

EVIDENCE SUMMARY

Patellar tendinopathy

Overview

EPIDEMIOLOGY

- Patellar or quadriceps tendinopathy occurs in active individuals who engage in activities involving forceful, eccentric contraction of the knee extensor mechanism, particularly jumping sports [1].
- Harder playing surfaces and increased frequency of practices have been associated with increased rates of tendinopathy [1].
- Patellar tendinopathy occurs most frequently in adolescents and young adults [1].
- Quadriceps tendinopathy occurs in middle-aged and older adults [1].

PATHOANATOMY

- Patellar tendinopathy tends to occur at the deep fibers of the patellar attachment of the tendon [1].
- The area of patellar tendinopathy has a tenuous blood supply [1].
- Affected tissue in patellar tendinopathy may demonstrate fibrinoid necrosis, angiofibroblastic change, or mucoid degeneration and disorganized collagen structure [1].
- Metaplasia of adjacent fibrocartilage may be present in patellar tendinopathy [1].
- The medial portion of the patellar tendon often demonstrates thickening compared with the rest of the tendon [1].
- The pathoanatomy of quadriceps tendinopathy is similar to that of patellar tendinopathy [1].

EVALUATION

- Patients with patellar or quadriceps tendinopathy describe an insidious onset of pain and swelling of the affected tendon [1].
- Symptoms initially develop after activity, gradually start to bother the individual both during and after activity, and eventually limit athletic performance during the activity [1].
- Patients may report buckling of the knee, which represents reflex quadriceps inhibition due to pain [1].

- Physical examination reveals tenderness and soft-tissue swelling, usually in the area where the tendon attaches to the patellar bone [1].
- Patients often have discomfort with resisted extension of the knee [1].
- Plain radiographs of the knee may demonstrate degenerative spurring where the affected tendon attaches to bone [1].
- MRI usually shows thickening in the affected portion of the tendon and may demonstrate intrasubstance signal abnormalities [1].
- Thickening is much more diagnostic than signal changes when identifying abnormal tendon on MRI [1].

CLASSIFICATION

- The three stages of tendinopathy according to Blazina are: Stage 1 (pain after activity), Stage 2 (pain during and after activity), and Stage 3 (pain that limits function during an activity) [1].

TREATMENT

- Nonsurgical intervention is the mainstay of treatment [1].
- Initial treatment consists of activity modification [1].
- Progressive flexibility and eccentric strengthening exercises follow initial treatment [1].
- Taping to aid proprioception and patellar tracking or using an infrapatellar strap can be helpful [1].
- NSAIDs can be beneficial [1].
- Corticosteroid injection is contraindicated because of the increased risk of tendon rupture [1].
- No recommendation can be made currently regarding prolotherapy injections using a local irritant to elicit an inflammatory healing response [1].
- No recommendation can be made currently regarding platelet-rich plasma injection [1].
- Surgery is reserved for patients who continue to have pain and swelling of the tendon after a nonsurgical treatment regimen has been attempted [1].
- Surgical procedures are performed according to the surgeon's preference [1].
- Surgical options include various methods of débriding diseased tissue and stimulating a vigorous healing response [1].
- A surgical method involves simple longitudinal excision of the diseased portion of tendon, followed by abrasion of the bone to provide a bleeding surface for tendon healing, and finishing with the application of side-to-side sutures or suture anchors as needed [1].
- Variations of the surgical procedure include drilling of the bone to stimulate a healing response or multiple tendon perforations ("pie crusting") to stimulate healing of the tendon tissue [1].
- All surgical procedures can be performed using a standard anterior midline incision to expose the diseased tendon and its attachment to the patella [1].

Anatomy & Pathophysiology

EPIDEMIOLOGY & RISK FACTORS

- Harder playing surfaces and increased frequency of practices are associated with increased rates of tendinopathy [1].
- Patellar tendinopathy occurs most frequently in adolescents and young adults, whereas quadriceps tendinopathy occurs in middle-aged and older adults [1].
- Patellar tendinitis affects up to 20% of jumping athletes [4].
- Males are more commonly affected by patellar tendinitis than females [4].
- Risk factors for patellar tendinitis include poor quadriceps and hamstring flexibility [4].
- Patellar tendinopathy is most common in athletes who participate in jumping sports such as basketball and volleyball [13].

