Relation of Primary Knee Osteoarthritis with Bone Mineral Density in Postmenopausal Women

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Abstract*—Osteoarthritis and osteoporosis are two common age related musculoskeletal diseases, which are highly prevalent health problems in postmenopausal women associated with considerable morbidity. This study was conducted with the aim to find out the relation between knee osteoarthritis (OA) and bone mineral density (BMD) in the left femur of postmenopausal women. A total of 100 postmenopausal women were assessed and KL grading was done according to Kellgren–Lawrence criteria. The BMD of the subjects was measured using Dual-Energy X-ray Absorptiometry (DEXA) and classified using WHO criteria on basis of T score. It was found that out of 100 postmenopausal women 68% were in KL-2 grade in which 53% were osteopenic and 37% were osteoporotic. The significant negative correlation was observed between KL grading left knee and T score. So it can be concluded that primary OA knee in postmenopausal women is associated with decreased BMD. So, it is recommended that OA knee in postmenopausal women should be evaluated for BMD for further management of pain & prevention of complication of low bone mass.*

Keywords: Bone mineral density, KL grading, Osteoarthritis, Osteoporosis, DEXA scan.

I. INTRODUCTION

Osteoarthritis and osteoporosis are two common musculoskeletal diseases affecting millions of eldely people with high morbidity.[1]

Osteoarthritis has generally been considered as a cartilage disease characterized by slow progressive degeneration of articular cartilage due to "wear and tear" mechanisms**.** This disease impacts on all anatomical joint structures.[2] It is characterized by joint pain and stiffness, cartilage degeneration, thickening of subchondral bone, loss of joint function and reduction in mobility.[2]

The etiology of osteoarthritis is multifactorial and it can affect both weight bearing and non weight bearing joints. It is initiated as a result of mechanical, structural, genetic and environmental factors.

Osteoporosis consist of heterogeneous group of syndromes in which bone mass per unit volume is reduced in healthy bone, resulting in fragile bone, this increment of bone porosity results in instability of bone and increase likelihood of fracture. Fractures, chronic pain, disability and decreased bone mineral density are major symptoms of Osteoporosis.[3] Postmenopausal women are susceptible to primary osteoporosis since osteoporosis is closely related to estrogen deficiency.[4]

WHO operationally defines osteoporosis as bone density that falls 2.5 SD below the mean for young healthy adults of same gender (T score less than or equal 2.5).[5] The life time risk of an osteoporotic fracture to be 40-50% in women and 13-22% in men are associated with substantial morbidity and a significantly increased mortality risk.[6]

Loss of estrogen increases production of RANKL (receptor activator of nuclear factor kappa B ligand) and may reduce production of osteoprotegerin, increasing osteoclast recruitment. Estrogen also determines the life span of osteoblast is decreased and longevity and activity of osteoclasts is increased.[7]

The relationship between osteoarthritis and low bone mass, the two most common age related skeletal disorders, is puzzling and controversial. Mechanism of increased bone mass related to increased loading of articular cartilage leading to cartilage damage, has been proposed as an independent risk factor for development of OA.[8] In contrary, due to OA, the reduced mobility caused by pain can increase bone loss and reduction of bone mineral density proximal femur.[9]

So this study was conducted to find out relation between knee osteoarthritis (OA) and bone mineral density (BMD) in the left femur of postmenopausal women.

II. METHODOLOGY

This hospital based descriptive study was conducted at Department of Physical Medical Rehabilitation (PMR) of SMS Medical College, Jaipur (Rajasthan) India in 2019.

Before collecting the data this study was approved by the institutional Ethics committee of SMS Medical College and attached Hospitals. For taking the written informed consent, all participants read and signed a study consent form approved by the Ethics Committee.

