Treatment of Athletes With Symptomatic Intra-Articular Hip Pathology and Athletic Pubalgia/Sports Hernia: A Case Series

Christopher M. Larson, M.D., Bradley R. Pierce, M.D., and M. Russell Giveans, Ph.D.

Purpose: The purpose of the study was to evaluate the results of surgical treatment in athletes with associated intra-articular hip pathology and extra-articular sports pubalgia. Methods: Between December 2003 and September 2009, 37 hips (mean patient age, 25 years) were diagnosed with both symptomatic athletic pubalgia and symptomatic intra-articular hip joint pathology. There were 8 professional athletes, 15 collegiate athletes, 5 elite high school athletes, and 9 competitive club athletes. Outcomes included an evaluation regarding return to sports and modified Harris Hip Score, Short Form 12 score, and visual analog scale score. Results: We evaluated 37 hips at a mean of 29 months (range, 12 to 78 months) after the index surgery. Thirty-one hips underwent thirty-five athletic pubalgia surgeries. Hip arthroscopy was performed in 32 hips (30 cases of femoroacetabular impingement treatment, 1 traumatic labral tear, and 1 borderline dysplasia). Of 16 hips that had athletic pubalgia surgery as the index procedure, 4 (25%) returned to sports without limitations, and 11 (69%) subsequently had hip arthroscopy at a mean of 20 months after pubalgia surgery. Of 8 hips managed initially with hip arthroscopy alone, 4 (50%) returned to sports without limitations, and 3 (43%) had subsequent pubalgia surgery at a mean of 6 months after hip arthroscopy. Thirteen hips had athletic pubalgia surgery and hip arthroscopy at one setting. Concurrent or eventual surgical treatment of both disorders led to improved postoperative outcomes scores ($P < .05$) and an unrestricted return to sporting activity in 89% of hips. Conclusions: When surgery only addressed either the athletic pubalgia or intra-articular hip pathology in this patient population, outcomes were suboptimal. Surgical management of both disorders concurrently or in a staged manner led to improved postoperative outcomes scoring and an unrestricted return to sporting activity in 89% of hips. Level of Evidence: Level IV, therapeutic case series.

Intra-articular hip pathology and athletic/sports pubalgia are 2 separate entities that have been described as a source of significant disability in high-level athletes. Femoroacetabular impingement (FAI) is a disorder consisting of acetabular overcoverage and/or decreased femoral head neck offset. This disorder has been recognized in many athletes with intra-articular hip pathology. Open and arthroscopic surgical management of FAI has allowed many of these athletes to return to their preinjury level of sporting activities. Athletic pubalgia or sports hernia results in exertional lower abdominal and adductor pain, and multiple surgical procedures have been described, with excellent outcomes in the majority. Recently, a subset of athletes have been reported who present with both intra-articular hip pathology and extra-articular athletic/sports pubalgia symptoms. A majority of these athletes appear to have associated FAI with significant hip range-of-motion limitations primarily in flexion and internal rotation. A National Football League study reported the association of rectus abdominis, adductor, and hip joint pathology termed the “sports hip triad.” Other studies have found an association between preseason limitations in hip range of motion and the development of...
symptomatic hip/groin pain. Surgeons have noted athletes who have undergone prior hip procedures with continued pain due to underlying persistent hip impingement and sports pubalgia symptoms despite the resolution of a distinct portion of their pain after surgery.

The purpose of the study was to evaluate the results of surgical treatment in athletes with associated intra-articular hip pathology and extra-articular sports pubalgia. Our hypothesis was that failure to recognize and treat both symptomatic intra-articular pathology and symptomatic athletic/sports pubalgia would result in continued disability in a subset of athletes.

**METHODS**

Between December 2003 and September 2009, 1,033 hip arthroscopies were performed at a single institution (Minnesota Orthopedic Sports Medicine Institute, Edina, MN). In total 37 hips (31 patients) presented with the diagnosis of both symptomatic intra-articular hip pathology and athletic/sports pubalgia. There were 21 male and 9 female patients, with a mean age of 25 years (range, 16 to 43 years). There were 2 distinct pain generators in each patient: lower abdominal/adductor pain and deep hip/groin pain.

