

LEVEL OF VITAMIN D IN ORTHOPAEDIC TRAUMA AMONG ADULT PATIENTS

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ABSTRACT

Background: The evidence on level of vitamin D in trauma patients is scarce in the developing countries. **Objective:** To determine the levels of vitamin D in trauma patients above 18 years of age. **Methodology:** This was a cross sectional study conducted on patients admitted in the Orthopedic department of Sheikh Zayed Medical College /Hospital, Rahim Yar Khan, patients included in this study were 340. The duration of study was 21st July to 16th March 2016. Vitamin D level were measured by using vitamin D kits (Roche). Patients less than 18 years were not included in the study. Data was analyzed by using SPSS version 16. **Results:** A total of 340 patients admitted in orthopedic department were included in this study. Overall 92.6% patients have deficient or insufficient level of vitamin D. Most of the patients (68.8%) were less than 45 years of age. Majority of the patients were male (71.8%). Most of the patients (72.4%) were not smokers. Majority belonged to rural areas (56%), and have no history of steroid intake. **Conclusion:** This study confirmed that majority of the trauma patients were vitamin D deficient or insufficient. This highlights that trauma surgeons should consider vitamin D in the armamentarium of orthopaedic treatment.

Key words: Trauma, Vitamin D, Fracture, Vitamin D, Deficiency

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INTRODUCTION

Osteoporosis is a medical issue with reduced bone strength and increased risk of fractures. Each year more than two million people suffer from fragility fractures in United States.¹ Fragility fractures occurrence is more than combined occurrence of strokes, heart attacks and breast cancer each year. Between 3.1 to 4.3 billion dollars are spent each year for the treatment of osteoporotic hip fracture. More than 50% people will suffer from osteoporosis by 2020.² Worldwide about one billion people have vitamin D deficiency.³

Supplementation of vitamin D and calcium increase the bone mineral density and is associated with decreased hip fractures. Sun exposure of body between full sunny hours for 05 to 30 minutes two times a week can prevent vitamin D deficiency.^{4,5} Egg yolk, mushrooms, tuna, mackerel, sardines and salmon provide natural sources of vitamin D. Cereals, butter, milk, yogurts, cheeses, and orange juices also provide rich source of vitamin D.⁴

Most of the studies suggest that all the patients with hip fractures have low vitamin D level and falls on ground and fractures with minor trauma is common in this population.⁶ Different epidemiological studies show that falls and

muscle weakness may be due to vitamin D deficiency.⁷

Low calcium intake in diet and vitamin D deficiency resulting from gastrointestinal mal-absorption of calcium lead to a negative calcium balance in the elderly people is commonly observed. This negative calcium balance leads to rapid bone resorption, secondary hyperparathyroidism appears and mineralization of newly formed bone is depressed. Mineralization of newly formed bone (osteoid) matrix will not occur in the presence of severe and longstanding vitamin D deficiency. This leads to osteomalacia due to accumulation of insufficient osteoid tissue.⁸ The reduction of fractures in adults is achievable with an adequate dose of vitamin D.^{9,10,11,12}

The objective of this study was to determine the level of vitamin D in patients with traumatic injuries, of 18 years and above age.

METHODOLOGY

A cross sectional study, approved by. Institutional Review Board was conducted in Orthopedics Department of Sheikh Zayed Medical College/Hospital Rahim Yar Khan. All the patients admitted with closed fractures above 18 years of age were included in the study. There was no upper age limit of patients. The patients with multiple injuries,

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rheumatic diseases, younger than 18 years, renal insufficiency, psychiatric patients and malnourished patients were excluded from study. Consent of the patient and permission from ethical committee was retrieved.

The demographic data regarding age, sex, residence, smoking, soft drinks intake, previous fracture, associated diseases, steroids intake, duration of injury, previous treatment, site of fracture, mechanism of injury and bone involved was recorded on a performa.

Age was grouped as 18-25, 26-35, 36-45, 46-55, 56-65, 66-75 and above 76 years. Vitamin-D level of less than 20 ng/ml was considered as deficient and vitamin-D level between 21-30ng/ml insufficient, desirable level of vitamin D3 was from 31-100ng/ml.¹³ Serum vitamin D was assessed in each patient before manipulation or surgery by sending required sample to the pathology department of Sheikh Zayed Medical College/ Hospital Rahim Yar Khan. Collection of samples and retrieval of reports was done in a standard method. Uniform kits and other required material was used for calculation of results. All the patients were advised not to eat anything or drink milk 4 hours before sample collection. All the blood samples were taken in the morning by trained nurse with disposable syringes through venepuncture.

