Migration Letters

Volume: 21, No: S6 (2024), pp. 1867-1875

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Assessment Of Future Fracture Risk Among The Pre And Post-Menopausal Women Of Allahabad District With Osteopenia And Osteoporosis

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Abstract-

Osteoporosis is associated with low bone mineral density which is closely associated with compelling morbidity, mortality and socioeconomic burden. This bone disorder is responsible for over 1.5 million fractures annually and under consideration of this point, the main objective of this study was to measure the future fracture risk associated with osteoporosis among pre and post-menopausal women of Allahabad District. This study was a cross-sectional study conducted among 316 pre and post-menopausal women of Allahabad District aged between 35-65 years. This study was carried out in one specialized hospital named Yashlok Hospital, which provides advanced health services to the community and organized free BMD check-up camps regularly through P-DEXA machine for the general population of Allahabad district. All relatively healthy women aged between 30-60 years who came to the referral hospital outpatient department during the free BMD check-up camps were randomly and purposively approached to participate in the study and survey method was used for the collection of the information from the respondents. The investigation show that the prediction of future fracture risk based on fracture index shows a strong relation between fracture index score and prevalence of osteopo[1]rosis which increased the possibilities of osteoporotic fractures. found that there is a strong relationship between weight (More than 125lb) and arm assistance to stand up with the future risk of hip, vertebral and non-vertebral fractures in the pre and post-menopausal women. So, the assessment of future risk for the osteoporotic fracture is the key element to reduce the prevalence of osteoporotic fractures and associated disability and mortality.

Keywords- *Osteoporosis, Osteopenia, Osteoporotic Fractures, Menopausal Women, Bone Mineral Density.*

Introduction-

This bone disorder is a prevalent global public health problem associated with compelling morbidity, mortality and socioeconomic burden. Worldwide, women over 45 years of age, more than 200 million have osteoporosis and this is responsible for over 1.5 million fractures annually **[1].**

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All types of fractures are also associated with higher mortality rates [2]. To determine the rate of fracture in older people is the most appropriate way to compare prevalence of osteoporosis among the population. Usually osteoporosis is not a life threatening disorder, so the quantitative data from the developing country like India are still scarce. Despite increased awareness of consequences of osteoporosis and recommendations for screening and treatment, in Indian scenario, osteoporosis is still underdiagnosed and inadequately treated.

Objective-

1. To measure the future fracture risk associated with osteoporosis among pre and post-menopausal women of Allahabad District.

Method-

This study was a cross-sectional study conducted among 316 pre and post-menopausal women of Allahabad District aged between 35-65 years. This study was carried out in one specialized hospital named Yashlok Hospital, which provides advanced health services to the community and organized free BMD check-up camps regularly through P-DEXA machine for the general population of Allahabad district. All relatively healthy women aged between 30-60 years who came to the referral hospital outpatient department during the free BMD check-up camps were randomly and purposively approached to participate in the study and survey method was used for the collection of the information from the respondents. A WHO Guideline for the diagnosis of Osteoporosis was used to access the Prevalence of Osteoporosis and Osteopenia among the selected population.

Table-1 WHO Guideline (1994) for the Diagnosis of Osteoporosis [3]-

Bone mineral density value (T- Score)	**Classification**
>-1	**Normal**
-1 to -2.5	**Osteopenia**
-2.5 or lower	**Osteoporosis**

The **Fracture Index** developed by the investigators from the **Study of Osteoporotic Fracture Research Group** was used as tool to predict the future risk of hip, vertebral and non-vertebral fractures in pre and post-menopausal women. [4] This index takes into account the major established risk factors, which include age, personal history of fractures, and maternal history of hip fracture, weight, smoking, mobility and T-score for the Bone Mineral Density.

Table-2 The FRACTURE Index Questions and scoring [4]

QUESTIONS	**POINT VALUE**
1- What is your current age?	
<65 years	0
65-69 years	1
70-74 years	2
75-79 years	3
80-84 years	4
>85 years	5

2- Have you broken any bones after age? 50 Yes No/ Don't know	 1 0
3- Has your mother has a hip fracture? after age 50 Yes No/ Don't know	 1 0
4- Do you have weight125lb or less? Yes No	 1 0
5- Are you currently a smoker? Yes No	 1 0
6- Do you usually need to use your arms to assist yourself in standing up from a chair? Yes No	 2 0
7- What was your total T-score? >-1.0 Between -1.0 and -2.0 Between -2.0 and -2.5 <-2.5	 0 2 3 4

The investigators recommended that pre and post-menopausal women with a total score of 6 or greater should undergo further evaluation by their physician as they are at risk of future osteoporotic fractures. This fracture index also predicts percent future fracture risk of different sites based on the scores obtained by the respondents. The predictions of Fracture Index are as follows-

