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CHAPTER 88

TENDINOPATHIES ABOUT THE KNEE

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POPLITEAL TENDINITIS

Be suspicious of popliteal tendinitis in long-distance runners and walkers who present with atypical posterolateral knee pain (23). Often these individuals are involved in activities such as cross-country running or backpacking where extensive downhill walking or running occurs. Pain will usually present insidiously along the lateral femoral condyle at the insertion of the popliteal tendon. This lateral-sided knee pain can be reproduced with weight bearing and 15° to 30° of knee flexion.

Physical examination will reveal point tenderness just anterior and posterior to the lateral collateral ligament. Palpation of the knee while in a "figure of four" position can help locate the area of maximal tenderness. Close examination will locate the area of tenderness just proximal to the lateral joint line. Often the symptoms can be reproduced by externally rotating the tibia, which places tension on the popliteus tendon.

Other possible etiologies, which can be ruled out by careful history and examination, should include a lateral meniscus tear, biceps femoris tendinitis, and iliotibial band friction syndrome. In those cases where the etiology remains in question, magnetic resonance imaging (MRI) or knee arthroscopy can be helpful in identifying any intraarticular pathology or tendon rupture (19,20,46).

Treatment should start with restricting participation in the inciting activity. Altering training habits such as running on the other side of the road or uphill may help alleviate the symptoms. Oral nonsteroidal antiinflammatory medicines are often helpful (23). In recalcitrant cases, the use of a local steroid injection around the tendon may be required. Other modalities such as ultrasound and deep transverse tissue friction massage may prove beneficial. To maintain aerobic

conditioning, a program of cycling or deep-water aerobics should be initiated. After resolution of the symptoms, running can be gradually resumed.

PATELLAR TENDINITIS

Patellar tendinitis is also known as jumper's knee, and for good reason. The extreme demands placed on the patellar tendon by the quadriceps muscle during explosive jumping, and especially eccentric loading, result in microtears and focal degeneration of the tendon at its bony insertion

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along the inferior pole of the patella. In younger individuals this is known as Sinding-Larsen-Johansson disease and is usually self-limiting. The poor blood supply within the tendon results in a slow rate of healing (5). Therefore, the clinical history of patellar tendinitis is often a long and protracted course, and one that may become a persistent and recurrent problem in the adult population.

Continuing to pursue activities that aggravate the injury will only worsen the degenerative changes within the tendon's origin. Histologic findings include pseudocyst formation at the interface of bone and mineralized fibrocartilage along the inferior pole of the patella (9). The fibrocartilage exhibits thickening with myxomatous and hyalin metaplasia. Areas of microtears within the tendon display mucoid degeneration and fibrinoid necrosis (39). These findings are consistent with insertional tendinopathy.

Symptoms usually arrive gradually with no history of a single inciting event. Typically, there is pain along the inferior pole of the patella or within the patella tendon itself. Patients may relate a history of participation in sports, such as basketball or volleyball, that involve jumping and running. Rarely is there a history of trauma. Palpation along the inferior pole will elicit tenderness. In some instances there may be palpable enlargement and thickening of the patellar tendon. In longstanding cases there may be crepitus with range of motion of the knee.

During the examination, take note of any musculotendinous imbalance. Heel cord, hamstring, and quadriceps tightness have been implicated as sources for patellar tendinitis. Also, vastus medialis oblique dysplasia and weakness of ankle dorsiflexors are thought to be possible causes of patellar tendinitis (2).

Radiographs are often unrevealing. Both AP and lateral views may show bony changes along the inferior pole of the patella such as sclerosis and cyst formation. A lateral view may reveal mild patella alta. Patella alta is thought to cause enhanced transmission of the force developed by the quadriceps to the patellar tendon. A bone scan

will show increase uptake along the inferior pole. Magnetic resonance imaging is the most revealing study. It will localize the degenerative changes occurring both in the tendon and at the bone-tendon interface (14).

Treatment of patellar tendinitis involves activity modification with a controlled exercise program. It is important to remember that tendons are metabolically active and respond to stress with increased fiber size, number, and tensile strength (7). Initially, flexibility training and avoidance of activities that caused the symptoms are begun. Once the symptoms have subsided, a training program concentrating on eccentric exercises is started.

Treatment modalities such as ice, phonophoresis, and ionophoresis may prove beneficial as second-stage treatments in refractory cases. Ultrasound, deep tissue massage, and manual patellar mobilization may help.

