76635_CH27 p471-488.qxd 10/17/06 10:23 PM Page 471

27

HIP AND THIGH: INTRA-ARTICULAR LESIONS

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KEY POINTS

- When a pathologic process alters the function of the homeostatic chemical and mechanical forces within the hip joint, articular cartilage breakdown can occur and joint deterioration may follow.
- Disruption of the articular surface dynamics usually responds best to surgical debridement, repair, or removal of the offending lesion or lesions.
- Arthroscopy offers a minimally invasive solution compared to traditional open techniques.
- Open exposure of the joint remains an option for conditions not amenable to arthroscopic technique, such as fixation of large osteochondral lesions.
- Loose bodies within the joint can cause pain and may mimic the snapping hip phenomenon.
- A disruption of the acetabular labrum alters the biomechanical properties of the hip. The forces acting on the hip in the setting of a torn labrum often cause pain during sports participation. Patients with labral tears often present with mechanical symptoms, such as buckling, clicking, catching, or locking.
- The most commonly reported cause of a traumatic labral tear is an externally applied force to a hyperextended and externally rotated hip. However, a specific inciting event often is not identified, and the patient presents for evaluation after failed attempts to management of groin pulls, muscle strains, or hip contusions.
- Femoroacetabular impingement is a structural abnormality of the femoral neck which can lead to chronic hip pain and subsequent acetabular labral degenerative tears. The repetitive microtrauma from the femoral neck abutting against the labrum produces degenerative labral lesions in the anterior-superior quadrant.
- Impingement often occurs in extreme ranges of motion. While in flexed position, patients exhibit a decrease in both internal rotation and adduction, often accompanied by pain.
- Osteonecrosis can cause severe pain and disability in young patients. It occurs most commonly between the third and fifth decades of life. Osteonecrosis can be the result of trauma that disrupts the blood supply of the femoral head. *Non*traumatic risk factors include: corticosteroid use, heavy alcohol consumption, sickle cell disease, Gaucher and Caisson disease, and hypercoaguable states.
- Instability of the native hip is much less common than shoulder instability, but can cause a significant amount of disability. The labrum provides a great deal of stability at extremes of motion, particularly flexion. With a torn or absent labrum, a great deal of force is transmitted through the capsule.
- Traumatic dislocations of the hip can lead to capsular redundancy and clinical hip laxity.
- Hip instability has been recognized in sports with repetitive hip rotation with axial loading, such as golf, figure skating, football, gymnastics, ballet, and baseball. A common injury pattern for athletes is labral degeneration combined with subtle rotational hip instability. This has been successfully treated with labral debridement and thermal capsulorrhaphy.
- Rheumatoid arthritis is a common inflammatory arthritis that can affect the hip. Arthroscopic synovectomy has been used as a treatment aimed to improve symptoms and slow progression of the disease.

76635_CH27 p471-488.qxd 10/17/06 10:23 PM Page 472

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- Patients with underlying chronic conditions, such as osteonecrosis or connective tissue disorders, may benefit from a diagnostic and therapeutic arthroscopy, when mechanical symptoms are present.

~~INTRODUCTION~~

Approximately 2.5% of all sports related injuries are located in the hip region, and this figure increases to 5% to 9% of high school athletes (1). Painful hips in the young and middle-aged patients impose a diagnostic challenge. With improved imaging modalities and an increasing capacity to treat intra-articular pathology, more diagnoses and treatments are available than a decade ago. Arthroscopic treatment of intra-articular and extra-articular lesions of the hip continues to expand. With recent advances providing an invaluable diagnostic as well as treatment vehicle for hip pathology. As a result, our awareness of many hip problems has increased. We now have more definitive answers for the active patient without radiographic evidence of degenerative joint disease and less commonly must formulate vague diagnoses such as generalized hip sprains, strains, or tendonitis.

The hip joint often functions without problems for 7 or 8 decades under normal physiologic loads, which include loads of up to five times body weight. When a pathologic process alters the function of the homeostatic chemical and mechanical forces within the joint, articular cartilage breakdown can occur and joint deterioration may follow. Unfortunately, a large percentage of patients are not evaluated or diagnosed until the process affecting the joint is established. Once bony changes have occurred, the process of joint deterioration becomes progressive and usually irreversible. While aging defines a large portion of patients with hip degenerative joint disease, younger patients with intra-articular disruptions have acute symptoms and are at risk of developing a chronic disability. Improved imaging modalities and arthroscopic techniques have introduced the ability to identify and treat intra-articular pathology in hopes of preventing the degenerative cascade.

The majority of intra-articular pathology does not respond well to conservative treatment. Disruption of the articular surface dynamics usually responds best to surgical debridement, repair, or removal of the offending lesion or lesions. Treatment of intra-articular lesions can be performed either open or arthroscopically. Arthroscopy, however, offers a minimally invasive solution compared to the traditional open techniques. It spares extensive surgical dissection and violation of the hip capsule. While the range of pathology amenable to arthroscopic treatment in the hip continues to expand, open exposure of the joint remains an option for conditions not amenable to arthroscopic techniques such as fixation of large osteochondral lesions. The goal of surgical treatment of intra-articular lesions is to restore near normal intra-articular anatomy and biomechanical forces. Inferior arthroscopic results, therefore, should not be accepted from inexperienced surgeons.

Burman (2) first introduced arthroscopic surgery of the hip in 1931. While procedures for the shoulder and knee flourished in the 1980s, hip arthroscopy received relatively little attention. Within the last 10 years, a variety of studies have documented the success of treating a wide range of intra-articular pathology of the hip. Current indications for intra-articular hip arthroscopy include removal of loose bodies, treatment of acetabular labral tears, avascular necrosis (AVN), synovial and connective tissue disorders, chondral lesions, and the treatment of impingement.

LOOSE BODIES

Loose bodies within the joint can cause pain and may mimic the snapping hip phenomenon. Anterior groin pain, episodes of clicking or locking, buckling, giving way, and persistent pain during activity suggest an intra-articular loose body. McCarthy and Busconi (3) showed that loose bodies within the hip, whether ossified or not, correlated with locking episodes and inguinal pain.

In cases of traumatic injury or dislocation, suspicion should be high for loose bodies to explain hip symptoms. Besides hip trauma, other diseases known to be associated with loose bodies include Perthes disease, osteochondritis dissecans, AVN, synovial chondromatosis, and osteoarthritis. When identified by computed tomography (CT) scanning during closed treatment of an acetabular fracture or a hip dislocation, Keene and Villar (4) advocate early arthroscopic retrieval of traumatic loose bone fragments from the joint to eliminate additional insult to the articular surface.

Radiographs often identify loose bodies, but noncalcified lesions may not appear on standard radiographs. CT scans are highly sensitive for detection of suspected loose bodies and are more sensitive than magnetic resonance imaging (MRI) (5). Loose bodies may occur as an isolated lesion following trauma or may present with many intra-articular lesions as seen in synovial chondromatosis.

Although arthrotomy remains the gold standard for direct observation and removal of intra-articular and extra-articular objects or loose bodies, the morbidity of an open approach and hip dislocation is significant. Hip arthroscopy offers an excellent method for removal of the lesions. McCarthy and Busconi (3) reported that radiographs did not visualize 67% of loose bodies in the hip. When persistent symptoms of locking or catching are present, further work-up for loose bodies should be performed. A CT scan is the imaging modality of choice to pursue, followed by a diagnostic or therapeutic hip arthroscopy **(Fig 27-1)**. A history of trauma followed by mechanical symptoms suggests either an articular loose body, chondral injury or a labral injury. While CT scans best evaluate loose bodies, an MRI offers the best imaging modality for labral injures, therefore occasionally both studies are required for the diagnosis.

Osteoarthritic changes in the hip can be caused by intra-articular bone and chondral fragments or from a step-off at the articular surface. Osteoarthritis has been documented to

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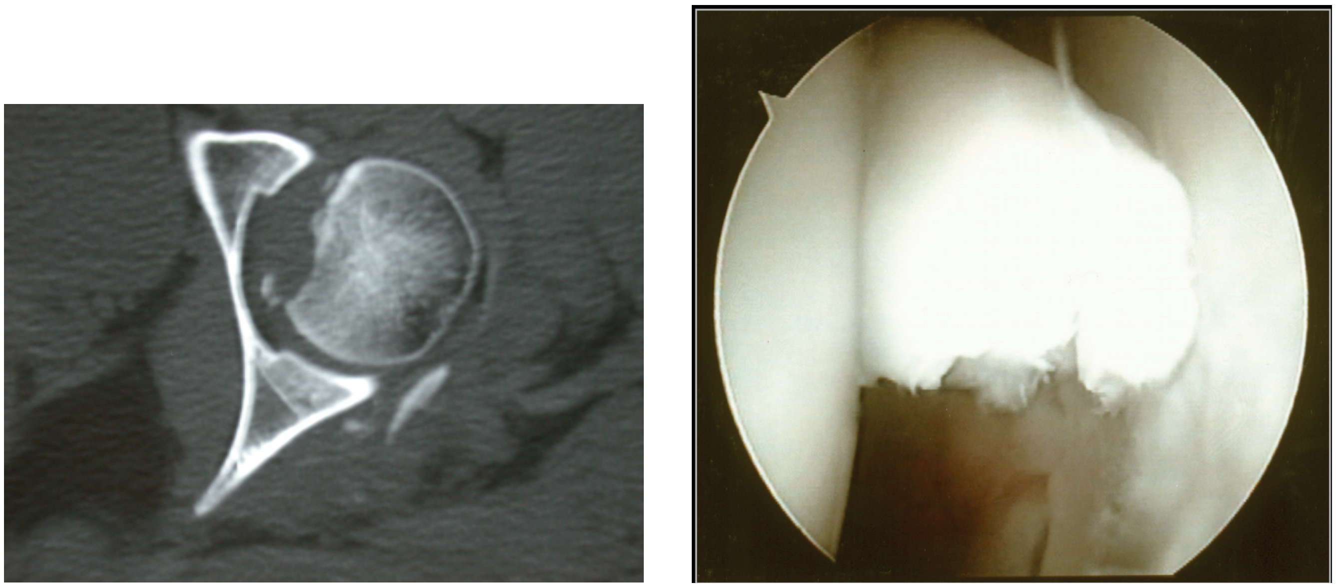

