

Hypovitaminosis D in an hospitalized old population of Western Friuli

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SUMMARY

Objectives: Hypovitaminosis D is very common in the elderly in Italy and generally in the world, contributing to bone fractures and muscle weakness. The aim of the study was to evaluate bone metabolism in an old population of patients hospitalized not for musculo-skeletal complaints.

Methods: The clinical records of 175 patients, 98 female and 77 male, aged >65 years, hospitalized in a Department of Internal Medicine (Sacile, Western Friuli) were retrospectively reviewed. Serum levels of calcium, phosphorus, alkaline phosphatase, parathyroid hormone (PTH) and 25-OH vitamin D were evaluated. Correlations between these parameters were investigated.

Results: Abnormalities of bone metabolism parameters were frequently founded, particularly hypocalcemia, increased PTH and reduced 25-OH vitamin D. Hypovitaminosis D were detected in 88% of patients, low levels in 30.28% and very low levels in 57.72%. Hypovitaminosis D was related to female sex, old age of patients and high levels of PTH.

Conclusions: Our data confirm that hypovitaminosis D is very common in elderly population. The study has been performed in an Italian Region where the supplementation of vitamin D in the elderly is not performed, suggesting that a awareness campaign of the doctors could be very useful to prevent bone metabolism abnormalities.

Key words: Bone metabolism, hospitalized old patients, hypovitaminosis D.

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■ INTRODUCTION

The improvement of living conditions and the increasing availability of medical care in the industrialized countries determined an increase of average population age. Accordingly, the increasing number of elderly people discloses new complex issues dealing with social order and medical care. The compromised autonomy of the elderly, resulting from accidental drops and subsequent hip fracture, is of special interest, being complex and expensive. This particular issue causes significant mortality (estimated 5% in the acute phase and 15-25% within a year) and disability (only 30-40% of patients regain autonomy compatible with the previous activities of daily living) (1, 4). The factors that are cause of balance disorders and motor instability in the elderly are multiple and only partially controllable.

The aetiology of hip fractures is associated to the following factors:

- a) *drops*: only 10% of hip fracture is spontaneous and precedes the fall. The drops are due to neurologic, visual, cardiovascular and muscular disorders. Further medications, environmental factors and institutionalization must account for part of the drops in the elderly (5, 7);
- b) *reduction of bone mass*: subjects who had a hip fracture often have a severe osteoporosis (8);
- c) *history of hip fracture*: it is the most serious risk of new fracture, but the connections with this risk factor still have to be fully clarified (9).

Hypovitaminosis D exerts a strong influence on these factors and contributes to the pathogenesis of osteoporosis and fractures (10), but also it is the cause of sarcopenia which predisposes to the drops (11, 12).

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The administration of vitamin D improves bone strength and muscle trophism.

Usually, 90% of vitamin D requirement is guaranteed by skin exposure to the sunlight, while food supplementation provides the remaining 10% (13, 14). At present vitamin D insufficiency is commonly due to the city life, little use of animal fats in the diet and use of beauty products with sunscreen.

Hypovitaminosis D is actually very common in the Italian (15, 17) and world population (18, 22).

In the elderly, the low exposure to sunlight, especially due to living in nursing homes, and the low intake of vitamin D through food are the main causes of hypovitaminosis D. A primary prevention of bone fragility diseases in old population is possible providing adequate vitamin D supplementation, as the availability of convenient pharmaceutical formulations and their low risk of toxicity, in addition to oral supplements of calcium (23, 26). In Some regions of Italy, such as Veneto and Tuscany, detection and treatment of hypovitaminosis D have already been encouraged, through the promotion of bolus administration of vitamin D at the same time of of the influenza vaccination or during the hospitalization following hip fracture (27, 28). The clinical practice in Friuli-Venezia Giulia widely disregards the promotion of calcium and vitamin D supplementation through the diet, and no extensive attempt of information has been done. This study aims to analyze bone metabolism, with particular regard to the levels of vitamin D, in a large series of geriatric patients in the Department of Internal Medicine in the Sacile Hospital, located in Western Friuli on the border with Veneto.

■ PATIENTS AND METHODS

Patients

The clinical records of the geriatric patients, hospitalized in the Department of Internal Medicine of Sacile Hospital between October 2009 and July 2011, were retrospectively reviewed. Among 375

patients aged >65 years we selected 175 patients. We considered only those that had not been admitted to the hospital because of musculo-skeletal complaints and that had not been previously treated with supplements of vitamin D and/or medications for osteoporosis (bisphosphonates, ranelate strontium or analogs of PTH). The most frequent causes of hospitalization were: respiratory infections, heart failure, stroke, dehydration, dementia, anemia and alcoholic liver disease.

The study included 98 women (56%) and 77 men (44%), aged between 65 and 100 years (82.82 ± 7.27). The mean age was 83.2 years for women and 82.4 years for men. Eighty-five patients (48.5%) were normal weight, 40 (22.9%) underweight and 50 (28.6%) overweight.

