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EXPLORATIVE STUDY OF VITAMIN D DEFICIENCY IN ELDERLY PATIENTS AND ITS ASSOCIATION WITH HIP FRACTURE

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ABSTRACT **Introduction:** Vitamin D is the most important vitamin for bone health; Hip Fracture is the most severe fragility Fracture and is associated with a remarkable increase in mortality and morbidity. **Objective:** to assess the effect of vitamin d deficiency among elderly patients with hip fracture and without hip fractures. **Material and Methods:** This study was conducted during period of May 2017- May 2018 at our tertiary care centre. Male patient sixty year or more and postmenopausal women fifty year and above with or without fracture were selected as per following inclusion and exclusion criteria It is a prospective, analytical, case control study to measure assessments of vitamin D deficiency. We studied serum vit D level, BMD score and FRAX score in these patients. **Observation and Result:** In our study, among elderly patients who presented to us with hip fracture, 72% had vitamin D deficiency and 2% patients had vitamin D insufficiency while 26% of patients with hip fracture had sufficient levels of vitamin D. The values of vitamin D in respective group are: In control group, mean value of vitamin D level was 35.549 (SD ± 13.285) and the case group had mean value of 22.380 (SD±12.059).The data was statistically significant (p value 0.001). The mean value of BMD in control group: was 1.8278 (SD± 0.77778) and in case group was 2.7480(SD ± 0.72766). In our study we also included FRAX score and the mean value of FRAX score in control group is 5.6260 (SD±3.16362). In case group the, mean value was 7.8560 (SD ± 4.09146). **Conclusions:** Elderly patient who presented to us with hip fracture had a low concentration of vitamin D, BMD and high FRAX score as compared to the control group

KEYWORDS : Vitamin D, BMD, FRAX scores, elderly patients.

INTRODUCTION

Vitamin D is required for absorption of dietary calcium and for normal mineralization of bone. Reduction in the levels of vitamin D is associated with impaired calcium absorption and this leads to compensatory increase in parathyroid hormone (PTH) levels which in turn, stimulates resorption of bone and leads to bone loss.[1]

Serum 25-Hydroxy vitamin D ($25(OH)D_3$) is the best indicator of vitamin D status.[2]Therefore status of vitamin D deficiency is classified on the basis of serum 25 -hydroxy vitamin D_3 levels i.e.<20ng/ml. However, many Studies indicate that even a less severe deficiency, called vitamin D insufficiency (i.e. serum 25-hydroxy vitamin D_3 levels 20-30 ng/ml) can impair bone Health[3]

Hip Fracture is the most severe fragility Fracture and is associated with a remarkable increase in mortality[4], and morbidity[5]. Survivors of Hip Fracture are at high risk of permanent disability up to 25 % and simultaneously require nursing home care for longer durations, and only 40% of patientsfully regain their pre Fracture level of independence.Postmenopausal women have a higher incidence of Fracture than men due to deficiency of estrogen. Hip Fractures are considered to be of greater concern because these may result in disability and mortality hence lead to higher burden on family and Society expenditure"[6].The risk for Subsequent Fracture in women with a Hip fracture is 2.5 times higher than for those without a Hip fracture.

According to records from the NHI, the rate of mortality following hip fractures in the elderly within the 1st year is about 15 % for women which is almost equal to mortality rate of patients with Stage III &1V breast Cancer[7]Incurrent available literature there are only few studies on vitamin D status in elderly Indian population with hip fracture .Hence ,this study is planned and designed to assess the effect of vitamin D deficiency among elderly patients with hip fracture and without hip fracture.

MATERIALS AND METHODS

This study was conducted in the department of orthopedic surgery, L.L.R.M. Medical College, Meerut on elderly patients attending the outdoor clinics, casualty and orthopedics wards of associated SVBP hospital. Patients for the study were selected as per following inclusion and exclusion criteria.

