



## TO ASSESS AND COMPARE BONE MINERAL DENSITY (T-SCORE) OF FEMUR NECK BY DEXA SCORE IN AMBULATORY STROKE PATIENTS.

<b>Dr Ashok Kumawat</b>	Senior Resident Department of PMR SMS Medical College Jaipur.
<b>Dr Sunil Goenka</b>	Professor Department of PMR SMS Medical College Jaipur.
<b>Dr Ram Dayal Sahu</b>	Medical Officer, Department of Urology SMS Hospital Jaipur.
<b>Dr Vinay Gahlot*</b>	Senior Medical Officer Govt. Jaipuria hospital Jaipur. *Corresponding Author

### ABSTRACT

**Background-** Early mobilization after stroke decreases BMD to less amount makes a sense, bed rest is believed to have a potentially negative effect on cardiovascular, respiratory, renal, gastrointestinal, musculoskeletal, and neurological system. Loss of muscle strength of as much as 40% has been reported within the first week of immobilization and the antigravity muscles appears to atrophy at a faster rate than non-antigravity muscles.

**Methods-** The present cross-sectional study comprises only male stroke patients to investigate the correlation between the stroke and BMD. Only male stroke patients of age 50 to 65 at duration of 3 to 12 months post strokes were included in the study because they showed significant demineralization activity at this period, the other factors that are closely involved in the decreasing of BMD would be observed with this study design.

**Results-** Maximum number (N= 15) have average BMD (T score) -0.31 at lumbar spine and 20 patients have average BMD (T-score) -0.3 at femur neck. osteopenia was seen in 12 patients have T-score of -1.48 at lumbar spine and 10 patients have T-score of -1.45 at femur neck. only 3 patients where having T-score of -3.53 at lumbar spine having osteoporosis in lumbar spine.

**Conclusion-** Stroke patients with better cognition have high BMD. Patients with decreased daily functionality (ADL) shows low BMD. Early measures should be taken to prevent post stroke complication i.e. osteoporosis in non ambulatory patients.

**KEYWORDS :** BMD, Ambulatory stroke, Osteoporosis.

### INTRODUCTION

Evidence suggests that patients can lose up to 14% BMD at the proximal femur<sup>1</sup> and up to 17% at the upper extremities<sup>2</sup> during first year of stroke.

Early mobilization after stroke decreases BMD to less amount makes a sense, bed rest is believed to have a potentially negative effect on cardiovascular, respiratory, renal, gastrointestinal, musculoskeletal, and neurological system. Loss of muscle strength of as much as 40% has been reported within the first week of immobilization and the antigravity muscles appears to atrophy at a faster rate than non-antigravity muscles. There is 6-40% decrease in bone density in just 4 to 6 weeks as a result of bed rest.<sup>3</sup>

In stroke patients devastating conditions like fall and fractures causes a economic and psychological stress to the patient and family. Fall orientation<sup>4</sup>, protective response, local shock absorption and bone strength at hip are the important factors which determine fractures due to fall in stroke patients. Osteoporosis is a condition characterized by low bone mineral density and deterioration of skeletal microarchitecture which leads to reduction in bone strength. Bone re-modelling is fundamental process in pathophysiology of osteoporosis and it is vital for healthy skeleton through removal of damaged tissue by osteoclasts and new bone matrix is generated by osteoblasts.. Osteoporosis in patients with hemiplegia of more than 1 month duration occur as a result of immobilization during the 1<sup>st</sup> year particularly. BMD in hemiplegic limb decrease by 4.6% at 11.3 weeks after the stroke<sup>5</sup>

