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Screening of serum 25-hydroxyvitamin D levels among elderly Egyptians admitted to the orthogeriatric unit by fracture hip

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Abstract

Background: Vitamin D deficiency increases muscle weakness and pain leading to reduced power and function, increased bone turnover and increased risk of falls and hip fractures in elderly. We postulated that vitamin D deficiency in sunny Egypt should be lower than western countries so we screen for prevalence of vitamin D deficiency among all elderly patient admitted to orthogeriatric unit by fracture hip.

Results: Our study showed that vitamin D deficiency is common in elderly Egyptian patients admitted to orthogeriatric unit with hip fractures.

Of the study group (n 290 patients) vitamin D levels were sufficient (30 ng/dl or more) in 24 patients (8.3%) and insufficient (between 20 ng and 30 ng) in 125 patients (43.1%) and deficient (less than 20) in 141 patients (48.7%). Among the study group, female patients had lower levels of vitamin D (18.8 ± 6.9) compared to males (20.5 ± 6.7) P value 0.034.

Although our study failed to link different levels of vitamin D with activity of daily life: P value was (0.116) in bathing, (0.058) in dressing, (0.115) in toileting and (0.054) in transfer.

A little difference was found in feeding (0.036) and previous fall (0.011) and cognitive impairment; MiniCOG < 3 P value 0.017. Both previous falls and cognitive decline are in turn linked to increased fracture risk

Conclusion: Hypovitaminosis D is common among older patients with hip fractures even in sunny Egypt remaining slightly lower than its prevalence in western countries. Although no direct significant correlations with activity of daily life, vitamin D deficiency was associated with higher risks of previous falls and cognitive impairment both in turn increases the risk of fractures.

Background

Nearly a billion suffer vitamin D deficiency or insufficiency worldwide, being more prevalent among elderly [1].

Vitamin D deficiency increases muscle weakness and pain leading to reduced muscle power and function [2], increased bone demineralization [3], and higher risk of falls and hip fractures in elderly [4].

With aging, vitamin D deficiency increases because of inadequate sunlight exposure and lower cutaneous formation of vitamin D, lower dietary intake of vitamin D,

defective intestinal absorption, and Impaired 1 and 25 hydroxylation [1].

In western countries vitamin D deficiency is more common in elderly patients due to impaired cutaneous synthesis during winter months [5, 6] both in house-bound [7] and in medical inpatients [8].

Prevalence of vitamin D deficiency is even higher in elderly patients with fragility fractures reaching about 55 to 91.6% [9, 10].

Many observational studies fail to find a dependent relationship between vitamin D levels and frailty, while only few interventional studies yielding a positive effect

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Table 1 Descriptive data of the study group

	N	%
Bathing		
Dependent	219	75.50
Independent	71	24.50
Dressing		
Dependent	236	81.40
Independent	54	18.60
Toilet		
Dependent	242	83.40
Independent	48	16.60
Transfer		
Dependent	229	79.00
Independent	61	21.00
Feeding		
Dependent	240	82.80
Independent	50	17.20
Continance		
Incontinent	67	23.10
Continent	223	76.90
Falls		
No	214	73.80
Yes	76	26.20
MiniCOG		
> 3	210	72.40
3 or less	80	27.60

of vitamin D supplements on frailty, mainly due to improvement in the physical performance parameters [11].

Egypt is described as the land of the sun with a desert and semi desert climate and the sun shines throughout the year (<https://www.wildland.com/details-egypt-seasons&climate>). So, we postulated that vitamin D deficiency in Egypt should be lower than in the countries with seasonal winters.

