Mid-term Clinical and Radiologic Outcomes of Arthroscopic Rotator Cuff Repair in Patients with Glenohumeral Cartilage Defect: Propensity Score-Matched Comparative Study

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INTRODUCTION:
Glenohumeral joint cartilage defect (GHCD) presents challenges in diagnosis. Shoulder radiographs, initially chosen for imaging, primarily show associations with osteoarthritis (OA), such as joint space narrowing and subchondral cysts. However, they offer limited representation of the disease process until its advanced stages. Moreover, magnetic resonance imaging (MRI) diagnosis is easier in the knee due to its thicker articular cartilage (3-4mm), whereas the glenohumeral joint exhibits less accurate diagnoses with only fair interobserver agreement. Thus, GHCD is frequently diagnosed unexpectedly during arthroscopic assessments or while managing other pathologies. Due to the lack of prior research on the impact of GHCD on the outcomes of arthroscopic rotator cuff repair (ARCR), surgeons may encounter decision-making challenges when such defects are unexpectedly identified during the procedure. Previously, only conflicting results regarding changes in joint compression pressure after ARCR have been reported, making the decision-making process more complex when considering ARCR in the presence of a cartilage defect, typically recognized for inducing osteoarthritis progression. This study aimed to assess clinical and radiologic outcomes of ARCR in patients with concomitant GHCD, and to investigate the impact of GHCD on OA progression and tendon healing.
METHODS: This retrospective study reviewed patients who underwent ARCR between June 2011 and June 2019 with at least 4-years of follow-up. Using propensity score matching (1:3ratio) for covariates related to potential outcomes, such as age, sex, follow-up duration, rotator cuff tear (RCT) size, preoperative OA, and repair options, this study included 40 patients with GHCD (group A) and 120 well-balanced matched patients without GHCD (group B). Intraoperatively, GHCD was assessed for extent and depth of affected cartilage, scoring based on extent (GHCD score) and using Outerbridge grade for depth. To quantify the extent of invaded cartilage, the ratio of the GHCD area to the articular surface area is evaluated separately for the glenoid and humerus. Assuming the glenoid articular surface with a best-fit circle and the humerus articular surface with a best-fit hemisphere, scoring was based on the ratio of GHCD area to these surfaces: 1 point for 0-25%, 2 points for 25-50%, 3 points for 50-75%, and 4 points for over 75% (Figure). Each side was scored from 0 to 4 points, with their sum defining the GHCD score. After completing the assessment, a microfracture procedure was performed on the GHCD lesion. Assessment of OA was performed using the modified Samilson-Prieto (S-P) grade, and OA progression was defined as an increase in the S-P grade on follow-up X-rays compared to preoperative levels. Clinical and radiologic outcomes were compared between the two groups, and subgroup analysis was conducted to analyze factors contributing to OA progression and re-tear by dividing the subgroups based on OA progression and re-tear occurrence.
RESULTS:
Group A demonstrated more severe preoperative pain ($p=0.032$) and poorer function ($p=0.045$). However, both groups showed significant improvements in pain, function, other PROMs, and abduction range of motion after ARCR (all $p<0.001$). There was no difference between the two groups in the proportion exceeding the minimal clinically important difference (MCID), indicating no impairment in clinical outcomes due to GHCD. In terms of radiologic outcomes, OA progression was observed in 58% (23 patients) of group A and 28% (34 patients) of group B, showing a significant difference ($p < 0.001$). On the other hand, re-tear rates were comparable in both groups at 23% (9 patients in group A vs. 28 patients in group B), with no significant difference. Subgroup analysis identified female, preoperative concomitant OA, and a high GHCD score (≥3.5) as independent risk factors influencing OA progression. On the other hand, there were no significant risk factors found for re-tear in the subgroup analysis.
DISCUSSION AND CONCLUSION:
This study comes with several limitations. Firstly, we were unable to compare with a patient group that had GHCD but did not undergo microfracture, so the exact impact of the microfracture could not be determined. Secondly, the follow-up duration was relatively short, which showed a radiologic difference in OA progression but was not sufficient to result in a clinical difference. Thirdly, the use of newly defined measurements, such as the GHCD score. While there may be concerns about potential distortions due to wide-angle lenses during arthroscopic evaluation, assessment by three different orthopedic surgeons confirmed excellent interobserver reliability, enhancing confidence in the measurements.
Despite several limitations, the conclusion is that in RCT patients, GHCD can lead to preoperative pain and functional impairment, but it does not negatively impact clinical outcomes after ARCR. Regarding the radiologic outcome, there was no significant impact of GHCD on the re-tear of repaired tendon. However, significant GHCD (GHCD score≥3.5) poses a risk for postoperative OA progression. Therefore, surgeons encountering GHCD during ARCR should recognize its limited

impact on postoperative clinical outcomes. However, it is crucial to remain vigilant regarding potential osteoarthritis progression after surgery.

