

To assess the prevalence of osteoporosis among elderly people presenting with hip fractures: An observational study

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Abstract

Introduction: Osteoporosis is a silently progressing metabolic bone disease that leads to gradual depletion of bone mass thereby making the bones fragile and increasing the tendency to fracture, even after a trivial fall. Osteoporosis is widely prevalent in India and osteoporotic fractures of hip are a common cause of morbidity and mortality in elderly Indian women and men. Vertebral compression fractures and fractures of the distal radius are two other common fractures due to osteoporosis in the elderly population. A review of the International pattern of osteoporosis reveals that “hip fractures” occur a decade earlier in Indians in comparison with the west. Old age, female sex, sedentary lifestyle, Calcium and vitamin D deficiency are common risk factors for osteoporosis. **Aim:** To assess the prevalence of Osteoporosis among elderly people presenting with hip fractures using DEXA scan of lumbar spine. **Material and Methods:** This prospective study is conducted in the Dept. of Orthopaedics, Chettinad Hospital and RI, IT Highway, Kelambakkam, Kanchipuram district, Tamilnadu. Elderly patients, presenting with newly sustained hip fracture, (Fractures of neck of femur, trochanter and sub-trochanteric region) would be selected for the study, based on the inclusion and exclusion criteria. This prospective study will be conducted for a period 24 months from October 2014 to September 2016. Patients admitted with hip fractures will undergo a DEXA SCAN of the lumbar spine, in the department of Radiology, CHRI. Patients who are found to be osteoporotic viz, T score of -2.5 or less, will then be treated with a single dose of bisphosphonate – Inj. Zoledronic acid 5mg IV infusion stat. **Results:** We are presenting the “Preliminary report” of this prospective study, assessing the Prevalence of Osteoporosis in the study group of first 52 patients, starting from October 2014 to June 2015. The Prevalence of Osteoporosis is 65.6% (34 patients out of 52). Sixteen patients (30.6%) had Osteopenia and two patients (3.8%) reported a normal dexa scan. **Conclusion:** Osteoporosis is an important risk factor for sustaining fractures of the hip in elderly people, following trivial falls. The high prevalence of osteoporosis in the study group could be due to the fact that more than 2/3 rds of the patients in the study group were females and about 50 out of 52 patients were in the age group of 61 years & above. Detection of osteoporosis at the time of admission for hip fracture and treatment with bis-phosphonate injection not only improves the bone mineral density at the time of fracture healing but also theoretically reduces the incidence of fractures of the contra-lateral hip in future. A larger sample size and a longer follow-up of the operated patients is required to substantiate the same.

Keywords: Osteoporosis, prevalence, dexa scan, hip fracture, bis-phosphonates, inj. Zoledronic acid.

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INTRODUCTION

Osteoporosis is a highly prevalent condition characterized by decrease in bone mass and microarchitectural alterations in bone which results in bone fragility and increased risk of fractures. Bone fractures, especially of the hip, vertebrae and distal radius are the most burdensome complications of osteoporosis, being associated with high risk of disability, institutionalization and mortality. However, therapeutic decision-making should be based on a comprehensive fracture risk assessment, which may be obtained through validated algorithms. According to the World Health Organization

(WHO), osteoporosis is defined as a bone mineral density (BMD) at the hip and/or the spine, at least 2.5 standard deviations below the mean peak bone mass of young healthy adults, as determined by dual-energy X-ray absorptiometry (DEXA). The prevalence of osteoporosis rises steadily with advancing age and is projected to increase substantially due to the demographic transition occurring worldwide. Osteoporosis is estimated to cause 1.5 million fractures annually in the United States. Mortality associated with osteoporotic fractures ranges from 15 to 30%, a rate similar to breast cancer and stroke. Furthermore, 50% of women with osteoporotic hip fractures develop disability, with significant impact on the capacity to live independently and, in most cases, institutionalization. The aim of this study is to assess the prevalence of Osteoporosis among elderly people presenting with fresh hip fractures, sustained due to a trivial fall, using dexa scan of the lumbar spine. Dexa scan of both the hips was not done as the presence of a fracture can increase the blood supply to the affected hip and can result in false negative reports for osteoporosis.

