Role of Bone Densitometry in Postmenopausal Osteoporosis

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Summary

A total of 75 postmenopausal women with natural or surgical menopause were studied for pattern of osteoporosis by Achilles ultrasound Bone Densitometer. Only 9.33% women were normal, 40% were in osteopenic range, 33.32% were osteoporotic and 13.33% were severely osteoporotic. Regarding nonspecific musculo skeletal symptoms, back pain was the leading symptom found in 62.20% and all the patients who were severely osteoporotic had backache. 26.68% had polyarthralgia. Round kyphosis and multiple collapse of vertebrae were present in 40% of severely osteoporotic patients.

Introduction

'Osteoporosis' implies a low quantity of bone without any obvious abnormality in its quality. As a definition osteoporosis can be said to be present in a bone or skeleton in which the amount of bony tissue per unit volume of anatomical bone falls below the lower normal limit in young adult of the same sex. Whole bone density falls with age in all human races so far studied, and in women the process starts or at least greatly accelerates at the menopause. Because young women have lower bone density than young men, because of menopausal effect and because women live longer then men, the social and medical and medical complication of osteoporosis are far more significant in women than in men and this review will therefore concentrate largely on the women. The risk of osteoporotic fracture is larger than the sum of the risk of developing breast, uterine and ovarian cancer. Since osteoporosis diagnosed after a fracture occurs is like bolting the stable after the horse has fled. So it is of great importance to diagnose the risk of osteoporosis at menopause either natural or surgical.

The awareness of osteoporosis is a major public health problem but the importance attached to osteoporotic fracture and related complication is unfortunately low. It can be said that presently in India, hardly any screening/diagnostic measures are undertaken. There have been dramatic advances in methods to diagnose osteoporosis and assess the risk of future fracture. Previously conventional X-Ray was being used as a diagnostic test which reveals bone loss more

than 30%, Singh et al (1970) introduced an index of osteoporosis as regards the changes in trabecular pattern of femur. Pogrund et al (1979) also advocated the radiological diagnosis of osteoporosis by studying X-ray of spine, pelvis and hand. Beck and Nordin (1960) attempted a histological grading of osteoporosis in standard trephine biopsy.

Among the considerable advances in bone densitometry, USG has been researched for last 15 years and is now commercially available from different sources. The basis of measurement of attenuation verses frequency, also called broadband ultrasonic attenuation 'BUA' in transmission through os calcis was established by Langton et al (1984). Later on Rossman et al (1989), proposed to measure the speed of sound in transmission through the os calcis. In this study we have done a general survey by the Achilles Ultrasound Bone Densitometer to diagnose the pattern of osteoporosis in postmenopausal women.

Aims and Objective

- To screen the postmenopausal women having either natural or surgical menopause who are at high risk to have fracture in future and require treatment in form of HRT.
- To correlate the low bone density with nonspecific musculoskeletal symptom in postmenopausal women.

Material and Methods

This study was carried out in Swaroop Rani Nehru Hospital, Allahabad in association with City Hospital and Orthopaedic Trauma Center Allahabad, stretched over a period of 6 months from Aug 98 to Feb 99. Seventy five postmenopausal patients having either natural or surgical menopause were randomly selected from outdoor and their bone marrow density was performed by Achilles Uoltrasound Bone Densitometer. The report offers us a convenient assessment of bone quality with a 'result graph' comparing the patient's stiffness results to the patient's age and plotting it with a "*" (Fig 1)

1. Stiffness

The stiffness Index relates to bone density, structure and elasticity of the bone and provides a clinically significant score with a high diagnostic sensitivity. The stiffness index for a patient is direct indicator of the fracture risk of the patient.

2. % Young Adult

The coloured bars on the results graph are used to compare the patient's stiffness result with the expected value for a 20 year old normal subject of the same sex (assumed to have stiffness of 100) and is indicative of the patient's relative fracture risk.

3. % Age matched

The black regression line compares the patient's stiffness with the expected stiffness for someone of the same age and sex. This can help to determine if the patient deviates from the normal pattern for his/her age and sex. Stiffness values that fall below the black age matched regression line may suggest factors in addition to ageing affecting the patient's bone.

4. T-Score

The T-Score demonstrates the number of intrapopulation standard deviations separating the patient's results from the reference values. A patient's fracture risk doubles for every unit decrease in T-score. T-Scores of upto – 2 may be considered 'normal'. (Fig 1)

WHO recommended diagnostic categories for BMD reading. Results (T-scores) are compared with the mean of young adults.

- Normal-A value of BMD not more than 1SD below the mean for young adult.
- Osteopenia-a value of BMD between 1 & 2.5 SD below the mean for young adults.
- Osteoporosis- a value of BMD more than 2.5 SD below the mean for young adult.
- Severe Osteoporosis- a value for BMD more than 2.5 SD below the mean for young adults in the presence of one or more fragility fracture.

Results and Discussion

Among 75 postmenopausal women having surgical or natural menopause, which are randomly selected from outdoor, 9.33% (n=7) were found to be normal, 40% (n=30) were in osteopenic range, 33.32% (n=28) were osteoporotic & 13.33% (n=10) were severely osteoporotic (Table I)

Besides fracture, osteoporosis may present itself as back pain, polyarthralgia, kyphotic deformity and loss of height. The symptoms are by themselves nonspecific and often do not draw attention of family or patients. Aging is often cited as a cause of these pains.

