Vitamin D Testing Protocol

Effective Date: October 1, 2010; Revised June 1, 2013

Scope

This laboratory protocol describes the appropriate use of vitamin D testing within the general adult (≥ 19 years) population in British Columbia (BC). Patients with malabsorption syndromes, renal failure, unexplained bone pain, unusual fractures, and other evidence of metabolic bone disorders are excluded from this protocol.* Recommended vitamin D supplementation is discussed and a patient handout is included.

Routine Diagnostic Testing

- Routine serum vitamin D testing or screening for vitamin D deficiency is not recommended.
- Routine serum vitamin D testing during vitamin D supplementation is not recommended.

Population at Risk

The BC population is at risk of low vitamin D levels from autumn to spring. There is no clinical utility in performing vitamin D tests on patients who are thought to be at risk for sub-optimal vitamin D levels and who would benefit from vitamin D supplementation.

Vitamin D Supplementation without Testing

Because vitamin D supplementation in the general adult population is safe, it is reasonable to advise supplementation without testing. Routine testing of vitamin D levels [25-hydroxyvitamin D or 25(OH)D] is not medically necessary prior to or after starting vitamin D supplementation.

Utilization and Cost of Serum Vitamin D Testing in BC

Utilization of vitamin D testing [as 25(OH)D] in BC has increased ten-fold in the past five years. Medical Service Plan expenditures are approximately $3 million annually for outpatient vitamin D testing with a cost per test of $61.32 in 2013.

Measuring serum vitamin D as 1,25-dihydroxyvitamin D [1,25-$(OH)_2$-D] is seldom indicated, except in selected patients with advanced renal failure, mineral and/or bone diseases. Specialist consultation should be considered for patients with malabsorption, unexplained bone pain, unusual fractures or other evidence suggesting metabolic bone disorder.

Sun Exposure and Vitamin D Synthesis by Skin

The amount of vitamin D produced by the skin is dependent on the surface area exposed, skin pigmentation, age, season, latitude and use of sun block. During winter months in Canada there is insufficient ultraviolet (UV) radiation in sunlight for adequate vitamin D production.[1] Adequate vitamin D can be made in the body during careful exposure of the arms and legs to sunlight for 10-15 minutes per day in the summer months. However, the risk of skin cancer due to sun exposure and tanning beds must be considered.

Dietary Sources of Vitamin D

Vitamin D can be obtained from dietary sources (e.g., salmon, mackerel, tuna, egg yolk), fortified foods (e.g., cow, soy or rice milk), and supplements. There are no plant sources that provide a significant amount of vitamin D naturally. (See Patient Guide)

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* Vitamin D testing is only covered under MSP when patient is <19 years or ordered by a specialist. All other vitamin D tests are user paid.

Vitamin D Supplementation

During the Canadian autumn, winter and spring, the adult population is unlikely to achieve adequate vitamin D levels through diet and sunlight only. Consideration should be given to supplementation during those seasons. The two major forms of vitamin D supplements are available as D_2 (ergocalciferol) or D_3 (cholecalciferol). Vitamin D_3 has been shown to be three times more effective than vitamin D_2 at increasing serum 25(OH)D levels and maintaining these levels over a longer period of time.[2,3,4] As a result, D_2 dosage must be tripled to achieve the same benefit.

Osteoporosis Canada recommends supplementing with vitamin D_3 over vitamin D_2.[4] Most over the counter supplements available in Canada contain vitamin D_3 whereas high-dose Vitamin D_2 is available only by prescription. There is good evidence that supplementation with at least 800 international units (IU) of vitamin D_3 per day, combined with calcium, is required to reduce the risk of fragility fractures, therefore 800 – 1000 IU daily is recommended (although the optimum daily requirement of vitamin D_3 is not known).[4,5,6] Weekly dosing (one week's adult dose of vitamin D_3 taken as a single weekly dose, i.e. 7000 IU) or monthly dosing (one month's adult dose of vitamin D_3 taken once a month, i.e. 30,000 IU) may be more convenient for some patients and has been shown to be safe.[1,4,7] At this time, high doses of vitamin D_3 once a year is not recommended as recent evidence has shown possible increased fracture risk.[8]

Vitamin D Toxicity

Vitamin D toxicity is uncommon.[3,6,9] Daily doses of up to 10,000 IU of vitamin D_3 for up to five months has not been shown to cause harm in adults.[10,11] Any harm that would occur from excessive vitamin D ingestion is mediated by hypercalcemia. Therefore, if there is a strong clinical suspicion of vitamin over-use (e.g. patients with eating disorders), then the recommended test is serum calcium (albumin-corrected total calcium* or ionized calcium).[12] Only if the calcium level is elevated would a serum vitamin D measurement be indicated.

