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Review Article

Osteoporosis — Are we aware?

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ABSTRACT

The number of women with osteoporosis, a condition characterized with reduced bone mass and the disruption of bone architecture is on the rise in India. Deficiency of calcium and low vitamin D levels are important risk factors for the development of osteoporosis. Low sun exposure, inadequate dietary vitamin D intake, lack of food fortification with vitamin D, pigmented skin, environmental pollution, and traditional dress code further aggravate the condition. Age, gender (female), Asian origin, low BMI also act as a threat for the disorder. It is estimated that maximum bone loss occurs in women during perimenopause and menopause, indicating the prevalence of osteoporosis to increase with advancing age, resulting in a geriatric female population prone to fractures and related morbidities. For the proper management of any disorder, it is imperative that the patient should have an understanding of the disease, which begins with awareness. However, owing to societal pressures the elderly Indian female population rarely prioritizes osteoporosis as a major health issue. In the last few decades the life expectancy has increased giving rise to a larger geriatric population. It is necessary to ensure proper health status for this populace, in order to improve their quality of life which will uplift the national health benchmark. The key to effective and compliant therapy is adequate knowledge of the disorder among the target subjects. The current review highlights the prevalence, etiology and awareness of osteoporosis among Indian women.

Keywords: Osteoporosis; Indian women; Awareness

INTRODUCTION

Osteoporosis is a disorder where bones become brittle and weak. Fragility fractures are more likely to occur as a result of this and for the patients who are affected, there will be pain, suffering, impairment, and possibly death. These are some of the most serious repercussions of the disease. The number of Indian women diagnosed with osteoporosis is increasing, which is in line with their increased life expectancy.[1] The most common metabolic bone disease, postmenopausal osteoporosis, develops after ovarian activity ceases, resulting in a substantial drop in female sex hormones. Furthermore, a lack of calcium and vitamin D in the diet and subsequent vitamin D deficiency has been widely reported in the Indian subcontinent, which further contributes to adverse bone health.[2]

According to World Health Organization, Osteoporosis is defined by a value of bone mineral density (BMD), T-score of ≤ -2.5.[3] Osteoporosis is a clinically silent disease unless it is worsened by fractures,[4] necessitating rigorous observation to ensure an accurate diagnosis. Dhanwal et al. conducted a study in northern India and observed that hip fractures were expected to affect 159 out of every 100,000 women in India per year.[5] Osteoporotic fractures pose a tremendous burden on the community, in terms of loss of productivity, increased morbidity, prolonged hospital stay, and the huge costs involved in the treatment and rehabilitation of those affected.[6] A gold standard diagnostic tool for osteoporosis is Dual-energy X-ray absorptiometry (DXA) scan. However, the restricted availability of DXA only in metro cities,[4] coupled with a lack of portability and poor affordability, make it inaccessible to the vast majority of people in rural and suburban areas, which bear the brunt of this debilitating condition. It is, therefore, imperative to employ reasonably priced alternatives that will cater to the meagre resources of rural-dwelling women. As a result of inadequate calcium intake, widespread vitamin D deficiency, a lack of understanding about osteoporosis, and problems in

diagnosis of osteoporosis among Indian women are major factors that contribute to osteoporosis as a major public health concern. The present review aims to highlight the significance of awareness of osteoporosis, a slow and silent debilitating disorder in the geriatric population.

METHODOLOGY

A literature search with PubMed was performed with the terms, osteoporosis and pathophysiology, osteoporosis and prevalence, osteoporosis etiology, osteoporosis and related hormones; osteoporosis and awareness and Indian women; osteoporosis and healthcare providers. The search was conducted by two independent authors. Only English language articles of the preceding 10 years were studied. Cross-references were also referred to. This article did not keep the design of the studies under any limitation.

PATHOPHYSIOLOGY

Bone is a living tissue that constantly remodels, providing mechanical support for stature and mobility while also safeguarding essential organs.[7] Bone also serves as a calcium and phosphate storage facility. Every ten years, the skeleton renews itself through a process known as bone remodelling, in which the old bone is replaced by a new one.

Old or damaged bone is eliminated by osteoclasts and replaced by new bone generated by osteoblasts during bone remodelling. Osteoclasts, also known as bone-resorbing cells, are derived from hematopoietic stem cells (HSCs) and destroy bone by secreting acid and proteolytic enzymes, which dissolve collagen and other matrix proteins during bone resorption.[7] Through the sequential activity of transcriptional factors, osteoblasts, or bone-forming cells, develop from mesenchymal precursors through osteoprogenitor lineages and differentiate into osteocytes.

