

# Current Analysis of Women Athletes with Pelvic Pain

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## ABSTRACT

MEYERS, W. C., D. M. KAHAN, T. JOSEPH, A. BUTRYMOWICZ, A. E. POOR, S. SCHOCH, and A. C. ZOGA. Current Analysis of Women Athletes with Pelvic Pain. *Med. Sci. Sports Exerc.*, Vol. 43, No. 8, pp. 1387–1393, 2011. **Background and Methods:** Accurate diagnosis and effective management of pelvic pain in women have become more challenging now that the number of women athletes and the number of diagnostic possibilities are increasing. We conducted a prospective study of women athletes with pelvic pain seen during a 2-yr period within a large well-defined clinical practice to clarify some of the current causes and treatment possibilities. **Results:** One hundred fourteen females, 14% of the total male/female cohort, were referred for treatment of suspected musculoskeletal injury. On the basis of history and physical and radiological examinations, 74 (64.9% of females) turned out to have injuries of the hip (group A) and/or soft tissues surrounding the hip (group B), and 40 (35.1%) had other sometimes more threatening diagnoses. In groups A and B, 40 (90.1%) of 44 patients who chose surgery achieved previous performance levels within 1 yr compared with only 4 (13.8%) of 29 who did not have surgery. Factors such as sport type, competitive status, and age did not affect the outcomes. Most diagnoses in group C, e.g., inflammatory bowel disease, reflex sympathetic dystrophy, and malignancy, usually eclipsed the potential musculoskeletal diagnoses in terms of long-term importance. **Conclusions:** In this series of patients, most pelvic pain in women athletes was identifiable and treatable. Most had benign musculoskeletal causes, and surgery played an important role in treatment of those causes. Still, we found a large number of other causes that required longer specialized care. Health care professionals seeing such patients need to be alert to the new concepts of pelvic injury and the various roles for surgery and the broad list of other considerations. **Key Words:** ATHLETIC PUBALGIA, SPORTS HERNIA, HIP, SPORTS, PELVIC PAIN, FEMALE

Chronic pelvic and hip pain in women athletes seems to be a growing problem during the past 20 yr. A recent review of 8490 patients showed that the proportion of women athletes with hip and pelvic injuries increased from <1% to 15.1% during the past two decades (12). Accurate diagnosis and effective management of these women has challenged many primary physicians and specialists for years (5) because the differential diagnosis is so broad and includes a wide range of visceral problems plus musculoskeletal (MSK) injuries (8).

It is easy to forecast that this patient population will present an even larger challenge for diagnosticians because of recent clarifications of the range of newly recognized hip and pelvic injuries in women athletes (1,3). Athletic pubalgia (AP) or “sports hernia” is a large class of injuries that has become more broadly applicable to both men and women

athletes. Similarly, great progress has occurred in the diagnosis and management of hip labral tears and impingement syndromes (15).

Within a large well-defined population of such women athletes, i.e., with chronic pelvic pain suspected to be MSK by their referring health professionals, a 2-yr sampling of these patients was analyzed carefully to determine their ultimate diagnoses and outcomes. The patients with benign MSK causes were followed for at least a 1-yr period after diagnoses.

## METHODS

**General considerations.** In a recent study, we noted improvements in recognition of benign MSK pelvic injuries and in identification and treatment of various injury types during the past two decades (12). Excluded from those analyses were patients with clear nonmusculoskeletal (non-MSK) causes of pain. In the present study, we investigated all women seen in one clinic with a primary complaint of pelvic pain related to athletic exertion, whether or not the ultimate diagnosis turned out to be benign MSK or something else. We limited this analysis to a 2-yr period, from January 2006 to January 2008, and to patients whose radiologic studies were done at our institutions; we followed the institutional review board guidelines with respect to

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this protocol and patients' consent, obtained through Drexel University College of Medicine. Outcomes of patients with benign MSK causes were assessed prospectively at predetermined periods. For statistical analysis, we used primarily  $\chi^2$  and unpaired *t*-tests with  $P < 0.05$  considered significant.

