

Referred Knee Pain in a Young Athlete: A Case Study

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An 8-year-old, male, grade-school sports participant was evaluated in the clinic accompanied by his mother. During the physical therapy evaluation, the following subjective information was provided by the patient and his mother, who were both good historians. Chief complaints of right knee pain began 3 months prior to the visit as a result of a fall directly on the patella. At the time of injury, pain was not severe and the patient continued normal recreational sporting activities and activities of daily living with only occasional pain. An orthopaedic consultation was sought after approximately 2 months for the inconsistent knee pain. X-rays of the knee were negative for fracture or any other bony defect. No specific diagnosis was given and no formal treatments were undertaken. Pain at the knee gradually worsened, and the patient developed a nonpainful limp. For these reasons, the patient presented for initial physical therapy evaluation.

Pain in the right knee was not associated with any particular activity. Stairs did not affect the pain, pain was increased with prolonged sitting, and the patient denied locking and catching sensations. There had been no discernible swelling between the initial fall on the knee and the time of the evaluation. When pain was present, prolonged weight bearing seemed to make matters worse. Also, when the knee was painful, use of superficial moist heat did

Parapatellar pain is a common complaint in the active adolescent patient population. Patellofemoral pain syndrome, Osgood-Schlatter disease, Sinding-Larsen-Johansson syndrome, patellar tendinitis, and other stress failure conditions are the primary causes of these parapatellar symptoms. Not all cases of knee discomfort are related to knee pathology. This case study discusses hip pathology as a source of referred knee pain in an 8-year-old male athlete. Care must be taken to evaluate all possible sources of both primary and referred pain in all cases.

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not help to decrease the pain, and the patient had not tried ice application. Pain was not worse in the morning and there was no morning stiffness. Pain did not wake him during the night, although it did occasionally prevent him from falling asleep.

EVALUATION

Physical examination of the knee revealed the following information:

Swelling There was no periarthritic swelling noted by circumferential measurement. Milking potential fluid from the suprapatellar pouch and performing the patellar tap and fluctuation tests did not reveal intra-articular swelling.

Posture and Gait Assessment Analysis of the standing posture showed listing to the right. Gait analysis revealed compensated gluteus medius gait on the affected right side. Hip flexion was decreased on the right side, and the patient had a tendency to spend less time on the right side during stance phase.

Range of Motion Active range of motion of the bilateral knees was

symmetrical, full, and pain free. No audible or palpable patellofemoral crepitus was present through the range of motion.

Flexibility Hamstrings were tight bilaterally, with active knee extension lacking 35° from neutral on the right side and 30° from neutral on the left side with the hips flexed to 90°. Both calves were tight; active dorsiflexion was 0–5° without maintaining subtalar neutral.

Palpation No tenderness was present at the tibial tubercle, pes anserinus insertion, patellar tendon, inferior or superior pole of the patella, or at the quadriceps tendon. No plica could be palpated. Palpation of the lateral patellar facet revealed no discomfort, but there was moderate discomfort with palpation of the medial facet. There was no medial retinacular tenderness.

Patellofemoral Assessment Patellar mobility was normal bilaterally. With the knees flexed to 45°, it was not possible for the patella to be subluxed greater than one-third of the patellar width bilaterally. Patellar tracking was normal with active knee flexion and extension. Resting posi-

tion of the patella did not reveal asymmetrical tilt or rotation. The Q angle was symmetrical and well within normal limits bilaterally.

Muscle Testing An isokinetic test was not indicated. A manual muscle test of the quadriceps revealed good+ strength on the uninvolved left side, with good strength on the involved right side. Bilateral hamstring strength was good.

Special Tests Laxity of the knee was assessed bilaterally via varus/valgus stress at 0 and 30° of flexion, Lachman's test, and anterior and posterior drawer tests. There was no asymmetrical or abnormal laxity detected of the medial/lateral collateral ligaments or of the anterior/posterior cruciate ligaments. No joint line tenderness was elicited by palpation, and rotational signs were negative for possible meniscal involvement.

Girth Measurement Circumference of the involved right quadriceps was approximately 3/8-in less than the noninvolved left quadriceps at 3, 6, and 8 in proximal to the joint line.

Upon concluding the above examination, there were no strong clinical findings present to indicate a primary knee problem. Proximal and distal joints were then examined as potential sources of referred pain to the knee.