PATHOANATOMY

- The area of patellar attachment has a tenuous blood supply [1].
- Affected tissue in patellar tendinopathy may demonstrate fibrinoid necrosis, angiofibroblastic change, mucoid degeneration, and disorganized collagen structure [1].
- Histologic evaluation of patellar tendinitis tissue reveals degeneration rather than inflammation [4].
- Patellar tendinopathy is characterized by disorganized collagen structure visualized on MRI by thickening of the tendon and signal intensity changes [6].
- The patellar tendon receives its blood supply from the infrapatellar fat pad and from the retinaculum through the medial and lateral inferior geniculate arteries [14].
- The patellar tendon routinely sees forces of 3 times body weight when ascending stairs [14].
- It takes over 17 times body weight to rupture a normal patellar tendon [14].
- Under normal conditions, tensile overload of the extensor mechanism usually leads to fracture of the patella, which is considered the weakest link in the extensor mechanism [36].
- Between 50% and 75% of tendon fibers had to be transected to result in a rupture under forces greater than those seen under physiologic conditions in a rabbit model [36].
- Patellar tendon ruptures secondary to indirect trauma have been considered the end stage of long-standing chronic tendon degeneration secondary to repetitive microtrauma [36].
- Biopsy specimens of spontaneously ruptured tendons reveal pathologic findings that are degenerative in nature, including hypoxic tendinopathy, mucoid degeneration, tendolipomatosis, and calcifying tendinopathy [36].
- Ruptures may occur in the absence of pathologic tendon degeneration [36].
- The frequent prevalence of prodromal symptoms associated with tendon failure supports the finding of tendon degeneration prior to rupture [36].

- In a series of 13 athletes with chronic jumper's knee that resulted in tendon rupture, younger patients had more severe symptoms than older patients [36].
- More advanced degeneration is required to weaken younger healthier tendons [36].
- Prodromal symptoms were present in 46% of professional football players prior to patellar tendon rupture [36].
- Underlying chronic degeneration is often present in patellar tendon ruptures and is characterized by angiofibroblastic tendinosis, mucoid degeneration, and pseudocyst formation at the attachment of tendon to bone [2].
- The quadriceps tendon has been described as having two to four distinct layers [2].

CLINICAL PRESENTATION

- Patients often present with an insidious onset of anterior knee pain at the inferior border of the patella [4].
- In chronic cases, pain may be present at rest with prolonged sitting [4].
- Palpation is painful at the insertion of the patella tendon to the inferior pole of the patella [4].
- A Bassett sign is tenderness to palpation at the distal pole of patella in full extension, but no tenderness to palpation at the distal pole of patella in full flexion [4].
- Patellar tendinosis is associated with pain and tenderness near the inferior border of the patella, which is worse in extension than in flexion [13].
- Patients with quadriceps tendinosis may note painful clicking and localized pain at the superior border of the patella [13].

IMAGING

- Plain radiographs are often normal but may show inferior traction spurs or enthesophyte in chronic cases [4].
- Ultrasonography will show thickening of the tendon and hypoechoic areas [4].
- MRI may be useful to identify partial tears and chronic tears and may be used for surgical planning [4].
- MRI can show increased signal intensity on both T1 and T2 images and loss of the posterior border of the fat pad in chronic cases [4].

CLASSIFICATION

- Phase I of the Blazina classification is pain after activity only [4].
- Phase II of the Blazina classification is pain during and after activity [4].
- Phase III of the Blazina classification is persistent pain with and without activity along with deterioration of performance [4].

