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Management of fragility fractures in India

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A B S T R A C T

Osteoporosis and fragility fractures have become a major healthcare challenge globally in the recent years. However, this problem has only recently been accorded its due importance in developing countries such as India. India is a model case study for the management of osteoporosis and fragility fractures in a resource-limited setting, as it harbors a large geriatric population and has the highest prevalence of osteopenia globally. It is imperative to identify the myriad factors contributing to poor bone health and understand the many hurdles encountered to tackle this healthcare problem in a developing country. Innovative methods for managing fragility fractures are commonly seen. Collaborative multidisciplinary care and structured, evidence-based management has finally found its place in India with the establishment of a regional fragility fracture network. This chapter outlines the current status of management of fragility fractures in India by focusing on the disease burden, hurdles, innovative treatment methods, and the challenges lying ahead.

Introduction

India is known for its vast healthcare system, but there remains a huge chasm between the quality of care available in rural and urban areas as well as between public and private health care. India's healthcare system possesses a multifaceted structure – with myriad types of providers engaged in practice of different systems of medicine and in facilities with different ownership structures. There is a huge

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rural–urban divide, with rural India presenting some of the most challenging environments in the world for healthcare providers. In such a scenario, a study of the management of fragility fractures in India will be a model case study for how a *difficult healthcare problem* is managed in a *difficult environment*.

With an estimated population of 1.34 billion, India is the second most populous country in the world. Whereas over half of India's population is under 25 years of age, which makes it a country with an overwhelmingly young population, the geriatric population of India is huge in terms of absolute numbers. India is projected to overtake China as the most populous country in the world by 2030, and in the next three decades, it is also set to undergo a significant demographic change, thereby leading to an increasing proportion of geriatric population with each passing decade [1].

Osteoporosis and fragility fractures are a rampant health problem in India. Some of the hard facts underlining this are as follows [2]:

- More than 61 million Indians have osteoporosis; globally, India has the highest prevalence of osteopenia.
- As compared to Western countries, osteoporotic fractures in the Indian population occur 10–12 years earlier in age [3].
- More than 4.5 million women above the age of 60 years in India have a fractured spine.
- More than 250,000 people in India sustain a hip fracture every year.
- Approximately 80% of India's urban population is deficient in Vitamin D [4].

Given the demographic trend, fragility fractures and osteoporosis are set to become a priority for India's healthcare system.

Factors contributing to osteoporosis in India

Vitamin D deficiency

Vitamin D deficiency has essentially taken the form and nature of an epidemic in India. As many as 80% of urban Indians have been found to have 25(OH)D levels below 20 ng/mL [5]. Vitamin D insufficiency during childhood can cause rickets and hence lead to diminished peak bone mass in adults, which is a precursor of osteoporosis in old age. Pregnant and lactating mothers are also found to be Vitamin D deficient, which they pass on to their neonates. Vitamin D deficiency has been documented in 80–90% of patients with hip fracture in previous studies [6]. There are several factors that contribute to the widespread prevalence of Vitamin D deficiency in Indian population. Cultural and social customs and the dark pigmented skin of Indians can lead to low sun exposure. The majority of Indians are vegetarians, while dietary sources of Vitamin D tend to be limited. In the absence of fortification of food with Vitamin D, the only possible source can be Vitamin D supplements – something that many Indians are neither aware of nor can they afford. A couple of states have recently taken a step to combat this problem by introducing vitamin D fortification of edible oil and milk, hence making it an effective means of delivering vitamin D [7].

Poor calcium intake

Most sections of the Indian population partake much lower amounts of calcium (300–500 mg/day) than the recommended daily intake. Higher salt content of the Indian diet can lead to increased urinary calcium excretion. Additionally, tea and coffee are popular beverages consumed by a large section of the Indian population. These beverages are notorious for reducing the bone mineral density and posing a greater risk of hip fracture owing to their high caffeine and low milk content [6].

Lifestyle changes

Like other Asian countries, India has also undergone a transition to a more urbanized society, which appears to have an increased prevalence of osteoporosis owing to changes in lifestyle, lack of physical

activity, increase in indoor living, and decreased sun exposure. Males are often addicted to alcohol/smoking, which can also contribute to osteoporosis.