The diagnosis of symptomatic intra-articular pathology and athletic/sports pubalgia was made based on clinical examination by an experienced sports medicine hip orthopaedist and general surgeon, imaging studies, and selective anesthetic injections followed by provocative activity. Preoperatively, an anteroposterior plain radiograph of both hips, as well as cross-table lateral, false-profile, and 45° modified Dunn radiographs of the affected hip, was obtained in all patients. In addition, all patients underwent magnetic resonance imaging (MRI) arthrography of the affected hip preoperatively. The presence of FAI was evaluated by use of plain radiographs and 3-dimensional computed tomography scans. Pincer-type impingement was evaluated on a well-centered anteroposterior radiograph and defined as a lateral center edge angle greater than 40°, presence of a crossover sign with a lateral center edge angle of greater than 25° (acetabular retroversion or focal anterior overcoverage), presence of coxa profunda (teardrop medial to ilioischial line), or protrusio acetabuli (femoral head medial to ilioischial line). Pincer-type impingement was verified arthroscopically when a labral-chondral separation with varying degrees of chondral delamination was present. Acetabular dysplasia was present radiographically when the lateral center edge angle and anterior center edge angle were less than 25° and 20°, respectively, on well-centered radiographs. Preoperatively, all patients had a positive anterior impingement sign (hip flexion, internal rotation, and adduction) that re-created their typical limiting deep anterior or deep lateral hip pain. In addition, all patients had a preoperative intra-articular anesthetic injection followed by provocative activity to verify the hip joint proper as a component of their pain. The mean rate of temporary relief of deep groin and deep lateral pain after intra-articular anesthetic injection was 90% (range, 60% to 100%). Importantly, all patients noted the persistence of lower abdominal– and superficial groin/adductor–related pain that was significantly limiting, indicating the additional presence of extra-articular pain generators (mean, 56% [range, 40% to 80%] relief of all areas of pain with intra-articular injection). Osteitis pubis was defined as tenderness over the pubic symphysis; by radiographs showing symphyseal lysis, cystic changes, and sclerosis; and/or by MRI showing increased parasymphseal bony edema. Rectus abdominis pathology was defined as tenderness to palpation over the distal rectus abdominis/conjoined tendon and resisted sit-ups consistent with a portion of the patient’s limiting pain, MRI evidence of rectus abdominis/adductor aponeurotic tears, and evidence of tearing/attenuation at the time of pubalgia repair. Adductor pathology was defined as tenderness to palpation over the proximal adductor tendon/myotendinous junction, resisted adduction that re-created a portion of the patient’s typical pain, and MRI evidence of partial tendon tearing or tendinosis. Abdominal oblique/transversalis fascia/posterior inguinal floor tears and insufficiency were defined as tenderness to palpation with external and internal (hernia evaluation) palpation that re-created a portion of the patient’s pain and was confirmed with intraoperative exploration. Psoas tendon disorders were present when painful internal snapping was reproduced on physical examination, a psoas bursal injection temporarily relieved a portion of the patient’s limiting pain, and arthroscopy showed bruising of the labrum and/or psoas capsular adhesions at the level of the anterior rim, anterior inferior labrum, and psoas tendon by central compartment arthroscopy.

With respect to intra-articular pathology, 95% of hips (35 of 37) were diagnosed with FAI. Of these, 2
hips had isolated cam-type impingement and 33 had mixed cam- and pincer-type impingement. In contrast, 1 patient (1 hip) had a traumatic labral tear with no evidence of bony pathomorphology, and 1 patient (1 hip) had borderline acetabular dysplasia. All 37 hips had labral pathology. With respect to extra-articular pathology, 26 hips (70%) were diagnosed with osteitis pubis, 21 (56%) had rectus abdominis pathology, 19 (53%) had adductor pathology, 27 (76%) had transversalis fascia/external oblique tears, and 4 (11%) had evidence of psoas impingement based on the previously mentioned criteria.

The athletes were involved in a variety of sporting activities and at different levels of athletics. There were 8 professional or Olympic-level athletes: 5 played hockey, 2 played soccer, and 1 was a track-and-field athlete. There were 15 collegiate athletes: 3 participated in hockey, 2 in track, 6 in soccer, 1 in wrestling, 1 in basketball, 1 in football, and 1 in lacrosse. There were 5 high school athletes: 3 played soccer, 1 hockey, and 1 basketball. All of these high school athletes were considered high level, and 4 of 5 went on to play collegiate athletics or had committed to a college at most recent follow-up. Finally, 4 patients were club hockey athletes, and 5 were competitive club distance runners. All club-level athletes had previously competed at a professional (2 hips) or collegiate (7 hips) level.