Various hormones have been found to be associated with the metabolism and structural integrity of bone. Albright, who observed a link between osteoporosis and menopause more than 50 years ago, recognised the sensitivity of bone to sex hormone shortage.[8] Observations in other states of premature oestrogen deficit, such as anorexia nervosa, secondary amenorrhoea and usage of gonadotropin inhibitors, have confirmed the hypothesis of a causative relationship between oestrogen deficiency and rapid bone loss. Oestrogens are considered to be inhibitors of bone resorption by preventing osteoclast differentiation. In-vitro evidence supports a modulating role for oestrogens on the release of inflammatory cytokines from osteoblasts and T-cells.[9]

Thyroid stimulating hormone receptor (TSHR) is expressed in both osteoclast and osteoblast precursors. Researchers have found that a 50% decrease in TSHR expression can cause osteoporosis and focal osteosclerosis in the euthyroid null mice. These data support the hypothesis of a direct effect of TSH on bone metabolism, and it is thought to directly decrease bone remodelling, acting both on osteoclast formation and survival and on osteoblast differentiation.[9] Thyrotoxicosis is also linked to bone loss due to a temporal uncoupling of bone remodelling. Glucocorticoids are known to affect bone metabolism, predominantly through osteoblasts, and the inhibition of bone formation has been proposed as a primary factor in glucocorticoid-induced osteoporosis. Glucocorticoids are capable of causing osteonecrosis or avascular necrosis as it induces osteoblast apoptosis and decreases bone blood flow and hydration. Interestingly, the adrenocorticotropic hormone (ACTH) has been shown to have protective effects against glucocorticoid induced osteonecrosis.[10] A significant effect of Parathyroid hormone (PTH) on bone metabolism triggers both bone resorption and bone formation, depending on the fact as to which cell-types are activated as also the temporal pattern of activation.

Increased vitamin D levels are reported to improve bone production by stimulating osteoblast differentiation. Vitamin D has a protective effect on bone mass; primarily acting on osteoblasts.[11] Osteoblasts express insulin-like growth factor 1 receptor (IGF1R) activation of which enhances osteoblastogenesis.[9]

With age the picture changes and a imbalance of the hormones leads to osteoporosis in both males and females. However, the loss of oestrogen in post-menopausal women tends to make them more susceptible to bone loss. A rise in TSH level has a protective role on bone mass, whereas a declineof oestrogen, testosterone, IGF1, and vitamin D and the rise of cortisol, parathyroid hormone, and FSH favour bone loss in the elderly.[9] In particular, a decrease in oestrogen serum levels and the resulting increase in FSH promote bone resorption leading to a change in bone structure and osteoporosis. A decrease in testosterone and IGF1 has a detrimental impact on bone production. The importance of hormones in bone health mandates a complete representation of an individual's hormone status to predict the possibility of osteoporosis.

PREVALENCE

While evidences on the prevalence of osteoporosis among Indian women comes from small-group studies conducted around the country, estimations imply that 20% of the 230 million Indians above 50 years of age in 2015 had the disease.[12] The prevalence of osteoporosis in Indian women of various age groups has been observed to range from 8% to 62 % since 2005.[1] A study based in Mumbai on 200 women aged 40yrs or more, showed 34% osteopenic and 8% osteoporotic.[13] In 2005, when 289 slum dwelling women of Hyderabad between 30—60 age group were screened, 52% were found to be ostopenic and 29% osteoporotic.[14] A survey carried out in Jammu in 2006 covering 158 urban women of 28—65 age group reported 36.79 % to be

osteopenic and 20.25% as osteoporotic.[15] Reports of 430 elderly women aged 60—80 years living in Delhi & rural Haryana showed osteopenia in 29% and osteoporosis in 62%.[16] In south India, a study conducted on 609 women aged 52years, alarmingly showed osteopenia in 41.1% and osteoporosis in 44%.[17] In 2010 a survey carried out in Pune on 105 women of 40 yrs and above, reported 31% to be osteopenic and 14.3% to be osteoporotic.[18] An extensive study on 808 women above 50 yrs in Delhi, revealed osteoporosis in 42.5%.[19] An interesting study carried out in Pune on 112 elderly women belonging to two socioeconomic groups, reported 12% of the 58 upper class women to have lumbar spine osteoporosis while 33% of the 54 lower class women to have the same.[1]

