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# Osteoporosis and Osteopenia in Pre and Post Menopausal Women – a Cross-Sectional Study

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**ABSTRACT**

*A cross-sectional study was carried out to assess the prevalence of osteoporosis and Osteopenia in pre and post menopausal women by measuring their bone mineral density. A total of 350 women were enrolled for the study, of whom 190 were pre menopausal and 160 were post menopausal. BMD was measured by Ultrasound attenuation in the calcaneus bone. T-scores were used to categorise subjects into normal, osteoporosis and Osteopenia based on WHO criteria. It was observed that, of all the subjects recruited for the study 39.4%(n=138) were osteoporotic, 49.4%(n=173) were osteopenic and only 11.2%(n=39) had normal BMD. The prevalence of osteoporosis was high(71.2%) in post menopausal women whereas Osteopenia was found to be more(72.1%) in pre menopausal women. There is a need to study the risk factors associated with high prevalence of osteoporosis in post menopausal women and take preventive measures at an early age in pre menopausal women to reduce the incidence of this metabolic bone disease and the morbidity associated with it.*

**KEYWORDS : Bone Mineral Density, Osteoporosis, Osteopenia**

## I. Introduction

Osteoporosis and Osteopenia are clinical conditions characterised by decrease in bone mass and density. Bone Mineral Density (BMD) is amount of bone per square meter. Osteoporosis is defined by World Health Organisation as a BMD that is 2 or more standard deviations below normal peak bone mass and Osteopenia is a BMD between 1.0 and 2.0 standard deviations below normal peak bone mass.[1] These are major public health problems all across the world and leads to increased susceptibility to fractures and hence morbidity and mortality in elderly population.

In adults bone resorption by osteoclasts is closely coupled with bone formation by osteoblasts to maintain a state of equilibrium until around age 30, after which bone density starts to slowly decline. At menopause bone loss is accelerated as oestrogen deficiency increases the activity of osteoclasts. Consequently, the net rate of bone resorption exceeds the rate of bone formation. Osteoporosis can affect the whole skeleton and consequently increases risk of fractures[2] most commonly causes fractures to bones in the wrist, spine and hip.

## II. Materials And Methods

A cross sectional study was conducted at several different outpatient clinics in Gulbarga. Posters were displayed in the clinics a week before the test was scheduled in order to invite maximum number of participants on the day of the examination. The procedure was explained to the participants, an informed consent was obtained. Relevant data of history and clinical examination was collected on a proforma. Patients with associated medical illness were excluded from the study.

### 2.1 Inclusion Criterion:

All female patients attending the BMD camps in the age group of more than 25 years were included in the study.

### 2.2 Exclusion Criterion:

Patients suffering from

- Rheumatoid arthritis
- Renal disorders
- Chronic liver diseases
- Diabetes mellitus

Patients on long term treatment with

- Thyroid hormones
- Steroids

2.3 **Exercise:** subjects doing 30 minute or more work against gravity like walking, climbing stairs etc. every day were considered as doing exercise.

2.4 **Body Mass Index:** The height and weight of the subjects were recorded and their BMI was measured using the formula weight in kg divided by height in meter squared.

2.5 **Bone Mineral Density:** It was measured by using the Bone Densitometer machine, which is a small portable machine that measures broadband ultrasound attenuation of beam that is passed through the heel of the patient. It measures the density of the calcaneum. The measurements were conventionally taken from right heel unless it had a fracture or any other disorder, in which case left heel was used for BMD measurement. T-scores were used to evaluate the risk of Osteoporosis and Osteopenia. WHO criteria was used to categorise the subjects. T-score greater than -1 shows normal BMD, less than -2.5 shows Osteoporosis whereas T-scores in between -1 and -2.5 shows Osteopenic condition.