Outcomes scoring was collected for all patients who underwent hip arthroscopy by use of the modified Harris Hip Score, Short Form 12 score, and pain score on a visual analog scale preoperatively; at 6 weeks, 3 months, 6 months, and 1 year; and yearly thereafter. Radiographic alpha angles on anteroposterior and lateral radiographs and hip internal rotation and forward flexion as measured with a goniometer were documented for all patients preoperatively and postoperatively by the senior author (C.M.L.). Internal rotation was tested with the patient in the supine position with the hip and knee flexed 90°, and flexion was tested in the supine position with neutral hip abduction and adduction. End range of motion was defined as a firm endpoint or pain that restricted further range of motion. In addition, outcomes with respect to full return to sports without limitations were divided between hips that underwent only hip arthroscopy or sports pubalgia surgery as the index procedure versus hips that underwent both hip arthroscopy and sports pubalgia surgery concurrently or at some point during the study period.

To evaluate improvement between preoperative and most recent follow-up scoring, paired-samples t tests were used. Fisher exact tests were used to determine significance between “rates of return to sports” between groups. Significance level was achieved for P values less than .05.

A 3- to 6-month course of nonoperative treatment had failed in all athletes in this study. Nonoperative treatment included core stability exercises focusing on gluteus maximus recruitment, avoidance of deep hip flexion, heavy weight, low-repetition squats, clean and jerks, and dead lifts. An intra-articular, symphyseal, psoas bursal, or peritendinous adductor corticosteroid injection was occasionally used to allow the athlete to finish a season.

Surgical indications for in-season management included continued disability that limited the athlete’s ability to compete. If the athlete continued to have disability but was able to finish the season and be productive, surgery was typically performed at the completion of the season. For athletes with mild symptoms that did not limit performance, nonoperative management was recommended with close follow-up.

Surgical management of intra-articular pathology was performed with hip arthroscopy, typically through a 2-portal technique (anterolateral and midanterior portals). Rim resection was performed for associated pincer-type impingement with labral debridement orrefixation depending on the status of the labrum (Fig 1). Cam impingement, when present, was treated with an arthroscopic femoral osteochondroplasty (Fig 2). Chondral pathology was treated with chondroplasty, and microfracture was performed for contained full-thickness chondral lesions. Any other intra-articular pathology (e.g., ligamentum teres ruptures or loose bodies) was treated as appropriate. Psoas impingement was treated with tenotomy at the level of the joint through the midanterior portal. The 1 case of borderline dysplasia was treated with labral repair and capsular plication. Sports pubalgia repairs were performed by multiple surgeons in multiple locations (Milwaukee, Philadelphia, Minneapolis, and Germany). When both hip arthroscopy and sports pubalgia repairs were done at the same setting, the hip arthroscopy was typically performed first, followed by the sports pubalgia repair, to avoid excessive stress placed on the pubalgia repair during positioning and traction for arthroscopy. Postoperative rehabilitation generally began the day of surgery or the day after surgery, with restrictions based on arthroscopic hip procedures.
RESULTS

In total, 37 hips (31 patients) were evaluated at a mean of 29 months (range, 12 to 78 months) after the index procedure, and no patients were lost to follow-up (Table 1). Thirty-one hips underwent 35 athletic/sports pubalgia repairs. Of the hips, 2 underwent laparoscopic repairs, 4 had open pelvic floor repairs, and 27 had repairs with mesh reinforcement; moreover, 13 adductor tenotomies were performed. Thirty-two hips underwent hip arthroscopy. The treatment of hips undergoing hip arthroscopy consisted of 30 hips undergoing arthroscopic treatment of FAI. Twenty-nine hips underwent femoral resection osteoplasty and 30 hips underwent rim resection. The mean improvement in the alpha angle for patients undergoing femoral resection osteoplasty was 19° (range, 2° to 42°) on the anteroposterior radiograph and 26° (range, 15° to 47°) on the lateral radiograph. The mean range-of-motion improvement after FAI correction was 14° (range, 5° to 25°) for internal rotation and 11° (range, 0° to 23°) for forward flexion.

