Save the Torn Labrum in Hips With Borderline Acetabular Coverage

Niraj V. Kalore MD, William A. Jiranek MD

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Abstract

Background Hip arthroscopy for labral tears improves short-term function, but reoperations occur in 5% to 47% of patients. The effect of borderline acetabular coverage on reoperation rate has been debated. Labral repair rather than débridement has been proposed to improve function, but the effect on reoperation rate is unclear.

Questions/Purposes We determined whether (1) borderline compared to adequate acetabular coverage increased reoperations and (2) labral repair compared to débridement reduced reoperations.

Methods We retrospectively reviewed 106 patients (mean age, 39 years) who underwent hip arthroscopy for labral tears. Based on radiographs, we classified patients into those with borderline ($n = 50$) or adequate ($n = 56$) acetabular coverage. We further divided each group into those with labral débridement or repair: borderline acetabular coverage, $n = 25$ and 25 , respectively; adequate acetabular coverage, $n = 39$ and 17 , respectively. We assessed

reoperations in borderline versus adequate acetabular coverage and labral débridement versus repair, modified Harris hip scores (mHHSs), and survival. Minimum followup was 12 months (mean, 33 months; range, 12–65 months).

Results Twenty-three of 106 patients had reoperations. Reoperation rate was higher with borderline than with adequate acetabular coverage. Reoperation rate was lower with labral repair than with débridement. Survival to reoperation was similar in the four subgroups although there was a tendency for early reoperation in patients with borderline acetabular coverage with débridement. Improvement in mean mHHS was comparable in the four subgroups.

Conclusions We found borderline acetabular coverage increased reoperation rates. Labral repair reduced the likelihood of reoperation, especially in hips with borderline acetabular coverage. Hip arthroscopy for labral tears was associated with high reoperation rates in hips with borderline acetabular coverage.

Level of Evidence Level IV, prognostic study. See Instructions for Authors for a complete description of levels of evidence.

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Each author certifies that his or her institution approved the human protocol for this investigation that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

N. V. Kalore, W. A. Jiranek (✉)
Department of Orthopaedics, Virginia Commonwealth
University, West Hospital, 1200 East Broad Street,
Richmond, VA 23298, USA
e-mail: wjiranek@gmail.com

Introduction

The acetabular labrum is a fibrocartilaginous structure attached to the rim of the acetabulum. It protects the articular cartilage by distributing joint force, improving stability, helping lubrication, and acting as a sealant of joint space [6, 11]. Labral tears and osteoarthritis are frequently a part of the continuum of joint disease [12, 21, 33].

Arthroscopic débridement of labral tears improves patients function, but a proportion of patients require

Table 1. Patient demographics

Variable	Subgroup DD	Subgroup DR	Subgroup NDD	Subgroup NDR	p value
Study population (number of patients)	25	25	39	17	
Mean age (years)	41	35	40	40	0.44
Female (number of patients)	22	22	29	13	
Male (number of patients)	3	3	10	4	
BMI	25	25	27	24	0.88
Presence of preoperative Grade 1 or 2 osteoarthritis (number of patients)	5	2	4	2	0.58

DD = borderline acetabular coverage, labral débridement; DR = borderline acetabular coverage, labral repair; NDD = adequate acetabular coverage, labral débridement; NDR = adequate acetabular coverage, labral repair.

reoperations, including THA [1, 3, 10, 18, 31]. Parvizi et al. [25] reported a high reoperation rate in dysplastic hips with labral tears. However, Byrd and Jones [4] and Yamamoto et al. [36] reported functional improvement and low reoperation rates in dysplastic hips with labral tears. Thus, the effect of borderline acetabular coverage (dysplasia) on reoperation rate after hip arthroscopy is debatable.

Two recent reports [9, 18] suggest repairing the labrum rather than débridement improves functional scores. However, eight of 24 revision cases of Heyworth et al. [14] were for failed labral repairs. Thus, it is unclear whether labral repair reduces reoperation rate.

We therefore explored the following questions: (1) Does borderline acetabular coverage (dysplasia) increase reoperation rate in labral tears treated with hip arthroscopy compared to adequate acetabular coverage? (2) Does repairing the labrum reduce reoperation rate in labral tears treated with hip arthroscopy compared to labral débridement?