**Clinical groups.** For this cohort of patients, we considered three groups of diagnoses. Groups A and B were the benign MSK categories of AP and athletic hip problems (H), respectively. AP refers to injuries of soft tissue structures outside the "ball-in-socket" hip joints and attaching to or symmetrically distributed around both pubic symphyses (13), and hip problems refer to only the ball-in-socket hip joint itself. Group C comprised other noninjury ("other") diagnoses, i.e., pertaining to the gastrointestinal, genitourinary, gynecologic, or other systems or noninjury MSK diagnoses or malignancy. We did not include any patients in this study who had <3 months of symptoms.

At the time of their initial visits, all patients of groups A and B filled out questionnaires with demographic, historical, and functional information. They filled out similar forms during follow-up visits. It was not possible to assess in a randomized prospective fashion the effectiveness of surgery in this population. However, randomization to a control group with no surgery was impossible because most patients traveled with the bias that they wanted surgery to get them back to preinjury playing status. Nevertheless, some patients chose no surgery despite having seemingly repairable problems, so we thought it would still be interesting to evaluate the patients according to their choices whether or not to have surgery.

By our definitions, each of the patients in groups A and B had to have AP, hip problems, or both. Resultantly, there were eight possibilities concerning surgery: AP or H treated by surgery or not (four possibilities) plus AP and H combination injuries treated by one, two, or no surgeries (four additional treatment possibilities).

Therefore, we followed up all A and B patients at predetermined intervals after their initial decision to have surgery or not via direct contact and/or phone calls. The focus of the follow-up questions was return to play and level of play compared with preinjury by their own assessments. The follow-up in groups A and B was 100% for the chosen time spans.

**Diagnostic considerations.** We based our diagnoses of the various clinical entities primarily on history and physical examination supported by the new magnetic resonance imaging (MRI) techniques (29). All patients in groups A and B underwent AP dedicated MRI, and depending on clinical suspicion, many also had direct MR arthrograms with sensorcaine/lidocaine tests (29). Because of the newness of these diagnoses, it seems important to describe these diagnostic considerations in some detail.

Histories were conducted with careful attention to three sets of diagnoses: AP, H, and other causes. Because AP resulted primarily from muscular disruption, the pain of AP

was primarily exertional in nature and often predictable with initiation of forceful activities such as sprinting and changes of direction. The pain could also affect normal activities such as coughing, sneezing, or rolling over in bed at nighttime. The pain could also vary from side to side, depending on patterns of compensation, and involve multiple sites of soft tissue attachments such as the rectus abdominis and specific adductor muscles. The inflammatory response associated with the osteitis pubis that sometimes accompanied AP could cause tenderness and pain particularly after cessation of activities (27).

In contrast, patients with hip problems usually described pain with or after minimal activity such as prolonged standing, walking, or jogging or with certain postures such as prolonged sitting or going up and down stairs. Their pain was often more sporadic and less predictable. Pain subsequently documented from the other causes often had historical clues such as genitourinary, gastrointestinal, or gynecological symptoms or past problems or continuous or sporadic pain totally unrelated to physical activity. Some of the patients who had other causes also had benign MSK injuries at the same time, sometimes making accurate diagnosis perilous.

Physical examinations were conducted with careful attention to the same three categories of diagnoses. For AP, we have developed resistance tests for each of the muscles attaching to or crossing the pubic symphysis or joint (13). These tests involve resistance against the primary action of each muscle. Interpretation of each test involves three considerations: 1) does the test cause pain? 2) Does the resultant pain correlate to the muscle being tested? And 3) does the resultant pain recreate the pain causing the athlete's disability? For the hip problems, the examination involved primarily range of motion tests without interference from contraction of muscles. These include the standard flexion-abduction-external rotation and flexion-adduction-internal rotation tests plus numerous other rotational or hyperflexion or hyperextension tests that could isolate anterior, posterior, or lateral impingements or other pathology. Localized tenderness, of course, was sometimes helpful for specific diagnoses, although the tenderness associated with various types of bony or soft tissue inflammation can also be confusing. Extreme pain with light touch was considered a clue to the existence of CRPS (chronic regional pain syndrome)/RSD (reflex sympathetic dystrophy). Comprehensive physical examinations, sometimes with internal pelvic or rectal examinations, were considered important, of course, to detect the non-MSK diagnoses.