Glucocorticoid consumption

An estimated 1% of the Indian adult population takes steroids for different reasons on a long-term basis. Steroids are an established cause of poor bone mineral density and contribute to osteoporosis in India [8].

Genetic differences

Expatriate Indians have also shown evidence of inferior bone health as compared to their Western counterparts. A study conducted in Iowa, USA, discovered that when the bone mineral density and propensity to have a hip fracture were calculated for Indian/Pakistani women who are migrants to Western countries and their American counterparts from the same geographical location, the former are at an increased risk of accelerated age-related bone loss [9]. These findings may point toward a genetic predisposition toward osteoporosis in the Indian population.

Poor level of awareness

Even in the urban population, awareness of osteoporosis is quite low, with numerous small-scale surveys indicating that only 10–15% of this group are familiar with the disease [10]. Educated people have a greater awareness as do those with a family history of the disease. Television and radio (55%) are the chief sources of information about osteoporosis, although these channels of information are not always reliable. Information obtained from family/friends, newspaper, and doctors each accounts for approximately 20%. With only 20% of information coming from doctors, there is a dire need for an increased role of doctors in patient education about osteoporosis [11].

Government apathy

Osteoporosis is still not a national health priority (NHP) in India. There is, however, a nutritional program targeting schoolchildren to be provided with vitamins and minerals including vitamin D and calcium, which can reduce the future occurrence of osteoporosis.

Management of fragility fractures

Initial hurdles

- **Lack of DEXA scans**

India has 0.26 DEXA machines for every one million people, and only a few of these machines are available at government hospitals [2]. In the private centers having DEXA facilities, the waiting time for DEXA is practically nonexistent, but only a very small proportion of the population are beneficiaries of insurance schemes or receive reimbursements. Thus, getting a DEXA done is invariably cost-prohibitive for most people in India.

- **Lack of awareness**

Delayed presentation, neglected fractures, and mismanaged fractures – are all very commonly seen in India. Information about neither the prevention nor the management of fragility fractures is easily accessible to the majority of population.

- **Quacks**

Informal providers, who lack scientific knowledge about the management of various healthcare problems, provide most primary care in India. In total, 50–80% of the population is first attended to by untrained and unlicensed healthcare providers, the so-called "quacks." The severe shortage of qualified doctors in the country, particularly in its rural parts, is responsible for this.

- **Transport facilities**

A study on fragility hip fractures in elderly patients in Bhubaneswar, India, found that the patients travel an average distance of 86.4 km for quality treatment of their fragility fracture [12]. Such distances are often spread over a difficult terrain with lack of public transport. Such difficulties to appropriate healthcare providers on considerations of distance and time can act as a deterrent for patients who already stand compromised as far as awareness about the problem is concerned.

Innovative treatments for resource-limited settings

The limited resources and primitive nature of healthcare facilities available in large parts of the country temper management of fragility fractures in India. Whereas standard worldwide treatment protocols and therapeutic strategies are routine in tertiary care hospitals, the same is practically impossible in smaller set-ups more prevalent in our country. This has promoted a search for cheaper, practically feasible, and reasonably effective treatment alternatives.

Hip fractures

Whereas an exact measure of hip fracture incidence in India is lacking because of the lack of a national registry, small-scale hospital-based studies indicate that hip fractures are also common in India. A retrospective study from Rohtak, a North Indian district, found an annual incidence rate of 121 and 163 per 100,000 per year in men and women above the age of 55 years, respectively [13]. The preponderance of hip fractures in females typically seen in Western populations is not as conspicuous in India, although this might simply be due to men being exposed to trauma more often during their professional pursuits in a patriarchal society [3,13]. In the Caucasian populace, women sustain a hip fracture twice more often than men, whereas in India, this ratio is 3:2 [13]. Additionally, it has been observed that fragility fractures of the hip occur much earlier in Indians than in their Western counterparts, with the peak age being the seventh decade [3]. As many as 34% of Indian osteoporotic, postmenopausal women who sustained a hip fracture were aged below 60 years. The 12-month mortality after hip fractures is alarmingly high – in the public hospital setting, it has been quoted at 30% [13]. Owing to the disparity in the quality of healthcare available across the country, India does not have any standardized criteria or guidelines for the management of hip fractures – and the treatment mainly varies by the hospital setting. Indian Society for Bone and Mineral Research (ISBMR) estimated that surgical management is procured for 90% or more of hip fractures in urban areas [2]. The waiting time for surgery – which, in osteoporotic hip fractures, is to be kept as short as possible – is less than a day in private hospitals but can increase up to 5 days in public hospitals where majority of patients are treated. In rural areas, the proportion of patients undergoing surgery is much less, and not much data are available to comment upon this.