Patients and Methods

We retrospectively reviewed medical records and radiographs of all 148 patients who underwent hip arthroscopy from January 2004 to August 2009. Indications for hip arthroscopy were disabling groin pain with positive provocative maneuvers and not responding to 6 weeks of NSAIDs and physical therapy, supported by evidence of labral tear on gadolinium-enhanced MR arthrogram. In patients with discordance between clinical and radiographic signs or with other possible etiology of pain, a fluoroscopically guided intraarticular injection of corticosteroid and local anesthetic medication was performed to ascertain the source of pain. Contraindications for hip arthroscopy included presence of Grade 3 or 4 [34] radiographic osteoarthritis and no relief of pain with intraarticular hip injection in patients with discordance between clinical and radiographic signs or with other

possible etiology of pain. We excluded 42 patients because of femoral osteochondroplasty ($n = 17$), synovial chondromatosis ($n = 4$), prior hip surgery ($n = 6$), osteonecrosis ($n = 1$), and clinical followup of less than 1 year or loss to followup after surgery ($n = 14$), which left 106 patients with arthroscopically proven labral tears for inclusion in the study. Seven of the 106 patients had preoperative Grade 1 osteoarthritis and six had Grade 2 osteoarthritis. These 106 patients were classified into two groups: those with borderline acetabular coverage ($n = 50$) and those with adequate acetabular coverage ($n = 56$). We further subdivided those with borderline acetabular coverage into two subgroups based on labral management: those who had labral débridement ($n = 25$) and those who had labral repair ($n = 25$). We similarly subdivided adequate acetabular coverage into two groups: those who had labral débridement ($n = 39$) and those who had labral repair ($n = 17$). Demographics in the four subgroups were comparable in terms of age, BMI, and presence of preoperative Grade 1 or 2 osteoarthritis (Table 1).

All patients presented with considerable groin pain exacerbated with prolonged sitting. Mechanical symptoms of catching, clicking, or snapping were present in 22 patients (21%). On physical examination, 97 patients (91%) had positive impingement test, 84 (79%) had positive flexion-abduction-external rotation test, and 85 (81%) had pain with hip flexion of more than 90°. Of the 106 patients, 25 were active athletes: 18 involved in non-contact sports (running most common) and seven involved in contact/collision sports (football most common). Only 33 of the 106 patients could remember an acute onset of symptoms. The inciting causes reported by patients included twisting injury of the hip ($n = 17$), a fall ($n = 7$), motor vehicle accident ($n = 5$), vaginal delivery ($n = 3$), and uterine surgery ($n = 1$).

All patients had appropriately aligned AP pelvis radiographs (with collinear alignment of the symphysis and coccyx with the distance between the top of the pubic symphysis and the sacrococcygeal junction approximating

Table 2. Radiographic findings

Variable	Borderline acetabular coverage	Adequate acetabular coverage
Mean lateral center-edge angle (°)	23	37
Mean anterior center-edge angle (°)	24	39
Mean Sharp's angle (°)	43	36
Presence of preoperative Grade 1 or 2 osteoarthritis (number of patients)	7	6

32 mm in men and 47 mm in women) and false-profile radiographs of the hip before surgery and at annual followup as part of the senior author's (WJ, treating surgeon) protocol. Radiographs were independently analyzed for acetabular coverage as indicated above and osteoarthritis per Tönnis grading [34] by the two authors. Patients were classified as having borderline acetabular coverage if the lateral center-edge angle of Wiberg [35] was less than 25° or Sharp's angle [32] was more than 40° [5, 7, 19, 23] on an appropriately aligned AP pelvis radiograph or the anterior center-edge angle of Lequesne and de Seze [19] was less than 25° on a false-profile radiograph of the hip. Radiographic findings are summarized (Table 2).

All patients had MRI of the affected hip with intraarticular gadolinium enhancement to confirm diagnosis of labral tear. We considered presence of dye extravasation in the labrum or chondrolabral junction as evidence of labral tear [15, 20].

All patients underwent an initial trial of nonoperative treatment, including a partial weightbearing protocol with physical therapy, antiinflammatory medications, and activity modification for a minimum of 6 weeks. Indications and contraindications of surgery were as discussed above.

