ROLE OF BONE MINERAL DENSITY MEASUREMENT BY CALCANEAL ULTRASOUND IN HIP FRACTURE

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ABSTRACT

Objective: *To find out the frequency of osteoporosis in patients with hip fracture as measured by Quantitative Ultrasound of Calcaneal Bone.*

Material and Methods: *We scanned 68 patients randomly with Sahara Clinical Bone Sonometer from Orthopedic Department of Hayatabad Medical Complex Peshawar with low energy hip fracture in male and females of age 30 and above. The study took six months from January2004 to June 2004. Two main variables in the study were the age and sex. The patients were grouped separately for either sex according to their ages and then divided into age groups as; young age (30-49 years), middle age (50-69 years) and old age (70years & above).*

Results: *Out of total sixty eight patients with fracture of the hip, 52 were female and 16 were male. Out of the 52(76.47%) female, 36(69.23%) were osteoporotic and 16(30.77%) were osteopenic. In the remaining 16(23.52%) male patients 9(56.25%) were osteoporotic and 7(43.75%) were osteopenic. Thus there is a strong association between hip fracture and osteoporosis that exists in these patients.*

Conclusion: *Most of the patients who sustain hip fracture have associated underlying osteoporosis, which if not treated can result in further fragility fractures.*

Key Words: *Hip fracture, Calcaneal ultrasound, Osteoporosis, Osteopenia.*

INTRODUCTION

Osteoporosis is a skeletal disease characterized by low bone mass and micro architectural deterioration of bone tissues leading to increased fragility of bones and subsequent risk for fracture.[1] Low bone mineral density is the most important determinant of osteoporotic or fragility fracture.[2,3] Fragility fracture is defined by the World Health Organization as "a fracture caused by injury that would be insufficient to fracture a normal bone...the result of reduced compressive and/or torsional strength of bone"[4]. Clinically, a fragility fracture may be defined as a fracture "that occurs as a result of a minimal trauma, such as a fall from a standing height or less, or no identifiable trauma"[4].

Fracture is the most serious clinical consequence of osteoporosis and can occur without any symptom. Osteoporosis commonly occurs in post menopausal and elderly women due to accelerated bone loss after menopause. Reduced mobility, endocrine diseases, chromosomal disturbances and a number of other conditions may also contribute (Table 1).[5,6] Spine, hip and wrist are the common sites for osteoporotic fractures.[7]

Every second woman and every third man over the age of 50 will eventually suffer from an osteoporosis-related fracture. The lifetime risk for an osteoporotic fracture of the hip, spine or wrist has been reported to be 40% for Caucasian women in Europe.[8,9] The risk for a hip fracture is between 11% and 18% in women.[10]

Different fractures have different consequences. Vertebral fracture can lead to significant back pain, disability, disfigurement, poor quality of life and an increased mortality rate.[11,12] Hip fractures are more worrisome, as the subsequent mortality rate is approximately 25% for those greater than 65 years of age.[13,14] In 1990, the estimated total number of these injuries in persons over the age of 50 was 1.7 million worldwide.[15] Assuming that there are no changes in the age and sex-specific incidence, the number of such fractures is estimated to reach 6.3 million

RISK FACTORS FOR OSTEOPOROSIS AND FRAGILITY FRACTURES

Risk Factors for Osteoporosis
Female gender
Increased age
Hypogonadism
White race
Low body mass index
Family history of osteoporosis
Tobacco use
History of fracture
Chronic Glucocorticoid or Anticoagulant use
Endocrinopathies
High bone turnover and micro architectural changes
Risk factors for fragility fractures
History of falls
Poor physical condition
Dementia
Impaired vision
Environmental hazards
Current use of benzodiazepines or anticonvulsants

Table 1

worldwide by 2050 and in Europe the number will double in 50 years and exceed 970 000.[15] As the cost of treating these patients will also rise, a three- to eight fold increase of the overall expenditure by the year 2030 can be expected.[16] The projected total costs are expected to be US $131.5 billion worldwide by 2050.[17]

