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# Comparison of Primary Radial Head Replacement and ORIF (Open Reduction and Internal Fixation) in Mason Type III Fractures: A Retrospective Evaluation in 72 Elderly Patients

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**Background:** The aim of this study was to compare radial head prosthesis replacement with open reduction and internal fixation (ORIF) in the surgical treatment of Mason type III radial head fractures in 72 elderly patients.





**Material/Methods:** Seventy-two elderly patients (mean age, 67.1±1.25 years, range, 62–81 years) with Mason type III radial head fractures were treated from January 2001 to June 2012. Of these, 37 cases received radial prosthesis and 35 cases were treated with ORIF. All patients were followed up for 10 to 15.6 months.

**Results:** Based on the elbow functional evaluation criteria score by Broberg and Morrey, 29 cases achieved excellent results, 7 were good, and 1 was fair in the replacement group. In the ORIF group, excellent results were seen in 24 cases, good in 9, and fair in 2. The rates of good or excellent results were 78.4% and 68.6% for prosthesis replacement patients and ORIF patients, respectively ( $P<0.05$ ). The Visual Analogue Scores (VAS) for replacement and ORIF groups were 2.25 and 1.67, respectively ( $P<0.05$ ).

**Conclusions:** The radial head prosthesis replacement method is a relatively better surgical approach than ORIF in the treatment of elderly patients with Mason type III radial head fractures.

**MeSH Keywords:** **Arthroplasty, Replacement, Elbow • Fracture Fixation • Health Services for the Aged**

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## Background

Radial head fractures occur in approximately 33% of elbow fractures. Mason proposed the first classification of radial head fractures in 1954 [1] and this is currently the most widely used classification. The surgical methods for treatment of complex fractures include open reduction and internal fixation (ORIF), radial head excision, and replacement of the radial head. Lindenhovius [2] found that radial head excision may lead to a higher risk of complications such as symptoms in the wrist, increased elbow valgus deformity, and degenerative arthritis when compared to ORIF. Coincident with the rapid development of modern techniques and new implants has been a great revolution in the field of treatment for comminuted radial head fractures. The radial head has increasingly been found to play an important role in the stability of the elbow joint as well as the forearm. Currently there are 2 major surgical methods for patients who sustain unstable comminuted radial head fractures: prosthesis replacement and ORIF. Our main purpose in this study was to compare the clinical efficacy of these 2 methods by evaluating the postoperative function of the whole elbow joint and the forearm.

## Material and Methods

Approval for this retrospective study was obtained from the hospital board of ethics. Seventy-two consecutive patients with Mason type III radial head fractures from January 2001 to June 2012 in the Orthopedics Department of the Tenth People's Hospital of Tongji University in Shanghai in the People's Republic of China were selected for this study. Standard X-rays, CT, and MRI scans were obtained when necessary. The choice of treatment with radial head prosthesis replacement or ORIF depended on each patient's condition. Inclusion criteria were as follows: Mason type III radial head fractures; concomitant fracture of the coronoid process, including ulnar coronoid process fracture, ulnar proximal end fracture, and ulnar anconeal process fracture; and ligament injuries, including ulnar collateral ligament injury and interosseous ligament injury. Patients with Mason type I and II radial head fracture, a severely comminuted radial head, an old radial head fracture, or concomitant nerve injury were excluded. Of the 72 patients, 31 were men and 41 were women, with an average age of  $67.1 \pm 1.25$  years (range, 62–81). Patients were divided into 2 groups according to the best treatment option based on patient/doctor discussion. The radial head prosthesis replacement group included 37 patients (19 men and 18 women). The other 35 patients (19 men and 16 women) received ORIF. The average age was  $68.7 \pm 2.22$  years in the replacement treatment group and  $65.5 \pm 1.61$  years in the ORIF treatment group ( $P > 0.05$ ; rank sum test). The average delay between injury and surgery was  $6.7 \pm 1.27$  days (range, 5–11) in the replacement group and  $3.7 \pm 1.31$  days (range, 1–6) in the ORIF treatment group ( $P > 0.05$ ; rank sum test). All were fresh fractures.

## Surgical techniques

Replacement patients were placed in the supine position with the affected extremity in abduction; they received local anesthesia at the same time the pneumatic tourniquet was applied. A routine posterolateral approach was used to expose the annular ligament through a posterolateral capsular incision. The annular ligament was incised transversely and then the neck of the proximal radius was osteotomized in the plane approximately 5 mm above the biceps tuberosity. The prostheses from Wright Medical Technology, Memphis, TN, USA were tried from the small to the large size until the appropriate size was determined. Radiographic and clinical examinations were also performed to confirm the suitability of the prostheses and the stability of the elbow joint and radial neck. The annular ligament was repaired with non-absorbable sutures (Ethicon, Johnson & Johnson Company, Europe).