Table-3- The Prediction of Future Fracture Risk according to Fracture Index Score [4]

Fracture Index Scores Obtained	**Risk of fracture (%)**		
	Vertebral	**Non-Vertebral**	**Hip**
1-2	1.2	8.6	0.4
3-4	2.5	13.1	0.9
5	5.3	16.5	1.9
6-7	7.1	19.8	3.9
8-13	11.2	27.5	8.7

The statistical representation of the data was done with the help of statistical techniques like assessment of Chi-Square

Result and Discussion

Prevalence of Osteoporosis-Low bone mineral density is a considerable public health problem as it is leading to osteoporosis and fractures after minimal trauma is the most serious consequence of the osteoporosis. Estimates of prevalence of osteoporosis vary with the specific definition chosen but according to the definition of World Health Organization, bone mineral density being more than 2.5 standard deviations below the mean for young healthy adult women at any site, defined as osteoporosis. [3] Measuring bone mineral density is a measure

tool for the assessment of prevalence of osteoporosis as well as early identification of individual at high risk of a fracture related to osteoporosis. [5]

Table- 4- Distribution of Selected Women according to Bone Mineral Density-

S. No.	Bone Mineral Density	No. of Respondents	Percentage
1.	**T-Score (>-1) Normal**	86	27.22
2.	**T-Score (-1to-2.5) Osteopenia**	146	46.20
3.	**T-Score (≤-2.5) Osteoporosis**	84	26.58
Total		**316**	**100**

The results of the study show that among the women who were selected as respondents in this study 27.22 percent women were normal while 46.2 percent had osteopenia and 26.58 percent had osteoporosis.

The findings of our study were similar when compared with the studies related to the prevalence of osteoporosis in different countries like in Korean women (24.3 percent) aged between 40-79 years [6] while in Brazil it was 33 percent among the pre and post-menopausal women aged more than 40 years. [7]

Table-5- Distribution of Respondents in Relation with their Probability of Future Fracture Risk of Different Sites

S. No.	Fracture Index	N	%	Risk of Fracture (%)		
				Vertebral	Non-Vertebral	Hip
1.	1-2	33	10.44	1.2	8.6	0.4
2.	3-4	71	22.46	2.5	13.1	0.9
3.	5	146	46.20	5.3	16.5	1.9
4.	6-7	38	12.02	7.1	19.8	3.9
5.	8-13	28	8.86	11.2	27.5	8.7

The data regarding future fracture risk among the respondents on the basis of fracture index obtained were depicted in the Table-5. The observation shows that maximum women (46.20 percent) has 5 score in fracture index which will comprise an estimate 5.3 percent risk of future vertebral fractures among them followed by16.5 percent risk of non-vertebral fracture and 1.9 percent risk of hip fractures while the highest risk of future fractures of vertebral (11.2 percent), non-vertebral (27.5 percent) and hip (8.7 percent) was recorded among the group of women who obtained future index score between 8 to 13. Among the group of women who had fracture index score 3 to 4, the future risk of vertebral, non-vertebral and hip fracture was recorded as 2.5 percent, 13.1 percent and 0.9 percent respectively while the risk of future fracture of vertebral, non-vertebral and hip was recorded as 1.2 percent, 8.6 percent and 0.4 percent respectively among the women and they had fracture index score between 1 to 2.

Results from the **National Osteoporosis Risk Assessment (NORA)** reported that osteoporosis was associated with a fracture Rate approximately four times that of normal BMD and osteopenia was associated with a 1.8 fold higher rate. Although no symptoms occur prior to

fracture, BMD and other risk factors can be used to identify high risk patients. Due to the magnitude of the morbidity and mortality associated with untreated osteoporosis, it is essential that high risk individuals be identified so that they can receive appropriate evaluation and treatment**.** [4] Assessment of future fracture risk related with osteoporosis with the help of Fracture Index Tool based on combination of questions as well as ultrasonic measurement of BMD is the major milestone towards helping health professionals worldwide to improve identification of patients at high risk of fracture**.** [8] The observations of this study should be taken into consideration while formulating public health policies for prevention and early stage treatment strategies for this disease and resource allocation, thereby minimizing the direct and indirect costs associated with osteoporotic fractures.

