Arthroscopic Synovectomy and Treatment of Synovial Disorders

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INTRODUCTION

The hip is a synovial joint that bears significant loads over a lifetime. There are various conditions that can lead to hip joint dysfunction and result in significant disability. Synovial hip disorders are less common hip conditions and include synovial chondromatosis, pigmented villonodular synovitis (PVNS), septic arthritis, and inflammatory arthropathies.

Much of the literature that addresses the management of hip synovial disorders is based on reports that involve the treatment of other joints. However, these conditions do affect the hip joint proper, and a systematic approach can lead to acceptable outcomes in appropriately selected individuals. This chapter will describe synovial disorders and their typical presentation, physical examination findings, appropriate imaging studies, and hip arthroscopy indications for the management of these less commonly encountered disorders. In addition, a detailed surgical technique for central and peripheral compartment synovectomy is described.

BASIC SCIENCE

Synovial chondromatosis and synovial osteochondromatosis are the result of intrasynovial cartilage metaplasia, and it can cause the formation of multiple intra- and extra-articular loose bodies. These loose bodies may be primarily cartilaginous and associated with very little articular cartilage damage. With time, these loose bodies can ossify to variable degrees and result in progressive erosive changes near the hip joint proper. The cause and pathogenesis of PVNS remain unclear.

The condition appears to be the result of a fibrohistiocytic chronic inflammatory or neoplastic response. It is associated with synovial proliferation (either diffuse or focal), joint effusion, and bony erosion with characteristic hemosiderin deposition within the synovial mass. Multiple loose bodies and PVNS of the hip are associated with more erosive and degenerative changes than those seen in the knee as a result of the more constrained nature of the hip joint proper. Rheumatoid arthritis is the most common inflammatory arthropathy that affects the hip joint. The initial pathology involves the inflammation of the synovium, which leads to the eventual destruction of the joint if left untreated. A septic hip results in microorganisms activating an inflammatory response that recruits polymorphonuclear cells. Bacteria, synovial cells, and polymorphonuclear cells release enzymes that facilitate the degradation of glycosaminoglycans and the subsequent loss of collagen; this ultimately results in the gross destruction of articular cartilage and the development of arthritis if untreated early during the course of its development.

HISTORY

The typical history is quite variable for patients who present with synovial disorders. Patients with synovial chondromatosis are more commonly males in the third to fifth decade of life. They will typically present with deep groin and deep lateral hip pain that is often mechanical in nature as a result of loose bodies. These patients will frequently report catching and locking that may be quite unpredictable and that can have variable asymptomatic periods. Over time, the symptoms may become more frequent, with associated rest pain that is not related to activity; this may be the result of progressive articular cartilage destruction caused by the mechanical effects of the loose bodies. Pigmented villonodular synovitis typically presents during the third and fourth decades of life, with no gender predilection. It is typically monoarticular with associated aching and rest pain and variable mechanical symptoms. A longer duration of symptoms is associated with progressive degenerative and erosive changes and with a presentation that is similar to that of degenerative arthritis at a relatively young age. Patients will note progressive stiffness and range-of-motion limitations. Septic arthritis of the hip has a similar presentation to septic arthritis elsewhere. There is usually no history of trauma, and there may be a preceding illness. Septic arthritis of the hip is more prevalent among immunocompromised hosts and patients with frequent bacteremic episodes. Patients will often present with fever, chills, rapidly progressive groin pain, and irritability with range of motion. Joint aspiration is usually diagnostic. Inflammatory arthropathies that affect the hip joint can lead to end-stage arthritis. Earlier during the course of the disease, however, patients will occasionally present with hip joint irritability as a result of synovitis that is unresponsive to oral or injectable medication. Occasionally, this may be the first presentation of a patient with an undiagnosed inflammatory arthritis.