Studies have indicated the existence of a large population of peri- and post-menopausal Indian women who live in slums and show a high prevalence of Vitamin D deficiency and osteoporosis.[20] In another study[2] 8.99 % patients had osteoporosis and 59.55 % patients had osteopenia. In this study, the overall population at risk was approximately 69 %. Studies have reported 9 % prevalence of osteoporosis in northern India.[1] According to a research of Indian women of various ages, the prevalence of osteoporosis ranged from 8 to 62%.[18] All these points to a serious socio-burden in the future as the senior population grows. Studies by Marwaha et al.[19] and Aggarwal[21] have reported high prevalence of osteopenia in Indian women indicating the need to target this population at risk for preventing the progression to osteoporosis in future.

In another study carried out in 2014, in Central India a total of 3532 rural women aged more than 20 yrs, attending the OPD at Acharya VinobhaBhave Rural Hospital, were screened for osteoporosis, Nikose et al.[22] have reported that out of 1141 patients below the age of 30 yrs, 373 had normal Bone Mineral Density (BMD), 398 were osteopenic and 379 osteoporotic. Out of 1190 women in the age group of 31—45 yrs, 378 had normal BMD while 431 were osteopenic and 384 osteoporotic.[22] In case of 1201 patients above the age of 46 yrs, 382 had nomal BMD, 435 had osteopenia and 372 osteoporosis.[22]

ETIOLOGY

Human beings of all races are prone to osteoporosis; however, there is a greater propensity in Asian females to develop osteoporotic conditions. Various factors play a role in the aetiology of osteoporosis in Indian women. Gender, advancing age, race, and genetic variables are among the non-modifiable elements. Women also have a slimmer physique, lower calcium rich food in their diet and also have less sunlight exposure due to their socio-cultural status. Moreover during a women's lifetime there are periods of decreased exposure to estrogen, a hormone crucial for the development of bones, which in turn may contribute immensely to osteoporosis.[23] In Indian women, the age of menopause is often earlier than that seen in Caucasian women. Among the significant risk factor responsible for osteoporosis in women, many studies have reported early menopause as leading cause.[24]

Genetic factors

Literature survey have also suggested that genetic factors have a great influence on peak bone mass, which is related to a vitamin D receptor gene polymorphism (VDR).[25] Variances in VDR gene polymorphism in various races could account for differences in bone density because the VDR gene may be a predictor of bone mass. Vupputuri et al.[26] in another study, found that variation in BMD in vitamin D deficient urban Asian Indians was linked to parathyroid hormone levels and VDR gene polymorphism at the spine and forearm, and vitamin D deficiency at the hip. Moreover, polymorphisms in the oestrogen receptor alpha gene may be linked to BMD in Indian women and may impact several determinants of bone metabolism, resulting in increased bone loss.[27]

Nutritional Status

Poor nutritional status is also an important risk factor for osteoporosis. Calcium and Vitamin D, are the two major nutrients required for bone health and thus play a vital role in influencing this condition. The hardness of bone is determined by calcium, which is formed in the form of hydroxyapatite crystals in the bone matrix. Many studies have found that Indian diets fall short of the recommended dietary intake of 600 milligrams of calcium per day for adult women, who can come from both dairy and non-dairy sources.[28] Although India is a sun rich country and vitamin D synthesis requires exposure of skin to sunlight, yet Indians suffer from vitamin D deficiency.[29–31] Poor sunlight exposure due to traditional clothing, vitamin D deficient diet and skin pigmentation are some of the factors that contribute to vitamin D insufficiency in Indians.[32]

Lifestyle

Modernization, resulting in a sedentary way of existence, lesser physical activity and decreased sun exposure, are very bad for bone health. Among the urban class there is practically no walking, using of stairs or sitting on the floor for carrying out regular activities in office or at home. This lack of exercise is found to be a significant cause of lower BMD in Indian women.[21,33]

Medication

Studies have reported that use of long-term medications, such as glucocorticoids, by the elderly population, can prove to be a significant factor in the rising prevalence of osteoporosis among elderly Indians.[32]

Awareness

WHO defines osteoporosis as "a systemic skeletal disease characterised by low bone mass and micro architectural deterioration of bone tissue with a consequent increase in bone fragility and susceptibility to fractures involving the wrist, spine, hip, pelvis, ribs or humerus."