Specialized pelvic MRI and MRI-hip arthrography have become increasingly accurate in demonstrating pathology that correlates with the history and physical examinations. The initially reported MRI sensitivity and specificity, respectively, of 68% and 100% for rectus abdominis injury and 86% and 89% for adductor injury have been considerably improved with the development of a dedicated AP MRI protocol (6,14). The technique uses surface coils, a

send–receive body coil, and new angles to visualize the pelvis. This objective way of demonstrating injuries has provided convincing evidence of the multiplicity of soft tissue injuries and the overlap with ball and socket hip injuries. Similarly, MR arthrography has become increasingly sensitive in the diagnosis of intrinsic hip pathology and increasingly accurate with the use of dedicated sensorcaine or lidocaine protocols (18).

**Treatment considerations.** Both surgical and nonsurgical treatments varied depending on the precise pathology. For example, in a recent article (12), we counted 26 different procedures and 121 different combinations of those procedures for the various AP pathologies (13). These operations involved both direct repairs of the defects and repair or releases of compensatory injuries. Similarly, we counted 17 different surgical procedures, e.g., labral repair, debridements, and osteotomies, for the hip problems. Nonoperative treatment included rest, physical therapy, and various forms of injection, e.g., steroids, platelet-rich plasma (PRP), and prolotherapy.

All AP surgeries were performed at our institution. All hip surgeries were performed at other institutions by experienced arthroscopists.

**Definitions.** For clarity, we adhered to some previously accepted definitions. We used the term *athletic pubalgia* as an umbrella term that refers to injuries of the soft tissues of the pelvis outside the hip joint and arranged symmetrically around and including the pubic symphyses but not including the sacrum or spine (12,25). *Hip joint* refers to the ball-in-socket joint consisting of the acetabulum, ligamentum teres, articular and labral cartilages, head and neck of the femur, and other soft tissue enclosed within this space, for example, the synovium (7).

The term *competitive athlete* (CA) refers to patients currently or recently participating in competitive athletic activity as a livelihood or an integral way of life. The patients themselves determined their highest level of competition and education and their primary sport. All the other women were called *noncompetitive athletes* (NCA), yet all these women still prided themselves in being physically fit.

**Follow-up.** Follow-up was conducted after 3 and 6 months and 1 yr after surgery or after completion of diagnostic testing if the patient decided not to have surgery. We graded results on a 1–4 scale. The patients or trainers provided the principal input for the grading, on the basis of whether or not the patients were back to their previous performance status. “1” meant the patient was worse after surgery, “2” meant no change, “3” meant improvement but not to the maximally desired level, and “4” meant back to fully

desired level of performance. Only grade 4 was considered a success because all such patients had returned to their previous levels of performance. All other grades were considered failures. Some patients who received grades of 3 disagreed with our definition of success because they were happy with their improvement and sense of well-being; nonetheless, they had reduced their level of competitiveness compared with maximal preoperative levels.

We also assessed performance at 2 yr. All results in the surgical groups either were the same or were better at 2 yr compared with 1 yr, and all the results in the nonsurgical groups were either the same or worse at 2 yr. However, because only 60% of patients were out 2 yr at the last data collection, 1-yr results became the primary measure of patient outcome.

## RESULTS

### Female Population

We identified 114 women (14% of the 2-yr male/female cohort) with pelvic problems suspected initially to be MSK. The patients came from 19 different states, Canada, and Israel. All the patients had at least 4 months of pain that had not been getting better. Forty-seven patients fit into group A (AP), 40 into group B (hip problems, H), and 41 into group C (other diagnoses). Fourteen patients (16% overlap) fit into both groups A and B. In other words, each of the latter patients had both symptomatic AP and symptomatic H. Overall mean age was  $30.7 \pm 1.8$  yr (mean  $\pm$  SEM, range = 13–61 yr). Fifty-nine (52%) of the women were CA, and 55 (48%) were NCA. All group A and B patients reported exertionally induced pain longer than 3 months in duration.

