Putting the Brakes on Breaks: Osteoporosis Screening and Fracture Prevention

Sarah C. Goode, DNP, FNP-C[1], Jacqueline L. Beshears, FNP-BC[4],
Russell D. Goode, MD[3], Theresa F. Wright, DNP, RN, CCRC[1],
Anita King, DNP, MA, FNP, CDE, FAADE[1], and Brett D. Crist, MD[2]

Abstract

Introduction: This prospective study sought to implement a screening tool to identify and risk stratify at-risk patients for osteoporosis and evaluate patient knowledge of osteoporosis and fragility fractures in an orthopedic trauma clinic affiliated with a level 1 trauma academic center. **Methods:** Of 297 eligible patients, 291 were screened and risk stratified. Patients completed an osteoporosis screening questionnaire and were risk stratified. Lifestyle advice was given to patients at low fracture risk. A dual-energy X-ray absorptiometry scan was ordered for patients at intermediate fracture risk. A referral was initiated for treatment to a bone health specialist in high fracture risk patients. Twenty patients completed a knowledge-based pretest/posttest. **Results:** A total of 291 patients were screened, which represented 97.7% of patients over the age of 50. Of those patients, 165 (56.7%) patients met criteria for further osteoporosis evaluation as they were considered either intermediate or high risk for future fractures. One hundred thirty-six (82.4%) patients were referred for bone mineral density evaluation. For the knowledge-based evaluation portion, patients had a 33% gain in knowledge (*P* = .0004). The largest knowledge deficit identified pertained to osteoporosis risk factors and lifestyle management. **Discussion:** The use of an osteoporosis screening questionnaire in the orthopedic trauma clinic produced clinically significant improvement in identification of at-risk patients. A lack of knowledge regarding osteoporosis and fragility fractures was found to exist among these patients. **Conclusion:** The implementation of an osteoporosis screening tool to identify, risk stratify, and treat patients with osteoporosis and related fragility fractures can be successfully integrated into a busy clinical practice.

Introduction

Osteoporosis and associated fragility fractures are an age-related phenomenon. As the population continues to live longer, care must be taken to preserve bone health to ensure the quality of the additional years. By 2020, half of all people older than 50 will have decreased bone health.[1]

Osteoporotic-related fractures present a substantial burden in morbidity, mortality, cost, and quality of life. Hip fractures carry up to a 36% mortality rate, a 2.5 times increased risk for a second fracture, and decreased mobility in 40% of patients.[2,3] Patients with hip fractures are 4 times more likely to die within the first 3 months after injury and a 1 in 5 chance of placement in a nursing home within the first year.[1] Fragility fractures occur every 3 seconds and affects 1 in 2 women and 1 in 4 men.[4] Direct care costs during the first post-fracture year are estimated to be US$37000. per patient for hip fractures, US$11300 for other nonvertebral fractures, and US$8380 for

vertebral fractures.[5-6] A projected 25.3 billion US health-care dollars will be spent on fragility fractures by the year 2025.[2]

Guidelines have been published for proper screening, diagnosis, and treatment of osteoporosis. However, a major gap in care exists because of a lack of awareness among patients and health-care providers.[7-12] The Fracture Risk Assessment (FRAX) tool was developed by the World Health Organization

[1] College of Nursing, University of South Alabama, Mobile, AL, USA
[2] Boone Hospital Center, University of Missouri, Columbia, MO, USA
[3] The Orthopaedic Group, PC, Mobile, AL, USA
[4] Department of Orthopaedic Surgery, University of Missouri, Columbia, MO, USA

Corresponding Author:
Brett D. Crist, Orthopaedic Trauma Service, Department of Orthopaedic Surgery, University of Missouri Hospital, Room N116, Columbia, MO 65212, USA.
Email: cristb@health.missouri.edu

(WHO) as an algorithm to assess individual fracture risk and it has been shown to be an integral part of initial screening for osteoporosis and fracture risk.[2,13] Multiple approaches ranging from treatment algorithms to a fracture liaison service (FLS) have been implemented to care for patients with fragility fracture. However, significant evidence-based knowledge gaps still persist for both patients as and health professionals.[14-18]

The purpose of this quality improvement project was to address the clinical and administrative aspects of the addition of a screening tool that identifies patients who are at risk of osteoporosis and to aid in the prevention of sentinel fracture events by decreasing the risk of secondary fractures in patients 50 years and older. The goals of screening patients for fracture risk are to improve patient knowledge and quality of life and decrease associated mortality, morbidity, and cost of these fractures to health-care systems.

