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Jumpers Knee

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Introduction

“Jumper's knee,” also called patellar tendinopathy, is a painful condition of the knee caused by small tears in the patellar tendon that mainly occurs in sports requiring strenuous jumping. The tears are typically caused by accumulated stress on the patellar or quadriceps tendon. As the name implies, the condition is common in athletes from jumping sports such as volleyball, track (long and high jump), and basketball. The condition has a male predominance. Contrary to traditional belief, jumper's knee does not involve inflammation of the knee extensor tendons. Studies dating back 40 years describe jumper's knee as a degenerative condition. Jumper's knee is a clinical diagnosis made through detailed history taking and a physical exam. Ultrasound can facilitate the diagnosis, as this imaging study is readily available and affordable. Treatment mainly revolves around conservative measures such as reducing activities that place loading impact on the knee. Once the pain subsides, restoration of function is achieved through physical and exercise therapy. Surgery usually remains the last resort for chronic refractory cases.

Etiology

Jumper's knee is an overuse injury of the knee extensor mechanism due to repetitive mechanical stress from athletic activities requiring movements such as jumping, landing, acceleration, deceleration, and cutting.[1] Micro-tearing of the knee extensor tendons can arise after constant repetition of these movements during a single exercise session or if there is insufficient rest between sessions. The component of the knee extensor mechanism most likely to be affected is the inferior pole of the patella where the patellar tendon inserts. Other less frequently involved regions of the knee are at the insertion of the quadriceps tendon to the superior pole of the patella and where the patellar tendon inserts into the tibial tuberosity.[2] For purposes of simplicity, and considering that the majority of the cases for jumper's knee are due to a problem on the patellar tendon at its insertion in the inferior patella, we will use the term patellar tendinopathy interchangeably. It is appropriate to mention that patellar "tendinitis" is a misnomer as the condition is felt by many clinicians to be more tendinosis than it is tendinitis. In published studies, it is noted that classic inflammatory cells are usually absent.[3]

There are several intrinsic factors of the knee that predispose to this pathology. These include ligamentous laxity, excessive Q-angle of the knee, abnormal patellar height, previous ongoing inflammation of the knee and excessive force generation on the knee. Other factors can also lead to the development of the jumper's knee such as excessive volume and frequency of training, the athlete's performance level, and the hardness of the ground where the sport is practiced.[4]

Epidemiology

Since sports injuries often are under-reported, it is hard to determine the exact frequency of patellar tendinopathy both in the United States and on an international scale. Jumping sports such as volleyball, basketball, and long and high jumps have a high prevalence of the disease.[2] Studies have shown that patellar tendinopathy is substantially higher

in elite versus recreational athletes.[5][6] Patellar tendinopathy can occur in adolescent athletes to those in their third decade and up.[7] Jumper's knee occurs more often in males.[8]

Pathophysiology

Overload on the knee extensor tendons will cause it to weaken progressively, eventually leading to failure. Microscopic failure occurs within the tendon at high loads and eventually leads to alterations at the cellular level, which undermine its mechanical properties. Tendon micro-trauma may cause individual fibril degeneration due to stress across the tendon. As the fibril degeneration becomes ongoing, chronic tendinopathy will ensue.[9]

Examination of the tendon under ultrasound shows three pathologic changes. At first, there will be edema along the damaged tendon fibers. The affected tissue is swollen and thickened, but still homogenous. The second is a "stage with irreversible anatomical lesions," the tendon has a heterogeneous appearance with hypoechoic and hyperechoic images without edema (granuloma). At this point, the tendinous envelope is still more or less well defined. In the final stage of the lesion, the tendinous envelope is irregular and thickened. Its fibers appear heterogeneous, yet the swelling has disappeared.[1]

Histopathology

Historically, the condition was considered to be inflammatory. A study from 2 decades ago demonstrated the absence of inflammatory cells.[10]

Repetitive microtrauma on the tendons causes microscopic changes. Histologic studies of specimens reveal degeneration, fibrinoid necrosis, pseudocyst change, randomized collagen with neovascularization, tenocyte infiltration, micro-tears of the tendinous tissue, focal degeneration near the bone-tendon insertion, hyaline degeneration, and metaplasia.[1] Repetitive micro-trauma affects tenocytes, altering protein and enzyme production as well as deforming the nucleus. Loading of the tendon fibroblasts increases prostaglandin E2 and leukotriene B4, both of which contribute to tendinopathy. In vitro studies have shown that vascular endothelial growth factor (VEGF) and matrix metalloproteinase (MMP) activity have also been linked to tendon breakdown. In vivo studies show that VEGF may have a role in the neovascularization process. Although several studies have shown neovascularization associated with tendinopathy, there are also conflicting studies showing no association with neovascularity. Diseased tendons also have a higher percentage of cells undergoing apoptosis, as well as multiple pro-apoptotic proteins and genes present.[9]