Clinical parameteres

We evaluated the following laboratory values related to bone metabolism: serum calcium, phosphorus, alkaline phosphatase (ALP), 25-OH-vitamin D (25-OH-D) and intact parathormone (PTH); for each parameter we considered the normal range provided by the laboratory of Sacile Hospital.

We separated the serum levels of 25-OH-D into three discrete categories: normal values, low and very low in accordance with European validated thresholds (29, 30):

- *normal values*: between 30 and 75 ng/ml, vitamin D concentration that does not stimulate parathyroid and ensures an optimal intestine calcium absorption;
- *low values*: between 29 and 15 ng/ml, levels that induce calcium malabsorption, secondary hyperparathyroidism, high bone turnover, osteoporosis and increased risk of bone fractures;
- *very low values*: <15 ng/ml, levels that are associated with osteomalacia and sarcopenia.

Statistical analysis

The Spearman test was used to correlate serum levels of 25-OH-D with patients age and other parameters of bone metabolism. The Pearson's chi-square test was used to correlate normal, low and very low levels of

25-OH-D to bone metabolism parameters and classes of body weight (underweight, normal weight and overweight). We used linear correlation (with logarithmic transformation of data) and Pearson test to process the values of 25-OH-D and PTH. We considered significant p values <0.05.

■ RESULTS

Normal values of bone metabolism parameters in our laboratory are reported in Table I. Serum calcium, corrected for the values of serum albumin, and 25-OH-D levels were low respectively in 34.28% and in

55.43% of patients, PTH was increased in 57.71% of patients.

The statistical analysis of serum levels of 25-OH-D showed a significant inverse correlation with patient age (p<0.0001) and serum levels of PTH (p<0.0001), and a direct correlation with serum calcium values (p<0.01).

The 88% of patients had values below the normal range: according to the international validated thresholds 57.72% had low 25-OH-D and 30.28% had very low 25-OH-D. Only 12% of patients had normal values of 25-OH-D, >30 ng/ml (Tab. II). The vitamin D deficiency was more common in female than in male patients. There were no signif-

Table I - Parameters of bone metabolism in 175 elderly patients.

	Calcium (8.5-10.5 mg/dl)	Phosphorus (2.5-4.5 mg/dl)	ALP (50-136 U/l)	PTH (12-72 pg/ml)
Lower than normal	34.28%	8.57%	8.00%	1.14%
Normal	64.00%	85.14%	78.29%	41.15%
Above normal	1.72%	6.29%	13.71%	57.71%

Table II - Low and very low levels of 25-OH-vitamin D in 175 elderly patients.

	Very low (<15 ng/ml)	Low (15-30 ng/ml)	Normal (>30 ng/ml)
Men	n. 40 (22.86%)	n. 26 (14.85%)	n. 11 (6.28%)
Women	n. 61 (34.86%)	n. 27 (15.43%)	n. 10 (5.72%)
Total	n. 101 (57.72%)	n. 53 (30.28%)	n. 21 (12.00%)

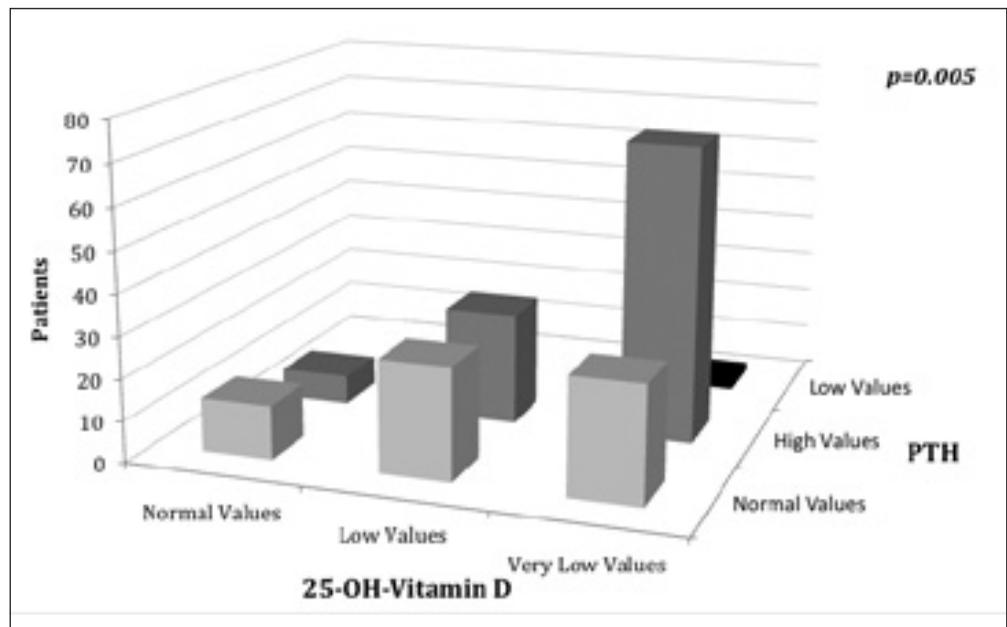


Figure 1 - Correlation between serum levels of vitamin D and PTH.

icant correlations with the classes of body weight. The correlation between low levels of 25-OH-D and high serum PTH was significant ($p < 0.005$, figure 1 and 2).

