrease in testosterone physiologic effects.

Note: 39% of men age 45 and older have hypogonadism leading to low testosterone.

Classification^{1,6,7,8,9}

Primary hypogonadism (or primary testicular failure): issue with testes.

Secondary hypogonadism: issue with hypothalamic axis.

Causes^{1,6,8,9}

- Testicular failure
 - Causes include Klinefelter syndrome; testicular trauma, torsion, or irradiation; environmental toxins (e.g., chemicals, pesticides); heavy alcohol consumption; human immunodeficiency virus (HIV); hemochromatosis; aging.
- Problem with the hypothalamic-pituitary axis

- Causes include pituitary tumor or other brain tumor located near the pituitary gland, some medications (e.g., opioids, steroids), severe systemic illness, head injury, radiation, obesity, stress; may be idiopathic.

Risk Factors^{1,3,5,7}

Risk factors of hypogonadism coincide with causes.

- Male sex
- Aging
- Associated with obesity, diabetes, chronic obstructive pulmonary disorder (COPD), hyperlipidemia, and hypertension; unclear if low testosterone is a cause or effect of these diseases.

Signs & Symptoms^{1,3,5,9}

- Decreased libido, spontaneous erections, shrinking testes
- Gynecomastia
- Loss of body hair
- Low trauma fracture, low bone mineral density
- Hot flashes/sweats
- Less specific symptoms: decreased muscle mass and strength, depressed mood, diminished energy, and increased fatigue

Tests^{1,3,4,5,7}

- Total testosterone (< 280–300 ng/dL is the normal lower limit range, per the Endocrine Society)
- Should be obtained when patient is fasting, between 8–10 A.M. (peak testosterone levels).
- If patient has condition that can affect sex hormone-binding globulin (SHBG) free testosterone should be obtained.
- Levels must be checked on two separate days to confirm diagnosis.
- Routine testing in older men for low testosterone is not recommended without clinical signs or symptoms.

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- Gonadotropins (luteinizing hormone [LH] and follicle-stimulating hormone [FSH])
- Low testosterone and low to normal LH and FSH implies secondary hypogonadism.
 - Consider checking prolactin, pituitary function test, iron saturation, and magnetic resonance imaging (MRI) of pituitary.
- Low testosterone in the presence of high LH and FSH implies primary hypogonadism.

Management & Treatment^{1,2,3,4,7,8,10}

- **Nonpharmacological and nursing interventions:**
 - Encourage therapies to reduce stress: regular exercise, acupuncture, yoga.
 - Stress can depress testosterone levels.
 - Evaluate for depression as symptoms can often overlap.
- **Pharmacological and other interventions:**

Treatment should be considered in older men with a testosterone level ≤ 200 ng/dL; the target level should be between 300–400 ng/dL.

Testosterone is on the **Beers list** (avoid unless hypogonadism confirmed and with clinical symptoms).

- Intramuscular injections (e.g., testosterone enanthate [Delatestryl], cypionate [Depo-Testosterone])
 - Dosed 75–100 mg weekly or 150–200 mg q2 weeks.
 - Can be done at home, not as costly.
 - Testosterone levels may vary more than compared to transdermal form of replacement.
- Transdermal testosterone patch (Androderm)
 - Androderm patch 2–4 mg applied q24 hours
 - Rotate sites with each application.
 - Therapy of choice in older men due to convenience and reversible action.
 - Monitor for skin irritation.

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- Transdermal gels (available forms: gel packets, gel tubes, gel pump)
 - 50–100 mg daily (applied to upper arm/shoulder).
 - Allow the gel to air dry for about 10 minutes before dressing. Either wear a shirt or wash the area with soap and water to prevent spreading testosterone to others.
 - Easy to apply, flexible dosing, and decreased risk of skin irritation.
 - Important to educate patients that this medication may transfer to others via contact; has unpleasant odor.
- Buccal testosterone (Striant)
 - 30 mg tablet q12 hours (not to be chewed or swallowed).
 - May not be a preferred agent for some because it requires twice daily dosing.
 - Monitor for gum pain or irritation; causes $\geq 32.6\%$ of gingivitis in patients.
- Subcutaneous pellets (Testopel)
 - Consider consultation with specialist.
 - These are difficult to reverse; should only be used in those in whom tolerance to testosterone therapy has been established. Duration of action can last up to 6 months.