Inclusion Criteria

1. Elderly males (more than 60yr) with or without fracture.
2. Postmenopausal women (more than 50yr)having amenorrhea for last 12 months with or without hip fractures .
3. Elderly patients/postmenopausal women not taking vitamin D supplementation for last one year.
4. Patients who were ready to give written informed consent.

Exclusion Criteria

1. Hip fracture secondary to tumors, periprosthetic fracture, and high energy trauma
2. Elderly patientswith Co-morbid condition like renal insufficiency, malabsorption, gastrectomy, active liver disease, acute myocardial infarction, alcoholism, and anorexia nervosa.
3. Elderly patients , on medications which could affect bone condition e.g. Glucocorticoids, androgens, anabolic steroids, anticonvulsant, calcitonin, Sodium Fluoride, Bisphosphonates and pharmacological doses of vitamin D (>800 IU).
4. Elderly patientswith underlying Hip diseases other than osteoarthritis.
5. Elderly patientswith dementia / unable to give consent.
6. Elderly patients who suffered cancer within 5 years
7. Infections
8. More than one fractures or polytrauma patient.
9. Elderly patients receiving estrogen replacement therapy.

Study Design

It is a prospective, analytical, case control study which is time bound and Hospital based.

The study is allocated into 2 groups
Group A – Case Group
Group B – Control Group.

In this case control study, elderly patients with hip fracture (group A) were compared with those without hip fracture (group B)

This study was conducted during period of May 2017- May 2018 and ethical clearance was taken by institutional ethical committee with letter no 721/2018 dated 1/2/2018.

Procedure

Questionnaire and Interview:
All participants were questioned and examined.

Group A was questioned and examined during admission while group B was questioned and examined at the outpatient clinic and during admission. All the interviews wereconcluded in person.

We ascertained the level of education, weight and height of patient, age when menopause was attained, whether the patient have had undergone bilateral oophorectomy before the age of 45 years, previous history of hip fracture, any significant fracture history, current or previous estrogen therapy within the past year. Smoking habits, alcohol intake history, history of caffeine intake and calcium supplements. History of Sun exposure for >30 min/day and weight bearing exercise thrice or more per week.

We also inquired about hyperthyroidism, diabetes mellitus, chronic diseases including renal disease, coronary heart disease, cancer, rheumatoid arthritis, epilepsy etc.

Furthermore participants were asked about their current medication including hormone therapy, steroid, osteoporosis medication, diuretics (including thiazide) etc.

Examination
It included vitamin D estimation.

Methods
1. Vitamin D Estimation
The fasting venous samples were taken and analyzed for 25[OH] D_3, the most reliable marker.

Vitamin D levels were defined using Holick's Classification

Vitamin D level	Interference
<20ng/ml	Vitamin D deficiency
21 to 29 ng/ml	Vitamin D insufficiency
>30ng/ml	normal vitamin D

Statistical Analysis
Continuous variables were taken in mean± standard deviation / median while categorical variable in frequency (%). To test the association / difference in proportions between the variables, Chi-square test / man-whitney u test was used. To compare the means between two groups or more than two groups, Independent samples t-testwas used as appropriate. P value <0.05 was considered as statistically significant. Statistical package for social sciences, version -23 (SPSS-23, IBM, Chicago, USA) was used for statistical analysis.

OBSERVATION AND RESULTS
In our study 100 patients were taken. Patients with history of trivial trauma leading to fracture were included as case group, and other 50 patients with same age and sex variable were included in control group.

In our study, we have distributed the patients according to their gender in case and control groups (Table 1). In case group, out of 50 patientsthe male patients were 29 i.e. 58% and female patients were, 21 i.e. 42%. Simultaneously In control group out of 50 patients 22 were male i.e. 44% and 28 were female 56%. The distribution of patients according to their gender in case and control group was statistically satisfactory with chi-square value of 1.961 and p value of 0.161, which denotes no significant difference.

