Case Report

Knee pain: A diagnostic dilemma

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Abstract

Tears of the anterior cruciate ligament (ACL) are common among athletes. We present the case of a 17-year-old Asian male rugby player with a one-year history of undiagnosed traumatic right knee pain. On physical examination, range of motion (ROM) of the right knee was restricted. There were neither gross deformities nor tenderness elicited on palpation. Magnetic resonance imaging (MRI) revealed a complete tear of the right ACL and a bucket handle tear of the anterior horn of the medial meniscus. Arthroscopic reconstruction of the ACL was performed, and the patient engaged in regular physical therapy post-operatively. This case demonstrates that skilled clinical assessment, advanced imaging, and diagnostic arthroscopy can facilitate the early detection of ACL and meniscal injuries to ensure timely and appropriate treatment. In order to minimize individual patient and healthcare system burdens, it is essential to develop and implement a primary care decision protocol and a follow-up protocol with appropriate referral criteria to diagnose and manage ACL and meniscal injuries.

Keywords: Anterior cruciate ligament; meniscus; magnetic resonance imaging; arthroscopy; primary Care

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Introduction

Orthopaedic surgeons commonly encounter knee pain in practice. The most common knee pathologies include meniscal tears, loose bodies, and synovial, ligamentous, and articular cartilaginous injuries. Among them, anterior cruciate ligament (ACL) injuries are the most common ligamentous injury of the knee, especially in athletes participating in sports involving jumping or pivoting movements (1). ACL injuries often lead to instability in valgus and external rotation, and also to anteromedial instability of the knee. Since ACL injuries have poor healing potential, undiagnosed ACL injuries can increase stress on the menisci and can damage articular cartilage over time (2). Therefore, early detection of ACL injuries is important, especially in younger patient populations.

Assessment of patients presenting with knee pain or instability begins with a full history and a comprehensive physical examination (3,4). Advanced imaging modalities should also be considered. Although computed tomography (CT) imaging is the modality of choice for evaluating bony lesions, magnetic resonance imaging (MRI) allows for fast, non-invasive imaging of intraarticular soft tissue pathologies (5). However, some abnormalities detected on MRI are normal variants between individuals or can be artifacts rather than true pathology (6,7).

Arthroscopy is the most common orthopaedic surgical procedure for diagnosis and treatment of various knee pathologies (8). Arthroscopy is a minimally invasive procedure that allows visualization and evaluation of intraarticular anatomy. As a result, arthroscopy has become the gold standard technique for definitive diagnosis of ACL and meniscal injuries (5). This case report presents a 17-year-old male patient with chronic knee pain who underwent arthroscopic ACL repair. It highlights the importance of early detection and accurate diagnosis of ACL and meniscal injuries in primary care settings.

The case

A 17-year-old, otherwise healthy, Asian male rugby player presented to the emergency department with right knee pain and instability. He reported that the pain started 12 months prior, following a traumatic injury during a rugby training session where he collided face-to-face with an opponent while running to catch a high ball. He fell backward, hyperextended his right knee, and hit his head against the ground. He did not lose consciousness. However, immediately following the incident, he experienced intense right knee pain. He was subsequently unable to bear weight on it. He presented to his local primary care clinic with an oedematous and unstable right knee. Radiographs revealed no fractures. Recommendations for management included analgesia and taping. He subsequently went home with no follow-up.

He found these initial recommendations inadequate, and consequently pursued physical therapy to improve stability of the joint. Five months later, he presented to the same clinic with recurrent subluxation and persistent moderate pain of the right knee without further trauma. Pain was exacerbated by bending the knee or squatting. He was prescribed isometric knee exercises and further analgesia. No additional follow-up was arranged.

Despite conservative treatment, pain and instability progressively worsened. He was unable to participate in training sessions or tournaments, and he had trouble with day-to-day activities. As a result, he explored alternative therapies, including Ayurvedic remedies and acupuncture, which provided no relief. This patient did not have any significant past medical or surgical history. He did not report any allergies, medications, or substance use, either.

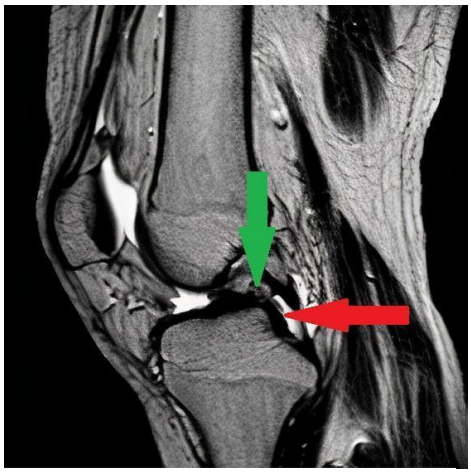

Figure 1. MRI demonstrating bucket handle tear of the anterior horn of medial meniscus (red arrow), complete tear of the right ACL (green arrow), anterior translocation of tibia compared to femur, and joint effusion.

