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BONE MINERAL DENSITY IN PATIENTS WITH CHRONIC LOW BACK PAIN

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ABSTRACT

Objective: To determine mean bone mineral density in patients with chronic low back pain presenting at Armed Forces Institute of Rehabilitation Medicine Rawalpindi based on dual energy x-ray absorptiometry studies.
Study Design: Cross sectional study.
Place and Duration of Study: Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi from Apr 2015 to Mar 2016.
Patients and Methods: Two hundred and forty patients having low back pain of more than 6 months duration fulfilling the inclusion criteria were included both from indoor and outdoor departments through non-probability consecutive sampling. Bone mineral density was measured at lumbar spine by dual energy x-ray absorptiometry studies by the same technical staff using the same equipment. A written informed consent was taken from each patient. Data were collected and recorded on specialized proforma by the principal investigator.
Results: Spine BMD on DXA scan ranged from 0.90 to 0.98 g/cm^2 with a mean of 0.95 ± 0.02 as shown in. When stratified, the mean BMD decreased significantly with increasing age and severity of LBP; 20-30 years vs. 31-40 years (0.95 ± 0.01 vs. 0.92 ± 0.02; p=0.001). However, there was no significant difference in mean BMD across genders; male vs. female (0.94 ± 0.01 vs. 0.94 ± 0.02; p=0.680). Similarly there was no significant difference in mean BMD across various durations of low back pain; 7-10 vs. 11-14 months (0.94 ± 0.03 vs. 0.93 ± 0.01; p=0.617).
Conclusion: The mean bone mineral density at spine was found to be lower in patients with chronic low back pain. It was significantly lower in older patients and those with severe low back pain. However, it didn't change significantly with various durations of low back pain or gender.

Keywords: Bone Mineral Density, Chronic Low Back Pain, Dual Energy X-Ray Absorptiometry, Low Back Pain.

INTRODUCTION

Low back pain (LBP) is one of the commonest musculoskeletal disorders disabling people worldwide. The mean overall prevalence of LBP is 31.0% globally[1]. Chronic low back pain (CLBP), defined as LBP of more than six months duration, has a significant impact on the ability to perform activities of daily living (ADLs)[2]. CLBP is associated with multiple psychological, biomechanical and occupational factors[3]. Factors affecting quality of life (QOL) in persons with CLBP include pain, stiffness, sleep, socializing and housework[4,5]. Bone health is an important factor to be considered in management of patients with CLBP[6]. Individuals suffering from CLBP show evidence of decreased bone mineral density (BMD) at the lumbar spine, reason being disuse associated with the fear of provoking back pain with physical activity[7]. Individuals with severe back pain tend to stiffen their trunks and adopt alternative movement strategies while limiting normal movements at the intervertebral joints[8]. This alters the biomechanics of spine and decreases the normal physiologic stress to the spine that is necessary for maintenance of skeletal integrity[9,10]. A survey of large population in United States concluded that the normal value of BMD at lumbar spine in persons aged between 20 and 40 years ranges from 1.05 to 1.08 g/cm^2 [11]. It was also confirmed in another study that individuals with CLBP have lower mean spine BMD (0.94 ± 0.13), because CLBP restricts some

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ADLs which exert negative influence on BMD[12]. The imaging modalities used for the assessment of BMD include conventional x-ray radiographs, dual energy x-ray absorptiometry (DXA) scan, ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI) scans[13]. The current standard for predicting bone mass loss is DXA scan. The hip and lumbar spine are conventionally used as the measurement sites for BMD[14], and the results are depicted via two measures, T-scores and Z-scores. The Z-score is used for measuring BMD in premenopausal woman, children and men less than 50 years of age. Low BMD is defined as Z-score less than -2.0 on DXA scan. According to a study mean BMD at spine was 0.94 ± 0.13 in patients <40 years of age with chronic low back pain. The T-score is the value of BMD as compared to those healthy controls having their peak BMD and is used for postmenopausal woman and older men[13]. Although there is evidence of a relationship between CLBP and reduced BMD, it has not been studied extensively in Pakistani population. Aim of this study is to explore the relationship between CLBP and low BMD in Pakistani population presenting at a large tertiary care rehabilitation institute. This will help physicians and patients with CLBP to develop preventive strategies in their daily life so as to reduce the consequences of low BMD.

MATERIAL AND METHODS

This cross-sectional study was conducted at Armed Forces Institute of Rehabilitation Medicine (AFIRM) Rawalpindi from April 2015 to Mar 2016. After obtaining permission from the institutional ethical committee, 240 patients having LBP of more than six months duration, aged 20 to 40 years, of both genders both from indoor and outdoor departments of AFIRM during the study period were included, through non-probability consecutive sampling, who had willingly accepted to participate in the study. The sample size was calculated using WHO sample size calculator (with confidence Level being 95%, anticipated population mean being 0.94, standard deviation being 0.13, and absolute precision being 0.065)[12]. All participants underwent interview for detailed clinical history and relevant physical examination including measurement of pain using visual analogue scale (VAS) in various age groups. The patients who had either the confounding factors or effect modifiers which could have resulted in bias were excluded, such as: Patients who were immobile due to any reason for ≥6 weeks within the last 12 months, Current smokers or those having history of smoking in the last 10 years, those having other comorbid conditions that affect BMD e.g. Rheumatoid Arthritis, Osteomalacia, Paget's disease, Cushing's syndrome, Seronegative spondyloarthropathies, Chronic renal failure, those having Body mass index (BMI) <18 or >30, and those who were taking medications which effect BMD, for more than 6 months, e.g. estrogen, progesterone, bisphosphonates and other osteoporosis therapies.

