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Evaluation of Association of Serum Vitamin D Levels with Radiological Grading of Osteoporosis in Proximal Femoral Fractures in Elderly Patients

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Abstract:-

➢ ***Introduction***

Proximal femoral fractures are very common in elderly patients. These fractures are thought to be due to osteoporosis. Vitamin D is a possible risk factor for osteoporosis. So, this study was done to evaluate the association of serum Vitamin D level with grading of Osteoporosis in proximal femoral fractures in elderly patients.

➢ ***Method***

This study was done between September 2013 to August 2016.75 patients with age>60 years with proximal femoral fractures were studied. Serum Vitamin D, Calcium, Phosphate, Alkaline phosphatase levels, Liver function test, Renal function test, Blood glucose level, haemoglobin and complete blood counts was done. Singh's index was evaluated in each patient in plane radiograph of pelvis. Serum Vitamin D level was tested with 25-hydroxy Vitamin D-ELISA/Chemiluminiscence Macropartite Enzyme Immunoassay method.

➢ ***Results***

On assessment of serum Vitamin D in proximal femoral fracture elderly patients, it shows an increase incidence of proximal femoral fractures in patients with low serum Vitamin D level. Singh's index has significant statistical relationship with serum Vitamin D levels and it depends on it.

➢ ***Conclusions***

Grading of Osteoporosis depends on Serum Vitamin D levels. Osteoporosis and Serum Vitamin D level depends on age and sex of the patient.

Keywords:- *Singh's Index, Serum Vitamin D Level, Elderly, Proximal Femoral Fractures.*

I. INTRODUCTION

Osteoporosis is the most common skeletal disorder in the world and is second only to arthritis as a leading cause of musculoskeletal morbidity in the elderly. As people around the world are having increased life expectancy, Osteoporosis has become one of the major health problems worldwide(1). Epidemiological studies in Asian- Indian population indicates that elderly patients with proximal femoral fractures had high prevalence of vitamin D deficiency.Osteoporotic fractures tend to occur earlier in Indian population than in their western counterparts and they are more common in women. It is believed that half of all women and one third of all men will sustain a Osteoporotic fracture during their lifetime. More fractures occurred at home than outside, with a majority of falls being in the bathroom. These fractures contribute to substantial suffering for the patients as well as the relatives and severe economic burden for the society(2).

The cause of osteoporosis is multifactorial and Vitamin D deficiency is one possible risk factor, although the importance of Vitamin D for bone health, especially in a general population, is not well understood(3).It has been presumed that Indians are Vitamin D sufficient as Indian subcontinent is situated between 8.4N and 37.6N latitude and has adequate sunshine and UV-B rays(290-315nm) reaching the earth's surface throughout the year. However, a recent study has suggested a high prevalence of subnormal 25-hydroxy Vitamin D concentration among healthy Indians(4).

In the present study, it was planned to assess serum Vitamin D levels and routine bone biochemistry in elderly patients who presented with proximal femoral fractures and to do radiological grading of osteoporosis and to study association of serum Vitamin D with grading of Osteoporosis in proximal femoral fractures in elderly patients.

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II. MATERIALS AND METHODS

Present cross-sectional study was conducted in the Department of Orthopedic Surgery, B. R. D. Medical College and Nehru Hospital, Gorakhpur, during the period between September 2013 and August 2014, after getting approval from ethical committee for this. Patients were selected according to following criteria:

Age>65 years,Type of fracture – Proximal femoral fractures(fracture of neck of femur, Fracture of intertrochanteric femur, fracture of subtrochanteric femur), Patients having informed consent.Patients having Pathological fracture were excluded from the study.

Pelvis with both hips –AP view were taken for diagnosis and radiological grading of Osteoporosis.