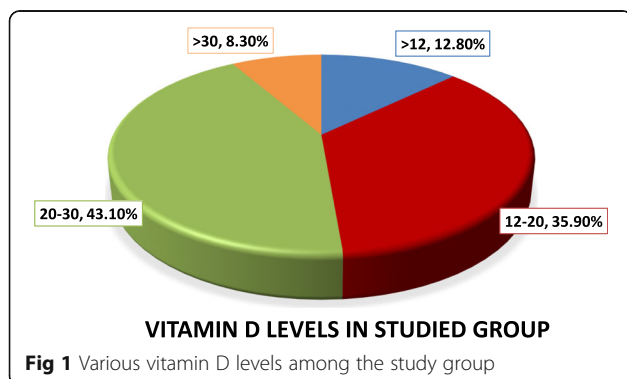


Table 2 25 hydroxy vitamin D levels in both sexes

	25 hydroxy vitamin D		P value
	Mean ± SD	Median (IQR)	
Female	18.8 ± 6.9	17.5 (13.7:22.8)	0.034
Male	20.5 ± 6.7	21 (14.9:24)	

Methods

We enrolled a prospective observational study over 290 patients aged older than 60 years admitted to orthogeriatric unit (OGU) with hip fractures between November 2017 and June 2019.

Admission of male patients to OGU started at October 2017 with four beds. While to the female OGU (four beds) started 4 months later.

After ethical approval by local ethical committee of internal medicine department faculty of medicine at 25 October 2017, written informed consents were obtained from all participants.

All patients are subjected to: geriatric functional assessment [12] including age, sex, and history of previous falls (Y or N) and the pre-fracture state including: premorbid mobility, mini Cog (score 3 or less), activity of daily life (ADLs); bathing, dressing, toileting, transfer, feeding, and grooming (described as dependant or independent).

Mini-Cog: an easy test for cognitive functional assessment consists of two parts: three item recall and clock draw test (CDT) and is superior to mini mental state examination in identifying mild cognitive impairment irrespective the age or educational level [13].

CDT: serves as the recall distracter where patients are asked to draw the hands of the clock to make a specific time in a clock face.

CDT in a cross sectional study over geriatric patients from outpatient clinics with heterogeneous educational levels showed high sensitivity and specificity even in people with lower education [14].

Laboratory assessment of Ca, phosphorus, Albumen, TSH, FreeT4, Urea and Creatinine, 25 (OH) vitamin D level. Using Holick classification [2] vitamin D deficiency is considered with vitamin D level < 20 ng/mL, insufficiency with vitamin D level 21 to 29 ng/mL, and normal vitamin D levels are defined as 30 ng/mL or more.

The 25-hydroxyvitamin D3 was measured using the Roche Elecsys vitamin-D3 assay (Roche Mannheim, Germany) in the hospital’s laboratory.

We excluded patients with impaired renal functions, abnormal thyroid function, and other fractures.

Study’s outcomes

The primary outcome is to screen for prevalence of vitamin D deficiency among all elderly patient admitted to OGU by fracture hip The secondary outcomes included

the correlation of vitamin D levels to other functional geriatric assessment parameters.

The statistical analysis

Statistical analysis was performed with SPSS statistical software, version 21. Continuous data were described as mean ± standard deviation (SD).

- Description of qualitative variables as number and percent
- Mann-Whitney test was used instead of independent t-test to compare quantitative variables between two groups in non-parametric data (SD > 30% mean).
- Kruskal-Wallis test was used instead of one-way ANOVA to compare quantitative variables between more than two groups in non-parametric data and pair wise comparison used in case of significant variables
- Chi-square test used to compare between qualitative variables and exact correction when cell contain count less than 5
- Pearson correlation used to test for linear relation between vitamin D and other quantitative variables $P \leq 0.05$ significant while $P < 0.01$ highly significant.

Results

We screened 290 patients > 60 years with the mean age 67 ± 6.7 years admitted over 20 months to orthogeriatric unit of them 158 were males (54.5%) and 132 were females (45.5%).

Of the study group 193 (66.6%) patients were smokers and 97 (33.4%) were non-smokers.

One year before the fracture 229 (79%) patients were ambulant and 61 (21%) were using walking aids.

Demographic data are shown in Table 1

Vitamin D levels were sufficient (30 ng/dl or more) in 24 patients (8.3%) and insufficient (between 20 ng and 30 ng) in 125 patients (43.1%) and deficient (less than 20) in 141 patients (48.7%) among the study group (Fig. 1)

Vitamin D levels were significant lower among female patients (18.8 ± 6.9) compared to male patients (20.5 ± 6.7) P value (0.034) (Table 2).

Also we noticed that vitamin D levels were positively correlated to calcium and phosphorus (Table 3).