A B

Fig 27-1. **A:** Axial CT illustrates loose bodies within the hip joint along with a humeral head defect following a posterior hip dislocation. **B:** Arthroscopy of the joint allows for loose body removal.

occur at a rate of approximately 25% to 55% following all native hip dislocations at a follow-up of 10 years, with simple dislocations having a better prognosis (6). Upadhyay et al. (7) reported osteoarthritic changes at 5 years following traumatic posterior dislocation of the hip. Yamamoto et al. (6) evaluated 11 hips arthroscopically after major hip trauma. In seven cases, small osteochondral or chondral fragments visualized arthroscopically were not seen on radiographs or CT scans. Even though the patient series was small, because over half of the patients had free fragments documented on arthroscopy, there is a broadening indication for diagnostic arthroscopy and lavage following hip trauma.

The presence of a loose body within the articulating surfaces of any joint theoretically will result in destruction of the hyaline cartilage, and ultimately result in premature arthritic degeneration. The significance of a symptomatic loose body in the hip should not be understated, and the treatment, arthroscopically or open, should not be delayed. When hip disease or a pathologic condition results in loose body formation, symptomatic improvement can be expected after arthroscopic removal, but the effect on the future of the joint remains dependent on the natural history of the underlying condition. The minimally invasive nature and low morbidity associated with hip arthroscopy make the procedure ideal for establishing an early preventive strategy to treat symptomatic patients with loose bodies in the hip.

LABRAL TEARS

The acetabular labrum is a rim of triangular fibrocartilage that attaches to the base of the acetabular rim. It surrounds the perimeter of the acetabulum and is absent inferiorly where the transverse ligament resides. The labrum provides structural resistance to lateral motion of the femoral head within the acetabulum, enhances joint stability, and preserves joint congruity (8). Similar to the meniscus, it also functions to distribute synovial fluid and provides proprioceptive feedback (9).

A disruption of the acetabular labrum alters the biomechanical properties of the joint. The forces acting on the hip in the setting of a torn labrum often cause pain during sports participation in athletes. Altenberg (10) in 1977 was the first to describe tearing of the acetabular labrum as a source of hip pain. Patients with labral tears often present with mechanical symptoms, such as buckling, clicking, catching or locking. Athletes may present with subtle findings, including dull, activity-induced, positional pain that fails to respond to rest. The most commonly reported cause of a traumatic labral tear is an externally applied force to a hyperextended and externally rotated hip (11). However, a specific inciting event often is not identified and the patient presents for evaluation after failed attempts at conservative management for groin pulls, muscle strains, or hip contusions.

The mechanism of labral tearing can be either traumatic and acute, or chronic and degenerative. Hip impingement chronically loads the anterosuperior labrum and leads to degenerative tears in that region of the acetabulum. The location of labral tears has varied based on different regions. North American series have reported that the vast majority of tears are located anteriorly and acute tears result from sudden pivoting or twisting motions (12). In contrast, in Asian populations, tears are found more frequently posteriorly and are associated with hyperflexion or squatting (11).

Lage et al. (13) have described an arthroscopic classification of labral tears. Labral tears were divided into four groups: radial flap tears, radial fibrillated tears, longitudinal peripheral tears, and mobile tears. Radial flaps were the most common, followed by radial fibrillated, longitudinal peripheral and

76635_CH27 p471-488.qxd 10/17/06 10:23 PM Page 474

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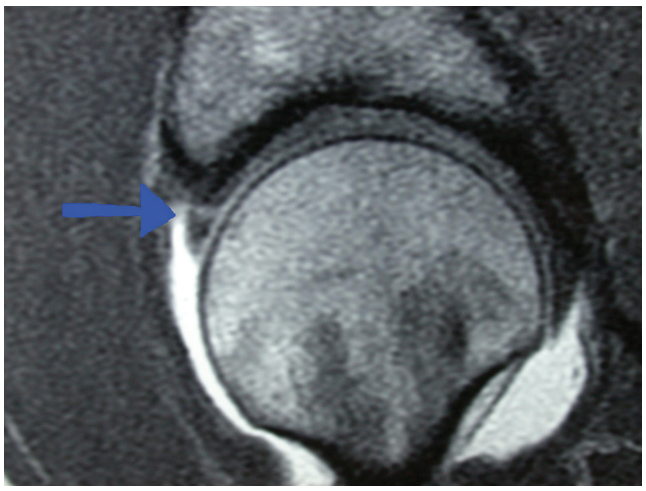
mobile tears. They also classified degenerative tears based on location and the extent of the tear. Stage I degenerative tears are localized to one segment of an anatomic region, anterior or posterior. Stage II tears involve an entire anatomic region, and stage III tears are diffuse and involve more than one region. They found that the extent of the degenerative tear correlated to the degree of degenerative changes within the joint. The degree or increasing stage of degenerative labral tears correlated with erosive changes of the acetabulum or femoral head. The articular lesions are most often located adjacent to the labral tear, often at the labrochondral junction.

Labral tears secondary to trauma generally are isolated to one quadrant depending on the direction and extent of the trauma. For instance, patients with a known posterior subluxation or dislocations most frequently have posterior labral tears. If a bone fragment is avulsed as a result of a dislocation, the labral injury most often occurs on the capsular or peripheral region of the labrum and may be amenable to an arthroscopic repair (14). Patients with minor trauma often have anterior and more central tears, located in the same region as those for impingement and those seen in athletes.

Idiopathic tears are often seen in the athletic population. Chronic, repetitive loading of the hip can subject the labrum to tensile and compressive forces and lead to tearing **(Fig 27-2)**. Often, no specific recognizable injury is reported. The majority of patients participate in sports requiring repetitive pivoting or twisting, such as football, soccer, basketball or ballet. It has been theorized that recurrent torsional maneuvers subject the anterior portion of the articular-labral junction to recurrent microtrauma and eventual mechanical attrition (14). McCarthy et al. (14) performed arthroscopic labral debridement on 13 hips in ten competitive athletes with mechanical symptoms stemming from labral tears. All hips had anterior labral tears, with two hips having additional posterior tears. Twelve of thirteen patients had successful results following arthroscopy and returned to competitive activities. Of note, four of the twelve hips had associated chondral lesions requiring debridement. Stated in their conclusion, "hip arthroscopy is the new gold standard for treating the elite athlete with intractable hip pain with mechanical symptoms".

Radiographs are often unremarkable when evaluating for a labral tear. Specific attention should be given to the superior neck, looking for subtle irregularities in the femoral head-neck offset and decreased neck concavity compared to the contra lateral side, which would suggest impingement.



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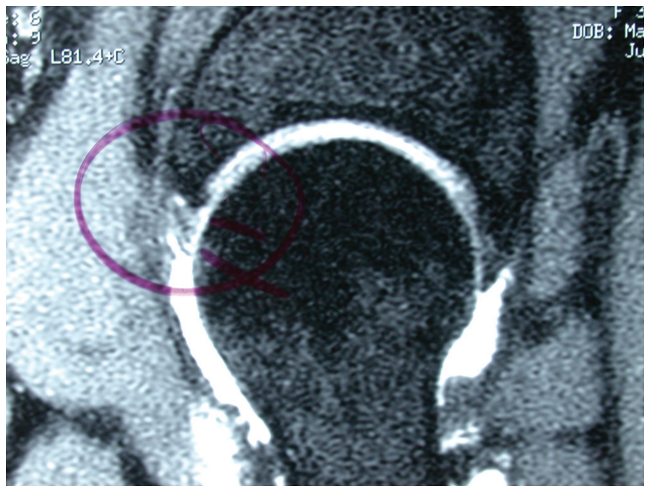

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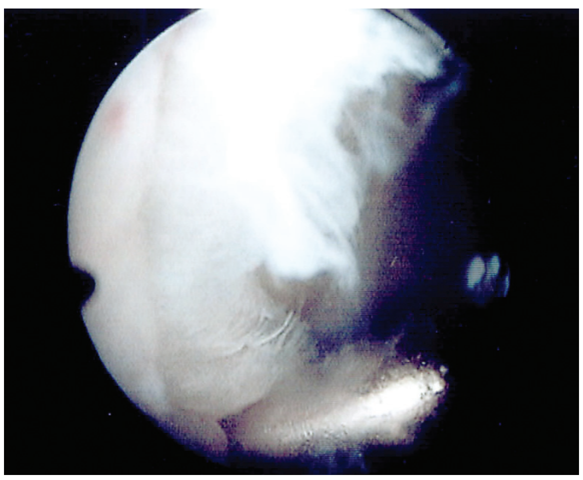

C

Fig 27-2. A T1 **(A)** (*arrow*) and a T2 **(B)** (*circle*) MRI sagittal oblique illustrate a degenerative labral lesion in the anterosuperior quadrant. Arthroscopy **(C)** reveals the degenerative lesion.

