

Vitamin D and Calcium for the Prevention and Treatment of Osteoporosis

Osteoporosis is a common systemic skeletal disorder that is responsible for bone fractures in 50% of women and 30% of men in New Zealand¹. International guidelines on the use of vitamin D and calcium for this condition have been the subject of some debate. Therefore, the evidence basis for prescribing vitamin D and calcium has been reviewed to provide local guidelines. The following is a summary of these guidelines.

Vitamin D deficiency and osteoporosis

Vitamin D deficiency leads to secondary hyperparathyroidism, increased bone turnover, bone loss and osteoporosis. People at high risk of vitamin D deficiency include those:

- house-bound or institutionalised, especially the elderly
- with chronic debilitating illnesses
- on enzyme-inducing anticonvulsants (eg. phenytoin)
- on glucocorticosteroids
- with dark skin or extensively covered skin
- older than 50 years (men or women), presenting with fractures or low bone mineral density

A local study investigating older adults with fractures related to minimal trauma, found that vitamin D deficiency (serum 25-hydroxyvitamin D₃ concentrations < 50 nmol/L) occurred in 95% of patients admitted to the orthogeriatric rehabilitation ward at Burwood Hospital².

Endogenous synthesis of vitamin D

The term 'vitamin D' refers to two closely related compounds ergocalciferol (vitamin D₂) and cholecalciferol (vitamin D₃) which have the same pharmacological action. Ergocalciferol is produced in plants, while cholecalciferol is the form of vitamin D synthesised in humans. Cholecalciferol is transformed from 7-dehydrocholesterol in the skin following exposure to UV light. It is then transported to the liver and hydroxylated to 25-hydroxyvitamin D₃ (25-OHD₃). This is the major circulating metabolite, and can be measured clinically to detect vitamin D deficiency. Further hydroxylation takes place in the kidney to form 1,25-dihydroxyvitamin D₃ (calcitriol), the most biologically active metabolite of vitamin D. Elderly people produce 75% less cholecalciferol than young adults³ and only small amounts are sourced from the diet.

Oral dosage forms of vitamin D & metabolites

Various preparations are available in New Zealand. Those commonly used in adult patients at hospitals in Christchurch include:

- cholecalciferol 1.25 mg (50,000 IU) tablets (as Calciferol Strong® - also called Calciferol BP)
- cholecalciferol 7.5 mcg (300 IU) in multivitamin tablets (Apo-Multivitamin®, Healtheries Multivitamin®)
- calcitriol 0.25 mcg/0.5 mcg capsules (Rocaltrol®)

Prescribing guidelines

- **LOADING DOSE**
Cholecalciferol 1.25 mg daily for ten days
- **MAINTENANCE DOSE**
cholecalciferol 1.25 mg monthly with calcium 1000 – 1500 mg daily

Cholecalciferol 1.25mg, as Calciferol Strong®, is the preferred vitamin D formulation. This is cheaper than calcitriol and less likely to cause hypercalcaemia. The multivitamin preparations are unsuitable as two tablets provide insufficient cholecalciferol to correct deficiency, and more than two tablets will exceed the recommended maximum daily dose of vitamin A.

A loading dose should be considered for all patients who have a high risk of vitamin D deficiency (see above), or established serum 25-OHD₃ concentrations below the recommended range of 50 – 150 nmol/L.

Baseline blood tests

Serum calcium, phosphate and creatinine should be assessed prior to prescribing vitamin D and calcium. If hypercalcaemia, hyperphosphataemia or significant hypercalciuria exist then vitamin D and calcium would normally be avoided.

Serum 25-OHD₃ concentrations *do not need to be measured routinely* prior to loading or maintenance doses of cholecalciferol, except in clinical situations where vitamin D status may be variable. These include patients:

- with a malabsorption disorder
- taking enzyme-inducing anticonvulsants (phenytoin, carbamazepine, primidone)
- who have previously taken cholecalciferol, but are still suspected to be vitamin D deficient

Renal impairment

Patients with renal impairment can still be prescribed cholecalciferol at usual doses. In severe chronic renal failure calcitriol may be indicated, under the advice of the nephrologists.

References

1. NZ Orthopaedic Assoc. July 2003; The Ageing of New Zealand: an epidemic with major impact on musculoskeletal disease <http://www.bonejointdecade.org/>
2. Sidwell AI et al. Int Med J 2004; 34: 129-132
3. Lips P. Endocr Rev 2001; 22: 477-501