Fracture Index Score: Distribution with Prevalence of Osteoporosis- Low bone mineral density may lead to osteoporosis and fragility fractures are the most serious consequences of osteoporosis. A risk assessment tool for osteoporotic fractures at different site such as vertebral, non-vertebral and hip can be effective in a resource poor country like India which combines the different questions and ultrasonic screening of BMD. The obtained score in the Fracture Index can be effective in the assessment of prevalence of low bone mineral density and osteoporosis**.** [9]

Table-6 Distribution of Fracture Index Score of the Respondents in Relation with Prevalence of Osteoporosis -

S. No.	Fracture Index Score	Osteopenic		Osteoporotic		Normal		Total	
		N	%	N	%	n	%	N	%
1.	1-2	8	5.47	4	4.76	21	24.41	33	10.44
2.	3-4	12	8.21	7	8.3	52	60.46	71	22.46
3.	5	86	58.90	53	63.01	7	8.13	146	46.20
4.	6-7	21	14.38	12	14.28	5	5.81	38	12.02
5.	8-13	19	13.01	8	9.52	1	1.16	28	8.86
Total		**146**	**100**	**84**	**100**	**86**	**100**	**316**	**100**
χ (cal) = 147.72 **χ(tab)= 15.5** **d.f. = 8**				**S*** **(At 5% level of Significance)** ***Significant**					

The data regarding prevalence of osteoporosis according to Fracture Index Score of the respondents were assessed and gathered in Table-6. The data shows that highest prevalence of osteoporosis (63.09 percent) and osteopenia (58.9 percent) was observed among the women who had 5 point Fracture Index Score and may be due to the highest number of women involved in this group. The lowest prevalence of osteoporosis (4.76 percent) and Osteopenia (5.47 percent) was recorded among the group of women who had Fracture Index Score between 1 to2. The prevalence of osteoporosis and osteopenia was recorded as 8.3 percent and 8.21 percent respectively among the women who had their Fracture Index Score between 3 to 4, among the women who had Fracture Index Score between 6 to 7, the prevalence of osteoporosis and osteopenia was recorded as 14.28 percent and 14.38 percent respectively while the prevalence of osteoporosis (9.52 percent) and osteopenia (13.01 percent) were recorded among the women, who had Fracture Index Score between 8 to 13. The observations indicated that as the scores of the Fracture Index increased, the prevalence of osteoporosis also increased.
The statistical interpretation of the data shows that there is significant difference **($P \leq 0.05$)** between the data regarding prevalence of osteoporosis and Fracture Index score of the

respondents. So it is stated that Fracture Index Score was significantly linked with the prevalence of osteoporosis.
Many studies have documented a positive link between the low bone mineral density and risk of fractures at different sites as well as strong link between osteoporosis and fracture risk. Due to its high prevalence and association with mortality and disability, osteoporosis and its main consequences-fracture due to bone fragility are considered a major public health problem worldwide**.** [7]

Fracture Index Score: Distribution in Relation with Age of the Respondents- The relationship between Fracture Index Score and the age of the respondents are very strong because as the age increased, the fracture index score was also increased which predict the greater chances of future fracture risk among the pre and post-menopausal women. [10]

Table-7 Distribution of Fracture Index Score of the Respondents in Relation with their Age

S. No.	Fracture Index Score	35-44 Years		45-54 Years		55-64 years		Total	
		N	%	N	%	n	%	n	%
1.	1-2	8	7.01	11	10.19	14	14.89	33	10.44
2.	3-4	13	11.40	34	31.48	24	25.53	71	22.46
3.	5	81	71.05	42	38.88	23	24.47	146	46.20
4.	6-7	8	7.02	11	10.19	19	20.21	38	12.02
5.	8-13	4	3.52	10	9.26	14	14.9	28	8.86
Total		**146**	**100**	**84**	**100**	**86**	**100**	**316**	**100**
χ (cal) = 55.16 χ(tab)= 15.5 d.f. = 8				**S* (At 5% level of Significance) *Significant**					

The data regarding distribution of Facture Index Score of the respondent according to their age were depicted in the Table-7. The observations show that among the women aged between 35-44 years, majority of women (71.05 percent) obtained 5 score in the fracture index followed by score between 3 to 4 (11.04 percent), score between 6 to 7 (7.02 percent), score between 1 to 2 (7.01 percent) and score between 8 to 13 (3.52 percent). Among the women aged between 45-54 years, majority of women (38.88 percent) had scored 5 in fracture index while 31.48 percent women had fracture index score between 3 to 4, 9.26 percent had score between 8 to 13 and equal percentage of women (10.19 percent) had fracture index score between 1 to 2 and 6 to 7. The observations among the women belonging to the age group 55-64 years shows that majority of women (25.53 percent) scored between 3 to 4 in the fracture index followed by 24.47 percent women who scored 5 in fracture index, 20.21 percent had scores between 6 to 7, 14.9 percent had scores between 8 to 13 and 14.8 percent women had scores between 1 to 2 in fracture index which predict future fracture risk in pre and post-menopausal women.
The statistical interpretations indicate that there is significant difference **($P \leq 0.05$)** between the data regarding scores obtained by the respondents in the fracture index and age of the respondents. So it is stated that there is significant association between the scores of the fracture index obtained by the respondents and the age of the respondents. The observations indicated that majority of women (46.20 percent) had scored 5 which predict greater probability of future fracture risk among the respondents and women who had fracture index score between 6-7 and 8-13, majority of them belonged to the age group 55-65 years 20.21 percent and 14.9 percent respectively. So it was indicated that risk of future fracture risk was increased with the increased age of the women.