76635_CH27 p471-488.qxd 10/17/06 10:23 PM Page 475

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Contrast enhanced MRI arthrography is more sensitive than standard MRI at detecting intra-articular lesions of the hip (15). Czerny et al. (15) compared conventional MRI with MR arthrography in the diagnosis of labral lesions. They reported a sensitivity and accuracy of 80% and 65% for conventional MRI compared with 95% and 88% with MR arthrography. However, hip MR arthrograms are not without frequent misinterpretation. Byrd and Jones (5) found an 8% false-negative rate and a 20% false-positive interpretation of MR arthrograms for all types of intra-articular pathology of the hip. While MR arthrograms offer a diagnostic advantage over conventional MRI for labral tears and other intra-articular pathology, their reported false-positive rate dictates cautious interpretation. Newer MR imaging modalities such as fast spin echo have improved the imaging capability of articular cartilage and may obviate the need for intraarticular gadolinium in the future (5).

Not only should imaging studies be interpreted with caution but physical exam finding are often inconsistent. Farjo et al. (16) did not find specific exam findings to correlate with labral injuries. However, Fitzgerald (17) found the Thomas test correlated with surgical pathology. Bilateral hip flexion, followed by abduction and extension of the involved hip with a palpable or audible click along with pain defines a positive Thomas test. Another available test, similar to the Thomas test, is the McCarthy test: both hips are flexed; the affected hip is then extended, first in external rotation, then in internal rotation. Hip extension in internal rotation will stress the anterior labrum and extension with external rotation will elicit posterior pathology.

MRI may confirm the diagnosis, but the decision to proceed with operative intervention should be heavily weighted on refractory, mechanical symptoms. The majority of labral tears are treated by debridement; however some tears are amenable to arthroscopic repair. Petersen et al. (18) studied blood supply to the labrum and found blood vessels enter the labrum from the adjacent joint capsule. Vascularity was detected in the peripheral one-third of the labrum and the inner two-thirds of the labrum are avascular, similar to the meniscus. Thus, peripheral tears have healing potential and repairs should be considered **(Fig 27-3)**. Peripheral tears, however, are a rarity. McCarthy et al. (14) reported 436 consecutive hip arthroscopies performed over 6 years and treated 261 labral tears, all of which were located at the articular junction.

For articular or centrally based as well as degenerative tears, the goal of arthroscopic debridement is to relieve pain and mechanical symptoms while preserving healthy, intact portions of the labrum. Kelly et al. (19) reviewed the results of more the 500 acetabular debridements and found nearly 90% good to excellent results at short-term follow-up. Farjo et al. (16) reported good to excellent results for debrided acetabular tears without concomitant arthritis and only 21% good or excellent results for patients with articular cartilage damage discovered intra-operative. McCarthy et al. (14) published good to excellent results for debridement of labral lesions without articular cartilage involvement and less than 40% good to excellent results for patients with associated articular cartilage lesions. Therefore, patient outcomes are significantly more favorable after operative treatment for labral lesions without concomitant degenerative joint disease.

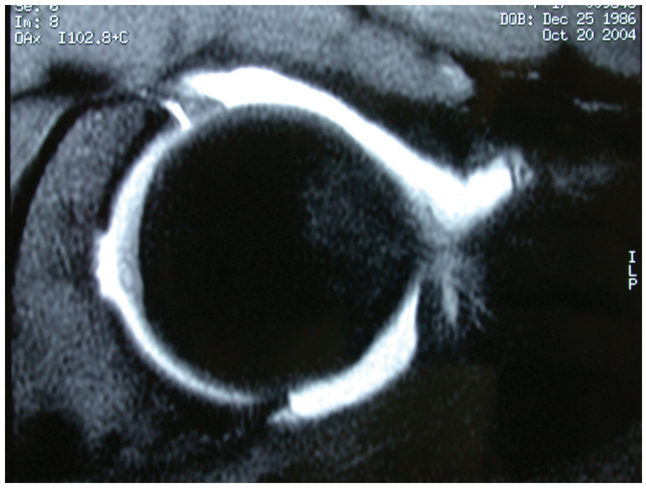

Fig 27-3. An anterior peripheral labral tear is seen on this T2 axial MRI.

Whether acetabular labral tears lead to degenerative joint disease has yet to be determined. McCarthy et al. (20) reported that labral tears might contribute to the progression of degenerative disease of the hip. They found an association between the progression of labral lesions and the progression of anterior acetabular articular cartilage lesions. The frequency and severity of acetabular articular degeneration was statistically significantly higher in patients with labral lesions than those without. This association, however, does not offer a definitive causal relationship. Currently, arthroscopic findings have supported the theory that labral disruptions and degenerative joint disease are linked as part of a continuum. Labral tears, idiopathic, traumatic or degenerative in nature can progress to articular cartilage delamination adjacent to the labral lesions and slowly progress to more global labral and articular destruction. Therefore, treatment of patients with mechanical symptoms with underlying labral pathology will not only alleviate symptoms but may prevent the development of degenerative cartilage lesions.

IMPINGEMENT

Femoral neck impingement against the acetabular labrum or femoroacetabular impingement has been described as a structural abnormality of the femoral neck which can lead to chronic hip pain and subsequent acetabular labral degenerative tears. The repetitive microtrauma from the femoral neck abutting against the labrum produces degenerative labral lesions in the anterior-superior quadrant of the labrum. This mechanical impingement is believed to originate from either

76635_CH27 p471-488.qxd 10/17/06 10:23 PM Page 476

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a "pistol grip" deformity of the femoral neck or a retroverted acetabulum.

A "pistol grip" femoral neck is a neck with a decreased femoral head-neck offset on the superior or anterolateral neck. A decreased offset of the anterolateral head-neck junction causes a reduction in joint clearance and can lead to repetitive contact between the femoral neck and the acetabular rim. Several recent studies (20–22) have shown an association between labral tears and osteoarthritis as well as labral tears in the setting of impingement. Therefore, a specific subset of patients may be predisposed to the development of labral lesions and osteoarthritis based on an altered morphology of the anterolateral femoral neck. Evidence to support this theory remains circumstantial, but treatment of symptoms by attempting to correct the structural abnormality often allows patients to return to normal activities.

Impingement often occurs in extreme ranges of motion. Abutment from the superior neck occurs in flexion, often with a variable degree of adduction and internal rotation. The repetitive trauma not only damages the labrum, but can create adjacent chondral injuries. Beck et al. (23) noted all patients treated operatively for impingement had labral lesions in the anterosuperior quadrant and that labral and cartilage lesions correlated with an absent anterolateral offset of the head-neck junction.

The etiology of the abnormal neck morphology is not completely understood. The pistol grip deformity has been attributed as a form of mild or sub clinical slipped capital epiphysis (24). *Non*spherical heads with a wide neck have also been described as the result of a growth disturbance of the proximal femur (25). Recently, Siebenrock et al. (26) reported an increase in the lateral epiphyseal extension in patients with decreased head-neck offset and a larger extension of the epiphysis onto the neck in the anterosuperior quadrant. They showed that an increased physeal extension into the cranial hemisphere of the femoral head neck is associated with a decreased head-neck offset. This suggests that a growth abnormality of the capital physis is a possible cause of the development of a decreased head-neck offset in patients with anterolateral impingement. Overall, several theories exist to explain the femoroacetabular impingement phenomenon but the inciting event has not been agreed upon.

Currently, evidence suggests that femoroacetabular impingement may play a role in the cascade of hip osteoarthritis in some patients; those with structural proximal femoral head-neck abnormalities (20–23,27). This entity usually appears in younger and more physically active adults and can be physically debilitating. Subsequent labral and chondral lesions have been linked to repetitive microtrauma caused by the pistol grip deformity of the femoral neck (28). The operative management of these lesions offers two benefits. First, for symptomatic patients, who fail conservative treatment, the removal of the structural abnormality will provide significant pain relief. Because labral and chondral lesions are seen more frequently in early osteoarthritic hips, early recognition and treatment of this entity may curb or halt the unfortunate progression to osteoarthritis in these younger patients.

The typical patient is a middle-aged, athletic individual complaining of groin pain with activity. This often occurs during activities requiring hip flexion. Sporting activities may cause symptoms, but often-simple acts like walking may aggravate the situation. Symptoms range from mild to severe and are often intermittent in presentation. The groin pain can become activity limiting, especially for athletes. Patients often have been seen by multiple physicians and have been given a wide range of diagnoses, such as a sports hernia, tendonitis, or synovitis.

Patients often exhibit a decrease in both internal rotation and adduction while in a flexed position, often accompanied by pain. The impingement test, done by passively flexing the adducted hip and gradually internally rotating, will often elicit groin pain. This moves the proximal and anterior part of the femoral neck into contact with the rim of the acetabulum (28). Leunig et al. (29) have shown that positive impingement tests correlate with labral tears on MR arthrograms, corresponding to the location of impingement. A complete examination to rule out other sources of hip pain such as bursitis, nerve entrapments and referred pain will help ascertain the diagnosis.

