

Lateral Radial Stem Angle and the Rate of Prosthetic Failure for Fixed and Adjustable Anatomical Radial Head Prosthetics

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INTRODUCTION

Radial head and neck fractures account for one-third of all elbow fractures, with radial head arthroplasty being the procedure of choice for the surgical treatment of comminuted fractures unmanageable by open reduction and internal fixation (Jackson and Steinmann, 2007). Anatomic implants, which can be further classified as fixed or adjustable, are commonly utilized for radial head arthroplasty. Improper restoration of radial length and joint biomechanics lead to an increase in contact forces between the radius and capitellum, resulting in capitellar wear, humeral osteopenia, and capitellar degeneration (Bachman et al, 2015) (Van Riet et al, 2010). Further, the radial stem angle is crucial for restoring proper radiocapitellar contact forces within the elbow, and an elevated prosthetic lateral radial stem angle is associated with increased rates of postoperative complications and revision surgery (Cherches et al., 2022). This study aims to investigate the relationship between anatomic prosthetic type, lateral radial stem angle, and differences in postoperative outcomes, range of motion, and prosthetic failure.

METHODS

This is an IRB approved retrospective review of all patients who underwent radial head arthroplasty at our institution between January 1st, 2010, and August 31st, 2022. Information on patient demographics, radiographic parameters, complications, and patient outcomes (range of motion, pain, and QuickDASH scores) was obtained. Patients were excluded if they were under the age of 18 or admitted for polytrauma. Patients were stratified into groups based on the type of anatomic radial head prosthetic they received (fixed vs. adjustable), and comparisons were assessed at their initial postoperative and final follow-up appointments. Categorical variables were assessed using Chi-square tests, while continuous variables were assessed using paired or unpaired Student's t-tests, where appropriate.

RESULTS

77 patients were identified for retrospective review, with an average follow-up of 12.6 months. Adjustable radial head prosthetics were used in 13 patients, while 64 received fixed radial head implants. Prosthetic failure occurred in 10 cases, with failure rates of 7.7% (n=1) and 14.3% (n=9) for adjustable and fixed radial head prosthetics, respectively (p=0.522). There was a statistically significant relationship between lateral radial stem angle and prosthetic failure, with the average lateral radial stem angle being 8.1° and 5.2° for failure and non-failure groups (p<0.05). The adjustable radial head prosthetic group had a significantly lower initial lateral radial stem angle compared to the fixed prosthetic group (3.4° vs 7.3°, p=0.005), however, there was no difference in lateral radial stem angle at the final follow-up (5.2 vs. 5.7, p=0.74). Both groups showed improvements in QuickDASH, pain, and all range of motion parameters at the final follow-up (p<0.05).

DISCUSSION

This study shows that increased initial lateral radial stem angle is correlated with prosthetic failure for fixed and adjustable radial head prosthetics. Further, the adjustable radial head prosthetic had a lower initial lateral radial stem angle compared to the fixed radial head prosthetic group, suggesting that an adjustable radial head prosthetic may have improved postoperative outcomes compared to a fixed radial head prosthetic. This is reflected in the rate of failure for fixed (14.3%) vs adjustable (7.7%) anatomic radial head prosthetics, although this relationship was not significant due to the relatively low sample size of patients receiving adjustable radial head prosthetics. Additional research is necessary to fully understand the impact of prosthetic type and radial stem angle on radial head arthroplasty postoperative outcomes.

SIGNIFICANCE

This research substantiates that the lateral radial stem angle is a significant predictor of prosthetic failure. These findings are supported by previous work done by Cherches et al (Cherches et al., 2022). Additionally, this research shows that patients who received an adjustable radial head prosthetic had a lower initial lateral radial stem angle. Due to the high prevalence of radial head fractures, the identification of an intraoperative parameter that can guide surgeons in the placement and dimensioning of the radial head prosthetic will reduce postoperative prosthetic failure rates and improve outcomes for patients undergoing radial head arthroplasty.

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