Displaced fractures of the neck of the radius in adults

AN EXCELLENT LONG-TERM OUTCOME

We have reviewed 20 women and three men aged 22 to 73 years, who had sustained a Mason type-IIb fracture of the neck of the radius 14 to 25 years earlier. There were 19 patients with displacement of the fractures of 2 mm to 4 mm, of whom 13 had been subjected to early mobilisation and six had been treated in plaster for one to four weeks. Of four patients with displacement of 4 mm to 8 mm, three had undergone excision and one an open reduction of the head of radius. A total of 21 patients had no subjective complaints at follow-up, but two had slight impairment and occasional elbow pain. The mean range of movement and strength of the elbow were not impaired. The elbows had a higher prevalence of degenerative changes than the opposite side, but no greater reduction of joint space.

Mason type-IIb fractures have an excellent long-term outcome if operation is undertaken when the displacement of the fracture exceeds 4 mm.

Between 14% and 35% of proximal fractures of the radius affect the neck.\textsuperscript{1-3} Those that are undisplaced or minimally displaced usually have an excellent outcome,\textsuperscript{1,4,5} similar to that following displaced fractures of the proximal radius in children.\textsuperscript{6} However, the outcome in those with greater displacement is variable.\textsuperscript{1,5,7-18} This may be because most reports have included fractures of both the head and the neck, with varying proportions of each in the studies. Also, the degree of angulation may have varied and not been taken into account. Other studies have included displaced and comminuted fractures, which would give a worse result.\textsuperscript{6-9,12,13,16-18} An intra-articular displaced fracture may result in joint incongruity, whereas a displaced extra-articular fracture will leave the joint surface unaffected.\textsuperscript{19} Comminuted fractures of the proximal radius (Mason type-III) may have a worse outcome than two-fragment fractures (Mason type-II), as they are more often associated with a high-energy trauma.\textsuperscript{12-14} This study was restricted to assessing the outcome of displaced two-fragment fractures of the neck of the radius (Mason type-IIb).

**Patients and Methods**

Between 1969 and 1979, 756 patients with fractures of the head or neck of the radius were seen in the emergency department of the main hospital in Malmö. Of these, 238 (34%) were Mason type-II or type-III fractures. All of the patients who were still living in the city (n = 131) were invited for re-examination at a mean of 19 years (14 to 25) after the injury. None had presented with any other major fractures or soft-tissue injuries. Seven individuals refused to participate. We excluded 24 patients who had sustained the fracture when they were below the age of 16 years, 24 who had sustained a Mason type-III fracture and 53 with a Mason type-II fracture of the head of the radius, leaving 23 with a Mason type-IIb fracture of the neck for this study. The latter group were assessed by questionnaire, 17 agreed to further radiographs, of whom 16 also had a clinical follow-up.

The right elbow was affected in 13 patients and the left in ten. Low-energy trauma, defined as a fall or direct impact, caused the fracture in 18 patients and high-energy trauma, such as a fall from above 2 m or a motor vehicle accident, was the cause in five. The primary treatment included an elastic bandage or collar and cuff with mobilisation as soon as the pain allowed in 13 patients, immobilisation in a cast for a mean of two weeks (one to four) in six, excision of the head of the radius in three and open reduction followed by treatment with a brace in one. The mean displacement of the fracture overall was 3 mm (2 to 8). In those who were treated conservatively it was also a mean of 3 mm (2 to 4), while in those treated...
DISPLACED FRACTURES OF THE NECK OF THE RADIUS IN ADULTS

Table I. Range of movement in elbows and wrists, circumference of the upper arm and forearm 10 cm from the tip of the olecranon and grip strength (kp/cm²) in the injured and uninjured upper limb in 16 patients with a Mason type-IIb fracture of the neck of the radius. Values are presented as mean (SD).

<table>
<thead>
<tr>
<th></th>
<th>Fractured side</th>
<th>Uninjured side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elbow flexion (°)</td>
<td>140 (8)</td>
<td>140 (7)</td>
</tr>
<tr>
<td>Elbow extension (°)</td>
<td>-6 (9)</td>
<td>-3 (5)</td>
</tr>
<tr>
<td>Forearm pronation (°)</td>
<td>86 (6)</td>
<td>87 (4)</td>
</tr>
<tr>
<td>Forearm supination (°)</td>
<td>83 (9)</td>
<td>84 (6)</td>
</tr>
<tr>
<td>Elbow valgus angle (°)</td>
<td>10 (6)</td>
<td>10 (9)</td>
</tr>
<tr>
<td>Wrist flexion (°)</td>
<td>70 (10)</td>
<td>72 (8)</td>
</tr>
<tr>
<td>Wrist extension (°)</td>
<td>64 (11)</td>
<td>63 (11)</td>
</tr>
<tr>
<td>Circumference upper arm (cm)</td>
<td>28 (3)</td>
<td>28 (4)</td>
</tr>
<tr>
<td>Circumference forearm (cm)</td>
<td>25 (2)</td>
<td>25 (2)</td>
</tr>
<tr>
<td>Grip strength (kp/cm²)</td>
<td>0.7 (0.3)</td>
<td>0.8 (0.3)</td>
</tr>
</tbody>
</table>

All comparisons between the arms showed a non-significant difference. Data are presented as the mean, the range, or mean and the standard deviation (SD).

Surgical the mean was 6 mm (4 to 8). Those who were operated on were subsequently immobilised in plaster for two weeks. The method of treatment was chosen according to the preference of the surgeon on call when the patient presented. One patient had a secondary neurolysis of the ulnar nerve at the elbow three years after the injury.