Although many patients will have been previously told that their hip radiographs are normal, subtle abnormalities may be present and should be suspected. An anteroposterior (AP) pelvis allows a gross comparison of both proximal femurs, with particular attention given to head-neck offset **(Fig 27-4)**. The contour of the anterolateral neck should be compared to the unaffected side. A normal superior neck will have a distinctive concave appearance, with the concave contour takeoff at the head-neck junction through the neck-greater trochanter junction. A cross table lateral radiograph is essential in addition to the AP radiograph. A properly taken cross-table radiograph will illustrate the appearance of the femoral neck, allowing for an additional view of the anterolateral neck **(Fig 27-5)**. MR arthrography detects labral pathology in addition to an assessment of the femoral head, neck and acetabulum **(Fig 27-6)**.

Hip impingement can be a difficult entity to diagnose and treat. We feel that conservative treatment should be attempted for all patients with the understanding that a structural abnormality often does not improve with conservative treatment, especially the younger, active patient group. When conservative modalities fail, the location of the pathology dictates the treatment plan. Impingement secondary to variations in proximal femoral anatomy is often amenable to arthroscopic debridement. With a normal head-neck offset, repetitive impingement will not occur and subsequent labral and chondral damage may be obviated.

While open techniques have been the traditional approach to address a retroverted acetabulum or altered morphology of the femoral neck, arthroscopy has recently been introduced as a method of treating hip impingement secondary to structural abnormalities of the anterolateral neck. The peripheral

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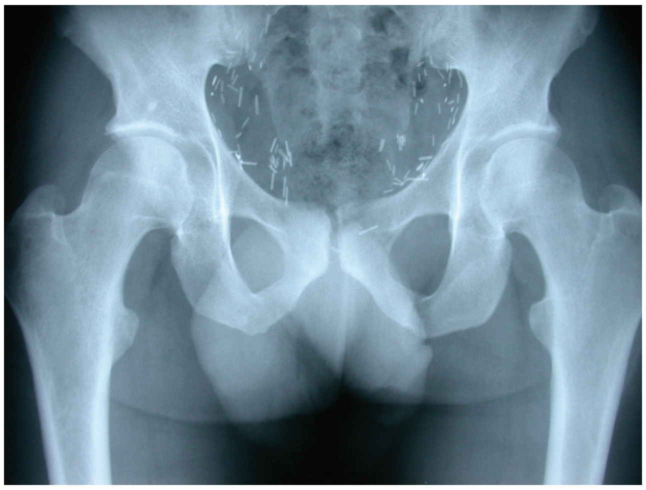

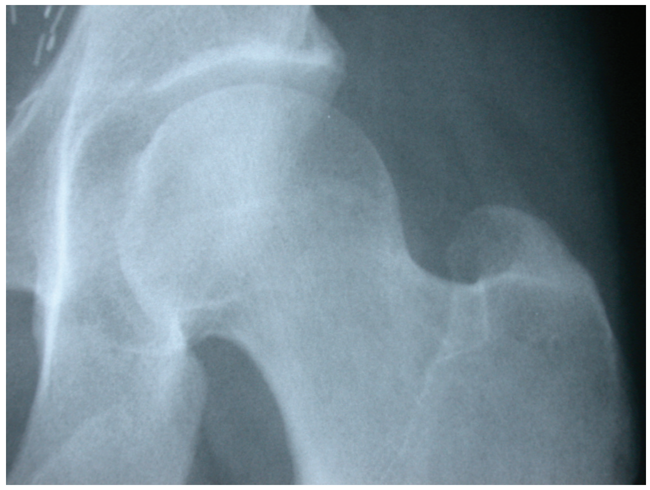

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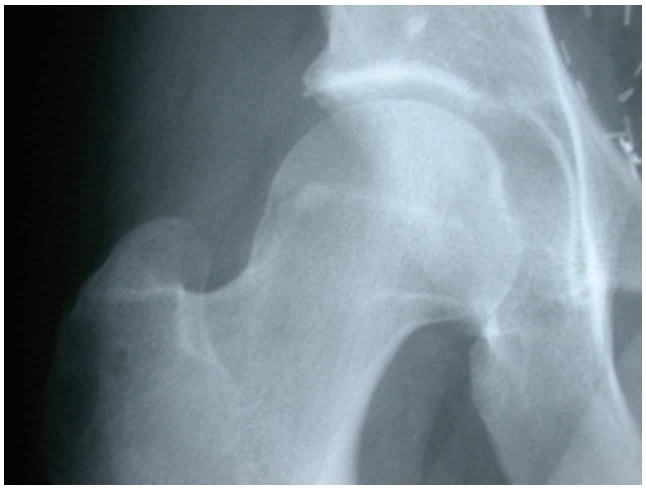

Fig 27-4. **A:** An AP pelvis XR offers a comparison of the morphology of both femoral necks. The asymptomatic hip **(B)** has a normal superior neck contour with a normal head-neck offset. The affected hip **(C)** has a near vertical superior neck slope with a loss of the normal head-neck offset.

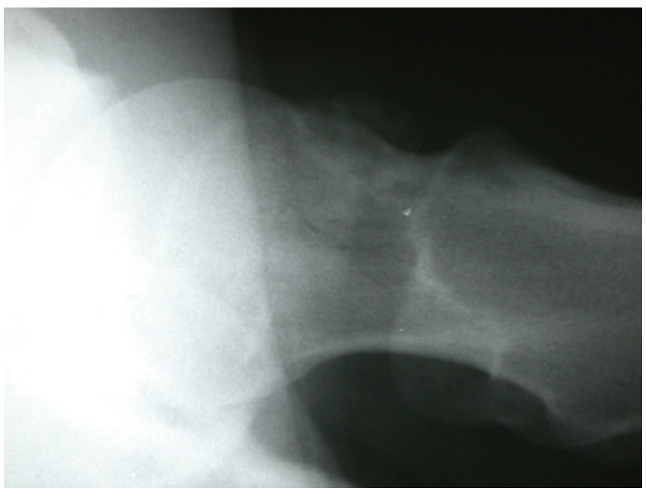

Fig 27-5. A cross table lateral XR illustrates the abnormal head-neck junction.

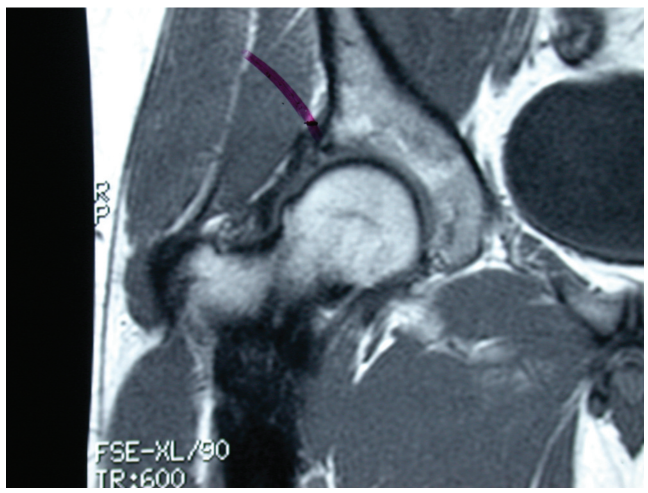

Fig 27-6. An MRI confirms the abnormal morphology of the femoral neck as well as a degenerative tear of antero-superior labrum.

76635_CH27 p471-488.qxd 10/17/06 10:24 PM Page 478

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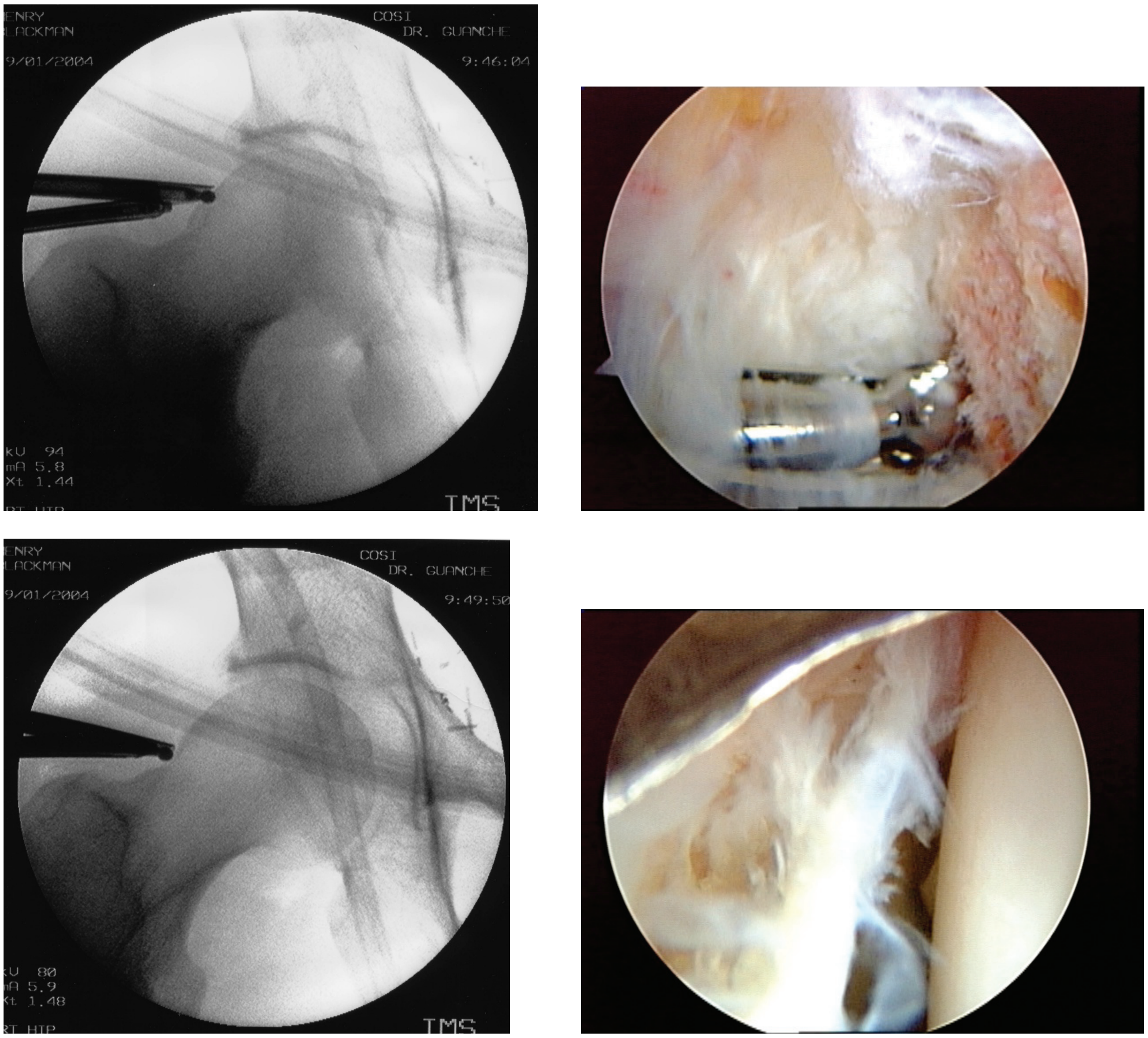