For the study purpose, post menopausal women with primary OA knee visiting OPD in the Department of PMR, RRC, SMS Medical College, Jaipur giving written informed consent were included in the study. Knee pains other than clinically diagnosed primary Osteoarthritis knee were excluded from the study. Female who had any of thyroid, adrenal, hepatic or renal disease, metabolic bone disease, diabetes mellitus, rheumatic disease, neurological disorder and malignancy were also excluded from study. Bed ridden patient or female who had any surgery on knee were also excluded from study.

All the consented study subjects were given a screening performa for identifying the subjects included for the study as per inclusion and exclusion criteria. Those who were eligible for included in the study were administrated a semi-structured interview schedule to obtain information from the study participants regarding the presence of any significant past medical or surgical history, any current medication, history of daily smoking; and alcohol consumption. Physical examination was also done to have data related to any disease. Weight in Kg and height in meter was measured and BMI was calculated.

ACR clinical classification criteria was used for diagnosis of primary knee OA including age> 50 years, morning stiffness< 30 minutes, Crepitus on knee motion, Bony tenderness, Bony enlargement, No palpable warmth, ESR >40mm /hr, RF > 1/40, Synovial fluid compatible with OA. At least 5 of the above 9 items can classify the knee OA in patients with knee pain.

For assessment of knee osteoarthritis bilateral weight bearing knee radiographs antero-posterior & lateral in 30 degree knee flexion were taken and graded into 4 categories as per Kellgren-Lawrence grading as follows:

Grade 1: Doubtful narrowing of joint space and possible osteophytic lipping.

Grade 2: Definite osteophytes, possible narrowing of joint space.

Grade 3: Multiple osteophytes, definite narrowing of joint space ,some sclerosis and possible deformity of bone contour.

Grade 4: Large osteophytes marked narrowing of joint space, severe sclerosis and definite deformity of bone contour.

To assess osteoporosis, BMD of the patients were measured by Dual-Energy X-ray Absorptiometry (DXA) scan for left hip and in the present study for BMD (Bone Mineral Density) interpretation, T score was used as per WHO criteria for classification of Osteopenia and Osteoporosis as follows:-

WHO Criteria for Classification of Osteopenia and Osteoporosis	
Category	**T-Score**
Normal	-1.0 or above
Low bone mass (Osteopenia)	Between -1 and -2.5
Osteoporosis	-2.5 or below

Statistical analysis: Qualitative data were expressed in percentage (%) and quantitative data were summarized as mean and standard deviation (S.D.). Chi-square test was used to find out associations and correlation was found with Pearson Correlation. P value< 0.05 was taken as significant. For analysis, SPSS Trial version 23 software was applied.

III. RESULTS

In this present study, 100 postmenopausal women with primary osteoarthritis knee were taken as subjects. Most of the study subjects were between the age group of 61 -70 years (52%) followed by 51-60 years (40%) and 40- 50 years (8%) with mean age of 59.43 (SD ± 5.096) years. (Table 1)

TABLE 1
AGE WISE DISTRIBUTION OF THE STUDY POPULATION

Age group (yrs)	Number of subjects	Percentage
40 to 50	8	8
50 to 60	40	40
60 to 70	52	52
Total	100	100

On analysis of BMD of left hip, only 10% were with normal T score i.e. above -1, maximum patients were osteopenic (51%) and 39% were with osteoporosis. (Table 2)

TABLE 2
LEFT HIP T SCORE WISE DISTRIBUTION OF THE STUDY POPULATION

Left hip T score	Number of subjects	Percentage
Normal (above -1)	10	10
Osteopenia (-1 – -2.5)	51	51
Osteoporosis (-2.5 or below)	39	39
Total	100	100

In total 100 postmenopausal women, maximum number of patients were in KL grade 2 (68%) followed by K-L grade 3 (20%), K-L grade 1(11%), K-L grade 4 (1%). (Table 3)

TABLE 3
LEFT HIP T SCORE WISE DISTRIBUTION OF THE STUDY POPULATION

KL grafting Left hip T	Number of subjects	Percentage
KL-1	11	11
KL-2	68	68
KL-3	20	20
KL-4	1	1
Total	100	100