Classification

- The Blazina classification describes three stages of patellar or quadriceps tendinopathy [1].
- Stage 1 of the Blazina classification is characterized by pain after activity [1].
- Stage 2 of the Blazina classification is characterized by pain during and after activity [1].
- Stage 3 of the Blazina classification is characterized by pain that limits function during an activity [1].
- Phase I of the Blazina classification is defined as pain after activity only [4].
- Phase II of the Blazina classification is defined as pain during and after activity [4].
- Phase III of the Blazina classification is defined as persistent pain with and without activity along with deterioration of performance [4].

Clinical Presentation

EPIDEMIOLOGY AND RISK FACTORS

- Poor quadriceps and hamstring flexibility are risk factors for patellar tendinopathy [4].

PATHOANATOMY

- The area of patellar tendon attachment has a tenuous blood supply [1].

HISTORY AND SYMPTOMS

- In chronic cases of patellar tendinitis, pain may be present at rest with prolonged sitting [4].

PHYSICAL EXAMINATION

- A Bassett sign is defined as tenderness to palpation at the distal pole of the patella in full extension, but no tenderness to palpation at the distal pole of the patella in full flexion [4].

IMAGING

- Plain radiographs are often normal but may show inferior traction spurs or enthesophyte in chronic cases of patellar tendinitis [4].
- Ultrasonography shows thickening of the tendon and hypoechoic areas [4].

CLASSIFICATION

- The Blazina classification Stage 1 is characterized by pain after activity [1].
- The Blazina classification Stage 2 is characterized by pain during and after activity [1].
- The Blazina classification Stage 3 is characterized by pain that limits function during an activity [1].

Investigations

RADIOGRAPHY

- Weight-bearing AP and lateral radiographs are the standard for initial evaluation of knee pathology [11].
- A weight-bearing knee flexed at 45-degree angle, imaged posterior to anterior, is included in standard radiographic evaluation [11].
- The sunrise view (Merchant view) is included in standard radiographic evaluation [11].
- Extension and flexion lateral views are included in standard radiographic evaluation [11].
- A standing full-length AP radiograph from hip joint to ankle joint is used to evaluate limb alignment and knee deformity [11].
- Patella alta on radiographs is a diagnostic feature of patellar tendon rupture [7].
- In a sleeve fracture of the patella, the small osseous portion of the displaced fragment is visible on lateral radiograph, but the cartilaginous portion is not seen [7].

MAGNETIC RESONANCE IMAGING (MRI)

- MRI is not indicated if the joint space is significantly narrowed on radiograph [11].
- MRI is used when osteonecrosis is suspected [11].
- MRI has been found to underestimate the size of articular cartilage defects in approximately 75% of cases [33].
- The reliability of clinical findings and magnetic resonance imaging for the diagnosis of chondromalacia patellae has been evaluated [12].
- Quantitative MRI analysis has been used to assess the association of patellofemoral joint morphology with chondromalacia patella [12].
- T2 mapping has been investigated for its role in MRI for patellofemoral chondromalacia [12].
- MRI findings have been documented in cases of symptomatic bilateral dorsal patellar defects presenting with cartilage involvement and bone marrow edema [12].
- The accuracy and reproducibility of identifying cruciate and collateral ligament insertions using MRI have been evaluated [34].
- Current concepts on MRI evaluation of postoperative knee ligaments have been reviewed [34].
- MRI features of the anterolateral ligament of the knee have been described [8].
- The MRI appearance of the anterolateral ligament and its association with the Segond fracture have been described [8].
- Visibility of anterolateral ligament tears in anterior cruciate ligament-deficient knees with standard 1.5-Tesla magnetic resonance imaging has been assessed [8].

COMPUTED TOMOGRAPHY (CT)

- Three-dimensional CT with remodeling is used for preoperative planning for reconstruction associated with dysplasia, post-trauma planning, and complex total knee arthroplasty planning [11].
- CT and MRI measurements of tibial tubercle–trochlear groove distances are not equivalent in patients with patellar instability [5].

ULTRASOUND

- Dynamic sonography has been used for the diagnosis of medial plica syndrome of the knee [30].
- Sonographic examination of knee ligaments has been described [34].

