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Cemented bipolar radial head arthroplasty: midterm follow-up results

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Background: Theoretical advantages of bipolar over monopolar radial head arthroplasty include better accommodation of radiocapitellar malalignment, reduction of capitellar abrasion, and reduction of stress at the bone-to-cement and cement-to-implant interfaces. Our purpose was to report the midterm results of cemented bipolar radial head arthroplasty.

Methods: Twenty-five patients were treated by cemented bipolar radial head arthroplasty for acute fracture of the radial head, earlier treatment that had failed, or posttraumatic sequelae. One patient refused follow-up after surgery. Results are presented for the remaining 24 patients.

Results: At a mean follow-up of 50 months (range, 24-72 months), 1 prosthesis (4%) had been removed 2 years after implantation for dissociation of the prosthesis due to failure of the snap-on mechanism. There were 2 (8%) additional radiologic failures in the subluxated position: 1 prosthesis due to malalignment of the radius onto the capitellum and another due to ulnohumeral erosion. The average flexion-extension arc was 129° (range, 80°-140°), and the average pronation-supination arc was 131° (range, 40°-180°). According to the Mayo Elbow Performance Score, the combined excellent and good results accounted for 83%. In 8 patients, the bipolar design compensated for radiocapitellar malalignment.

Conclusions: The overall midterm outcome of this series of 25 cemented bipolar radial head arthroplasties can be considered favorable. There was 1 (4%) revision and 2 (8%) additional radiologic failures. The bipolar design was able to compensate for radiocapitellar malalignment. We suggest considering a cemented bipolar radial head prosthesis in case of concerns about radiocapitellar alignment.

Level of evidence: Level IV; Case Series; Treatment study

Keywords: Elbow; fracture; prosthesis; replacement; trauma; upper extremity

It is generally accepted that preserving or restoring the integrity of the native radial head is preferred when treating radial head fractures, but prosthetic replacement should be considered when this is not feasible or not advisable.[22] In general, Mason type I fractures are treated conservatively with early range of motion, Mason type II fractures are treated by open reduction and internal fixation or conservatively, and most Mason type III fractures are replaced. In particular, the radial

Approval for this study was waived by the author's institutions' Medical Ethical Committee because the data were collected as part of routine clinical care and each patient was informed that data concerning their case would be submitted for publication.

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head should be replaced when the secondary stabilizing function of the radial head is required, as is the case with fracture of 25% to 50% of the coronoid process, disruption of the medial collateral ligament, disruption of the lateral collateral ligament, or acute longitudinal radioulnar dissociation. Magnetic resonance imaging studies have demonstrated that associated injuries are common.[11,23] Radial head arthroplasty can also be a salvage procedure after failed osteosynthesis or failed conservative treatment.

Despite the growing amount of data, evolving surgical technique, and improving implant design and rationale, prosthetic radial head replacement can be a challenge. Comparing reported results is difficult due to the considerable variation in indications and associated injuries, timing of surgery, implant design, duration of follow-up, and outcome surveillance. Satisfactory outcome can generally be expected in approximately 85% of immediately treated isolated radial head fractures, whereas this is, at best, approximately 50% with fractures treated in a delayed fashion.[22] Although associated injuries about the elbow may have a significant effect on prosthetic function and survival, none of the studies available in the literature are of sufficient methodologic quality to be able to analyze this effect.

Radial head prostheses may be categorized according to material (silicone, polyethylene, pyrocarbon, metal), modularity (monoblock vs. modular), polarity (unipolar or monopolar vs. bipolar), or fixation (cemented, uncemented press-fit, intentional loose fit, or fixation with an expandable stem).