WHO defines osteoporosis as bone density that falls 2.5 sd below the mean for young healthy adults of same gender (t score < -2.5). Although many studies in the past have identified the causes of bone demineralization in stroke patients but the participants were mainly both genders, the average period of illness for the men was as long as 4 years<sup>6</sup> or the studies were conducted on patients in the acute phase within 1 month of the stroke, or in the chronic phase of over 1 year after the stroke<sup>7</sup>. Previous studies confirmed that postmenopausal period is the strongest factor affecting the decrease of bone mineral density<sup>7</sup> and it is affected by several

different pharmacological treatments<sup>8</sup>. Therefore present study comprises only male stroke patients to investigate the correlation between the stroke and BMD. Only male stroke patients of age 50 to 65 at duration of 3 to 12 months post strokes were included in the study because they showed significant demineralization activity at this period, the other factors that are closely involved in the decreasing of BMD would be observed with this study design.

### MATERIAL & METHODS

**Study Area :** Patients attending the dept. of Physical Medicine and Rehabilitation, SMS Hospital, Jaipur.

**Study Design :** Cross-sectional study.

**Duration :** May 2018 to July 2019.

### Sample Size:

Sample size is calculated at 80% study power and alpha error of 0.05 assuming SD of 1.29 in t-score of Femoral neck in non ambulatory group as found in the study of Hui Dong King MD, Sae Hyun Kim, MD et al. (Dept. of PMR, Kosin University College of Medicine, Busan, KOREA) Ann Rehabil Med. 2016 Dec; 40(6):981-98. 26 participants are required as sample which is further enhanced and rounded off to 30 participants for present study expecting 10% dropout/attrition size.

### Inclusion Criteria:

- 1) Established stroke male patients of age between 50-65 years
- 2) Post stroke period is 4 to 12 months
- 3) Those willing to participate in study.

### Exclusion Criteria:

- 1) Patient taking drugs affecting BMD eg corticosteroids, calcium salts, bisphosphonates, parathyroid hormone substitutes etc.
- 2) Patients having co morbidities likely to affect BMD.
- 3) History of recent fracture, immobilisation with cast etc.
- 4) Non Cooperative, severely ill

### METHODS:

Eligible patients fulfilling inclusion criteria were approached by investigator and they were explained about nature and purpose of the study. After obtaining informed written consent detailed clinical history, treatment history and past history

was taken along with socio-demographic characters recorded on a predesigned semi-structured study proforma.

Patients having muscle power of 3/5 at hip extensors and knee extensors were included in the Ambulatory group. All the patients were examined and evaluated for Manual Muscle Test (muscle power), Modified Asworth Scale (spasticity), Mini-Mental Status Examination (cognition), Modified Barthel Index (activity of daily life) and Body Mass Index. and DEXA-SCAN was done to measure Bone mineral density of lumbar spine and femur neck of paretic limb.

Data thus generated were entered in Microsoft excel sheet to prepare master chart and were subjected for statistical analysis.

#### Material used:

- 1) HologicQdr-delphi dual x ray absorptometry in Radiology deptt SMS hospital Jaipur
- 2) X ray hip and lumbar spine
- 3) Knee hammer inch tape, weighing machine, torch
- 4) Pointed instrument pin

#### Outcome Measures

- 1) BMD with HologicQdr-delfi dual X-Ray absorptiometry to measure T score of hip and lumbar spine.
- 2) Manual muscle testing
- 3) Modified Barthel Index for ADL, modified ashworth scale for spasticity MMSE for cognition (higher mental functions)
- 4) Bone deformity and old fracture

#### Statistical Analysis

- 1) Continuous variable were summarized as mean and standard deviation, whereas nominal variables are in percentage.
- 2) Parametric test like unpaired t test and person correlation coefficient and repeated measure ANOVA test was used for continuous variables, while fisher exact test and chi-square test for nominal/categorical values. Ordinal variables were analysed by using Mann-Whitney test and Friedman test. Medcalc16.4 version software was used for all statistical analysis
- 3) For significance, p value of <0.05 was considered as significant.

