Prevalence of Vitamin D Deficiency in Patients with Minimal Trauma Fractures*

Prevalência da deficiência de vitamina D em pacientes com fraturas ocasionadas por trauma de baixa energia

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Abstract

Objective To analyze the serum 25-hidroxyvitamin D [25(OH)D] in patients with minimal trauma fractures, and to verify the profile of these patients and their main fractures.

Methods Cross-sectional study in which blood samples were obtained from 40 patients with minimal trauma fracture to evaluate their 25(OH)D levels. Variables analyzed: fracture type; age; sex; Vitamin D supplementation; smoking habits; exercise; sunscreen use.

Results A total of 29 (72.5%) patients presented with 25(OH)D deficiency, 10 (25%) had insufficiency, and only 1 (2.5%) had sufficient levels. The patients who used vitamin D supplementation had 25(OH)D levels (24.8 ± 12.75) that were significantly ($p = 0.048$) higher than those who did not use it. In addition, patients who practiced exercise 2 to 3 times a week obtained a medium concentration of 25(OH)D (22.5 ± 6.08 ng/mL) significantly ($p = 0.042$) higher compared with those who did not exercise (15.5 ± 7.25 ng/mL).

Conclusion The prevalence of vitamin D deficiency was 72.5%; those patients who exercised 2 to 3 times a week and those who used vitamin D supplementation had higher levels of vitamin D.

Keywords
- bone fractures
- vitamin D deficiency
- exercise

Resumo

Objetivo Avaliar os níveis séricos da 25–hidroxivitamina D [25(OH)D] em pacientes internados com fraturas causadas por traumas de baixa energia e analisar o perfil desses pacientes e os principais tipos de fraturas.

Métodos Estudo transversal observacional em que foram obtidas amostras séricas de 25(OH)D de 40 pacientes internados com fraturas resultantes de trauma de baixa energia. As seguintes variáveis foram analisadas: tipo da fratura, idade, sexo, uso de vitamina D, tabagismo, atividade física e uso de protetor solar.

* Work developed at the Universidade de Santa Catarina e Hospital Nossa Senhora da Conceição, Tubarão, SC, Brazil.

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Resultados Apresentaram níveis deficientes de 25(OH)D 29 (72,5%) pacientes, dez (25%) apresentaram níveis insuficientes e apenas um (2,5%) apresentou níveis suficientes. Os pacientes que faziam uso de vitamina D obtiveram níveis de 25(OH)D (24,8 ± 12,75) estatisticamente significantes ($p = 0,048$) em relação aos que não usavam (16,47 ± 6,28). Além disso, aqueles que praticavam exercícios físicos duas a três vezes por semana obtiveram uma concentração média de 25(OH)D (22,5 ± 6,08 ng/mL) estatisticamente significante ($p = 0,042$) em comparação com o grupo que referiu não fazer atividade física (15,5 ± 7,25 ng/mL).

Conclusão A prevalência da deficiência de 25(OH)D foi de 72,5%, indivíduos que praticavam atividade física duas a três vezes por semana, bem como aqueles que faziam uso de vitamina D, apresentaram um nível maior de vitamina D.

Palavras-chave
- fraturas ósseas
- eficiência de vitamina D
- exercício

Introduction

Osteoporosis fractures have a high incidence, and are among the major causes of morbidity and mortality in the elderly; in addition, these lesions cost approximately 6 million dollars to the Brazilian private health care system.[1–4] Since projections estimate that the elderly population will continue to grow, the prevalence of these fractures will increase even more.[5] The lifetime risk of developing some osteoporosis fracture is of 40 to 50% in women and 13 to 22% in men.[6]

Vitamin D, unlike many other vitamins, is a hormonal precursor that can be obtained through diet and endogenous production by the skin.[7] Vitamin D deficiency reduces calcium absorption and, as a result, increases parathyroid hormone (PTH) levels, which increases serum calcium levels, diminishes phosphate levels, increases osteoclasts activities, and, therefore, exacerbates osteopenia and osteoporosis.[8,9] As such, evidences show that vitamin D deficiency relates to a reduction in bone mineral density even in healthy populations. Moreover, the reduced muscle strength in the elderly increases their risk of fall.[10,11]

The present study evaluates the prevalence of vitamin D deficiency in patients admitted with fractures caused by minimal trauma and their possible associated factors.

