ORAL VITAMIN D REPLACEMENT AFTER HIP FRACTURE: A COMPARATIVE REVIEW

To the Editor: Hip fracture is a commonly encountered clinical problem, with an annual estimated prevalence of 512,000 in the United States by 2040, at a cost of $16 billion.[1] Hypovitaminosis D is commonly associated with hip fracture in older adults[2,3] and is caused by multiple factors, such as decreased sun exposure with reduced skin production of vitamin D and low dietary D2/D3. This problem may result in proximal muscle weakness, pain, poorer dynamic balance, and slower performance speed,[4] affecting rehabilitation during the acute postoperative and initial rehabilitation periods. Furthermore, symptomatic hypocalcemia may occur with intravenous bisphosphonate use, exacerbated by hypovitaminosis D, and may be life threatening and require hospitalization.[5] In Australia, vitamin D supplementation is generally available only in an oral formulation at a dose of 1,000 IU (25 μg). The optimal dose and mode of replacement in vitamin D–deficient adults after hip fracture are not known. This study aimed to investigate the effectiveness of moderate-dose oral vitamin D replacement in improving 25-hydroxyvitamin D (25OHD) levels and rehabilitation outcomes after hip fracture surgery.

METHODS

This study analyzed a cohort of older adults with a hip fracture requiring surgical intervention admitted to the orthopedic ward of a 450-bed metropolitan hospital in Sydney, Australia, over a 9-month period (February–October 2008). Junior orthopedic staff were provided with a protocol that included a suggested oral vitamin D replacement dose (2,000 U twice a day for 14 days). Exclusion criteria were hypercalcemia and severe renal impairment. Three independent assessors reviewed patient data retrospectively. Demographic, functional, and clinical data (including comorbidities) were collected for the two oral vitamin D replacement regimens: moderate dose (MD; 4,000 IU) and usual care (UC; 1,000 IU). The primary outcomes were improvement or maintenance of 25OHD level and change in 25OHD level at Day 14; secondary outcomes included time to mobilization, mobility and activity of daily living (ADL) status, length of stay, discharge destination, and mortality (inpatient, 6-month). Differences in 25OHD levels and rehabilitation outcomes between the two groups were identified using analysis of variance for continuous variables and chi-square for nominal variables.

RESULTS

One hundred thirty-four patients met the eligibility criteria for the study; 10 were excluded because of renal failure or medical instability. The 124 patients studied had a mean age of 80.3 ± 8.6 (range 53–97); 75.8% were female and 74.2% lived in a private home before admission. A baseline analysis showed no significant imbalances between patients with the two vitamin D replacement regimens in terms of age, premorbid place of residence, dementia status, prior mobility and ADL status, and medical comorbidities. Vitamin D deficiency was prevalent in 76.7% of participants, with a mean 25OHD of 44.1 ± 23.2 nmol/L (range 10–131), being severe (<12.5 nmol/L) in four participants (3.3%), moderate (12.5–24 nmol/L) in 18 (15.0%), and mild (25–49 nmol/L) in 70 (58.3%). Thirty-two percent had secondary hyperparathyroidism (parathyroid hormone >5.25 pmol/L in the presence of hypovitaminosis D). All patients were followed up, but it was possible to obtain a second 25OHD measurement on only 66 patients, mostly because of early release from the hospital. At 14 days (Figure 1), the MD group showed greater gains in serum 25OHD levels (22.4 ± 18.3 vs 7.5 ± 19.6 nmol/L, $P = .002$) than the UC group and was slightly more likely to improve (88.9% vs. 62.5%, $P = .05$) and less likely to worsen (11.1% vs 37.5%, $P = .05$). There were no significant differences in terms of symptomatic hypercalcemia, time to mobilization, change in mobility and ADL status, discharge destination, rehabilitation and total length of stay, or inpatient or 6-month postdischarge mortality.

DISCUSSION

This study confirms that hypovitaminosis D is common in patients presenting with hip fractures and reports the novel finding that 25OHD levels can decrease after hip fracture despite standard oral vitamin D treatment. A moderate oral dose (4,000 IU daily) replacement approach can significantly improve and maintain 25OHD levels within 2 weeks after a hip fracture. This approach may prevent hypovit-

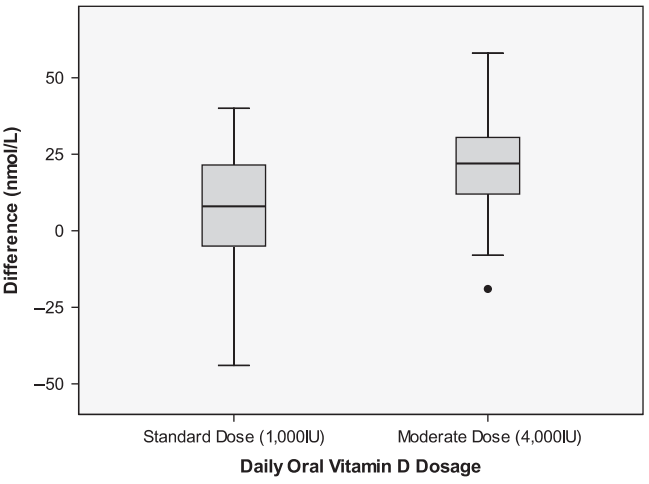

Figure 1. Differences in 25-hydroxyvitamin D levels 14 days after hip fracture according to daily oral vitamin D protocol (n = 66).

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aminosis D–related adverse effects after subsequent oral or intravenous bisphosphonate treatment, although this did not translate into detectable improvements in rehabilitation outcomes, which may have been because of insufficient responsiveness of these outcome measures and possibly because of the small doses of vitamin D supplemented and short duration of the study. With regard to the optimal dosage of vitamin D after hip fracture, a daily oral vitamin D replacement was shown to be more effective in improving 25OHD levels after 1 year than 300,000 IU D2 intramuscularly once yearly,[6] suggesting the benefits of ongoing vitamin D supplementation. According to the results of the current study, we would advocate a vitamin D replacement protocol similar to that of a previous study,[7] consisting of an initial parenteral loading dose (50,000–125,000 IU intramuscularly) within 10 days of hip fracture, followed by daily oral vitamin D (800–1,200 IU) and calcium (1,000–1,500 mg daily).[7] We would also advocate for a large-dose parenteral vitamin D formation to be made available in Australia, because this is not currently available. Further studies are required to ascertain whether a larger initial loading dose of parenteral vitamin D can translate into improvements in rehabilitation outcomes.

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Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper.

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COMPARING INDEXES OF FRAILTY: THE CARDIOVASCULAR HEALTH STUDY AND THE STUDY OF OSTEOPOROTIC FRACTURES

To the Editor: There is a need for a unifying clinical description of frailty, an instrument that could be useful for the practicing physician and also in the research setting. The Cardiovascular Health Study (CHS) index developed by Fried and colleagues is a step forward.[1] It uses objective and relatively easily measured criteria and has been shown to detect a population of patients with a high risk of falls, disability, and death. The Study of Osteoporotic Fractures (SOF) index, as described by Ensrud and colleagues,[2] is an attempt to develop an instrument that detects this same population of at-risk individuals, albeit using a more easily applied diagnostic tool. We would like to make two comments.

The first is that the CHS index used in the SOF study was composed of items that were not the same ones used by Fried and colleagues. Even though the authors admit this limitation, they make no additional comments about how this could have interfered with the results or about the possible theoretical implications of this considerable change in the nature of the indicator.