Infrapatellar straps placed across the tendon can improve symptoms by altering the direction of mechanical force across the bone-tendon interface at the inferior pole of the patella. McConnell taping works in a similar manner but seems to have more consistent results than use of an infrapatellar strap (27).

The use of steroid injections for treatment needs to be undertaken with extreme caution. The patellar tendon is one of the highest load-bearing tendons, and there are numerous cases of patellar tendon rupture after steroid injection. If steroid injections are performed, then forced rest is advocated.

In chronic cases that are unresponsive to nonoperative management, an open procedure is warranted. Be cautious about surgical intervention, as the results are unpredictable (9,39). The MRI is useful in identifying the area of degenerative changes within the tendon. This area of focal degeneration needs to be debrided. After removal of the necrotic tissue, the tendon needs to be fixed to the patella through drill holes with use of large, #2 or #5, nonabsorbable suture. Multiple longitudinal incisions, in the direction of the fibers, at the area of degenerative change may stimulate a healing response and revascularity.

Return to activity is based on elimination of pain. After strength and flexibility have been addressed, a gradual return to sports can be started. Plyometrics can be helpful postoperatively. Plyometrics activity should be instituted cautiously and with supervision, however, as it may cause a relapse of symptoms.

QUADRICEPS TENDINITIS

Pain along the superior pole of the patella, at the insertion of the

quadriceps tendon, is quadriceps tendinitis. You would expect quadriceps tendinitis to be analogous to patellar tendinitis; however, it is seen much less frequently.

Pain often begins insidiously over the proximal pole of the patella. There may be a history of changes in training habits before the onset of symptoms. Palpation will reveal localized tenderness over the proximal pole. Pain can be reproduced with extension of the knee against resistance or with eccentric loading of the quadriceps. During the examination, other associated findings such as patellar malalignment or hamstring tightness may be present.

Radiographs usually reveal little (41), but calcifications within the tendon may be identified. The differential diagnosis should include a suprapatellar plica. A bone scan or MRI may be helpful in ruling out other sources of pain. The MRI is very helpful in localizing the affected area if operative intervention is warranted.

Treatment is similar to that for patellar tendinitis. This includes activity modification or active rest. Physical therapy exercises directed toward patellar tendinitis are helpful. Modalities such as ice, massage, ultrasound, iontophoresis,

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and phonophoresis can be instituted as second-stage treatments. The use of nonsteroidal antiinflammatories may prove beneficial. A corticosteroid injection into the quadriceps tendon is less risky than with patellar tendinitis, but it should be used with extreme caution.

Surgical treatment is rarely needed. When conservative therapy fails, the affected area needs to be localized with MRI. The area of degenerative tissue is excised, and any heterotopic calcifications are removed (9). Reattachment of the quadriceps tendon to the superior pole of the patella is performed with use of drill holes and large #2 or #5 nonabsorbable sutures of suture anchors.

The criteria for return to sports are similar to those for patellar tendinitis. Return to activity is based on the elimination of pain. Once range of motion, strength, and flexibility have been addressed, then a slow return to sports can be pursued.

ILIOTIBIAL BAND FRICTION SYNDROME

Iliotibial band friction syndrome is a common tendinous overuse syndrome of the knee. Activities that involve repetitive knee flexion and extension will incite and aggravate the symptoms located over the lateral side of the knee. This is commonly seen in long-distance runners (29) and cyclists (24), where excessive friction between the iliotibial band and the lateral femoral condyle is the cause of the pain.

Point tenderness is located over the lateral femoral condyle.

Inflammation and hyperplasia develop within the synovium below the iliotibial band, which is a lateral extension of the joint capsule (31). There may be a catching or grating noted as the iliotibial band passes over the lateral femoral epicondyle. Maximum discomfort is elicited by flexing the knee to about 30° (32). As this angle of knee flexion is encountered, the iliotibial band is passing posteriorly directly over the prominent lateral femoral condyle. During the physical examination, check for excessive tightness of the iliotibial band. The Ober's test has been described as a way to determine if any iliotibial band tightness exists. Athletes should be evaluated for other underlying factors that may predispose them to iliotibial band friction syndrome such as genu varum, tibial torsion, or excessive foot pronation.

Other entities that must be included in the differential diagnosis of lateral side knee pain include lateral meniscal pathology, biceps and popliteus tendinitis, and patellofemoral syndrome. The MRI can help confirm the diagnosis of iliotibial band friction syndrome in patients with an appropriate clinical history (30).