About 5ml of venous blood was retrieved. Complete centrifugation of blood samples was done within two hours of venepuncture for separation of serum.

All the samples were collected in sterile packed tubes and preserved at a temperature of 20°C until analyzed. The data was analyzed by using SPSS version 16. Categorical variables were expressed as percentages whereas numerical variables were expressed as mean \pm SD.

RESULTS

This study was conducted on 340 patients admitted in orthopedic department. Vitamin D deficiency and insufficiency was detected in most of the patients (92.6%). The age distributions of patients is shown in Table-I.

Table I: Overall vitamin D level among study subjects

Level of Vitamin D	Frequency	Percent
Insufficiency	49	14.4
Deficiency	266	78.2
Desirable	23	6.8
Toxicity	2	.6
Total	340	100 %

Table II-a: Frequency of Vitamin D deficiency according to different variables.

Variable	No (%)	Vitamin D level			
		Deficiency	Insufficiency	Desirable	Normal
Age group					
18 -25	100 (29.4)	81 (81%)	12 (12%)	6(6%)	1(1%)
26 -45	134 (39.4)	102 (76%)	22(16%)	9(6.7%)	1 (0.7%)
46 -65	89 (26.2)	71 (79.7%)	11(12.3%)	7(7.8%)	0. (0.0%)
66 -85	15 (4.4)	10 (66.6%)	5 (33.3%)	0(0.0%)	0(0.0%)
>85	2 (0.6)	1 (50%)	0(0.0%)	1(50%)	0(0.0%)
Sex					
Male	244(71.8)	190(77.8%)	36(14.7%)	18(7.3%)	0(0.0%)
Female	96(28.2)	76(79.1)	14(14.5%)	4(4.1%)	2(2%)
Residence					
Rural	192(56.5)	152(79.1%)	28(14.5%)	12(6.2%)	0(0.0%)
Urban	148(43.5)	113(76.3%)	22(14.8%)	11(7.4%)	2(1.3%)
Smoking					
No	246(72.4)	202(82.1%)	28(11.3%)	14(5.6%)	2(0.8%)
Yes	94(27.6)	64(68%)	21(22.3%)	9(9.5%)	0(0.0%)
Soft Drink					
No	34(10)	24(70.5%)	7(20.5%)	3(8.8%)	0(0.0%)
Yes	306(90)	243(79.4%)	41(13.3%)	20(6.5%)	2(0.65%)
Previous Fractures					
No	266(78.2%)	204(76.6%)	40(15%)	21(7.8%)	1(0.3%)
Yes	74(21.8%)	62(83.7%)	9(12%)	2(2.7%)	1(1.3%)
Comorbidity					
Diabetes	20(5.9%)	13(65%)	6(30%)	1(5%)	0(0.0%)
Hypertension	45(13.2%)	35(77.7%)	4(8.8%)	6(13.3%)	0(0.0%)
No comorbidity	275(80.9%)	220(80%)	37(13.4%)	16(5.8%)	2(0.7%)

Table II-b: Frequency of Vitamin D deficiency according to different variables

Variable	No (%)	Vitamin D level			
		Deficiency	Insufficiency	Desirable	Normal
Steroids intake					
No	327(96.2%)	257(78.5%)	45(13.7%)	23(7%)	2(0.6%)
Yes	13(3.8%)	9(69.2%)	4(30.7%)	0(0.0%)	0(0.0%)
Duration of injury					
Acute (with in 30 days)	271(79.7%)	223(82.2%)	32(11.8%)	15(5.5%)	1(0.3%)
Chronic (>30days)	69(20.3%)	40(57.9%)	19(27.5%)	09(13%)	1(1.4%)
Previous treatment					
No	232(68.2%)	187(80.6%)	35(15%)	09(3.8%)	1(0.4%)
Yes	108(31.8%)	79(73%)	14(12.9%)	14(12.9%)	1(0.9%)
Site of Fracture					
Lower limb	256(75.3%)	201(78.5%)	38(14.8%)	15(5.8%)	2(0.7%)
Upper limb	84(24.7%)	61(72.6%)	15(17.8%)	8(9.5%)	0(0.0%)
Mechanism of injury					
Fall	59(17.4%)	48(81.3%)	6(10.1%)	5(8.4%)	0(0.0%)
Fight	4(1.2%)	2(50%)	2(50%)	0(0.0%)	0(0.0%)
Patho logical Fracture	11(3.2%)	9(81.8%)	1(9%)	0(0.0%)	1(9%)
Road Side Accident	266(78.2%)	207(77.8%)	41(15.4%)	18(6.7%)	1(0.3%)
Bone involved					
Flat bones	6(1.8%)	03(50%)	01(16.6%)	02(33.3%)	0(0.0%)
Proximal femur	76(22.4%)	54(71%)	14(18.4%)	6(7.8%)	2(2.6%)
Radius	61(17.9%)	39(63.9%)	19(31.1%)	03(4.9%)	0(0.0%)
Shaft of femur	78(22.9%)	66(84.6%)	07(8.9%)	05(6.4%)	0(0.0%)
Tibia	105(30.9%)	77(73.3%)	21(20%)	07(6.6%)	0(0.0%)
Ulna	14(4.1%)	12(85.7%)	0(0.0%)	02(14.2%)	0(0.0%)

