The Incidence of Scaphoid Fracture in the United States Military

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Introduction

The scaphoid is the most frequently fractured carpal bone in the wrist.1 The epidemiology of scaphoid fractures has been previously evaluated in both population studies and injured cohort studies, indicating that this injury is relatively rare in comparison to other upper extremity injuries. A study of injured snowboarders in Colorado showed a total of 54 scaphoid fractures of 1108 upper extremity injuries treated over a 10 year period, compared to 821 distal radius fractures during the same interval.2 In this study, we evaluated the incidence of scaphoid fractures in a large military population, including all four services in the United States over an 8 year period.

Materials and Methods

The Defense Medical Epidemiology Database (DMED) compiles ICD-9 coding information for every patient encounter occurring in a United States (U.S.) military treatment facility, in addition to maintaining the total number of U.S. service members on active duty at any given time. To determine the total number of scaphoid fractures identified, we queried the DMED system by race, gender, military service, rank, and age for the years 1998–2006 using the code 814.01, fracture of the scaphoid. The age categories used were < 20, 20–24, 25–29, 30–34, 35–39, and ≥40 years. Inpatient data were excluded to capture only ambulatory encounters. Events were limited to a “first occurrence” to exclude repeat coding of the same initial injury during subsequent follow-up encounters during the study period. The use of the “first occurrence” filter was designed to avoid overestimation of the injury incidence. The database was also queried for the total number of service members on active duty during the study time period by race, gender, service, rank, and age. One exposure year was defined as one year that the service member was in the Armed Forces.

We used multivariate Poisson regression to estimate the rate of scaphoid injury per 1,000 person-years, controlling for covariates. The unadjusted, or raw, incidence and rate ratios for scaphoid fractures in this population were calculated. Adjusted incidence rates were calculated after other factors (covariates) had been controlled for or balanced across groups when calculating the incidence. Adjusted rates and rate ratios (with corresponding confidence intervals) were reported after controlling for factors such as age, race, and gender.

Results

A total of 14,704 scaphoid fractures were documented in our population at risk of 12,117,749 person-years. The unadjusted incidence rate of scaphoid fracture in our population was 1.21 fractures per 1,000 person-years.

Males were more likely than females to sustain a scaphoid fracture (p<0.0001). Males had an unadjusted incidence rate of 1.29 per 1,000 person-years, while females had an incidence rate of 0.79 per 1,000 person-years. The adjusted rate ratio for males when compared to females controlling for age, race, service, and rank was 1.55 (95% C.I., 1.47, 1.64).

The highest rate of fracture was seen in the 20-24 year old group (unadjusted incidence rate 1.64 per 1,000 person-years) (Figure 1). The adjusted rate ratio for this group compared to the ≥40 year old age group was 1.51 (95% C.I., 1.38, 1.66), indicating a statistically meaningful difference between the groups. We found significantly higher rates of fractures among younger soldiers when compared to those ≥40 years (Figure 1).

Race also had a significant impact on incidence rate with whites sustaining more injuries. The incidence rate for whites was 1.31 per 1,000 person-years compared with blacks at 1.00 per 1,000 person-years, and other racial/ethnic backgrounds at 0.96 fractures per 1,000 person-years. The adjusted rate ratio of scaphoid fractures in whites compared with blacks was 1.32 (95% C.I., 1.26, 1.38), showing a statistically significant difference between the two groups (p<0.0001).

Table 1. Comparative epidemiology of scaphoid fractures.

<table>
<thead>
<tr>
<th>Author</th>
<th>Type of population</th>
<th>Number of scaphoid fractures</th>
<th>Population denominator (person-years)</th>
<th>Incidence per 1000 person-years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vandley, 1984</td>
<td>British, urban, South Africa, suburban</td>
<td>16</td>
<td>150,000</td>
<td>0.11</td>
</tr>
<tr>
<td>Larsen, 1992</td>
<td>Danish, urban</td>
<td>273</td>
<td>1,225,000</td>
<td>0.22</td>
</tr>
<tr>
<td>Hove, 1993</td>
<td>Norwegian, urban</td>
<td>106</td>
<td>215,000</td>
<td>0.49</td>
</tr>
<tr>
<td>Hove, 1999</td>
<td>Norwegian, urban</td>
<td>273</td>
<td>635,197</td>
<td>0.43</td>
</tr>
<tr>
<td>Van der Molen, 1999</td>
<td>Netherlands, laborers</td>
<td>447</td>
<td>5,550,000</td>
<td>0.081</td>
</tr>
<tr>
<td>Bradvik, 2003</td>
<td>Norwegian, urban, pediatric</td>
<td>17</td>
<td>47,750</td>
<td>0.36</td>
</tr>
<tr>
<td>Burtis, 2006</td>
<td>United States, military</td>
<td>50</td>
<td>77,984</td>
<td>0.64</td>
</tr>
<tr>
<td>Current</td>
<td>United States, military</td>
<td>14,704</td>
<td>12,117,749</td>
<td>1.21</td>
</tr>
</tbody>
</table>

Discussion

Scaphoid fractures, as well as carpal bone fractures overall, are relatively uncommon compared to distal radius fractures. There have been relatively few studies of the incidence of this fracture in large populations. A comprehensive listing of the reported incidence rates for scaphoid injury to date is shown in Table 1.

The occurrence of scaphoid fractures has previously been noted to be highest in younger age groups, as seen in Bohler’s early study, with the highest incidence seen in the 20-29 year age group.3 This study also showed similar results, with stratification by age indicating that the groups less than 20 years and 20-28 years of age had the highest incidence of scaphoid fracture. (Figure 1)

The difference in the incidence of scaphoid fractures between genders has been noted previously. An epidemiology study of scaphoid fractures in Odense, Denmark showed an incidence of 38 fractures per 100,000 population in males compared to 8 fractures/100,000 in females.4 In our study, the adjusted incidence rate ratio was 1.55 (95% C.I., 1.47, 1.64), suggesting that males are at higher risk of scaphoid injury.

Finally, our study found a significantly higher adjusted rate ratio of scaphoid fractures occurring in whites compared to blacks. The limited literature on the effect of race on fractures is based on older age groups with fractures due to low-energy trauma or osteoporosis, while our study population represents a younger cohort and controlled for age in the analysis. The significance of the effect of race on scaphoid fracture incidence is unknown but warrants further study.

This study’s limitations include the unique characteristics of military personnel. While the youth and high activity level of our cohort is ideal for the study of scaphoid fractures, findings on fracture incidence may not be specifically applicable to the general United States population. Another limitation is the use of diagnostic codes without specification of the provider type entering the code. This may overestimate the incidence of scaphoid fracture because of the inability to identify who determined the coding.

Conclusions

• In the largest population denominator to date, we report an incidence of scaphoid fracture of 1.21 per 1000 person-years, using a United States military database.
• Males sustain more scaphoid fractures than women.
• Younger age groups show a significantly higher incidence of scaphoid fracture compared to older age groups.
• White race was a risk factor for scaphoid fracture when compared to incidence in blacks.

References

4. 2.

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