Contemporary Analysis of Revision and Resection Rates in Radial Head Arthroplasty Used in Elbow Trauma

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INTRODUCTION: Radial head arthroplasty (RHA) has emerged as a preferred surgical treatment for unreconstructible radial head fractures, particularly in the setting of complex elbow trauma such as terrible triad injuries and Monteggia fracture-dislocations. Preservation of radial column stability, restoration of elbow biomechanics, and early mobilization are primary goals. Historically, outcomes have varied, with early-generation implants associated with high complication and revision rates—including instability, stiffness, loosening, and overstuffing. Contemporary implant designs, including press-fit modular systems, have sought to address these limitations by improving anatomical conformity, reducing stress shielding, and enabling intraoperative customization. Despite these advancements, pooled literature continues to cite reoperation rates as high as 22.7%, raising questions about long-term durability and complication risk in trauma populations. This study aims to provide a modern, single-center analysis of RHA outcomes, revision indications, and implant survivorship using exclusively press-fit modular designs in patients with at least one-year clinical follow-up.

METHODS: A retrospective cohort study was conducted at an urban academic medical cetner. Patients undergoing RHA between 2012–2024 for isolated comminuted radial head fractures or associated injuries (terrible triad, Monteggia variants—OTA 2R1) were included. All received press-fit modular implants and had a minimum of one-year follow-up. Demographics, injury patterns, and complications (e.g., fracture-related infection, nerve injury, periprosthetic fracture, return to OR/revision) were recorded. Elbow range of motion and patient-reported outcomes were analyzed. Implant survivorship was evaluated using Kaplan–Meier methods. All statistical analyses were conducted using SPSS Statistics Version 29.0 (IBM Corp., Armonk, NY), with p-values < 0.05 considered statistically significant.

RESULTS: 250 patients were included (mean age 52.2 ± 17.8 years; BMI 28.7 ± 6.3 kg/m²; mean follow-up 43.76 ± 35.16 months). Injury indications were Monteggia fractures (38.0%), isolated radial head fractures (23.6%), and terrible triad injuries (19.2%). Return to OR occurred in 7.2% (18/250); 33.3% of revisions occurred within one year. Revision indications included stiffness (n = 5), infection (n = 4), neuropathy (n = 3), pain (n = 2), dislocation (n = 2), and aseptic loosening (n = 2). One-year implant survival was 97.6%. Mean implant survivorship was 6.58 ± 0.75 years (95% CI: 5.10–8.05). Postoperative nerve injury occurred in 7.2%, primarily ulnar nerve; nearly half required surgical intervention. Infection occurred in 2.8%, and one periprosthetic fracture (0.4%) was treated nonoperatively. Final mean ROM was 125.4° flexion, −14.9° extension, 73.5° pronation, and 79.3° supination. Implant-specific resection rates were highest for Wright Medical (11.0%) and Acumed (6.5%), though not statistically significant ($p = 0.16$).

DISCUSSION AND CONCLUSION: This is the largest known single-center evaluation of modern press-fit modular RHA in elbow trauma. Findings demonstrate a low overall rate of return to OR/revision beyond one year, suggesting improved durability of contemporary implants in complex elbow injuries.