The senior author performed all hip arthroscopies using the supine distraction method, with a medial thigh post on a fracture table and standard anterior and anterolateral portals with a 30° arthroscope. Portals were placed using fluoroscopic guidance by the cannulated technique. Initially, a diagnostic examination of the entire hip was performed. A beaver blade was used to perform a capsulotomy to improve instrument maneuverability in the hip. All surgeries before 2006 involved a conservative débridement of loose flaps of labrum with a shaver until it presented a stable edge (Fig. 1). However, as the importance of preserving the labrum evolved, the senior author has been preserving the labrum in the majority of cases depending on the condition of the labral tissue since 2006. The acetabular rim was trimmed to expose bleeding

Fig. 1 An arthroscopic view of the left hip through the anterolateral portal shows an anterolateral torn labrum (TL) being débrided with a shaver (S). The femoral head (H) is to the left and the acetabular cartilage (AC) to the right.

Fig. 2 An arthroscopic view of the right hip through the anterolateral portal shows a rim trim to expose bleeding subchondral bone (AR) to promote healing of the torn labrum (L). The femoral head (H) is seen below.

subchondral bone using a high-speed burr (Fig. 2) to enable good labral healing. This rim trimming was not aimed at altering the morphology of the acetabulum but was isolated to the region of the labral repair. The suture anchors were placed to adequately hold the labrum to the acetabular rim and to support adjacent cartilage delamination providing a face-lift effect (Fig. 3). If there was not enough healthy tissue in the labrum to enable a repair, labral débridement was performed as mentioned above.

Postoperatively, we allowed all patients 50% weight-bearing for 1 week with two crutches. We advised them to avoid twisting movements of the hip and hip flexion of

more than 90° for 6 weeks. Physiotherapy was aimed at restoring passive movements first, followed by active movements, and then strength. Patients used 325 mg aspirin twice a day by mouth for thromboprophylaxis for 3 weeks.

Followup after surgery was at 1 week, 1 month, 1 year, and annually thereafter. Length of followup included time from date of hip arthroscopy to date of last followup or reoperation. The minimum followup was 12 months (mean, 33 months; range, 12–65 months). No patients were recalled specifically for this study; all data were obtained from medical records and radiographs.

We evaluated function using the modified Harris hip score (mHHS) [3] and the Hip Dysfunction and Osteoarthritis Outcome Score (HOOS) [24]. The mHHS included an assessment based on pain (44 points) and function (47 points). The assessment of ROM (5 points) and deformity (4 points) from the original Harris hip score was removed. A multiplier of 1.1 provided a total possible score of 100. We recorded this score both pre- and postoperatively. At last followup, we gave all patients postal questionnaires, including the mHHS and HOOS. The questionnaire also included questions regarding need for reoperation and its nature. Eighty-eight of the 106 patients (83%) responded to the postal questionnaire. The 18 non-responders were followed up and scored during telephone calls. There were no missing data.

Patients had AP pelvis and false-profile radiographs at annual followup visits as part of the senior author's protocol to monitor for osteoarthritis progression, heterotopic ossification, and development of cam or pincer lesions.

Fig. 3 An arthroscopic view of the right hip through the anterolateral portal shows a suture anchor (SA) repair of the labrum (L) to provide a stabilizing effect on the acetabular cartilage (AC). The sagging of acetabular cartilage close to the acetabular rim has been face-lifted and stabilized with the labral repair. The femoral head (H) is seen below and the fovea (F) is seen in the right inferior corner.

Fisher's exact test was used to compare reoperation rates among groups: borderline versus adequate acetabular coverage and labral repair versus débridement. Kaplan-Meier survival analysis [2] was performed for the four subgroups with (1) reoperation and (2) THA as end points. We used the log-rank test to compare the survival in the four subgroups. The paired t-test was used to compare mHHS preoperatively and at last followup or before reoperation. We used Cox multivariate analysis to identify independent predictors of reoperation after hip arthroscopic treatment. We performed statistical analysis using WinSTAT® for Excel® (R Fitch Software, Bad Krozingen, Germany) and GraphPad Prism® (GraphPad Software, Inc, La Jolla, CA, USA).