A bipolar design is thought to have several theoretical advantages. The bipolar articulation theoretically allows for free rotation and, therefore, reduced abrasion of the capitellar cartilage and reduced stress at the implant-to-cement and cement-to-bone interfaces during forearm rotations compared with monopolar designs. In addition, the radiocapitellar joint contact area may be increased and, consequently, radiocapitellar contact pressure reduced, which may also reduce radiocapitellar cartilage abrasion.[14] A bipolar prosthesis may also accommodate to some degree to malalignment of the radius on the capitellum, which may be the case in certain post-traumatic conditions where contraction and scaring have occurred.[9] The cemented prosthesis might be better able to do this than the more recently introduced press-fit version (Fig. 1). A disadvantage may be that bipolar prostheses have been shown not to provide as much stability as monopolar prostheses in cadaveric models.[12,14,16]

The English, peer-reviewed literature on bipolar metallic radial head arthroplasty is limited[1,2,4,5,7,10,17-20] (Table I). Short-term to midterm results seem favorable; however, no methodologically sound studies are available to compare bipolar and monopolar prostheses. Long-term results are not available. The purpose of this study is to report our experience with 25 patients who were treated by cemented bipolar metallic radial head replacement for acute fracture of the radial head, for earlier treatment that had failed, or for post-traumatic sequelae. We hypothesized the results would not be different than those reported in the available literature.

Materials and methods

Between March 2005 and March 2012, 25 cemented bipolar radial head arthroplasties (RHS; Tornier, Montbonnot-Saint-Martin, France; Fig. 1, *B*) were performed in our institution. All were treated for acute radial head fracture, for earlier treatment that had failed, or for post-traumatic sequelae. The inclusion period was set to ensure minimum follow-up of 2 years for each patient. The senior author (D.E.) performed all operations.

We initially treated these patients routinely with a cemented bipolar prosthesis. When press-fit designs became available, we started placing a press-fit prosthesis if bone quality was good and the trial components showed a good press-fit. We used a cemented prosthesis if there was any doubt about bone quality or fixation of the trial components and also in case of concerns about radiocapitellar alignment,

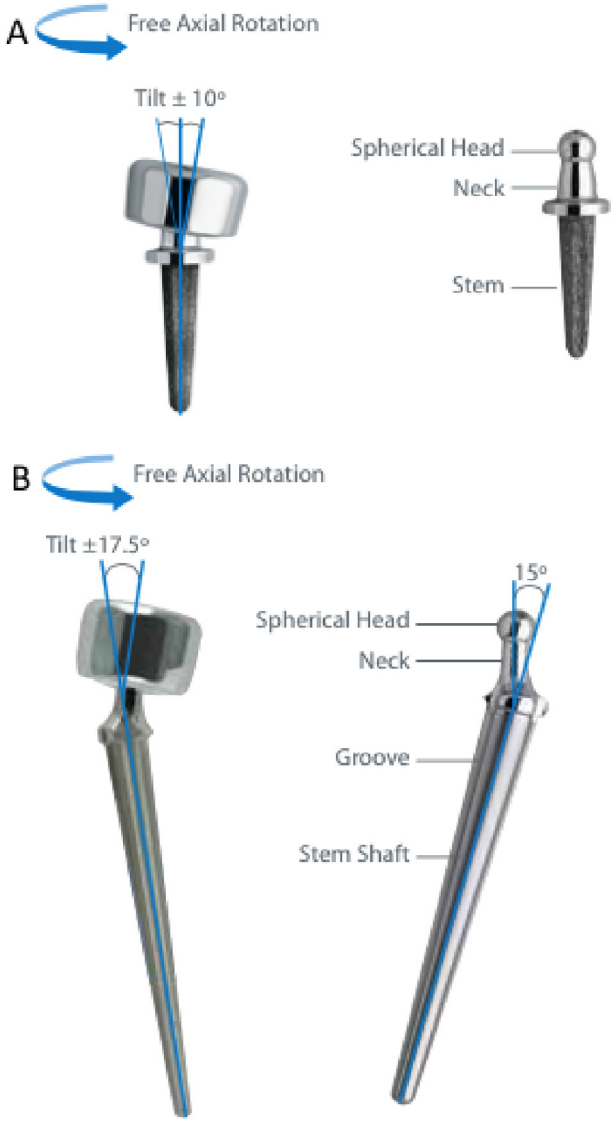

Figure 1 **(A)** The press-fit and **(B)** the cemented RHS (Tornier, Montbonnot-Saint-Martin, France) bipolar radial head prostheses. The design of the cemented prosthesis allows for more tilting of the articular component (ie, head) than the press-fit design.