Material and Methods

Experimental Design and Inclusion and Exclusion Criteria

This is a cross-sectional, observational study. The study was conducted from July 1, 2016 to October 31, 2016 with a population of patients with minimal trauma fractures admitted to Hospital Nossa Senhora da Conceição, in Tubarão, Santa Catarina, Brazil. Fifty-five patients were admitted during this period. Fifteen patients were excluded for not fulfilling the inclusion criteria. The enrolled patients were admitted with minimal trauma fractures; falls from standing height and torsions were considered low-energy traumas. The exclusion criteria were the following: children; refusal in study participation; patients unable to answer the questionnaire or those without a caregiver capable of properly answering it, and patients with incomplete data for search at medical records.

Variables

Data collection was performed through a questionnaire answered by the patients and/or their caregivers, consisting of age, gender, previous fracture history, osteoporosis diagnosis, vitamin D supplementation, solar protection use, smoking habits and physical activities inquiries. Osteoporosis was diagnosed by bone densitometry as preconized by the World Health Organization.[12] Questions regarding vitamin D ascertained its current supplementation or not and the used dose. Patients were also inquired about their past and current tobacco use. Walking, dancing, swimming and riding a bike were considered physical activities and distributed per weekly frequency. Vitamin D levels were evaluated in blood samples collected through peripheral venous puncture; the serum concentration of 25-Hydroxivitamin D [25(OH)D] was determined by chemiluminescence. The results were classified according to Holick,[13] who proposes that levels lower than 20 ng/mL constitute a vitamin D deficiency, levels between 21 and 29 ng/mL, vitamin D insufficiency, and levels higher than 150 ng/mL, toxicity.

Processing and Analysis

The collected data were entered in a database created with the Epi Info software, version 7.2, for analysis. The qualitative variables were described as absolute frequency (n) and percentage (%), whereas central tendency measures and data dispersion (average and standard deviation) described quantitative variables. The subgroups were compared using Student *t*-tests in case of parametrical distribution or analysis of variance (ANOVA) for multiple comparisons. The significance level adopted was 5%.

The study was approved by the local institution Ethical Committee under number CAAE 51401915.4.0000.5369.

Results

The sample totaled 40 patients, including 12 (30%) men and 28 (70%) women, with a mean age of 78.3 years-old (±8.14), and average vitamin D concentration of 17.10 ng/mL (±7.05); vitamin D classification is showed in ►**Fig. 1**.[13] Thirty-six (90%) of these patients were admitted for proximal femoral fractures, 1 (2.5%) for radial distal fracture, 2 (5%) for humeral proximal fracture and 1 (2.5%) for ankle fracture.

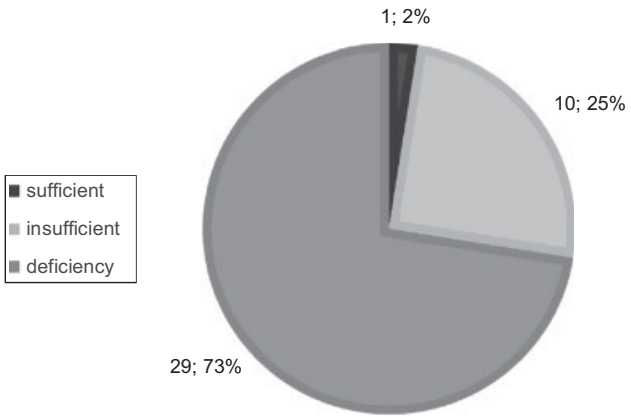

Fig. 1 Vitamin D levels according to the Holick classification.[13]

In patients who exercised 2 or 3 times a week, the average 25(OH)D levels (22.5 ng/mL and ± 6.08) were statistically significant ($p = 0.042$) in comparison with the group referring no physical activity (15.5 ng/mL ± 7.25).

