Case Report

Catastrophic Failure of Hip Arthroscopy Due to Iatrogenic Instability: Can Partial Division of the Ligamentum Teres and Iliofemoral Ligament Cause Subluxation?

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Abstract: Hip arthroscopy is an evolving surgical tool, and with any new procedure, it is important to learn from the complications encountered. A patient with mild hip dysplasia and a symptomatic labral tear underwent uneventful hip arthroscopy and labral repair including partial debridement of a hypertrophied ligamentum teres. Despite preservation of the labrum, no pincer resection, and a modest capsulotomy, 3 months, subluxation and joint space narrowing were noted. One year, end-stage arthritis was present, requiring total hip replacement. Instability after hip arthroscopy is due to a number of factors, including excessive rim trimming, capsulotomy, overzealous labral resection, or inadequate labral repair. This report emphasizes the importance of the ligamentum teres and small disruptions of the capsule in patients with mild dysplasia.

As the diagnostic and therapeutic indications for hip arthroscopy expand, the associated risks require consideration. The hip arthroscopy literature reports an acceptable complication rate, generally under 1.5%, and most cases are minor or temporary.[1] Complications were attributed to aspects of the arthroscopic technique, such as patient positioning, traction, and fluid management.[1]

The relation between failure of arthroscopic femoroacetabular impingement treatment and iatrogenic instability is not fully understood. We present a case of rapid clinical and radiographic deterioration after hip arthroscopy due to femoral head subluxation, despite minimal disruption of the static stabilizers (Tables 1 and 2).

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CASE REPORT

A 42-year-old woman presented to our clinic with a 1-year history of right hip pain, worsened by impact loading and hip flexion. She reported decreased range of motion without locking episodes. She was otherwise well, with no previous hip problems or familial arthritis.

The patient had a normal gait, equal leg lengths, and no signs of hyperlaxity. Flexion was 120° bilaterally but painful on the right side. External rotation was limited to 45° on the right versus 60° on the left. Internal rotation measured 30° bilaterally. The Faber test was restricted and uncomfortable, whereas the quadrant test was strongly positive. Findings from examination of the remainder of the pelvic girdle and spine were normal. Radiographs and magnetic resonance imaging of the hip and pelvis are shown in Fig 1.

A symptomatic labral tear, possibly induced by mild acetabular dysplasia,[2,3] was diagnosed. Treatment options were discussed, and hip arthroscopy was scheduled with the patient's consent.

With the patient in the lateral position under general anesthesia, a large, padded perineal post (McCarthy

Table 1. *Tips and Pearls to Prevent Iatrogenic Hip Instability*

Preoperative assessment
1. Identify patients at risk for postoperative instability
a. CEA <25°
b. Hyperlaxity
c. Patients prone to extreme range of motion (ballet dancers, gymnasts)
d. Previously reported dislocation/subluxation or instability episodes
2. Ensure that patient expectations match disease status. Arthroscopic results with early joint space narrowing or femoral head wear are less predictable. The possibility of early arthroplasty should be raised.
3. Would your young dysplastic patient with a labral tear be better treated with periacetabular osteotomy?
Intraoperative decision making
1. If significant femoral head cartilage fragmentation or wear is encountered, consider minimal labrum/loose cartilage debridement only. Avoid further compromise of a failing joint.
2. Minimize your capsulotomy, in particular the anterior component transecting the iliofemoral ligament.
3. Using extra capsule traction sutures can increase visualization of the femoral neck.
4. Take time to repair the capsule.
5. If the hip is mildly dysplastic, repair the enlarged labrum because it plays a role in maintenance of stability.
6. Avoid excessive and/or long traction.
Postoperative protocol
1. Protected weight bearing for 6 weeks postoperatively to ensure advanced healing of the labrum and capsule repair before full weight bearing.
2. If the iliofemoral ligament has been repaired, avoid external rotation stretching in first 6 weeks.
3. Ensure close follow-up with early imaging.

distractor; Innomed, Savannah, GA) was placed between the legs. Under fluoroscopic guidance, traction was applied until 10 mm of joint distraction was achieved. A standard posterolateral portal was made under fluoroscopic guidance, and an anterior portal was made under direct vision.

