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IMPACT OF SOCIO-DEMOGRAPHIC FACTORS ON THE BONE IN DIABETIC OSTEOPOROSIS POSTMENOPAUSAL WOMEN

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Keywords:

Diabetes, Post-Menopausal women, Osteopenia, Osteoporosis, Bone Mineral Density, Quantitative ultrasound

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ABSTRACT: Background: Diabetic postmenopausal women and osteoporosis are both chronic conditions and the relationship between them are complex. **Objective:** The aims of this study were to assess the socio-demographic factors inflicted in Diabetic postmenopausal women with Osteoporosis condition. **Method:** A Prospective, comparative and interventional study with a convenient sample of 520 Diabetic postmenopausal subjects were recruited from both inpatient and outpatient: Orthopedic, General Medicine and Obstetrics and Gynecology departments in Malla Reddy Hospital, measuring Bone Mineral Density (BMD) at the heel bone using QUS. In addition, tabulated self – reported data forms, about the socio-demographic details of subjects were collected. **Results:** The QUS measurements at the culmination of the study deduced that 520 Diabetic postmenopausal women posed a high risk of anomalous BMD were 17% (n=89), whereas Low risk of anomalous BMD accounted for 61% (n=317) and No risk accounted for 22% (n=114), out of validated subjects. The socio-demographic and osteoporotic conditions were illustrated. There were significant differences in QUS-score (normal BMD, Osteopenia and osteoporosis) patient demographic details like current age, age at menopause, Menopausal duration, BMI, Occupation, Family history of osteoporosis, Family history of Fracture, Smoking habit, Alcohol habit, economic status, and education details were noted. **Conclusion:** The study emphasizes the pre-requisites, namely risk factor identification and evaluation, strive for the decreased incidence of Osteoporosis. It also denotes the Health education programs to be an utmost desideratum amongst the population for Osteoporosis management.

INTRODUCTION: Diabetes mellitus and osteoporosis are chronic diseases with an elevated and growing incidence in the elderly. Diabetes currently affects more than 62 million Indians, which is more than 7.1% of the adult population. The average age of onset is 42.5 years [1]. Many studies indicate the significance of Quantitative Ultrasound Scan (QUS), being emerged as a new and adequate tool that offers alternate option than other diagnostic tests, for screening and assessing the peripheral skeleton status. QUS parameters reflect BMD, as well as, other mechanical characteristics of the bone, such as elasticity, micro architecture and solidity [2]. Osteoporosis is more described phenomenon in elderly diabetic women, after subsequent menopause stage which can also affect bone mineral density.

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Hence, there is a cardinal requirement to identify and perform a bone mineral density test for all the postmenopausal women who are at risk. Body fat mass, which is a component of weight and an important index of obesity, is thought to exert a detrimental effect on bone [3]. Several conditions, like aging, menopause, metabolic and endocrine diseases, inadequate physical activity, body mass index (BMI), smoking, alcohol, economic status, education, occupation type, familial history of osteoporosis, have been proposed as associated factors of BMD changes in the elderly subjects. But the influence of these factors may be affected by lifestyle and physical activities. Affecting factors of BMD changes in post-menopausal differ according to BMD measurement sites [4]. Therefore, the present study aimed to assess the Impact of Socio-Demographic Factors in the Bone Health Status in Diabetic Postmenopausal Women

Objectives:

- To discern the Socio-Economic factors which influence Bone Mineral Density in Diabetic postmenopausal women.
- To estimate the prevalence of osteoporosis in Diabetic postmenopausal women, categorized into three groups: Normal, Osteopenia, and Osteoporotic groups.

MATERIALS AND METHODS:

Materials:

1. Patient profile forms: Used to collect the information about patient clinical condition.
2. Case Report
3. Subjective evidence
4. Objective evidence
5. Physician interaction
6. Qualitative Ultra sonometer (Achilles Ultra sonometer)

Study Site: Both in and out Patients who are willing to participate in the study from the orthopedic and general medicine department in Malla Reddy Hospital, Suraram crossroad, Jeedimetla, Hyderabad, Telangana.

Study Period: The study will be conducted for a period of 6 months *i.e.*, from January 2018 to June 2018.

Study Design: A Prospective, Interventional and Comparative study was conducted among both in-patient and outpatient - diabetic postmenopausal subjects, who are willing to participate from Orthopedic, General Medicine, Obstetrics, and Gynecology department in Malla Reddy Hospital, Suraram, Jeedimetla, Hyderabad, Telangana. The study population was recruited based upon the inclusion criteria; Diabetic Postmenopausal women age group more than 45 years of all weight groups and Postmenopausal women using either insulin or oral hypoglycemic agents.

Sample Size: 600 Diabetic Post-menopausal Women

Bone Mass Measurements: Achilles ultra-sonometer was used to measure the bone mineral density (BMD). The heel is measured because its bone composition is similar to that of the spine and hip, where osteoporotic fractures occur most. Ultrasound does not travel well through the air. Therefore, during an Achilles test, warm water fills membranes that contact your heel to provide a path for the ultrasound energy to follow. Isopropyl alcohol is used to provide coupling between the heel and the membranes.