A recently published mixed-methods observational study from Delhi, India, provided an insight into the manifold problem that India faces. Data were collected from healthcare providers and patients, and medical records were reviewed in three major public tertiary care hospitals in Delhi. Of the 136 patients who had a hip fracture during the recruitment period, 74 were men and 62 were women, with a mean age of 66.5 years. Only 85 of them (63%) were admitted for treatment. Importantly, 30% of these patients were operated within the first 48 h of hospital admission, whereas almost all patients (95%) were operated within 39 days of hospital admission. Two patients (3%) had expired within 30 days of injury. Multidisciplinary co-management, falls assessment at discharge, osteoporosis workup, and

addressal – all of which are the standard of care in Western countries – were not practiced in any of the hospitals that participated in the study. Only 9 patients (10%) underwent falls assessment and were prescribed anti-resorptive therapy at discharge. Critical evidence-practice gaps were identified in the care pathway for the management of geriatric population with fragility fractures of the hip in Delhi. Healthcare providers were interviewed, and their perspective on ways and recommendations to improve practices in the management of geriatric patients with hip fractures was analyzed to identify six intervention functions and five policy categories to enable the development of contextually appropriate areas for implementing best practices. Inadequate resources and patient overload prevented adequate care of patients with hip fracture, in the opinion of a majority of the healthcare providers who participated in the study. They unanimously voiced the need for protocol-based management of hip fracture in India.

Fragility hip fractures internationally continue to be treated by total hip replacements and bipolar hemi-replacement arthroplasties for intracapsular fractures and intramedullary implants such as proximal femoral nail and extramedullary implants such as the dynamic hip screw for extracapsular/intertrochanteric fractures, and the same is the case in India's urban areas and tertiary hospitals. However, approaches considered unconventional for such fractures in modern practice such as traction and external fixation are often resorted to in the resource-limited austere environments more often found in rural India. Functional outcome of Austin Moore prosthesis in older adults (above 60 years) with femoral neck fracture was satisfactory in the majority of cases with minimal morbidity and hence can be the obvious choice where it is possible [14]. Short operative times and hospital stays with external fixation have been repeatedly demonstrated in earlier studies [15,16]. External fixators can be applied under local anesthesia for many high-risk patients in whom anesthesia is unsafe or contraindicated. Although conservative treatment with traction can be considered for high-risk patients, it enforces a period of recumbency and condemns a patient to several weeks of in-bed immobilization and hospitalization nor is this feasible for a developing country setting like in India given the high bed occupancy rates [15]. Potentially fatal complications in such bed-ridden patients are deep venous thrombosis, urinary tract infections, and hospital-acquired pneumonia. As such, external fixation may be a more practical option for elderly patients with long-standing medical comorbidities, especially in a low-resource setting, as there is significantly reduced surgical trauma and minimal blood loss. The secure splintage offered by the fixator helps in early ambulation and leads to a shorter hospital stay with reduced healthcare costs. The fixator can be removed later in the outpatient department (OPD) itself.

Vertebral fractures

Vertebral osteoporotic fractures are quite common in Indians. At least one vertebral fracture was evident in 15–20% of older urban adults aged more than 50 years. In the Delhi Vertebral Osteoporosis Study (DeVOS), the lateral radiographs of more than 800 adults aged > 50 years were studied and a prevalence of radiographic vertebral fractures of 17.9% (18.8% male and 17.1% female) was found – a figure similar to that in Western populations [17]. Increasing age had a greater effect on females than on males in terms of the prevalence of vertebral osteoporotic fractures.

Most osteoporotic vertebral fractures are managed conservatively in India. Innovative means of immobilization using indigenous braces is quite common. Surgery is reserved for exceptional cases with increased vertebral body collapse (>50%), increased kyphosis (>30°), and presence of neurological compromise – all of which are rare in fragility fractures of the spine. Other treatment options such as vertebroplasty, kyphoplasty, and vesselplasty are offered to patients in tertiary care hospitals.