### Group A (AP)

The mean age of women in group A was  $28.7 \pm 2.0$  yr. Twenty-three (49%) of group A women were CA, and 24 (51%) were NCA. The most common sport for group A was running, followed by soccer (Table 1). The largest sport category in Table 1 was “other sports.” Other sports included traditional sports such as swimming, cheerleading, gymnastics, track and field, etc., and less traditional sports or activities such as calisthenics, spinning, and exercise biking. MRI demonstrated pathology in every case. All the patients with AP had abnormalities of the central pubic symphyseal soft tissue attachments. Thirty (63.8%) of the 47 patients also had involvement of the more lateral structures (Table 2). Twenty-two (42.5%) of the patients also had

TABLE 1. Sports for patients in groups A and B and the overlap group (combination of AP and H injuries) and for CA versus NCA.

	Running	Soccer	Field/Ice Hockey	Basketball	Dancing	Other Sports	Not Determined
Group A	13	7	4	4	3	14	2
Group B	12	4	3	3	2	13	3
Overlap	5	2	3	3	1	2	0
CA	11	6	3	3	3	12	0
NCA	9	3	1	0	0	14	8

TABLE 2. Most common sites of pathology in groups A and B and the overlap group.

	Medial Pubic Symphyseal Attachments <sup>a</sup>	Lateral Soft Tissue Structures <sup>b</sup>	Pubic Symphyseal Inflammation (Osteitis Pubis)	Hip Labral Pathology	Impingement Anatomy	Other Hip Pathology <sup>c</sup>
Group A	47	30	22	13	13	7
Group B	14	13	8	37	32	14
Overlap group	14	13	5	14	13	7

<sup>a</sup> Involving rectus abdominis, pectineus, adductor longus, and/or adductor brevis.

<sup>b</sup> Involving more lateral structures, e.g., rectus femoris, sartorius, iliacus, psoas, obturator externus, quadratus, etc.

<sup>c</sup> Involving articular cartilage, dysplasia, ligamentum teres, osteoarthritis, etc.

pronounced inflammation of the pubic symphysis (osteitis pubis). Thirty-seven (79%) of the 47 women in group A ended up having surgery.

### Group B (Hip)

Mean age of women in group B was 32.7 ± 2.4 yr and significantly greater than group A women. Twenty-one females (52%) were CA, and 19 (48%) were NCA. Like group A, the most common sport was running. The second most common sports were hockey and basketball (Table 1). Injuries fit into three major categories: labral pathology, impingements (cam or pincer) (2,20), or other hip abnormalities (such as osteoarthritis or hip dysplasia). MRI exhibited pathology in every case. The most commonly identified pathology was labral tear (Table 2). Sixteen (40%) of the 40 women in group B had surgery.

### Overlap Group (A and B)

As mentioned, 14 patients fit into both groups A and B. The mean age of this combined injury group was 28.6 ± 2.9 yr. Of the 14 women, 6 (43%) were competitive athletes and 8 (57%) were not. The most common sports again were running followed by hockey and basketball (Table 1). All 14 of the overlap patients had medial pubic attachment pathology. Thirteen (93%) of the 14 overlap patients had abnormalities of the lateral soft tissue structures (Table 2), significantly more than group A patients. All 14 overlap patients had labral tears and 13 of the 14 had impingement. Of the 14 overlap patients, 9 (64%) had surgery, and all 9 had two operations, one for AP and the other for the hip pathology. The other five patients had no surgery for either AP or H. No such patients underwent AP surgery without H surgery, and no patients underwent H surgery without AP surgery.

