

Vitamin D Testing

Indications for Ordering

- Use to diagnose vitamin D insufficiency and monitor response to vitamin D therapy
- Testing is recommended only for patients at risk for vitamin D insufficiency

Test Description

Vitamin D, 25-Hydroxy

- Quantitative chemiluminescent immunoassay
- Tests for combined D₂ and D₃ forms of vitamin D, 25-hydroxy

Vitamin D, 1, 25-Dihydroxy

- Quantitative chemiluminescent immunoassay

25-Hydroxyvitamin D₂ and D₃ by Tandem Mass Spectrometry, Serum

- Quantitative high performance liquid chromatography-tandem mass spectrometry (LC-MS/MS)

Tests to Consider

Typical testing strategy

Screening

- Vitamin D, 25-Hydroxy

Hypercalcemia and/or renal failure

- See Related tests

Monitoring therapy

- Vitamin D, 25-Hydroxy – preferred test
- 25-Hydroxyvitamin D₂ and D₃ by LC-MS/MS – may be useful in individuals who are not responding to supplementation

Primary tests

[Vitamin D, 25-Hydroxy 0080379](#)

- Preferred screening test for vitamin D deficiency
- Preferred test to monitor response to supplementation

[Vitamin D, 1, 25-Dihydroxy 0080385](#)

- May be useful for evaluating calcium metabolism in individuals with hypercalcemia or renal failure in addition to Vitamin D, 25-Hydroxy testing
- Test is not appropriate for diagnosing vitamin D insufficiency

[25-Hydroxyvitamin D₂ and D₃ by Tandem Mass Spectrometry, Serum 2002348](#)

- May be useful for individuals with vitamin D insufficiency/deficiency who are not responding to supplementation
- Not the test of choice for initial evaluation of vitamin D insufficiency; Vitamin D, 25-hydroxy is preferred

Related tests

[Parathyroid Hormone, Intact with Calcium 0070172](#)

- Preferred test to diagnose calcium disorders suspected to be a result of parathyroid dysfunction

[Parathyroid Hormone-Related Peptide \(PTHrP\) by LC-MS/MS, Plasma 2010677](#)

- Aid in the diagnosis and monitoring of treatment for hypercalcemia

[Renal Function Panel 0020144](#)

- Screen kidney function for renal failure in individuals at risk for vitamin D deficiency

Disease Overview

Vitamin D Deficiency

Prevalence

- African American – 82.1% (may be less if weakly bound to vitamin D, 25-hydroxy)
- Hispanics – 69.2%
- Overall – 42%

Symptoms/signs

- Bone/joint pain
- Decreased bone mineral density (BMD)
- Nontraumatic fractures
- Hypercalcemia
 - Nausea, coma, vomiting, diarrhea, headache, polydipsia and polyuria, hypertension, nephrolithiasis, and metastatic calcifications

Diagnostic issues

- Vitamin D deficiency associated with
 - Rickets
 - Osteomalacia
 - Osteoporosis
- Other conditions thought to be associated with vitamin D deficiency
 - Autoimmune disease
 - Cancer
 - Cardiovascular disease

Physiology

- Refer to vitamin D metabolism diagram below
- Vitamin D, 25-Hydroxy – prohormone
 - Synthesized in the skin
 - Absorbed from diet when exposed to sunlight
 - Stored in the liver
- Vitamin D, 1, 25-Dihydroxy
 - Converted from vitamin D, 25-hydroxy by the kidneys
 - Conversion under control of the parathyroid hormone
 - Directs calcium absorption from the small intestine and reabsorption from bones
- Chronic vitamin D deficiency causes a secondary hyperparathyroidism
 - Excretion of phosphorus by the kidneys
 - Calcium reabsorbed from bones
 - Leads to decreased bone mineral density, osteomalacia, rickets (in children), and osteoporosis

Screening/detection

Screening recommended for at-risk populations

- African American and Hispanic ethnicities
- Body mass index (BMI) greater than 30 kg per m²
- Chronic kidney disease
- Granuloma-forming disorders
- Hepatic failure
- Hyperparathyroidism
- Malabsorption
- Medication that impairs vitamin D metabolism (eg, antiseizure medications, glucocorticoids, AIDS medication, antifungals, cholestyramines)
- Advanced age with history of falls or nontraumatic fractures
- Osteomalacia
- Osteoporosis
- Pregnancy and lactation
- Rickets
- Some lymphomas

Etiology

Major causes of vitamin D deficiency (The Endocrine Society Clinical Practice Guideline, 2011)

- Inadequate exposure to sunlight (sunscreen or dark skin)
- Obesity
- Fat malabsorption syndrome (eg, celiac disease)
- Bariatric surgery
- Nephrotic syndrome (vitamin D bound to albumin)
- Drug catabolism (HIV and anticonvulsants)
- Granuloma-forming disorders, lymphomas, and primary hyperparathyroidism

Laboratory Findings

Hypocalcemia		
Clinical Disorder	25(OH)D	1,25(OH) ₂ D
Vitamin D deficiency	D	D, N, I
Severe hepatocellular disease	D	D, N
Nephrotic syndrome	D	D, N
Renal failure	N	D
Hyperphosphatemia	N	D
Hypoparathyroidism	N	D, N
Pseudohypoparathyroidism	N	D, N
Hypomagnesemia	N	D, N
Vitamin D dependent rickets, type I (pseudo vitamin D deficiency rickets)	N, I	D
Vitamin D-dependent rickets, type II (pseudo vitamin D deficiency rickets)	N, I	D

D = decreased, N = normal, I = increased

Hypercalcemia		
Clinical Disorder	25(OH)D	1,25(OH) ₂ D
Vitamin D, 25(OH)D intoxication	I	D, N
1,25(OH) ₂ D intoxication	N	I
Granulomatous diseases	N	N, I
Lymphoma	N	N, I
Hypercalcemia of malignancy	N	D, N
Hyperparathyroidism	N	N, I
Idiopathic hypercalciuria	N	N, I

D = decreased, N = normal, I = increased

Test Interpretation

Vitamin D, 25-Hydroxy

Reference Ranges for Adults and Children		
	0-17 years	18 years and older
Deficiency	<20 ng/mL	<20 ng/mL
Insufficiency	--	20-29 ng/mL
Optimum level	≥20 ng/mL*	30-80 ng/mL
Possible toxicity	--	>150 ng/mL

*Wagner CL et al. Pediatrics 2008; 122: 1142-52

Vitamin D 1, 25-Dihydroxy

- Normal – 19.9-79.3 pg/mL
 - Normal result does not rule out deficiency

Vitamin D Metabolism