GRADE	RADIOGRAPHIC APPEARANCE OF PROXIMAL FEMUR
VI(NORMAL)	All normal trabecular groups are visible. Upper end of femur appears to be completely occupied by cancellous bone.
V	Loss of trochanteric and secondary tensile trabeculae, attenuation of secondary compressive trabeculae, ward's triangle appears prominent.
IV	Loss of secondary compressive, attenuation of primary tensile trabeculae.
III	There is a break in the continuity of the principal tensile trabeculae opposite the greater trochanters. This grade indicates definite osteoporosis.
II	Only principle compressive trabeculae stand out prominently. Remaining trabeculae have essentially been absorbed.
I	Principle compressive trabeculae are markedly reduced in number and are no longer prominent.

Table 1:- Singh's Index

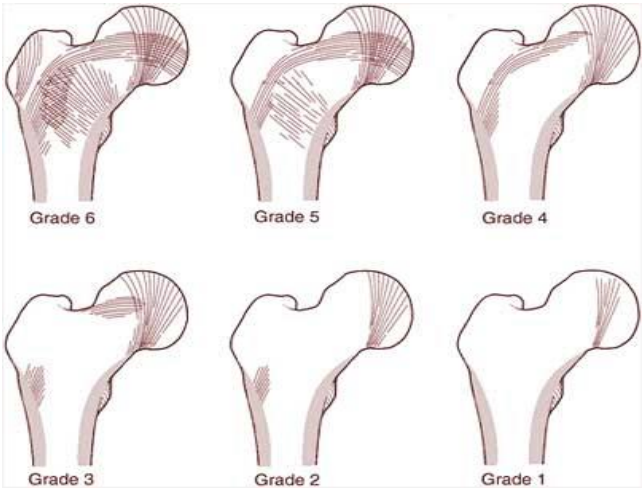

Fig 1:-Grading

III. BLOOD INVESTIGATIONS

Routine blood investigations including Serum Vitamin D level, serum Calcium level, serum phosphate level, serum alkaline phosphatase level, Liver function test, Renal function test, Blood glucose level, haemoglobin and complete blood counts were carried out.Serum Vitamin D level was tested with 25-hydroxy Vitamin D-ELISA/Chemiluminiscence Macropartite Enzyme Immunoassay method.

IV. RESULTS

In our study Proximal Femoral Fractures were more common in Females (41/75) and in them fracture neck of femur(28/41) was more common.39 patients out of 75 patients were having Serum Vitamin D Level<20ng/ml.66 Patients out of 75 have Singh's index III or less than III.Singh's index has statistical relationship with serum Vitamin D levels and it depends on it.Most of the females with proximal femoral fractures have Singh's index II or less(32/41).Singh's index has significant relationship with sex statistically.35.29%(12/34) of total males have serum Vitamin D levels<20 ng/ml and 65.85%(27/41) of total female patients have serum Vitamin D levels<20 ng/ml. Serum Vitamin D levels have significant relationship with sex.In patients with proximal femoral fracture, 63% of patients have osteoporotic Singh's index I or II .

V. DISCUSSION

Incidence of proximal femoral fractures in Indian sub-continent is high and these fractures are mostly low velocity fractures associated with trivial injury. These fractures have multiple risk factors and most of which are preventable.In my study ,I have studied 75 patients of aged more than 60 years , presented to our hospital with proximal femoral fractures which includes fracture neck of femur, intertrochanteric fractures and subtrochanteric fractures. Out of those patients 45.34% patients were male and 54.67% were female ,which comes to 1:1.2 of male to female ratio , study conducted by Ramalho AC, Lazaretti-Castro M, found male female ratio

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for elderly patients with proximal femoral fractures to be 1:3.1(10) and by Bartonícek J, Dzupa V, Fric V, 1:2.5(5).

Vitamin D deficiency has definite association with Osteoporosis.In my study group average Serum Vitamin D level was 22 ng/ml, average Serum Vitamin D of male patients was 25 ng/ml ,and average Serum Vitamin D of female patients was 19ng/ml.

Grading of the osteoporosis with Singh's index was noted in my study . 88% of patients have Singh's osteoporotic index III or less than III and most of them have serum Vitamin D level <30 ng /ml .In my study, relationship between Singh's index and serum Vitamin D levels were significant, i.e. Singh's index depends on serum Vitamin D levels.Relationship between Singh's index and sex was highly significant, Males have overall greater Singh's index than Females. T Masud, , S Jawed, did study in Singh's index and bone mineral density ,and their data suggest that the Singh index is a reproducible tool which may detect differences in bone mass between populations or subgroups within populations, and found sensitivity and specificity of the Singh's method in diagnosing low bone mass was 35.1% and 90.0%, respectively(6).

