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Study of bone mineral density in medical faculties and students of Tezpur medical college and hospital

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ABSTRACT

Aim and Objectives of Study: To examine the prevalence of low bone mineral density among the faculties and students of Tezpur medical college and hospital
Materials and Methods: Hospital based cross-sectional study. Study will be conducted in the department of orthopaedics, Tezpur medical college and hospital for a period of 1 year. All faculties and students above 18 years attending outpatient department of orthopaedics were included in the study.
Results: Mean T-score among health staffs is -1.4. Maximum people in health staff groups are osteopenic with T-score of -1 to -2.5 comprising of 42%. Mean T-score among students is -1.2 with majority students is normal with T-score comprising of 52%. 45 patients had severe established osteoporosis. It was found that most individual in osteoporotic group had age group above 45 years.
Conclusion: Ultrasonography can predict hip fractures and vertebral fractures. People with low bone mass and fragility fractures have osteoporosis and should be treated.

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1. Introduction

Bone mineral density is measure of inorganic mineral content of bone and is one of the more informative assessment of bone quality in both clinical studies and forensic investigation. Several factors such as age, sex, disease, genetics and lifestyle affect BMD measurements. Most common disorder associated with low BMD is Osteopenia and osteoporosis and fractures risk. BMD evaluation has been used as the main clinical and preoperative screening tool for low bone mass and increased fracture risk.

Bone's composite nature gives it its unique mechanical properties. Organic matrix (mainly type I collagen) and mineral matrix (hydroxyapatite crystal embedded in the collagen fibres) are the main components of bone. Considering their contribution in terms of material properties, it has been proven that the mineral component plays a major role in bone strength, while the organic matrix is primarily responsible for its toughness and plastic deformation.[1–4]

Osteoporosis is characterized by low bone mass and micro-architectural deteriotion of bone tissue, leading to enhanced bone fragility and an increase of fracture.[5] Osteoporosis is silent, painless disease until the fragility fractures occurs. As per the world health organization, clinical criteria for the diagnosis of osteoporosis is based on bone mineral density measurement and presence of fractures.[6]

Several diagnostic methods exist for assessment of bone mineral density with dual-energy x-ray absorptiometry being most widely used method.[7,8] Non-invasive method that can be used in the assessment of BMD is an ultrasound-based bone densiometer named quantative

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ultrasound(QUS).[9–11]

Osteopenia is a condition characterized by low bone mass, but not to the extent of osteoporosis. It is often considered a precursor to osteoporosis, as it signifies a decrease in bone density. Osteoporosis, on the other hand, is a more severe condition in which the bones become weak and brittle, leading to a higher risk of fractures.

Bone mineral density (BMD) evaluation is an important tool for assessing bone health. It is typically measured using dual-energy x-ray absorptiometry (DXA), which is the most widely used method. DXA provides a T-score, which compares an individual's BMD to that of a healthy young adult. A T-score of 0 means the person's BMD is equal to the standard for a healthy young adult. A negative T-score indicates a lower BMD and a higher risk of fractures.

Various factors influence BMD measurements. Age is a significant factor, as bone density naturally decreases with age. Sex also plays a role, as women tend to have lower BMD compared to men. Other factors such as disease, genetics, and lifestyle choices can also affect BMD. Certain medical conditions, such as rheumatoid arthritis or hormonal disorders, can contribute to low BMD. Additionally, lifestyle factors like a sedentary lifestyle, smoking, excessive alcohol consumption, and a diet lacking in calcium and vitamin D can also negatively impact bone health.

Fracture risk is closely associated with BMD. Patients with low BMD, especially those with osteoporosis, are at a higher risk of fractures. This is due to the weakened and fragile nature of their bones. Fractures, particularly hip fractures, can have severe consequences for individuals, leading to decreased mobility, increased morbidity, and even mortality in some cases.

The World Health Organization (WHO) has established clinical criteria for diagnosing osteoporosis. It is primarily based on BMD measurements and the presence of fractures. BMD evaluation serves as both a clinical and preoperative screening tool to identify individuals with low bone mass and an increased risk of fractures.