A hypertrophied labrum with a ragged tear was noted with minimal attachment to the acetabulum between the 1- and 3-o'clock positions (Fig 2A). The labrum was freed from the edge of the acetabulum, and the acetabular rim was prepared with a bur, with care taken to remove less than 1 mm of bone. Labral repair was achieved with 2 single-loaded 3-mm BioSutureTak anchors (Arthrex, Naples, FL) (Fig 2B). A 2-cm^2 grade 4 chondral defect of the anterolateral acetabulum, adjacent to the labral tear (Fig 2C), was microfractured with an awl. The femoral head and the posterior aspect of the acetabulum had a normal appearance. The ligamentum teres (LT) was hypertrophied and synovitic (Fig 2D), so it was partially debrided with a radiofrequency wand (Arthrocare, Austin, TX). Capsulotomy was limited to approximately 2.5 cm, localized over the labral tear, and was not repaired at the end of the case. Traction was not objectively measured but was not excessive, and the case time was 45 minutes. The patient was restricted to partial weight bearing with crutches for 2 weeks, with no impact loading for 3 months.

Three months postoperatively, the patient complained of stiffness and pain. Range of motion was 110° of flexion, 50° of external rotation, and 30° of internal rotation. Radiographs are shown in Fig 3. The patient was prescribed nonsteroidal anti-inflammatory drugs and physiotherapy and advised to return to our clinic if the symptoms worsened.

One year postoperatively, the patient described progressive sleep disturbance and pain with activities of daily living. Examination showed 3 cm of shortening of the right leg with a marked limp, 100° of painful flexion, 30° of total rotation, and 20° of abduction. Radiographs and magnetic resonance imaging are shown in Fig 4.

The patient underwent a total hip replacement (THR) because of ongoing severe pain. Pathologic examination of the femoral head ruled out avascular necrosis (Fig 5). Hip aspirate showed no signs of infection. THR yielded good pain relief and return to activities of daily living.

DISCUSSION

We report post-arthroscopy catastrophic arthritic progression due to femoral head subluxation in the presence of preserved labrum, no pincer resection, and

Table 2. *Common Radiographic Markers and Indirect Signs of Dysplasia*

1. Lateral CEA of Wiberg
Borderline dysplasia (precautions warranted), 20°-25°
Dysplasia, <20° (is periacetabular osteotomy more appropriate?)
2. Sourcil (Tonnis) angle
Normal, 0°-10°
Dysplasia, >10°
3. Anterior CEA (false-profile view)
Borderline dysplasia, 20°-25°
Dysplasia, <20°
4. Femoral head coverage (3-dimensional CT scan/XR)
5. Hypertrophic labrum on MRA or at arthroscopy

Abbreviations: CT, computed tomography; MRA, magnetic resonance arthrography.