Physiology

Vitamin D is a fat-soluble vitamin that is naturally present in very few foods.[13] It stimulates intestinal calcium and phosphate absorption, and is important in maintaining adequate calcium levels for bone mineralization, bone growth and remodelling.[14] Vitamin D deficiency has been linked to a wide variety of common diseases including cancer, diabetes, and cardiovascular disease. Vitamin D is reported to be involved in the regulation of cell growth and metabolism, modulation of immune function, and reduction of inflammation.[15,16]

For humans there are two sources of vitamin D: vitamin D_2 (ergocalciferol) is derived from plants, and D_3 (cholecalciferol) is produced in the skin by action of UV light on 7-dehydrocholesterol. (See Figure 1) Vitamin D_2 is only one-third as effective as vitamin D_3 in raising levels of 25(OH)D.[17]

Both D_2 and D_3 are hydroxylated in the liver to 25(OH)D, the major circulating form of vitamin D (metabolically inactive). It undergoes further hydroxylation in the kidney to the active metabolite, 1,25-$(OH)_2$-D or calcitriol. Calcitriol stimulates intestinal calcium absorption, decreases parathyroid hormone secretion, enables parathyroid hormone-mediated mineral absorption within the kidney, stimulates osteoclastic bone resorption and osteoblasts, decreases production of collagen, influences muscle function, stimulates cell differentiation and modulates the immune system.

Aging brings with it a reduction in the efficiency with which the skin synthesizes vitamin D and a reduction in the kidney's ability to convert vitamin D to its active form.[18] Increased skin pigmentation and use of high efficiency sun blockers also reduce skin synthesis of vitamin D.[1]

Because serum 25(OH)D concentration represents both skin production (D_3) and oral intake (D_2 or D_3) of vitamin D, it may be used to determine the adequacy of vitamin D production and intake.[19] Consensus has been reached that a 25(OH)D level that is less than 25 nmol/litre indicates vitamin D deficiency. The optimum level of serum vitamin D, if one exists, has not been determined.

