Radial head fracture: a potentially complex injury
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Citation for published version (APA):

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Chapter 3

Epidemiology of Radial Head Fractures


ABSTRACT

Background: Recent literature shows an increased mean age of female patients with radial head fractures compared with male patients with radial head fractures. However, data on epidemiology of radial head fractures and specifically in relation to age distribution and male-female ratios of radial head fracture, are scarce. Methods: A retrospective database search was performed to identify all patients with a radial head fracture over a 3-year period. Results: A total of 328 radial head fractures were diagnosed in 322 patients. The incidence was 2.8 per 10,000 inhabitants per year. The male-female ratio was 2:3. The average age was 48.0 years (range: 14–88, SD 14.8). The average age of female patients (52.8 years) was significantly higher than male patients (40.5 years) (p = 0.001). As the age increases above 50 years, the number of female patients becomes significantly higher than male patients (p = 0.001). An associated injury occurred in 40 patients (12.4%). Conclusions: Radial head fractures are common and associated injuries are frequent.
INTRODUCTION

Radial head fractures are common and account for one third of all fractures of the elbow. They usually result from a fall on the outstretched arm with the elbow in pronation and partial flexion.\(^1\) Radial head fractures can be classified using the Mason-classification, which is based on a series of 100 patients. According to this classification, radial head fractures can be divided into three types: a type I fracture is a non-displaced fracture, a type II fracture is a displaced fracture and type III fractures are comminuted fractures.\(^2\) Johnston added a fourth type: a radial head fracture with dislocation of the elbow (table I).\(^3\) Because it has been shown that the outcome of radial head fractures is highly dependent on associated lesions recently, a Mayo Clinic adaptation of the Mason classification (based on 333 cases\(^4\)) was published in order to include these lesions.\(^5\)

Historically, most fractures have been reported to occur between 20-60 years of age, with a mean age of 30 to 40 years.\(^2,6\) Radial head fractures have also been reported to be more common in females than in males, with a ratio of 2:1.\(^1\) However, recent publications provide a different insight in the epidemiology of radial head fractures and its associated injuries. van Riet et al.\(^4\) and Kaas et al.\(^7\) found an average age of 45-45.9 years and that on average females are 7-16.8 years older than males. Male-female ratios are 2:3. The goal of this study is to examine the epidemiology of radial head fractures and specifically to describe age distribution and male-female ratios of radial head fracture above the age of 50 years.

METHODS

A retrospective database search was performed to identify all patients who presented with a radial head fracture on the emergency department of our hospital between January 1\(^{st}\) 2006 and January 1\(^{st}\) 2009. This level 2 trauma centre provides a region of 400.000 inhabitants with acute medical care and is annually visited by approximately 44.000 patients. Radiographs of the elbow were reviewed by two of the authors. Gender, age, side and associated osseous injury were documented. Radiographs of the ipsilateral upper extremity were also reviewed for associated injuries. Radial head fractures were classified

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Non-displaced fracture</td>
</tr>
<tr>
<td>II</td>
<td>Minimal displacement with angulation or impression</td>
</tr>
<tr>
<td>III</td>
<td>Comminuted fracture with dislocation</td>
</tr>
<tr>
<td>IV</td>
<td>Radial head fracture with dislocation of the elbow</td>
</tr>
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Table I: The Mason-Johnston classification of radial head fractures.\(^2\)
according to the Mason-Johnston classification (table I) and coronoid fractures according to the Regan and Morrey classification (table II).\textsuperscript{8}

The statistical analysis was performed by a biostatistician. A Chi-square test was used to statistically analyse differences between genders for: types of fractures, over or under 50 years of age and associated lesions. This test was also used to analyse differences between Mason types for average age and associated injuries. The analysis of variance test was performed to determine significant difference in age for Mason type and gender. A paired t-test was performed to determine the significance of the difference of average age between patients with or without associated injuries. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

In the selected three-year period, a total of 322 patients, with a mean age was 47.9 years (range: 14–88 years, SD: 16.7), were diagnosed with a total of 328 radial head fractures.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Avulsion fracture the coronoid process</td>
</tr>
<tr>
<td>II</td>
<td>Fracture of &lt;50% of the coronoid process</td>
</tr>
<tr>
<td>III</td>
<td>Fracture of &gt;50% of the coronoid process</td>
</tr>
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Table II: The Regan and Morrey classification of coronoid fractures.\textsuperscript{8}

![Figure 1: Age distribution of the patients with a radial head fracture (left = total, middle = male, right = female).](image-url)
The estimated incidence was 2.8 per 10,000 inhabitants per year. The male-female ratio was 2:3, with 126 male patients (39.1%) and 196 female patients (60.9%), which represents a significant difference in gender (p = 0.001). In 122 patients (37.9%) the radial head fracture was on the right side, and 194 patients (60.2%) had a radial head fracture on the left. In addition, 6 patients (1.9%) had bilateral radial head fractures.