MATERIAL AND METHODS

This prospective study was conducted in the Department of Orthopaedics, Chettinad Hospital and Research Institute, IT Highway, Kelambakkam, Kanchipuram district, Tamilnadu. Elderly patients, presenting with newly sustained hip fracture, between October 2014 and June 2015, were selected for the study, based on the inclusion and exclusion criteria. The inclusion criteria were:

1. All Post-menopausal women, admitted with fresh fractures of the hip (fractures of neck of femur, trochanteric and sub-trochanteric region) sustained due to a trivial fall.
2. All men above the age of 50 years, admitted with fresh fractures of the hip, sustained due to a trivial fall.

The exclusion criteria were:

1. Elderly Patients presenting with fresh hip fractures, previously diagnosed with and on treatment for Osteoporosis.
2. Hip fractures due to high velocity trauma, following road traffic accidents.
3. Patients with hip fractures in association with fresh fractures of shaft of femur or tibia.

All the patients satisfying the inclusion and exclusion criteria were included in the study consecutively, hence no sampling was done. Of the 52 patients selected, there were 47 females and 5 males. 50 patients were in the age group of 61 years and above, one patient between 51 and 60 years and one patient less than 50 years. 16 patients sustained fracture neck of femur and 32 patients sustained

inter-trochanteric fracture. Three patients had a baso-trochanteric fracture and one a sub-trochanteric fracture. The fractures were right sided in 31 patients and left sided in 21 patients (Table – 1). One patient with an unstable trochanteric fracture on left side had a surgery (PFN Fixation) done earlier on the opposite hip, for similar fracture. Another patient with an unstable trochanteric fracture on right side had a cemented bi-polar hemiarthroplasty done earlier on the opposite hip for fracture neck of femur.

Statistical Analysis

The prevalence of osteoporosis would be the primary outcome measure and was documented as frequency and percentage. 95% CI of the prevalence was calculated. Age, gender and socio-demographic variables would be the explanatory variables. The differences in prevalence among different groups of explanatory variables were studied by calculating percentage differences, odds ratios and their 95% CI. Chi square test was used to assess the statistical significance and p-value < 0.05 would be taken as statistical significance. Statistical analysis was done using IBM SPSS software, version 21 and Microsoft Excel.

Table 1: Descriptive analysis of fracture related parameters:

Parameter	Frequency	Percentage
Side of fracture		
Right	31	59.6%
Left	21	40.38%
Site of fracture		
Inter-trochanteric	32	61.5%
Baso-trochanteric	3	5.8%
Sub-trochanteric	1	1.9%
Neck of femur	16	30.7%

Patients admitted with hip fractures undergo a DEXA scan of the lumbar spine, in the department of Radiology, CHRI and the bone mineral density in terms of “T” and “Z” scores are documented. The dexa scan is done using GE Lunar brodigy advance machine. In a DEXA scan, a person lies on a table while a technician aims a scanner mounted on a long arm. DEXA currently is the easiest, most standardized form of bone density testing. The DEXA scanner uses beams of very low-energy radiation to determine the density of the bone. The amount of radiation is tiny: about one-tenth of a chest X-ray. The test is painless, and considered completely safe. Patients then undergo the pre-operative workup for anaesthetic fitness prior to surgical stabilisation of hip fractures including blood tests, X-ray Chest, ECG, Echo. The blood tests included determination of blood cell count, ESR, serum calcium, serum phosphorus, alkaline phosphatase, serum creatinine, urea and protein electrophoresis in order to exclude secondary causes of osteoporosis. Thirteen patients underwent

Hemiarthroplasty, 15 patients underwent Dynamic hip screw fixation (DHS) and 20 patients underwent Proximal femoral nailing (PFN). One patient had an AFN fixation and one patient underwent osteo-synthesis in the form of a Valgus osteotomy of the hip (Table -2).

Table 2: Management of the hip fractures

Management done	Frequency	Percentage
Hemiarthroplasty	13	25.0%
DHS Fixation	15	28.8%
PFN Fixation	20	38.4%
AFN Fixation	1	1.9%
Osteosynthesis (Valgus Osteotomy)	1	1.9%
Not Operated	2	3.8%

One patient was not willing for surgery and one elderly patient expired a day before surgery due to a suspected pulmonary embolism. All the operated patients were given adequate post-operative care warranted by a hip surgery. Early ambulation with walker support under the guidance of a Physiotherapist was encouraged, to prevent the complications of recumbency. Before discharge from Hospital, patients with Osteoporosis (T score of -2.5 or less) were given a single dose of Inj. Zoledronic acid 5mg as a slow IV infusion over a period of one hour, after getting written consent from the patient and explaining the possible side effects related to the injection. Normal blood levels of urea and creatinine was ascertained before the injection, in all the patients. Patients were given Oral Paracetamol 650mg thrice daily for 3 days to control the flu-like symptoms due to the injection. Minor side effects like fever, headache and body pain were present following the injection. After discharge, patients were followed up clinico-radiologically at six weekly intervals to assess fracture union.