In addition to DXA, another non-invasive method for assessing BMD is quantitative ultrasound (QUS). This technique utilizes ultrasound waves to measure bone density. QUS has shown promising results and is particularly useful in settings where DXA is not readily available.

In conclusion, bone mineral density is a vital parameter for evaluating bone health. It provides valuable information about an individual's bone quality and fracture risk. Early detection and intervention for low BMD can help prevent the progression to osteoporosis and reduce the risk of fractures. It is important for individuals to maintain a healthy lifestyle, including a balanced diet and regular exercise, to optimize bone health throughout their lives.

Table 1: World health organization criteria for diagnosing osteoporosis using bone densitymeansurements

Category	T score
Normal	Not more than 1.0 standard deviation (SD) below the young adult mean
Osteopenia	Between 1.0 and 2.5 SD below the young adults mean
Osteoporosis	More than 2.5 SD below the young adult mean
Severe or established osteoporosis	More than 2.5 SD below the young adults mean with a fracture

1.1. BMD test

It is an easy, reliable test that measures the density or thickness of bone. It measures the amount of mineral (calcium) in a specific area of bone. The more mineral in the bone measured, greater is the bone density or bone mass. Helps to predict the chance of fractures and effectiveness of treatment of osteoporosis. Different test can be done to measure the bone mineral density in the bones includes dual energy x-ray absorptiometry (DEXA), quantitative ultrasound, peripheral dual energy x-ray absorptiometry (P-DEXA), dual photon absorptiometry, quantative computed tomography.

2. Materials and Methods

Type of study- Hospital based cross-sectional study
Place of study- Tezpur medical college and hospital
Duration of study- 1 year

2.1. Patient's selection

Inclusion criteria-all health staffs and students attending orthopaedics OPD at Tezpur medical college and hospital with

1. Age more than >18 year
2. Either gender
3. No pathological disease

2.2. Exclusion criteria

1. H/O intake of drugs altering bone metabolism
2. Metabolic bone diseases
3. Metabolic or surgical disorder affecting vit d metabolism

Sample size – 800 people that includes health staffs and students of Tezpur medical college and hospital

2.3. Procedure

Ultrasound bone densiometer is non-ionising, relatively inexpensive, and simple to use. Moreover, since ultrasound

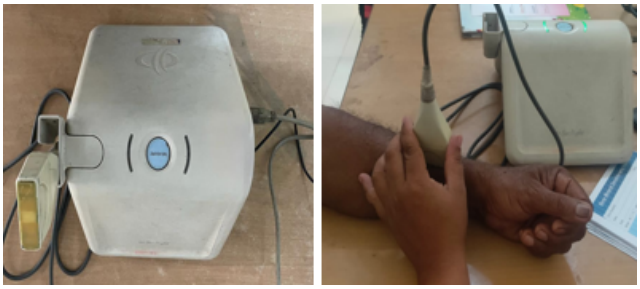

Figure 1: T-score measured using ultrasonic bone densiometer at distal radius

is a mechanical wave and interacts with a bone in a fundamentally different manner than the electromagnetic radiation, it may be able to provide additional components of bone strength, notably its trabecular architecture. The velocity of transmission and the amplitude of the ultrasound signal are influenced by the bone tissue, reflecting its density, architecture and elasticity.[12–15] It permit real time evaluation of of the BMD by computing a parameter known as net time delay(NTD). The NTD is defined is the difference between the transit time through the bone of ultrasound signal and the transit time through a hypothetical objects of equal thickness(of bone) but containing soft tissue only. The parameter is sensitive to the total amount of bone contained in the propagation path. Computer simulation of ultrasound propagation were used to study the relationship between NTD and BMD. One of the primary advantages is that it is non-invasive method, meaning there is no need for any surgical procedure or exposure to ionizing radiation. Other advantages includes site flexibility. Main clinical application of ultrasonic bone densiometer is in osteoporosis diagnosis, fracture risk assessment and to monitor the effectiveness of osteoporosis treatment.