In our series, backpain was present in majority

Fig 1: Bone Marrow Density by Achilles Ultrasound Bone Densitometer

PATIENT ID: 00031229. A10	SCAN:	1.71	19.12.1997
NAME: SINGH, SHEELA	ANALYSIS:	1.51	19.08.1999
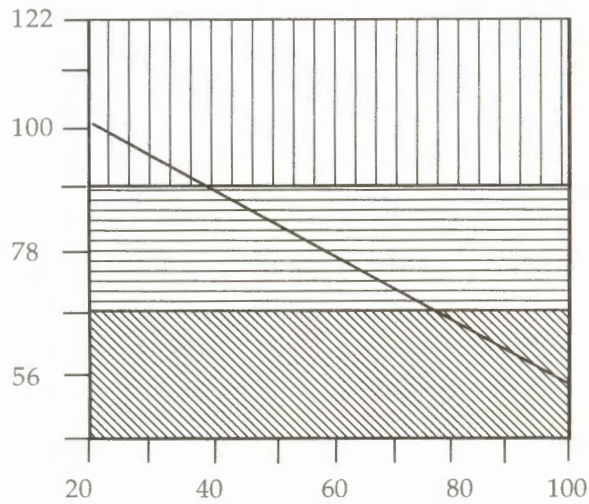
Stiffness[1]	50 ± 2
% Young Adult[2]	50 ± 2
% Age matched[3]	53 ± 2

RIGHT HEEL

Age (years)	29	Weight (kg)	43	Ethnic	A
Sex	F	Height (cm)	158	System	1002

	Stiffness[1]		
Young Adult[2]	50%	-3.81	T-score
Age Matched[3]	53%	-3.43	Z-score

Table I:-

Distribution of postmenopausal women according to Bone densitometry Index:

Patient	No. of Patients	%age	Mean Age	T-Score	Z-Score	Stiffness	Age Matched
Normal	7	9.33	43.71 ± 6.4	-0.41 ± 0.51	0.38 ± 0.90	94.42 ± 6.07	110.42 ± 11.05
Osteopenic	30	40	50.93 ± 10.91	-2.11 ± 0.51	-0.90 ± 0.48	72.40 ± 6.76	86.30 ± 6.76
Osteoporotic	28	33.32	61.35 ± 11.35	-3.53 ± 0.48	-1.90 ± 0.44	53.73 ± 3.19	68.08 ± 5.17
Severely Osteoprotic	10	13.33	58.10 ± 14.76	-4.86 ± 0.49	-3.14 ± 0.43	35.90 ± 7.43	44.5 ± 7.91

Table II:-

Distribution of postmenopausal patients according to nonspecific musculoskeletal symptoms

Symptom	Normal	Ostopenic	Osteoporotic	Severe Osteoporotic	Total No.	% age
Backache	1	16	20	10	47	62.20
Polyarthralgia		10	6	4	20	26.68
Kyphosis & Shortening of Height				4	4	5.34

of cases, 62.20% (n=47) and all the patients who are severely osteoporotic had backache, 26.68% (n=20) had polyarthralgia. Round kyphosis and multiple collapse of vertebrae were present in 40% of severely osteoporotic patients. (Table-II).

Till the last decade, osteoporosis was being diagnosed on clinical and radiological parameter by X-Ray of hands, spine and pelvis as done by Pogrund et al (1979), but more accurate and popular diagnostic criteria was of Singh et al (1970) who has classified osteoporosis in 6 groups according to trabecular pattern of proximal femur. However, this was not very accurate mode of diagnosis.

The other methods of diagnosis of osteoporosis were histopathology and histomorphometry of cancellous bones. Beck and Nordin (1960) attempted a histological grading of osteoporosis in standard trephine biopsy of iliac crest by comparing photomicrographs of these with 9 similar photomicrographs, with increasing amount of bone selected from a large control series. In this way a biopsy specimen may be given a "score" between 1 and 9, using half units as well as whole number. The authors suggested that score of 5 ½ or more should be regarded as normal and score of 5 or less as abnormal. In our series, here we advocate-

• that bone densitometry is more accurate and more sensitive then the conventional x-ray diagnosis of osteoporosis as densitometry can detect change in bone mineral density as small as 2-4% while x-ray detected changes only more than 30-40%.

• that bone densitometry is noninvasive, cost effective, quick and easy for determining the osteoporosis while hitopathology and histomorphometry was invasive, costly and time taking procedure, though accuracy was comparable to bone densitometry.

Conclusion

Bone densitometry has well established usefulness in assessing osteoporosis and the fracture risk. We conclude that this method is superior than other diagnostic measures available till date because it is precise, noninvasive, quick and cost effective. Every postmenopausal woman should undergo testing, so they can be saved from this silent crippling disease. Almost all patients with BMD in the osteoporotic range on densitometry and many of those with value in osteopenic range should be considered for HRT, calcium supplementation and vit D metabolite.

References

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