A B C D

Fig 27-7. **A:** Fluroscopic imaging assists in documenting the correct positioning for debridement. **B:** Debridement of the prominent with a burr. **C:** Fluroscopy documentation of the femoral neck after completion of the debridement. **D:** Intra-compartmental visualization of the degenerative labral lesion.

compartment or extracapsular compartment is entered and the neck is debrided with the help of fluoroscopy. After the anterolateral femoral neck has been contoured, the central or intra-articular region is explored and concomitant labral and chondral pathology is addressed **(Fig 27-7)**.

CHONDRAL LESIONS

Articular surface lesions create an irregular contour of the joint surface and lead to abnormal intra-articular forces with motion and weight bearing, predisposing the patient to the development of progressive degenerative disease. Chondral injuries are found following trauma and have been associated with degenerative labral lesions as well as with early arthritic hips. McCarthy et al. (20) reported 74% of patients with a torn labrum had some degree of articular surface damage. In 80% of these patients, the labral and articular lesions occurred in the same quadrant. They also found an association between labral tears, the severity of articular injury and age. The frequency and severity of cartilage lesions increased with age, and 24% of chondral injuries were observed arthroscopically in patients less than 30 years of age compared to 81% of patients with chondral lesions in patients older than 60 years of age.

Arthroscopic debridement of chondral flaps can be performed through a standard arthroscopic approach. Chondral flaps are debrided and associated labral pathology is treated

76635_CH27 p471-488.qxd 10/17/06 10:24 PM Page 479

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as well. Full thickness chondral defects, more often associated with trauma, can be treated with microfracture or acute repair of large full-thickness acute lesions. Arthroscopic microfracture as well as internal fixation of large lesions can be challenging and an open approach should be considered if the desired results cannot be achieved through the arthroscope.

LIGAMENTUM TERES

The ligamentum teres is a triangular shaped ligament, arising from the posteroinferior region of the cotyloid fossa, inserting on the base of the femoral head. It provides blood supply to the femoral head in children. Its function in adults remains unclear. Gray and Villar (30) suggest that the ligamentum teres injury causing symptoms without a history of traumatic hip dislocation may be more common than previously reported. Byrd and Jones (31) reported that rupture of the ligament was the third most commonly encountered pathology during hip arthroscopy. The ligament becomes taut in flexion, adduction and external rotation. This has been a proposed mechanism for traumatic rupture (30).

Gray and Villar (30) reported twenty injuries to the ligamentum teres observed among 472 consecutive hip arthroscopies. They discovered three distinct patterns of ligament injury: complete rupture, partial tears, and degenerative ligaments, which were associated with degenerative changes of the hip **(Fig 27-8)**. Complete ruptures were associated with trauma and labral or chondral injuries were often present. Partial tears often occurred without associated pathology and presented as hip pain of unknown etiology prior to arthroscopy. The degenerative ligament all had articular changes on both the femoral and acetabular surfaces. All patients presented with groin or thigh pain and most complained of a limp or clicking sensation with weight bearing. They were unable to elicit any specific exam finding pathgnomonic for ligament tears and reported the imaging studies did not aid in the diagnosis **(Fig 27-9)**.

Byrd and Jones (31) reported 41 lesions of the ligamentum teres among 271 consecutive hip scopes: 23 injuries were traumatic, including 12 complete and 11 partial ruptures; 18 ligaments were found to be hypertrophic or degenerative. Of the patients with traumatic injuries, 80% complained of mechanical symptoms, 15 resulted from major trauma, and 8 from twisting injuries. Preoperative diagnosis was made on imaging studies in only 2 of 23 cases. 8 lesions were isolated findings during arthroscopy, and 15 hips had additional pathology discovered during arthroscopy. All patients improved with arthroscopic debridement, with an average preoperative hip score of 47, and postoperative score of 90 with more than a 1-year follow-up **(Fig 27-10)**.

Overall, ligamentum teres ruptures respond well to arthroscopic debridement. Ligamentum teres disruption has been known to occur with hip dislocations, and its occurrence following minor trauma, and twisting injuries has just recently been appreciated. Twisting injuries often result in labral tears, so the clinician should consider ligamentum teres disruption as a potential source of pain after twisting injuries. The diagnosis of ligament tears remains elusive to imaging technology and an index of suspicion should be maintained in the presence of mechanical symptoms and a history of trauma or twisting injury. Debridement of a complete or partial rupture has not been shown to produce detrimental effects on hip stability; however the complete function of the ligament has not been fully elucidated.

OSTEONECROSIS

Osteonecrosis can cause severe pain and disability in young patients, occurring most commonly between the third and fifth decades of life (32). Approximately 10,000 to 20,000 of

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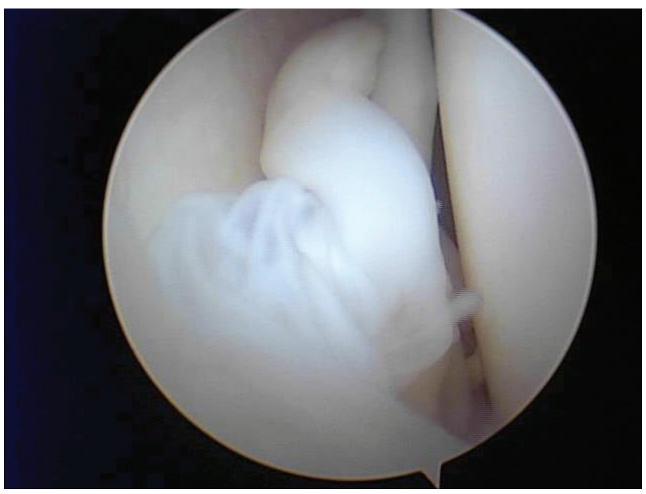
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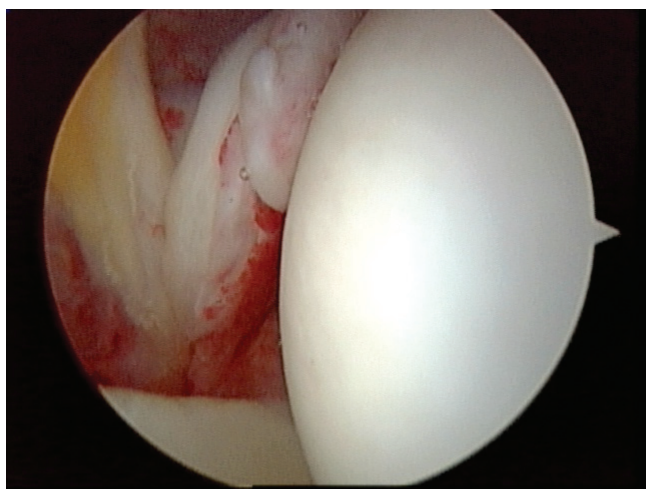

Fig 27-8. A: Arthroscopy confirms a complete ligamentum rupture. **B:** A partial ligamentum tear with surrounding synovial inflammation.