A prone examination of the non-weight-bearing lower extremities revealed a slight rearfoot varus bilaterally. The rearfoot to forefoot relationship was acceptable, and mobility of the first ray was normal. No calluses or blisters at the retrocalcaneal area or plantar aspect of the foot were noted. Femoral anteversion on the noninvolved left hip was unremarkable. However, passive internal rotation of the right hip was decreased approximately two-thirds of the normal range of motion. Passive external rotation was decreased approximately one-third of the normal range. Attention was then directed to the hip. Strength of the right hip flexors was good-; on the left, strength was good+. In a sidelying

position, abductors on the right side were fair+; on the left, strength was good+. Strength of the internal and external rotators on the left side was good+ compared with a fair grade in the available range, and this maneuver was accompanied by hip and knee pain. Provocative testing was positive as manual overpressure applied to the hip in the supine position was not tolerated by the patient nor was he able to assume a figure-four position for the Patrick's test due to pain.

When the patient first arrived

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for evaluation, and after subjective evaluation, the clinical picture was that of patellofemoral pain syndrome (clinical diagnosis), with other impressions of chondromalacia patella (via direct observation of the retropatellar surface) or possibly osteochondritis dissecans (OCD). Knee X-rays were normal, which would normally rule out OCD. With lack of strong objective findings relative to patellofemoral pathology, the examination was concluded and the clinical impression of hip pathology as the source of referred knee pain was

reached. The patient was referred to another orthopaedist, and X-rays of the hip were ordered (Figure). Radiographs revealed Perthes disease of the hip, with two-thirds of the femoral head involved.

DISCUSSION

Perthes, or Legg-Calve-Perthes, disease was first described during 1908-1910 by American physician Dr. T. Legg, French physician Dr. J. Calve, and German physician Dr. G. Perthes (4). This condition refers to an avascular necrosis of the femoral head. Incidence of the disease is approximately 1 in 1,200 (5). As exemplified in this case, males are affected with Perthes disease more often than females by an approximate 4:1 ratio (4,5). Cases have been reported in children from 3 to 12 years of age, with the highest incidence occurring between the ages of 5 and 7. Chief complaints from the patient with Perthes disease are pain and a limp of long-standing duration. Pain from Perthes disease is usually localized to the groin; however, it is commonly referred to the anteromedial thigh and frequently to the knees (2,4,5). Motion of the hip is usually restricted, especially in the planes of abduction and rotation. Atrophy of the thigh and buttock musculature is also a common finding.

X-rays are required to determine the degree of bony involvement. Comparison to views of the opposite hip is usually helpful. Early X-ray signs, best seen on a lateral view, demonstrate failure of the epiphysis to grow. This failure of growth produces a greater loss of density and subsequent widening of the metaphysis. Changes seen later on X-ray include shortening of the femoral neck and flattening of the femoral head, with subsequent femoral head enlargement. A bone scan is also helpful in estimating how much of the femoral head is involved, using the percentage of decreased uptake

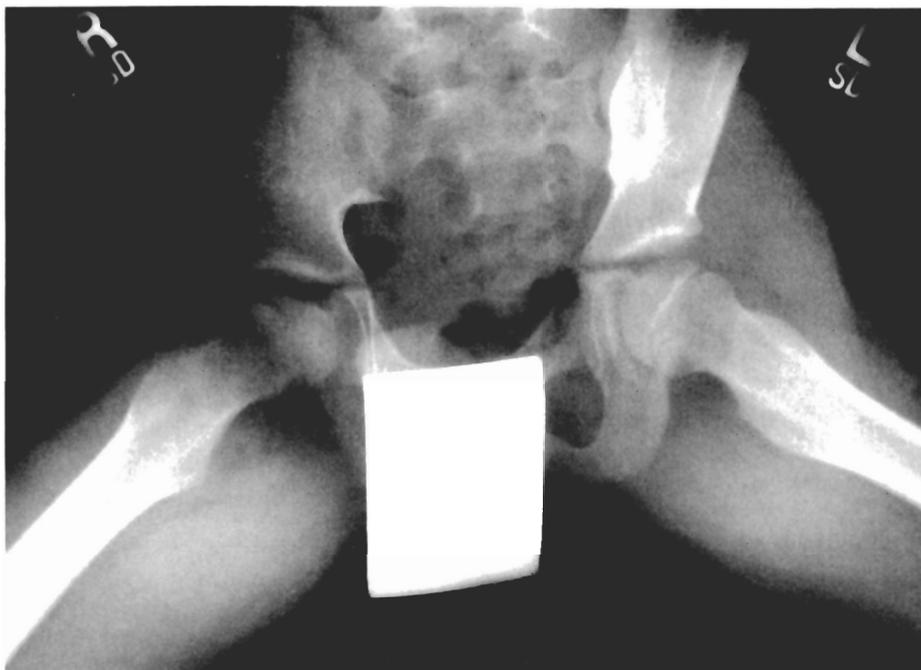


FIGURE. An X-ray of the pelvis demonstrating irregularity of the right hip, which is indicative of Perthes disease. Note widened epiphyseal plate and flattened femoral head.

of the involved hip compared with the contralateral hip.