Four psoas tenotomies were performed for recalcitrant snapping (2 hips) and psoas impingement (2 hips). The 1 case of borderline dysplasia was treated with labral repair and capsular plication, and the 1 case of a traumatic labral tear was treated with selective labral debridement. Overall, 8 hips underwent labral debridement, and 24 hips underwent labral repair/refixation. Thirteen hips had hip arthroscopy and athletic/sports pubalgia surgeries performed at the same setting.
Sixteen hips had sports pubalgia as the index procedure. Only 4 of these 16 hips (25%) returned to unrestricted sports, and 11 of 16 hips (69%) subsequently had hip arthroscopy performed for persistent functional disability at a mean follow-up of 20 months (range, 10 to 50 months) after the sports pubalgia surgery. Of the 11 hips that underwent subsequent hip arthroscopy, 10 (91%) returned to sports without limitations. The 1 hip that had continued limitations and had not undergone arthroscopy continued to be limited in sports and is scheduled for hip arthroscopy after the current season is finished.

Eight hips had hip arthroscopy as the index procedure. Of these 8 hips, 4 (50%) returned to unrestricted sports, and 3 of 8 hips (38%) subsequently had sports pubalgia surgery performed for persistent functional disability at a mean of 6 months (range, 5 to 7 months) postoperatively. All 3 hips that had subsequent sports pubalgia surgery returned to sports without limitations. The 1 patient that had continued limitations and had not undergone sports pubalgia surgery retired from his sport and continued to be limited with sports. One additional patient had hip arthroscopy after an initial pubalgia surgery and eventually had revision pubalgia surgery 1 year after hip arthroscopy with complete resolution of symptoms.

Thirteen hips underwent concurrent hip arthroscopy and sports pubalgia surgery as their index surgery. Of these 13 hips, 11 (85%) returned to unrestricted sports. The 2 hips that continued to have limitations after concomitant surgery were improved and returned to sports but did not achieve their preinjury level of sports. One of these patients was near retirement at the time of surgery and the other was hospitalized for an eating disorder, which ended her competitive sporting career. All same-setting surgeries were performed as outpatient procedures, and no patient was hospitalized.

Interestingly, there were no statistically significant differences for return to sports without limitations (85% v 93%, $P = .0593$) or outcomes scoring ($P > .05$) for hips that underwent concurrent versus separate-setting hip arthroscopy and sports pubalgia surgery respectively at most recent follow-up (Figs 3-5). There were statistically significant improvements for Harris Hip Score, Short Form 12 score, and visual

![Figure 3](image.png)
analog scale score postoperatively for hips that underwent concurrent and separate-setting hip arthroscopy and sports pubalgia surgery (Figs 3-5). There was a significantly greater rate of return to full sporting activities without limitations after concurrent or eventual surgical management of both intra-articular pathology and athletic pubalgia (89% of hips) when compared with sports pubalgia surgery or hip arthroscopy alone (33%) during the study period ($P < .01$).

There were 2 patients with transient lateral femoral cutaneous nerve neurapraxias that completely resolved. Superficial wound infections developed in 2 patients (1 sports hernia incision and 1 arthroscopy portal) and resolved with oral antibiotics. There were no cases of femoral neck fracture, iatrogenic hip instability, symptomatic heterotopic ossification, avascular necrosis, pudendal/sciatic/peroneal/femoral neurapraxia, intra-abdominal fluid extravasation, or deep infection.

**DISCUSSION**

FAI and intra-articular hip pathology have been increasingly recognized as a source of disability in high-level athletes. A high percentage of good/excellent outcomes has been noted after arthroscopic joint-preservation procedures for FAI. Athletic/sports pubalgia has been a recognized source of disability in athletes as well. This typically presents as either an insidious or acute presentation of exertional lower abdominal pain with associated rectus abdominis, adductor longus and brevis, pectineal, external oblique/transversalis fascia, and symphyseal pathology in some cases. Laparoscopic, mini-open, and open pelvic floor repairs with or without mesh, adductor tenotomies, and nerve neurolysis and releases have all been reported to yield high success rates with respect to improvement in pain and return to a high level of athletic activity.
Our study supports the concept that a subset of high-level athletes exist who have both symptomatic intra-articular hip pathology and extra-articular athletic/sports pubalgia symptoms. The majority of these athletes will describe a deep lateral or groin pain consistent with intra-articular pathology and a more superficial lower abdominal/adductor symptomatology. Management of the sports pubalgia symptoms alone when both were present resulted in a return to preinjury sporting level in only 25%. Management of intra-articular pathology alone when both were present resulted in a return to preinjury sporting level in 50%. When both intra-articular and extra-articular symptoms were managed concurrently or at separate settings, 85% and 93%, respectively, returned to full sports without limitations. There were no statistically significant differences for outcomes scoring or return to sports without limitations when we compared concurrent surgery with separate-setting intra-articular and sports pubalgia surgery.