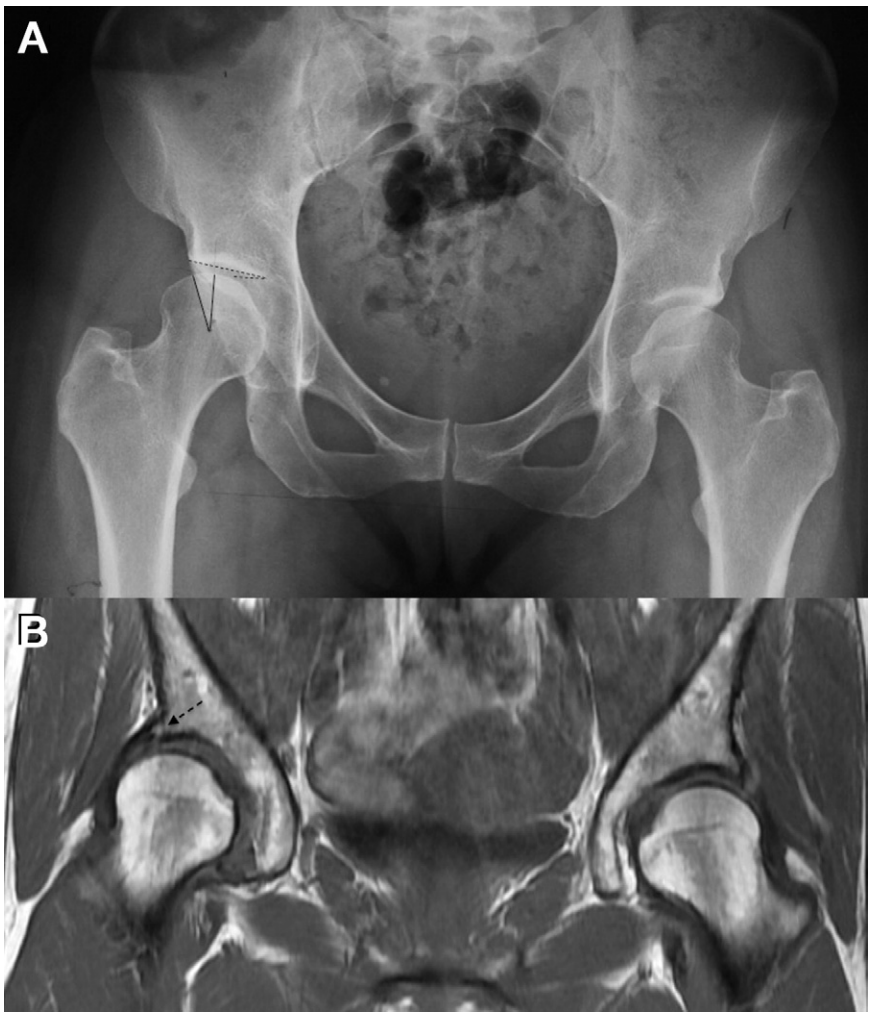

Figure 1. (A) Preoperative radiograph of patient with right hip pain shows normal joint space, mildly increased anteversion, and mild anterolateral dysplasia with a CEA of 22° (solid lines), a sourcil angle of 11° (dashed lines), and less than 75% head coverage. (B) Magnetic resonance imaging emphasizes the radiographic findings and shows significant anterolateral labral tear (arrow) and a sublabral cyst.

a modest capsulotomy involving only a small percentage of the iliofemoral ligament. Instability of the hip is uncommon because of the substantial conformity of the osseous femoral head and acetabulum and the strong surrounding capsuloligamentous complex.

Two cases of post-arthroscopy hip instability have recently been reported. Matsuda[4] reported frank femoral head dislocation after hip arthroscopy resulting from alteration of both dynamic and static stabilizers. The acetabular rim was trimmed, the labrum was debrided, and the capsule was opened and likely attenuated by supranormal distraction. This hip was stabilized with a mini-open capsuloligamentous repair, suggesting that soft-tissue alteration had a major destabilizing effect. Benali and Katthagen[2] described femoral head subluxation after arthroscopy due to extensive labral debridement and lateral acetabular rim trimming in a patient with a preoperative center-edge angle (CEA) of 23°. Three months postoperatively, the hip was subluxated and the patient required THR.

A multifactorial etiology of the previously mentioned complications is postulated. Hip joint stability is determined by static (osseous, labral, and capsuloligamentous) and dynamic (neuromuscular and adhesional forces) factors.[2,4] Our case shows that catastrophic instability can result despite minimal disruption of the static stabilizers. LT trimming and a minimal capsulotomy appear to have compromised the delicate balance of soft-tissue stabilizers in this mildly dysplastic hip, enough to cause rim loading without initial gross subluxation. In patients with dysplasia, rapid, sustained degeneration can be expected with any degree of subluxation.[5]

To prevent instability, rim trimming is contraindicated with a CEA of less than 20°.[6] In our patient with

