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"CLINICO-RADIOLOGICAL EVALUATION OF POSTMENOPAUSAL WOMEN FOR OSTEOPOROSIS IN A TERTIARY CARE HOSPITAL OF WESTERN MAHARASHTRA."

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Abstract
Introduction: Menopause is a natural transition marked by hormonal changes, leading to various health concerns, including increased osteoporosis risk. Osteoporosis weakens bones, making them susceptible to fractures, impacting mobility and independence. We studied the clinico-radiological aspects of postmenopausal women for low bone density and osteoporosis.
Methodology: The study involved 100 postmenopausal women aged 50 and above with low bone density (LBD) as confirmed by DEXA scans. Researchers categorized LBD as either osteoporosis (T-score ≤ -2.5) or osteopenia (T-score between -1.0 and -2.5). Data collection included medical history, clinical examination, and a pre-tested questionnaire.
Results: DEXA scans revealed 58% (n=58) of women had osteoporosis and 42% (n=42) had osteopenia. Age distribution differed significantly between the two groups. The percentage of osteoporosis diagnoses steadily increased with age, with the highest prevalence (over 23%) in women above 70. While there were no significant differences in menarche or menopause age, women with osteoporosis had a higher average BMI (26.57 kg/m2) compared to those with osteopenia (23.36 kg/m2). Women with osteopenia engaged in more physical activity (35.68 minutes/day) compared to the osteoporosis group (24.71 minutes/day).
Conclusion: We observed higher BMI and lower physical activity levels as potential risk factors for osteoporosis compared to osteopenia. These findings emphasize the importance of promoting weight management, exercise, and early bone density screening for better bone health management in postmenopausal women.

Key Words: Menopause, Low Bone Density (LBD), Osteoporosis, Osteopenia, DEXA Scan.

Introduction:

Menopause, the natural end of a woman's reproductive years, can usher in a rollercoaster of health changes. The most recognizable symptoms are often related to fluctuating hormones, particularly estrogen. Hot flashes, sudden sensations of intense heat radiating through the body, and night sweats, which can disrupt sleep, are common experiences. Vaginal dryness and discomfort during intimacy can also occur due to thinning tissues. [1]

Beyond these immediate symptoms, menopause can increase the risk of developing certain long-term health conditions. The decrease in estrogen puts women at greater risk for osteoporosis, a condition that weakens bones and makes them more prone to fractures. Heart disease risk, which is generally lower in women compared to men before menopause, also starts to climb. Additionally, some women may experience changes in mood, like irritability or anxiety, and difficulty sleeping. [2, 3]

However, menopause doesn't have to be a time of solely challenges. There are various treatment options available to help manage symptoms. Hormone therapy, for instance, can alleviate hot flashes and vaginal dryness. Lifestyle modifications like staying active, maintaining a healthy weight, and practicing stress-reduction techniques can also be beneficial. With open communication with a healthcare provider and exploring

available options, women can navigate menopause and thrive in this new chapter of their lives. [4,5]

One of the key concerns for bone health after menopause is osteoporosis. [6] Some of the important concepts behind osteoporosis and poor skeletal health in these age group women are:

The Estrogen Connection: Estrogen plays a vital role in regulating bone health. It helps maintain the balance between bone breakdown (resorption) and bone formation. During menopause, estrogen levels plummet. This imbalance tips the scales towards more breakdown than formation, leading to a gradual decrease in bone mineral density.[7]

Rapid Bone Loss: The most significant bone loss occurs in the initial 5-10 years following menopause. Women can lose up to 10% of their bone mass during this period, primarily affecting the spine, hips, and wrists. These areas are crucial for mobility and weight-bearing, making them especially vulnerable to fracture in osteoporosis. [8]

Increased Fracture Risk: As bone density declines, bones become weaker and more susceptible to fractures, even from minor falls or bumps. These fractures can be debilitating, causing pain, limited mobility, and even increased mortality risk. Hip fractures, for example, are a significant concern as they can lead to complications and loss of independence.[9]

Silent Threat: One of the biggest challenges with osteoporosis is the lack of noticeable symptoms in the early stages. Bone loss often happens gradually, and fractures are the first sign for many women. This highlights the importance of preventive measures like bone density scans to assess bone health before fractures occur. [10]