The cause of Perthes disease is not known. Trauma may be a predisposing factor in 25% of the cases; in other cases, there may be a genetic predisposition. There is also a history of recurrent synovitis, and most cases show retarded bone growth. The pathology of the disorder is categorized into five stages (1). *Pre-necrosis* is the initial stage, in which vascular shutdown occurs. This vascular compromise may be related to trauma, arterial blood supply deficiency, or positional arterial compression. Other factors that may contribute to vascular insult are hypercoagulability and resultant thrombosis, microemboli, increased intra-articular pressure, or venous occlusion. The second stage is characterized by *necrosis* involving the femoral epiphysis and, at times, the metaphysis. A *revascularization* stage follows the necrosis stage. During this stage, dead bone is resorbed and replaced by granulation tissue. Deformity is most likely to occur dur-

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ing this stage, as the softened femoral head may slide anteriorly and laterally out of the acetabulum. In some cases, secondary flattening of the acetabulum may also occur. The fourth stage involves *reossification* from the periphery into the center of the femoral head, with completion of this stage taking up to 3 years. *Remodeling*, the final stage, occurs with little impact on the shape of the involved femoral head.

TREATMENT

The governing principle in the treatment of Perthes disease is con-

taining the femoral head within the acetabulum. By achieving and maintaining containment, the femoral head can reform appropriately (1). In the young patient, containment is often satisfactorily achieved through bracing, in which the hip is maintained in abduction and internal rotation. However, if femoral head involvement is severe, this conservative treatment is not optimum and surgery is indicated. A classification system developed by Lloyd-Roberts, Catterall, and Salamon is valuable in staging the disease and determining if surgical intervention is required (1). This classification system is based upon the degree of capital femoral epiphysis involvement. Group I involves less than half of the femoral head. Groups II and III have greater than half-head involvement and sequestrum formation. Group IV patients demonstrate involvement of the entire epiphysis. Group II, III, and IV patients may show X-ray changes that correlate with poor results. These X-ray changes are described as signs of a "head at risk." Head at risk signs consist of lateral subluxation of the femoral head from the acetabulum, speckled calcification lateral to the capital epiphysis, diffuse metaphyseal cysts, a horizontal growth plate, and a V-shaped radiolucent defect in the lateral epiphysis and adjacent metaphysis (Gage's sign).

Surgical intervention is in the form of an innominate osteotomy or a varus derotational osteotomy. Surgery is usually recommended for older children in Groups II, III, or IV with head at risk signs. The patient in this report had greater than half femoral head involvement, demonstrated lateral subluxation and leg length inequality, and subsequently underwent an innominate osteotomy.

CLINICAL COURSE

Six months after the initial physical therapy visit and subsequent initial evaluation by the orthopaedist,

the patient was scheduled for an innominate osteotomy. Two weeks prior to the date of surgery, the patient was hospitalized in order to achieve an increase in preoperative range of motion. The patient was placed in Russel's traction and was kept nonweight bearing.

Briefly, the innominate osteotomy involved dividing the iliopsoas tendon for surgical exposure while maintaining muscle belly continuity. An osteotomy was performed from the sciatic notch to the anterior inferior iliac spine with rotation of the inferior bony fragment anteriorly. The posterior spike from the inferior fragment was allowed to press on the wing of the ilium in order to reduce pressure on the femoral head. A bone graft was then harvested from the anterior iliac crest with a triangular wedge held by two pins in the defect of the anterior ilium.

Three months after the surgery, the patient demonstrated symmetrical passive hip rotation but had only 0–25° of abduction compared with 0–45° on the opposite side. At this time, the two pins were re-

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moved, and the patient underwent percutaneous adductor tenotomy. Postoperative rehabilitation at another facility consisted of range of motion and strengthening efforts of the lower extremity as well as progressive weight-bearing activities. The patient passed uneventfully through the rehabilitation program. Two years after surgery, the hip X-rays are good, and range of motion is full and symmetrical with the opposite hip. The patient complains of occasional pain in the hip that does not affect normal activities of daily living.

CONCLUSION

Knee problems are commonly seen in sports-related injury, especially in today's active youth (3). Although many overuse injuries to the knee are not of significant consequence, all deserve a thorough evaluation. Because the orthopaedic or sports physical therapist is often the first health care professional consulted in these cases, the physical therapist must be able to discern true knee pathology from other potential sources of pain. JOSP1

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