Although our study failed to link different levels of vitamin D with activity of daily life: P value was (0.116) in bathing, (0.058) in dressing, (0.115) in toileting, and (0.054) in transfer. A little difference was found in feeding (0.036) and previous fall (0.011) and

Table 3 Descriptive of all quantitative variables

Age	< 12	12–20	20–30	> 30	P value
Mean ± SD	65 ± 4	65 ± 3.7	64.7 ± 3.6	64.7 ± 3	0.862
Median (IQR)	64 (62:66)	65 (62:67)	64 (62:67)	64.5 (62.5:66.5)	
CA					
Mean ± SD	7.7 ± 0.6	8.4 ± 0.4	8.7 ± 0.3	8.9 ± 0.3	< 0.001
Median (IQR)	7.9 (7.2:8.23)	8.4 (8.3:8.6)	8.7 (8.4:9.03)	8.8 (8.6:9.1)	
PHOSP					
Mean ± SD	2.5 ± 0.7	2.7 ± 0.5	3.8 ± 0.4	3.8 ± 0.4	< 0.001
Median (IQR)	2.8 (1.8:2.97)	2.9 (2.2:3.13)	3.9 (3.6:4.1)	3.9 (3.5:4.11)	
Albumin					
Mean ± SD	3.8 ± 0.4	3.7 ± 0.4	3.7 ± 0.5	3.7 ± 0.4	0.996
Median (IQR)	3.9 (3.6:3.99)	3.9 (3.5:4)	3.9 (3.5:4)	3.9 (3.8:4)	
Creatinine					
Mean ± SD	1.1 ± 0.1	1 ± 0.2	1 ± 0.1	1 ± 0.1	0.051
Median (IQR)	1.1 (1.1:1.16)	1.1 (1:1.15)	1 (0.9:1.1)	1.1 (0.9:1.13)	
TSH					
Mean ± SD	2.5 ± 1	3.3 ± 0.9	2.8 ± 1	1.9 ± 0.4	0.062
Median (IQR)	2.2 (1.8:3.4)	3.8 (2.8:3.99)	2.9 (1.8:3.88)	1.9 (1.7:2.15)	
FT4					
Mean ± SD	1.1 ± 0.2	1 ± 0.2	1.1 ± 0.2	1 ± 0.2	0.061
Median (IQR)	1.1 (1.1:1.2)	1 (0.9:1.09)	1.1 (1:1.2)	0.9 (0.8:1.2)	

Regarding age no statistically significant difference

Regarding Ca and phosphorus. There was statistically significant increase in Ca and phosphorus levels with higher vitamin D level

Regarding creatinine, TSH, and free T4. There was no statistically significant difference

Table 4 Correlations between 25 hydroxy vitamin D levels and comprehensive geriatric assessment

ADLs	25 hydroxy vitamin D levels				P value
	> 12	12–20	20–30	> 30	
Premorbid mobility	N (%)	N (%)	N (%)	N(%)	
Aid	17 (15)	47 (41.6)	43 (38.1)	6 (5.3)	0.138
Ambulatory	20 (11.3)	57 (32.2)	82 (46.3)	18 (10.2)	
Bathing					
Dependent	24 (11)	77 (35.2)	102 (46.6)	16 (7.3)	0.116
Independent	13 (18.3)	27 (38)	23 (32.4)	8 (11.3)	
Dressing					
Dependent	25 (10.6)	83 (35.2)	106 (44.9)	22 (9.3)	0.058
Independent	12 (22.2)	21 (38.9)	19 (35.2)	2 (3.7)	
Toilet					
Dependent	27 (11.2)	84 (34.7)	109 (45)	22 (9.1)	0.115
Independent	10 (20.8)	20 (41.7)	16 (33.3)	2 (4.2)	
Transfer					
Dependent	25 (10.9)	82 (35.8)	106 (46.3)	16 (7)	0.054
Independent	12 (19.7)	22 (36.1)	19 (31.1)	8 (13.1)	
Feeding					
Dependent	25 (10.4)	85 (35.4)	108 (45)	22 (9.2)	0.036
Independent	12 (24)	19 (38)	17 (34)	2 (4)	
Continent	N (%)	N (%)	N (%)	N (%)	
Incontinent	13 (19.4)	27 (40.3)	22 (32.8)	5 (7.5)	0.127
Continent	24 (10.8)	77 (34.5)	103 (46.2)	19 (8.5)	
Falls					
No	21 (9.8)	76 (35.5)	102 (47.7)	15 (7)	0.011
Yes	16 (21.1)	28 (36.8)	23 (30.3)	9 (11.8)	
MiniCOG					
> 3	22 (10.5)	70 (33.3)	102 (48.6)	16 (7.6)	0.017
3 or less	15 (18.8)	34 (42.5)	23 (28.8)	8 (10)	