History and Physical

Patellar tendinopathy is mainly a clinical diagnosis made through a detailed history and meticulous physical examination. Appropriate questions which will cue-in the diagnosis: Sport practiced, schedule of practice and competition, which position the athlete plays, level of performance. The patient will usually complain of well-localized pain and tenderness on the inferior tip of the patella.[11][1]

Patellar tendinopathy shares other common signs and symptoms of other knee pathologies such as pain with prolonged sitting, squatting, and stair climbing. Usually, during activities that store and release energy in the patellar tendon, load-related pain increases with demand on the knee extensors. Sudden tendon pain occurs with loading and usually stops almost immediately when the load is removed. Rarely does a patient feel pain when they are resting.[12]

A thorough examination of the entire lower extremity is needed to identify relevant deficits at the hip, knee, and ankle/foot region. Often malalignment of the foot, heel, or tibia can place excess stress on the knee extensor tendons increasing the risk of tendinopathy.[12]

Evaluation

Currently, there is no widely accepted gold standard diagnostic technique. [13] Ultrasound offers several advantages; it is time and cost-saving, it is non-invasive, repeatable, and accurate and provides a dynamic image of the knee

structures.[1] Both ultrasound and magnetic resonance image (MRI) can be used to detect abnormalities in the patellar tendon itself. Imaging can also be used to guide clinicians as to the severity of the pathology.[14]

Radiographic changes on the tendon are noted (elongation of the involved pole of the patella, calcification and increased density within the patellar tendon matrix), although these changes are rare in the first six months of symptoms. Thickening of the patellar tendon along with foci of increased signal intensity may also be seen on CT and MRI. Although not usually indicated, a bone scan can be used in the initial stages of the disease. This test will demonstrate increased pooling of blood and localized tracer activity in the affected region.[15]

Treatment / Management

There is no evidence-based, preferred treatment of choice for jumper's knee. Refractory response to treatment is also typical for the condition which often leaves the health professional and patients searching for alternative therapies. [16]

Most patients with jumper's knee are managed through medical and rehabilitative treatment in the initial stages of the disease.[17] Early recognition and diagnosis of jumper's knee are vital as it can have a progressive course. Although non-steroidal anti-inflammatory drugs were used traditionally, these have recently become less judicious as more physicians come to realize that the disease is not inflammatory. Hence, NSAIDs may not provide significant long-term benefit in tendinopathy.[3]

Eccentric training has been suggested to play a key role in the rehabilitation of jumper's knee.[18][19][1] According to Rodriguez-Merchan eccentric training appears to be the treatment of choice for patients suffering from patellar tendinopathy.[20] Athletes must avoid activities such as excessive jumping or impact loading of the knee which only aggravate the situation. As the pain begins to subside, the intensity of rehabilitation therapy and sport-specific training can be slowly increased.[1] Given the refractory response to many initial treatments, new methods have recently emerged. These include dry-needling, sclerosing injections, platelet-rich plasma therapy, extracorporeal shock wave treatment and hyperthermia thermotherapy.[16]

Surgery usually remains the last resort for chronic refractory cases. Traditionally, the gold standard for surgical treatment of patellar tendinopathy involved open debridement of the inferior pole of the patella, as well as debridement of the patella tendon. Recently, knee arthroscopy has gained popularity for tissue debridement and release.[16]

Differential Diagnosis

Jumper's knee can be mistaken for other injuries or pathologies such as Osgood-Schlatter disease, meniscal injuries, patellofemoral syndrome, knee bursitis (superficial and deep infrapatellar bursae), patellar subluxation, pathologies of the knee fat pad, chondromalacia, or a patellar tracking problem.[5]

Staging

Blazina et al. first used the term jumper's knee in 1973. They also classified the pathology by stage according to the onset of pain in relation to physical activity. This classification along with its modifications are still widely employed. Blazina et al. suggest 4 stages.

1. Pain after sports activity
2. Pain at the beginning of sports activity yet disappearing with warm-up and sometimes reappearing with fatigue
3. Pain at rest and during activity
4. Rupture of the tendon[21]

It may be useful to classify the pathology into 3 stages according to the duration of symptoms.