The relationship between age and risk of hip fractures is very strong and age was observed as a strong component of this fracture index. Among the various risk factors of the osteoporotic fracture, most of them were correlated with the age and the higher values of fracture index tend to occurs more often in older women. [4] In a similar study it was recommended that all women aged more than 65 years must have bone density measurements as they have higher score in the fracture index which predict higher risk of future fracture risk**.** [11] Based on the results of this study it is strongly recommended that women with a total fracture index score 6 or above should certainly undergo further evaluation by a physician.

Table-8 Fracture Index Score: Distribution in Relation with other variables of Fracture Index- The assessment tool, called the Fracture Index, is comprised of a set of seven variables that include age, BMD T-score, fracture after age 50 years, maternal hip fracture after age 50, weight less than or equal to 125 pounds (57 kg), smoking status, and use of arms to stand up from a chair**.** This fracture index can be used without the screening data for the Bone Mineral Density as these risk factors which were involved in this fracture index are the strong predictors of the future fracture risk among the pre and post-menopausal women. [4]

Variables	**Particulars**	**Fracture Index Score**											
		1-2		**3-4**		**5**		**6-7**		**8-13**		**Total**	
		n	**%**	**n**	**%**	**N**	**%**	**n**	**%**	**N**	**%**	**n**	**%**
History of Previous Fracture	Yes	6	1.9	4	1.3	47	14.9	20	6.3	15	4.7	92	29.11
	No	27	8.5	67	21.2	99	31.3	18	5.7	13	4.2	224	70.89
Maternal History of Fracture	Yes	4	1.3	6	1.9	34	10.8	7	2.2	4	1.3	55	17.4
	No	29	9.2	65	20.6	112	35.4	31	9.8	24	7.5	261	82.6
Weight (More than 125lb)	Yes	26	8.2	66	20.9	100	31.7	23	7.3	21	6.7	236	74.68
	No	7	2.2	5	1.61	46	14.6	15	4.8	7	2.2	80	25.3
Presence of Smoking	Yes	2	0.63	3	0.95	5	1.6	4	1.3	3	0.95	17	5.38
	No	31	9.8	68	21.5	141	44.6	34	10.8	25	7.9	299	94.6
Arm assistance for stand-up	Yes	15	4.8	64	20.3	88	27.8	21	6.7	19	6.01	207	65.5
	No	8	2.5	7	2.2	58	18.4	17	5.4	9	2.8	109	34.5

The data regarding Fracture Index Score obtained by the selected respondents and its distribution according to the different variables of the Fracture Index were gathered in this study and depicted in the Table-8. The observed data shows that 29.11 percent women had history of previous fractures and among them majority of women obtained more than 5 score in the fracture index which is a major prediction for the future fracture risk of different sites but majority of women (70.89 percent) had no history of previous fractures. Among the selected women, 17.4 percent had maternal history of fractures and among them most of women had more than 5 score in the fracture index but 82.6 percent had no history of maternal history of fracture. The presence of smoking was also not significantly associated with the future fracture risk as majority of women (94.6 percent) had no smoking status. In context with weight (more than 125lb) majority of women (74.68 percent) had positive response and among them most of the women had more than 5 score in the fracture index. Similarly majority of selected respondents used arm assistance to stand up and among them higher percentage of women had 5 or more than 5 score in the fracture index.

In the Fracture Index, a score of 5 or more than 5 is a strong prediction of future fracture risk in the pre and post-menopausal women and these predictions are based on the different variables included in the Fracture Index. In this study it was found that there is a strong relationship between weight (More than 125lb) and arm assistance to stand up with the future risk of hip, vertebral and non-vertebral fractures in the pre and post-menopausal women. In the similar studies these two variable shows a positive association between the future risk of hip fracture in postmenopausal women and fracture risk prediction from these variable can be used with or without the data regarding BMD screening of the respondents**.** **[12]**

Conclusion-

The prediction of future fracture risk based on fracture index shows a strong relation between fracture index score and prevalence of osteoporosis which increased the possibilities of osteoporotic fractures. The age has been also significantly associated with fracture index score and respondents with advanced age gained high score and among the different variables of the fracture index, there was a strong relationship between weight (More than 125lb) and arm assistance to stand up with the future risk of hip, vertebral and non-vertebral fractures in the pre and post-menopausal women.

Acknowledgement-

I want to extend my sincere gratitude to all of those with whom I have had the pleasure to work during this Research Work. Each of the members of my Dissertation Advisory Committee has provided me extensive personal and professional guidance and taught me a great deal about both scientific research and life in general.

Funding Sources-

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest-

The author(s) declares no conflict of interest.

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