Contraindications to the above treatment:

 - Male breast cancer or prostate cancer
 - Any patient with a prostate nodule, prostate-specific antigen (PSA) above 4 or above 3 in high-risk patients (i.e., black, first-degree relative with prostate cancer) should have evaluation by urology prior to starting replacement.
 - Hematocrit (Hct) above 50%
 - Testosterone can cause increases in hematocrit leading to increased venous thromboembolism (VTE) risk.

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- Untreated obstructive sleep apnea (OSA)
- Poorly controlled heart failure
- International prostate symptoms score above 19

Monitoring

- Prior to initiation:
 - PSA, CBC, liver function tests (LFTs), lipid panel, digital rectal exam (DRE)
- 3–6 months after initiation of testosterone:
 - Testosterone level
 - Hct (if > 54% therapy should be stopped)
 - DRE and PSA
 - This is due to prostate cancer concerns.
- Annually
 - Testosterone level
 - Hct
 - DRE and PSA
- Endocrinology consultation/referral (if therapy not working, Hct increasing, lipid abnormalities, and/or dose adjustments needed)
- Urology consultation/referral (if PSA increases or DRE exam abnormal)
Beers listed items, as mentioned above, include: testosterone (avoid unless hypogonadism confirmed and with clinical symptoms).

Differential Diagnosis^{6,7}

- Depression: Consider this when evaluating a patient with hypogonadism; may include vague symptoms of mood changes and decreased energy.
- Pituitary macroadenoma or prolactinoma: Headache and visual changes would be noted; MRI of the pituitary would reveal lesion.

CLINICAL PEARLS^{1,2,4,7}

- Testosterone therapy is associated with drug–drug interactions. Caution use in men taking warfarin (Coumadin); the combination can increase the risk of bleeding. It can also produce hypoglycemia in men taking oral hypoglycemia agents and/or insulin.
- Men who are on testosterone replacement therapy may also require a bisphosphonate and vitamin D if they have severe osteoporosis.
- Benefits of testosterone replacement therapy: Improves mood, sexual desire, erectile function, muscle strength, exercise endurance, ability to climb stairs, weight loss (if used long term), bones mineral density, and quality of life, and may help support cardiovascular health (reduces cardiac events if serum testosterone is maintained between 212–742 ng/day). It may also improve obesity, type 2 diabetes mellitus, and exercise capacity.
 - Risks: It may worsen benign prostatic hyperplasia (BPH), sleep apnea, and increase risk for VTE.

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Hypothyroidism

Definition

Hypothyroidism is a condition when the thyroid underproduces thyroid hormones, which affects multiple organs; patients will have an elevated thyroid-stimulating hormone (TSH).

Note: TSH upper limit of normal is near 4.5.

Categories^{1,3,4,5}

Subclinical hypothyroid: TSH will be above normal with normal free T4 (thyroxine).

Overt hypothyroid: Hypothyroidism associated with TSH levels above 10 and with a low free T4.

Causes^{1,3,4,5}

- Most common cause outside the U.S. is iodine deficiency.
- The most common cause within the U.S.: chronic autoimmune thyroiditis (Hashimoto thyroiditis).
- Treatment of hyperthyroidism.
- Surgical thyroidectomy.
- Radiation therapy.
- Medications (e.g., amiodarone [Cordarone], lithium [Eskalith, Lithobid]).

Risk Factor³

Risk factors of hypothyroidism coincide with causes.