The mean age of female patients was 52.8 years (range: 14–88 years, SD: 16.3), which is significantly older (p = 0.001) than the mean age of male patients, which was 40.5 years (range: 16–76 years, SD: 14.4). The peak incidence of radial head fractures in female patients was between 50 and 59 years of age, compared to the peak incidence between 30 and 39 years in male patients (figure 1). There was no statistical difference (p = 0.65) between the number of male patients and female patients below the age of 50 years. However, as the age rises above the age of 50 years, there were significantly more female patients (n = 120) than male patients (n = 36) (p = 0.001).

A Mason type I fracture was seen in 207 patients (64.3%), with a mean age of 45.9 years (SD: 14.8). A Mason type II fracture was diagnosed in 69 patients (21.4%), with a mean age of 52.3 years (SD: 15.0). A Mason type III fracture was found in 38 patients (11.8%) (mean age: 50.2 years, SD: 18.8), and 8 patients (2.5%) with a mean age of 54.0 years (SD 9.2), had an associated elbow dislocation. There was no statistical significant difference in age and gender between the Mason-types (p = 0.99).

Of the 322 patients, 40 (12.4%) presented with some sort of associated osseous injury on the emergency department (figure 2). Coronoid fractures were most common. Of the

![Figure 2](image_url)

**Figure 2:** A lateral elbow view of a 35 year-old male with a Mason-Hotchkiss type 3 radial head fracture (arrow R) with posterior dislocation of the elbow, a displaced olecranon fracture (arrow O) and a Regan-Morrey type 1 fracture of the coronoid (arrow C).
19 patients (5.9%) with this type of injury, 16 presented with a Regan and Morrey type I coronoid fracture and 3 patients had a type II fracture. Scaphoid fractures were seen in 9 patients (2.8%) and capitellar fractures in 5 patients (1.6%). Fractures of the proximal ulna or olecranon were diagnosed in 4 patients (1.2%). Distal radial fractures or an avulsion fracture of the lateral collateral ligament were seen in 2 patients each (1.2%). An Essex-Lopresti injury, triquetral fracture, avulsion fracture of the medial collateral ligament and a dislocation of the radial head were each seen in 1 patient (0.3%) (table III).

Associated osseous injuries were present in 15 patients (7.2%) with a Mason type I and 6 patients (8.7%) with a type II fracture. 36.8% (n = 14) of the patients with a Mason type III fracture and 62.5% (n = 5) with a type IV fracture had associated fractures (table IV). The difference between the incidence of associated osseous injuries and Mason types were significant (p = 0.001). The mean age of patients with associated injuries did not differ significantly compared to the patients without associated injuries (p = 0.18). There was also no statistical significant difference between the number of male patients (n = 16) and females patients (n = 24) with associated injuries (p = 0.99).
DISCUSSION

The results found in this study are similar to those in a previous study, published by our study group in 2008: a retrospective study that consisted of a series of 147 patients. The estimated incidence was 2.5 per 10,000 per year, compared with 2.8 per 10,000 per year in the current study. The mean age of the patients was similar as well: 45.9 compared to 47.9 years old. The mean age increases from 30 to 40 years in the earlier literature, to 47.9 years. This is a similar increase to that reported in a previous retrospective study of 333 patients.

In literature, male-female ratios vary between 1:1 and 3:2. However, the more recent publications show male-female ratios of 2:3, with female patients being significantly older than male patients (37-41 years vs 48-54 years). The current study confirms a peak incidence in men between the age of 30 and 40 and in women between 50 and 60 years. The number of female patients with a radial head fracture is significantly larger than male patients as the age rises above 50. Under the age of 39, male patients are more commonly affected by this injury, but this difference is not significant. These findings might suggest a possible link between radial head fractures and osteoporosis. The correlation between radial head fractures and osteoporosis has to be further investigated. If a strong correlation could be established, females above the age of 50 should be offered screening for osteoporosis in order to prevent other osteoporotic fractures.

The incidence of associated osseous injury is similar to that found earlier by our study group in 2008: 10.2% versus 12.4% found in this study. It is interesting that in a study by van Riet et al., associated fractures were described in 23%, but this difference may be due to the fact that the study was conducted in a referral practice, and showed a relatively higher incidence of Mason type 3 fractures (19.6% compared with 11.8%). In both studies coronoid fractures were most the commonly associated osseous injury, followed by scaphoid fractures. No significant difference in age was found in this study between patients with or without associated injuries, so a possible relationship of associated osseous injuries and osteoporosis is not likely. Recent literature shows the clinical importance of these associated injuries, so the treating physician should be aware of these injuries when treating patients with a radial head fracture.

CONCLUSIONS

A radial head fracture is a common injury, frequently accompanied by associated osseous injuries. On average, female patients are significantly older than male patients, with a significant increase in incidence as the age rises above 50 years. A possible correlation between radial head fractures and osteoporosis has to be further investigated.
## Reference List