He was seen in the emergency department 12 months after the initial trauma. On assessment, antalgic gait was observed—he hesitated to flex and bear weight on his right knee. Physical examination revealed no gross deformities, erythema, or oedema of the right knee joint. There was no tenderness on palpation over the medial and lateral joint lines, patellar tendon, popliteal fossa, or distal iliotibial insertion. Active left knee flexion ROM was 140°, while active right knee flexion ROM was limited to 70° due to pain. ACL injury was suspected due to a positive anterior drawer test and positive Lachman's test. Suspicion for a PCL injury was low due to a negative posterior sag sign. The stroke test for effusion, valgus and varus stress tests for collateral ligament injuries, McMurray test for meniscal injuries, and subluxation suppression test for subluxation of the patella were all negative. Neurovascular examination of both lower extremities was normal.

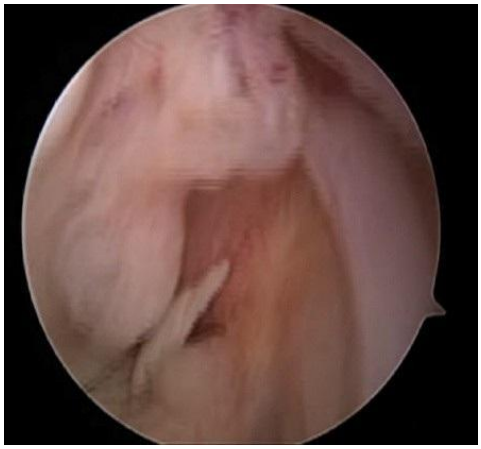

Figure 2. Arthroscopic view of the torn ACL.

Due to a high index of suspicion for an ACL injury, an urgent right knee MRI was performed three days later. MRI revealed a complete tear of the right ACL, a bucket handle tear of the anterior horn of the medial meniscus, anterior translocation of the tibia relative to the femur, and joint effusion (Figure 1). Arthroscopic ACL and meniscal repair were offered. Consent for the procedure was obtained and the operation proceeded one week later.

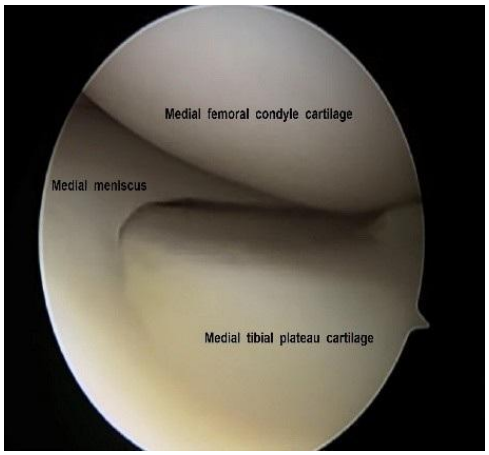

Figure 3. Arthroscopic view of the medial meniscus.

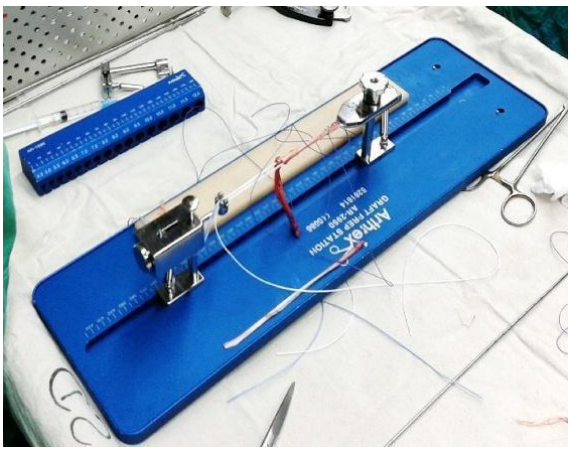

Figure 4. 9 × 80 mm tendon graft.

Diagnostic arthroscopy confirmed a complete tear of the right ACL (Figure 2). However, no bucket handle tear of the medial meniscus was seen (Figure 3). Ipsilateral semitendinosus and gracilis tendons were harvested and the right ACL was reconstructed by placing a 9 × 80 mm autologous tendon graft (Figure 4). A brace was prescribed postoperatively for 12 weeks.

The patient was discharged the following day after experiencing no postoperative complications and was scheduled for follow-up with physical therapy. Partial and then full weight-bearing were permitted nine and 11 weeks postoperatively, respectively. Six months of physical rehabilitation were successfully completed. He was asymptomatic and was able to return to sport. The rehabilitated knee demonstrated nearly the same functional parameters as the healthy knee (Table 1).

Table 1. Clinical evaluation of the right knee joint before surgery and at final follow-up

Test	Preoperative	6 months postoperative
Anterior drawer test	+3	+1
Lachman's test	+3	+1

Discussion

Primary care physicians often encounter musculoskeletal complaints. ACL injuries represent about 4% of all knee joint pathologies in primary care settings (9). However, only about 6.8 to 28.2% of patients with ACL injuries are accurately diagnosed (10,11). Therefore, patients are often required to consult with multiple healthcare providers before being diagnosed correctly. This delays rehabilitation or surgical management, as seen in this patient (11,12).