Osteoporosis is diagnosed on assessment of bone mass and bone mineral density (BMD) that can be measured by several methods including dual-energy X-ray absorptiometry(DEXA), single-energy X-ray absorptiometry, quantitative computerized tomography, and quantitative ultrasonography of the heel (QUS).[18] Quantitative ultrasonography (QUS) is a cheap and radiation free method that assesses both the bone mass and BMD.[19] Cross-sectional and prospective studies have shown that QUS variables are as good as bone mineral density determined by DEXA in predicting hip and vertebral fracture, and provide additional information that is independent of bone mineral density.[18]

The objective of the study is to find out the frequency of Osteoporosis in patients with hip fracture as measured by Quantitative Ultrasound of Calcaneal Bone that presented in Orthopedic Department of Hayatabad Medical Complex Peshawar.

MATERIAL AND METHODS

We scanned 68 patients randomly from Orthopedic Department of Hayatabad Medical Complex Peshawar with hip fracture (male and females of age 30 and above). The study took six months started from January 2004 to June 2004. Two main variables in the study were age and sex. So patients were grouped separately for either sex according to their ages. Then they were divided into young age (30-49 years), middle age (50-69 years) and old age (70years & above).

We used Sahara Clinical Bone Sonometer (Quantitative Ultrasound) in our study to measure the calcaneal bone mineral density as stiffness index.

WHO Osteoporosis Diagnostic Classification[20]

BMD is expressed as T-scores, the number of standard deviations (SD) above or below average in young normal adults.

Normal bone mass: T-score no lower than −1. Osteopenia: T-score between −1 and −2.5. Increased risk for future osteoporosis.

Osteoporosis: T-score equal to or less than −2.5. High risk for fracture.

T Score can be measured by subtraction of the patients' measured BMD from a BMD reference range of young normal Caucasian

OSTEOPOROSIS IN HIP FRACTURE IN MALE AND FEMALE (n=45)

Age in Years	Total No of patients	Osteoporotic		
		Male	**Female**	**Total**
30-49	11	0	11(24.44%)	11(24.44%)
50-69	23	6(13.33%)	17(37.77%)	23(51.11%)
70& above	11	3(6.66%)	8(17.77%)	11(24.44%)
Total	45	9(20.0%)	36(80.0%)	45(100%)
			45(66.17%)	

Table 2

OSTEOPENIA IN HIP FRACTURE IN MALE AND FEMALE (n=23)

Age in Years	Total No of patients	Osteoporotic		
		Male	Female	Total
30-49	8	2(8.69%)	6(26.08%)	8(34.78%)
50-69	11	3(13.04%)	8(34.78%)	11(47.82%)
70& above	4	2(8.69%)	2(8.69%)	4(17.39%)
Total	23	7(30.43%)	16(69.56%)	23(100%)
		23(33.82%)		

Table 3

females in their thirties divided by SD.[18]

INCLUSION CRITERIA

In our study we included patients of age 30 and above and either sex who presented with hip fracture to Orthopedic Department of Hayatabad Medical Complex Peshawar.

EXCLUSION CRITERIA

Patients with known diseases that can lead to osteoporosis like hyperthyroidism, hyperparathyroidism, malignancy and osteomalasia were excluded from the study.

RESULTS

To make it more understandable we have divided patients into three age groups i.e. young age (30-49 years), middle age (50-69 years) and old age (70years and above). Out of the total sixty eight patients with fracture of the hip, 45(66.17%) were Osteoporotic, 23(33.82%) were Osteopenic.

Fifty two (76.47%) were females (Table No 2) and 16(23.52%) were males. (Table No 3).

Out of the 52 female, 36(69.23%) were Osteoporotic and 16(30.77%) were Osteopenic (Table No 4).

In the remaining 16 male patients, 9(56.25%) were osteoporotic and 7(43.75%) were Osteopenic (Table No 5).

The frequency of osteoporosis in young age group was 11(24.44%), in middle age group 23(51.11%) while in old age group it was 11(24.44%). The frequency of osteopenia in young age group was 8(34.78%), in middle age group 11(47.82%) and in old age group was 4(17.39%).