Treatment

NON-OPERATIVE MANAGEMENT

- Nonsurgical intervention is the mainstay of treatment for patellar tendinopathy [1].
- Progressive flexibility and eccentric strengthening exercises follow initial activity modification [1].
- Taping to aid proprioception and patellar tracking can be helpful in nonsurgical management [1].
- Using an infrapatellar strap can be helpful in nonsurgical management [1].
- NSAIDs can be beneficial for patellar tendinopathy [1].
- Corticosteroid injection is contraindicated for patellar tendinopathy because of the increased risk of tendon rupture [1].
- No recommendation can currently be made regarding prolotherapy injections using a local irritant to elicit an inflammatory healing response [1].
- No recommendation can currently be made regarding platelet-rich plasma injection [1].
- Treatment for patellar tendinitis includes ice, rest, and activity modification [4].
- Physical therapy focusing on quadriceps and hamstring stretching is part of the treatment for patellar tendinitis [4].
- Ultrasonography treatment may be helpful for patellar tendinitis [4].
- Taping may be helpful for patellar tendinitis [4].
- Chopat straps may be helpful for patellar tendinitis [4].
- Treatment with platelet-rich plasma showed a significantly better outcome when used correctly [4].
- Treatment with shock waves has shown positive effects for patellar tendinopathy [4].
- Treatment with sclerotherapy has shown positive effects for patellar tendinopathy [4].
- Treatment with corticosteroid injections showed positive short-term effects only [4].
- Treatment with oral NSAIDs showed positive short-term effects only [4].
- There was no evidence to support Kinesio taping for patellar tendinopathy [4].

- There was no evidence to support acupuncture for patellar tendinopathy [4].
- There was no evidence to support fascial therapy for patellar tendinopathy [4].
- There was no evidence to support cryotherapy for patellar tendinopathy [4].
- Cortisone injections are contraindicated due to risk of patellar tendon rupture [4].
- A systematic review and meta-analysis of 2530 patients found that eccentric exercise therapies obtained the best results at short-term [38].
- A systematic review and meta-analysis of 2530 patients found that multiple injections of PRP obtained the best results at long-term follow-up [38].
- One randomized controlled study reported results comparable to surgery for eccentric training in patellar tendinopathy [38].
- Another randomized controlled study reported no effect of a 12-week eccentric training program for patellar tendinopathy [38].
- A randomized controlled trial comparing ultrasound-guided injection of autologous skin-derived tendon-like cells and injection of autologous plasma alone found faster response and greater improvements in pain and function with cell therapy [38].
- Satisfactory results were obtained in 74% of 83 knees treated with extracorporeal shockwave therapy for patellar tendinopathy [38].
- Athletes treated with extracorporeal shockwave therapy for patellar tendinopathy returned to participation in their sport in an average of 6 weeks [38].
- Two studies comparing extracorporeal shockwave therapy with PRP injection found that PRP had significantly better results at 6 and 12 months [38].
- Mesenchymal stem cells may have therapeutic utility in the future for patellar tendinopathy [38].
- Suggested alternatives to open patellar tenotomy include eccentric exercise, sclerosing injections targeting the area of neovessels and nerves on the dorsal side of the patellar tendon, injections of PRP, arthroscopic shaving of the same area, and extracorporeal shockwave therapy [38].
- Treatment for patellar tendinosis includes nonsteroidal anti-inflammatory drugs (NSAIDs) [13].
- Treatment for patellar tendinosis includes physical therapy involving strengthening including eccentric exercise and ultrasonography [13].
- Treatment for patellar tendinosis includes orthoses such as a patella tendon strap [13].

OPERATIVE MANAGEMENT

- Surgical procedures for patellar tendinopathy are performed according to the surgeon's preference [1].
- Simple longitudinal excision of the diseased portion of tendon is a surgical option for patellar tendinopathy [1].
- Abrasion of the bone to provide a bleeding surface for tendon healing is a surgical option for patellar tendinopathy [1].

