Osteoporotic fractures and vitamin D deficiency

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Case study

A caucasian woman aged 79 years, with a history of hypertension, hyperlipidaemia, and osteoarthritis, was referred for assessment of osteoporosis and generalised musculoskeletal pain after surgery for a right midshaft femoral fracture. Further history revealed she had suffered nonspecific musculoskeletal pain, particularly of the pelvic girdle, and unsteady gait for many weeks, but denied suffering any falls. She had limited mobility due to osteoarthritis of both knees. She had been mostly housebound and was on an animal product restricted diet in view of her history of hypercholesterolaemia. Initial X-rays confirmed an incomplete fracture of the midshaft of the right femur. She had an orthopaedic review, and subsequent bone scan and X-rays (*Figure 1*) revealed incomplete fractures of the midshaft of both femurs and the seventh rib. She was managed conservatively (alendronate 70 mg per week) and progress was closely monitored. Three weeks later, she presented to the emergency department with worsening right thigh pain and difficulty in weightbearing. X-rays revealed an extension of the right femoral fracture traversing the entire cortex that required surgery.

Physical examination revealed a mild thoracic kyphosis. There was no muscle or bone tenderness, proximal muscle weakness, or other significant abnormality. The plasma biochemistry revealed:

- mild hypocalcaemia (1.98 mmol/L)
- hypophoshataemia (0.7 mmol/L)
- raised alkaline phosphatase (ALP) (216 iu/L)
- low 25-hydroxyvitamin D (250HD) (22 nmol/L), and
- a mildly raised parathyroid hormone (PTH) level (8 pmol/L).

Thyroid, renal, and liver functions were normal. The patient was treated with nine capsules of Ostelin 1000 per day, which was tapered over 8 weeks to one capsule. The repeat plasma 25OHD after 6 weeks was 56 nmol/L, and her musculoskeletal symptoms were completely resolved. There was normalisation of biochemical abnormalities and X-rays demonstrated healing of both femoral fractures. A bone biopsy taken at the time of surgery revealed an increased amount of osteoid. However, undecalcified bone sections were not examined, nor was quantitative histomorphometry performed. Dual energy X-ray absortiometry (DEXA) scan revealed a T-score of –3.32 at the hip and –1.38 at the lumbar spine. Corresponding Z-scores were –1.05 and –0.7.

Vitamin D deficiency is common among elderly people and numerous studies have confirmed its high prevalence in both selected and unselected samples.[1–4] However, there is little information on the prevalence of osteomalacia in elderly people.[5] As osteomalacia is essentially a histological diagnosis, assessment of its true prevalence is difficult, and reported prevalence has varied depending on the diagnostic criteria adopted.[5]

The main risk factor for vitamin D deficiency in an otherwise healthy person is inadequate exposure to sunlight;[6] insufficient dietary intake may also contribute.[6] The vitamin D deficiency in this patient was most likely due to a combination of these factors. Although it is assumed casual exposure to sunlight is adequate to sustain vitamin D status in people living in Australia, studies suggest vitamin D deficiency is widely prevalent[7] and dietary intake of naturally occurring vitamin D and vitamin D supplements may be important, particularly during winter.[7,8] Therefore, there may be a need for a recommended dietary intake (RDI) of vitamin D for people in Australia, which is not available at present. The Australian and New Zealand Bone and Mineral Society Working Group on Vitamin D and Adult Bone Health recommends exposure of the hands, face and arms to one-third of a minimal erythemal dose (MED) of sunlight (the amount that produces a faint redness of skin) on most days for adequate endogenous vitamin D synthesis.[9] People who are not exposed to adequate sunlight are recommended a daily vitamin D supplementation of at least 400 IU (10 µg).[9]

The clinical, biochemical, and radiological features in

this case are characteristic of osteomalacia, which may not be seen in most cases. Screening would miss a significant number of patients with vitamin D deficiency and osteomalacia if only the standard biochemical features were used.[10] In most patients a prompt diagnosis of vitamin D deficiency would require a high index of clinical suspicion. Plasma 25OHD should be routinely measured in patients at high risk of vitamin D deficiency. This generally includes:

- patients with low trauma fracture[3,11]
- elderly patients, particularly those in residential care and those mostly housebound[4]
- dark skinned women, particularly if veiled[12]
- patients with potential causes of malabsorption,[13] and
- patients on long term anticonvulsants.[6]

Patients with chronic liver disease[14] and renal failure[6] are also at increased risk.