- Female sex

Signs & Symptoms^{3,4,5}

- Nonspecific weakness
- Weight gain
- Decreased appetite
- Dry skin
- Cold sensitivity
- Fatigue
- Muscle cramps
- Voice changes
- Constipation
- Neurologic (e.g., carpal tunnel syndrome, dementia)
- Psychiatric/behavioral (e.g., apathy, depression, cognitive impairment)

Tests^{1,2,3,5}

- Serum TSH
 - May vary during the day (lowest in last afternoon, highest around time of sleep).
 - U.S. Preventive Services Task Force (USPSTF) recommends against routine screening in asymptomatic individuals.²
 - Upper limit of normal increases with age so mild elevation in older patients may not represent subclinical hypothyroidism.¹
 - Levels are decreased in hospitalizations and in severe illness.
 - In patients with elevated TSH with normal free T4 (subclinical):
 - Free T4 (metabolically available form) is the test of choice over total T4.
 - Obtain thyroid peroxidase antibody (TPOAb); elevation can predict progression to overt hypothyroidism.

- In patients with decreased free T4 (overt):
 - Obtain thyroid antibodies.
- Serum T3 (triiodothyronine)
 - Not much utility in order this; it is often normal due to hyperstimulation of remaining functioning thyroid disease.

Treatment & Management^{1,3,4,5,6}

- **Nonpharmacological and nursing interventions:**
 - Monitor for weight changes.
 - Common to have a weight gain due to slowing of metabolic processes.
 - Encourage a diet low in calories, cholesterol, and saturated fats.
 - Patients will require fewer calories to support metabolic activity.
 - Not atypical to have higher cholesterol levels in hypothyroidism.
 - Recommended: about six small meals throughout the day (this may improve energy levels).
 - Educate patient about sources of dietary fiber.
 - This will ease constipation (common symptom).
- **Pharmacological and other interventions:**
 - Levothyroxine (Unithroid, Tirosint, Synthroid, Levoxy): Therapy is usually lifelong.
 - If decision is made to treat, start dose between 25 mcg and 50 mcg.
 - Use 1.6 mcg/kg for overt hypothyroidism (TSH > 10).
 - Doses of 25–75 mcg usually sufficient for subclinical (TSH 4.5–10).
 - Patients with cardiac disease should be started on lower doses of 12.5–25 mcg daily.
 - There are differing recommendations regarding treatment of subclinical hypothyroidism, but consider if symptoms consistent with hypothyroidism or high risk for cardiovascular disease.

- Take medication 30–60 minutes before breakfast or 4 hours after last meal at night with water.
- Monitor for drug effects such as arrhythmias (e.g., atrial fibrillation), palpitations, and bone loss in postmenopausal women.
- Drug monitoring
 - Repeat TSH in 4–8 weeks (*except in cases of central hypothyroidism in which free T4 should be monitored*).
 - Small dose adjustments of 12–25 mcg are recommended.
 - Once adequate dosage determined, TSH should be monitored every 6–12 months.
 - Dosing requirements may change with some medications and aging.
 - Older adults often require 20%–25% less per kg daily due to decreased lean body mass.
- Dietitian consultation/referral
 - To assist in determining the patient's caloric needs and achieve a stable weight.
- Endocrinology consultation/referral
 - Consider in patients with cardiac disease, structural changes in thyroid, presence of other endocrine disease, or unusual constellation of thyroid function tests.

Differential Diagnosis^{3,5}

- Depression: Symptoms present similarly to hypothyroidism; depression will however respond to behavioral therapy and/or antidepressants, not to thyroid hormone replacement therapy. Those with depression will have normal TSH.
- Alzheimer's dementia: Can be difficult to distinguish this from hypothyroidism in older adults (which is why a TSH is ordered in the workup of dementia); patients with Alzheimer's dementia will have normal TSH and will not respond to thyroid replacement therapy.
- Myxedema coma: Rare representation of hypothyroidism; symptoms may include altered mental state, hypothermia,

bradycardia, hypoventilation, hyponatremia, and hypoglycemia. This occurs almost exclusively in older patients, causing profound slowing across systems.

CLINICAL PEARLS¹

- If TSH elevated during monitoring, make sure patient is taking the medication appropriately (as discussed above) before changing levothyroxine dose.
- Brand name may be more effective for some patients (brand name and generic name can have different absorption).

References

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