### Group C (Other Diagnoses)

All 39 patients in group C experienced ailments other than AP or H (Table 3). The most common specific diagnosis was RSD (24), followed closely by Crohn's disease, endometriosis, rheumatologic problems, and primary osteitis pubis (11). Bony abnormalities (e.g., total hip complications, fractures, stress reactions, growth plate abnormalities) outnumbered gynecologic problems 13 to 9. No patients had hernias as a cause for pain. Interestingly, there were no primary genitourinary problems in the women during this 2-yr period. One case of appendicitis was diagnosed 3 months after onset of pain.

Two patients had malignancies: an adductor synovial cell sarcoma diagnosed early and treated aggressively with resection and radiation and a malignant teratoma involving the posterior rectus abdominis muscle treated by resection alone. Fortunately, neither tumor had recurred at 22 and 14 months, respectively.

### Follow-Up

**Overall (surgical and nonsurgical groups).** Twenty-eight (38%) of the 73 women in groups A and B were performing successfully after 3 months; 37 (50%) women, after 6 months; and 44 (60%), after 1 yr. Forty-four women in groups A and B underwent surgery, and 29 did not.

Two of the 44 surgical patients had postoperative complications: a superficial wound infection and a presumptive nerve entrapment. The latter patient underwent a negative reoperation, after which the pain resolved promptly. Most patients had minor bruising or small-area skin sensory loss, neither of which was reported as bothersome at the designated follow-up intervals.

**Outcomes according to treatment categories.** Twenty-five (89.1%) of the 28 patients who chose surgery for AP reported success at 1 yr, which was significantly

TABLE 3. Group C (other) diagnoses.

Diagnosis	Total Number of Patients	Surgery for Ailment	CA	NCA
RSD	4	1	2	2
Crohn's disease	3	2	3	0
Endometriosis	3	2	2	1
Rheumatologic diseases	3	0	2	1
Primary osteitis pubis	3	0	1	2
Unusual nerve entrapment syndromes	2	0	0	2
Malignant neoplasms	2	2	2	0
Complicated deep pelvic stress reactions	2	0	2	0
Total hip replacement complications	2	0	0	2
True pelvic fractures	2	0	2	0
Childbirth pubic symphyseal disruption	2	2	0	2
Other inflammatory bowel disease	1	0	1	0
Appendicitis	1	1	1	0
Infarcted uterine fibroma	1	1	1	0
Ovarian cyst	1	1	1	0
Benign neoplasms	1	1	1	0
Growth plate problems	1	0	1	0
Back problems	1	0	1	0
Salter fracture/stress reaction	1	0	1	0
Avascular necrosis	1	1	0	1
Pelvis venous varices	1	0	0	1
Sacroileitis	1	0	1	0
Uncertain diagnosis	2	1	1	1
Total	41	15	26	15

TABLE 4. One-year performance.

Diagnosis and Treatment	Score = 1	Score = 2	Score = 3	Score = 4
<b>Groups A and B</b>				
AP, operation	0 (0%)	1 (3.6%)	2 (7.2%)	25 (89.2%)
AP, no operation	0 (0%)	1 (20%)	3 (60%)	1 (20%)
Hip, no operation	1 (5%)	9 (47.4%)	6 (31.6%)	3 (15.8%)
Hip, operation	0 (0%)	0 (0%)	1 (14.3%)	6 (85.7%)
AP and hip, operations for both	0 (0%)	0 (0%)	0 (0%)	9 (100%)
AP and hip, no operations	0 (0%)	3 (60%)	2 (40%)	0 (0%)
<b>CA</b>				
AP, operation	0 (0%)	1 (5.9%)	1 (5.9%)	15 (88.2%)
AP, no operation	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Hip, no operation	0 (0%)	3 (37.5%)	4 (50%)	1 (12.5%)
Hip, operation	0 (0%)	0 (0%)	0 (0%)	5 (100%)
AP and hip, operations for both	0 (0%)	0 (0%)	0 (0%)	5 (100%)
AP and hip, no operations	0 (0%)	0 (0%)	1 (100%)	0 (0%)
<b>NCA</b>				
AP, operation	0 (0%)	0 (0%)	1 (9.1%)	10 (90.9%)
AP, no operation	0 (0%)	1 (20%)	3 (60%)	1 (20%)
Hip, no operation	1 (9.1%)	6 (54.5%)	2 (18.2%)	2 (18.2%)
Hip, operation	0 (0%)	0 (0%)	1 (50%)	1 (50%)
AP and hip, operations for both	0 (0%)	0 (0%)	0 (0%)	4 (100%)
AP and hip, no operations	0 (0%)	3 (75%)	1 (25%)	0 (0%)