The subjective outcome was assessed by a questionnaire which evaluated the activities of daily living, pain on loading and at rest, tenderness, range of movement, stability and strength in the affected elbow. Strength, numbness and tenderness in the wrist and hand were also assessed. The uninjured arm served as a control. The 16 patients who returned for clinical examination were seen by two of the authors (MK, RH) who had not been involved in the primary treatment. Flexion and extension of the elbow and wrist, pronation and supination of the forearm and the angle of the extended elbow were measured with a goniometer (KeboCare, Hvidovre, Sweden). Grip strength in the hand was evaluated with a Martin vigorimeter (Heinrich C. Ulrich, Werkstätten für Medizinn mechanik, Ulm-Donau, Germany) and the circumference of the arm and forearm was measured with a tape measure, 10 cm distal and proximal to the tip of the olecranon. The Tinel test was carried out in both elbows at the level of the cubital tunnel.

On the basis of the primary radiographs the fractures were classified according to Mason’s system, which was later modified by Broberg and Morrey. This evaluation was carried out by a radiologist (JB) who had no knowledge of the treatment or the subjective or clinical outcome. Follow-up radiographs included anteroposterior and lateral projections of the elbow in 17 patients. Subchondral cysts, subchondral sclerosis and osteophytes were defined as degenerative changes and the number of individuals with a reduction in the joint space greater than 1 mm was recorded. The diameter of the radial head and the presence of nonunion, avascular necrosis, proximal radio-ulnar synostosis and peri-articular ossification were also documented.

The study was approved by the ethics committee of Lund University, Sweden. Comparisons of values for the two arms of the same individual were performed using Student’s t-test and the chi-squared test, with p < 0.05 indicating a statistically significant difference. Data are presented as the mean and the range, or mean and the standard deviation (SD).

Results
At follow-up 21 patients (91%) had no subjective complaints in their elbow. However, two (9%) described slight impairment and occasional pain, mainly when lifting heavy objects, and in one case occasionally at rest. The first of these had suffered low-energy trauma to the right elbow, with a displacement of the fracture of 6 mm, treated with excision of the radial head. The second had suffered high-energy trauma to the left elbow. The fracture was displaced by 2 mm and had been treated in plaster.

There was no restriction of movement or deformity in the elbows. The circumference of the upper arm or forearm, the range of movement in the wrists and the grip strength were the same in both arms (Table I). Loss of extension of 15°, 20° and 25°, respectively, was seen in three elbows. One had a deficit of pronation of 15° and two of supination of 10° and 25°, respectively. Tinel’s sign was positive in four of the elbows and in one of the controls.

Evidence of degenerative change, including cysts, sclerosis, osteophyte formation and/or irregular subchondral bone was seen in 12 of the 17 elbows subjected to radiographs and in two of the controls (p < 0.001). There was no evidence of nonunion, avascular necrosis, proximal radioulnar synostosis or peri-articular ossification and no difference in the prevalence of reduced joint space when sides were compared.

Discussion
This study indicates that patients with a Mason type-IIb fracture of the neck of the radius have an excellent outcome in most cases, at least if an operation is undertaken if the fracture is displaced more than 4 mm. Up to 25 years after the fracture, more than 90% of our patients had no remaining symptoms and none rated their elbow as severely impaired. There were no objective signs of impaired function, although the injured elbows had more radiographic degenerative changes than the uninjured.

The reported outcome after Mason type-IIb fractures of the radial neck is excellent. In a study of 63 patients, Arner et al reported that 95% were completely free from symptoms from one to 15 years after the injury. Poulsen and Tophoj found that all six of their patients with conservatively treated, isolated fractures of the neck of the radius had excellent results at a mean of 5.2 years after the injury. However, neither of these studies indicated whether both displaced and undisplaced fractures were included. There are some reports of a more unfavourable outcome following fractures of the radial neck. In 36 patients with a dis-
placed fracture of the radial neck, Merchan reported a good outcome in 50%, fair in 22% and poor in 28% at a mean of 4.3 years after the fracture. However, this study included children, Mason type IV fractures and those who were subjected to operative treatment with open reduction and temporary transarticular internal fixation.

When fractures of the radial head are included in the evaluation of Mason type-II fractures (that is, both Mason type-IIa and type-IIb), the majority of previous papers describe a less favourable outcome than in this study. Of 29 cases with Mason type-II fractures described by Johnston, 35% complained of occasional pain after heavy work at a mean of 26 months after the injury. Of 20 patients with this type of fracture, Mason found that nine complained of pain in the elbow at a mean of 2.5 years after the injury. The current study includes individuals who had been subjected to less severe trauma than many others in the literature, which included patients with additional soft-tissue injuries and dislocations of the elbow. The conclusions in our study apply only to isolated displaced fractures of the neck of the radius.

We have studied the largest sample so far and had the longest follow-up period after this type of fracture and have been able to analyse and reclassify the original radiographs. The size of the sample assessed is relatively small, but when conducting long-term follow-up studies it is inevitable that a large proportion of former patients will be unavailable for follow-up. In addition, the methods of treatment were not randomised, so no direct comparison between different strategies could be made, nor could we specify the maximum displacement that could be accepted without undertaking surgery. However, the study indicates that the outcome following a Mason type-II fracture of the neck of the radius (type-IIb) is superior to that following a Mason type-II fracture of the radial head (type-IIa).

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References