PHYSICAL EXAMINATION

The physical examination findings of patients with synovial disorders can be variable. If intermittent mechanical symptoms are the primary complaint, the physical examination can be normal.
When synovitis is present, pain is typically experienced with range of motion of the hip, primarily at the end of the range. These patients may have secondary labral tears and chondral pathology. The anterior impingement test (i.e., hip flexion, adduction, internal rotation) is indicative of anterolateral rim pathology, and the posterior impingement test (i.e., hip extension, external rotation) indicates posterolateral rim pathology. A septic hip will often present with a severely antalgic gait and extreme pain with any attempts at range of motion, whereas an active synovitis caused by an inflammatory arthropathy will present with pain at the end of the range of motion with variable, less dramatic pain during early and mid-range-of-motion testing. Global restrictions of range of motion are usually indicative of advanced disease and end-stage hip joint destruction. A complete examination of the lower back, the pelvis, extra-articular hip structures, and, occasionally, the gastrointestinal and genitourinary systems is critical to rule out other causes of pain that can be referred to the hip region.

IMAGING AND DIAGNOSTIC STUDIES

When evaluating a patient with symptoms that are consistent with hip joint pathology, plain radiographs should be obtained first. We typically obtain an anteroposterior radiograph of both hips with 2 cm to 4 cm between the pubic symphysis and the sacrococcygeal junction. A frog-leg lateral radiograph and a cross-table lateral radiograph with 15 degrees of internal rotation complete the initial series. Radiographic abnormalities may include arthritis, arthrosis, dysplasia, femoroacetabular impingement, and loose bodies. It has been reported that radiographs fail to diagnose loose bodies up to 50% of the time; this may be a result of the inconsistent calcification of these loose bodies and because they may be obscured by overlying structures. Large and multiple lucencies on plain radiographs are consistent with PVNS (Figure 21-1, A). Magnetic resonance arthrography (MRA) is the gold standard imaging technique for evaluating the hip joint proper. MRA has been shown to be very sensitive for labral tears and less accurate for chondral pathology. A septic hip will often present with a severely antalgic gait and extreme pain with any attempts at range of motion, whereas an active synovitis caused by an inflammatory arthropathy will present with pain at the end of the range of motion with variable, less dramatic pain during early and mid-range-of-motion testing. Global restrictions of range of motion are usually indicative of advanced disease and end-stage hip joint destruction. A complete examination of the lower back, the pelvis, extra-articular hip structures, and, occasionally, the gastrointestinal and genitourinary systems is critical to rule out other causes of pain that can be referred to the hip region.

INDICATIONS

- Arthroscopic synovectomy of the hip is infrequently performed in isolation, and it is often performed along with the management of associated labral tears, chondral pathology, and loose bodies. The removal of loose bodies from patients with mechanical symptoms is one of the clearest indications for hip arthroscopy. These loose bodies may be the result of synovial chondromatosis, and, in this situation, a synovectomy is performed in addition to the removal of the loose bodies (Figure 21-2).
- Pigmented villonodular synovitis is best managed in its focal form. However, in diffuse PVNS it may not be possible to perform a complete synovectomy as the posterior and posterior inferior portions of the hip are difficult to access arthroscopically. In this situation we have performed a central compartment synovectomy (lunate fossa), followed by peripheral compartment (anteroinferior to posteroinferior) synovectomy (Figure 21-3). A T-capsulotomy and the addition of a postero-peritrochanteric portal allows for access to posterior capsular areas in some cases. A follow up MRI is obtained at 2 to 3 months and if residual disease is seen posteriorly, a limited open posterior approach to the hip can be performed to remove residual disease. Some nonarthroscopists would argue for open treatment primarily for diffuse PVNS.
- An arthroscopic irrigation, debridement, and synovectomy are effective for treating an acutely septic hip; these treatments result in less postoperative morbidity than an open arthrotomy. MRA images should be obtained before the performance of arthroscopy for a septic hip, because chronic infection, osteomyelitis, and the local extension of a periarticular abscess are contraindications to arthroscopic treatment.
- Arthroscopic synovectomy for inflammatory arthritis is less well defined, and the indications should be limited. Treatment of rheumatoid arthritis consists of immunosuppressive
medication, disease-modifying agents, and anti-inflammatory medications. For patients with early rheumatoid arthritis with minimal degenerative disease and symptoms that are consistent with synovitis and unresponsive to oral and intra-articular medications, a synovectomy can be offered as an alternative treatment. There is no conclusive evidence that demonstrates that synovectomy slows the disease process and the eventual bony destruction. Again, it is difficult to access the posterior and posteroinferior hip joint arthroscopically, making a complete synovectomy very difficult if not impossible in many cases, which is a clear limitation to arthroscopic management.

