

Radiographic Outcomes of Anatomic Total Shoulder Arthroplasty in Biplanar Glenoid Deformities

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INTRODUCTION:

Increased attention to the impact of retroversion and humeral subluxation on outcomes of anatomic total shoulder arthroplasty (aTSA) has resulted in increased awareness of pathologic glenoid deformity as part of surgical preparation. However, limited knowledge exists regarding the impact of glenoid inclination on outcomes of aTSA. More specifically, biplanar glenoid deformities—a combination of version and inclination deformities—may complicate anatomic glenoid reconstruction and therefore affect outcomes of aTSA. This matched-cohort study aims to assess the relationship between biplanar glenoid deformities and mid-term radiographic outcomes of aTSA.

METHODS:

An institutional repository of 337 preoperative CT scans from November 2010 to October 2017 were utilized to identify the study cohort. CT scans were uploaded to preoperative planning software to reliably assess glenoid retroversion, inclination, and humeral subluxation relative to the scapular plane. For each case, Walch classification was assigned by agreement of two independent reviewers. Patients with both a retroversion deformity greater than or equal to 20° and inclination deformity greater than or equal to 10°, and who subsequently underwent aTSA by a fellowship-trained shoulder and elbow surgeon, formed the study cohort. These patients were matched by age, gender, and degree of retroversion to patients who underwent aTSA without biplanar glenoid deformities. Surgical technique for glenoid reconstruction involved eccentric reaming to achieve near complete seating of a standard, non-augmented, glenoid component. Immediate postoperative radiographs were assessed by two independent reviewers for implant seating, modified beta-angle, and cement fixation quality. Final radiographs, at a minimum follow up of two-years, were reviewed for development of frank posterior glenohumeral subluxation and development of glenoid radiolucency assessed by Lazarus grade.

RESULTS:

Twenty-three cases of aTSA performed in the presence of a biplanar glenoid deformity were identified and compared to 46 cases of aTSA for Walch B-type glenoids without inclination deformities. As anticipated, patients with biplanar deformities had greater inclination deformity (14.5° versus 5.3° ; p<0.001). Despite matching, the biplanar cohort also had slightly greater retroversion (30.0° versus 25.6° ; p=0.01) and humeral subluxation (86.3% versus 82.1%; p=0.03). There was no difference in age (60.7 years versus 63.0 years; p=0.32), gender (73.9% versus 69.6% male; p=0.78), duration of follow up (mean 5.6 versus 5.0 years; p=0.32), or proportion of B2 glenoids (60.8% versus 69.5%; p=0.59). On initial postoperative radiographs, there was no difference in complete component seating (52.2% versus 34.7%; p=0.20) or initial radiolucency grade (0.24 versus 0.36; p=0.27). Patients with biplanar deformities had greater glenoid component superior inclination (5.0° versus 2.7° ; p=0.05) on immediate postoperative radiographs. At a mean radiographic follow up of 5.2 years (range: 2-9.3 years), patients with biplanar glenoid deformities had more significant radiographic radiolucency (mean Lazarus score 2.3 versus 1.4; p=0.002) and greater incidence of posterior humeral subluxation relative to the glenoid component (26% versus 4.4%; p=0.02).

DISCUSSION AND CONCLUSION:

In comparison to isolated retroversion deformities, the addition of increased superior inclination—resulting in a biplanar glenoid deformity—creates a unique challenge in the reconstruction and balancing of an anatomic total shoulder arthroplasty. In this cohort, biplanar deformities were associated with greater degrees of time-zero glenoid implant superior inclination, increased mid-term radiographic loosening, and mid-term radiographic posterior subluxation. Attention to inclination deformities, in addition to version deformities, is likely important for successful anatomical glenoid reconstruction. Future research is required to understand the clinical implications of these findings and the impact of utilizing advanced technology such as augmented glenoid implants or reverse total shoulder arthroplasty to manage biplanar glenoid deformities.