Table 1: Distribution Of Subjects According To Gender In Case And Control Group

Group		Frequency	Percent
Case	Male	29	58.0
	Female	21	42.0
	Total	50	100.0
Control	Male	22	44.0
	Female	28	56.0
	Total	50	100.0

Chi-square = 1.961, p-value=0.161$^{\#}$ ($^{\#}$ denotes no significant difference)

In this study we also distributed our patients according to their age in case and control groups (Figure 1). Case group comprised of 15 patients in the age group of 50 to 60 years, 16 patients under age group of 61 to 70 years, 10 patients in 71 to 80 years and 9 patients of age 81 years or more. Similarly control group had 18 patient in 50-60 yrs age group, 22 patients in age group of 61 to 70 years, 7 patients in age group of 71 to 80 years and 3 patients of age 80 years or more. Comparison was made between case and control groups according to their ages which was established by chi-square test. The value of chi square test is 2.311 and p value 0.510 which denotes no significant difference.

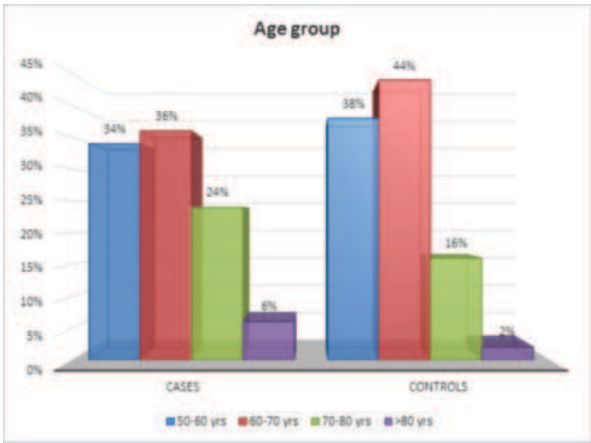

Figure 1: Distribution Of Subjects According To Age In Case And Control Group

In our study of 100 patients, the value of vitamin D in control group i.e. mean value was 35.549 with standard deviation of 13.285, Standard error mean of 1.878. The mean value of vitamin D in case group was 22.380 with standard deviation of 12.059, standard error value of 1.705. The value of BMD in control group was 1.8278 with standard deviation 0.77778, standard error value of 0.10999. In case group the value of BMD i.e. mean value was 2.7480 with standard deviation of 0.72766, standard error mean of 0.10291. In our study we also included FRAX score and the value of FRAX score (mean value) in control group was 5.6260, the standard deviation value was 3.16362, standard error value was 0.44740. In case group, the FRAX score (mean value) was 7.8560 with standard deviation value of 4.09146 and standard error mean value of 0.57862.(Table2)

Table 2: T Test ; Value Of Substrate According To Case And Control Group

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
VIT-D	Control Group	50	35.5494	13.28524	1.87882
	Case Group	50	22.3800	12.05985	1.70552
BMD	Control Group	50	1.8278	.77778	.10999
	Case Group	50	2.7480	.72766	.10291
FRAX SCORE	Control Group	50	5.6260	3.16362	.44740
	Case Group	50	7.8560	4.09146	.57862

Independent Sample Test
To compare the two group statistics we used independent sample t-test and the value for vitamin D, (test statistics) was 0.793 and sig (p-value) for test statistics was 0.375 and the t-test for equality of means value of t (computed test statistics) was 5.190 with 98 (degree of freedom). The sig (2-tailed) i.e. p value of 0.001 with mean difference values of 2.53747 at the 95% CI the lower value of 8.13387 and the upper value was 18.20493(Table 3).

Table 3: Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
VIT-D	0.793	0.375	5.190	98	0.001	13.16940	2.53747	8.13387	18.20493
BMD	1.019	0.315	-6.109	98	0.001	-0.92020	0.15063	-1.21912	-0.62128

FRAX Score	1.070	0.303	-3.049	98	0.003	-2.23000	0.73142	-3.68147	-0.77853

In our study of 100 patients, we also compared the values of vitamin D on the basis of their Gender i.e. (males & Female) between the control group and case group.

