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Minimum 2-Year Clinical Outcomes After Arthroscopic Treatment for Glenolabral Articular Disruption (GLAD) Lesions: A Matched Case-Control Study

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Objectives:
The presence of glenolabral articular disruption (GLAD) lesions has been shown to be associated with higher rates of recurrent anterior shoulder instability and the need for repeat surgery; however, no series has yet reported clinical outcomes in a GLAD-specific cohort. Further investigation is warranted to characterize the prognosis of GLAD injuries and to identify risk factors associated with inferior outcomes.

Purpose: The purpose of this study was to compare clinical outcomes between anterior shoulder instability patients with and without GLAD lesions after undergoing arthroscopic anterior shoulder stabilization and to evaluate potential risk factors that may predispose patients with GLAD lesions to inferior outcomes.

Methods:
Prospectively collected data was retrospectively reviewed for patients who underwent arthroscopic anterior shoulder instability repair with and without GLAD lesions at a minimum of 2 year follow-up. Consecutive patients who underwent arthroscopic surgery for GLAD lesion were matched to patients who underwent arthroscopic anterior Bankart repair by age, sex, and number of anchors. Patient reported outcomes (PROs) were evaluated pre- and post-operatively, including American Shoulder and Elbow Surgeons (ASES), Single Assessment Numeric Evaluation (SANE), and satisfaction (10-point scale). Recurrent instability, defined as recurrent dislocation, as well as reoperation were analyzed. Patients were asked to report their subjective shoulder stability compared to preoperatively (much better, better, same, worse, or much worse). Additionally, outcome scores were assessed based on GLAD lesion morphology and surgical treatment including lesion thickness (full vs. partial), size (mm^3), anchor placement (in the defect vs. outside the defect), and microfracture (performed vs. not performed). Statistical significance was defined as $P < .05$.

Results:
A total of 58 patients (29 GLAD, 29 non-GLAD (Bankart only)) with a mean age of 28.5 ± 11.9 years were analyzed at 4.1 ± 1.7 years (range, 2.0-8.2) postoperatively. Seventy-six percent (44/58) of the patients were males and 24% (14/58) were females. Patients in both groups experienced significant improvements in all outcome scores after surgery ($P < .05$ for all) (Table 1). No significant differences were found in postoperative scores between the GLAD and non-GLAD groups [ASES (94.8 ± 8.5 vs 93.4 ± 14.1), SF-12 PCS (55.5 ± 4.5 vs 54.2 ± 8.5), SANE (90.4 ± 7.7 vs 91.3 ± 15.5), DASH (9.4 ± 15.1 vs 7.0 ± 14.9) ($P > .05$ for all)] (Table 2). The median satisfaction for the GLAD and non-GAD groups was 10 (range, 1-10) and 10 (range, 1-10), respectively. Two patients in the GLAD cohort underwent reoperation: 1 for symptoms of instability at 1.5 years and the other for persistent anterior shoulder pain at 1 year post-operatively. No patients in the non-GLAD cohort underwent reoperation. No statistical differences in recurrent dislocation were observed between the GLAD (n=2, 9%) and non-GLAD (n=4, 15%; $P = .67$) groups; however, a significantly greater proportion of patients in the GLAD group reported worse or much worse (n=11, 50%) shoulder instability after surgery compared to the non-GLAD group (n=1, 3.8%; P=.0004). No significant differences in outcome scores were observed in GLAD patients based on thickness of the lesion, labral advancement into the defect, or treatment with microfracture ($P >.05$ for all). Additionally, there was no

significant association between PROs and GLAD lesion size (P >.05 for all) (Table 3).

Conclusions:
Patients with GLAD lesions had significantly higher subjective shoulder instability when compared with a matched cohort of non-GLAD (Bankart only) patients. No difference between frank shoulder dislocation was seen. All patients had significant improvements in post-operative outcome scores with high satisfaction. There was no difference in outcomes in those with larger GLAD lesions nor if a microfracture or labral advancement was performed. Anterior shoulder instability patients with GLAD lesions were not found to have inferior outcomes but do have higher subjective instability compared with patients with Bankart only lesions. Longer term studies are necessary to evaluate the risk of arthritic change in those with GLAD lesions.

Table 1: Post-operative Patient Reported Outcome Scores

	GLAD (Range)	Non-GLAD (Bankart only) (Range)	P value
ASES score	94.8 (66.6-99.9)	92.7 (31.6-100)	0.352
SF-12 PCS score	55.5 (41.2-58.3)	54.2 (26.6-60.2)	0.883
SANE score	90.4 (69-99)	95.7 (84-99)	0.424
QuickDASH score	9.4 (0-54.5)	5.0 (0-27.2)	0.357

Table 2: Pre- and Post-operative Patient Reported Outcome Scores

	GLAD (Range)	Non-GLAD (Bankart only) (Range)
Pre-op ASES score	68.5 (34.9-98.3)	67.8 (16.6-99.9)
Post-op ASES score	94.8 (66.6-99.9)	92.7 (31.6-100)
p-value	**P<0.0001***	**P<0.0001***
Pre-op SF-12 PCS	43.1 (24.4-60.4)	46.1 (29.9-57.2)
Post-op SF-12 PCS	55.5 (41.2-58.3)	54.2 (26.6-60.2)
p-value	**P<0.002***	**P=0.001***
Pre-op SANE score	57.1 (7-87)	60.9 (13-85)
Post-op SANE score	90.4 (69-99)	95.7 (84-99)
p-value	**P=0.0001***	**P=0.0001***
Pre-op QuickDASH score	32.1 (2.2-65.9)	24.1 (2.2-63.6)
Post-op QuickDASH score	9.4 (0-54.5)	5.0 (0-27.2)
p-value	**P=0.0068***	**P=0.0055***

Table 3: Relationships Between GLAD Lesion Morphology, Treatment Characteristics, and Patient Reported Outcomes

	ASES Score (Range)	SF-12 Score (Range)	SANE Score (Range)	QuickDASH score (Range)
Partial-thickness GLAD	99.5 (98.3-99.9)	56.8 (54.2-58.8)	95.3 (89-99)	3.4 (0-6.8)
Full-thickness GLAD	94.8 (66.6-99.9)	55.7 (41.2-59.3)	91.6 (69-99)	7.5 (0-6.8)
p-value	P=0.245	P=0.883	P=0.443	P=0.757
Labral advancement into defect	94.7 (66.6-99.9)	56.3 (48.7-59.3)	92.1 (69-99)	3.8 (0-22.7)
Labral advancement outside defect	97.0 (86.6-99.9)	55.3 (41.2-58.3)	92.8 (89-99)	10.6 (0-54.5)
p-value	P=0.956	P=0.856	P=0.842	P=0.536
Microfracture treatment	97.0 (86.6-99.9)	55.6 (41.2-58.3)	92.7 (84-99)	7.1 (0-54.5)
No microfracture treatment	97.1 (84.9-99.9)	56.2 (48.7-58.8)	91.5 (69-99)	5.7 (0-22.7)
p-value	P=0.565	P=0.347	P=0.63	P=0.995
GLAD lesion size (mm^3)				
Spearman's rho	0.0303	-0.0627	0.0930	-0.1486
p-value	P=0.893	P=0.781	P=0.700	P=0.520

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