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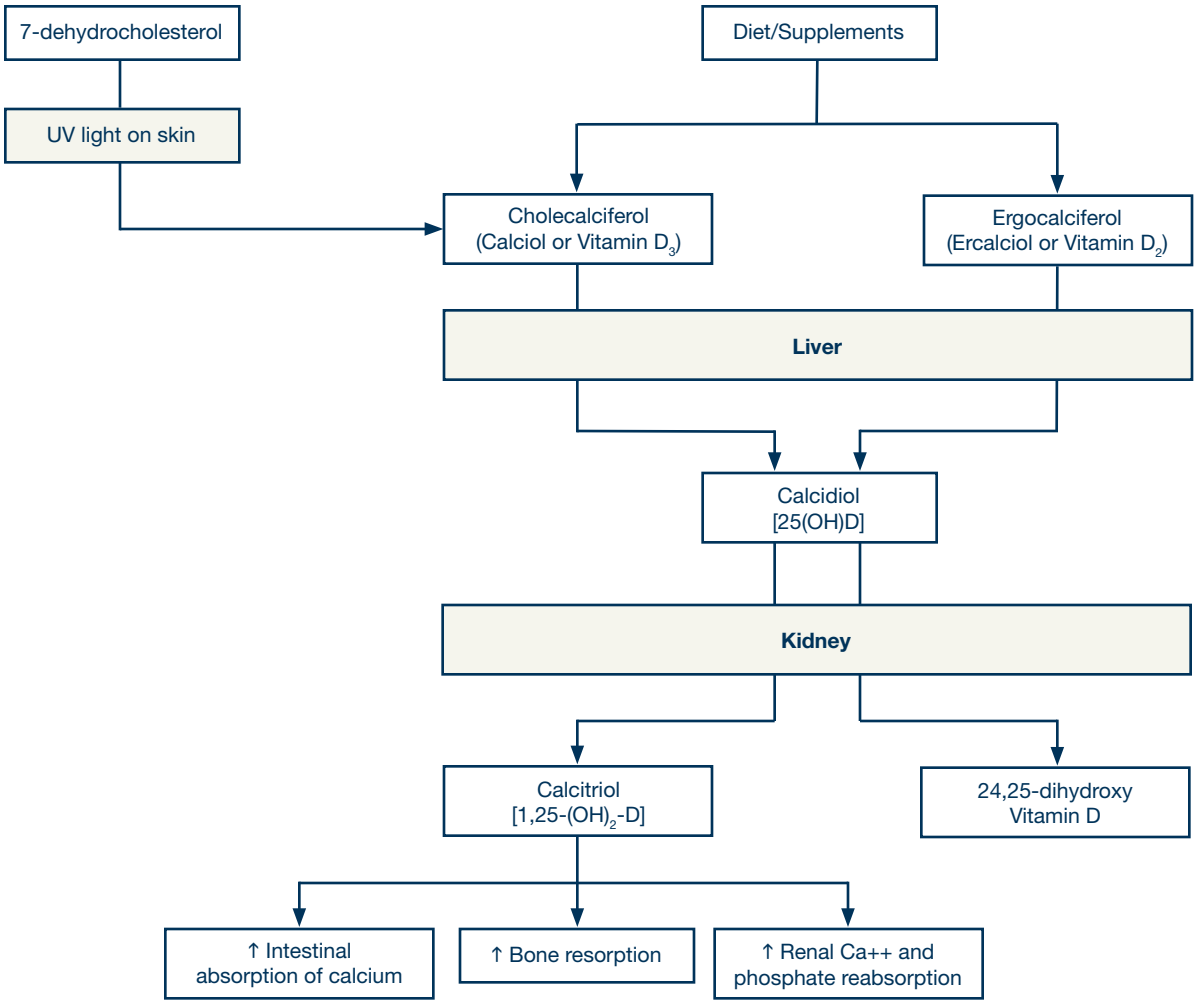
* Corrected Ca = Ca.measured + (40-alb) X 0.02, [Ca in mmol/L; albumin in g/L]

Figure 1: Pathways of vitamin D synthesis*



* Adapted from from Janssen HC, Samson MM, Verhaar HJ. Vitamin D deficiency, muscle function, and falls in elderly people. Americal Journal of Clinical Nutrition 2002;75:611-615.

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Resources

HealthLink BC: www.healthlinkbc.ca
Telephone - Anywhere in BC call 8-1-1, Translation services are available in over 130 languages on request.
TTY (Deaf and hearing-impaired) call 7-1-1.

List of Abbreviations

25(OH)D - 25	- hydroxyvitamin D
1,25-$(OH)_2$-D	- 1,25-dihydroxyvitamin D
UV	- ultraviolet
IU	- international units

Associated Documents

Vitamin D: A Patient Guide for Adults

This guideline is based on scientific evidence current as of the Effective Date.

This guideline was developed by the Guidelines and Protocols Advisory Committee, approved by the British Columbia Medical Association and adopted by the Medical Services Commission.

A mobile version of this and other guidelines is also available at www.BCGuidelines.ca

The principles of the Guidelines and Protocols Advisory Committee are to:

- encourage appropriate responses to common medical situations
- recommend actions that are sufficient and efficient, neither excessive nor deficient
- permit exceptions when justified by clinical circumstances

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The Clinical Practice Guidelines (the "Guidelines") have been developed by the Guidelines and Protocols Advisory Committee on behalf of the Medical Services Commission. The Guidelines are intended to give an understanding of a clinical problem and outline one or more preferred approaches to the investigation and management of the problem. The Guidelines are not intended as a substitute for the advice or professional judgment of a health care professional, nor are they intended to be the only approach to the management of clinical problems. **We cannot respond to patients or patient advocates requesting advice on issues related to medical conditions. If you need medical advice, please contact a health care professional.**