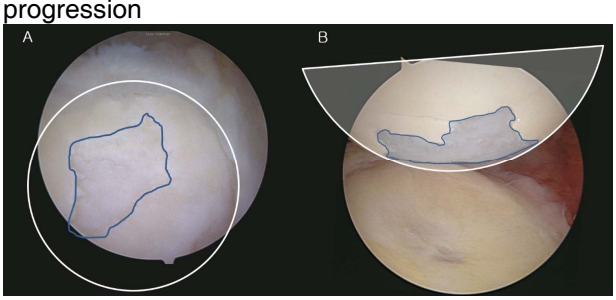

Table. Patient-reported outcome measures (PROMs) and range of motion (ROM)

		Group A	Group B	P2 value
PVAS	Preoperative	5.77 ± 2.39	4.88 ± 1.91	0.032
	Final	1.62 ± 1.42	1.84 ± 1.49	
	P1 value	< 0.001	< 0.001	
	exceeding MCID (-1.5)	30 (75.0)	88 (73.3)	0.836
FVAS	Preoperative	4.36 ± 2.10	5.20 ± 2.23	0.045
	Final	7.69 ± 1.52	8.44 ± 7.54	
	P1 value	< 0.001	< 0.001	
	exceeding MCID (NA)	NA	NA	NA
ASES score	Preoperative	48.33 ± 16.17	50.52 ± 17.71	0.805
	Final	75.08 ± 15.28	73.66 ± 15.51	
	P1 value	< 0.001	< 0.001	
	exceeding MCID (21.0)	31 (77.5)	90 (75.0)	0.750
Constant score	Preoperative	48.38 ± 15.10	51.05 ± 17.51	0.532
	Final	65.78 ± 12.88	65.03 ± 14.30	
	P1 value	< 0.001	< 0.001	
	exceeding MCID (4.6)	29 (72.5)	88 (73.3)	0.918
SST score	Preoperative	4.17 ± 1.89	4.79 ± 2.66	0.145
	Final	8.60 ± 1.95	8.60 ± 2.18	
	P1 value	< 0.001	< 0.001	
	exceeding MCID (4.3)	29 (72.5)	86 (71.7)	0.918
FE, degrees	Preoperative	146.32 ± 17.31	142.07 ± 30.77	0.297
	Final	150.79 ± 13.23	149.70 ± 16.71	
	P1 value	0.262	< 0.001	
	exceeding MCID (NA)	NA	NA	NA
ER, degrees	Preoperative	46.22 ± 19.49	49.63 ± 17.94	0.418
	Final	43.92 ± 18.22	52.92 ± 19.23	
	P1 value	0.495	0.100	
	exceeding MCID (NA)	NA	NA	NA
IR, points	Preoperative	9.62 ± 3.61	9.59 ± 4.05	0.873
	Final	9.78 ± 3.01	9.35 ± 3.05	
	P1 value	0.755	0.799	
	exceeding MCID (NA)	NA	NA	NA
ABD, degrees	Preoperative	119.72 ± 31.58	124.25 ± 40.55	0.736
	Final	151.25 ± 11.30	150.18 ± 18.46	
	P1 value	< 0.001	< 0.001	
	exceeding MCID (NA)	NA	NA	NA

Data are presented as mean ± standard deviation or number (percentages) unless otherwise indicated. PVAS, visual analog scale for pain; FVAS, visual analog scale for function; ASES, American Shoulder and Elbow Surgeons; SST, Simple Shoulder Test; FE, forward elevation; ER, external rotation; IR, internal rotation; ABD, abduction; MCID, minimal clinically important difference.

Behind-the-back IR score, T1–T12: 1–12, L1–L5: 13–17, and buttock: 18.

P1, comparison between preoperative and final measurements; P2, comparison preoperative measurement or the proportion of patients exceeding the MCID between group A and B.