3. Results

Table 2:

T-score	Health staffs	Students
Normal	145	210
Osteopenia	170	160
Osteoporosis	85	30

Table 3:

	Health staffs		Students	
	Male	Female	Male	Female
Normal	78	67	70	140
Osteopenia	64	106	86	74
Osteoporosis	24	61	14	16

4. Discussion

A total of 800 people were taken in the study and they were divided into two groups comprising of health staffs and students. Health staffs comprised 400 people of which 41% were male and 59% were female sex. Students comprised of 400 people of which 42% were male and 58% were of female sex. Mean age among health staffs is 48.3 years and mean age among students is 24.7 years. Each group were examined for bone mineral density using ultrasound bone densiometer in orthopaedic out-patient department in distal radius region of left hand.

Mean T-score among health staffs is -1.4. Maximum people in health staffs groups are osteopenic with T-score of -1 to -2.5 comprising of 42%. Mean T-score among students is -1.2 with majority students is normal with T-score comprising of 52%. Among health staffs 36.25% people were within the range of normal T-score of which 19.5 % were male and 17% were female sex. Among students 52.5% were in the range of normal T-score of which 17.5% were male and 35% were female. Among health staffs 42.5% were in osteopenic T-score range of which 16 % were male and 26.5% were female sex. Among students 40 % are in osteopenic T-score range of which 21.5% were male and 18.5% were female sex. Among health staffs 21.25% were in osteoporotic range of T-score of which 6% were male and 15.25% were female sex. Among students 7.5% were in osteoporotic range of which 3.5% were male and 4% were of female sex. 45 patients had severe established osteoporosis in 800 people. Among health staffs 66% were from Hindu community and 34 % were Muslim. Amon Hindu community, 27% were in normal T-score range, 27.5% were in osteopenic group and 14.25% were in osteoporotic group. Among Muslim community, 9.25% were in normal T-score range, 15% were in osteopenic and 9.5% were in osteoporotic range. Among health staffs 87.5% people consumes non-vegeterian food and 12.5% were consume vegetarian food. Health staffs consuming strict vegetarian diet constitutes higher percentage of osteopenia and osteoporosis.

Among students 70% were from Hindu community and 30% were Muslim. Amon Hindu community, 31% were in normal T-score range, 27% were in osteopenic group and 12% were in osteoporotic group. Among Muslim community, 12.5% were in normal T-score range, 10.5% were in osteopenic and 7% were in osteoporotic range. Among students 91% people consumes non-vegeterian food and 9% were consume vegetarian food. Students consuming strict vegetarian diet constitutes higher percentage of osteopenia and osteoporosis.

It was found that most individual in osteoporotic group had age group above 45 years.

5. Conclusion

Ultrasonography calculates bone stiffness as a surrogate for bone density.

Clinical studies suggest that ultrasonography can predict hip fractures [16] and vertebral fractures [17] in a similar way to bone mineral density.

Benefits of USG bone densiometer include no ionising radiation, and portability of the machine & limitations include significant manufacturer and operator differences and less specificity

Patients with low bone mass and fragility fractures have osteoporosis and should be treated.

Apparently healthy patients in the upper range of low bone mass should be reassured and monitored periodically; those in the lower range deserve consideration of pharmacologic intervention.

Scores should not be used in premenopausal women or in young men or children.

Osteopenia in Health staffs may be due to lack of sunlight exposure because of sedentary lifestyle.

All patients come to orthopaedics department should T-score because it is a latent ailments, mostly diagnosed after fracture> 45 years.

Most patients were found to be osteoporotic may be attributed because of lower socioeconomic status, unbalanched food habits and addiction towards alcohol and tobacco.

Apparently health patients in the upper range of low bone mass should be reassured and monitor periodically; those in the lower range deserve consideration of pharmacologic intervention.

6. Authors' Contributions

Prof Dr. Chinmoy Das has made substantial contributions to the concept and design, and is the main author. Dr. Feroz Pegu Dr. Ahmed Saifuddin and Dr. Washim Akram have been involved in the drafting of the manuscript and revised it critically for important intellectual content. All authors have agreed to be accountable for all aspects of the work. Dr Washim Akram is the corresponding author. All authors read and approved the final manuscript.

7. Source of Funding

No funding sources.

8. Conflict of Interest

None declared.

9. Ethical Approval

The study was approved by the Institutional Ethics Committee

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