## III. Results

A total of 350 subjects were recruited for the study, out of which 190 were premenopausal women and 160 were post menopausal. Out of the total 160 post-menopausal women who were included in the study, 114 (71.2%) were found to be Osteoporotic, while 36 (22.5%) were osteopenic (as per WHO Criteria) and 6.3% were found to be normal (n=10) **(Table 1)**. In the Premenopausal women who were included in the study (n=190), 12.6% were found to be Osteoporotic (n=24), 72.1% were reported to be osteopenic (n=137) and 15.3% individuals were found to be normal (n=29) **(Figure 1)**.

Overall out of 350 women, 138 (39.4%) were found osteoporotic, 173 (49.4%) were osteopenic and only 39 (11.2%) were normal **(Figure 2)**.

The mean estimated BMI was 23.8, 22.6 and 20.1 for normal, Osteopenic and Osteoporostic group respectively **(Table 2)**. Only 147 (42%) women from both groups included did any physical exercise whereas the remaining 58% women (n=203) did not perform any exercise.

## IV. Discussion

Healthy bone is in a constant state of remodelling, with repeated cycles of bone resorption followed by deposition of new bone, without overall loss of bone. This constant turnover is done by the bone re-

modelling units which combine the sequential action of osteoclasts, which resorb bone leaving a lacuna or cavity, and the subsequent action of osteoblasts which secrete osteoid which is eventually mineralized into new bone.[3]

Bone is a major reservoir for calcium, and in various physiologic and pathologic situations, bone mass may be sacrificed to satisfy intra and extra cellular calcium needs. Osteoporosis is essentially caused by failure to maintain this physiologic balance.

**Pathogenesis:** Three major pathogenetic mechanisms for low bone mass include [4]

1. Failure to achieve optimal peak bone mass – it is influenced by genetics, lifestyle, calcium intake and physical activity during skeletal growth.

2. Increased bone resorption – estrogen deficiency is a major factor in women, especially after menopause. Calcium and vitamin D deficiency also contribute.

3. Inadequate bone formation – due to complete loss of bone by excessive resorption, so that there is no template on which to form new bone.

*"Primary osteoporosis"* is the condition in postmenopausal women and older men in whom no specific pathogenetic mechanisms other than estrogen deficiency, calcium deficiency, and age can be identified. *"Secondary osteoporosis"* is the condition where specific pathogenetic mechanism can be identified for osteoporosis.

**Risk factors for osteoporosis:**
Primary osteoporosis

- Female gender
- Increased age
- Family history
- Estrogen deficiency
- Low BMI
- Smoking

Secondary osteoporosis

- Alcoholism
- Anorexia
- Malabsorption
- Hypogonadal states
- Hyper thyroidism/parathyroidism
- Glucocorticoid therapy

**Clinical Manifestations:**
Pain is the most common symptom. The axial skeleton is most commonly involved area in bone fractures frequently at mid thoracic, lower thoracic and lumbar vertebrae. Femoral neck fracture, colles' fracture etc. are also common. Osteoporotic fractures are sudden in onset and may be caused by a fall, sudden movement, lifting, jumping etc. Examination demonstrates tenderness to palpation over area of fracture, spinal deformity, loss of height and development of a lax abdominal musculature with a protuberant abdomen. Progressive anterior vertebral compression produces an exaggerated kyphosis of the thoracic spine, which leads to a characteristic deformity called a "dowager's hump".

**Diagnosis:**
1. Biochemical markers. The markers of bone formation in serum include Bone specific alkaline phosphatise and Osteocalcin. The marker of bone resorption include urinary Deoxypyridinoline.3 The degree of elevation of these marker reflect the extent of severity of the abnormal bone turnover.

2. Radiography – reveals only a semiquantitative assessment of bone mass

3. Single photon densitometry – usually done in distal radius

4. Dual photon absorptiometry – uses photon energy from gadolinium source, allows distinction between mineral content of bone and soft tissues.

5. Quantitative computed tomography – most expensive method, in forearm and vertebrae, distinguishes trabecular bone from cortical bone mass.