- Application of side-to-side sutures or suture anchors as needed is a surgical option for patellar tendinopathy [1].
- Drilling of the bone to stimulate a healing response is a variation of the surgical procedure for patellar tendinopathy [1].
- Multiple tendon perforations (“pie crusting”) to stimulate healing of the tendon tissue is a variation of the surgical procedure for patellar tendinopathy [1].
- All surgical procedures for patellar tendinopathy can be performed using a standard anterior midline incision to expose the diseased tendon and its attachment to the patella [1].
- Surgical treatment for patellar tendinitis is usually reserved for cases refractory to conservative management and for partial tears [4].
- Surgical treatment for patellar tendinitis involves excision of the diseased tendon and suture repair [4].
- Surgery involving excision of necrotic tendon fibers is rarely indicated for patellar tendinosis [13].
- Operative treatment is occasionally necessary for quadriceps tendinosis [13].
- The inferior pole of the patella can be curetted or drilled to incite a healing response during tenotomy and repair for chronic patellar tendinosis [38].
- The defect in the tendon is sutured with side-to-side interrupted 2-0 Vicryl sutures during tenotomy and repair for chronic patellar tendinosis [38].
- The peritenon is closed with interrupted absorbable sutures during tenotomy and repair for chronic patellar tendinosis [38].
- A knee immobilizer is applied after tenotomy and repair for chronic patellar tendinosis [38].
- The knee immobilizer is worn for 3 to 4 weeks after tenotomy and repair for chronic patellar tendinosis [38].
- Crutches are used for partial weight bearing after tenotomy and repair for chronic patellar tendinosis [38].
- Stage 1 of rehabilitation after tenotomy and repair for chronic patellar tendinosis should emphasize range of motion and isometric strengthening [38].
- Closed-chain kinetics are started in stage 2 of rehabilitation after tenotomy and repair for chronic patellar tendinosis when swelling and tenderness have resolved [38].
- Stage 3 of rehabilitation after tenotomy and repair for chronic patellar tendinosis should consist of activity-specific exercises, avoiding eccentric overload [38].
- Return to full activities after tenotomy and repair for chronic patellar tendinosis can be allowed when 85% to 90% of strength and full range of motion are achieved [38].
- Postoperative rehabilitation for patellar tendinitis surgery includes immobilization in extension [4].
- Postoperative rehabilitation for patellar tendinitis surgery includes progressive range of motion and strengthening [4].
- Return to activities is achieved by 80% to 90% of athletes after patellar tendinitis surgery [4].
- Activity-related aching may persist for 4 to 6 months after patellar tendinitis surgery [4].

Complications

- Repair of chronic patellar tendon rupture can be complicated by proximal retraction of the patella [2].
- Repair of chronic patellar tendon rupture can be complicated by insufficient tissue for repair [2].
- Proximal retraction in chronic patellar tendon rupture repair can be addressed by surgical dissection and mobilization of the quadriceps tendon [2].
- Tendon augmentation for chronic patellar tendon rupture can be performed with a hamstring autograft passed through tibial and patellar drill holes [2].
- Tendon augmentation for chronic patellar tendon rupture can be performed with a central quadriceps tendon–patellar bone autograft [2].
- Tendon augmentation for chronic patellar tendon rupture can be performed with a contralateral bone–patellar tendon–bone autograft [2].
- Tendon augmentation for chronic patellar tendon rupture can be performed with an allograft [2].
- Augmentation for chronic patellar tendon rupture can be considered using wire, nonabsorbable tape, or heavy suture [2].
- Chronic quadriceps tendon ruptures can be complicated by proximal migration of the tendon stump [2].
- Proximal migration of the tendon stump in chronic quadriceps tendon rupture requires débridement and mobilization of the tendon [2].
- Following débridement and mobilization for chronic quadriceps tendon rupture, the tendon can be augmented with autograft or allograft tissue and secured to bone [2].
- Corticosteroid injection is not recommended for patellar or quadriceps tendinopathy because it increases the risk of tendon rupture [6].

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