Other fractures

Distal radius fractures and proximal humerus fractures are the other two common fragility fractures. Both of these types, in large parts, can be managed conservatively by casting and shoulder immobilization, respectively. Conservative management of distal radius fractures is an art in itself, and trained healthcare professionals deliver better results when it comes to casting and ensuring subsequent hand therapy. Where resources are available, the gold standard of open reduction and internal fixation with modern implants is practiced in India. However, where such facilities are not available, Kirschner wires

(K wires) are effectively used to hold the displaced fracture fragments in the reduced position. Long bone fractures are treated conservatively with casts or skeletal traction where possible, but even in most resource-limited settings, closed intramedullary nailing of these fractures is readily performed. Locally available implants come with modifications to enable their use in situations where experienced assistant or C-arm is not available – this includes having a targeting arm or jig for inserting interlocking bolts and use of hand reamers, as electricity often comes at a premium [18]. Most orthopedic surgeons in developing countries such as India are sufficiently trained and oriented to rely on visual and tactile feedback and operate long bone fractures even without fluoroscopy guidance [19,20].

Fragility Fracture Network (FFN) and Fragility Fracture Liaison Services (FFLS)

FFN India

FFN India was established in March 2015 with an aim to improve management of elderly people with fragility fractures through evidence-based care in India and bring together the various specialties involved in the management of fragility fractures and profile the benefits of collaborative multidisciplinary care. The key strategic goals of FFN India are as follows:

a. Identify the orthopedic patient with risk factors and fragility fractures.
b. Inform the patient about the need for an osteoporosis evaluation.
c. Investigate whether osteoporosis is an underlying cause of the fracture.
d. Ensure that appropriate intervention is initiated.
e. Educate the patient and their family.
f. Regular follow-up and liaison services.

FFN India has identified 3 priority areas to achieve its goals: i) Research ii) Physician education, and iii) Generating public awareness.

- As a part of its research, the first step it has taken is to establish a much-needed fragility fracture registry, which in itself would provide significant information like prevalence and incidence of various fragility fractures and generate India-specific BMD standards. Projects are being finalized to look into genetic aspects of osteoporosis; newer diagnostic and prognostic modalities like bone scan. The Indian Council of Medial Research (ICMR) has already funded two currently ongoing projects on the following: i) Role of bone scan in the evaluation of osteoporosis and patients receiving alendronate and teriparatide and ii) comparison of yearly zoledronic acid Versus Weekly Alendronate in Preference, Convenience, compliance, persistence and Bone Turnover Markers in Indian Postmenopausal Osteoporotic Women. State-of-the-art equipment has been acquired and is in use in tertiary care hospitals to help in this aspect.
- Physician awareness is a prerequisite to the later goal of generating public awareness. FFN India has given a greater impetus to the orthopedic initiative and launched a dedicated registration drive to recruit more healthcare professionals on their mission. Use of the Internet and newsletters is being made to disseminate information. FFN India also aims to encourage more structured government-supported programs to provide education on a national scale and call for osteoporosis to have a greater weightage and place in undergraduate medical curriculum.
- The members of FFN India hold public talks on a large scale with the aim to generate public awareness regarding osteoporosis. Fall prevention brochures are regularly distributed in hospitals. Innovative strategies with an intention to catch the public eye are being promoted, such as SATHI (meaning a “friend”; stands for “Save The Hip”) and SSAHARA (meaning a “support”; stands for “Save the Spine And Hip And Radius in Aged”).

FFLS

Prevention of a secondary fracture has become a primary focus from a patient care and societal standpoint. There is lack of data regarding the burden of fragility fractures in India. There is no

comprehensive study wherein risk factors for the development of fragility fractures and strategies for prevention/early detection and treatment modalities have been analyzed. Bone health evaluations should be an integral part of management for fragility fractures in all patients who are aged 50 years or older. This requires establishment of a specialized Fragility Fracture Liaison Service (FFLS). The FFLS is a coordinated care model of multiple healthcare providers who ensure that the patient is directed to appropriate osteoporosis management after a fragility fracture with the aim of preventing future fractures. A FFLS is a unique team-approach to achieve recommended standards of care for fragility fractures, including bone health evaluation, evaluation of risk factors, interventions for osteoporosis, and secondary fracture prevention. The FFLS model provides a centralized source and tools for management with early identification of patients with a fragility fracture who, by definition, are at risk for a secondary fracture. The FFLS then provides a framework for investigation and initiation of appropriate treatment. This is a model of patient-centered care with examples of coordinated care and improved communication pathways between the patient and the healthcare team.