In individuals referring continuous vitamin D use, average 25(OH)D levels (24.8 ± 12.75) were statistically significant ($p = 0.048$) when compared with those from patients with no vitamin D supplementation (16.47 ± 6.28).

The remaining variables were not statistically significant and are presented in ►**Table 1**.

Discussion

This research found a prevalence of vitamin D deficiency of 72.5%. This result parallels the 80% prevalence reported by Schweitzer et al[14] in a similar population, but presenting only proximal femoral fractures, with mean age of 84 ± 7 years-old and a positive correlation between age and 25(OH) D level. This correlation might be explained by the older age, and, therefore, higher number of comorbidities, of the population studied by Schweitzer. This can reduce mobility and increase the patients' dependence, resulting in a diminished exposure to sun light.

Guerra et al[15] reported a case control study comparing 110 elderly patients with fractures to 231 control patients without fractures. Among the fracture group, 54, 27.2 and 18.2% of the patients presented vitamin D deficiency, insufficiency and sufficiency, respectively, in addition to lower levels compared with the control group. This study did not reveal significant differences regarding gender and age.

Gumiero et al[16] analyzed vitamin D relation with gait recovery in patients with proximal femoral fractures. The population was similar, with a mean age of 80.2 ± 7.3 years-old and 77% of women. However, unlike the present study, vitamin D deficiency was observed in 33.7% of the patients and it was not related to other variables, such as gender, fracture type or gait recovery.

In the United States, Simonelli et al also evaluated previous vitamin D use in patients with low-energy hip, humerus, wrist,

Table 1 Vitamin concentration measurement according to the variables

Variables	Subgroups	n	Average	Standard deviation	*p*
Gender	Male	12	17.76	7.27	0.7[a]
	Female	28	16.81	7.07	
Age	60–65 years-old	2	13.85	7.84	0.71[b]
	66–70 years-old	5	15.9	5.56	
	71–75 years-old	7	16.97	7.62	
	76–80 years-old	12	19.46	6.62	
	> 80 years-old	14	16.03	7.9	
Smoking	Smoker	2	14.4	5.37	0.79[b]
	Former smoker	16	16.68	6.74	
	Never smoked	22	17.65	7.58	
Physical exercises	2–3 times per week	2	22.5	6.08	0.048[c]
	None	25	15.55	7.26	
Solar protection	Daily use	6	16.08	7.27	0.85[b]
	Occasional use	3	18.63	6.22	
	Never uses	31	17.15	7.26	
Osteoporosis	Present	11	19.38	8.03	0.21[b]
	Absent	29	16.23	6.59	
Vitamin D supplementation	Yes	3	24.8	12.75	0.048[b]
	No	37	16.47	6.28	

[a]Student *t*-test; [b] ANOVA; [c] Mann-Whitney test.

vertebrae and ribs fractures.[17] The study evidenced a prevalence of 25(OH)D deficiency of 82%, with no relation with gender or age. In addition, vitamin D levels in supplemented patients [16.4 (±6.9)] were significantly higher than those from non-supplement individuals [11.9 (±5.5)], corroborating the data from the present research. Importantly, although supplementation is useful to increase serum levels, it is necessary to review the patients' adhesion to the treatment and the therapeutic protocol, since even supplemented individuals may present insufficient and/or deficient levels.

Physical exercises were considered significant in the present study, but other works did not evaluate this variable. Therefore, more evidence is required to confirm this fact, since the higher exposure to sunlight by people who perform physical activities could increase vitamin D levels.

The main weakness of the study is that the questionnaire was answered by the patients themselves and their caregivers, which can lead to a memory bias. Moreover, the comorbidities presented by each patient were not evaluated; although these conditions could interfere with the obtained results, their analysis might introduce confounding factors.

Conclusion

The prevalence of 25(OH)D deficiency and insufficiency were 72.5 and 25%, respectively; only 2.5% of the patients presented sufficient levels. Patients who performed physical exercises and vitamin D supplementation had higher 25(OH) D levels.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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