On further analysis, however lesser BMD was found with higher KL grade in left hip but this difference was not found significant (p value=0.138NS). So statistically no association was found between BMD and KL grading of left hip. (Table 4)

TABLE 4
ASSOCIATION OF K-L GRADING OF LEFT OA KNEE WITH LEFT HIP BMD IN STUDY POPULATION

KL grafting Left hip T	Total of subjects	Normal		Osteopenia		Osteoporosis	
		No.	(%)	No.	(%)	No.	(%)
KL-1	11	3	30	6	11.8	2	5.1
KL-2	68	7	70	36	70.6	25	64.1
KL-3	20	0	0	9	17.6	11	28.2
KL-4	1	0	0	0	0	1	2.6
Total	100	10	100	51	100	39	100

Chi square =9.693 with 6 degrees of freedom; p=0.138 (Not significant)

In present study T score of left hip was significantly negatively correlated with age (r=-0.243 p=0.015) and KL grading left OA knee (r=-0.262 p=0.009).The other studied variables (BMI, menopause age, duration after menopause, vitamin D level, ACR score) were not found significantly correlated. (Table 5)

TABLE 5
CORRELATION OF T SCORE OF LEFT HIP WITH STUDIED VARIABLES

Studied Variables	T Score Value Left Hip			
	Total of subjects	Pearson Correlation	Sig. (2-tailed)	Significance
Age	100	**-.243**	0.015	**Significant**
BMI	100	.050	0.622	Not Significant
Menopause Age	100	-.027	0.789	Not Significant
Duration after Menopause	100	-.196	0.051	Not Significant
Vitamin D Level	100	-.031	0.761	Not Significant
K L Grading Left hip	100	**-.262**	0.009	**Significant**
ACR Score	100	-.047	0.640	Not Significant

IV. DISCUSSION

In present study studied study population of 100 postmenopausal women with primary osteoarthritis, mean age was 59.43years with SD ± 5.096 years. It is comparable to the similar study done by Pooja Dhaon et al (2017)[10] on osteoporosis in postmenopausal females in which mean age was 51 years with

SD ± 5.3. In other almost similar studies conducted by Sezer I et al (2010)[2] and Lihui Wen et al (2016)[9] the mean age 61.9 (SD± 9.1) years and 63.2 years respectively.

In the present study, osteopenic women were 51% as per BMD of left hip. A study conducted by Breijawl et al[11] reported ostopenia in 42.7% in females of their study which was in line of observations of present study.

In present study, maximum number of females were in KL grade 2 (68%) followed by K-L grade 3 (20%), K-L grade 1(11%), K-L grade 4 (1%). These results are comparable to the study conducted by Pooja Dhaon et al (2017)[10] who reported KL grade 2, 3, and 4 OA in 57%, 35% and 8% respectively in their 75 patients.

On further analysis in present study, however BMD was observed lesser with higher KL grading but this difference was not found significant. So no association was found between occurrence of osteopenia and KL grading. Almost similar observations were observed by other authors. Breijawi N et al (2009)[11] and Linde KN et al (2017)[12] also reported the observations well in resonance with the present study that bone mineral density was lower with severity of knee osteoarthritis.

In present study T score of left hip was significantly negatively correlated with age (r=-0.243 p =0.015) and KL grading left OA knee (r=-0.262 p=.009). Other authors like Breijwei et al(2009)[11] Linde K N et al(2017)[12], Gun II im et al (2014)[13], GW Goerres et al (2005)[14] also reported observations well in resonance with present study.

V. CONCLUSION

In the present study, the bone mineral density of proximal femur of left hip was negatively correlated (r=-0.262 poor correlation p value=0.009) with left knee osteoarthritis and T score of BMD was also found negatively correlated (r=-0.243 p=0.015). It is recommended that OA knee in postmenopausal women should be evaluated for BMD for further management of pain & prevention of complication of low bone mass.

CONFLICT OF INTEREST

None declared till now.

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