Osteoporosis is found to be more prevalent among the geriatric population especially post- menopausal women.[34] The disorder makes the bones fragile and weak—wherein a slight trauma may lead to fractures and disability. As the average life expectancy rises, the geriatric population is on the rise and with it disorders like osteoporosis are becoming epidemics. However, to tackle such health issues, it is essential to study the awareness of the disorder in the target population. On the basis of such information adequate steps, in the prevention and management of the disease can be taken.[34] Awareness of the disease will help the patient to understand the condition better, which will result in enhanced compliance and improved outcome.

Studies have indicated the dearth of awareness among Indian women about osteoporosis. A study on unmarried, educated Indian women demonstrated a low level of awareness,[35] with undergraduate students having a lower level than post graduates. Another study among female staff members of a teaching institute used the Osteoporotic Questionnaire (OPQ) to assess awareness[36] including the risk factors, treatment options and consequences. The study demonstrated that the elderly population had a better awareness. Interestingly, many subjects were found to confuse osteoporosis with arthritis.

To assess the knowledge of osteoporosis among post-menopausal women in Chandigarh, a group of workers used the Osteoporosis Health Belief Scale (OHBS).[37] The women were divided into normal, osteopenic and osteoporotic groups but across the groups knowledge about osteoporosis was very poor. In fact, the osteoporotic population was comparatively less serious regarding this problem.

The OPQ questionnaire was used to evaluate women's knowledge of osteoporosis in a Mumbai urban health centre.[38] The study population included women in the perimenopausal to postmenopausal stage and it revealed that there was a lack of knowledge about the disorder. As in other studies, most participants were unaware of the difference between Osteoporosis and Osteoarthritis.

A study[6] which assessed a female population attending a hospital in Lucknow, concluded that rural women were less informed (40% were aware) and educated women were more aware when compared to uneducated women (56.25% vs 27.78%). Very recently at a hospital in south India it was reported that less than 10% of the population of post menopausal women had good knowledge of osteoporosis.[39] However, they did not note any significant difference between illiterate and the educated populace.

Knowledge of risk factors is an important aspect of awareness as it tends to decrease the incidence of morbidities associated with the disease. The few studies which have assessed the knowledge of risk factors have reported that the population studied were unaware of them. A study[40] among nurses at a tertiary care hospital suggested that even though they were aware of certain risk factors, knowledge needs to be improved. Senthilraja et al.[39] also observed that knowledge of risk factors and the consequences of osteoporosis was poor and only a small fraction (13%) were aware that effective treatment was possible in India. Most of the studies implied that media–both print and television were the sources of information on osteoporosis.[6,38,39,41] Doctors were rarely considered to be the primary knowledge providers.

CONCLUSION

As the geriatric population grows in size and life expectancy increases— a pill to cure a disease is not the only solution. Quality of life needs to be improved so that the longer life can be lived fully and completely. Osteoporosis is a key risk factor for fractures in old age, which curbs mobility and deteriorates the quality of life. As researchers have suggested osteoporosis education should commence from the adolescent period. Awareness should be imparted regarding the disease, associated risk factors, its complications and treatment options.

Over the years the role of the pharmacist has evolved into the sphere of "pharmaceutical care' wherein he provides not only drug information but also improves therapeutic outcome through patient counselling, education, medication management and physician referrals. Researchers discovered that a pharmacist interventions that include patient counselling, education, Quantitative ultrasound (QUS), and physician contact, increased central DXA testing and calcium intake among individuals at high risk for osteoporosis when compared to "usual care" in osteoporosis management.[42] As this pharmacist intervention has improved outcomes it could be utilised to further lower the prevalence.

Are approaches that may be adopted in osteoporosis management to further lower the prevalence of the disease.

To create awareness the possible strategies could be

- Pharmacist counselling both at the clinic, bedside and community.
- Pharmacist education through workshops and seminars
- QUS measurement of high risk population during clinic visits.
- arranging health camps in the community (especially in lower income localities).
- arranging awareness camps in colleges.
- advertising in print, social and broadcast media.

These approaches offer a systematic solution to streamline the disorder and bring it under some control.

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