## RESULTS

### Table no 1. General information

Mean Age	57.34±4.67 Yrs
Side (Left:Right)	18:12
Duration of stroke	8.10 ± 2.56 months
Diet ( Veg:Non-Veg)	18:12
Muscle power (3:4:5)	12:18:0
T-score lumbar spine	-1.12 ± 1.13
T-score femur neck	-0.69 ± 0.79
Barthel index (20)	18.33 ± 1.71

The Mean ±SD of age in group A was (57.34±4.67). 60% of the patients were having weakness on the left side. 60% ambulatory patients are Vegetarian. Motor power of 4/5 was found in (60%) followed by motor power of 3/5 in (40%). T-score lumbar spine was -1.12 ± 1.13. T-score femur neck was -0.69 ± 0.79. Barthel index was 18.33 ± 1.71.

### Table No 2. BMD (T-score)

		normal	Osteopenia	osteoporosis
ambulatory	BMD(Lumbar spine)	N=15 (0.31)	N=12(-1.48)	N=3(-3.53)
	BMD-Femur neck	N=20(-0.3)	N=10(-1.45)	N=0(0)

Maximum number (N= 15) have average BMD (T score) -0.31 at lumbar spine and 20 patients have average BMD (T-score) -0.3 at femur neck. osteopenia was seen in 12 patients have T-

score of -1.48 at lumbar spine and 10 patients have T-score of -1.45 at femur neck. only 3 patients were having T-score of -3.53 at lumbar spine having osteoporosis in lumbar spine.

### Table no 3. Spasticity(Lower Limb)

Spasticity (Lower limb)	No.	%
0	16	53.33
1	0	0.00
1+	11	36.67
2	3	10.00
3 & 4	0	0.00
Total	30	100.00

Spasticity MAS score of 1+ was highest (36.67%) followed by MAS score of 2 in (10%) there was no spasticity found in 53.33% patients.

### Table no 4. MMSE (30)

MMSE(30)	No.	%
18	1	3.33
21	1	3.33
24	0	0
25	0	0
26	2	6.67
27	1	3.33
28	9	30
29	3	10
30	13	43.33
Total	30	100
Mean ±SD	28.23	2.70

43.33% cases were having MMSE score of 30 followed by 28 in 30%.

## DISCUSSION

Osteoporosis is a known consequence of stroke, associated with an increased incidence of fractures, mainly of the hip due to decrease of bone mineral density. In these patients due to decreased balance and decreased muscle strength the chances of fall and fractures is higher as compared to normal healthy person and complications from fractures leads to increased morbidity and mortality Osteoporosis after stroke differs from senile osteoporosis, bone loss secondary to endocrine diseases, nutritional disorders and drug related factors, as it affects more on the paretic side and involve the upper extremity more than lower. In the present study only male stroke patients were included as postmenopausal osteoporosis is well known in age group 50 to 65 years taken for study

The diagnosis of the stroke was based on the clinical evaluation, history of illness, mode of onset, neurological examination and investigations like CT scan brain if available with the patients, total 26.66% patients were not having CT scan reports with them.

All the patients were informed about the nature of the study before witness and consent was taken from each participant. The protocol of the study was approved by Local Ethical Committee.

Sang HWa Lee et al<sup>8</sup>(2018) ,in their study on 239 patients with stroke to know the effect of cognitive impairment measured by MMSE-K found that 26.9% patients have osteoporosis and 14.6% have osteopenia and cognitive impairment was more severe in patients who are having Osteoporosis. In other study by Sun J H et al<sup>3</sup> (2014) come to the result that 24- 70% stroke patients with osteoporosis have low cognition.

In the previous study done by Thomas J. Schnitzer et al<sup>9</sup> (2014) they found that mean BMD of femoral neck at the paretic side (0.762±0.133 g/cm sq.) was lower than Non-paretic side (0.783±0.137 gm/cm sq.).