■ DISCUSSION

Our study shows significant abnormalities of bone metabolism in an elderly population admitted to a Department of Internal Medicine not because of disorders musculoskeletal complaints.

Only 41.15% of patients had normal serum PTH levels, and 64% had normal serum calcium, according to our laboratory. The most significant changes concerned vitamin D: it was found to be low in 30.28% of patients and very low in 57.72%, according to the validated thresholds of the international literature.

Notably, the average age of our patients was quite old. There were no substantial differences between the data, in relation to the season of the year in which they were hospitalized. Moreover, many of the patients were already living in nursing homes before admission to the hospital.

The statistical analysis showed a significant direct correlation between levels of vitamin D and serum calcium values and inversely with serum PTH. Low vitamin D and calcium concentration with high PTH levels are suggestive of osteomalacia.

The results of our study are consistent with the data of the scientific literature. The percentage of patients with low vitamin D (88%) is similar to other trials, although the reported incidence is highly variable in the epidemiologic studies. The reasons of this variability could be the different ranges of normal values taken in account, and the biases underlying the selection of patients such as sex-restricted populations.

With respect to Italian studies conducted on hospitalized patients, hypovitaminosis D was found in 89% of residents in a Cosenza hospital (31), in 82.3% and 71.4% in two groups of patients hospitalized in Rome (32).

In our study females were mainly affected

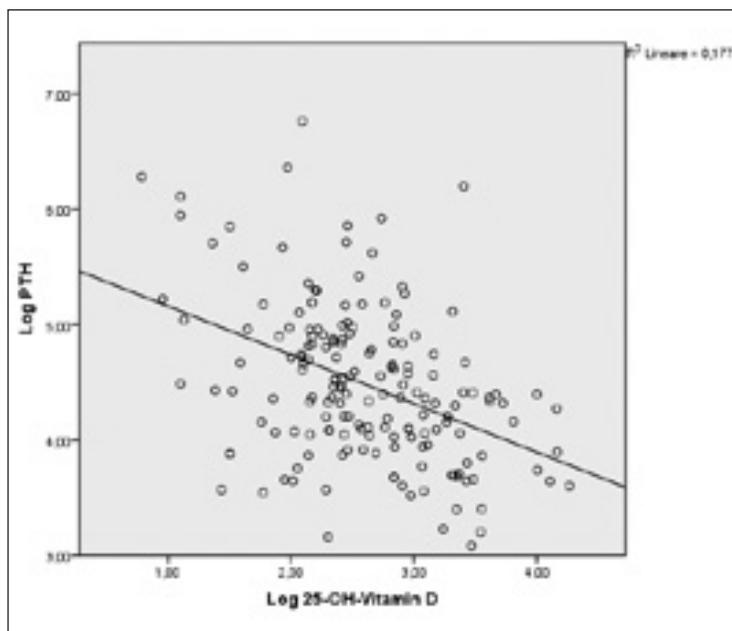


Figure 2 - Linear correlation between serum levels of vitamin D and PTH, with logarithmic transformation of data.

by bone metabolism alterations: the rate of women with hypovitaminosis D appeared higher than men. Likewise, a study conducted on 700 Italian women aged >60 years showed a reduction of vitamin D in 76% of cases (15).

Hypovitaminosis D is usually related to obesity (33) and in our study the patients with lower levels of vitamin D were predominantly overweight (we could not perform the correlation with BMI, because height was not available in many patients). The evidence that low levels of vitamin D are inversely correlated with age of the patients, supports the fact that the abnormalities of bone metabolism are more frequent in older patients: hypovitaminosis D was detected in 95% of 104 centenarian subjects, living both in private houses and in nursing homes in the area of Parma and Mantua (34).

Vitamin D deficiency is endemic among the elderly, as it is still frequently found, and therefore far from being exceeded. Poor exposure to sunlight in winter and inadequate intake of foods rich in Vitamin D (fish, fish oil, eggs, green vegetables, etc.) are considered the main causes for hypo-

vitaminosis. Other factors may contribute: low concentration of vitamin D precursors in the senile skin, low intestinal absorption and impaired activity of enzymes, especially renal 1α -hydroxylase, responsible of the endogenous activation of vitamin D.

In view of the results of our study, vitamin D supplementation in the elderly is far from satisfactory in Friuli-Venezia Giulia, despite the examples of neighboring regions of Northern Italy, such as Veneto, where awareness campaigns have already been implemented.

Given that the deficiency of vitamin D is closely related to osteoporosis and bone fragility fractures, the importance of the socio-economic problem arises. Although this issue is often disregarded by physicians, in Italy the number of bone fragility fractures, especially hip fractures, is increasing. In 2002, fractures in women (in 80% of cases over 70 years) were 66,912, and 19,807 in men.

In 2002 the estimated cost for medical care of over 65 patients with fractures was more than one billion euros in Italy (35). The administration of 700-800 IU/day of vitamin D to elderly subjects proved to decrease the risk of hip fractures by 26% and the risk of any non-vertebral fracture by 23% (26). Thus, this unexpensive intervention could reduce social costs with low financial commitment.

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