Original Article

Eighty-One Percent of Unrepaired Interportal Capsulotomies Showed Healed Capsules on Magnetic Resonance Imaging 5 Years After Primary Hip Arthroscopy

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Purpose: To evaluate whether unrepaired interportal capsulotomy presents with capsular defect on magnetic resonance imaging (MRI) 5 years after primary hip arthroscopy and to determine its effect on functional results and findings of osteoarthritis on radiographs or MRI scans. **Methods:** Patients with femoroacetabular impingement (without arthritis or dysplasia) were retrospectively reviewed after arthroscopic labral repair or debridement and femoroplasty through interportal capsulotomy without closure. Patients were assessed preoperatively and at a minimum of 5 years postoperatively using patient-reported outcomes (Hip Outcome Score—Activities of Daily Living scale, modified Harris Hip Score, and visual analog scale pain score), radiographic measures, and MRI scans. **Results:** Forty patients (42 hips) were deemed eligible for the study and were evaluated. Of the hips, 81% had healed capsules, whereas 8 (19%) had capsular defects on the latest MRI scan. There were 3 hips with subchondral edema in the defect group compared with 1 in the healed-capsule group ($P = .01$) on the latest MRI scan, which was not present on preoperative MRI (still positive on multivariate analysis when the preoperative alpha angle was also taken into consideration). Functional results did not differ between the groups ($P > .05$). **Conclusions:** In this study, 81% of interportal capsulotomies healed without repair at 5 years after primary hip arthroscopy. **Clinical Relevance:** Understanding the prevalence and implications of unhealed capsulotomies could encourage surgeons to be meticulous in capsular closure.

There has been a growing increase in hip arthroscopy use to treat hip disorders.[1] A capsulotomy is performed to enhance vision and maneuverability inside the joint. The most used capsulotomy technique involves interportal capsulotomy extending from the anterior portal to the anterolateral portal.[2] However, whether to repair this capsulotomy at the end of the procedure remains a controversial issue. Most meta-analyses and studies report similar or superior results with capsular repair compared with an unrepaired capsule.[3-12] However, some literature suggests that keeping the capsule unclosed after hip arthroscopy may result in better postoperative functional scores than closing the capsule.[2,13] The current literature attributes this difference in outcomes to factors such as the surgeon's learning curve, early use of unrepairable capsule techniques, and adjustments made during surgery for variables such as cam excision and labral treatment.[2-13]

A second controversial issue is whether the capsule will heal with the repair. Some studies still report capsular defects with repair, whereas others report complete healing without repair[14-20]; most have assessed the completeness of healing less than 2 years after the surgery. Magnetic resonance imaging (MRI) has been reported to show substantially more reliability for the detection of subchondral cysts compared with the grading of osteoarthritis, especially on radiographs.[21]

The purposes of this study were to evaluate whether unrepaired interportal capsulotomy presents with

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capsular defect on MRI 5 years after primary hip arthroscopy and to determine its effect on functional results and findings of osteoarthritis on radiographs or MRI scans. The hypothesis was that capsular defects present at medium-term follow-up would be associated with more frequent MRI cartilage damage findings than in the capsule-healed group.

Methods

Patient Enrollment

Local ethics committee approval was obtained. Patients who were treated with primary hip arthroscopy between January 2013 and September 2018 with interportal capsulotomy without capsular closure, who had at least a 5-year follow-up, and who underwent MRI examination at the latest follow-up and preoperatively were included. Patients were excluded if they had avascular necrosis, advanced-level hip osteoarthritis (Tönnis grade 3),[22] or dysplasia (based on the lateral center-edge angle); underwent any previous ipsilateral hip surgical procedures; underwent revision hip arthroscopy; had incomplete radiographs or MRI scans; or could not be reached. Surgery was indicated when patients had persistent hip pain refractory to conservative treatment for at least 3 months. Femoroacetabular impingement was diagnosed based on clinical symptoms and radiographic findings (alpha angle $> 55°$ for cam deformity using the Dunn 45° view).[23,24]

Surgical Technique and Rehabilitation Protocol

The patient was placed supine on a hip arthroscopy–specific traction table to obtain appropriate hip distraction against a well-padded perineal post. Horizontal interportal capsulotomy improved visualization and access to the central compartment.

A 4.5-mm arthroscopic burr was used to perform acetabuloplasty. Degenerative labral tears or tears with multiple cleavage planes were considered irreparable, and unstable flaps were selectively debrided. Tears that involved the base of the labrum with chondrolabral disruption were repaired using 1 to 3 suture anchors. Traction was then released, the peripheral compartment was entered, and decompression of the cam deformity was performed and confirmed by intraoperative fluoroscopy and arthroscopic dynamic examination. The capsule was routinely left open at the end of the procedure.