A bone mineral density (BMD) test measures the density of calcium and other types of minerals present in an area of the bone. With an increase in age, bones become thinner (Osteopenia) as they lose calcium, and also the deterioration of existing bone tissue occurs faster than the formation of a new bone. Bone mineral density tests are used to detect bone loss, Osteopenia, and osteoporosis[5]. It determines the efficacies of those medications indicated for osteoporosis, whether being effective and moreover predict the risk of future bone fractures. The results of the test are usually reported as T-score and Z-score. This test also gives the values of Stiffness Index, BUA (broadband ultrasonic attenuation) [6].

The QUS-score measurements were categorized into three groups (normal BMD, osteopenia, and osteoporosis) according to the World Health Organization (WHO) criteria, which have been standardized by the manufacturer for the Asian population. Osteoporosis, osteopenia, and normal conditions are identified as (T-score ≤ -2.5 SD), (T-

score between -1.0 and -2.5), and (T-score > -1.0) below the healthy young adult reference mean, respectively [7]. In addition, osteoporotic conditions of the diabetic postmenopausal women patients were stratified into two groups: a normal group (low risk for abnormal BMD with T-score > -1) and an osteoporotic condition group (high risk for abnormal BMD with T-score ≤ -1(i.e., osteopenia and osteoporosis) [8].

Ethical Considerations: Before the initiation of this study, all aspects of the study protocol were approved by the Institution Ethics Committee (IEC) of MRH (No. IEC.IEC/MRIMS/25/2019). All subjects were provided with a written informed consent form prior to participation in this study. All personal information collected was considered confidential.

Statistical Analysis: Data acquisition was concluded from the study interviews and medical records, thereupon scrutinized to ensure completeness. The categorical assessment of statistic data, percentages, and frequencies were used; the associations between these categorical variables were analyzed using the chi-square ($\chi 2$) test. In addition, One Way Analysis Of Variance (ANOVA) test and independent student t-test: were both brought into the analysis for the comparison of continuous normally distributed variables.

RESULTS:

Overall Response Rate: A total of (n=600) postmenopausal women with Diabetes Mellitus were recruited from both in patient and outpatients of Orthopaedic, General Medicine, and Obstructive and Gynecology department. Out of the 600 patients, 80 patients were excluded due to unavailability of data (n=80).

Bone Health Status and Prevalence of Osteoporotic Conditions: All Diabetic post-menopausal women were screened for BMD using QUS measurement. The mean value of T-score for Normal BMD, Osteopenia and Osteoporotic patients were (-0.45 ± 0.89), (-1.27 ± 0.29) and (-2.81 ± 0.38), respectively. According to QUS measurements, the prevalence of normal BMD was 22% (n=114), while the prevalence of osteopenia and osteoporosis were considered as 61% (n=317) and 17% (n=89), respectively.

Bone Health Status and Socio-Demographic Data: The QUS measurements at culmination of study, deduced that 520 Diabetic postmenopausal women posed high risk of anomalous BMD (17%), whereas Low risk of anomalous BMD accounted for 61% and No risk accounted for 22%, out of validated subjects. The socio-demographic and osteoporotic conditions were presented in **Table 1**. There were significant differences in QUS-score (normal BMD, osteopenia and osteoporosis) Patient demographic details like current age, age at menopause, menopausal duration, BMI, occupation, family history of osteoporosis, family history of fracture, smoking habit, alcohol habit, blood sugar levels and treatment details were noted.

TABLE 1: THE SOCIO-ECONOMIC CHARACTERISTICS INFLUENCING THE BONE HEALTH STATUS AMONG POSTMENOPAUSAL DIABETIC PATIENTS (N=520)

Variable	Total Sample (M±SD)	QUS score, N (%)			*P* Value
		Normal BMD	LBMD		
		Normal	Osteopenia	Osteoporosis	
		114(22%)	317 (61%)	89(17%)	
Age (years)	54.32±8.66	52.10±8.88	54.16±8.87	56.20±8.89	0.0012
Menopausal age (years)	9.55±8.12	9.50±7.12	9.55±8.12	9.60±9.12	0.0037
Menopausal duration (years)	7.5±3.12	6.4±2.10	7.5±3.11	8.6±4.10	0.0029
BMI, kg/m2	23.32±4.26	22.16±4.24	23.32±4.28	24.48±4.26	0.0001
Occupation					
Homemaker	162	59(36.42)	78(48.15)	25(15.43)	
Agriculture	39	9(23.07)	26(66.67)	4(10.26)	
Construction	61	6(9.84)	53(86.89)	2(3.27)	
Public Health	34	3(8.82)	16(47.06)	15(44.12)	
Education and Training	23	6(26.09)	13(56.52)	4(17.39)	
Information Technology	36	7(19.45)	26(72.22)	3(8.33)	
Manufacturing Science &Technology	126	15(11.90)	82(65.08)	29(23.02)	
Educational levels					
<12 years	176	85(48.30)	53(30.11)	38(21.59)	0.000288