VI. CONCLUSIONS

Grading of Osteoporosis i.e. Singh's Index depends on Serum Vitamin D levels.Both in turn depends on age and sex of patient.

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SINGH'S INDEX	FRACTURE NECK OF FEMUR	INTERTROCHANTERIC FRACTURE	SUBTROCHANTERIC FRACTURE	TOTAL
I	08	08	00	16
II	18	12	01	31
III	12	05	02	19
IV	06	03	00	09
V	00	00	00	00
VI	00	00	00	00
TOTAL	44	28	03	75

Table 2:- Relationship between Singh's Index and Type of Fracture

SINGH'S INDEX	SERUM VITAMIN D3 LEVEL			TOTAL
	<20 ng/dl	20-100 ng/dl	>100 ng/dl	
I	12	03	01	16
II	20	10	01	31
III	07	10	02	19
IV	05	04	00	09
V	00	00	00	00
VI	00	00	00	00
TOTAL	44	27	04	75

Table 3:- Relationship Between Serum Vitamin D Levels And Singh's Index

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In my study, 39 patients out of 75 studied with proximal femoral fractures with serum Vitamin D level<20 ng/dl were in singh's grading III or less.27 patients out of 75 with proximal femoral fractures with serum Vitamin D level(20-100 ng/dl) were in singh's grading III or less.This observation is significant($X^2=6.812$,df=1,$P<0.05$).Singh's index depends on serum Vitamin D levels.

AGE (in years)	SERUM VITAMIN D3 LEVEL (ng/dl)			TOTAL
	<20	20-100	>100	
60-70	29	29	04	63
71-80	07	02	00	09
>80	03	00	00	03
Total	39	31	04	75

Table 4:- Relationship between Age and Serum Vitamin D Level

In my study, most of the patients >70 years of age with proximal femoral fractures have serum Vitamin D level<20 ng/dl(10/12).in age group 60-70 years, patients having serum Vitamin D level<20 ng/dl(29/75) and 20-100 ng/dl are same(29/75).This observation is significant.Serum Vitamin D levels have significant relationship with age($X^2=7.8$,df=1,$P<0.05$).

AGE(in years)	SINGH'S INDEX						TOTAL
	I	II	III	IV	V	VI	
60-70	11	26	17	09	00	00	63
71-80	03	04	02	00	00	00	09
>80	02	01	00	00	00	00	03
TOTAL	16	31	19	09	00	00	75

Table 5:- Relationship between Age and Singh's Index

In my study, most of the patients with proximal femoral fractures are in Singh's grading III or less in all age groups(66/75).This observation is significant.Singh's index has significant relationship with age($X^2=6.483$,df=1,$P<0.05$).

SINGH'S INDEX	SEX		TOTAL
	MALE	FEMALE	
I	07	09	16
II	08	23	31
III	12	07	19
IV	07	02	09
V	00	00	00
VI	00	00	00
TOTAL	34	41	75

Table 6:- Relationship between Sex and Singh's Index

In my study,most of the females with proximal femoral fractures have singh's grading II or less(32/41).Most of the males have singh's grading III or less(27/34).This observation is highly significant.Singh's index depends on age($X^2=23.444$,df=1,$P<0.01$).

SERUM VITAMIN D3 LEVEL(ng/dl)	SEX		TOTAL
	MALE	FEMALE	
<20	12	27	39
20-100	19	13	32
>100	03	01	04
TOTAL	34	41	75

Table 7:- Relationship between Sex and Serum Vitamin D Level

In my study 35.29% 0f total male patients(12/34) have serum vitamin d3 level<20 ng/dl and 65.85% 0f total female patients have serum vitamin d3 level<20 ng/dl.Relationship between sex and serum vitamin d3 levels is significant($X^2=9.568$,df=1,$P<0.05$).