All patients were instructed to use crutches to limit weight bearing for 2 weeks. Daily passive range-of-motion exercises were begun on the first postoperative day. At 3 weeks, active range of motion and full weight bearing were commenced. After 6 weeks, strengthening and light treadmill walking were begun. For the first 4 weeks, daily oral anti-inflammatory medication was prescribed.

Table 1. Patient Demographic Variables, Radiologic Parameters, and Functional Results

Category	Healed Capsule	Capsular Defect	*P* Value
No. of hips	34	8	
Age, yr			
Mean (SD)	36 (10)	42 (7)	.09
Range	16-57	31-55	
BMI			
Mean (SD)	27 (3)	27 (2)	.8
Mean (range)	27 (18-33)	27 (24-31)	.8
Sex, n (%)			.2
Female	15 (44)	2 (25)	
Male	19 (56)	6 (75)	
Symptom duration, mo	17 (3-48)	16 (8-36)	.8
Follow-up time, yr	7 (5-10)	7 (5-10)	.7
Laterality: right, n (%)	15 (44)	4 (50)	.5
Smoker, n (%)	18 (52)	3 (37)	.3
Tönnis grade, n (%)			
Preoperative			.5
0	18 (52)	3 (37)	
1	15 (44)	5 (62)	
2	1 (2)	—	
Postoperative			.5
0	7 (20)	1 (12)	
1	21 (61)	3 (37)	
2	5 (14)	4 (50)	
3	1 (2)	—	
Change (postoperative − preoperative)	0.5 (0.5)	0.7 (0.4)	0.2
Labrum treatment, n (%)			0.2
Debridement	7 (20)	1 (12)	
Repair	27 (80)	7 (87)	
Radiographic parameters			
Preoperative alpha angle (Dunn), °	79 (7)	85 (4)	.03*
Preoperative LCEA, °	37 (8)	39 (7)	.3
Postoperative alpha angle, °	48 (4)	49 (8)	.8
PROs			
Preoperative			
HOS-ADL	52 (11)	50 (9)	.1
mHHS	57 (12)	51 (10)	.2
VAS pain score	6 (1)	7 (1)	.6
Postoperative			
HOS-ADL	86 (10)	81 (14)	.4
mHHS	90 (10)	82 (16)	.09
VAS pain score	1 (1)	2 (1)	.2

NOTE. Data are presented as mean (SD) or mean (range) unless otherwise indicated.

BMI, body mass index; HOS-ADL, Hip Outcome Score–Activities of Daily Living scale; LCEA, lateral center-edge angle; mHHS, modified Harris Hip Score; PRO, patient-reported outcome; SD, standard deviation; VAS, visual analog scale.

*Statistically significant ($P < .05$).

Radiographic Measures and Outcome Scores

Radiographs were obtained and evaluated in all patients, consisting of anteroposterior supine pelvis and 45° Dunn radiographs. Osteoarthritis was graded using

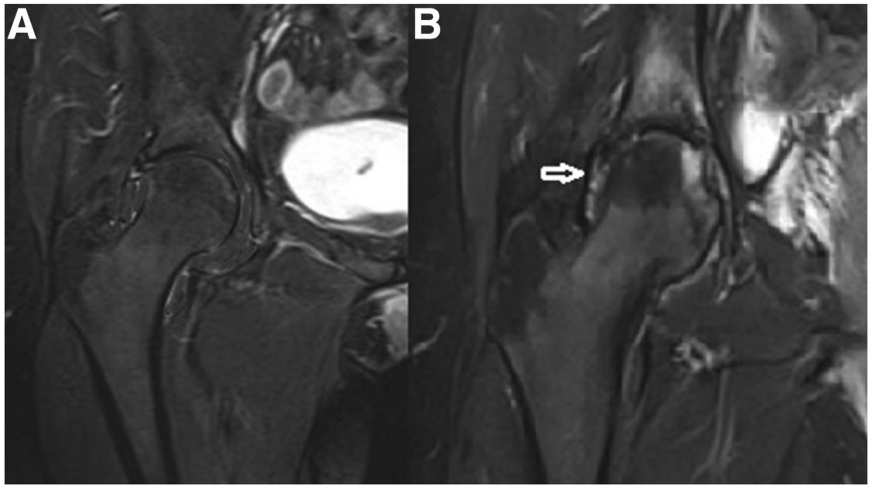


Fig 1. Preoperative (A) and postoperative (B) coronal T2-weighted magnetic resonance images of right hip in patient with prominent acetabular subchondral edema on latest scan. The arrow indicates the healed capsular defect.

the Tönnis classification,[22] and the lateral center-edge angle was measured using anteroposterior pelvis radiographs according to the method described by Wiberg.[25] Patient-reported outcomes, which included the Hip Outcome Score—Activities of Daily Living scale,[26] modified Harris Hip Score,[27] and visual analog scale pain score, were collected by direct contact with patients. The Hip Outcome Score—Activities of Daily Living scale, visual analog scale pain score, and modified Harris Hip Score were recorded the day before the surgical procedure and at the latest follow-up assessment.