Cessation of the inciting activity is the first course of treatment. This, along with time and a stretching program, is often successful in eliminating the symptoms. Alteration of training activities and habits can be helpful. Cyclists may find relief by changing the height of their saddle or their foot position on the pedals. Runners can try altering stride length or changing the direction of running on the track.

Symptomatic treatment should include oral antiinflammatory medications (43). Use of other modalities such as ultrasound, phonophoresis, ionophoresis, and deep tissue friction massage may be beneficial. If the syndrome is recalcitrant to these measures, then complete activity restriction is required. Rarely do athletes not respond to nonoperative treatment.

If conservative measures are ineffective, then surgical intervention is indicated. The surgical technique involves removing inflamed tissue and doing an elliptical excision of the portion of the iliotibial band that contacts the lateral femoral epicondyle when the knee is flexed to 30°. Martens recommends removing a triangular section of the iliotibial band that contacts the lateral epicondyle with the knee in 60° of flexion (24). A gradual return to activities can be started at 3 weeks postoperatively.

PES ANSERINUS BURSITIS

The tendinous aponeurosis of the sartorius, gracilis, and semitendinosus muscles makes up the pes anserinus. The per anserinus bursa is located directly beneath this aponeurosis and lies on top of the underlying superficial medial collateral ligament.

Repetitive flexion and extension of the knee can cause irritation of the

bursa or the overlying pes tendons. Point tenderness along the anteromedial surface of the tibia, two fingerbreadths below the joint line, is present on examination. In longstanding cases there may be a palpable boggy fullness to the inflamed bursa. It can be difficult to distinguish bursitis from tendinitis clinically, but distinguishing them is unnecessary, as the two are treated in a similar fashion. It is not uncommon to find medial compartment osteoarthritis associated with pes anserinus bursitis (3). Other entities that must be considered in the differential diagnosis include medial meniscus tear or cyst, juxtaarticular bone cysts (26), and medial collateral ligament injury. The MRI can prove helpful in determining the etiology of pain along the medial side of the tibia (10).

Initial treatment involves active rest and avoidance of irritating activities. At the same time, a stretching and conditioning program is initiated, beginning with isometric exercises and electrical muscle stimulation and incorporating resistive exercises as symptoms allow. Ice and nonsteroidal antiinflammatory medication have proven beneficial.

Further treatment modalities can include ultrasound (3), phonophoresis, iontophoresis, and deep tissue transverse

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friction massage. Corticosteroid injections have also been successful in treating the symptoms (21,33). In refractory cases of chronic pes anserinus bursitis, a bursectomy may be necessary.

SEMIMEMBRANOSUS TENDINITIS

Semimembranosus tendinitis occurs near the tendon's insertion along the posteromedial corner of the knee. This insertion is made up of a five-footed tendinous expansion that embraces the posteromedial side of the tibia and knee (13,18). Strenuous, repetitive activities can elicit pain along the posteromedial knee joint.

Palpation of the knee joint often reveals point tenderness inferior to the posteromedial joint line and posterior to the superficial collateral ligament. The examination should include a comprehensive evaluation of the knee to rule out any intraarticular pathology that can mimic or be the source of the resulting tendinitis.

Begin treatment with cessation of any inciting activities. An exercise program with emphasis on hamstring and quadriceps static stretching should be started. As tolerated, an eccentric exercise program can be introduced.

Oral antiinflammatory medications have proven beneficial. Also, modalities such as ultrasound, phonophoresis, iontophoresis, and deep tissue massage can be helpful. A local injection with cortisone and an anesthetic can be beneficial both in differentiating the etiology and in

treatment (37).

In chronic cases that fail conservative therapy, look for intraarticular etiology. An MRI can be valuable for evaluating any meniscal or articular cartilage pathology (13,18,40). In patients who remain symptomatic with no intraarticular pathology, surgery may be indicated. This involves a posteromedial approach to the tendinous insertion of the semimembranosus. Removing overlying inflamed soft tissue can initiate a "healing response." Care should be taken to avoid violating the tendon itself (47).