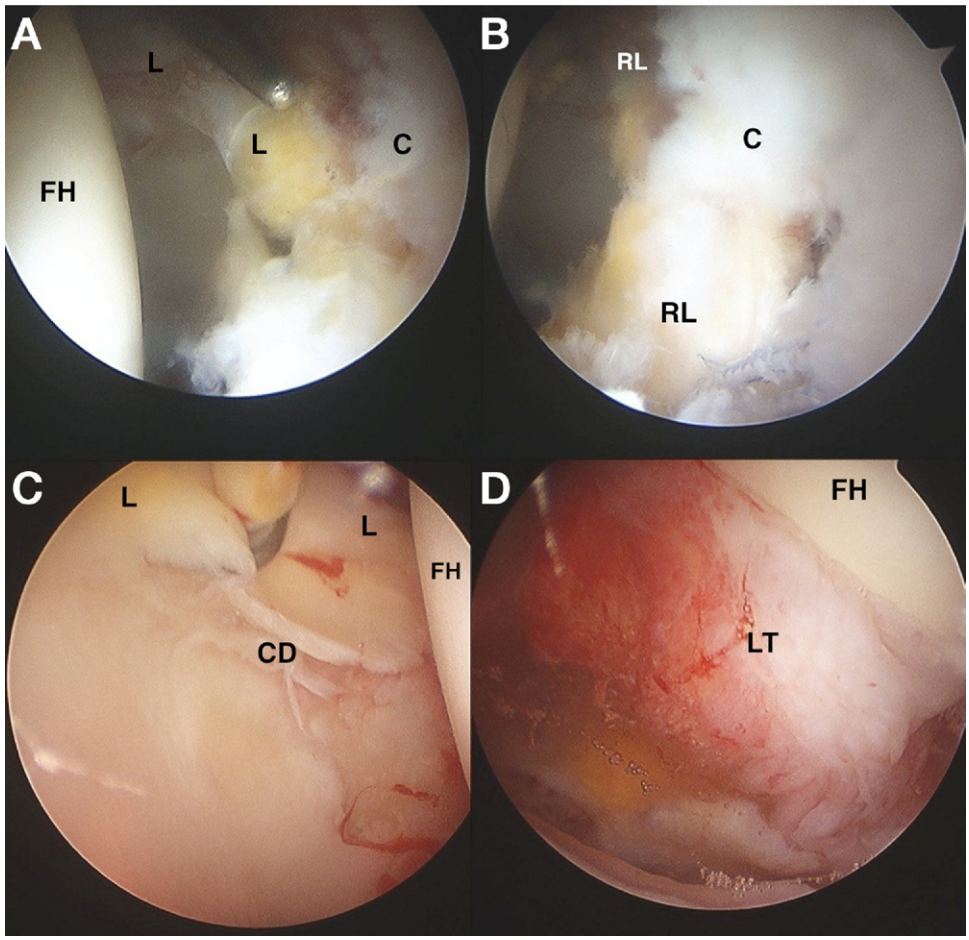

FIGURE 2. The patient is in the lateral position and under traction with the arthroscope in the posterolateral portal. (A) A hypertrophied labrum with nearly complete detachment from the 1- to 3-o'clock position is noted. (B) Stable repair is completed with 2 suture anchors. (C) A full-thickness chondral lesion is noted adjacent to the labral tear. (D) Hypertrophied, ragged, and synovitic LT seen before partial debridement. (C, capsule; CD, chondral defect; FH, femoral head; L, labrum; RL, repaired labrum.)

