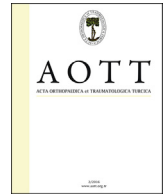


Contents lists available at [ScienceDirect](#)

Acta Orthopaedica et Traumatologica Turcica

journal homepage: <https://www.elsevier.com/locate/aott>

A comparison of the open reduction-internal fixation and resection arthroplasty techniques in treatment of Mason Type 3 radial head fractures

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ARTICLE INFO

Article history:

Received 12 January 2016

Received in revised form

24 February 2016

Accepted 21 March 2016

Available online xxx

Keywords:

Comminuted

Isolated

Open reduction-internal fixation

Radial head fracture

Resection arthroplasty

ABSTRACT

Objective: The aim of this study was to retrospectively compare a series of patients surgically treated with ORIF or early resection arthroplasty due to isolated comminuted radial head fractures.

Methods: Between the years 2009 and 2013, 34 patients with isolated comminuted fractures of the radial head (Mason Type 3) had been operated (ORIF in 19 patients, resection arthroplasty in 15 patients). The mean age of the patients in the ORIF group was 38.5 years and 54 years in the resection group. The carrying angle (CA) and ulnar variance were measured bilaterally, and radiographs were reviewed for degenerative elbow arthritis. The Mayo elbow performance score, Turkish version of the Disabilities of the Arm, Shoulder and Hand questionnaire (DASH-T) and visual analog scale (VAS) were used to evaluate the clinical results.

Results: The mean follow-up period in the ORIF group was 40.2 months and 44.4 months in the resection group. In the ORIF group, 11 patients were clinically rated excellent, six good, and two fair. In the resection group, seven patients had excellent, five had good, and two had fair scores. We did not find a statistically significant difference between the ORIF and resection groups regarding the clinical and radiological outcomes.

Conclusion: With these short-term results, resection arthroplasty may be considered an effective method in the treatment of isolated comminuted radial head fractures, as it is less technically demanding and it also allows for early postoperative motion. However, the patients should be evaluated in detail, regarding ligamentous injuries prior to resection arthroplasty.

Level of evidence: Level III, Therapeutic study.

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The surgical treatment of comminuted radial head fractures is challenging and controversial. Surgical treatment options include open reduction-internal fixation (ORIF), resection arthroplasty and radial head arthroplasty, with no clear advantage of one over the other.¹

Recent studies have addressed the proper restoration of the radial head fractures in maintaining the stability of the elbow and

the forearm^{2–5}; and resection arthroplasty has been associated with complications, including postoperative pain, joint instability, decreased strength, proximal radial migration and osteoarthritis.^{6–8} Therefore, instead of resection arthroplasty, performing ORIF or radial head arthroplasty is suggested to preserve the elbow function and forearm kinematics in cases of comminuted radial head fractures.^{9–13} On the other hand, some authors believe that resection arthroplasty does not have an effect on stability and remains a valid option in the treatment of isolated comminuted radial head fractures.^{7,14} Good long-term clinical outcomes have been reported with resection arthroplasty,^{15–17} but the clinical relevance of the functional impairment related to the absence of the radial head is still very much in question.

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Peer review under responsibility of Turkish Association of Orthopaedics and Traumatology.

<http://dx.doi.org/10.1016/j.aott.2016.03.010>

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The aim of this study was to retrospectively compare a series of patients surgically treated with ORIF or resection arthroplasty due to isolated comminuted radial head fractures, and to report the clinical and radiological outcomes.

Patients and methods

Between 2009 and 2013, 55 patients with radial head fractures were surgically treated. After reviewing their medical records, 19 patients, in whom radial head fracture was accompanied by a complex elbow fracture–dislocation, who had undergone ORIF due to a Mason Type 2 radial head fracture, in whom radial head arthroplasty, delayed radial head resection or additional surgical procedures for ligamentous repair were performed and who were reported to have an obvious ligamentous injury detected by valgus/varus stress and/or radius pull tests,¹⁸ were excluded from the study. Two patients were lost to follow-up. The remaining 34 patients (16 males, 18 females, mean age: 45.4 [range: 29–64] years) who were surgically treated due to isolated Mason Type 3 radial head fractures were included in the study.

The patients were operated by five different surgeons with no definitive surgical protocol, thus, the selection criteria for surgical indications for each case was not clear on the medical records.

Patients were divided into two groups. Group 1 consisted of 19 patients (9 males, 10 females; mean age: 38.5 [range: 29–56] years) who underwent ORIF, and Group 2 consisted of 15 patients (7 males, 8 females; mean age: 54 [range: 38–64] years) who underwent resection arthroplasty. Patient demographics are demonstrated in Table 1.