- Moderate to advanced degenerative changes without primary mechanical symptoms as a result of loose bodies should be considered a relative contraindication to hip arthroscopy. Occasionally arthroscopy will reveal significantly more advanced degenerative changes than appreciated on plain radiographs or MRA, and this can help to expedite more definitive management (e.g., hip arthroplasty).

- In all of these situations, chondral and labral pathology may be encountered, and these can be treated during the same procedure.

**SURGICAL TECHNIQUE**

Hip arthroscopic synovectomy can be performed with the patient in the supine or lateral position; the senior author (CML) prefers the supine position. The central compartment and the peripheral compartment need to be addressed for the full visualization of all of the pertinent structures and for the performance of a near-complete synovectomy, when indicated. The central compartment is visualized with traction on, and the peripheral compartment is best evaluated with hip flexion and variable degrees of abduction, adduction, and rotation. The structures visualized in the central compartment include the medial femoral head; the acetabular fossa (i.e., the ligamentum teres and the pulvinar); the anterior, superior, and posterior lunate articular cartilages and labrums; and the medioanterior, superior, and posterior capsule. The Weitbrecht fibers are visualized in the peripheral compartment as well and include the medial, anterior, and lateral (i.e., the retinacular vessel site) synovial folds.
The patient is initially placed in the supine position on a fracture table or a standard table with the addition of one of various available distractors. Intraoperatively, a preprocedure fluoroscopic “around the world” evaluation of the hip in extension is performed, with internal, neutral, and external rotation; a frog-leg lateral view with the trochanter superimposed on the femoral neck is obtained; and a cross-table lateral view with the hip in 15 degrees of internal rotation is also obtained to evaluate for bony abnormalities (e.g., femoroacetabular impingement), when indicated. Next, the leg is initially placed in slight hip flexion, neutral to slight hip abduction, and internal rotation. The minimum amount of traction that appropriately distracts the hip is then applied.

A spinal needle is placed at the level of the anterior paratrochanteric portal (i.e., just anterior to the proximal aspect of the greater trochanter), roughly parallel to the sourcil or the acetabular roof. Care is taken to not damage the femoral head articular cartilage and to place the needle between the labrum and the femoral head. The inner stylet is then removed, which releases the intra-articular negative pressure and allows for easier distractibility, if needed. A cannulated system is then used to introduce a blunt obturator into the joint over a guidewire, and this is followed by a 70-degree arthroscope. At this point, the anterior femoral head, the acetabulum, the acetabular labrum, and the anterior capsule are identified (Figure 21-4, A).

An anterior portal 2 cm distal to the junction of the anterosuperior iliac spine and the proximal greater trochanter is made with the use of direct visualization. We make this portal farther distal than what is typically described, which allows for the better placement of anchors and for chondral work on the acetabulum without accessory portals when labral repair and/or chondroplasty procedures are indicated. A limited capsulotomy is then performed with a beaver blade to allow for improved maneuverability. At this point, the arthroscope is placed into the anterior portal looking back at the initial anterior paratrochanteric portal. If this portal has penetrated a portion of the labrum, then it is repositioned outside of the labrum and followed by a limited capsulotomy. The arthroscope is then placed back into the anterior paratrochanteric portal, and the superior and posterior portions of the femoral head, the labrum, and the acetabulum are visualized (see Figure 21-4, B). A spinal needle is placed in the posterior paratrochanteric portal initially for outflow; this portal can later be established as a working or arthroscopic portal if one is required for the procedure that is to be performed.