MRI Analysis

A musculoskeletal radiologist (A.I.A.) analyzed each postoperative and preoperative MRI scan. The technique used for detecting capsular defects has been previously described by Strickland et al.[16] Capsular integrity was diagnosed on the T2-weighted sequence in the coronal plane. MRI scans were also assessed for the presence of subchondral cysts and subchondral sclerosis.

Statistical Analysis

Data analysis was performed using SPSS Statistics for Windows (version 24; IBM). $P < .05$ was considered statistically significant. The effect of dichotomous or categorical variables, including side, sex, and treatment method for the labrum (debridement or repair), was analyzed using the Fisher exact test or χ^2 test. Continuous variables (age, alpha angle, etc.) were analyzed using the Mann-Whitney *U* test.

Results

Forty subjects (42 hips) were included for analysis. There were 8 hips (19%) with capsular defects on the latest MRI scan. Demographic variables and functional results are reported in Table 1. The only variable showing a significant difference between the capsular defect group (n = 8) and the healed-capsule group was the preoperative alpha angle, which was higher in the defect group.

There were 3 hips with subchondral edema in the defect group compared with 1 in the healed-capsule group ($P = .01$) on the latest MRI scan, which was not present on preoperative MRI; this difference still yielded positive outcomes on multivariate analysis when the preoperative alpha angle was also taken into consideration (multivariate logistic regression analysis constant [B], 3; standard error, 1.4; $P = .03$) (Fig 1). There was 1 newly formed subchondral cyst in the defect group compared with 2 in the healed-capsule group ($P = .4$).

Discussion

The most important finding of this study was that 81% of the hips with unrepaired interportal capsulotomies did not have a capsular defect on MRI 5 years after hip arthroscopy. Capsular repair and healing of the capsule are still controversial issues in the literature. Evidence exists that capsular defects may remain with repair, whereas some studies have reported complete healing without repair.[14-20] This mostly depends on the interportal capsulotomy size and follow-up time, given that Strickland et al.[16] reported complete healing with no repair at 24 weeks, as none of the capsulotomy sizes exceeded 3 cm. With the longest-term follow-up period in the literature, our study partially supports this, showing that most of the capsules (81%) healed without repair; the rest did not, probably owing to the larger interportal capsulotomy size.

Most studies and reviews have reported superior functional results with capsular repair compared with nonrepair.[3-12] However, evidence remains that nonrepair may result in better postoperative functional

scores than capsular closure.[2,13] A recent systematic review by Kaplan et al.[2] showed similar functional results at a minimum 5-year follow-up after capsular repair. However, the unrepaired group underwent more labral debridement than the repair group. The authors tried to explain the poor results seen in previous studies, regardless of capsular management, with the evolving techniques in the area of hip arthroscopy.[2]

More important is whether nonhealing of the capsule leads to earlier joint degeneration and/or osteoarthritis development. We tried to analyze this using preoperative and postoperative conventional radiographs and MRI scans. As expected, owing to low reliability, our study could not find a difference between the 2 groups regarding Tönnis grading or change in osteoarthritis grade on radiographs.[21,28] Recently, it was reported that MRI had strong reliability for detecting subchondral cysts but did not improve osteoarthritis grading compared with radiographs.[21] Supporting this observation, our study found more subchondral edema in the unhealed group.

Limitations

Some study limitations exist. First, because the number of unhealed hips is low, this study could not determine the effect of healing on functional results. Second, the size of the interportal capsulotomy was not measured, so its impact on healing needs to be clarified. The last intraoperative status of chondrolabral tissue or grade of the severity of chondrolabral lesions was not reported. However, we have reported the type of labral treatment and measured indirect signs of cartilage damage such as the Tönnis grade and preoperative alpha angle.[29-31] Moreover, preoperative subchondral edema and/or cystic changes have been reported to be linked with cartilage lesion injury at the time of arthroscopy despite a mild radiographic appearance.[32]

Conclusions

In this study, 81% of interportal capsulotomies healed without repair at 5 years after primary hip arthroscopy.

Disclosures

All authors (O.H., S.A., A.I.A., M.C., O.A., B.G., O.G.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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