Risk Factors: While menopause is a major risk factor, other factors can contribute to developing osteoporosis after menopause. These are family history of osteoporosis, thin or small body frame, certain medical conditions like rheumatoid arthritis. Others are Long-term use of medications like glucocorticoids, Low calcium and vitamin D intake, Sedentary lifestyle and lack of weight-bearing exercise and Smoking and excessive alcohol consumption. [6, 7] Post Covid-19 Pandemic, the females all over world have experienced more stress and health issues in their daily routine impacting their quality of life. [11]

Prevention and Treatment can be done with Diet, to Ensure adequate calcium intake through diet or supplements and maintain good vitamin D levels, crucial for calcium absorption. Exercise, with the regular weight-bearing exercises like walking, jogging, or dancing help build and maintain bone strength. Changes in Lifestyle like quitting smoking, limiting alcohol intake, and getting enough sleep are all beneficial for bone health. Hormone Therapy with estrogen may be an option to help prevent bone loss. However, it's important to discuss the risks and benefits with a healthcare provider. Several medications are available to treat and manage osteoporosis, including bisphosphonates and denosumab. These medications work by slowing down bone breakdown or stimulating bone formation. [12, 13]

By understanding the link between menopause and osteoporosis, women can take proactive steps to safeguard their bone health. Early intervention and a focus on preventive measures can significantly reduce the risk of fractures and ensure a strong and independent life throughout their postmenopausal years. [14]

DEXA (Dual-energy X-ray Absorptiometry) scans are the gold standard for diagnosing osteoporosis in postmenopausal women. DEXA scans use two low-dose X-ray beams to measure the mineral content of the bones. This provides a value called Bone Mineral Density (BMD), which reflects the amount of mineral per square centimetre of bone. [15]

Identifying Osteoporosis and Risk: Based on the BMD score, there are three main categories:

- Normal: A healthy BMD score indicates no current osteoporosis.
- Osteopenia: BMD is lower than normal but not low enough to be classified as osteoporosis. This indicates an increased risk of developing osteoporosis in the future.
- Osteoporosis: A significantly low BMD score confirms the presence of osteoporosis.

DEXA scans typically focus on the lumbar spine and hip – areas most susceptible to osteoporosis fractures in postmenopausal women. [16]

Benefits of DEXA Scans are Early Detection as DEXA scans can identify osteoporosis before fractures occur, allowing for early intervention and treatment to prevent future breaks, monitoring Progress as DEXA scans can be used to monitor the effectiveness of osteoporosis treatment by tracking changes in BMD over time. And Relatively Painless the procedure is painless and takes about 10-15 minutes. [17]

The decision to get a DEXA scan depends on various factors, including a woman's age, medical history, and risk factors for osteoporosis. Routine Screening: The National Osteoporosis Foundation recommends that all women over 65 get a DEXA scan. Younger Women: Women under 65 with risk factors like family history, low body weight, or previous fractures might need a scan at a doctor's discretion. Monitoring Treatment: Women diagnosed with osteoporosis will need regular DEXA scans to track their response to treatment. [10, 13]

We conducted this study in a tertiary care hospital in western Maharashtra to evaluate the clinical presentation and DEXA scan results for osteoporosis of the postmenopausal women presenting to the hospital.

Methodology:

Study Participants and Methods

This study, conducted in a tertiary care hospital and a medical college in western Maharashtra, India. We focused on Postmenopausal women aged 50 and above who presented in the hospital. Detailed medical history was taken and clinical examination of the participants was done, DEXA scans were done.

Classification of the DEXA scan reports:

A T-score in a DEXA scan report is a statistical value that reflects your bone mineral density (BMD) compared to a healthy young adult (usually around 25 years old) of the same sex. It essentially tells you how much your bone density deviates from the average for young adults.

- Higher T-score (positive number): Indicates bone density that's stronger than the average young adult.
- T-score of 0: BMD is similar to the average young adult.
- Lower T-score (negative number): Indicates bone density that's weaker than the average young adult. The lower the score, the weaker the bones.

T-score and Diagnosis:

Normal bone density: A T-score of -1.0 or above is considered normal.

Osteopenia: A T-score between -1.0 and -2.5 suggests low bone density, sometimes referred to as osteopenia. This indicates an increased risk of developing osteoporosis in the future.

Osteoporosis: A T-score of -2.5 or below confirms osteoporosis, a condition where bones become weak and more prone to fractures.

Inclusion criteria:

- Postmenopausal women
- Women aged 50 years and above
- Women with low bone density (LBD) as per DEXA scan, Osteoporosis (<-2.5) and Osteopenia (-1 to -2.5).