≥ 12 years	344	29(8.43)	264(76.74)	51(14.83)	0.000677
Monthly income					
Less than Rs 15000	381	92(24.15)	212(55.64)	77(20.21)	0.000814
More than RS 15000	139	22(15.83)	105(75.54)	12(86.33)	0.000929
Family history of osteoporosis					
No	447	91(20.36)	293(65.55)	63(14.09)	0.000605
Yes	73	23(31.50)	24(32.88)	26(35.62)	0.000823
Family history of Fracture					
No	433	81(18.71)	286(66.05)	66(15.24)	0.000515
Yes	87	33(37.93)	31(35.63)	23(26.44)	0.000424
Smoking habit					
Not smoking	472	103(21.82)	301(63.77)	68(14.41)	0.000881
Smoking	48	11(22.92)	16(33.33)	21(43.75)	0.000458
Non alcoholic	406	63(15.52)	257(63.30)	86(21.18)	0.000981
Alcohol habit	114	51(44.74)	60(52.63)	3(2.63)	0.000597

Continuous data are presented as mean ±standard deviation (M±SD) and *p* values were derived from one-way analysis of variance (for continuous variables normal distributed), Categorical variables, expressed as frequency (percentage, %) of sample and *p* values were derived from the Chi-square test, **p* < 0.05. QUS, quantitative ultrasound; BMD, bone mineral density; LBMD, low bone mineral density

DISCUSSION: Among the profound chronic disorders prevalent in the global rate, Diabetes is the significant clinical condition. Bone involvement is one of the complications of DM. Several patterns of evidence indicate declined bone mass at the hip region, femoral neck, spine, and calcaneal regions.

Both Diabetes mellitus and osteoporosis are two relative clinical syndromes with a vast impact on public health, affecting a large number of populations. The clinical relevance of osteoporosis associated to diabetes mellitus is less acknowledged, and, to date, no clear conclusions have been reached due to the contradiction among researchers; they have reported Low, Moderate and High bone mass in diabetic post-menopausal women [9]. To the ulterior knowledge of researcher, this was the first extensive field study using calcaneal QUS to determine and identify the prevalence of Osteopenia and Osteoporosis, in diabetic postmenopausal women[10].

Certain studies displayed how the factors like age; oestrogen deficiency affects bone loss. With increase in the age, osteoblast number, and activity decrease; while osteoclast number and activity increases leading to osteopenia and, in severe situations, osteoporosis. Oestrogen loss resulted in an increased bone resorption in postmenopausal women due to the stimulation of osteoclastogenesis [11].

Prevalence of Osteoporotic Conditions: The determined prevalence of osteoporosis in the present study was lower when compared with other studies as well as other western countries. Therefore, it heeds that osteoporosis in diabetic postmenopausal women is underdiagnosed and overlooked until now.

Socio-Demographic Data and Bone Health Status: Another study showed that the duration of menopause, as well as the age and duration of diabetes, were amongst risk factors for decreasing BMD in diabetic postmenopausal women. It is obviously known that osteoporosis is a problem related to age and hormonal changes in women, suggesting a hormonal influence on BMD [12]. Moreover, similar findings were reported in postmenopausal women with T2DM using QUS [13]. This might be due to the fact that there is an increase in bone resorption relative to the formation as a consequence of aging, which is an important cause of osteoporosis in the elderly.

The high prevalence of osteoporosis in postmenopausal women is probably related to their short, small skeletal frame and the mainly sedentary lifestyles [14]. Additionally, in this study, QUS parameters and the T-score positively correlated with BMI. Similar findings were reported in other studies, as QUS parameters were inversely correlated with age and positively correlated with weight and BMI [15].

In contrast, other studies could not find any momentous relationship between the duration of diabetes and BMD. This incongruity may be possibly due to the non-randomized control study with small sample sizes, contrasting duration of diabetes, and different sites of measurements.

CONCLUSION: This study found that diabetic postmenopausal women patients were having a

high risk of abnormal BMD. As there is evidence that osteoporosis is a preventable disease, the screening, identification, and prevention of potential risk factors for osteoporosis in diabetic postmenopausal women patients is pivotal. It is recommended to offer a community-based health education program to intensify Osteopenia and Osteoporosis preventative behaviors. Specific healthy lifestyles propagated that could potentially prevent or control osteoporosis, like engaging in physical activity, maintaining a healthy body mass, minimizing the use of tobacco and alcohol, and consuming appropriate nutrition. This action may contribute to healthy bones and play a role in the practical prevention of osteoporosis in diabetic postmenopausal women.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE: This study was approved before the initiation of this study; all aspects of the study protocol were approved by the Institution Human Ethical Committee (IHEC) of MRH. All subjects were provided with a written informed consent form prior to participation in this study. All personal information collected was considered confidential.

HUMAN AND ANIMAL RIGHTS: No animals were used in this research. The study involved quantitative ultrasound measurement from human subjects after obtaining written informed consent. It was conducted in compliance with the principles laid in the declaration of Helsinki in 1975 and revised in 1983.

CONSENT FOR PUBLICATION: An informed consent was obtained from the patients when they were enrolled.

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CONFLICTS OF INTEREST: Nil

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