RESULTS

The “T” score and the “Z” score values were documented for all the patients, using the dexa scan. The W.H.O classification of BMD is given below:

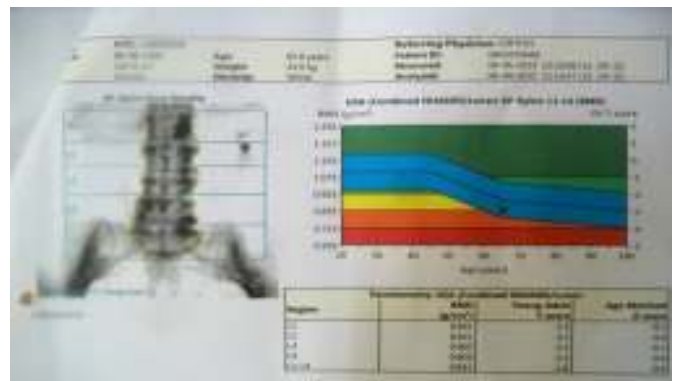
Table 3

Normal	T- score -1 or above
Osteopenia	T- score lower than -1 and greater than -2.5
Osteoporosis	T- score of -2.5 or lower
Severe Osteoporosis	T- score of -2.5 or lower and presence of At least one fragility fracture

The T-score is a comparison of a person's bone density with that of a healthy 30-year-old of the same sex. The Z-score is a comparison of a person's bone density with that of an average person of the same age and sex. A T-score of -2.5 or lower qualifies as Osteoporosis. A T-score of -1.0 to -2.4 signifies Osteopenia, meaning below-normal bone density without full osteoporosis. Multiplying the T-

score by 10% gives a rough estimate of how much bone density has been lost. Z-scores are not used to formally diagnose osteoporosis. Low Z-scores can sometimes be a clue to look for a cause of osteoporosis.

DEXA SCAN SAMPLE OF THE LUMBAR SPINE OF A PATIENT UNDER STUDY



In our study group, the prevalence of osteoporosis was found to be 65% - 34 of the 52 patients in the study group were found to be osteoporotic with a “T” score of -2.5 or less. 30% of the study population (16 of the 52 patients) had osteopenia with a “T” score between -1 and -2.4. Two patients in the study group had a normal BMD.

Table 4: Prevalence of osteoporosis in the study population T-scores

	Frequency	Percent
Osteoporosis	34	65.6
Osteopenia	16	30.6
Normal	2	3.8
Total	52	100.0

The high prevalence of osteoporosis in the study group could be due to the fact that more than 2/3 rds of the patients in the study group were females and about 50 out of 52 patients were in the age group of 61 years and above.

Table 5: Prevalence of osteoporosis in the study population (Z-scores)

	Frequency	Percent
Osteoporosis (<-2.5)	6	11.5
Osteopenia (-.2.4 to -1)	24	46.2
Normal (above -1)	22	42.3
Total	52	100.0

Two elderly female patients in our study group, admitted with fresh fractures of the hip, had sustained similar fractures of their contra-lateral hip 2-3 years ago. Both the patients were previously operated for their hip fractures. Neither osteoporosis screening nor treatment was instituted for both the patients during their previous hospitalisation. This emphasises the need for osteoporosis screening and treatment, to be initiated during the first hospitalisation for fragility fractures of the hip. (Case reports 1 and 2 given below)

Case reports

Case1: 61 yr old lady, previously operated on right side for trochanteric fracture two years ago, sustained a fresh hip fracture (trochanteric fracture) and a fracture of the distal radius on left side, due to a trivial fall. Osteoporosis screening and treatment was not done at the time of first Surgery. Present dexa Scan of the patient revealed a “T” score of -3, suggestive of severe Osteoporosis. “Osteoporosis screening and treatment at the time of initial surgery on the right hip would have definitely prevented the recent fracture of the left hip and another surgery”.



Case 2: 62 yrs. old lady had hemi-arthroplasty done for fracture neck of femur-left hip, 4 years ago. Osteoporosis screening and treatment was not done at the time of first surgery.



