Open Reduction and Internal Fixation Versus Prosthetic Replacement for Complex Fractures of the Radial Head

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THE PATIENT
A 50-year-old man had a posterior Monteggia fracture dislocation after a fall he took while playing soccer (Fig. 1). Physical examination showed a swollen, ecchymotic, deformed, and painful upper dominant extremity. No neurovascular compromise was noted. After clinical and radiographic examination, a proximal third metaphyseal ulna fracture and a dislocated, comminuted fracture of the radial head were diagnosed. The fracture was reduced and immobilized in a splint.

THE QUESTION
Is it better to repair (via open reduction and internal fixation) or to replace (with a prosthesis) a displaced, comminuted fracture of the radial head?

CURRENT OPINION
Displaced fractures of the radial head are usually associated with other elbow or forearm fractures or ligament injuries. Regardless of the fracture type, the goals of treatment for radial head fractures are to restore forearm and elbow stability, to preserve forearm and elbow motion, and to maintain the relative length of the radius. Many surgeons believe that it is important to preserve the native radial head, whereas others believe that reliable restoration of radiocapitellar contact with a prosthetic radial head may better address the goals of treatment for complex fractures.

THE EVIDENCE
Open reduction and internal fixation
Early in the 1990s, King et al. reported the retrospective results of 14 displaced radial head fractures treated by open reduction and internal fixation. Of these fractures, 8 were Mason type 2 (part of the head) and 6 were Mason type III (entire head). They noted worse results among Mason type III fractures, largely related to complications such as failure of fixation, loss of reduction, and poor initial reduction. Consequently, they advised open reduction and internal fixation if stable anatomic reduction can be achieved and excision and prosthetic replacement if fracture reduction and fixation are inadequate.

Heim described avascular necrosis and nonunion of 6 of 10 complex whole-head fractures after open reduction and internal fixation.2

Ring and colleagues noted that 4 of 15 comminuted type II fractures recovered less than 100° forearm rotation, and 10 patients with type III fractures had failure of fixation or nonunion. Specifically, among the 14 patients with Mason type III fractures with more than 3 articular fragments, 3 had failure of fixation, 6 had nonunion, and 4 recovered less than 100° forearm rotation. Only 1 patient had a satisfactory result.3

In contrast, Ikeda et al. noted 100% union in 13 comminuted fractures treated with low-profile miniplates and bone grafting and better elbow extension, forearm rotation strength, and functional outcomes in patients treated with open reduction and internal fixation than that in a comparison group treated with resection.4 Nalbantoglu et al. evaluated open reduction and internal fixation of 25 Mason type III fractures and found 1 nonunion, 5 implant removals for symptoms, and no differences between patients with (7 fractures) and without (18 fractures) elbow dislocation.5 Koslowsky et al. prospectively evaluated 24 patients with Mason type III fractures treated with a new fixation device with 100% union, and 86% had a good or
excellent result according to the Broberg and Morrey score at an average of 2 years after surgery.\textsuperscript{6}

**Prosthetic replacement**

The anatomy of the radial head is difficult to reproduce precisely with a prosthesis.\textsuperscript{7–9} Consequently, most prostheses are designed to move and adapt to the complex anatomy, either with a cemented or press-fit stem with a mobile head or via an un cemented mobile stem.\textsuperscript{10–14} Biomechanical data suggest that neither bipolar head prostheses nor monoblock prostheses restore valgus stability in a medial collateral ligament-deficient elbow.\textsuperscript{15} However, most clinical studies have shown that replacement of the fractured radial head with a prosthesis helps to restore stability of the elbow and forearm, even in cases in which the collateral ligaments are not repaired.\textsuperscript{11,12}

Concerning the bipolar prosthesis, Judet et al. reported good functional results in 5 patients an average of 49 months after a Mason type III radial head fracture without elbow dislocation.\textsuperscript{16} Popovic et al. described 4 excellent, 4 good, 2 fair, and 1 poor result in 11 patients treated with the Judet prosthesis for complex radial head fractures associated with elbow dislocation.\textsuperscript{14} Another study reported 6 excellent, 4 good, 1 fair, and 1 poor result in 12 patients with complex fractures an average of 5 years after implantation of a Judet prosthesis.\textsuperscript{11}

Regarding a prosthesis with an intentionally loose, smooth stem (spacer arthroplasty), one study described 12 excellent, 4 good, 6 fair, and 2 poor results in 26 patients with unrepairable Mason type III fractures at an average of 25 months after fracture.\textsuperscript{17} Thirteen patients had some radiographic lucency around the stem of the prosthesis. Another study reported 13 excellent, 9 good, 3 fair, and 2 poor results among 27 patients with Mason type II (11 patients) and Mason type III (16 patients) fractures treated with loose metal spacer arthroplasty.\textsuperscript{10} Seventeen (63\%) patients had radiographic lucency around the stem, but this did not correlate with pain. In a third study, Harrington et al. reported 12 excellent, 4 good, 2 fair, and 2 poor results an average of 12 years after surgery.\textsuperscript{12} All patients demonstrated radiolucency around the stem of the prosthesis, and 4 requested removal of the prosthesis to treat pain. The arc of flexion–extension averaged 113\(^\circ\), and the arc of pronation–supination averaged 139\(^\circ\).

Because our hospital cannot afford to stock metal radial head prostheses and because most patients in our

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**FIGURE 1:** Anteroposterior and lateral radiographs showing a posterior Monteggia fracture dislocation.
country cannot afford them, we perform loose spacer arthroplasty using a custom spacer made of polymethyl methacrylate (PMMA) cement. An average of 56 months after treatment of 21 Mason type III fractures with a PMMA spacer, we documented 9 excellent, 7 good, and 5 fair results.18 Four spacers were removed to treat complaints of pain, and 4 fractured at the stem but did not require removal.

The main complication associated with radial head replacement is the “overstuffing” of the radiocapitellar joint due to the insertion of a prosthesis that is too long.19 This wears down the articular cartilage and causes elbow subluxation.20

SHORTCOMINGS OF THE EVIDENCE AND DIRECTIONS FOR FUTURE RESEARCH

Current evidence is limited to small cohort studies, and there exist no randomized trials. Recent reports are from enthusiasts of a given technique, sometimes the developers of a device,6,16,17 and it ports are from enthusiasts of a given technique, and there exist no randomized trials. Recent re-

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REFERENCES

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CURRENT CONCEPTS

We attempt to repair all comminuted fractures of the radial head, as experimental evidence has shown that radial head arthroplasty cannot restore normal valgus stability when the medial collateral ligament is defi-

17. Dotzis A, Cochu G, Mabit C, Charissoux JL, Arnaud JP. Comminuted fractures of the radial head treated by the Judet floating radial head prosthe-