Exclusion criteria:

- Women unwilling to participate.
- Women with history of any major medical disorder.
- Women on corrective hormonal therapy.
- Women with normal bone density (>-1)

Ethical considerations:

- All participants gave written informed consent before enrolling.
- The study employed a pre-tested, semi-structured questionnaire to gather data.
- Ethical approval was obtained from the college's ethics committee.

Sample Size Calculation:

According to a study by **N Aggarwal et al**, [18] the prevalence of low bone marrow density (BMD) was 53%. So,

p = 53% = 0.53

q = 1 - p = 1- 0.53 = 0.47

Considering, absolute error of 10%, e = 10% = 0.1, using Cochran's Formula,

Sample size = n = 4pq / e2

n = (4 x 0.53 x 0.47) / 0.1 x 0.1

n = 99.64

So, sample size taken for our study is 99.64, rounding it up to 100.

Data was gathered through a pretested questionnaire, and entered into Microsoft Excel, and analysed utilizing EpiInfo version 7.2.1. Statistical analysis involved the utilization of both Student's t-test and chi-square test to examine the data. Statistical significance was set for $p < 0.05$.

Results:

DEXA scan reports showed cases with low bone density (LBD) out of which 100 cases were included having Osteoporosis or Osteopenia. We observed that the cases with Osteoporosis as observed on DEXA scan were 58 (58%) and with Osteopenia were 42 (42%).

Table 1: Age distribution of the low bone density cases

Age Distribution	Osteopenia		Osteoporosis		Total
	Number	Percentage	Number	Percentage	
50 to 55	21	36.21%	8	19.05%	29
56 to 60	12	20.69%	7	16.67%	19
61 to 65	14	24.14%	8	19.05%	22
66 to 70	8	13.79%	9	21.43%	17
>70	3	5.17%	10	23.81%	13
Total	58	100.00%	42	100.00%	100

P = 0.035, Significant

Significant difference was seen in the age distribution of the cases with osteopenia and osteoporosis. (p = 0.035) The percentage of women diagnosed with osteoporosis increases steadily with age. Over 36% of women in the 50-55 age group have osteopenia, which indicates low bone density and a higher risk of future osteoporosis. This risk translates into a diagnosis of osteoporosis in nearly 20% of women by the 56-60 age range. The trend continues in older age groups, with the highest percentage of osteoporosis (over 23%) found in women over 70. [Table 1]

Table 2: Study variables in low bone density cases

Study Variables	Osteopenia	Osteoporosis	P value
Mean age (years)	54.25	62.38	<0.001*
Menarche Age (years)	12.36	12.54	0.25
Menopause Age (Years)	48.35	46.78	0.51
BMI (kg/m2)	23.36	26.57	<0.001*
Exercise min/day (5 days a week)	35.68	24.71	<0.001*

*Significant Difference p<0.05

The table summarizes the study variables amongst women with osteopenia and osteoporosis. The average age of women with osteoporosis (62.38 years) was significantly higher than those with osteopenia (54.25 years). There were no statistically significant differences in menarche age or menopause age between the two groups. However, women with osteoporosis had a significantly higher BMI (26.57 kg/m2) compared to those with osteopenia (23.36 kg/m2). Additionally, women with osteopenia exercised more (35.68 minutes/day) than women with osteoporosis (24.71 minutes/day), and this difference was statistically significant. [Table 2]