Same patient was admitted with a fresh intertrochanteric fracture of right hip in May 2015, following a trivial fall and underwent another surgery (PFN fixation right hip). Present dexa scan of the patient revealed a “T” score of minus 2.8, suggestive of Osteoporosis.



“Osteoporosis screening and treatment at the time of initial surgery on the left hip would have definitely prevented the recent fracture of the right hip and another surgery for the patient”.

DISCUSSION

Osteoporosis is now recognized as a major underestimated public health problem. With the gradual increase in life expectancy, advancing age -related illnesses are increasing. In addition to genetic determinants, several life-style related factors like physical activity, calcium-intake, smoking, alcohol consumption, and vitamin D status may influence the bone mass. Several risk factors have been identified for primary osteoporosis.

- Major risk factors for Primary osteoporosis⁶.
- Advancing age, Female sex
- White or Asian race
- Low body weight / body mass index
- Family history of osteoporotic fractures
- Early menopause
- Sedentary lifestyle
- Excessive alcohol (> 2 drinks per day), caffeine, and tobacco use
- Low calcium and/or vitamin D intake
- Inadequate sun exposure

Secondary osteoporosis may be the consequence of endocrine and metabolism disorders (e.g., hypogonadism, hypercortisolism, hyperparathyroidism, hyperthyroidism, anorexia, chronic steroid intake). Regardless of the etiology, in all cases of osteoporosis, an imbalance exists between bone resorption and formation: the rate of bone formation is often normal, whereas bone resorption by osteoclasts is increased. The demographics of world populations are set to change, with more elderly living in developing countries, and it has been estimated that by 2050 half of hip fractures will occur in Asia³. This study

aims at assessing the prevalence of osteoporosis in elderly patients admitted in our Institute with fresh fractures of hip, sustained due to trivial falls. Sixty five- 65% of the patients studied had osteoporosis while 30% had osteopenia and 4% had a normal BMD. The high prevalence of osteoporosis in the study group could be due to the fact that more than 2/3 rds of the patients in the study group were females and about 50 out of 52 patients in the study were in the age group of 61 years and above. A study was conducted by Department of Endocrinology, Diabetes and metabolism, Christian Medical College, Vellore, Tamil Nadu, India where in the "Prevalence of Osteoporosis in ambulatory postmenopausal women from a semi-urban region in southern India: Relationship to Calcium Nutrition and Vitamin D Status" was assessed⁴. The study cohort consisted of 150 ambulatory postmenopausal women (≤ 50 years old). Dual-energy x-ray absorptiometry for BMD was performed at the lumbar spine and femoral neck. Dietary calcium intake and biochemical variables were assessed. In their study, prevalence of osteoporosis was 48% at the lumbar spine, 16.7% at the femoral neck, and 50% at any site. The mean dietary calcium intake was much lower than the recommended intake for this age-group. There was a significant positive correlation between body mass index and BMD at the lumbar spine and the femoral neck. BMD at the femoral neck was significantly less in the vitamin D-insufficient study subjects in comparison with the vitamin D-sufficient women⁴. The prevalence of osteoporosis in their study is less (48%) compared to ours (65%) – The age group of their study population (≤ 50 years old) could explain the lower prevalence. Vitamin D deficiency coexists with low BMD in our study group. Serum 25(OH) D needs to be documented in women having low BMD. Calcium and vitamin D need to be supplemented as part of therapy in PMW⁵. Considering the cost involved, vitamin D levels was not checked routinely in our study group. Although bone mineral density (BMD) measurement is specific for detecting high-risk individuals, it misses a notable proportion of individuals who have clinical or epidemiological risk factors for osteoporotic fractures. Therefore, composite scores that rely both on BMD and on validated clinical risk factors have been developed. One such is the the Fracture risk assessment tool (FRAX) which was designed to predict the 10-year probabilities of sustaining a major osteoporotic fractures or a hip fracture. A number of risk factors such as family history of hip fracture, smoking, use of immunosuppressant drugs, hyperthyroidism, alcohol abuse, previous vertebral or femoral fracture, rheumatoid arthritis or other autoimmune diseases are taken into consideration. Individuals at high risk for fractures, as indicated by

FRAX are candidates for initiation of anti-osteoporotic treatment, regardless of BMD values². Therapeutic strategies against osteoporosis:

1. Non-pharmacologic treatment⁶
 - Physical activity
 - Prevention of falls in elderly
 - Vitamin D supplementation

Table - 5 Vitamin D supplementation dosages of vitamin D:

Baseline 25 (OH)D levels	Cumulative therapeutic dose	Daily maintenance dose
<10 ng/mL or 25 nmol/L	10,00,000	2000
10-20 ng/mL or 25-50 nmol/L	6,00,000	1000
20-30 ng/mL or 50-75 nmol/L	3,00,000	800

2. Pharmacologic treatment⁶

A relatively large number of medications is currently available. Each drug (or class of drugs) possesses specific advantages and side effects and should therefore be prescribed or avoided in selected patient populations.