Grades by diagnosis and CA versus NCA. Note that all overlap patients chose either both AP and H surgery or no surgery.

Scores: 1, worse after surgery; 2, no change; 3, improvement but not to maximally desired level; 4, back to fully desired performance.

better than the one out of five (20%) who chose not to have surgery (Table 4). Six (85.7%) of the seven patients who chose surgery for H reported success at 1 yr, also better than the 3 (15.7%) of 19 women who chose no surgery.

All nine (100%) of nine patients with overlap (AP and H) injuries who chose surgery reported success at 1 yr after surgery compared with zero out of five who chose no surgery. Interestingly, the 14 overlap patients all chose to undergo either both surgeries or no surgery, accounting for no patients in the last two categories of the table.

**Outcomes according to athlete status.** Fifteen (88.2%) of the 17 AP CA reported success with surgery (Table 4). No CA with AP chose not to have surgery. Five of the five hip CA had success with surgery, again significantly better than 2 (18.2%) of 11 CA women who chose no surgery. All five CA with overlap injuries reported success after surgery. The only overlap CA patient who chose no surgery was better at 1 yr but not back to a competitive level.

The results for NCA were only slightly different: 10 (90.6%) of 11 surgical success for AP, significantly higher than 1 (20%) of 5 with no surgery; 1 (50%) of 2 surgical success for H compared with 2 (18.2%) of 11 with no surgery (not significant); and 4 (100%) of 4 surgical success for the overlap patients, significantly better than 0 of 4 with no surgery.

**Interval outcomes.** There was significantly more success with surgery than without surgery at all three evaluation points (Table 5). Twenty-three of the 44 patients who chose surgery originally tried to avoid surgery by doing at least 3 months of physical therapy.

## DISCUSSION

The most important observation in this study should be clear. With the increased participation of women in all levels

of sports, we can identify and treat the causes of most pelvic pain in these patients. Advances in understanding most of the benign MSK causes have contributed to the success. Still, a large group of women may have other causes that can certainly affect their lives more than most of the benign injuries. Of course, primary care physicians (PCP), gynecologists, and other health care professionals treating these patients must be alert to the new concepts of pelvic injury and the broad list of other diagnoses.

Let us consider two scenarios: an injured female player in the training facility or in the PCP's office. Each setting has its advantages and disadvantages. In the training facility, the clinical examiner has the advantage of seeing an injury when it is relatively acute but the disadvantage of pressure to get the player back to her sport as soon as possible. We believe that pressure can lead to assumptions that the problem is benign and MSK (which it usually is) and can limit the comprehensive examination that the patient may need. On the other hand, in the PCP's office, the health provider has the advantage of being comprehensive, but that advantage can sometimes lead to an unnecessarily slow workup, causing frustration in the athlete anxious to return to play. In

TABLE 5. Outcomes at three different time points.

Score	3 months	6 months	1 yr
<b>Operative treatment</b>			
1	0 (0%)	0 (0%)	0 (0%)
2	2 (4.5%)	2 (4.5%)	1 (2.3%)
3	16 (36.3%)	9 (20.4%)	3 (6.8%)
4	26 (59.0%)	33 (75%)	40 (90.9%)
<b>Nonoperative treatment</b>			
1	1 (3.4%)	1 (3.4%)	1 (3.4%)
2	17 (58.6%)	14 (48.3%)	13 (44.8%)
3	9 (40.9%)	10 (34.4%)	11 (37.9%)
4	2 (6.8%)	4 (13.7%)	4 (13.7%)

Time points refer to date of first surgery or after completion of diagnostic testing.

fact, the patient may not need a long list of consultations that are sometimes ordered. With experience, much of this slow workup can be eliminated.