Patients and Methods

Study Design and Population

The quality improvement initiative evaluated adults who presented to an orthopedic trauma clinic for routine follow-up care at a rural academic, level 1 trauma center from January 2016 to April 2016 using an osteoporosis screening questionnaire. Eligible patients were at least 50 years old and able to speak English. Exclusion criteria included all patients less than 50 years old and unable to speak English. A subset of 20 randomly selected patients participated in a pretest/posttest osteoporosis knowledge exercise to evaluate the effectiveness of patient teaching.

A waiver of consent was granted by our institutional review board. Eligible patients received a 15-question osteoporosis screening questionnaire upon check in for the scheduled follow-up clinic visit. The screening questionnaire provided to eligible patients was developed from the FRAX tool and included patient demographics (age, sex, height, and weight), as well as questions regarding personal and family history (Figure 1). After completion of the questionnaire, an assessment of each patient's risk factors was completed and an FRAX score was calculated. The UK version of the FRAX tool was used to calculate the 10-year risk for a hip or other major osteoporotic fracture. The UK version of the tool has been accepted by the International Osteoporosis Foundation for use in all patient populations due to the treatment recommendations it generates.[19] The patients were plotted on a graph by age and FRAX score. This graph is stratified and assigns the patient to 1 of 3 risk stratums with accompanying intervention thresholds based on their age and FRAX score. It has been our experience that this patient pictorial is easy to incorporate in a clinical setting and furthermore, allowed for quick assessments and referral for additional workup of at-risk patients.

Risk stratum 1 included patients at low risk. Patients identified to be at low risk for fragility fractures received lifestyle intervention including bone health education regarding adequate calcium and vitamin D intake, weight-bearing exercise

regimen, fall prevention, limiting alcohol intake, smoking cessation, and need for rescreening in 5 years. Risk stratum 2 included patients at intermediate risk. Patients in the intermediate risk stratum were recommended to undergo further evaluation of bone mineral density (BMD) by way of a dual-energy X-ray absorptiometry (DXA). After a DXA scan was completed, the FRAX score was recalculated to determine whether patients are above or below the intervention threshold. Risk stratum 3 included patients identified as high risk, based on a FRAX score, qualified for pharmacologic treatment of osteoporosis, with or without additional measurement of BMD by the way of DXA.[13,16] Patients in all 3 risk stratums received education with their standard treatment.

Intervention

The project coordinator met with a subset of 20 randomly selected patients without a prior history of osteoporosis. A 5-question pretest was administered to assess the patient's knowledge regarding osteoporosis. The coordinator also used the allotted time to educate the patient on osteoporosis pathology and modifiable/nonmodifiable risk factors via a handout and discussion. Upon the completion of patient education, a posttest was administered. The pretest/posttest can be found in Figure 2.

Demographics

Patient demographics were extracted from the screening questionnaire and incorporated into the FRAX risk assessment. Data included patient age, sex, and race.

Statistical Analysis

Demographic variables were analyzed using descriptive statistics: means were calculated for age. Gender counts were completed. Total counts and percentages of the total sample were completed for each risk stratum. Percentage change was calculated between the pretest and posttest score using a 1-tailed paired t test to determine the significance level of knowledge gained.

Source of Funding

No external funding source was used in the execution of this study.

Results

During the 3-month project time frame, 804 total patient visits for routine, orthopedic trauma follow-up occurred. Four hundred and five patient visits met the inclusion criteria. Repeat visits accounted for 108 of the total visits, resulting in 297 eligible patients of whom 291 were screened. A breakdown of demographic data can be found in Table 1.