6. Dual energy x-ray absorptiometry (DEXA) still remains the gold standard for the measurement of BMD.

DEXA has been widely replaced by Quantitative Ultrasonography (QUS) because of low cost, portability and no ionizing exposure to the patients. If an ultrasound scan suspects reduced bone density, then the patient is advised to get a DEXA scan performed. To diagnose Osteoporosis, calcaneal QUS was used in current study, this technique is a reliable and cost effective method [5]

**Goals for prevention and treatment:**
✓ Education of patients about the disease and its long-term consequences

✓ Maximise peak bone mass by healthy dietary habits- increase calcium intake

✓ Lifestyle modification – physical exercises, no tobacco intake in any form

✓ Prevent age-related and secondary causes of bone loss – HRT in post menopausal women

✓ Prevention of fractures

✓ Decrease in morbidity and mortality.

Conner et al observed the influence of ethnicity on BMD and fractures and showed consistent ethnic differences in BMD such that blacks had the highest and Asians had the lowest BMD at all age groups [6]

**Conclusion**
The present study shows that the frequency of Osteoporosis increases with increasing age. It also shows a high prevalence of Osteoporosis in postmenopausal women and alarmingly high prevalence of Osteopenia in Premenopausal women. Osteoporosis and low bone mass are major health problems in India[7,8] which are responsible for an increased risk of fractures. Fractures, such as hip fracture, are of greatest public health concern because the consequences are often devastating and are cause of immobility and increased risk of death.

High BMI has been shown to have a protective effect on BMD. Although an increased weight may have a positive impact on BMD, yet it also increases the risk of heart disease, diabetes, hypertension and stroke. Considering these factors, the healthiest approach to protecting bones is not through weight gain but through other healthier approaches, like exercise and a healthy diet.

**Table 1: BMD in pre and post menopausal women.**

| BMD | Normal | Osteopenia | Osteoporosis | Total |
|---|---|---|---|---|
| Pre-menopausal | 29 (15.3%) | 137(72.1%) | 24 (12.6%) | 190 (100%) |
| Post-menopausal | 10 (6.3%) | 36 (22.5%) | 114 (71.2%) | 160 (100%) |

| | | | | |
|---|---|---|---|---|
| Total | 39 (11.2%) | 173 (49.4%) | 138 (39.4%) | 350 (100%) |

**Table 2: Mean values of Variables.**

| Variables | Normal | Osteopenia | Osteoporosis |
|---|---|---|---|
| Age (yrs) | 30.06 | 38.96 | 56.81 |
| T-Score | -0.63 | -1.98 | -2.89 |
| BMI | 23.8 | 22.6 | 20.1 |

**Figure 1: BMD in pre and post menopausal women**

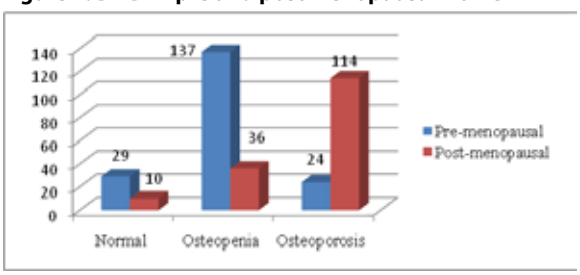
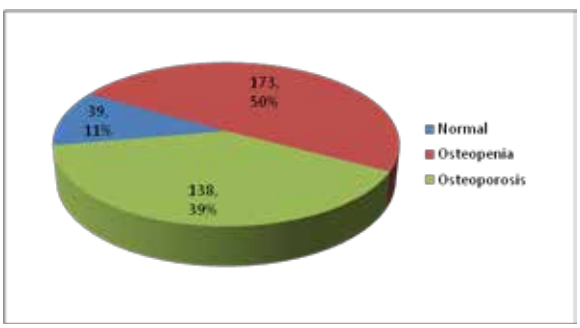



**Figure 2: BMD in all the study population.**





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