All the diagnostic testing can be done with three main diagnostic categories in mind: AP, H, and other causes. History should focus on such things as exertional nature of the pain and clues to visceral causes. Physical examination should be also divided into three parts: muscular testing, hip maneuvers, and a comprehensive examination. With modern technology and interpretation, most of the MSK diagnoses can be confirmed by MRI.

Even with this organized approach, diagnoses can be tricky. For example, we found a 16% overlap of significant hip and soft tissue injuries. This coincidence of injuries, of course, raises questions about simultaneous versus sequential relationships between the injuries (19). But the fact remains that both of the problems needed to be addressed. It was also interesting that many of the patients with visceral causes also had simultaneous benign MSK injuries that turned out to be minor.

Surgery for the MSK groups was highly successful even if the patients had simultaneous injuries. The overall 1-yr success rate with surgery was 91%, and without surgery, it was only 14%. Although there still may be some controversies about the roles for surgery as primary treatments for hip or pelvic soft tissue injuries in athletes (26,28), there was little doubt that surgery played a central role in treatment of these athletes. A good randomized prospective trial that includes a nonoperative arm is likely impossible. Given that all these patients had gone for at least 4 months with no improvement despite rest and/or physical therapy protocols, it seems that our study has achieved the next best thing, i.e., a close prospective follow-up based on the decision making of the individual patients.

The complexity of these patients goes up even another notch when one considers the neurologic pain syndromes that can be abundant in this area of the body. Although the clinical criteria, natural history, and pathophysiology of CRPS have been extensively documented, this diagnosis is frequently missed (4,22,23). Most CRPS patients are said to have a maintaining underlying injury, and neurologists spend a great deal of effort trying to eliminate the underlying problem before ketamine or other treatment (16,17,21). We did not test that assumption in our study.

The present study also brings up interesting comparisons with male athletes with AP. Our previous studies in predominantly male athletes showed success rates in the 95%–96% range (10,12). The slightly lower overall 89%–91% success rate in women in this study may reflect differences in pathology, smaller numbers, or undetermined factors such as CRPS. The data do strongly suggest that differences in female anatomic structure evoke different mechanical responses to pelvic injury. If one assumes similar mechanisms of injury as men, the females in this series had a higher incidence of hip problems than the males in the other series. Also, 63.8% of the women with AP had



**FIGURE 1**—Sagittal T1 fat saturation (fatsat) after contrast. MRI of synovial cell sarcoma in a 15-yr-old female athlete. Arrow points to the highly vascular tumor invading the profunda femoris vein.

involvement of lateral pelvic soft tissue structures (Table 2) compared with only 8% in the predominantly male studies. Like the gender differences in other sports injury studies, these differences could relate to anatomic structure and possibly a wider distribution of forces onto a relatively broader pelvis. Lateral compensation for a central peripubic derangement might spread over a wider area (9). The broader pelvis in the female then might be considered protective of these injuries.

Finally, the young girl with a synovial cell sarcoma is worth special note. This 15-yr-old athlete was examined several times in training rooms and was thought to have a mild mid adductor longus muscle strain. She and her parents were frustrated by the persistence of pain after several months. On examination, she had pain in the mid-muscle belly of the adductor longus with palpation more centrally and proximally in the femoral sheath area. Fortunately, the MRI (Fig. 1) included the more distal thigh and revealed a highly vascular tumor of the femoral vein thought to be a benign schwannoma. After resection of the tumor and recognition of its aggressive nature, she required a radical resection and radiation. Fortunately, she remains without evidence of recurrence and fully participatory in athletics for over 3 yr after the re-resection. This young woman represents well the difficult and sometimes confusing nature of problems in this region of the body. Her case also shows well how an organized approach to these patients can benefit them.

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