Fracture Risk Assessment in Postmenopausal Elderly Women of an Urban Area using Fracture Prediction Tools: A Cross-Sectional Study

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Abstract

Context: Osteoporosis is a commonplace metabolic disorder affecting millions of women worldwide. This study highlights the prevalence of various risk factors associated with the development of osteoporosis in postmenopausal women in the Indian population and the determination of risk of fractures in the same using questionnaire-based tools. Aims: The aim of the study is to estimate the prevalence of risk factors for fractures and determine the 10-year probability of developing major osteoporotic fracture and major hip fractures using QFracture score and Garvan Fracture risk calculator in postmenopausal women. Settings and Design: This was a cross-sectional analytical study. Subjects and Methods: A total of 384 patients were evaluated to estimate the prevalence of risk factors for fractures and the 10-year probability of developing major osteoporotic fracture and major hip fractures along with comparison of clinical risk factors between patients with history of prior falls and patients without history of prior falls using the QFracture score and Garvan Fracture risk calculator. Statistical Analysis Used: Mann–Whitney U-test for estimating the overall 10-year risk of developing major osteoporotic and hip fractures using the two scoring systems. Results: The age range of our study population was 50–86 years, while the mean age was 59.86 ± 8.86 years. The most prevalent risk factor for osteoporotic fractures in our study was diabetes mellitus (n = 98 [25.5%]), and the least prevalent risk factor was chronic kidney disease (n = 4 [1.04%]). We also estimated the overall 10-year risk of developing major osteoporotic and hip fractures in two groups: Group 1 (with a history of falls) and Group 2 (without any history of falls). Conclusion: QFracture score and Garvan tool are easily administrable, internationally validated questionnaires which provide definitive information related to risk factors for development of osteoporosis.

Keywords: Fracture, osteoporosis, postmenopausal women, risk

Introduction

Postmenopausal osteoporosis is a familiar disease with a spectrum ranging from asymptomatic bone loss to incapacitating hip fractures. The National Institutes of Health consensus conference has defined osteoporosis as a disease of increased skeletal fragility accompanied by low bone mineral density (BMD) (a T score for BMD below −2.5) and microarchitectural weakening.[1] Fractures occur because of qualitative and quantitative deterioration in the trabecular and cortical skeleton. Low bone mass at any skeletal site is linked with a substantially increased risk of fracture. Other risk factors include low body weight, advancing age, maternal history of osteoporosis, the direction of a fall, and most importantly, the existence of a prior fracture.[2] Bone quality cannot be evaluated clinically, but BMD can be calculated by several techniques, of which dual-energy X-ray absorptiometry (DEXA) is at present the most validated[3] but not easily accessible in slums or far-flung areas.

The QFracture algorithm is a well-validated tool, which was built by Julia Hippisley-Cox and Carol Coupland for the Fracture Risk Assessment in Postmenopausal Elderly Women of an Urban Area using Fracture Prediction Tools: A cross-sectional study. J Mar Med Soc 2020;22:25-9.
United Kingdom population and merged for evaluating risks of fragility fractures in the NICE guidelines. Risk factors included in QFracture score were selected carefully to limit their complexity and number, to include only well-recognized, independent contributors to fracture risk and for ease of input. The latest update of this tool is available as open access online at http://QFracture.org as QFracture 2016 risk calculator.

The Garvan Fracture Risk Calculator was developed using data collected in the internationally renowned Dubbo Osteoporosis Epidemiology Study conducted by the Bone Biology Division of the Garvan Institute of Medical Research. Risk factors considered in this assessment tool included age, gender, number of fractures since age 50 years, and number of falls in the past year. The tool is available for free at https://www.garvan.org.au/promotions/bone-fracture-risk/calculator/index.php.

It is estimated that a 50-year-old White woman has a 50% risk of any osteoporotic fracture and a 15%–20% lifetime risk of hip fractures. During a 12-year study period conducted using the Nationwide Inpatient Sample, formed by the US Agency for Healthcare Research and Quality, there were 4.9 million hospital admissions for osteoporotic fractures alone. In harmony with the aging of the global population, in India, according to United Nations Population Division, the share of 65 years and older is expected to increase from 5% to 14%, while the share in the oldest age group (80 years and older) will triple from 1% to 3%. Agreement that osteoporosis is a disorder of the elderly, along with the anticipated growth of the aging population and increasingly limited health-care resources, an economically efficient public health approach to the management of osteoporosis and its associated problems are warranted.

