Revision total elbow arthroplasty for humeral loosening: What factors can reduce the need of repeat revision for humeral loosening

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INTRODUCTION:
Revision total elbow arthroplasty (rTEA) in the setting of humeral loosening (HL) is a challenging problem. Design modifications such as increasing humeral stem and/or flange length have been proposed to enhance humeral fixation. The aim of this study is to determine re-revision rate in a cohort of patients who underwent rTEA for HL and identify factors that contribute to re-revision. We hypothesize that proportional increases in the stem and flange will stabilize the bone implant interface significantly more than unilateral/uneven increases in revision implant length. Additionally, we hypothesize that the original indication for the index arthroplasty will impact the need for repeat revision for humeral implant loosening. The secondary objective was to describe the functional outcomes, complications, and radiographic loosening.
METHODS:
We retrospectively reviewed 181TEAs performed between 2000 and 2021. Patients who underwent revision TEA for humeral loosening with a minimum of 2-year clinical and radiographic follow-up were included. One-hundred thirty-one cases were excluded for: 1) ulnar loosening (n= 35), 2) infection with no HL (n= 28), 3) failed bushing (n= 19), 4) primary TEA with removal of previous hardware (n=18), hardware failure without HL (n= 16), 5) insufficient follow up data (n= 12, 6 – lost to follow up, 6 – deceased), 6) trauma (n= 2), 7) excisional arthroplasty as first revision procedure for HL (n= 1). Fifty revision TEAs performed on 40 elbows (39 patients) met the inclusion criteria. Patients were grouped based on stem and flange length to determine the re-revision rate. Patients were then divided based on re-revision status into a not re-revised group and re-revised group (split based on the type of procedure: excision and re-revision). Stems and flange lengths at index, revision, and re-revision were evaluated. The stem to flange lengths (S/F) ratio was calculated for each surgery. Mean clinical and radiographic follow up was 71 months (range, 18-221 months) and 71 months (range, 3-221 months), respectively.
RESULTS:
The overall re-revision rate for humeral loosening was 25% at average 4.2 years (range, 1-19) from revision procedure. Rheumatoid arthritis was statistically significant for predicting re-revision TEA for humeral loosening (p value = 0.024). In the present cohort, there was a significant increase in stem and flange lengths from index procedure to revision, on average by 70±47mm ($p<0.001$) and 28±39mm ($p<0.001$), respectively. In cases of re-revisions (n=10), four patients went into excisional procedure (3 cases of infection, 1 progressive RA with severe bone loss), and in remaining six cases the size of re-revision implant increased on average by additional 37±40mm for stem and 73±70mm for flange ($p=0.075$ and $p=0.046$). Furthermore, average flange in these 6 cases were 7 times shorter than average stem (S/F=6.7±2.2). This was significantly different than cases that went into excision and cases that were not re-revised ($p=0.03$; S/F=4.6±1.8 and 4.2±2, respectively). Mean range of motion was 16° (range: 0°-90°; SD: 20°) to 119° (range: 0°-160°; SD: 39°) at final follow-up. Complications included ulnar neuropathy (n= 15; 38%), radial neuropathy (n= 4; 10%), infection (n=6; 14%), ulnar loosening (n= 6; 14%), and fracture (n= 6; 14%). None of the elbows were considered radiographically loose at the final follow-up.
DISCUSSION AND CONCLUSION: We identified two factors that significantly contribute to re-revision of TEA. First, the primary diagnosis of RA and second, a humeral stem with a relatively short flange relative to the stem length. The use of an implant where the flange length is at least ¼ of the stem length may increase implant longevity.