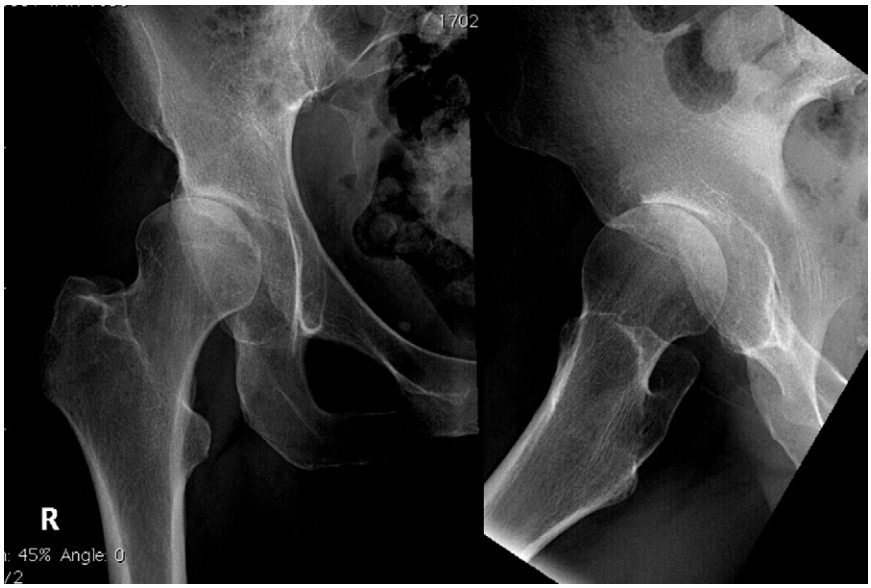

FIGURE 3. Follow-up radiographs 3 months after hip arthroscopy with labral repair and partial LT debridement show moderate femoral head anterosuperior subluxation, increase of sourcil angle, and dramatic loss of joint space superiorly.

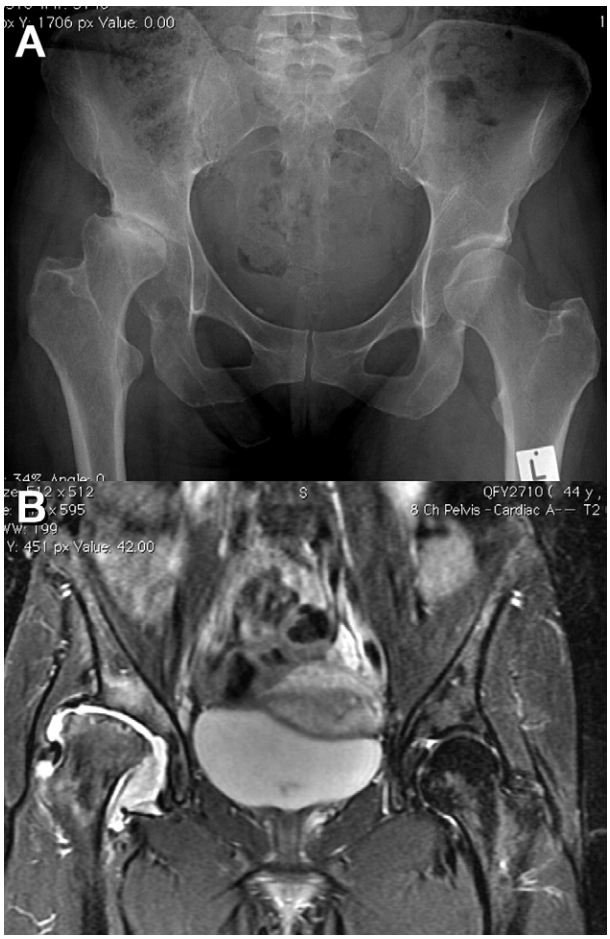

Figure 4. One year after hip arthroscopy, labral repair, and partial LT debridement, (A) the anteroposterior pelvis radiograph and (B) coronal MRI study show complete loss of joint space with marked flattening and sclerosis of the femoral head and sclerosis of the acetabulum.

mild dysplasia, the rim was prepared with a burr in preparation for labral repair, with care taken to avoid removing significant acetabular bone. Moreover, the labrum, which is known to have an exaggerated role in hip dysplasia,[2,7] was meticulously repaired. This large ragged labrum, commonly seen in shallow-socket hips, may be related to the extra stress placed on the chondrolabral junction, as a compensatory mechanism for inadequate bony coverage.[7]

In cases of inadequate bony coverage, the LT may have a role in keeping the femoral head in its concentric location. The LT's collagen distribution is similar to the ligaments of the knee,[8] with a similar load to failure as the anterior cruciate ligament.[9] A dense collagen network makes it particularly strong,[10] even around birth,[11] where it is assumed to minimize the likelihood of dislocation of the hip in utero.[12,13]