The patients meeting eligibility for screening during the study time frame (97.7%) accounted for 42% of the

1. Age:_____ Date of Birth:_____ Sex: **Male** ___   **Female** ___
2. Weight:_____ Height:_____
3. Have you been diagnosed with Osteoporosis (weak or brittle bone)? **Yes** ___ **No** ___
    a. If yes, do you take medication for osteoporosis (Fosamax, Forteo, Prolia, Reclast, Evista)? **Yes** ___ **No** ___
4. Do you take Calcium and/or Vitamin D? **Yes** ___ **No** ___
5. Have you broken a bone after age 40? **Yes** ___ **No** ___
    a. If yes, please describe what bone(s) were broken and briefly how the injury happened.
6. Do you have a family history of Osteoporosis? **Yes** ___ **No** ___
7. Did either of your parents ever have a broken or fractured hip? **Yes** ___ **No** ___
8. Have you ever taken daily steroid medications (medrol, prednisone) for longer than 3 months? **Yes** ___ **No** ___
9. Do you fall frequently? **Yes** ___ **No** ___
10. If you are female, are you:

    Premenopausal ___ **Currently menopausal** ___ **Postmenopausal** ___
    a. Do you receive hormone replacement therapy (i.e. estrogen)? **Yes** ___ **No** ___
    b. If you are postmenopausal, did you complete menopause before age 45? **Yes** ___ **No** ___
11. Do you regularly drink 3 or more alcoholic beverages in one day? **Yes** ___ **No** ___
12. Do you smoke cigarettes? **Yes** ___ **No** ___
13. Do you have any of the following medical conditions? (please circle)

Rheumatoid Arthritis	Diabetes	Cushing's Disease	Liver Impairment
Thalassemia/Sickle Cell	Hyperthyroidism	Seizures	Vit. D Deficiency
Lupus	COPD	Celiac Disease	Kidney Failure
Leukemia/Lymphoma	Hyperparathyroidism	Organ Transplant	Heart Failure
Pancreatitis	Depression	Chron's/Ulcerative Colitis	

    OTHER: _____
14. Have you had a Bone Density (DXA) scan within the past 2 years? **Yes** ___ **No** ___
15. Please specify your race:

    Asian ___ **African American** ___ **American Indian** ___ **Caucasian** ___ **Hispanic** ___

FRAX Score			
U.S		U.K	
Major	Hip	Major	Hip
NOGG Risk/Recommendation			

Developed from elements of FRAX tool available at: https://www.shef.ac.uk/FRAX/

Figure 1. Fracture risk assessment questionnaire.

1. What is Osteoporosis?
   a. Painful bones
   b. Strong bones
   c. Brittle bones
   d. It is not related to my bones

2. When should you first be screened for Osteoporosis?
   a. Age 20
   b. Age 50
   c. Age 65
   d. Age 80

3. Who is at risk for Osteoporosis?
   a. Only women over age 65
   b. Only men over age 65
   c. Only women over age 50
   d. Men and women over age 50

4. What are risk factors for Osteoporosis?
   a. Being over age 50, not getting enough Calcium and Vitamin D, being thin or underweight
   b. Being over-weight, overuse of joints, and repetitive movements for long periods of time.
   c. Exercising regularly and avoiding alcohol
   d. Eating a balanced diet, avoiding caffeine and tobacco

5. How do you prevent Osteoporosis?
   a. You cannot
   b. Proper screening, adequate intake of Calcium and Vitamin D, regular exercise
   c. Avoid regular exercise
   d. Drink more alcohol and caffeine

Figure 2. Pretest/posttest questions.

Table 1. Patient Demographics.

