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# What happens to the elbow joint after fractured radial head excision? Clinical and radiographic study at a mean 15-year follow-up

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**Abstract** Comminuted fractures of the radial head can be treated by radial head excision, open reduction and internal fixation, or radial head replacement. The aim of this study was to evaluate the long-term clinical and radiographic results of 22 patients with an isolated Mason type III fracture of the radial head treated by radial head excision. Mean age at the time of surgery was 36 years and average follow-up was 15 years. Overall outcome at the last follow-up was scored as excellent, good, fair or poor, considering elbow and wrist pain, valgus deformity, elbow and forearm range of motion, and elbow radiographic osteoarthritic changes. At follow-up 18 patients had no pain, while 4 had pain score 1 on VAS. Average increase in elbow valgus deformity was 8°, mean flexion of the elbow was 138°, pronation of the forearm averaged 78°, and supination averaged 85°. Degenerative changes were scored as grade 0 in 4 patients, grade 1 in 14 patients, and grade 2 in 4 patients. The overall outcome was excellent in 18 patients and good in 4 patients. When a comminuted radial head fracture is not associated with elbow dislocation or ligamentous injuries, resection of the radial head is a valid surgical option because it is a simple and rapid technique, it has a low learning curve, and it has a high rate of excellent clinical and radiographic long-term results.

**Key words** Elbow • Radial head • Excision • Arthritis

## Introduction

Fractures of the radial head are common and account for 2.5% of all fractures in traumatology [1]. The mechanism of trauma is usually indirect, being transmitted from the wrist to the elbow, along the radius, and causing the crashing of the radial head against the humeral condyle. Fractures of the radial head may be an isolated event, or may be associated with a fracture of the olecranon, a fracture of the coronoid process, an elbow dislocation, or a ligament lesion. The Mason classification system [2], which divides fractures of the radial head into 4 types (Fig. 1), is the most used.

Undisplaced fractures of the radial head are commonly treated conservatively by immobilization in plaster casts for 3–4 weeks. However, the treatment of displaced, comminuted fractures is controversial [2–9]. Surgical treatment options include excision of the radial head [2–8] open reduction and internal fixation [9–13], or primary replacement [14–19].

The purpose of this study was to assess the long-term functional outcomes and radiographic results of 22 patients with Mason type III fractures of the radial head treated by early excision.

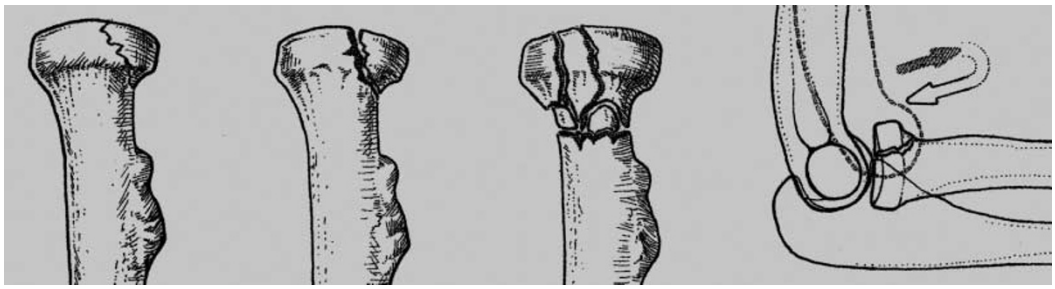

**Fig. 1** Mason classification system [2] for fractures of the radial head. Type I: undisplaced fracture; Type II, displaced fracture; Type III, comminuted fracture; Type IV, fracture associated with elbow dislocation

## Materials and methods

Between 1979 and 1999, 51 patients with fractures of the radial head were observed. Patients with Mason type I fractures were excluded from this study because they had been treated conservatively. Patients in whom the fracture of the radial head was open, or was associated with an injury or a dislocation of the upper extremity were also excluded. This left 30 patients, but 8 of these were lost to follow-up.

Therefore, 22 patients with an isolated radial head fracture treated by radial head excision were included in the study. There were 18 male and 4 female patients with a mean age at the time of trauma of 36 years (range, 16–68 years). In 8 cases the fracture was caused by high-energy trauma during a car accident or a sports incident, while in 14 cases it was the consequence of an accidental fall. The right limb was involved in 12 cases and the left one in 10. At physical examination the elbow appeared swollen in 14 cases and there was ecchymosis in 6 cases, while all of the patients had pain and antalgic limitations of the flexion-extension of the elbow and the pronosupination of the forearm. Plain radiographs were obtained in the anteroposterior and lateral views. All fractures were classified as Mason type III. Surgery was performed an average of 2 days (range, 1–6 days) after the trauma.