In young age group there were 2(8.69%) male and 6(26.08%) female, in middle age group there were 3(13.04%) males and 8(34.78%) females while in old age group there were 2(8.69%) males and 2(8.69%) females that were

OSTEOPENIA AND OSTEOPOROSIS IN HIP FRACTURE IN FEMALE   (n=52)

Age in Years	Female		
	Osteopenic	Osteoporotic	Total
30-49	6(11.54%)	11(21.15%)	17(32.69%)
50-69	8(15.38%)	17(32.69%)	25(48.07%)
70& above	2(3.84%)	8(15.38%)	10(19.23%)
Total	16(30.77%)	36(69.23%)	52

Table 4

OSTEOPENIA AND OSTEOPOROSIS IN HIP FRACTURE IN MALE   (n=16)

Age in Years	Male		
	Osteopenic	Osteoporotic	Total
30-49	2(12.5%)	0	2(12.5%)
50-69	3(18.75%)	6(37.5%)	9(56.25%)
70& above	2(12.5%)	3(18.75%)	5(31.25%)
Total	7(43.75%)	9(56.25%)	16

Table 5

osteopenic. Likewise patients who were diagnosed as osteoporotic were 11(24.44%) females in young age group, 6 (13.33%) males and 17(37.77%) females in middle age group and 3 (6.66%) males and 8 (17.77%) female in old age group. The male to female ratio of osteopenia is 1:3 and osteoporosis is 1:4 as evident from Table No 2 and 3.

DISCUSSION

BMD measurements are predictors of postmenopausal fracture risk[21] and have added value in hip fracture risk estimation[22].In our study there was a positive association of osteoporosis and osteopenia with the hip fracture caused by low energy trauma. Our study also shows all the patients were either osteopenic or osteoporotic and that the osteoporotic fractures are more frequent in middle and old age and are more frequent in females.

In a study done by Wehbe J et a[22]l in Lebanon there is a 2.45% of osteoporosis in females of young age but in our study in there is 24.44% of osteoporosis in the same age group which is five times high. Saadi HF et al[23] in United Arab Emirates has included 185 women in his study but had no osteoporotic female in young age group. This means that osteoporosis is quite frequent in young age group females. In females of middle age group there is 37.77% of osteoporosis but in Naheed et al[24] and Naganathan et al[25] studies it is 53.85% and 49.07% respectively. In females of middle age group osteoporosis is less frequent in our study as compared to other. Likewise in our study osteoporosis was 17.77% in female of old age group, while it was 40.84% in Wehbe J et al[23] study. Sadat Ali et al[26] has studied 256 postmenopausal women in Al-Khobar Saudi Arabia that has 46.70% frequency of osteoporosis. Sornay-Rendu et al[27] has recorded 158 fractures in 116 women in which 8% were normal, 48% were osteopenic, and 44% were osteoporotic. Chang KP et al[28] has studied 1055 individuals (786 women and 269 men) that had sustained at least one symptomatic osteoporotic fracture. Of these, 229 (21.7%) were hip fractures [175 (22%) in women and 54 (20%) in men].[28] Baddoura R et al[29] has studied the Estimated lifetime risk of osteoporotic fracture in men was 9.3% (CI: 6.7-11.9) and in women was 16.7% (CI: 13.4-19.9).

Despite the above fact, few patients with fractures are assessed for osteopenia and osteoporosis. A retrospective study of 300 randomly selected patients with fractures of the femoral neck was conducted by Gardner et al[30] in which he pointed out that only 58 (19.3%) had received a prescription for osteopenia at the time of their discharge. Forty of these patients (13.3% of the overall group) had been prescribed calcium but only 18 (6.0% of the overall group) had received medication to actively prevent bone resorption and to treat osteoporosis. The remaining 81% of patients were discharged without proper medication and none had a bone density scan done while in hospital.[19]

CONCLUSION

Osteoporotic fractures are more worrisome as once they occur then chances of other fractures increase. Patients admitted for treatment of low energy hip fracture are not assessed for osteopenia or osteoporosis. Patients with low energy hip fracture are only treated for fracture but not for the cause of fracture. The frequency of osteoporosis with fracture of hip in females is eighty percent in our study is enough for us to make a strategy for its treatment and prevention.

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