22 male patients were present in control group and 29 male patients were in case group and the value of vitamin D in control group was mean 41.2123 with standard deviation of 14.37296 with standard error mean of 3.06433 as compared to case group i.e. mean value of 22.9793 with standard deviation of 11.66433 and standard error mean of2.16601. Out of 100 patients, 49 patients were females (28 in control group and 21 in case group). The value of vitamin D in control group was mean value of 31.1000 with standard deviation value of 10.62900 with standard error value of 2.00869 as compared to case group i.e. mean value was 21.5524 with standard deviation value of 12.82999 with standard error mean of 2.79973 (table 4).

Table 4: Distribution Of Substrate According To Groups

Group Statistics						
Sex		Group	N	Mean	Std. Deviation	Std. Error Mean
Male	VIT-D	Control Group	22	41.2123	14.37296	3.06433
		Case Group	29	22.9793	11.66433	2.16601
	BMD	Control Group	22	1.7686	.71353	.15213
		Case Group	29	2.5862	.65122	.12093
	FRAX SCORE	Control Group	22	4.5182	1.97837	.42179
		Case Group	29	7.5345	3.34272	.62073
Female	VIT-D	Control Group	28	31.1000	10.62900	2.00869
		Case Group	21	21.5524	12.82999	2.79973
	BMD	Control Group	28	1.8743	.83473	.15775
		Case Group	21	2.9714	.78303	.17087
	FRAX SCORE	Control Group	28	6.4964	3.65153	.69007
		Case Group	21	8.3000	5.00130	1.09137

On application of independent sample tests, the values for male group on levene's test for equality of variances i.e. for vitamin D the F value was 1.219 and sig (p-value) was 0.275, Ont-test for equality of means the value was for vitamin D i.e. t-value of 5.001 with 49 degree of freedom sig (2-tailed), p-value was 0.001 with mean difference of 18.23296 with standard error difference of 3.64584 and 95% CI the lower value of 10.90638 and for upper value was 25.55954.

On applying t-test for equality of means the vitamin D value is t-2.847 at degree of freedom 47 the sig (2- failed) value is 0.007 with mean difference was 9.54762 with standard error of 3.35344 with 95 CI the lower value was 2.80136 and upper value was 16.29388 (Table 5).

Table 5: Independent Samples Test

Sex		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Male	VIT-D	1.219	0.275	5.001	49	0.001	18.23296	3.64584	10.90638	25.55954
	BMD	0.649	0.425	-4.261	49	0.001	-0.81757	0.19187	-1.20315	-.43199
	FRAX Score	0.886	0.351	-3.757	49	0.001	-3.01630	0.80280	-4.62959	-1.40301
Female	VIT-D	0.553	0.461	2.847	47	0.007	9.54762	3.35344	2.80136	16.29388
	BMD	0.523	0.473	-4.674	47	0.001	-1.09714	0.23473	-1.56936	-.62492
	FRAX Score	1.473	0.231	-1.460	47	0.151	-1.80357	1.23503	-4.28813	.68099

DISCUSSION

The present study was conducted on 100 patients for the assessment of the effect of vitamin D deficiency among elderly patients with hip fracture and without hip fracture. Case group comprised of patients with hip fracture and control group had patient without hip fracture.

In our study the mean value of vitamin D in control group was 35.549 with standard deviation of 13.285 with standard error of mean of 1.878, and the mean value of vitamin D in case group was 22.380 with standard deviation of 12.059, standard error value of 1.705.The p-value was 0.001 which meant that the data was statistically significant. This showed that vitamin D deficiency is common in elderly patients presenting with hip fracture, as compared to control group. Among elderly patients with hip fracture,72% had vitamin D deficiency and 2% patients had vitamin D insufficiency while 26% of patients with hip fracture had sufficient levels of vitamin D. In control group vitamin D deficiency was seen in 10% of patients while 34% of patients had vitamin D insufficiency and 56% of patient had a normal level of vitamin D.