With this background, the present study was undertaken with an aim of determining the 10-year probability of developing major osteoporotic and hip fractures in the postmenopausal female population using the QFracture score and Garvan Fracture risk calculator. Along with the assessment of the risk of development of osteoporotic fractures, our objectives included estimation of the prevalence of known risk factors for osteoporotic fractures and provision of counseling to the population found to be at risk for development of these fractures.

**Subjects and Methods**

The present study was conducted over a 3-month period from June 2018 to August 2018 in an urban field practice area of a medical college in Pune, India, which has a range of socioeconomic classes that reside therein. The study is a cross-sectional, analytical study.

Adult, postmenopausal females were chosen based on the telephone directory of Wānowrie area of Pune and randomly selected using computer-generated random tables. All patients were informed of the nature of the study and written informed consent was obtained prior to enrolment. The clearance of the Institutional Ethics Committee (Institutional Review Board) was obtained before the study was undertaken vide IEC No. IEC/2018/106 dt August 08, 2018.

Inclusion criteria included females who had completed at least 1 year after attaining menopause naturally. Perimenopausal women and women in whom menopause was attained either due to drugs or postsurgical menopause were excluded from the study.

All participants were subjected to fracture risk assessment using QFracture score and Garvan Tool, and 10-year probability of fracture risk was calculated. Clinical risk factors for fracture development were correlated with history of prior falls and risk estimated.

Data for the present study were collected by a single interviewer using the QFracture risk calculator and the Garvan Fracture risk calculator by personally interviewing the patients at their homes. The interview was a structured interview. The interviewer was not involved in data analysis to eliminate observer bias.

Presuming a prevalence of risk of developing fractures in postmenopausal women to be 50% and alpha error to be 5% with confidence level of 95%, the sample size for the present study was determined to consist of 384 participants.

Appropriate statistical tests were applied to analyze the data and SPSS version 21© software (SPSS Statistics for Windows, version x.0, SPSS Inc., Chicago, Ill., USA) was used to conduct data analysis.

**Results**

We divided our study participants into two groups: Group 1, with history of prior falls and Group 2, without history of prior falls. The range of age of our study population was 50–86 years, while the mean age of the study population was 59.86 ± 8.86 years. The mean body mass index (BMI) of Group 1 was 25.72 ± 4.35 kg/m² and mean BMI of Group 2 was 25.61 ± 4.13 kg/m². The most prevalent risk factor of osteoporotic fractures in our study was diabetes mellitus (n = 98 [25.5%]) and the least prevalent risk factor was chronic kidney disease (CKD) (n = 4 [1.04%]). The prevalence of risk factors in our study population is described in Table 1.

Risk factors were subjected to subgroup analysis vis-à-vis Groups 1 (with a history of falls) and 2 (without any history of falls), and the most prevalent risk factor in Group 1 was a previous history of fractures in wrist/spine/hip/shoulder and in Group 2 was diabetes mellitus. The least prevalent risk factor for both groups was CKD. There was a statistically significant difference between the two groups in risk factors such as asthma, patients having any history of previous fractures, angina/myocardial infarction (MI)/stroke, and dementia (P < 0.05).

We estimated the overall 10-year risk of developing major osteoporotic and hip fractures using the two scoring systems,
namely Garvan Tool and QFracture score, in the two groups using Mann–Whitney U-test and the results are depicted in Tables 2 and 3, respectively.

**DISCUSSION**

Many risk factors for development of osteoporotic fractures have been described in literature, and most of these have been incorporated in the calculation of fracture risk by Garvan and QFracture scoring systems. Our study enabled us to describe the distribution of these risk factors in our study population and correlate them to available facts in known literature.

The risk of major hip or major osteoporotic fractures in postmenopausal women using both scoring systems was significantly higher in the group which had a prior history of falls than the one without. This demonstrates that elderly women who have sustained falls earlier in life are at a significantly higher risk of sustaining a fragility fracture later in life.

The most prevalent risk factor overall in our study was diabetes mellitus. According to Cokolic, diabetes mellitus affects all tissues including bone and has a definite relation between risk of having an osteoporotic fracture. With a high prevalence of diabetes in our population, risk of developing an osteoporotic fracture rises considerably.