Gender	
Male	41.2%
Female	58.7%
Age	
Mean	65.8
Range	50-98
Race	
Caucasian	275
African American	12
Hispanic	3
Asian	1

clinic population. Of the 291 patients screened, 165 (56.7%) met criteria for additional follow-up via a DXA scan to evaluate BMD, or they were recommended for pharmacological treatment of osteoporosis (stratums 2 and 3). This composed 97 (33.3%) patients within the intermediate-risk range (stratum 2) and 68 (23.4%) patients within the high-risk range (stratum 3). These 165 patients represent 23.6% of the total practice population. The remaining 126 (43.3%) patients fell in to the low-risk stratum and only lifestyle advice was given. An unexpected finding of the study was that only 9.8% (28) of

patients screened were receiving osteoporosis treatment at the time of evaluation.

Twenty patients were randomly selected to participate in the pretest/posttest to evaluate their knowledge regarding osteoporosis. All patients were Caucasian—9 were males (ages 53-78 with a mean age of 61.6) and 11 were females (ages 51-78 with a mean age of 59.5). The patients had a 33% gain in knowledge which was statistically significant (at $P = .0004$). The largest knowledge deficit/gain was found in 35% of the patients and involved risk factors and lifestyle management to prevent osteoporosis.

Discussion

The need to screen for osteoporosis and fragility fracture risk is clearly supported by this project. More than half (56.7%) of the patients seen during routine visits met the recommendations for screening by the WHO and the National Osteoporosis Foundation (NOF). The American Academy of Orthopedic Surgeons (AAOS) has given a moderate recommendation in its clinical practice guidelines for evaluation and treatment of osteoporosis in patients with hip fractures. However, based on the substantial portion of the population identified in our study as "at risk"

through a simple screening questionnaire, we feel these recommendations should be expanded to include all patients over the age of 50. Without screening this vulnerable population, those at risk do not receive adequate diagnosis or treatment and are at increased risk of debilitating, costly, and often fatal fractures. As seen in this study, only 9.8% of patient screened were receiving treatment at the time of evaluation, but an additional 13.8% fell into risk stratum 3, suggesting treatment is necessary. Furthermore, 33.3% of patients fell into risk stratum 2 and were noted to have enough risk factors to warrant further evaluation with BMD testing. This indicates that treatment and/or further workup would not have been provided to 46.7% of those in need in our patient population without an FLS.

The project outcomes support previous work—in the use of an advanced practice provider (nurse practitioner or physician assistant) dedicated to the management of an FLS as vital to successful screening and treatment of osteoporosis helping close the gap between fragility fractures and osteoporosis management.[18] The advanced practice provider should incorporate the FRAX tool when screening the at-risk population. Once the initial screen is completed, the advanced practice provider can provide patient education, obtain additional screening measures, manage referrals for additional care, and prescribe pharmacologic management.

Findings are also supportive of previous studies that highlight the importance of an orthopedic surgeon serving as the physician champion on the FLS.[7] The orthopedic surgeon has established a relationship with the patient by virtue of treating his or her fracture and is the person the patient will continue to see for fracture care.

Constraints of the FRAX tool have been identified previously. Limitations include the inability to take into consideration dose-related questions (use of glucocorticoids, alcohol, tobacco, and number of previous fractures) as well as an individual's fall risk.[20] Several studies have proposed inequalities in the strength of fracture risk predictions in various subsets of populations when using the FRAX, namely, that the risk is underestimated in some portions of the world's population.[21-26] However, the FRAX tool has been accepted by the WHO, NOF, and AAOS as the best screening tool and is readily available from https://www.shef.ac.uk/FRAX/ without charge. Therefore, the FRAX tool should be used as the beginning point of screening combined with clinical judgment when rendering a plan of care for individualized patients.

Conclusion

Osteoporosis and associated fragility fractures will continue to affect the growing elderly population unless providers incorporate screening guidelines into daily practice. Our study shows that the implementation of an osteoporosis screening tool to identify, risk stratify, and treat patients with osteoporosis and related fragility fractures can be successfully integrated into a busy clinical practice. However, the authors acknowledge the pilot project was undertaken with the addition of a project coordinator to the clinic staff. Successful implementation of an FLS may be dependent on the introduction of a qualified provider to manage the service.

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