Next, a systematic evaluation of the central compartment is performed with the arthroscope initially in the anterior paratrochanteric portal. The anterior labrum, the medial femoral head, and the acetabular fossa with the associated ligamentum teres and pulvinar are evaluated (see Figure 21-4, C). External rotation of the hip should reveal a tightening of the ligamentum teres, if it is intact. Loose bodies, synovitis, and PVNS will frequently be found in the acetabular fossa when managing these synovial disorders. Occasionally a 30-degree arthroscope will allow for the better evaluation of the acetabular fossa. Loose bodies are then removed with various available graspers, and the pulvinar can be debrided with a shaver if it is pathologic. PVNS can be resistant to standard shaving, and a more aggressive grasper can be used to remove this tissue and to send the tissue for confirmatory biopsy. Switching the working and arthroscopic portals allows for complete access to this region for the removal of loose bodies and pathologic pulvinar or synovium.

A 70-degree arthroscope is then used to evaluate the chondral surfaces of the femoral head, the acetabulum, and the acetabular labrum. The management of any pathology is then performed as described in other chapters. The anterior, superior, and posterior capsule is then evaluated, and a shaver can be used to perform a synovectomy in this region. Any bleeding can be controlled with various available ablation devices.

The hip is flexed to approximately 30 to 45 degrees initially, with a spinal needle placed through the incision for the anterior paratrochanteric portal to be created over the anterior femoral neck. Either a 30- or 70-degree arthroscope can be used to visualize the peripheral compartment. Secondary portals can then be established through the anterior portal and the posterior paratrochanteric portal, and an accessory (mid-lateral) portal can be made 2 cm to 4 cm distal to the previous portals and midway between the anterior portal and the anterior paratrochanteric portal. Limited capsulotomies can then be performed with a beaver blade to improve maneuverability. The peripheral compartment is visualized in a systematic fashion as previously described.

The peripheral compartment can be divided into seven distinct regions (Figure 21-5). We have modified this description on the basis of the evaluation of the anterior, posterior, inferior, superior, medial, and lateral anatomic regions as recently described by Ilizaliturri and colleagues. The anterior neck region is identified first with its associated anterior (adherent to the femoral neck) and medial synovial folds, zona orbicularis, and iliofemoral ligament (Figure 21-6). Looking further inferolaterally (caudally) reveals the inferior reflection of the capsule at the intertrochanteric crest (Figure 21-7). Moving the arthroscope farther inferior over the medial synovial fold reveals the inferior neck, the inferolateral femoral head, the anteroinferior labrum, and the transverse acetabular ligament (Figure 21-8). The arthroscope is then brought back superiorly to reveal the anterolateral femoral head and the anterior labrum (Figure 21-9). Looking farther superior will then bring the superolateral femoral head and superior labrum into view (Figure 21-10). The arthroscope is then brought down over the superior femoral neck, which brings the lateral synovial fold into view.
A systematic approach to peripheral compartment arthroscopy and to identifying the peripheral compartment anatomy is described with the use of the modification of a prior description by Dienst and colleagues.  

**Figure 21-5** A systematic approach to peripheral compartment arthroscopy and to identifying the peripheral compartment anatomy is described with the use of the modification of a prior description by Dienst and colleagues. **1**, Anterior neck area; **2**, inferior neck area; **3**, inferolateral head area; **4**, anterolateral head area; **5**, superolateral head area; **6**, superior neck area; **7**, posterior area.

**Figure 21-6** Peripheral compartment arthroscopy that reveals the anterior neck area (area **1**) of the left hip. The anterior synovial fold (ASF), the medial synovial fold (MSF), and the zona orbicularis (ZO) are readily identified.

**Figure 21-7** Further caudally in the peripheral compartment, the inferior capsular reflection (IR) at the intertrochanteric crest is visible, along with the anterior femoral neck (FN) and the medial synovial fold (MSF).