1. Acute when symptoms have been present for 0 to 6 weeks
2. Sub-acute when symptoms have been present between 6 to 12 weeks
3. Chronic after more than 3 months[22]

Prognosis

Most cases of patellar tendinopathy will resolve with nonoperative management.[9] Nevertheless, mild to moderate pain may persist for 15 years in adult athletes with patellar tendinopathy but does not appear to limit leisure-time physical activity.[23]

Rudavsky and Cook say that the process of returning to sports play is slow. This process is often dependent on a variety of factors ranging from the severity of pain, grade of dysfunction, the sport practiced, the quality of rehabilitation, the athlete's performance level, and the presence of intrinsic and extrinsic factors.[5] A previous study that used imaging technology to classify the severity of the lesion said that mild pathologies might take anywhere from 20 days for the patient to return to sport, whereas more severe cases might take 90 days.[24] Other experts mention that athletes with severe dysfunction might need anywhere from 6 to 12 months to recover. Lang and coworkers published a study where they analyzed patients who were treated surgically (arthroscopic patellar release). They determined that the meantime to return to play was 4.03 plus or minus 3.18 months.[25]

Joshua et al. performed a systemic search of previous studies to compare the efficacy of treatment for commonly used invasive and non-invasive treatment options. The conclusion reached was that eccentric squat-based therapy, shockwave, or PRP could be used as monotherapies or as adjunct therapies to accelerate recovery. Surgery or shockwave can be considered for patients who fail to improve after six months of conservative treatment. Since patellar tendinopathy is not inflammatory, corticosteroid injections should not be used.[26]

Patellar tendinopathy may cause long-lasting symptoms that can lead to the athlete's early retirement from sport. In a small prospective case-control study, Kettunen et al. found that 53% of their symptomatic subjects with Jumper's knee had quit their sport when compared to their asymptomatic counterpart in which only 7% quit.[23]

Complications

Athletes, clinicians, coaches, and athletic trainers need to understand that the treatment for patellar tendinopathy can be a slow and sometimes frustrating process. There are multiple pitfalls to be aware of, including the failure to control pain. The athlete's beliefs about pain and pathology may influence the development and management of unresponsive tendinopathies. Because some athletes may have been told that they have weakened tendons due to tears and degeneration, and hence an increased risk of rupture, they may develop fear-avoidance behavior, which can be associated with poorer functional outcomes in individuals suffering from lower-limb tendinopathy. Over-reliance on non-invasive therapies like shockwave therapy and injections instead of including rehabilitation exercises as part of the treatment plan can also lead to complications. Failure to address the athletes landing kinematics can also bring difficulties. Athletes should have their jump-landing mechanics retrained after adequate rehabilitation.[12]

Deterrence and Patient Education

There is currently insufficient evidence for preventative interventions specific to patellar tendinopathy.[27] Some of the proposed preventive measures are proprioception training, eccentric training and stretching of the patellar tendon, reducing the training duration or frequency, and bracing or taping.

Pearls and Other Issues

- Studies have shown that rehabilitation exercises have a vital role in the treatment of jumper's knee.
- NSAIDs and steroid injections should be discouraged in the management of jumper's knee.

- The athlete and all personnel in charge of the care and training of the athlete should be aware that the jumper's knee management can be a lengthy process that can sometimes have long-lasting effects.

Enhancing Healthcare Team Outcomes

Managing patellar tendinopathy is a job for physicians trained in the care of musculoskeletal conditions. Sports medicine physicians, physiatrists, and rheumatologists provide the first line of care. Orthopedic surgeons are consulted for refractory cases or when the knee extensor tendons are partially or completely torn. A team of professionals from multiple disciplines including athletic trainers, physical therapists, sports biomechanists, and sports psychologists is needed since the condition commonly affects athletes.

Initially, the physical therapist must work at hand with physicians to implement a nonoperative regimen consisting of therapy with isometric or eccentric exercises as the mainstay treatment. In a level 2 study, at 12 weeks, patients undergoing an eccentric exercise program showed significant improvement compared with those undergoing a concentric exercise program.[9] As the treatment progresses, plyometrics and sport specific training, including at time, psychological training, is required to return the athlete to sport at the highest level

Alternative medical treatments have been studied at different levels of evidence, demonstrating mixed and inconclusive results. Acceptable outcomes have been obtained from surgical interventions in refractory cases.

Questions

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