



The incidence of Vitamin D deficiency amongst patients with a femoral neck fracture : are current bone protection guidelines sufficient ?

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Vitamin D is required for calcium homeostasis and bone metabolism. This prospective observational study examined the incidence of vitamin D deficiency amongst patients with a fracture of the femoral neck, and the correlation between pre-admission use of bone-protection medication and vitamin D levels. Vitamin D assays were available in 75 out of 151 patients admitted with a hip fracture in February-March 2012 ; the assays were performed within one week of admission and surgery. The incidence of suboptimal vitamin D levels was 90% (68/75), with severe deficiency (< 15 nmol/l) or deficiency (< 30 nmol/l) seen in 71% (53/75). Only 7 patients were on bone protection medication at the time of admission, and all of them had suboptimal vitamin D levels. This suggests that the prevention is practically inexistent or at best insufficient. According to the literature, vitamin D deficiency is also associated with falls and maybe with outcome of surgery. Current management strategies may not be sufficient to address vitamin D deficiency and are overlooking an important and potentially modifiable risk factor.

Keywords : vitamin D ; deficiency ; falls ; hip fracture ; bone protection guidelines.

INTRODUCTION

Vitamin D deficiency has reached pandemic levels and re-emerged as a global health concern (6,15). Elderly patients are at particularly high risk due to restricted mobility and limited exposure to UV

light (10,16). In the UK, deficiencies amongst Asian populations in the Midlands have been widely reported (8,10,17). This is of significance to the authors, while in Leicester, according to the 2001 census, 30% of the population is of Asian heritage (11), where vitamin D deficiency is very common (7).

Several studies suggest that daily administration of 700-800 IU vitamin D reduces the risk of hip fractures in the elderly (2,3). A 2005 meta-analysis of double-blind randomized controlled trials comparing vitamin D supplementation with or without calcium versus calcium alone or placebo, reported a 26% reduction in the relative risk of hip fracture in individuals ≥ 60 years receiving 700-800 IU of vitamin D daily (2). However, these guidelines may be insufficient.

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This study sought to examine the incidence of vitamin D deficiency amongst patients admitted with a femoral neck fracture, and to assess the correlation between pre-admission use of bone protection therapy and vitamin D levels.

PATIENTS AND METHODS

This prospective, observational study was carried out between February 1 and March 31, 2012. Postoperative vitamin D assays were performed in 75 out of 151 patients admitted with a femoral neck fracture. Assays were performed within one week of admission and operative intervention. Details on ethnicity and pre-admission use of bone protection therapy were obtained from individual case records.

RESULTS

Between February 1 and March 31, 2012, 151 patients were admitted to the Leicester Royal Infirmary with a femoral neck fracture. Vitamin D assays were performed in 75 patients. The mean age of these patients was 81 (range : 49-98), with 16 males and 59 females. Ten patients were of Asian ethnicity. Seven patients were on bone protection therapy with Adcal-D₃ alone (1 tablet twice daily) or in combination with weekly alendronic acid (70 mg). Each tablet of Adcal-D₃ contains calcium carbonate 1.5 g (calcium 600 mg or Ca²⁺ 15.1 mmol) and 400 units (10 micrograms) cholecalciferol (19).

The incidence of suboptimal vitamin D levels in this cohort was 90% (68/75) with severe deficiency (< 15 nmol/l) or deficiency (< 30 nmol/l) seen in 71% (53/75).

Also the 7 patients who were already on bone protection medication demonstrated suboptimal vitamin D levels ; two were severely vitamin D deficient, three were deficient and two were insufficient.

DISCUSSION

Prevention of vitamin D deficiency practically inexistent

The results of this study suggest that 68 out of 75 patients did not take any preventive medication,

while 90% had suboptimal vitamin D levels. The *Blue book on the care of patients with fragility fractures* (13) advises that restoration of vitamin D levels should be a tenant of secondary prevention of fragility fractures. Current management strategies may not sufficiently address vitamin D deficiency and are thus overlooking an important and potentially modifiable risk factor.

Vitamin D deficiency can lead to poor bone remodeling, cortical bone loss and decreased bone density, predisposing to fragility fractures (5,9).

Existing prevention of vitamin D deficiency insufficient

In this study, 7 of the 75 patients admitted with a fracture of the femoral neck were on bone protection therapy with Adcal-D₃ alone (400 IU twice daily) or in combination with weekly alendronic acid (70 mg). But all 7 demonstrated suboptimal vitamin D levels. These numbers suggest that standard Adcal-D₃ regimes are ineffective at correcting suboptimal vitamin D levels. Moreover, current bone protection strategies do not include assessment of vitamin D levels. Empirical administration of two tablets of Adcal-D₃ alone, or in combination with bisphosphonate therapy, provides 800 IU of vitamin D daily. This may be insufficient to correct vitamin D levels in those who are severely deficient. The Department of Diabetes and Endocrinology at the University Hospitals of Leicester NHS Trust recommends a more aggressive approach to treatment of vitamin D deficiency with bolus doses of 20,000 IU cholecalciferol daily for one month, followed by a maintenance dose of 1-2,000 units daily. Trivedi *et al* (18) found that 4-monthly administration of 100,000 IU of vitamin D was capable of reducing the number of fractures, including hip fractures, in individuals over 65 years.

Vitamin D deficiency associated with falls

The influence of Vitamin D supplementation extends beyond osteoporotic fractures : it encompasses falls prevention. Vitamin D is required for normal neuromuscular function ; deficiency leads to

muscular weakness, gait instability and recurrent falls (1,4,14,15). Bischoff-Ferrari *et al* (1) stress that vitamin D receptors on muscle cells are essential for intracellular calcium distribution and regulation; they may be associated with *de novo* protein synthesis promoting muscle cell growth, improved muscle function and decreased risk of falling. The same authors report a falls reduction risk of more than 20% in ambulatory elderly individuals of stable health receiving vitamin D supplementation. Currently the American and British Geriatrics Societies guidance on falls prevention in older persons advocate the daily administration of 800 IU of vitamin D to older persons at risk of falls (12). But this may be insufficient for protection against fractures of the femoral neck.

Vitamin D deficiency possibly associated with poor outcome after surgery

Vitamin D may also influence outcome following hip fracture surgery. Nawabi *et al* (10) have shown that in a cohort of patients undergoing total hip replacement (THR) for osteoarthritis, patients who were vitamin D deficient or insufficient (< 40 nmol/l) had lower preoperative Harris Hip Scores (HHS) and poorer outcome, as measured by HHS, than those who were vitamin D replete. It is plausible to suggest that similar outcomes would be seen after hip fracture, where improvement in functional outcome could result in a decreased length of stay and postoperative morbidity.

Limitations

The small sample size and percentage data capture (75/151 or 50%) limit the extent to which the results can be extrapolated. Moreover, this study was undertaken during the months of February and March, at a time of limited opportunity for UV exposure predisposing to vitamin D deficiency.

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