PATELLAR TENDON RUPTURE

Unlike patella fractures, ruptures of the patellar tendon are not uncommon and are frequently encountered in athletes. Rupture of the tendon is most often seen in middle-aged individuals who may deny any history of preexisting symptoms. There are case reports of patellar tendon rupture after procedures that violate the integrity of the patellar tendon, such as total knee arthroplasty, or after harvesting a patellar tendon graft for ACL reconstruction (25,35). Often individuals will describe the sensation of a sudden "pop" when force was applied to the extensor mechanism. With complete rupture of the patellar tendon, there is inability to support body weight on the affected side.

The amount of stress leading to rupture can vary greatly. Zernicke et al. describe an incident in which a force of approximately 17.5 times the body weight was produced by a power lifter before rupture of the patellar tendon (50). In other instances, only a trivial amount of force was applied before rupture. In these cases there is often an underlying autoimmune disorder that affects the integrity of the tendon (34,36,38,49).

The typical history of rupture involves application of a force across the extensor mechanism followed by a "pop" sensation (4,12,17,42). There may or may not be a history consistent with chronic inflammatory symptoms. Subsequently, injured individuals are unable to support themselves on the injured limb. They may even report severe proximal displacement of the patella.

On physical examination there will be a diffuse swelling throughout the knee because of the capsular disruption. Tenderness will be located at or below the inferior pole of the patella. The location of the patellas will be asymmetric. Patella alta will be present on the affected side. Patients may still have the ability to extend the knee against gravity if a portion of the extensor retinaculum remains intact. Typically there is a palpable defect in the patellar tendon at or just below the inferior pole of the patella.

Radiographs will demonstrate patella alta, particularly on the lateral view. If there is a question about tendon rupture, flexion of the knee

will make any displacement more pronounced on the lateral view.

With patellar tendon rupture, surgical repair is required and should be performed acutely or within a few days for optimal results. There is no place for nonoperative treatment. Delaying the surgical repair will result in contracture of the extensor mechanism, which can seriously complicate the repair (22,45).

OPERATIVE TECHNIQUES

- Make a longitudinal incision near the midline. A transverse incision can also be made at the level of the inferior pole of the patella. Because future incisions can be compromised by a transverse incision, most surgeons prefer a longitudinal incision.
- After incising the skin down to the extensor mechanism, elevate flaps medially and laterally to allow exposure to the tendon and the torn extensor retinaculum.
- Evacuate the hematoma and identify and mobilize the torn ends of the tendon. By extending the knee, the two ends of the tendon can be reapproximated. If this is a bony avulsion injury, then the avulsion site on the patella should be rasped to expose bleeding bone.
- Then make three drill holes in the patella that begin at

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the site of the avulsion and exit the proximal anterior surface of the patella. Make these drill holes large enough to pass a #2 or #5 nonabsorbable suture. A wire can be used for the repair but must be removed at a later date; it could fragment. See Chapter 22 for an illustration showing placement of the drill holes.

- Place two large nonabsorbable sutures (#2 or #5) through the patellar tendon in a Bunnell-type weave technique. Pass these sutures through the drill holes and tie them over the proximal anterior surface of the patella. Additional interrupted sutures can be placed to reinforce the repair of the tendon. Multiple interrupted figure-of-eight stitches with a #2 nonabsorbable suture are then used to close the extensor retinaculum medially and laterally. Finally, evaluate the adequacy of repair by putting the knee through a gentle range of motion.

Postoperatively immobilize the knee in extension for 1 to 2 weeks before limited range of motion is allowed. Weight bearing is allowed early on. The amount of motion will depend on the strength of the repair. The extension brace can be discontinued after 6 to 8 weeks. During the rehabilitative course, a patient can actively control knee

motion with the hamstrings while lying in the prone position.

CHRONIC PATELLAR TENDON RUPTURES

With untreated patellar tendon ruptures, the extensor mechanism can contract so that it is difficult to position the patella distally for repair. The clinical and radiographic exam can help determine if the extensor mechanism can be positioned distally to allow a primary repair. When there is inadequate length, skeletal traction can be placed on the extensor mechanism to regain length as described by Justis (15), Kelikian et al. (16), and others (45). A transverse pin is placed in the patella to apply skeletal traction. This traction can be maintained up to 4 weeks, until the inferior pole of the patella is positioned about 2.5 cm superior to the tibial plateau with the knee in extension. Once the patella has been brought back to its appropriate position, the patellar tendon is primarily repaired.