As observed in this patient, nonspecific musculoskeletal symptoms are well recognised in vitamin D deficiency,[15] which may be confused with other rheumatological conditions.[15,16] Measurement of plasma 25OHD would be diagnostically prudent in patients with persistent nonspecific musculoskeletal complaints.

Historically osteomalacia has been associated with severe vitamin D deficiency, usually with plasma 25OHD levels of less than 12.5 nmol/L.[17] However, this case shows clinical osteomalacia can develop even with less severe vitamin D deficiency. Secondary hyperparathyroidism occurring in vitamin D deficiency plays a leading role in the pathogenesis of osteomalacia and osteoporosis.[16–18] Although the optimal level of plasma 25OHD is not precisely known, a level of 50 nmol/L or more has been shown to be necessary to prevent secondary hyperparathyroidism and high bone turnover.[19] Therefore it is conceivable that osteomalacia may develop even in patients with less severe vitamin D deficiency.

Treatment of osteomalacia often requires large pharmacological doses of vitamin D.[15,16] Preparations containing higher doses of vitamin D (preferably cholecalciferol) that assist in the management of severe vitamin D deficiency are currently not available in Australia.

This case highlights the importance of excluding secondary and reversible causes of osteoporosis before considering treatment with specific antiosteoporotic drugs. In this context, the importance of screening for vitamin D deficiency cannot be overemphasised. Treatment with bisphosphonates in the setting of vitamin D deficiency may also have deleterious effects; clinically significant hypocalcaemia has been described with intravenous bisphosphonate treatment.[20] Correction of vitamin D deficiency will also optimise the effects of antiresorptive agents.

Summary of important points

- All patients with low trauma fractures or suspected osteoporosis should be routinely screened for vitamin D deficiency.
- Clinical features and routine plasma biochemistry are not sensitive screening tests for vitamin D deficiency, therefore measurement of plasma 25OHD is necessary.
- Vitamin D deficiency should be suspected in older patients with nonspecific musculoskeletal symptoms.
- Osteomalacia may develop even in patients with less severe vitamin D deficiency.
- Screening for secondary and reversible causes of osteoporosis should be routine before considering anti-osteoporotic therapy.

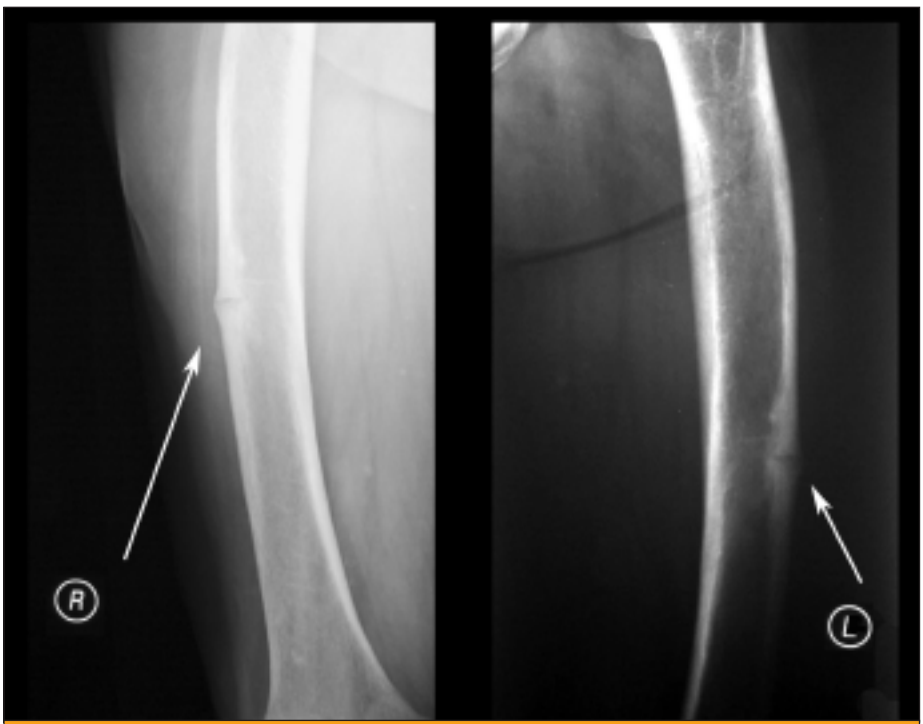

Figure 1. X-ray of femoral bones demonstrating lateral bowing and Looser's zones (indicated by arrows)

Conflict of interest: none declared.

Acknowledgment

Thanks to Anthony Baricevic, Radiology Department, Western Hospital, Melbourne, for his assistance in preparing the photograph used in Figure 1.

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