India is devoid of coordinator-based models of care, otherwise known as fracture liaison services (FLS), for the prevention of secondary fractures following a primary fragility fracture. However, since early 2016, the authors have established a thriving FFLS in their hospital and found a significant change in patient care outcomes. Before the establishment of FFLS in our institute, there was no organized system of active follow-up of postfracture patients. A retrospective analysis of patients with fragility fractures revealed a shockingly high dropout rate of >80%. After institution of FFLS, because of the coordination between the various participants/healthcare providers and the devotion of a dedicated nurse coordinator to this program, the dropout rate became <1% – a drastic improvement from our previous experience. Most of these patients, in spite of being diagnosed with a fragility fracture, did not undergo further investigations to assess bone mineral density nor were they put on anti-osteoporosis medications. The lack of coordination and communication between the different healthcare providers involved in patient management was glaring and resulted in poor patient enrolment and subsequent follow-ups. Compared with other osteoporosis management models, such as referral letters to primary care physicians or endocrinologists following fracture, the FFLS model yields higher rates of diagnosis and treatment and less attrition in the postfracture phase of care. In addition, the FFLS model is based on improved care coordination and communication about these patients, leading to success at achieving the ultimate goal of secondary fracture prevention. Such an approach will provide real-time data of fragility fractures from the largest cohort of trauma patients and opportunities for the prevention and rapid management of secondary fractures. Our experience has led us to believe that the establishment of an FFLS is the need of the hour in tertiary healthcare set-ups and will go a long way in mitigating osteoporosis and fragility fractures as a healthcare burden in developing countries.

Challenges ahead

- To establish a standardized care protocol for fragility fractures, particularly of the hip, in India and equip each district hospital with facilities to provide surgical care for such fractures
- To introduce a much-needed fragility fracture registry in India, which will act as a stepping stone for policy-making and guideline development
- To increase the public spending on healthcare and bring into place a community health insurance scheme to make healthcare more affordable
- Further collaboration of FFN India with Global FFN to enable coordination with global bodies
- To put greater emphasis on attainment of peak bone mass/childhood adolescent bone health by nutrition and lifestyle measures

Summary

India is anticipated to harbor the largest share of world's geriatric population in the coming years – with huge sections of this population having poor bone health on account of various social and cultural factors. With major hurdles such as lack of awareness, shortage of DEXA machines, and the typical resource-limited environment in rural India notwithstanding, healthcare providers have developed

unique and distinctive ways to manage fragility fractures, which can give valuable insight to surgeons globally. However, lack of data collection and fragility fracture registries remains a gaping problem in India and makes it difficult to obtain a true measure of the disease burden and current status of management. Collaborative efforts adopting a multidisciplinary approach such as FFN India and FFLS are now being encouraged and are the subject of focus in India. The authors believe that these are the keys to reduce the impact of osteoporosis and fragility fractures on India's already over-burdened healthcare system.

Practice points

- Vitamin D deficiency and poor dietary calcium intake are almost omnipresent in the Indian population and must be anticipated and addressed by treating physicians
- While there is lack of accurate data, fragility fractures of the hip and spine may be as common in the Indian population as is reported in Western literature and is likely to present at an earlier age
- While unconventional treatments have been reported with anecdotal success in resource-limited settings, early surgery, early mobilization, addressing underlying osteoporosis, and falls assessment are the standard treatment of fragility fractures of the hip
- Establishment of a collaborative multidisciplinary care model for osteoporosis and fragility fractures at the hospital level (Fragility Fracture Liaison Service) and at the national level (Fragility Fracture Network) can significantly improve patient outcomes

Research agenda

- Fragility fracture data and registries are nonexistent in India, and establishing and determining a true measure of disease burden by relevant epidemiological studies is needed
- The authors' experience has shown that following a coordinated, collaborative, multidisciplinary care-based model for fragility fracture management can yield positive results. Further research should be directed to compare treatment outcomes with conventional strategies seen in developing countries.

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Conflicts of interest

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