Our results were similar to the studies conducted by LanmeiLic, ShuaiHeaawang et al[8] on serum levels of 25-hydroxy vitamin D and functional outcome among postmenopausal women with hip fracture. Where they observed that the level of vitamin D is less in post menopausal women with hip fracture.A study conducted by Dhanwal DK et al[9] showed that 76.7% of patients had vitamin D Deficiency, while 32.3% patients of control group had vitamin D deficiency.Similar study was conducted by IsaiaG, Giorgino R et al[10] in which 76% of patients had a lower levels of vitamin D. Likewise study conducted by Nuti R et al[11] showed only 21.6% of patient with hip fracture had associated vitamin D deficiency. Bakhtiyarova et al[12] also observed the lower levels of vitamin D concentration in individuals with fracture in comparison with control groups. In our study we took less than 20 microgram/L to be vitamin D deficiency as based on Holick's Classification.

In our study the reason for vitamin D deficiency was mainly lower level of education, poor dietary habits and housebound state of patient.HO et al[13] in their study on educational level and osteoporosis risk in postmenopausal women observed a positive co-relation between educational level and BMD. The p value was 0.001 at hip sites. The study was conducted on 685 patients and they concluded that the higher level of education associated with good BMD value and a lower prevalence of osteoporosis among postmenopausal women. Our study was also supported by Guiley et al[14,15] who stated that low socioeconomic status is associated with increased risk of Hip fracture. Colon Emeric C et al[16] also observed the positive co-relation between education level and risk of hip fracture, but Shaw et al[17] found that there is no significant association between BMD and education in their cross sectional study.

Our study was further confirmed by Prakkari et al[18], they examined 206 patients within 24 hours of event and observed that 98% of cases had hip fracture as a result of fall. They concluded that a typical hip fracture is a result from fall and has a direct impact over greater trochanter. Thepresent study also observes that fall is the most common cause of hip fractures in elderly patients which is further supported by RychetnikL NelsonM etal[19,20] who stated that falls are one of the major risk factor for hip fracture.

In our study, the other reason of vitamin D deficiency in case group was their house bound state. case group was more in house bound state as compared to control group, this observation was supported by GlothFm et al[21] who stated that there is a higher risk of vitamin D deficiency in housebound population as compared to community bound individuals. Atti T et al[22] stated that there is a high risk of vitamin D deficiency in those who live in old age homes as compared to those who live in their own homes

In the present study, we calculated FRAX score by online calculator and found that there is high fracture risk in case group as compare to control group. Similar study was conducted by Ann V Schwartz, Vittinghoff et al[23]in which They concluded that lower femoral neck BMD T score and higher FRAX scores are associated with hip and non spinous fractures. Johanssson, J.A. Kanis[24] stated that FRAX score is used to identify the possible threshold for any interventions either therapeutic or preventive in a major osteoporotic fracture. But vitormorqesrochaetal[25] disagreed with our results and concluded that there were similar risk of fracture in sample population and older population overall.

CONCLUSION

The study was concluded as follows-

1. The elderly patient who presented to us with hip fracture had a low

concentration of vitamin D as compared to the control group.
2. The patients with low level of vitamin D had higher chances of fragility hip fracture as compared to control group. There is was positive correlation between the osteoporosis and vitamin D values, lower the vitamin D values, higher were the chances of osteoporosis.

Limitation Of Study

1. The combination of patient profile we selected were those patients who visited to LLRM Hospital only, which is a tertiary care center and may not represent the whole strata of the population
2. This study could not asses the when and how long vitamin D was decreased in these patient.

Conflict of Interest – Nil
Source of Support – Nil

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