cognitive impairment; MiniCOG < 3 *P* value (0.017) (Table 4).

Discussion

In this study we found that vitamin D deficiency is common in older patients presenting with hip fractures even in sunny Egypt. Of 290 elderly patients with hip fracture, vitamin D levels were sufficient in only 24 patients (8.3%) and insufficient in 125 patients (43.1%) and deficient in 141 patients (48.7%).

These percentages are slightly lower than the prevalence in western countries (55 to 91.6%) [15]. Where some middle east studies have shown a high prevalence of vitamin D deficiency (49.4–100%) in the middle east despite sunny climate, conservative clothing style has been identified as a risk factor [16, 17].

Also in the present study lower levels of vitamin D in female patients with hip fracture mirrors the image at western countries [4].

Lower levels of vitamin D are associated with more frequent falls which is consistent to Women Health Initiative (WHI) study that demonstrated that with fall of vitamin D deficiency odds ratio for hip fracture nearly doubles [4].

Our study showed that lower levels of vitamin D are associated with more decline in cognitive function as agreed by several studies which have linked vitamin D deficiency and basic and executive cognitive functions [18].

Although our study failed to link different levels of vitamin D with activity of daily life: *P* value was (0.116) in bathing, (0.058) in dressing, (0.115) in toileting, and (0.54) in transfer. A little difference was found in feeding (0.036) and previous fall (0.011) and cognitive

impairment; MiniCOG < 3 *P* value 0.017. Both previous fall and cognitive decline are linked to increased fracture risk [18].

There are few studies in the elderly about the total 25 hydroxy vitamin D statuses and functional independence relationship [19–23]. Three of these studies have found a positive association between vitamin D level and ADL. Houston and colleagues [19], Nakamura and colleagues [20] revealed that vitamin D deficiency was a predictor of low ADL scores in community-dwelling adults of advanced age. Also, Kotlarczyk and colleagues showed that women in long-term care facilities, who had low levels of vitamin D, had the greatest functional decline [21].

On the other hand, two studies with no association between vitamin D and ADL was found, and Navarro-Martínez and colleagues did not find an association between the vitamin D level and ADLs in frail octogenarian women [22]. Also, Formiga and colleagues showed no association between vitamin D status and IADLs, but a positive relationship between vitamin D level and ADL score was found [23].

Several limitations of this study should be mentioned; first, we missed the living areas (rural versus urban). Second, the nutritional state was not assessed. Another limitation is missing the data about receiving vitamin D supplementation before admission. But many systematic reviews and meta-analysis of hip fracture risk in relation to vitamin D supplementation argue that neither higher nor lower doses vitamin D supplementations prevented hip fracture, although these reviews were mainly uncontrolled observational studies [24, 25].

Conclusion

Hypovitaminosis D is common among older patients with hip fractures even in sunny Egypt but remains slightly lower than its prevalence in western countries. Although not significantly linked to activity of daily life, it was associated with higher risks of previous falls and cognitive impairment both of them in turn increases the risk of fractures.

Abbreviations

ADLs: Daily life activities; IDLA: Instrumental daily life activity; MINI COG: Cognition; WHI: Women Health Initiative

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Authors' contributions

AR and MAS designed the study and wrote the final manuscript, SMS collected the data and SAZ analyzed the collected data. All authors have read and approved the manuscript.

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Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Written informed consents approved by local ethical committee of Internal Medicine Department, Faculty of Medicine, Cairo University, was obtained from all participants in 25 October 2017. No ethical approval number is applicable.

Consent for publication

All patients included in this research gave written informed consent to publish the data contained within the study.

Competing interests

None.

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