**Figure 21-8** The anteroinferior region of the peripheral compartment (areas **2** and **3**) reveals the inferior femoral neck (IN), the inferolateral femoral head (PH), the anteroinferior labrum (L), and the transverse acetabular ligament (TL).

**Figure 21-9** The anterior region (area **4**) of the peripheral compartment reveals the anterolateral femoral head (FH) and the anterior labrum (L).
OUTCOMES

Outcomes are limited with respect to arthroscopic management of synovial disorders. Much of the arthroscopic literature focuses on septic arthritis. There have been case reports and several series that report excellent results after arthroscopic treatment of septic hip arthritis. One series reported 10 patients treated arthroscopically for septic hip arthritis with no recurrences at a mean 5-year follow up. These results have shown that this approach is safe with less morbidity than an open approach. When a surgeon with hip arthroscopic skills is treating this condition, arthroscopy may be the preferred approach.

There are fewer reports on arthroscopic management of synovial chondromatosis or osteochondromatosis of the hip. One large series reported on 120 patients who underwent hip arthroscopy for synovial chondromatosis of the hip with mean follow up of 78.6 months. More than one arthroscopy was required in 20.7%, and 37.8% went on to open surgery. Arthroscopy was beneficial with good to excellent results reported in greater than 50% of the cases. When discussing treatment options with these individuals, the potential for future surgeries open and arthroscopic should be stressed. A large number of loose bodies seen on MRI and plain radiographs in the posterior capsular region may be an indication for an open approach or result in a greater chance of requiring an open approach after arthroscopic treatment.

CONCLUSION

Arthroscopic synovectomy is indicated for select hip joint disorders. A detailed history, a physical examination, and imaging studies will help to identify those patients who may benefit from arthroscopic synovectomy. A systematic evaluation of the central and peripheral compartments allows for a predictable evaluation of much of the hip joint proper. Focal and near-complete synovectomies are possible when treating patients with synovial hip disorders. The decision to perform the open management (as compared with arthroscopic management) of synovial hip disorders should be individualized on a case-by-case basis and determined on the basis of surgeon experience, technical feasibility, and location and extent of pathology.
CHAPTER 21 Arthroscopic Synovectomy and Treatment of Synovial Disorders

This article compares the traditional “clock-face” description of the hip joint with a new proposed zone system for describing the arthroscopic hip joint anatomy. The accuracy of each method is tested by several hip arthroscopy master instructors and the identification of lesions in a cadaveric model.


This is an excellent review of current diagnostic methods and indications for hip arthroscopy, including labral tears, capsular laxity and instability, chondral lesions, ligamentum teres lesions, snapping hip, iliopsoas bursitis, and synovial chondromatosis.


This article describes the arthroscopic technique and treatment of 10 patients with septic arthritis of the hip. All patients had an excellent result without complications at a mean follow up of almost 5 years.


This is a detailed review of the current indications and outcomes for the arthroscopic management of various synovial disorders. This article includes a review of synovial chondromatosis, rheumatoid arthritis, pigmented villonodular synovitis, and septic arthritis of the hip.


This review article describes the use of magnetic resonance imaging as a diagnostic tool for inflammatory arthritis. The strengths and weaknesses of this imaging modality are discussed as they apply clinically to inflammatory disorders.


This article describes the arthroscopic management of septic arthritis of the hip in 6 patients. Arthroscopic irrigation, debridement, and postoperative antibiotics led to excellent outcomes in all patients at 6 to 42 months of follow up.


This article reports good results of the treatment of 10 patients with documented diffuse pigmented villonodular synovitis of large joints, including the hip. Patients were treated with a debulking surgery that was followed by the postoperative intra-articular injection of yttrium 90, and they were followed for a mean 6 years.


This study reports successful treatment of septic hip arthritis in 4 patients with hip arthroscopy. There were no recurrences at latest follow-up of 1 to 6 years.