Six patients received peripherical anaesthesia and 16 general anaesthesia. All patients were placed supine on the operating table with the elbow in 90° of flexion and the forearm in pronation. In all cases the lateral approach to the elbow was used, performing the incision along the lateral humeral condyle and the posterolateral aspect of the radial shaft. Passing through the interval between the anconeus and the extensor carpi ulnaris muscles, the capsula was incised and the fracture was exposed. All fragments and loose particles of bone were removed and the radial shaft was resected just proximally to the bicipital tuberosity. Closure was routine over a drainage. Postoperative radiographs were taken in two projections. With the elbow flexed at 90° and the forearm in intermediate rotation, a long plaster cast was applied and maintained for 4 weeks. Patients were dismissed an average of 2 days after surgery (range, 1–3 days).

One month after surgery the plaster cast was removed and anteroposterior and lateral radiographs of the elbow were obtained. Rehabilitation was initiated during the immobilization period and consisted of isometric contractions, in order to prevent muscle hypotrophy, osteoporosis, and rigidity of the adjacent joints. After plaster cast removal, rehabilitation was continued to regain complete joint movement, muscle strength, and joint stability, and consisted of gradual passive and active movements in flexion and extension of the elbow and pronation and supination of the forearm. All patients were monitored at 2 months, at 1 year, and then at last available follow-up.

Average follow-up time was 15 years (range, 7–27 years). At the last available follow-up, functional and radiographic evaluations were performed. A visual analogical scale (VAS) was used to evaluate pain at the elbow and wrist. Physical assessment included measurement of the elbow valgus deformity, flexion and extension of the elbow, and pronation and supination of the forearm. To evaluate osteoarthritic changes of the elbow, the Broberg and Morrey system [20] was used, classifying them into: grade 0 (absent, normal elbow); grade 1 (mild, with slight joint space narrowing or minimum osteophyte formation); grade 2 (moderate, with moderate joint space narrowing or moderate osteophyte formation); or grade 3 (severe, with severe degenerative changes and joint destruction). Other radiographic changes such as ectopic ossifications, formation of a neocapitellum, or radioulnar synostosis were also evaluated. The outcome was considered excellent, good, fair, or poor based on: elbow and wrist pain, valgus deformity, elbow and forearm range of motion, and elbow osteoarthritic changes (Table 1).

**Table 1** Overall assessment of outcome of radial head excision for Mason type III radial fractures

| | Excellent | Good | Fair | Poor |
|---|---|---|---|---|
| Pain at elbow or wrist | None | Occasional | Occasional | Persistent |
| Valgus deformity | None | Mild (≤10°) | Moderate (10°–30°) | Severe (>30°) |
| Elbow flexion-extension limitation | None | Mild (≤30°) | Moderate (30°–60°) | Severe (>60°) |
| Forearm pronation-supination limitation | None | Mild (≤45°) | Moderate (45°–60°) | Severe (>60°) |
| Elbow arthritis[a] | Grade 0 or 1 | Grade 2 | Grade 2 or 3 | Grade 3 |
| Periarticular ossification | None or few[b] | Small[b] | Clinically relevant | Clinically relevant |

[a] Broberg-Morrey system [20]; [b] Without clinical relevance

## Results

Mean operative time was 30 minutes (range, 20–45 minutes). There were no intra-operative complications encountered in this series.

At an average follow-up of 15 years, 18 patients had no pain (0 on VAS), while 4 patients had occasional pain (1 on VAS). Average increase in elbow valgus deformity was 8° (range, 5°–15°). Mean flexion of the elbow was 138° (range, 125°–145°), pronation of the forearm aver-