Authors have described the LT's role in hip stability[14,15] and found that injury to it contributes to recurrent hip subluxation in athletes.[16] This corresponds with the observation that the LT is tightest in adduction, flexion, and external rotation of the hip,[17,18] a position in which the joint is least stable. Some centers offer LT reconstruction to patients in whom arthroscopic surgery has failed and the symptoms are consistent with instability.[19]

The LT may aid in fine coordination of the hip. Leunig et al.[20] concluded that it may resist excessive movement and participate in nociception in patients with arthropathy. Finally, a theoretic role for the LT in the distribution of synovial fluid within the hip has been proposed,[21] known as the "windshield-wiper effect." Loss of these functions, specifically in dysplastic and arthritic hips, is a possible explanation for the rapid deterioration seen in our patient after debridement of the LT.

Understanding of the capsuloligamentous complex and its importance in hip stability continues to

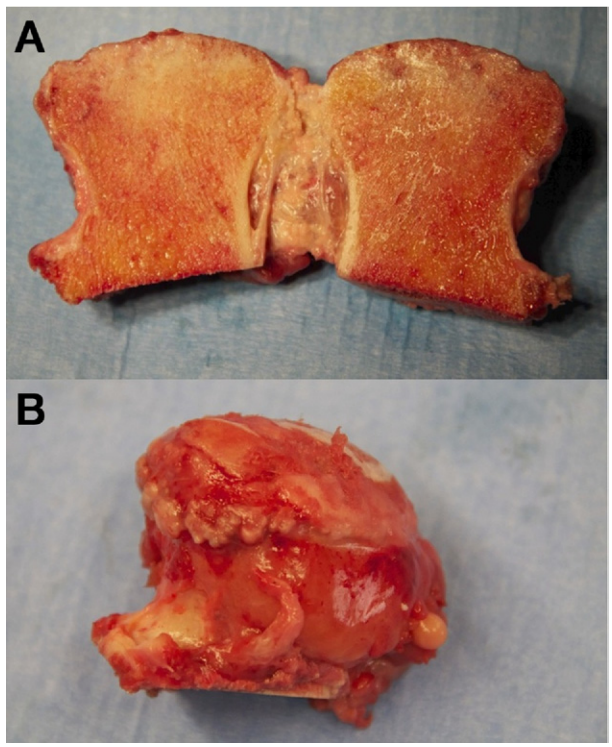

Figure 5. (A and B) Fourteen months after hip arthroscopy, at the time of THR, a pathologic specimen shows the significant arthritis with femoral head flattening and osteophyte formation. Histologic studies ruled out avascular necrosis.

grow.[17,22] Although a capsulotomy assists visualization and instrument navigation during hip arthroscopy, the optimal technique, amount of resection, and indications for capsular repair remain unknown.[23] Capsular repair is increasingly considered as concerns are raised regarding long-term effects of extensive capsulotomies. In our patient capsulotomy was minimal and confined to the superior border of the iliofemoral ligament, so no repair was deemed necessary. Because of this case, the senior author now performs labral repair in patients with a CEA of less than 25° using a "postage-stamp" capsulotomy, followed by a watertight repair. Weight-bearing radiographs are obtained at 6 weeks before full weight bearing is allowed.

In conclusion, instability after hip arthroscopy can be attributed to a number of factors including excessive acetabular rim resection, capsulotomy, overzealous labral resection, or inadequate labral repair.[4,23] This report emphasizes the role of the LT and even limited disruption of the iliofemoral ligament in patients with a CEA of less than 25°. To minimize the possibility of instability after arthroscopy, especially in dysplastic hips, consideration should be given to capsular repair[23] and preservation of the labrum and LT. Finally, protected weight bearing and hip precautions for 6 to 8 weeks will allow capsuloligamentous and/or labral repair to heal adequately before introducing full range of motion and weight-bearing stress.[17]

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