The ORIF treatment group was treated using an AO locking steel plate secured with screws. All ORIF and arthroplasty procedures were performed by the same surgeon. Celecoxib (Celebrex, Pfizer Pharmaceuticals Limited, USA) therapy (200 mg b.i.d.) was used in both groups. All patients began active flexion-extension movement rehabilitation 2 days after surgery.

## Statistical analysis

The Broberg and Morrey System [3–5], considered the most authoritative functional evaluation score scale for the elbow, was utilized to complete the postoperative clinical examination. This system includes 4 criteria: range of motion, functional stability, grip strength, and pain. The total score ranges from 0 to 100. The range of flexion-extension and rotation of the elbow were measured using a goniometer. X-ray was used to assess the healing progress of the fractures and the apposition of the joints. The visual analogue scale (VAS) was used to quantify patients' pain. The VAS consists of a 10-cm line with an anchor at each end; 0 represents no pain and 10 indicates unbearable pain. Each patient was asked to make a mark to represent the level of pain; the score was then calculated according to the length between the mark and the 0 point (total 10). Descriptive analyses were carried out using frequencies, means, and standard deviations. Differences between the 2 treatment groups with satisfactory outcomes were compared using the Fisher's exact test. A  $p$  value of 0.05 was assumed as statistical significance. All statistical analyses were performed using SPSS 10.0 software (SPSS Inc., Chicago, IL, USA).

## Results

All patients were followed for an average of  $12.7 \pm 1.28$  months (range, 10–15.6 months). The replacement group, consisting of

**Table 1.** Comparison of results between the internal fixation group and radial head replacement group.

Follow-up results	Internal fixation group (M ±SD)	Prosthesis replacement group (M ±SD)	P
Broberg and Morrey elbow scores	81.3±1.25	93.24±1.38	0.0079
Visual analogue scale	1.67±0.21	2.25±0.16	0.0084
Elbow flexion (°)	135±1.51	133±1.27	0.0731
Elbow extension (°)	-12.3±1.91	-10.5±2.11	0.0679
Forearm pronation (°)	71.3±1.24	73.9±1.12	0.0564
Forearm supination (°)	81.3±1.13	79.8±1.72	0.0519

M ±SD – mean ± standard deviation.

**Table 2.** Broberg and Morrey elbow scores.

Group	Elbow score (M ±SD)	Excellent	Good	Fair	Poor	Total
PR	93.24±1.38	29 (78.4)	7 (18.9)	1 (2.7)	0 (0)	37 (100)
ORIF	81.3±1.25	24 (68.6)	9 (25.7)	2 (5.7)	0 (0)	35 (100)

PR – prosthesis replacement; ORIF – open reduction and internal fixation.

37 patients who had undergone radial head replacement treatment, was followed for an average of 13.8±1.92 months. Based on the elbow functional evaluation criteria score described by Broberg and Morrey [3], the results were as follows: excellent results were achieved in 29 cases, good results in 7, fair results in 1, and poor results in 0. No instances of heterotopic ossification or radial nerve injuries were detected postoperatively. In contrast, the mean follow-up time of the ORIF group (35 cases with open reduction internal fixation) was 14.5±1.31 months, with excellent results in 24 cases, good in 9, fair in 2, and poor in 0. The results in excellent and good categories were considered as satisfactory outcomes and those in the fair or poor groups were considered to be unsatisfactory [3]. The outcome was satisfactory in 78.4% of the patients in the replacement treatment group and in 68.6% of the patients in the ORIF treatment group. All the differences were statistically significant ( $P<0.05$ ). Using the VAS, we calculated an average of 2.25±0.16 for patients in the replacement treatment group and 1.67±0.21 for patients in the ORIF treatment group. The differences were statistically significant ( $P<0.05$ ). However, the differences between groups in elbow flexion-extension and forearm rotation angles were not statistically significant ( $P>0.05$ ) (Table 1).

## Discussion

Because the new standards emphasize a greater level of satisfactory postoperative function after radial head fractures, ORIF treatment is widely used, but the radial head prosthesis replacement procedure is used only in selected cases. Radial

head fractures in elderly patients are mostly Mason type III and IV. Some authors believe that the radial head is a necessary component of the humeroradial joint and that it can provide stability to the distal ulnoradial joint [2,6]. Underlying disease such as osteoporosis and diabetes can impede surgical recovery in elderly patients. In our study we compared 2 surgical methods (ORIF and PR) in 72 elderly patients with Mason type III fractures. Results showed that, according to the Broberg and Morrey elbow scores (Table 2), the outcome of replacement surgery was better than with ORIF treatment, and the difference between them was statistically significant in the short-term ( $P<0.05$ ). However, no significant difference was found in range of motion and other outcomes. Several authors note that the radial head prosthesis is a safe and effective method for the treatment and management of severe radial head fractures, at least in the short-term [7–10].