76635_CH27 p471-488.qxd 10/17/06 10:24 PM Page 480

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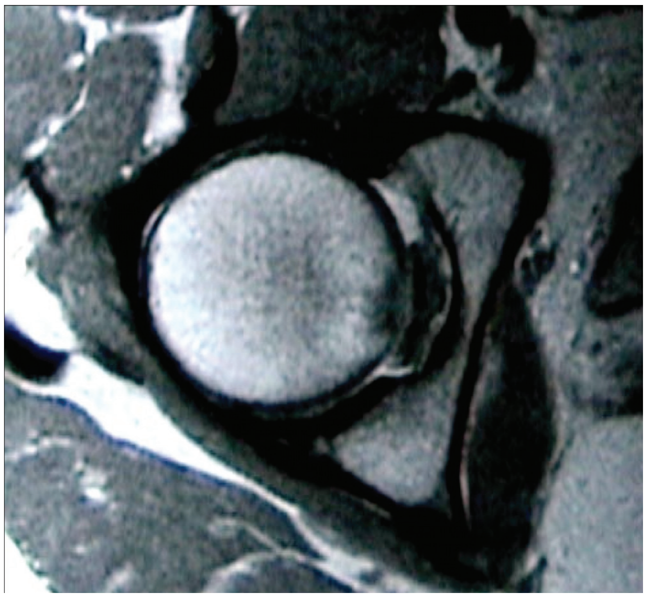
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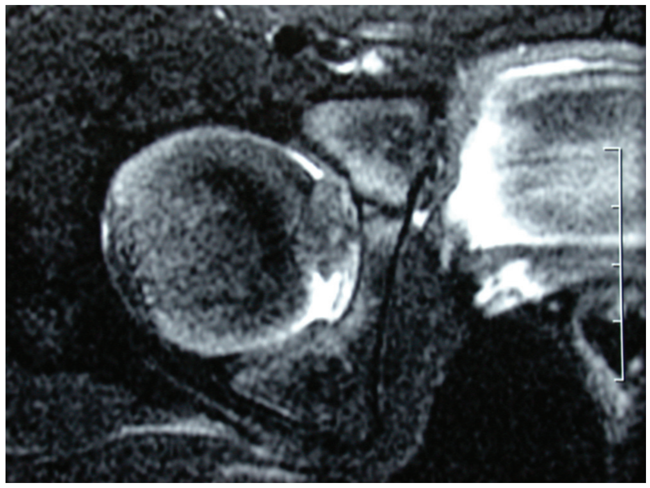
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Fig 27-9. Ligamentum tears are best visualized on axial MRI images. T1 image **(A)** shows ligamentous discontinuity (*arrow*) and a T2 image **(B)** often reveals corresponding fluid within the fovea.

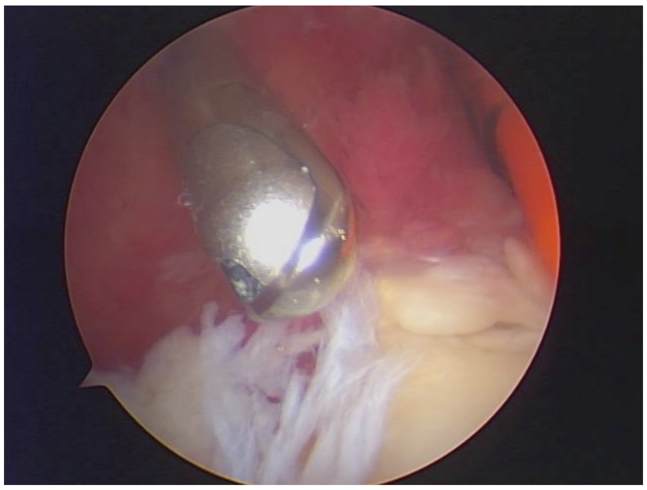

Fig 27-10. Arthroscopic debridement of the torn ligament.

new cases of hip osteonecrosis are reported each year in the United States (33). It has been estimated that up to 10% of total hip arthroplasties are performed because of AVN (34). It can be the result of trauma that disrupts the blood supply of the femoral head. Other nontraumatic risk factors include corticosteroid use, heavy alcohol consumption, sickle cell disease, Gaucher and Caisson disease as well as hypercoaguable states. However, the etiology of a large percentage of patients is idiopathic. Without treatment, AVN often progresses to articular collapse and degenerative joint disease. Prior to femoral head collapse, joint preserving procedures such as core decompression, vascularized fibular grafts and osteotomies attempt to obviate the problem by stimulating the vascular supply to the involved area of the femoral head.

While the traditional joint preserving procedures attempt to alter the intrinsic composition of the diseased subchondral bone, intra-articular changes do occur, most often in the form of chondromalacia, chondral flaps, and loose bodies. Arthroscopic evaluation of the joint offers the ability to treat intra-articular pathology and improve mechanical symptoms. Prior to subchondral collapse, some patients complain of mechanical symptoms such as locking, buckling, and clicking (32). O'Leary et al. (35) reported the results of hip arthroscopy for treatment of 37 cases of hip AVN. They found that outcomes were most favorable for patients with mechanical symptoms without articular collapse. As would be expected, patients with degenerative changes and no mechanical symptoms had the worst outcome. Of patients with stage Ficat III or IV, only 34% had significant pain relief following arthroscopy **(Table 27.1)**.

Patients with stage III (crescent sign with or without collapse) or stage IV (collapse with involvement of the acetabular cartilage) are best treated with either a total hip arthroplasty, hemiarthroplasty or resurfacing arthroplasty. Resurfacing

TABLE 27.1 Ficat Classification of Femoral Head Avascular Necrosis

Ficat Classification
I – Precollapse : Radiographs normal, clinical exam positive
II – Precollapse : Diffuse Porosis, Sclerosis, Cysts
III – Collapse : Broken contour of the femoral head, joint space maintained
IV – Collapse : Flattened contour, joint space collapse

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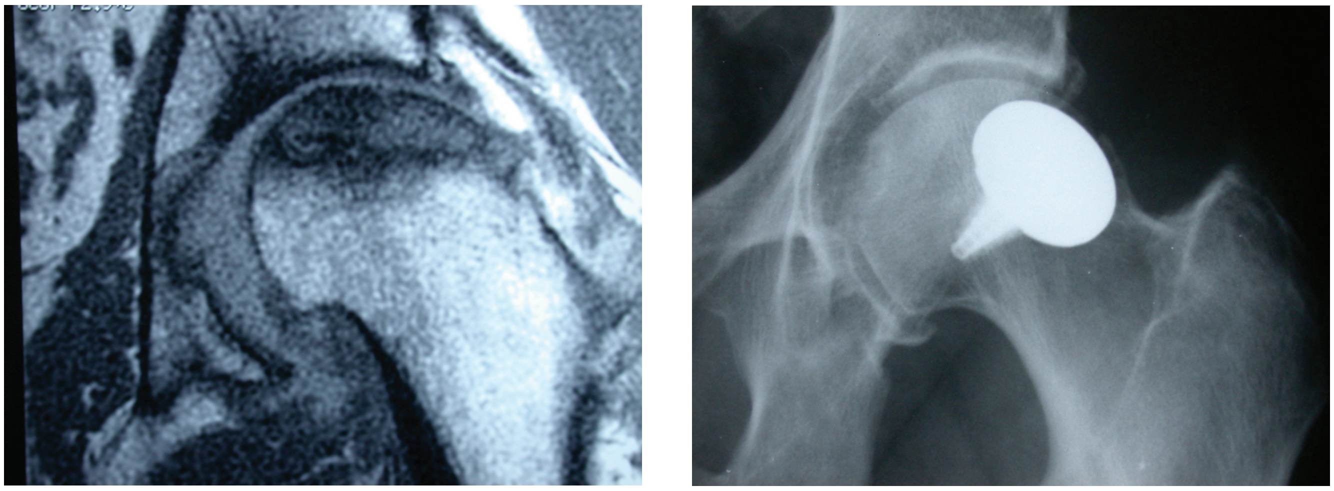

A B

Fig 27-11. **A:** Femoral head AVN with involvement of a large portion of the femoral head. **B:** Resurfacing arthroplasty of the femoral head.

arthroplasty of the femoral head **(Fig 27-11)** preserves bone stock and only removes the diseased portion of the head while not compromising future conversion to a total hip arthroplasty. It is indicated for Ficat stage III or early stage IV disease. Mont et al. (34) showed that resurfacing arthroplasty had a survival rate of 90% at 10 years, nearly identical to the total hip arthroplasty group. While survival rates are good, patient outcomes are less predictable with good to excellent results at early follow-up reported between 60% to 80% (34). Stage IV Ficat is best treated with a total hip arthroplasty.

In general, the goal in treating AVN of the hip is to improve patients' symptoms and give them the best opportunity to prevent subchondral collapse and degeneration, which often occurs at a young age. Patients without subchondral collapse (Ficat stage I or II and some stage III) and those complaining of pain associated with mechanical symptoms often will improve with hip arthroscopy and debridement. Arthroscopic debridement can be performed in conjunction with joint sparing procedures such as a core decompression or a vascularized fibular graft (32). After the femoral head has shown signs of collapse, the patient is best served by a prosthetic implant, either a total hip arthroplasty or a hemi-resurfacing implant.

Arthroscopy may also have a role for the evaluation and treatment of osteochondritis dissecans (OCD) and Perthes disease (19). Treatment parameters parallel those for osteonecrosis. OCD prevalence in the hip is estimated to be much less than the knee (36). Sporadic case reports have reported OCD in the hip in young patients (37). Perthes, more common than OCD of the hip, is often monitored conservatively, focusing attention on preserving range of motion with frequent follow-ups. Conservative treatment often is successful in treating the condition. However, if young patients with either OCD or Perthes develop symptomatic mechanical symptoms, consideration should be given to arthroscopic evaluation of the joint surfaces. Chondral flaps or loose bodies can be treated with limited morbidity to the patient.