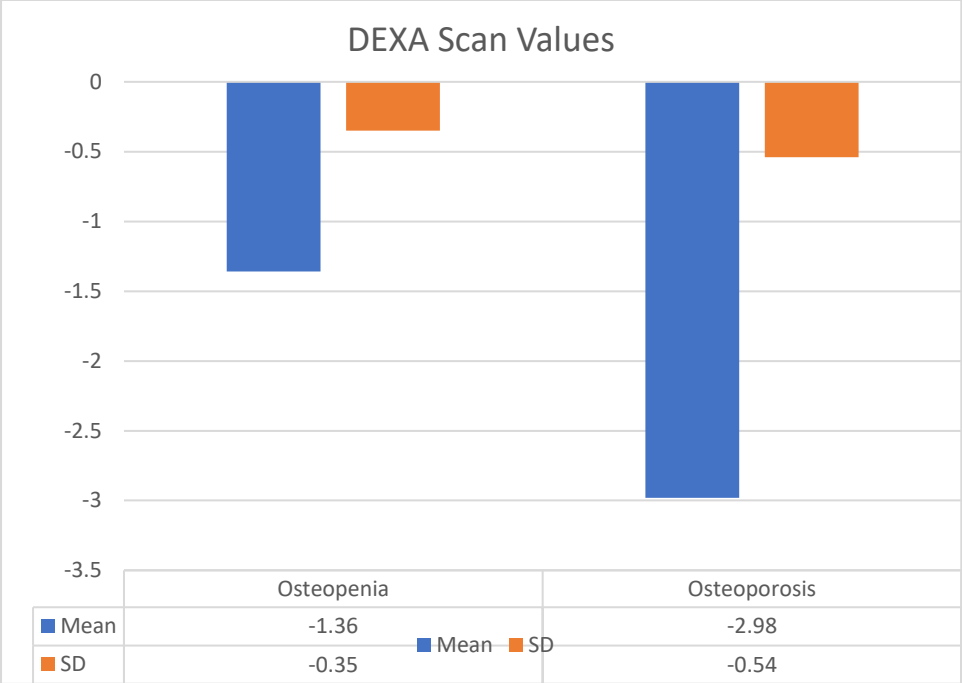

Fig 1: DEXA Scan values of the low bone density cases

The DEXA scan results further solidify the differences in bone density between osteopenia and osteoporosis. The average T-score, which compares bone density to a healthy young adult, is significantly lower in the osteoporosis group (-2.98) compared to the osteopenia group (-1.36). This confirms that women with osteoporosis have much weaker bones. While there's some variation within each group (indicated by the standard deviation), the overall trend suggests a clear distinction in bone mineral density between osteopenia and osteoporosis. [Fig 1]

Discussion:

Osteoporosis is a major public health concern for Indian women, affecting a significant portion of the population. Estimates suggest 20-46 million Indian women over 50 years old may have osteoporosis, accounting for roughly 80% of osteoporosis cases in the country.

Studies report a wide range of prevalence (8% to 62%) across different age groups, highlighting the need for further research and targeted strategies. [3, 9, 19-21]

DEXA scan reports showed cases with low bone density (LBD) out of which 100 cases were included having Osteoporosis or Osteopenia. We observed that the cases with Osteoporosis as observed on DEXA scan were 58 (58%) and with Osteopenia were 42 (42%). **N Aggarwal et al** [18] reported a similar finding with 53% cases having Osteoporosis.

In the whole adult female age group, **S Nikose et al** [22] reported a prevalence of osteoporosis in 32.13% and osteopenia in 35.78% of females in age between 20 and 76 years.

We observed a significant difference in the age distribution of the cases with osteopenia and osteoporosis. (p = 0.035) The percentage of women diagnosed with osteoporosis increases steadily with age. Our findings suggest that age, BMI, and exercise habits may be important factors in bone health. Women with osteoporosis tend to be older, have higher BMIs, and engage in less exercise compared to women with osteopenia.

S Acharya et al [23] also reported a similar finding with evidence of increasing age and higher BMI associated with osteoporosis. **S Nikose et al** [22] reported that there was a significant association between patients increasing age, poor nutritional intake, lack of exercise, low socio-economic status, and osteoporosis. These findings are similar to our study results. The DEXA scan results further solidify the differences in bone density between osteopenia and osteoporosis. The average T-score, which compares bone density to a healthy young adult, is significantly lower in the osteoporosis group (-2.98) compared to the osteopenia group (-1.36). This confirms that women with osteoporosis have much weaker bones. While there's some variation within each group (indicated by the standard deviation), the overall trend suggests a clear distinction in bone mineral density between osteopenia and osteoporosis.

DA Kumar et al [24] reported a similar finding they observed that the combined results of clavicle and femur shaft cortical thickness of cases strongly correlated with the DEXA femur T. Bone Mineral Density (BMD) measurements and it is also having strong correlation with low bone mass group. ($r = 0.87$, $P < 0.01$ and $r = 0.45$, $P < 0.01$)

M Pattnaik et al [25] also pointed out the accuracy of DEXA scans in the screening of osteoporosis both in men and women.

Conclusion:

Our study data underscores the crucial role of bone health awareness and osteoporosis prevention measures for women going through menopause and beyond. We observed the osteoporosis prevalence of 58% in low bone density cases in elderly postmenopausal women. Early intervention and consistent monitoring can significantly reduce the risk of fractures and ensure better bone health throughout the later years in these women. Women with osteoporosis tend to be older, have higher BMIs, and engage in less exercise compared to women with osteopenia. Our findings suggest that age, BMI, and exercise habits may be important factors in bone health. We recommend regular screening for low bone density via DEXA scans and following good lifestyle for all women aged 50 and above to maintain good health and better quality of life.

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