Yavuzer G et al.<sup>10</sup> (2002) in their study on bone mineral density on patients with stroke found that BMD of femur neck on paretic side was lower than non-paretic side and the rate of decrease in BMD was  $5.2 \pm 0.8\%$  on paretic side and  $2.1 \pm 1.1\%$  on non-paretic side within 6 months of stroke onset. The decrease of BMD was statistically significant in both sides.

Eimear M Smith et al.<sup>11</sup> (2009) examined 255 patients to find prevalence of low bone mineral density in patients with disability, he found that 42.4% had osteopenia and 23.5% had osteoporosis (calculated by T score) and ambulation in these patients found to be have a significant effect on BMD at femur neck. Those who were unable to walk had a decline in BMD on both the paretic and non- paretic side and greater decline on paretic side.

Marco Y C Pang and Janice J. Eng.<sup>12</sup> (2008) conducted a study and they come to the result that mean femoral neck BMD on the paretic side was  $0.746 \pm 0.149$  g/cm sq. , which was lower as compared to normal 79.48% patients were diagnosed as osteopenia( T=-2.5 to -1) and 20.51% were diagnosed with osteoporosis (T<-2.5).

## CONCLUSION

Stroke patients with better cognition have high BMD. Patients with decreased daily functionality (ADL) shows low BMD. Early measures should be taken to prevent post stroke complication i.e. osteoporosis in non ambulatory patients.

## REFERENCES

1. Ramnemark A, Nyberg Lorentzon R, et al. Progressive hemiosteoporosis on the paretic side and increased bone mineral density in the non paretic arm the first year after severe stroke. *Osteoporosis Int* 1999;9:269-275
2. Ramnemark A, Nilsson M, Borssen B, et al. Stroke, a major and increasing risk factor for femoral neck fracture. *Stroke* 2000;31:1572-1577
3. Liu M, Tsuji T, Higuchi Y, et al. Osteoporosis in hemiplegic stroke patients as studied with dual energy x-ray absorptiometry. *Arch Phys Med Rehabil* 1999;80:1219-1226
4. Iwamoto J, Tsukimura T, Takeda T. Bone mineral density of metatarsus in hemiplegic subjects. *Am J Phys Med Rehabil*. 1999;78:202-207.
5. Yavuzer G, Ataman S, Suldur N, Atay M. Bone mineral density in patients with stroke. *Int J Rehabil Res*. 2002;25:235-239
6. Sato Y, Kuno H, Kaji M, et al. Increased bone resorption during the first year after stroke. *Stroke* 1998;29:1373-1377.
7. Sato Y, Fujimatsu Y, Kikuyama M, Kaji M, Oizumic K. Influence of immobilization on bone mass and bone metabolism in hemiplegic elderly patients with a long standing stroke. *J Neurol Sci*. 1998;156:205-210
8. Jorgensen L, Jacobsen BK. Changes in muscle mass, fat mass and bone mineral Sang-Hwa Lee, Min UK Jang, Yerim, Yerim Kim, so Young Park, Chulho Kim, Yeo Jim Kim, JongHee Sohn. Low bone Mineral Density could predict cognitive impairment during the acute the acute and recovery phases of ischemic stroke: neural; 2019
9. Sun JH, Tan L, Yu JT. Post stroke cognitive impairment: epidemiology mechanisms and management. *Ann. Transl. med* 2014,2(8):80
10. Schnitzer TJ, Harvey RL, Nack SH, Supanwanid P, Maskala-Streff L, Roth E (2012) Bone mineral density in patients with stroke; relationship with motor impairment and functional mobility. *Top Stroke Rehabil* 19;436-443
11. Yavuzer G, Ataman S, Suldur N, et al. Bone mineral density in patients with stroke. *Int J Rehabil Res* 2002;25:235-239
12. Eimear M. Smith, Catherine M. Corniskey, Anie M Carroll. A study of Bone Mineral Density in Adults with Disability. *Arch phys Med Rehabil* 2009;90:1127-35