Results

The reoperation rate was higher ($p = 0.04$) in patients with borderline acetabular coverage than in patients with adequate acetabular coverage (Table 3).

The reoperation rate was lower ($p = 0.04$) in patients with labral repair than in patients with labral débridement (Table 4).

At a mean followup of 33 months after arthroscopy for labral tears, 23 patients (22%) had further hip surgery, including 13 THAs, two periacetabular osteotomies, and eight repeat hip arthroscopies (one femoral osteochondroplasty, two rim resections, two labral repairs, three labral débridements). Reoperations in the four subgroups are summarized (Fig. 4). The Kaplan-Meier survival analysis with reoperation (Fig. 5A) or THA (Fig. 5B) as end point showed no difference ($p = 0.18$) among the four subgroups. However, there was a tendency for early

Table 3. Reoperations in patients with borderline or adequate acetabular coverage

Variable	Borderline acetabular coverage	Adequate acetabular coverage	p value
Number of patients	50	56	
Number of patients with reoperation	15	8	0.04

Table 4. Reoperations in patients with labral repair or débridement

Variable	Labral repair	Labral débridement	p value
Number of patients	42	64	
Number of patients with reoperations	5	18	0.04

Fig. 4 A flowchart summarizes patient categorization and reoperations in the various subgroups. FU = followup.

Fig. 5A–B Kaplan-Meier survival analyses with (A) failure and (B) THA as end points are shown. There is no intergroup difference, but note the trend toward early failures in the DD group. DD = borderline acetabular coverage, labral débridement; DR = borderline acetabular coverage, labral repair; NDD = adequate acetabular coverage, labral débridement; NDR = adequate acetabular coverage, labral repair.

Fig. 6 A graph compares preoperative (preop) and postoperative (postop) mean mHHS in the four subgroups. The mHHS improved 33% (from 58 preoperatively to 77 at last followup). There was no intergroup difference ($p = 0.23$) in the mean improvement in mHHS. DD = borderline acetabular coverage, labral débridement; DR = borderline acetabular coverage, labral repair; NDD = adequate acetabular coverage, labral débridement; NDR = adequate acetabular coverage, labral repair.

reoperation in patients with borderline acetabular coverage with débridement.

The mean mHHS improved from 58 preoperatively to 77 at last followup (33% improvement). For patients with reoperations, mHHSs immediately before reoperations have been included to calculate the mean mHHS. There was no difference ($p = 0.23$) in the mean improvement in mHHS from before operation to latest followup among the four subgroups (Fig. 6). The HOOSs are summarized by category in the four subgroups (Fig. 7).

The presence of borderline acetabular coverage ($p = 0.04$) and débridement of the labrum ($p = 0.02$) independently predicted reoperation. Increasing age ($p = 0.01$) and labral débridement ($p = 0.01$) independently predicted subsequent THA.

Fig. 7 A graph compares HOOSs by category in the four subgroups at last followup. ADL = activities of daily living. DD = borderline acetabular coverage, labral débridement; DR = borderline acetabular coverage, labral repair; NDD = adequate acetabular coverage, labral débridement; NDR = adequate acetabular coverage, labral repair.

Discussion

The acetabular labrum protects the articular cartilage in the hip [6, 11, 29, 31]. Tears in the labrum are associated with chondral damage and this may be part of a continuum of joint disease leading to osteoarthritis [12, 21, 33]. Treatment of labral tears by arthroscopy improves patient function, but there is concern about reoperations [1, 3, 10, 18, 30]. The influence of dysplasia on reoperations has been debated. Repairing the torn labrum rather than débriding in femoroacetabular impingement is reportedly associated with better functional improvement, though the effect on reoperations is not clear [9, 18]. We therefore evaluated whether borderline compared to adequate acetabular coverage increased reoperations and labral repair compared to débridement reduced reoperations.

Our study has some important limitations. First, our selection of patients for labral débridement or repair is mostly chronologic: we performed mostly labral débridement until 2006; after that, as the surgical technique and importance of labral repair evolved, we repaired the labrum in the majority of our cases, based on the condition of the labral tissue. Second, we analyzed function with the mHHS, which is more suitable for elderly patients undergoing THA. The HOOS, which we could only assess at latest followup, is better suited for evaluation of outcomes in the younger, more active population undergoing hip arthroscopy. Finally, we did not have consistent documentation of chondromalacia at arthroscopy in this retrospective study. However, the four subgroups were comparable in terms of presence of preoperative radiographic osteoarthritis.