DXA scans were then performed via one pass single-sweep scanning technique by the same examiner using "Hologic Discovery DXA system" machine. All DXA scans were performed by the same technician and reports were verified by a single consultant to eliminate bias. Data thus collected were recorded on specialized proforma by the principal investigator. The outcome variable was BMD. Patients' confidentiality and anonymity were kept preserved. Data were analyzed with the help of statistical analysis program SPSS ver 17.0. For qualitative variables, like gender, frequency and percentages were used. For quantitative variables, like age and BMD, mean and standard deviation (SD) were used. Data were stratified for age, gender, and duration of LBP to address effect modifiers. Post-stratification independent sample student's t-test was applied taking *p*-value ≤0.05 as significant.

RESULTS

Out of 240 enrolled participants 48 (20%) were males and 192 (80%) were females. Mean age was 30.80 ± 5.69 years. The duration of low back pain ranged from 7 to 14 months with a mean of 10.05 ± 2.32 months. Spine BMD on DXA scan ranged from 0.90 to 0.98 g/cm^2 with a mean

of 0.95 ± 0.02 as shown in table-I. When stratified, the mean BMD decreased significantly with increasing age and severity of LBP; 20-30 years vs. 31-40 years (0.95 ± 0.01 vs. 0.92 ± 0.02; *p*=0.001) as shown in table-II. However, there was no significant difference in mean BMD across genders; male vs. female (0.94 ± 0.01 vs. 0.94 ± 0.02; *p*=0.680). Similarly there was no significant difference in mean BMD across various durations of low back pain; 7-10 vs. 11-14 months (0.94 ± 0.03 vs. 0.93 ± 0.01; *p*=0.617) as shown in table-III.

DISCUSSION

Amongst the musculoskeletal disorders LBP and osteoporosis are two major conditions which collectively lead to significant health problem. Bone health as measured by bone mineral density (BMD) is one of the important factors that affect management of patients with LBP/CLBP[6]. Patients suffering from LBP especially CLBP show evidence of decreased BMD at the lumbar spine, usually as a consequence of disuse associated with the fear of aggravation of back pain associated with strenuous physical activity[7]. Severe back pain results in stiffeness of trunk musculature making those affected to adopt alternative postures/ movement strategies[8]. The consequent altered spine biomechanics lead to decreased physiologic stress to skeletal elements of spine[9,10]. According to a United States based large population survey, normal BMD at lumbar spine in those aged between 20 to 40 years ranges from 1.05 to 1.08 g/cm^2 [11]. Yet another study concludes that patients with CLBP have lower mean spine BMD (0.94 ± 0.13), as a result of limitations in performance of ADLs which influence BMD positively[12]. In our study the age of the patients ranged from 20 years to 40 years with a mean of 30.80 ± 5.69 years. Makhdoom et al, similarly reported mean age at presentation to be 36.2625 ± 9.41 years[13]. There were 20% male and 80% female patients in our study giving a male to female ratio of 1:4. A similar female predisposition was reported by Al-Saeed *et al*. in Kuwait in which 19% were males and 81% were females[12]. The duration of LBP ranged from 7 months to 14 months with a mean of 10.05 ± 2.32 months in our study. BMD on DXA scan ranged from 0.90 to 0.98 g/cm^2 with a mean of 0.94 ± 0.02 in our study. Comparable results have been reported previously by Makhdoom *et al*. (0.93 ± 0.32) in Pakistani population at Karachi[13] and Al-Saeed *et al* (0.94 ± 0.13) in Kuwait[12].

When we stratified, the mean BMD decreased significantly with increasing age and severity of low back pain of the patient. A similar significant difference was previously observed by Al-Saeed *et al*[12]. There was no significant diffe-rence in mean BMD across the two genders and various durations of low back pain. Our results are in accordance with those of Makhdoom *et al*[13]. who also didn't observe any significant difference of

Table-I: Summary of age, duration of low back pain, bone mineral density (n=240).

Characteristic	Minimum	Maximum	Mean	SD
Age (Years)	20	40	30.80	5.70
Duration of LBP (Months)	7	14	10.05	2.32
BMD (g/cm^2)	0.90	0.98	0.95	0.02

Table-II: Comparison of bone mineral density across various age groups/pain scores.

Age Groups	N	Pain Scores (Mean ± SD)	BMD (Mean ± SD)	*p*-value
20-30 Years	69	5.58 ± 1.24	0.95 ± 0.01	0.001
31-40 Years	171	7.20 ± 0.92	0.92 ± 0.02	

*Student T-test has been applied taking *p*-value ≤0.05 as significant.

Table-III: Comparison of bone mineral density across various durations of low back pain.

Duration of LBP (Months)	n	BMD (Mean ± SD)	*p*-value
7-10	109	0.94 ± 0.03	0.617
11-14	131	0.93 ± 0.01	

*Student T-test has been applied taking *p*-value ≤0.05 as significant.

mean BMD across genders. The strengths of our study were strict exclusion criteria to minimize bias and stratification of data to address effect modifiers but inclusion of patients from a limited age group comprising 20 to 40 years was the main limitation.

CONCLUSION

The mean BMD at spine was found to be low in patients with CLBP. It was significantly lower in older patients and those with severe low back pain. However, it didn't change significantly with various durations of low back pain or gender.

RECOMMENDATIONS

The present study adds limited but important information to the existing evidence on mean BMD in local Pakistani population with CLBP emphasizing the need to repeat this study over a larger sample size with wide range of patient ages followed by data stratification for age groups to confirm this association of low BMD with CLBP.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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