It is now our routine approach for high-level athletes to manage both entities at the same setting when both intra-articular and sports pubalgia symptoms are considered to be significantly limiting. We believe that performing both procedures at the same setting might lead to less time lost from athletics due to continued disability and rehabilitation after 2 separate surgeries. The current authors have not found the addition of the athletic pubalgia surgery to significantly affect the initial rehabilitation or ultimate return to sports when compared with hip arthroscopy alone.

The cause and effect of this association are not proven. It is possible that range-of-motion restrictions due to FAI create compensatory patterns that affect extra-articular pelvic structures and could result in athletic/sports pubalgia-type symptoms. Prior studies have shown that limited hip range of motion leads to a higher incidence of chronic hip/groin pain and osteitis pubis.5,6 It may be that these motion limitations also lead to associated low back, sacroiliac, psoas, rectus femoris, and proximal hamstring pain/pathology in some athletes. FAI correction resulted in a 14° improvement in internal rotation and 11° improvement in forward flexion in our study. In addition, we reported that 50% of patients had resolution of sports pubalgia symptoms after arthroscopy alone. It is possible that improved hip range of motion and function after FAI correction could decrease stress on extra-articular pelvic structures, allowing the sports pubalgia symptoms to resolve. This study also reported that staged hip arthroscopy and sports pubalgia surgery had outcomes equal to concurrent surgery.

On the basis of these findings, it may be a reasonable approach to first manage the intra-articular component in these patients and consider sports pubalgia surgery at a later date if limiting symptoms persist. Regardless, this study underscores the importance of orthopaedic surgeons and general surgeons specializing in sports-related hip disorders working closely together to optimize outcomes in this subset of high-level athletes.

The strengths of this study include surgical management of intra-articular hip pathology by a single surgeon with prospective outcomes data collection. This is the first series, to our knowledge, evaluating various surgical approaches in athletes with both intra-articular hip disorders and athletic pubalgia/sports hernia. The patients were obtained from a large database of relatively young athletic patients who sought medical attention for activity-related hip pain. Only those patients who had significant limitations due to both intra-articular and athletic pubalgia complaints were included in this study.

The weaknesses of this study include its retrospective design and relatively small numbers. The patient population studied represented a very small subset of all patients evaluated for hip pain over the study period. These patients were all elite-level athletes, even at the high school and club level, and the eventual outcomes may not necessarily apply to lower-level athletes or non-athletes presenting with hip-related disorders. Only those athletes in whom nonoperative treatment failed and who had surgery were included in the study. There may have been some athletes who never had surgery or ultimately had surgery elsewhere without our knowledge who were not included in this study. In addition, the modified Harris Hip Score is not sports specific, and a sports-specific outcomes score was not used by us until later in the study period. We therefore included an evaluation throughout the study regarding return to the athlete’s sport and whether there were any limitations. The management of these patients changed over time as our understanding of these associated hip disorders and their eventual outcomes became clearer. In addition, the pathology present and surgical procedures varied considerably between athletes. This made a comparison of matched groups and their respective surgical outcomes difficult. Future studies with larger numbers should focus on a comparison of specific patterns of intra-articular and extra-articular pathology and outcomes after specific nonsurgical and surgical protocols in differing patient populations.
CONCLUSIONS

Isolated management of either symptomatic intra-articular hip pathology or athletic pubalgia in this elite athletic population led to suboptimal results. Surgical management of both disorders concurrently or in a staged manner led to improved postoperative outcomes scoring and an unrestricted return to sporting activity in 89% of hips.

REFERENCES