- Bisphosphonates
- Hormone Replacement therapy
- Selective Oestrogen receptor modulators (SERMs)
- *Denosumab*
- *Strontium ranelate*
- *Recombinant human PTH (teriparatide)*

Bisphosphonates

Bisphosphonates are synthetic compounds with anti-resorptive activity. They act on bone through binding to hydroxyapatite and inhibiting osteoclast activation. Bisphosphonates possess high affinity for bone and little effect on other organ systems. Bisphosphonates available for the treatment of osteoporosis include alendronate, clodronate, etidronate, ibandronate, risedronate and zoledronate. The adverse effects of the drug include,

Table 7

Common	Uncommon
Gastro-intestinal Flu-like reactions	Atypical sub-trochanteric fracs Atrial fibrillation Osteonecrosis of Jaw

Recombinant human PTH

Recombinant 1-34 fragment of human PTH – rhPTH¹⁻³⁴ teriparatide – stimulates bone remodeling by inducing an increase in bone formation followed by a slower increase in bone resorption. The best candidates for teriparatide treatment are patients with pre-existing osteoporotic fractures, patients with very low BMD and those with unsatisfactory response to antiresorptive therapy. A transient increase in serum calcium levels and calcium

renal excretion without clinical manifestation has been reported. Absolute contraindications to teriparatide include primary hyperparathyroidism, Paget's disease of bone, previous radiation therapy of the skeleton and primary or metastatic bone cancer. Bis-phosphonate Zoledronic acid was used in our study in place of teriparatide because of the low cost and convenient dosing of the former (once a year for three years) when compared to the latter. Although there is good evidence for the benefit of the bisphosphonates, teriparatide and Strontium ranelate in vertebral fracture reduction, there are very limited data for non vertebral and hip fracture reduction. Strontium ranelate is the only agent to date that has demonstrated a reduction in non vertebral and hip fracture events in this high risk elderly female population¹

CONCLUSION

- Osteoporosis is widely prevalent in post-menopausal women and elderly men in India leading to fragility fractures of hip, vertebrae and distal radius, following trivial falls. It is high time to address this "Osteoporosis Epidemic" on a war footing.
- Admission in hospital for a fragility fracture provides us an opportunity to screen the patient for osteoporosis by doing a simple dEXA scan of the lumbar spine.
- DEXA scan of the hip can give false-negative reports for osteoporosis due to increased blood supply to the fractured hip.
- Zoledronic acid injection is cost-effective, safe and has a convenient dosing schedule of once a year injection.
- The National Osteoporosis Foundation recommends anti-osteoporosis treatment for: Post-menopausal women with T-scores less than -2.0, regardless of risk factors. Post-menopausal women with T-scores less than -1.5, with osteoporosis risk factors present. In addition, anyone with a fragility fracture (fracture from a minor injury) should be treated for osteoporosis. This is true regardless of the DEXA scan results.
- Fracture risk assessment (FRAX) which predicts the 10-year probabilities of sustaining a major osteoporotic fracture using the BMD and the risk factors for osteoporosis, is another valuable and a more reliable tool for initiating treatment for osteoporosis.
- Early diagnosis of osteoporosis by screening all Post-menopausal women above 50 years and men above 60 years, early identification and

correction of risk factors for osteoporosis, initiation of anti-resorptive treatment promptly, goes a long way in the prevention of "Fragility fractures".

- Administration of zoledronic acid though theoretically reduces the incidence of fractures of the contra-lateral hip in the study group in future, a larger sample size and a longer follow-up of the operated patients at least for five years is required to substantiate the same.

Limitations of the study

Small sample size and a short follow-up of only eight months. Fracture risk assessment (FRAX), which predicts the 10-year probability of sustaining a major osteoporotic fracture was not done. Other than injectable bisphosphonate (Zoledronic acid), no other anti-osteoporotic medication was used in the study.

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