THE EFFECT OF OSTEOPOROSIS SCREENING AND TREATMENT ON THE RATE OF PROXIMAL HUMERUS FRACTURES

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Disclosures: The authors report no conflicts with this study. Funding: Intramural funds only

INTRODUCTION

Osteoporosis is a quantitative loss in bone mineral density that increases the rate of fragility fractures of the spine and long bones. As the population ages, this represents an increasing burden on our healthcare system in terms of patient morbidity, lost productivity, and expense to the healthcare system. The reduction in hip fracture incidence, cost, and morbidity by osteoporosis screening and treatment has been well documented. There is minimal data regarding the effect of such programs on proximal humerus fracture.

STUDY OBJECTIVES

To determine the effect of population-based osteoporosis screening and treatment on the rate of proximal humerus fracture.

METHODS

SCREENING

KPSC is a large nonprofit health maintenance organization (HMO) serving over three million members in the Southern California region. About 15% (approximately 465,000) of KPSC’s members are 60 years old or older and comprised the study group. Beginning in 2002, a comprehensive population-based screening and treatment program was initiated with the goal of screening all high risk individuals with dual x-ray absorptiometry scan and treating individuals with T-score from -1.0 to -2.4 with vitamin D and calcium, and individuals with prior history of fracture or T-score of -2.5 or worse with bisphosphonates, calcitriol, estrogen, or selective estrogen receptor modulators (SERMs).

CASE IDENTIFICATION

Institutional review board approval was obtained for a multicenter retrospective review of shoulder fractures in all patients aged 60 years old and older between 2002 and 2007. Fracture cases were screened using a comprehensive longitudinal electronic administrative database serving over three million individuals, identified by ICD-9 codes. Accuracy of this coding was regularly confirmed. Screening for osteoporosis was considered when a BMD test done during the study period. Any prescription for a pharmacological treating agent prior to fracture was considered treatment. Any patient with prior history of fragility fracture was excluded.

Patients’ history of osteoporosis and demographic variables, such as race, age, and gender, were also included in the study. A patient was classified as osteoporotic if the patient had a diagnosis record with codes 733.0x (osteoporosis: ICD-9-CM) or the patient had a BMD test score indicating osteoporosis or low bone mass requiring treatment (women t-score<-2.5, men t-score<-2.5) any time during the study period. Demographic data was also obtained from the administrative database. Race was a dichotomous variable (white vs. non-white).

STATISTICAL ANALYSIS

Both univariate and multivariate analyses were employed to examine the effectiveness of the Osteoporosis Management Program on reducing the incidence of humerus fracture among the elderly. Chi-square test was used to compare humerus fracture rates between demographic categories, osteoporosis diagnosis categories, screening status for osteoporosis, and pharmacological intervention for osteoporosis. All reported p-values are two-sided and are considered to indicate statistical significance if the p-value is less than 0.05.

To further understand the association between proximal humerus fractures and the management program indicators (pharmacological intervention for osteoporosis and screening status for osteoporosis), Cox proportional hazards survival analysis was performed. This model created hazard ratios for proximal humerus fractures associated with the dependent variables, including pharmacological intervention for osteoporosis, screening status for osteoporosis, race, gender, age, and osteoporosis diagnosis status. We found no interactions among the dependent variables. Therefore, only the main-model results are presented. All analysis were performed using statistical software package SAS (Version 9.1.3, SAS Institute, Cary, NC, USA). The KPSC institutional review board approved the study.

RESULTS

• Of the over 3 million patients that were screened, 15.5% of the individuals were over 60 years old, a good approximation for the US population.

• Demographic risk factors for proximal humerus fracture:
  - Females have a Relative risk (RR) of 3.1 (p<0.0001)
  - Type 1 or 2 Diabetes Mellitus RR=1.5 (p<0.0001)
  - Caucasian RR=2.0 (p<0.0001). Distal radius fracture increased the risk of humerus fracture by 33%, whereas proximal hip fracture had no effect.

• Risk of prior fragility fracture:
  - Prior hip fracture had no effect RR=1 (p=0.9137)
  - Prior distal radius fracture carries a relative risk of 1.3 (p<0.0001)

• Effect of Osteoporosis Screening and Treatment:
  - Patients screened for osteoporosis RR=0.17 (p=0.0001), or a reduction in the rate of proximal humerus fracture by over 80% versus the unscreened population.
  - Patients diagnosed with osteoporosis RR= 1.43 (p<0.0001), or individuals with osteoporosis have over 7 times the rate of proximal humerus fracture versus individuals without osteoporosis.
  - Pharmacological intervention RR=0.55 (p<0.0001), or on average a 45% decrease is in risk of proximal humerus fracture versus untreated individuals.

Table 1: Hazard Ratios for from the Cox Proportional-Hazards Model (N=525,758)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value</th>
</tr>
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<tbody>
<tr>
<td>Median Treatment</td>
<td>0.545 (0.504-0.585)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Screened for Osteoporosis</td>
<td>0.572 (0.543-0.605)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Diagnosed for Osteoporosis</td>
<td>0.700 (0.680-0.719)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Age (1.03-1.10)</td>
<td>1.035 (1.031-1.039)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Female</td>
<td>3.132 (2.913-3.362)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>White</td>
<td>2.016 (1.920-2.114)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.527 (1.448-1.631)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Hip Fracture</td>
<td>1.007 (1.090-1.130)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Distal Radius</td>
<td>1.501 (1.470-1.535)</td>
<td>&lt;.0001</td>
</tr>
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CONCLUSION

In a study population of 525,758 patients age 60 and over, a systematic osteoporosis screening and treatment program resulted in a significant decrease in the incidence of proximal humerus fracture.

CLINICAL SIGNIFICANCE

• Taken with prior data regarding the significant reduction of the expense and morbidity of hip fractures, our study reinforces the benefit of osteoporosis screening and treatment as the relative risk of humeral fractures is also significantly reduced.

• To our knowledge, there is no data outside of this study examining the role of osteoporosis treatment on proximal humerus fracture, however, data regarding the relative expense and number needed to treat are needed to set a new, perhaps lower threshold for treatment.

• The ideal long-term regimen of pharmacological therapy is still being investigated.