An Evaluation of Various Measurement Techniques to Characterize B2 Glenoid Morphology

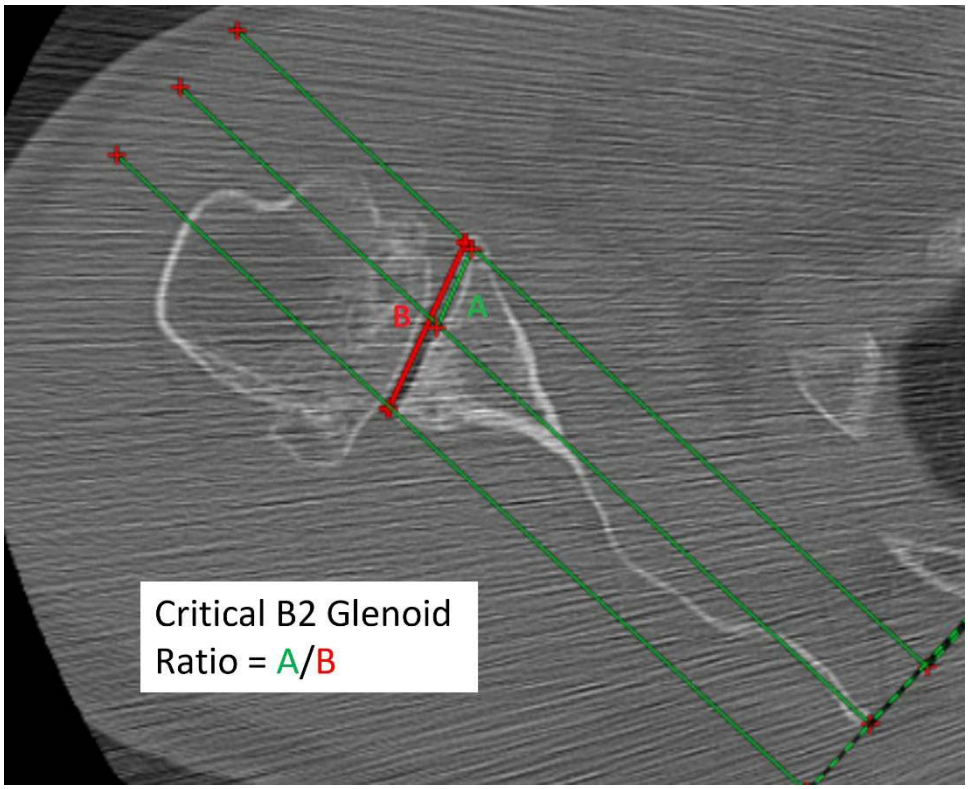
Authors: Sameer R. Oak (University of Michigan), Laurel Barras (University of Virginia), Jeffrey Horinek (Oregon Shoulder Institute), Brian C. Werner (University of Virginia),, Patrick J. Denard (Oregon Shoulder Institute), Asheesh Bedi (University of Michigan)

Background: Total shoulder arthroplasty (TSA) in patients with a B2 glenoid morphology can be especially challenging due to static posterior humeral head subluxation and posterior glenoid erosion. Historically, anatomic TSA to treat the B2 glenoid has shown inferior outcomes with increased glenoid loosening and posterior instability. Various surgical options can be utilized to address this complex deformity, including anatomic TSA with eccentric reaming, augmented glenoid, bone grafting, or reverse TSA with or without wedge augmentation. A standardized assessment of B2 morphology on three-dimensional imaging, and a correlational to guide the surgical approach is lacking in the literature. The critical B2 glenoid ratio is a novel proposed measure to aid in surgical decision making. The goal of the current study is to define inter- and intra-rater reliability of the critical B2 glenoid ratio and to validate it with other conventional methods of measurement on cross-sectional computed tomography (CT) imaging studies.

Methods: A retrospective cohort of 28 consecutive patients with a confirmed B2 glenoid morphology that underwent TSA was collected. A single axial pre-operative CT image was captured at the midpoint of the glenoid just distal to the coracoid for standardized measurement. 3 orthopedic surgeons measured posterior humeral subluxation, glenoid version, glenoid bone loss, and the critical B2 glenoid ratio on these images at 2 timepoints at a minimum of $\geq$ 1 weeks apart. The critical B2 glenoid ratio is defined as a ratio between the paleoglenoid length and the total glenoid length (measured in reference to a line parallel to Friedman's line) shown in the figure below. Intraclass correlation coefficients (ICC) were calculated to obtain Intra-rater and inter-rater reliability and spearman rank correlation coefficients were used to compare the critical B2 glenoid ratio to the other conventional measures. $P < 0.05$ was defined as statistically significant.

Results: The inter-rater reliability was excellent and statistically significant for the critical B2 glenoid ratio with ICCs of 0.917 and 0.897 for the 1st and 2nd measurement sessions, respectively. The intra-rater reliability was good to excellent with ICCs ranging from 0.678-0.989 for the 3 raters. There was a strong statistically significant correlation between glenoid bone loss along Friedman's line and the critical B2 ratio (spearman correlation coefficient or -0.734). The critical B2 ratio did not correlate with other measures.

Conclusions: Critical B2 glenoid ratio has excellent inter and intra-rater reliability. A reduced critical B2 glenoid ratio correlates with increasing glenoid bone loss; however, the ratio did not demonstrate a significant correlation with glenoid version or humeral head subluxation. Future prospective studies will help to assess if the critical B2 glenoid ratio predicts outcomes following anatomic TSA or reverse TSA and can offer some evidence-based guidance to select the optimal surgical decision based on the severity of B2 morphology.


B
A
Critical B2 Glenoid
Ratio = A/B