Most of the patients (68.8%) were less than 45 years of age. Majority of the patients were male (71.8%). Majority of the patient (56.5%) belong to rural area. Most of the patients (72.4%) did not smoke. (Table II-a)

Most of the patients (90%) used to drink soft drinks. Majority of the patients (78.2%) have no history of previous fractures. Majority of the patients (80.9%) have no associated disease. Most of the patients (96.2%) do not have history of steroid intake. Most of the patients (79.7%) presented within 30 days of injury trauma. In

majority of the patients (68.2%) there was no history of previous treatment. Most of the patients (75.3%) suffered from lower limb injuries. Majority of the patients (78.2%) suffered from road side accident. Femur was commonly involved in most of the patients (45.3%). (Table II-b)

DISCUSSION

The evidence in Vitamin D deficiency in trauma patients is sparse in Pakistan. A study was conducted by Robertson et al, on 201 patients with vitamin D deficiency having trauma of some type. 80% of these patients improved their vitamin D level after supplementation.¹² Vitamin D increases the level of calcium and phosphorus in normal bone metabolism. Bone is alive tissue that has osteoblastic and osteoclastic activities in balance to keep the body active and mobile.¹³

In the present study, 92.6% of the patients were less than optimal vitamin D level, 78.2% were vitamin D deficient and 14.4% were vitamin D insufficient. Only 6.8% of the patients have desirable vitamin D level. This is comparable to a study conducted, on 527 patients where 71% of the patients with fractures have less than normal vitamin D level. They found that 71% of the fractures belonged to upper extremity and in the present study 75.3% of the patients belong to lower extremity fracture group.¹⁴

Vitamin D supplementation in vitamin D deficient trauma patients improved their level as suggested by a study carried out on 201 patients. Where recruited patients were 97% vitamin D deficient and their level improved after giving doses of Vitamin D as 54.5% of the patients gained desirable level. The authors suggested that trauma surgeons should be vigilant about level of vitamin D in treating the patients with fractures so that good healing can be achieved and their post-operative results can be improved.¹⁵ Bone remodeling and callus formation need vitamin D in desirable level as suggested by clinical and experimental studies.^{16,17}

The level of vitamin D is not known in most of the trauma patients worldwide. A study was conducted in India on 90 patients with acute hip fractures and same number of control patients. This study showed that about 76.7% of the patients have vitamin D deficiency and 32.3% of the control patients have vitamin D deficiency. This is statistically significant and an important risk factor of hip fractures in India.¹⁸ Smoking is important risk factors as in the present study smokers have 90.42% risk of vitamin D deficiency or insufficiency.¹⁹

It is very important to keep in mind that during fracture surgery vitamin D level should be optimal to have good post operative healing of the fractures. In an cohort study conducted in USA, high incidence of vitamin D sub optimal levels were assessed in all age groups of orthopaedic trauma patients with no effect of residence.²⁰ In the present study urban and rural patients have almost similar level of vitamin D deficiency or insufficiency, 91.2% and 93.7% respectively. Most of the patients having low level of vitamin D, suffer from foot and ankle fractures, as evidenced by a study that 60% of a cohort study on 75 patients suffer from vitamin D deficiency or insufficiency.¹⁹

CONCLUSION

This study concluded that most of the trauma patients were vitamin D deficient or insufficient. This highlights that trauma surgeons should consider vitamin D in the armamentarium of orthopaedic treatment. Limitation of this study included FRAX tool was not used. Calcium level was not detected as kits. To establish the role of vitamin D in fracture healing and association with fractures needs a separate study.

Conflict of interest: There is no conflict of interest among all authors.

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