In Group 1, ORIF was performed using the lateral Kocher approach with anatomical titanium interlocking radial head plates and 2.7 mm screws (TST Tibbi Aletler San., Istanbul, Turkey) on seven patients (37%), and only headless cannulated compression screws (TST Tibbi Aletler San., Istanbul, Turkey) on the remaining 12 patients (63%). The mean follow-up period in this group was 40.2 (range: 27–58) months.

In Group 2, the Kocher approach was used on all patients, and the radial head was resected with a bone saw close to the surgical neck. The intraoperative notes in the medical records of the patients were reviewed, and only the cases in which radius pull test¹⁸ was intraoperatively performed and a probable intraosseous ligament or triangular fibrocartilage complex injury was not diagnosed were included in the study. The mean follow-up period in this group was 44.4 (range: 38–72) months.

Due to the retrospective design of the study, there was no specific postoperative rehabilitation protocol. Generally, a molded posterior plaster long-arm splint at 90° of flexion was kept for two weeks in both groups. Then, passive and active range of motion (ROM) exercises were begun and gradually commenced.

Clinical outcomes were assessed with the Mayo Elbow Performance Score (MEPS)¹⁹ and Turkish version of the Disabilities of the Arm, Shoulder and Hand questionnaire (DASH-T).²⁰ The MEPS rates pain, ROM, stability and function; and the results are graded as excellent (90–100 points), good (75–89 points), fair (60–74 points), or poor (<60 points). In DASH-T, 0 means 'no disability' and 100 means 'complete disability'. Pain was quantified using the visual analog scale (VAS). A goniometer was used to measure the range of flexion–extension and rotation of the elbow.

Bilateral anteroposterior and lateral radiographs of the elbows, including the forearms and wrists were used for the measurement of the carrying angle (CA), the evaluation of posttraumatic osteoarthritis and the presence of periarticular ossification. The CA was measured from the long axes of the humerus and forearm with the elbow at maximum extension. Degenerative changes were evaluated using the Broberg and Morrey classification.²¹ The ulnar variance was measured on posteroanterior radiographs of bilateral wrists as the distance between a line drawn perpendicular to the longitudinal axis of the radius at the distal ulnar aspect of the radius and the end of the ulna.

Statistical analyses were performed using the SPSS v.20.0.0 (SPSS Inc., Chicago, IL, USA) software. The outcomes of the two groups were compared by the independent samples t-test and Pearson correlation test.

Results

In Group 1, the mean MEPS, DASH-T and VAS scores were 86.8 (range: 65–100), 3.9 (range: 0–15) and 1.5 (range: 0–6), respectively (Table 2). According to the MEPS, 11 patients were rated excellent, six good and two fair. Eleven elbows were completely pain-free. The mean postoperative CA was 9.2° (range: 913°) and the mean increase in the CA was 1.1° (range: 0–4°). This increase was statistically significant ($p = 0.015$) (Table 3). The mean ulnar variance was 0.4 (range: 0–1) mm on the injured side. The mean increase in the ulnar variance in comparison to the uninjured side was 0.1 (range: 0–1) mm. The average increase compared to the uninjured side was found statistically insignificant ($p = 0.165$) (Table 3). Degenerative changes were observed in six cases (Grade 1 in four patients and Grade 2 in two patients) (Fig. 1). Periarticular ossification was present in two elbows. The hardware was removed in three patients due to limited ROM.

In Group 2, the mean MEPS, DASH-T and VAS scores were 85 (range: 70–100), 3.7 (range: 0–18) and 1.8 (range: 0–6), respectively (Table 2). Clinically, seven patients were rated excellent, six good, and two fair. Six elbows were completely pain-free (Fig. 2). The mean CA was found 9.4° (range: 7–15°) and the mean increase in the CA was 2.4° (range: 0–7°). The increase was statistically significant ($p = 0.0001$) (Table 3). The mean ulnar variance was 0.5 (range: 0–1) mm on the injured side. The mean increase in the

Table 1
Patient demographics.

	ORIF (Group 1)	Radial head resection (Group 2)	Total
Number of cases	19	15	34
Mean age (range)	38.5 (29–56) years	54 (38–64) years	45.4 (29–64) years
Side	8 right, 11 left	7 right, 8 left	15 right, 19 left
Sex	9 males, 10 females	7 males, 8 females	16 males, 18 females
Mean follow-up period (range)	40.2 (27–58) months	44.4 (38–72) months	42 (27–72) months
Mechanism of injury	<ul style="list-style-type: none"> • Ground level fall on the outstretched arm in 15 (79%) • Sports injury in 3 (16%) • Motor vehicle accident in 1 (5%) 	<ul style="list-style-type: none"> • Ground level fall on the outstretched arm in 13 (86%) • Motor vehicle accident in 1 (7%) • Work accident in 1 (7%) 	<ul style="list-style-type: none"> • Ground level fall on the outstretched arm in 28 (82%) • Sports injury in 3 (9%) • Motor vehicle accident in 2 (6%) • Work accident in 1 (3%)

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