CAPSULAR LAXITY

Instability of the native hip is much less common than shoulder instability, but its presence can cause a significant amount of disability (19). The hip relies less on the surrounding soft tissues for stability because it has a significant amount of inherent osseous stability. The labrum provides a great deal of stability at extremes of motion, especially flexion. With a torn or absent labrum, a great deal of force is transmitted through the capsule (19).

Hip instability can be difficult to diagnose. Patients often are performing a motion of pelvic rotation and external rotation of the hip to elicit symptoms (38). Motions such as swinging a golf club or throwing a football often precipitate symptoms in active patients (19). The cause of instability may be traumatic or atraumatic. Atraumatic patients are often able to voluntary sublux or nearly dislocate the affected hip and may exhibit generalized ligamentous laxity **(Fig 27-12)**. Some young patients may have an undiagnosed connective tissue disorders causing the ligamentous laxity (i.e., Ehlers-Danlos, Marfans, or Downs syndromes). Bellabarba et al. (39) linked a group of atraumatic patients with idiopathic hip instability to sub clinical capsular laxity from mild residual acetabular dysplasia.

Traumatic dislocations of the native hip can lead to capsular redundancy and clinical hip laxity. Liebenberg and Dommisse (40) described the development of capsular redundancy after recurrent posterior dislocation of the hip. They suggest that the presence of sub clinical hip instability in these patients may results from a damaged capsulolabral complex. The labrum may be torn and may not function as it did prior to the injury. The normal contribution of labrum to

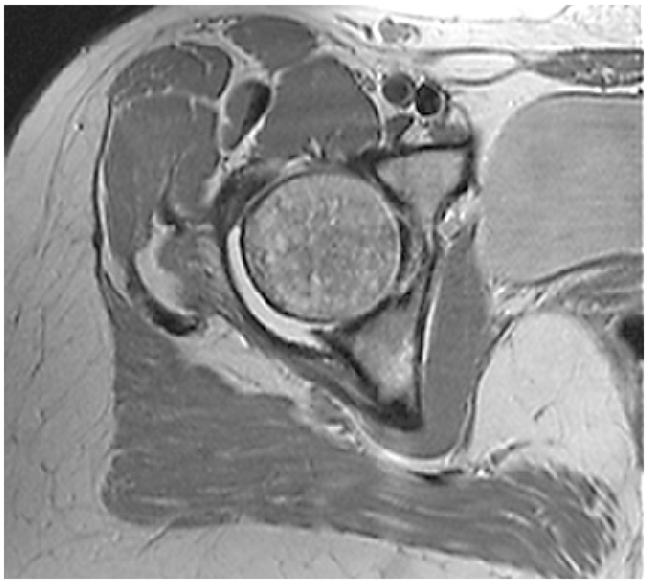

Fig 27-12. MRI with contrast illustrates a redundant posterior capsule with disproportionate amount of contrast posteriorly (*arrow*).

instability requires the hip to rely more on the redundant hip capsule, thus stressing an already lax capsule, which results in further instability.

High level athletes are also subject to hip instability. It has been recognized in sports requiring repetitive hip rotation with axial loading such as golf, figure skating, football, gymnastics, ballet and baseball. A common injury pattern in athletes is of labral degeneration combined with subtle rotational hip instability. This has been successfully treated by labral debridement and thermal capsulorrhaphy (19). Early results of this procedure have yielded very positive results with 82% return to pre-injury level of athletic competition (38).

Philippon (38) has described the role of arthroscopic thermal capsulorrhaphy for hip instability. Early results have been promising but long term results are necessary to make a conclusion about its effectiveness. Capsular suture plication of the hip arthroscopically in the future will allow us to treat the hip capsule in a similar manner as we treat the shoulder capsule. Improved arthroscopic techniques and equipment as well as experience will make this procedure possible.

SYNOVIAL PLICAE

In the knee, diagnosis and treatment of plica syndrome are well described (41–43). Other joints, including the elbow, tibiotalar joint and hip are also known to have synovial plicae that may become symptomatic, but few cases have been reported. Currently, six cases of symptomatic hip plica have been reported in the literature (44–46). Hip plicae have been described in cadavers (47) and have been discovered in patients either through diagnostic arthroscopy (45), or during arthrography (46). Plicae are present as unusually large folds that are vulnerable to impingement between the articular. Repeated minor entrapments of a plica or one traumatic episode of entrapment can cause pain.

Patients may have a palpable click during the examination with passive motion. One case reported by the senior author found flexion, abduction, and external rotation created pain as well as a click and this corresponded to a plica along the anteromedial aspect of the femoral neck (44). Plain films and nonenhanced MRI are likely to be reported as normal. Often, a gadolinium-enhanced MRI arthrography is obtained with the suspicion of a labral tear **(Fig 27-13)**. MRI can reveal an elongated ligamentous-like structure extending from the region of the femoral head-neck to a region of the hip capsule. Chondromalacia, if present, suggests repeated impingement from the plica on the articular surface has taken place.

Although plica syndrome of the hip seems to be rare, its true incidence may be underestimated. The presence of a symptomatically impinged hip plica should be considered in the differential diagnosis of recalcitrant hip pain. Suspicion of a hip plica that has failed conservative treatment should be treated with diagnostic arthroscopy, debridement of the plica and thorough evaluation of the articular surfaces, looking in particular for associated chondromalacia from chronic plica impingement.

DEGENERATIVE JOINT DISEASE

Hip arthroscopy has a limited role in the treatment of osteoarthritis. The best indications are for patients with mechanical symptoms such that degenerative disease may improve with arthroscopic evaluation and debridement.

Santori and Villar (48) reported a series of 234 consecutive hip arthroscopies, of which 66% had normal radiographs. Of these patients, more than 30% had evidence of early degenerative changes documented during the diagnostic arthroscopic examination. Therefore, osteoarthritis of the hip can present clinically prior to development of radiographic changes, with those complaining of mechanical symptoms responding most favorably to arthroscopic debridement.

SYNOVIAL AND CONNECTIVE TISSUE DISORDERS

Advances in hip arthroscopy have improved the treatment of synovial-based disorders. These include synovial chondromatosis, osteochondromatosis, pigmented villonodular synovitis (PVNS), and inflammatory arthropathies such as rheumatoid arthritis. Also, other conditions that result in acute and chronic synovitis of the hip such as hemosideric deposits from hemophilia as well as deposits from chondrocalcinosis may benefit from arthroscopic treatment. Indications for early treatment of progressive synovial diseases may curb the progression of articular destruction.

Synovial chondromatosis, or intrasynovial cartilage metaplasia, can form multiple or extracapsular loose bodies. More

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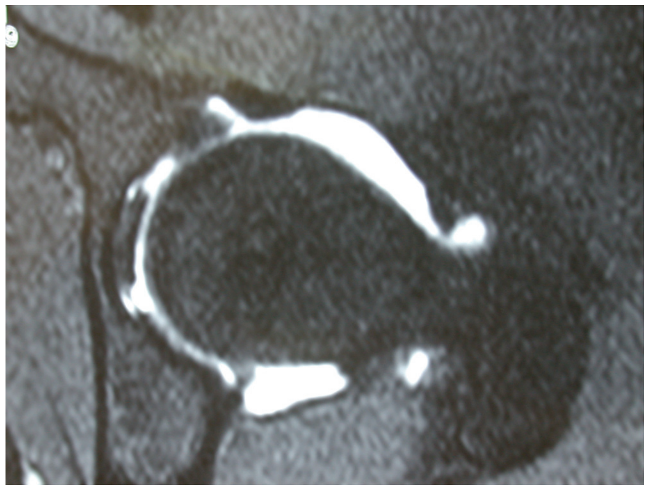

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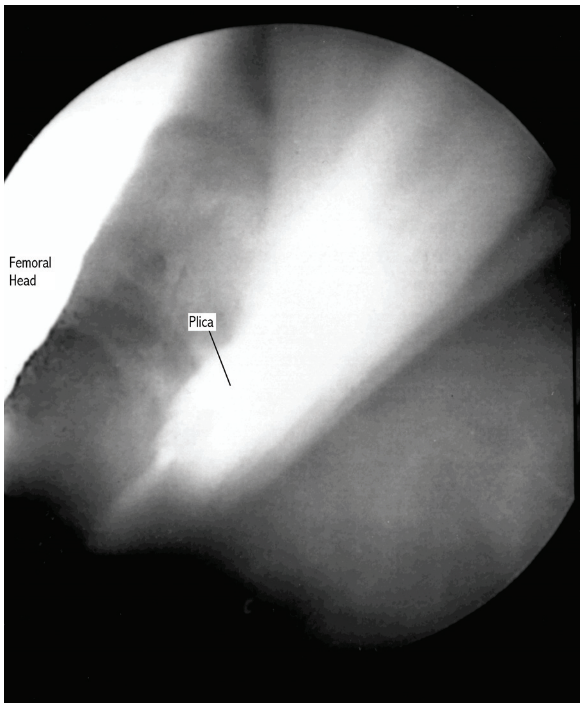

C

Fig 27-13. A: A sagittal MRI reveals a synovial plicae along the inferior neck. This is also visualized on the axial MRI (*arrow*) **(B)** as well during arthroscopy **(C).** (**A,C:** from Atlihan D, Jones DC, and Guanche, CA. Arthroscopic treatment of a symptomatic hip plica. *Clin Orthop*. 2003;411:174–177 with permission).

cases have been reported for the knee, shoulder and elbow, but hip involvement is not uncommon (49). Symptoms include the onset of dull, aching pain, catching or locking and often-mild restriction of motion. Periarticular loose bodies are seen on radiographs less than 50% of the time as the lesions are often not calcified (50).

