

Critical Humeral Bone Loss does not affect Long-Term Patient-Reported Outcomes After Arthroscopic Shoulder Stabilization

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INTRODUCTION: Recurrent anterior shoulder instability is a common and challenging condition to treat in the field of orthopaedics. Much of the literature to date has focused on glenoid bone loss as a major contributing factor to the risk of recurrent instability. However, there is increasing awareness of the concept of “bipolar” bone loss, bone defects of both the glenoid and the posterolateral humeral head (termed Hill-Sachs lesions). Recent studies have identified humeral head defects extending below the head equator, termed critical humeral bone loss (CHBL), as a risk factor for recurrent instability after arthroscopic Bankart repair (ABR).¹ Further literature has also shown that the addition of remplissage (ABR+R) offers protection against recurrent instability.² However, there has been very limited investigation into the association between critical humeral bone loss and subjective, patient-reported outcomes (PROs). Therefore, the objective of this study was to compare long-term patient-reported outcomes between patient with and without CHBL who underwent either ABR or ABR+R. We hypothesized that patients with CHBL would have poorer patient-reported outcomes compared to patients without CHBL.

METHODS: This study’s methodology was approved by an institutional review board (University of Pittsburgh, No. STUDY20030061). A retrospective review was conducted on consecutive patients aged 13–50 who underwent ABR or ABR+R for anterior instability from 2007-2023. All procedures were performed at one institution by six sports-fellowship trained orthopaedic surgeons. Exclusion criteria included less than 2 years of follow-up, missing post-operative PRO data, glenoid bone loss (GBL) greater than 20%, absence of HSL, off-track HSL, a concomitant rotator cuff tear or glenoid fracture, and revision surgery. CHBL was defined as inferior extension of the HSL below the humeral equator (90°) on sagittal T2 MRI using a measurement technique described by Cong et al.¹ Glenoid bone loss was measured by best fit circle technique on T2 sagittal MRI.³ Western Ontario Shoulder Index (WOSI), pain Visual Analog Scale (pVAS), and Subjective Shoulder Value (SSV) were analyzed at final follow-up. Recurrent instability was defined as dislocation requiring manual reduction or subjective subluxation (a feeling of persistent instability) not requiring manual reduction. Variable normality was assessed visually with a Q-Q plot, and statistical analysis was performed with the chi-square test, t-test, Mann-Whitney U test, or Fisher’s exact test as indicated. Significance was defined as $p < 0.05$. All statistical analysis was performed in Stata version 18.5 (StataCorp).

RESULTS SECTION: Ninety-nine patients were included, of which 41 (41%) patients had CHBL. The mean age of all patients was 23±9 years, 77 (78%) of patients were male. There were no significant differences between CHBL and non-CHBL groups regarding age, sex, percent GBL, contact sport participation, or shoulder hyperlaxity (all $p > 0.05$; Table 1). CHBL patients were more likely to undergo ABR+R versus ABR (44% vs. 21%, $p = 0.02$). At a mean follow-up of 88 months (range 24-206 m.), there were no significant differences between groups in WOSI, pVAS, or SSV scores (all $p > 0.05$; Table 1). Rates of recurrent instability were similar between groups (24% vs 21%; $p > 0.05$). Subanalysis by surgical technique (ABR vs. ABR+R) showed no significant differences in PROs between CHBL and non-CHBL patients.

DISCUSSION: The most important finding of this study is that patients with critical humeral bone loss demonstrate equivalent long-term patient-reported outcomes compared those patients without critical humeral bone loss, following arthroscopic Bankart repair without or without remplissage. This finding was contrary to our initial hypothesis and suggests that critical humeral bone loss may not impair long-term subjective outcomes for patients with recurrent anterior shoulder instability when appropriately managed with stabilization surgery. A major limitation of the present study is that it is a retrospective cohort study from a single institution, which predisposes the cohort to selection bias and may not reflect variances in practice patterns across the field.

CLINICAL RELEVANCE: Understanding the pre-operative factors that influence the post-operative, subjective outcomes for patients will aid orthopaedic surgeons in more accurate patient counseling, as well as set appropriate expectations for patient-centered improvement. Understanding these dynamics can lead to more effective care and higher patient satisfaction.

REFERENCES:

- Cong T, Charles S, Reddy RP, et al. Defining Critical Humeral Bone Loss: Inferior Craniocaudal Hill-Sachs Extension as Predictor of Recurrent Instability After Primary Arthroscopic Bankart Repair. *Am J Sports Med.* 2024;52(1):181-189. doi:10.1177/03635465231209443
- Steuer F, Marcaccio S, Cong T, et al. The Addition of Remplissage to Arthroscopic Bankart Repair and Effect on Recurrent Instability in Shoulders With Critical Humeral Bone Loss. *Am J Sports Med.* 2025;53(8):1799-1805. doi:10.1177/03635465251340082
- Lee RK, Griffith JF, Tong MM, Sharma N, Yung P. Glenoid bone loss: assessment with MR imaging. *Radiology.* 2013;267(2):496-502. doi:10.1148/radiol.12121681

Table 1. Cohort Demographics and Post-Operative Patient Reported Outcomes at Final Follow Up

	Total (n=99)	No CHBL (n=58)	CHBL (n=41)	p-value
Age at Surgery (years)	23 (9)	22 (8)	25 (10)	0.10
Male Sex	77 (78%)	45 (78%)	32 (78%)	0.96
Contact Athlete	43 (43%)	26 (45%)	17 (41%)	0.74
Shoulder Hyperlaxity	13 (13%)	5 (9%)	8 (20%)	0.14
% Glenoid Bone Loss	7% (7)	6% (7)	8% (9)	0.26
Any Recurrence of Instability	22 (22%)	12 (21%)	10 (24%)	0.95
Procedure				0.02
ABR	68 (69%)	45 (78%)	23 (56%)	
ABR+R	31 (31%)	12 (21%)	18 (44%)	
Follow-Up Time (months)	88 (47)	91 (49)	83 (45)	0.42
WOSI SCORE	319 (406)	347 (415)	278 (395)	0.41
Physical Symptoms Subscore	148 (194)	172 (201)	113 (179)	0.14
Sports/Rec/Work Subscore	56 (85)	61 (87)	49 (83)	0.50
Lifestyle Subscore	48 (78)	47 (75)	48 (82)	0.97
Emotional Subscore	68 (79)	67 (81)	69 (77)	0.93
VAS	2 (2)	2 (2)	1 (2)	0.35
SSV	82 (19)	84 (18)	79 (20)	0.18

Note: Data are presented as mean (SD) for continuous measures, and No. (%) for categorical measures. Data are significant if $p < 0.05$. ABR = Arthroscopic Bankart Repair. ABR+R = Arthroscopic Bankart Repair with Remplissage. CHBL = Critical Humeral Bone Loss. SSV = Subjective Shoulder Value. VAS = Visual Analog Pain Scale. WOSI = Western Ontario Stability Index. "Any Recurrence of Instability" includes dislocations or subluxations.