The effect of borderline acetabular coverage or dysplasia on the reoperation rate and function scores in treatment for labral tears is controversial [4, 8, 25, 36]. Byrd and Jones [4] reported labral débridement in hips with

borderline acetabular coverage resulted in improvement in the mHHS. At 12 to 50 months after surgery, only two of 48 patients had a THA. Yamamoto et al. [36] found a 28-point mean improvement of the mHHS and no rapid progression of osteoarthritis after arthroscopic débridement in 10 patients with borderline acetabular coverage at a mean followup of 8 years. Parvizi et al. [25] reported improvement in functional scores after arthroscopic labral débridement in 34 hips with borderline acetabular coverage. However, functional scores deteriorated at 2-year followup and 16 patients (47%) had reoperation (including three THAs) by 3.5 years. Our study is in agreement with Parvizi et al. [25] about the poor prognosis of labral débridement in hips with borderline acetabular coverage. We reoperated 44% of our hips with borderline acetabular coverage, which contrasts with the 18% reoperation rate in hips with adequate labral débridement. This highlights the increased importance of saving the labrum in hips with borderline acetabular coverage. The hypertrophied labrum in hips with borderline acetabular coverage increases the surface area of contact and reduces the joint stress [17]. The loss of labral tissue to débridement, therefore, increases joint stress and accelerates the progression of osteoarthritis [25]. This might explain the high incidence of reoperation and need for THA after labral débridement in hips with borderline acetabular coverage.

We found a lower reoperation rate after labral repair than after débridement, especially in the presence of borderline acetabular coverage. However, there was no difference in function in the débridement and repair groups as measured by mHHS. Few studies (Table 5) have reported favorable short-term results after arthroscopic labral repair [16, 18, 27, 28]. Espinosa et al. [9], comparing labral refixation versus excision as part of an open procedure for femoroacetabular impingement, reported improved outcomes and fewer radiographic degenerative changes with labral refixation at early followup. Larson and Giveans [18] reported better mHHS after arthroscopic labral repair compared to labral débridement.

We found hip arthroscopy for labral tears resulted in a 33% improvement in the mHHS, with an overall reoperation rate of 21.7%, at a mean followup of 33 months. Our study has a higher reoperation rate and less functional improvement as compared to previously reported studies on labral tears with femoroacetabular impingement [1, 3, 10, 18, 22, 26, 30]. This could be explained by the presence of preoperative osteoarthritis ($n = 13$) and borderline acetabular coverage ($n = 50$). We believe treatment of a torn labrum with hip arthroscopy has major limitations due to a high reoperation rate. This is especially so in the presence of borderline acetabular coverage. Patients with labral tears should be screened for signs of borderline acetabular coverage using multiple indexes as in our study

Table 5. Clinical studies for arthroscopic labral repair

Studies	Number of patients	Mean followup (months)	Function (mHHS)	Number of reoperations
Larson and Givens [18] (2009)	75 (39 repair, 36 débridement)	21.4	Better in repair than débridement (p = 0.029)	7
Philippon et al. [27] (2009)	112 (58 repair, 54 débridement)	27	24-point gain; higher in repair than débridement, but not statistically significant (p = 0.10)	10 (THA)
Philippon et al. [28] (2010)	28 (repair)	24	25-point gain	2
Current study	106 (42 repair, 64 débridement)	33	19-point gain	23

mHHS = modified Harris hip score.

and a study by Haene et al. [13]. Patients with signs of borderline acetabular coverage should be properly counseled before surgery about the likelihood of reoperations. Every attempt should be made to save the torn labrum in patients with borderline acetabular coverage. In patients with adequate acetabular coverage, hip arthroscopy seems to be an adequate procedure. Our study highlights labral débridement in hips with borderline acetabular coverage has a poor prognosis with a high early reoperation rate. We recommend labral repair over labral débridement because of the lower reoperation rate.

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