The best imaging modality is an MR arthrogram with gadolinium enhancement. Multiple filling defects within the joint suggest synovial chondromatosis. Conservative treatment of multiple intraarticular lesions can lead to articular erosions and hip subluxation. The standard of treatment includes removal of the loose bodies, while the role of concomitant synovectomy is controversial. While some authors recommend only removal of loose bodies (12,51), others support concomitant partial or complete synovectomy (49,52). No large series of hip synovial chondromatosis exist and the role of synovectomy has not been defined. If arthroscopic treatment is chosen, surgeons are limited to a partial

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synovectomy as complete synovectomy is technically extremely demanding.

Both arthroscopic (53) and open procedures have been described for removal of hip lesions. Limited disease often is more amenable to arthroscopic treatment, while extensive disease may require a formal open approach. Lesions also may be present in the extra-articular peripheral compartment and this compartment should be inspected independent of what operative procedure is performed. Recurrence does occur following removal of the lesions and estimates can best be extrapolated from the knee and shoulder experiences. Recurrence rates have been reported between 7% and 23% (49,54). The senior author recommends arthroscopy debridement and partial synovectomy for all lesions amenable to arthroscopic treatment and formal open debridement and complete synovectomy for recurrences, with a complete evaluation of the joint, paying particular attention to the peripheral compartment.

RHEUMATOID ARTHRITIS

Rheumatoid arthritis is a common inflammatory arthritis that can affect the hip. Traditional treatment modalities consisted of medical management with anti-inflammatory medications, disease modifying agents as well as immunosuppressive medications. The role of an orthopedic surgeon was relegated to patients with degenerative hips. Recently, arthroscopic synovectomy has been used as a treatment adjunct aimed to improve symptoms and slow disease progression. It is not a curative procedure and there has been no concrete evidence to suggest that synovectomy retards the bony destruction or the disease process (55). However, Holgersson et al. (56) showed that arthroscopic intervention can benefit patients early in the disease process with minimal degenerative changes. In their series, arthroscopy provided better information about the articular surface in addition to debulking of the synovial membrane and improving patient symptoms.

Arthroscopic synovectomy may be most useful for patients with minimally erosive stages of the disease when synovitis is not controlled by conservative suppressive modalities. As previously mentioned, a disparity exists between arthroscopically diagnosed degenerative changes and radiographic changes (56). In symptomatic hips without degenerative changes on radiographs, articular changes may be present during the diagnostic exam and this may help future decisions regarding treatment.

CHONDROCALCINOSIS

Calcium pyrophosphate deposition disease is a crystalline arthropathy that can affect the hip. While the cause is unknown, it results from increased calcium or inorganic phosphate in hyaline or fibrocartilage that precipitates to form crystals. Chondrocalcinosis is the descriptive term used to denote the presence of crystals in cartilage, and it often is not observed radiographically in the hip. The deposition of crystals can lead to acute, as well as chronic synovitis. While it has been postulated that chronic synovitis from calcium pyrophosphate deposition disease plays a role in the initiation of hip degenerative joint disease (57), this has yet to be proven. However the same authors (58) showed that the presence of chondrocalcinosis in the hip at the time of arthroplasty was found to be significantly higher in patients with rapidly destructive hips when compared to patients with osteoarthritis presenting in the 7th or 8th decade.

Currently, it is unknown whether lavage, synovectomy, or arthroscopic, or open crystal debulking will help symptoms or prevent articular degeneration. In patients with chronic or severe symptoms, diagnostic arthroscopy, synovial debulking, and lavage may provide clinical relief, but the literature has yet to confirm this observation.

PIGMENTED VILLONODULAR SYNOVITIS

PVNS is a non-neoplastic proliferative disorder that most commonly occurs in the knee, but hip involvement has been reported (59,60). It can affect any synovial lined structures including bursa, tendons, and intra-articular compartments. It typically presents in younger patients, with an average age within the 4th or 5th decade, without gender predilection. It should be considered in the differential diagnosis of this age group in patients with hip pain.

While similar to chondrocalcinosis, the pathogenesis remains unknown. It has been attributed to a chronic inflammatory response, or a benign but locally aggressive growth of fibrohistiocytic origin. Long-standing PVNS of the hip often results in hip degeneration (59). Treatment includes debulking of the lesion, synovectomy, and possible chemical or radio nuclear adjunctive therapy. Hips with degenerative arthritis are treated with a total hip arthroplasty. As these lesions present in the middle-age population, early diagnosis and treatment may prevent a younger patient from requiring a total hip arthroplasty.

Hip arthroscopy can provide tissue for pathologic identification; allow evaluation of the joint surfaces and the ability to perform a partial synovectomy. As a complete synovectomy is difficult to perform, adjunctive chemical synoviothesis in addition to partial synovectomy offers the most minimally invasive treatment option. This treatment regimen is most successful for patients with no or very limited degenerative joint disease. If the lesion recurs, as is common for PVNS (59), more aggressive open complete synovectomy can be attempted. Total hip arthroplasty, a concern for young patients, is the treatment of choice for PVNS presenting as, or progressing to diffuse, advanced degenerative disease.

COMPLICATIONS

Whether an open or arthroscopic procedure is chosen to treat intra-articular pathology, knowledge of the surrounding neurovascular structures is crucial to prevent iatrogenic injury. Accurate portal placement during arthroscopy will usually prevent iatrogenic injury to the neurovascular structures. Complications from traction and fluid management can also occur during arthroscopy and these complications should be realized by the arthroscopist.

Sampson reviewed 530 consecutive hip arthroscopies and published a total complication rate of 5.5% with 5.0% described as transient and 0.5% as permanent. The most common complication was secondary to traction and this caused temporary neuropraxias of the peroneal, femoral, sciatic, and lateral femoral cutaneous nerves. Most neuropraxias resolved within three days. Iatrogenic injuries to the femoral head from the instruments were also reported. No major nerve and vessel injuries were encountered but were mentioned as a potential problem. Extra-articular arthroscopy caused a few cases of excessive fluid extravasation, with some cases requiring a paracentesis for fluid removal and one case requiring an exploratory laparotomy. Rodeo et al. (62) reported similar complications and also identified direct injury to cutaneous nerves such as the lateral femoral cutaneous as well as injuries to the foot, scrotum or perineum from inadequate padding of the traction apparatus. New traction apparatuses will eliminate the need for the standard fracture table for traction **(Fig 27-14)**.

CONCLUSION

The indications for arthroscopic management of intra-articular lesions continue to expand and hip arthroscopy is gradually replacing the open approach as the preferred treatment modality. Until the last decade, the hip was thought to be arthroscopically inaccessible because of anatomical and technical constraints. As our experience with hip arthroscopy advances, our ability to diagnose and treat these lesions successfully with a minimally invasive procedure greatly benefits patients. Many patients are young, and avoiding an open approach with the complications associated with dislocation, certainly helps decrease morbidity. With the recent improvement in hip arthroscopy, the majority to intra-articular procedures can be performed safely, effectively and in an outpatient setting.

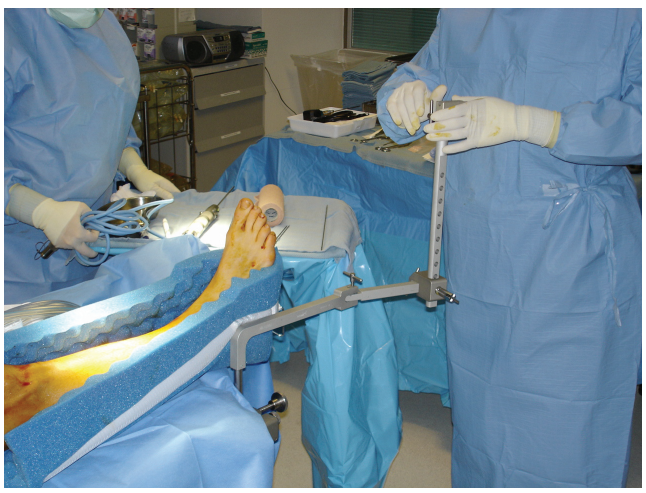

Fig 27-14. A sterile leg traction apparatus allows the surgeon to manipulate the leg during the procedure.

Selecting the correct patient for an operative procedure and understanding the limitations of the currently available imaging studies is important for providing the patient with an appropriate diagnosis and treatment plan. Imaging, even MR arthrography, has less success in identifying the correct pathology or lack there-of, than MR arthrography of the knee or shoulder. Patients with underlying chronic conditions, such as osteonecrosis or connective tissue disorders may benefit from a diagnostic and therapeutic arthroscopy when mechanical symptoms are present. Labral pathology is the most common pathology treated arthroscopically. Most lesions are degenerative and require debridement and assessment of the chondral surfaces. Labral repairs should be attempted for acute peripheral lesions. The entity of hip impingement should alert the clinician to routinely look for altered femoral neck morphology on radiographs. Early treatment of this abnormality may provide great benefits to patients. The future of hip arthroscopy for intra-articular lesion is bright and the future will likely see the advancement of challenging procedures such as labral repairs, capsular plications and impingement, as well as outcome studies for these procedures.

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76635_CH27 p471-488.qxd 10/17/06 10:24 PM Page 487

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76635_CH27 p471-488.qxd 10/17/06 10:24 PM Page 488

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