The overall prevalence of any previous history of fracture (wrist/spine/hip/shoulders) in our study was 19.05%. According to Kanis et al., history of any previous fracture was associated with the risk of having fracture in both males and females. The difference in our study is that we have considered only postmenopausal women, while Kanis had considered both.

The prevalence of asthma in our study population was 6.7%. A previous study done in China has indicated a strong association of osteoporosis in asthmatic patients, which is also brought out by our study.

MI/Heart attack/stroke have the prevalence of 7.4% in our study population. In a study of relationship of BMD and MI/angina/stroke done by Magnus, a significant association between heart-related problems and BMD has been established, which is in resonance with our study.

Another risk factor in our study was dementia, having a prevalence of 18.5%. A study conducted in Egypt by Amer et al. did not show dementia to be a significant risk factor for developing osteoporosis. However, the Egyptian study was conducted in geriatric homes, while our study is a population study conducted at patients’ homes, which may explain this difference.

A family history of osteoporotic fracture was also prevalent (19.05%) in our study population. A significant association between family history of osteoporotic fractures and risk of osteoporosis has been shown by a study done by Fox et al. However, the study by Fox et al. was conducted in Maryland, the USA, which has a much more educated and responsive population as compared to ours, and our figure may be lower than what is the actual prevalence.

Rheumatoid arthritis, which is a major problem in the postmenopausal population, has a prevalence of 21.9% in our study. The prevalence brought out in our study is likely to be underreported, as our study was conducted on an apparently healthy population, and this figure is achieved based only on historical data of the patients.

Steroid intake also alters the bone metabolism and causes a high probability of having fragility fractures. Its prevalence was 9% in our study population. As per Manolagas steroid intake is considered to be an important risk factor for development of osteoporotic fractures due to an imbalance between osteoblast and osteoclast activities.

The prevalence of cancer as a risk factor in our patients is 2.8%. According to Nazarian et al., some cancers like...
osteosarcomas are definitely related to weakened bones, thus causing increased risk for having fractures.[16] The paucity of cancer prevalence as a risk factor in our study may be due to a wide range of cancers considered by us (benign as well as malignant) and a possibility that some patients may be suffering from neoplastic processes but were unaware of the disease due to absence of symptoms or a lack of diagnosis.

Depression is also considered to be an important risk factor for having fractures, as shown by Amer et al.[13] Our study estimates the prevalence of antidepressant usage to be 6.7% which is an indirect estimate of depression per se. This discrepancy may be attributed to the fact that our study population considers mental illness (especially depression) to be a social taboo and does not seek any psychiatric help for the same.

Our study is the first cross-sectional study in the Indian scenario which has tried to estimate the prevalence of risk factors with development of osteoporosis using Garvan and QFracture fracture risk prediction tools. A sample size of 384 is relatively large sample size to extrapolate our results to the urban population. There is no observer bias in our study as the interviewer did not have any prior knowledge and subjective feelings about the topic being studied. Patients were included from all socioeconomic strata of the society to be a part of this study. All Patients were counseled on various aspects of osteoporosis and encouraged to eliminate modifiable risk factors for developing osteoporosis. This primary prevention strategy is expected to change the risk profile of the study participants and prevent an osteoporotic fracture in the future.

There are, however, a few limitations of our study. Our study population included only postmenopausal females. Hence, the result of this study cannot be extrapolated to the general population. Recall bias could not be eliminated as this was a questionnaire-based study.

This study will contribute to the sparse epidemiological data in the field of osteoporosis in the Indian scenario. This study may be carried forward to estimate and analyze the prevalence of osteoporosis in the Indian scenario using DEXA scan on the study patients who are found to be at high risk of osteoporosis. This study hopes to bring about the use of QFracture risk assessment tool and Garvan Fracture Risk Calculator as epidemiological instruments to screen the Indian population who do not have access to DEXA scanning.

**Conclusion**

QFracture score and Garvan tool are two of the easily administrable questionnaires which have been internationally validated. The use of BMI as BMD estimator in the algorithms makes them an attractive screening instrument in resource-poor countries like India. These calculators can be used as a screening tool in the wellness clinics proposed by the government by health-care workers and can serve as a useful tool in care of elderly. Adequate counseling at the screening level, too, may result in diminishing the risk profile of high-risk individuals.

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**Conflicts of interest**

There are no conflicts of interest.

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