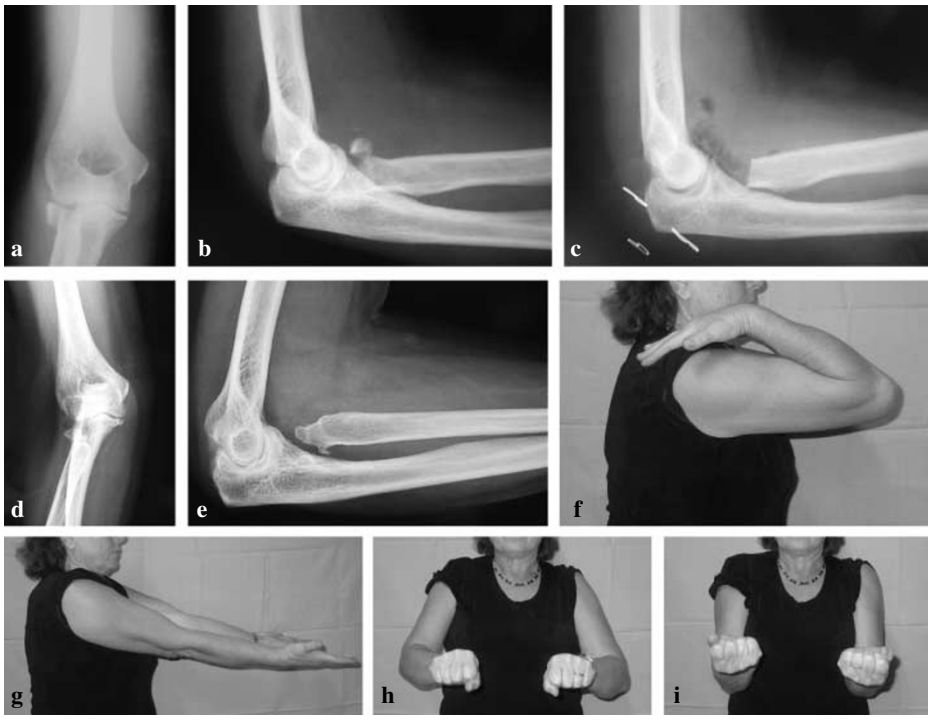


**Fig. 2a-i** *A 50-year-old woman with a Mason type III fracture of the right radial head.* **a**, **b** Preoperative radiographs. **c** Postoperative radiograph after radial head excision. **d**, **e** Radiographs at the 11-year follow-up show degenerative changes of grade 1 and the formation of a neocapitellium. **f** Mean flexion of the elbow was 145°. **g** There was no loss of elbow extension. **h** Pronation of the forearm measured 90°. **i** Supination measured 90°. The overall outcome was excellent


**Fig. 3a-i** *A 68-year-old man with a Mason type III fracture of the right radial head.* **a**, **b** Preoperative radiographs. **c** Postoperative radiographs after radial head excision. **d**, **e** Radiographs at the 12-year follow-up show a degenerative changes of grade 2 and small periarticular ossifications. **f** Mean flexion of the elbow was 138°. **g** There was no loss of elbow extension. **h** Pronation of the forearm was 70°. **i** Supination was 75°. The overall outcome was good

aged 78° (range, 70°–90°), and supination of the forearm averaged 85° (range, 75°–90°). Degenerative changes according to Broberg and Morrey were scored as grade 0 in 4 patients, grade 1 in 14 patients, and grade 2 in 4 patients. We observed small periarticular ossifications without clinical relevance in 8 patients and formation of a neocapitellum in 4 cases, while there were no cases of radioulnar synostosis. Therefore, the overall outcome was excellent in 18 patients and good in 4 patients. One case with an excellent outcome and another with a good outcome are illustrated in Figs. 2 and 3, respectively.

## Discussion

A radial head fracture is an articular fracture necessiting a perfect anatomic reduction; when the articular congruity is not regained, limitation of range of motion of the elbow and the forearm, pain on motion, and post-traumatic arthritis of the radio-ulnar and radiohumeral joints result [2].

Surgical options for Mason type III fractures consist of open reduction and internal fixation, radial head replacement, and radial head excision. Open reduction and internal fixation may be advisable and easy to perform in Mason type II fractures, but when the fracture is displaced and comminuted, a nonanatomical reduction or an inadequate internal fixation with secondary loss of reduction is commonly encountered, leading to secondary elbow arthritis [2–5, 7–10, 12]. Internal fixation should be performed when there is elbow instability and when an anatomical reconstruction of the radial head is feasible [10–13]. Other authors have preferred to use a radial head replacement, aiming to prevent proximal migration of the radius [14–18]. The implant used is usually a silastic radial head or a metallic implant [15–17, 19]. Thus, radial head replacement can lead to various complications, such as implant loosening, limitation of elbow range of motion, and neurological problems [15, 17, 21]. Some authors consider radial head arthroplasty an option in Mason type III fractures associated with instability, and in Mason type IV fractures if the radial head is irreparable [18, 19].

Resection of the radial head has been considered by many authors as the treatment of choice for Mason type III fractures, because of their complexity [22–26]. Resection of the radial head is a simple technique, avoids revision surgery, and prevents pain at the elbow joint. Proximal migration of the radius represents the most significant complication of this technique and the main reason for which many surgeons do not practice it. However, there is complete lack of correlation between the quality of the functional result and the extent of migration of the radius [26, 27].

In this series, no intra-operative complications were encountered, and there were no re-operations. At an average follow-up of 15 years, patients had no or slight pain at the wrist or elbow joints. The duration of immobilization after radial head resection is variable and tends to be short in order to avoid elbow and wrist stiffness. Coleman et al. [24] recommended an average immobilization of 12 days, while Herbertsson et al. [25] suggested a mean immobilization of 2 weeks. In our study, all patients received a plaster cast for 4 weeks. With the program of rehabilitation during this period and principally after plaster cast removal, patients had no limitation or only mild limitation. In fact, functional outcome was excellent in 18 patients (82%).

Osteoarthritic changes are commonly observed radiographically after a radial head fracture. Herbertsson et al. [25] reported an increased prevalence of arthritis in the elbow in the injured compared to the uninjured side; similar results were found by Coleman et al. [24] and Goldberg et al. [23]. However, some authors found no relationship between the gravity of the radiographic findings and the functional results [27]. In our study, degenerative changes were scored as grade 0 or 1 (excellent outcome) in 18 patients (82%).

When a comminuted radial head fracture is not associated with elbow dislocation or ligamentous injuries, resection of the radial head is a valid surgical option because it is a simple and rapid technique, it has a low learning curve, and it has a high rate of excellent clinical and radiographic long-term results.

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