Recent studies have proven the advantages of radial head replacement, and there has not been any evidence of complications such as osteoporosis of the radius or dislocation that were directly related to the prosthesis replacement. Lack of relevant anatomical knowledge, imperfect surgical instruments, and unskilled surgeons are the main iatrogenic factors that have led to an unfavorable prognosis for radial head fractures [11]. A recent meta-analysis revealed a lower malunion rate using unreamed intramedullary nailing rather than external fixation for the treatment of Gustilo grade III tibial fractures [12].

Some surgeons believe that ORIF should be attempted initially, followed by prosthesis replacement if the initial outcome

proves unsatisfactory. The contraction of nearby soft tissue scars caused by multiple operations, however, may result in poor resultant function of the elbow. Repeat surgical intervention may also increase the risk of heterotopic ossification. Because of these drawbacks, we prefer radial head prosthesis replacement for elderly patients with Mason type III radial head fractures.

There are some limitations to our study. First, the sample size in our study was not sufficiently large, which could increase the probability of false-positive or false-negative results. Second, because this was a retrospective study, it was difficult for us to evaluate the differences between the PR and ORIF groups. Third, because the decision to perform PR or ORIF depended on each patient's condition and was a joint decision between the patient and doctor, this selection process may introduce substantial bias into the study.

## References:

1. Mason ML: Some observations on fractures of the head of the radius with a review of one hundred cases. *Br J Surg*, 1954; 42: 123–32
2. Lindenhovius AL, Felsch Q, Doornberg JN et al: Open reduction and internal fixation compared with excision for unstable displaced fractures of the radial head. *J Hand Surg Am*, 2007; 32: 630–36
3. Broberg MA, Morrey BF: Results of delayed excision of the radial head after fracture. *J Bone Joint Surg Am*, 1986; 68: 669–74
4. Geel CW, Palmer AK, Ruedi T et al: Internal fixation of proximal radial head fractures. *J Orthop Trauma*, 1990; 4: 270–74
5. Geel CW, Palmer AK: Radial head fractures and their effect on the distal radioulnar joint. A rationale for treatment. *Clin Orthop Relat Res*, 1992: 79–84
6. Bain GI, Ashwood N, Baird R et al: Management of Mason type-III radial head fractures with a titanium prosthesis, ligament repair, and early mobilization. Surgical technique. *J Bone Joint Surg Am*, 2005; 87(Suppl.1): 136–47
7. Brinkman JM, Rahusen FT, de Vos MJ et al: Treatment of sequelae of radial head fractures with a bipolar radial head prosthesis: good outcome after 1–4 years follow-up in 11 patients. *Acta Orthop*, 2005; 76: 867–72
8. Chapman CB, Su BW, Sinicropi SM et al: Vitallium radial head prosthesis for acute and chronic elbow fractures and fracture-dislocations involving the radial head. *J Shoulder Elbow Surg*, 2006; 15: 463–73
9. Grewal R, MacDermid JC, Faber KJ et al: Comminuted radial head fractures treated with a modular metallic radial head arthroplasty. Study of outcomes. *J Bone Joint Surg Am*, 2006; 88: 2192–200
10. Loreto CA, Rollo G, Comitini V et al: The metal prosthesis in radial head fracture: indications and preliminary results. *Chir Organi Mov*, 2005; 90: 253–70
11. Rozental TD, Beredjikian PK, Bozentka DJ: Longitudinal radioulnar dissociation. *J Am Acad Orthop Surg*, 2003; 11: 68–73
12. Fang X, Jiang L, Wang Y et al: Treatment of Gustilo grade III tibial fractures with unreamed intramedullary nailing versus external fixator: a meta-analysis. *Med Sci Monit*, 2012; 18(4): RA49–56

## Conclusions

Our results indicate that radial head prosthesis replacement treatment is superior to ORIF treatment for the treatment of elderly patients with Mason type III radial head fractures. Prosthesis replacement provides better stability and range of flexion and extension motion at the elbow. However, the prostheses are prone to problems such as aging, loosening, and wear. No information is available regarding the durability of this construct because this new technique has only been in clinical use for a relatively short time. A longer-term follow-up study will be needed to reach more definitive conclusions regarding the use of radial head prosthesis in elderly patients.

## Disclosure

The authors report no conflicts of interest in this work.