Unfortunately, there is often a large defect in the tendon that needs to be reconstructed. Justis (15) recommends use of the fascia lata, as do Siwek and Rao (45). Weaving several strips of fascia lata through the two ends of the tendon can bridge the defect. Kelikian suggests use of the semitendinosus tendon (16).

OPERATIVE TECHNIQUES

- Harvest the semitendinosus tendon in a similar fashion to an anterior cruciate reconstruction (Chapter 89). However, maintain the insertion of the tendon on the tibia.
- Then pass the tendon through a transverse drill hole in the tibia at the level of the tibial tubercle and then through a transverse hole in the distal third of the patella.
- Then suture the free end of the tendon to itself after an appropriate tendon length has been obtained.

Postoperatively immobilize the knee in extension for 6 to 8 weeks. If the fixation is secure or augmented with wire or a large nonabsorbable suture, then motion and weight bearing can be instituted earlier.

Recently, Falconiero and others have described the use of an Achilles tendon-bone allograft to bridge the tendinous defect (8,28). Fixation of the Achilles tendon-bone allograft is augmented with a suprapatellar wire that is removed 8 weeks later. This treatment has allowed for much earlier mobilization and weight bearing. Use of a dacron graft has also been described as a method to reinforce and bridge the tendinous defect associated with a chronic rupture (22).

QUADRICEPS TENDON RUPTURE

Rupture of the quadriceps tendon is most often seen in elderly patients and in patients with chronic disease (1,44,45,48). In a healthy population, quadriceps rupture is often seen in middle-aged individuals. This population is somewhat older than that seen for patellar tendon ruptures. David et al. described bilateral quadriceps tendon rupture (6). They implied that anabolic steroid use leads to tendon failure.

The clinical examination is similar to that of a patellar tendon rupture. Patients will be unable to extend the knee actively. Often there is a palpable defect 1 to 2 cm proximal to the superior pole of the patella. The patella will not retract distally; however, the patellar tendon will feel lax on examination.

As with patellar tendon ruptures, early repair of the quadriceps tendon is imperative if good functional restoration is to be obtained (45). When the repair is delayed, the extensor mechanism will retract proximally, which complicates the repair. There is no place for nonoperative treatment of a complete quadriceps tendon rupture except in nonambulatory patients.

To avoid contractures of the quadriceps tendon, perform the repair within a few days (11). Often the tendon ruptures within its substance 1 to 2 cm from the proximal pole of the patella. At the site of disruption degenerative changes are usually noted (44). The operative technique to repair an acute quadriceps tendon rupture is similar to that used to repair a patellar tendon rupture (11).

OPERATIVE TECHNIQUES

- Pass large, nonabsorbable #2 or #5 sutures through the quadriceps tendon in a Bunnell-type weave. Then pass

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these sutures through drill holes in the patella and tie them distally over the inferior anterior surface of the patella. Before reapproximation of the tendon, abrade the superior pole of the patella to obtain bleeding bone at the tendon's insertion site.

- Next, repair the extensor retinaculum with a #2 nonabsorbable suture. The knee is then flexed to evaluate the integrity of the repair. After repair, the knee can usually be flexed 45° to 90°.
- If the repair is tenuous, it must then be augmented by rotating a flap fashioned from the proximal quadriceps tendon, as described by Scuderi (44). This partial thickness quadriceps flap is rotated with the apex distally to cover the site of the repair and then sutured in place with large nonabsorbable sutures. The base of

this flap is located about 5 cm proximal to the repair site and is horizontal to it. The apex of the flap is about 8 cm proximal to the flap's base.

Postoperatively, immobilize the knee into nearly full extension for 4 to 6 weeks. If the repair is secure, early motion can be started. Weight bearing is allowed, but only when the knee is in extension. Active quadriceps exercises should be avoided, but limited motion with use of the hamstrings while in the prone position is allowed. Until functional strength has returned, use an extension orthosis with ambulation.

A chronic rupture is much more difficult to repair. An attempt at lengthening the quadriceps is difficult or impossible because of changes in the quadriceps muscles. If the two ends can be reapproximated, then perform a repair with heavy nonabsorbable sutures as in an acute repair. If the tendon cannot be approximated, the Codivilla method can be employed (44,45). This entails a **V-Y** lengthening of the proximal quadriceps tendon. This repair can be reinforced with a fascia lata autograft.

Postoperative treatment is similar to that for acute repairs and depends on the integrity of the repair. It is important to warn patients that rehabilitation and outcome will be limited when repairs are delayed.

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