Typically, diagnosis of an ACL tear is achieved by considering various factors. It is important to consider the mechanism of injury. A clinician must consider hyperextension, hyperflexion, pivoting, valgus or varus motions, and whether the trauma was contact or non-contact. It is also important to consider what the patient experienced at the time of injury. This includes hearing or feeling a "pop", immediate or delayed pain and swelling, knee catching, locking or instability, inability to return to activity, or inability to weight-bear. Other important aspects of the clinical picture include pain localization, inspection, palpation, and outcomes of special tests (10,13). Attaining a detailed history of a sport-related traumatic event is imperative for the diagnosis of some ACL tears (14). For example, increased age and a family history of an ACL tear may increase risk for ACL tears (15). The anterior drawer test, Lachman test, and McMurray test are special clinical examination manoeuvres that can be utilized to aid in the diagnosis and differentiation of ACL and meniscal tears (16). The sensitivity and specificity of these special tests are found in Table 2 (17). However, it may be difficult to elicit positive physical signs in an acute presentation due to pain, swelling, and muscle guarding. This can contribute to inconclusive diagnoses. However, since this patient presented almost one-year post-trauma, a comprehensive physical examination was able to be performed, and an ACL injury was confirmed with MRI and arthroscopy.

Table 2: Sensitivity and specificity of special tests of the knee joint (17).

Special tests	**Pathology**		**Sensitivity (%)**	**Specificity (%)**
Anterior drawer	Anterior cruciate ligament tear		92	91
Lachman's	Anterior cruciate ligament tear		76–98	89–96
McMurray	Meniscal tear	Medial	86	73
		Lateral	56	95

Radiological assessment of the knee joint is often initiated with plain radiographs to rule out fractures. Segond fractures, lipohaemarthroses, and avulsions from the tibial spines are some radiographic findings consistent with ACL injuries (18). These changes can be missed in primary care settings before imaging is acquired. Additionally, plain radiographs may have limited diagnostic value unless an injury is caused by direct impact to the knee joint (19). In contrast to conventional CT scans, which can detect bony injuries such as tibial plateau fractures or osteochondral injuries, CT arthrography is effective at evaluating soft-tissue structures and identifying abnormalities such as ACL and meniscal injuries (20). MRI has better soft-tissue resolution and is usually performed as an initial non-invasive diagnostic modality to evaluate intra-articular soft tissue structures. The diagnostic accuracy of MRI for identifying a full-thickness ACL tear (sensitivity 77–96%, specificity 93–100%) is superior to identification of medial (sensitivity 47–76%, specificity 52–95%) and lateral (sensitivity 61–100%, specificity 75–92%) meniscal injuries (17). Preoperative MRI should be performed as part of

comprehensive surgical planning before performing arthroscopy (21,22). MRI should also be considered for more equivocal, difficult, or complex knee injuries (23). Therefore, this patient was an ideal candidate for MRI. If the primary care physician had requested MRI at the initial or subsequent presentation, the ACL injury and underlying pathologies would have been detected earlier. Although some abnormalities detected on MRI are true pathologies seen during arthroscopic evaluation, other abnormalities can be normal variants or artifacts (6,7). These cases may be due to poor quality of the MRI magnets, metallic artifacts, or positional changes of the patient during imaging.

The accuracy of diagnosing full-thickness ACL tears using clinical examination is high when performed by a physician with advanced orthopaedic training (sensitivity 77–99%, specificity 73–100%) (24). This patient initially presented to a primary care physician, who may not have had this level of training. This may have contributed to the delay in his diagnosis. However, similar to other cases with uncertain diagnoses, primary care physicians should follow up with patients at least until they show clinical improvement. This case highlights the need to implement proper follow-up protocols for patients with traumatic knee injuries.

Treatment options for traumatic ACL rupture include conservative management, ACL repair, and ACL reconstruction. Conservative management of ACL tears includes formal physical therapy to strengthen the muscles that help stabilize the knee (25). ACL repair can be performed by re-approximating the ruptured ends of the native ACL with the use of suture anchors (26). Conversely, ACL reconstruction is characterized by debriding the torn end of the native ACL and reconstructing a new ligament using grafts harvested from the hamstring tendon, quadriceps tendon, or patellar tendon (26). Arthroscopy is a common diagnostic and therapeutic modality performed by orthopaedic surgeons for ACL and meniscal injuries. It offers real-time visualization of the joint cavity. In-office needle arthroscopy, a newer technique, allows orthopaedists safe, cost-effective, and accurate diagnosis with low risk for post-surgical complications (27). Patients with ACL injuries should be referred to an orthopaedic surgeon if they have recurrent giving-way episodes, intent to resume high-intensity activity, concomitant meniscal or collateral ligament damage, or lack of success with conservative treatment (28,29). This patient had undergone five months of physical therapy without improvement. He was a young patient with recurrent subluxation of the right knee and planned to resume playing rugby. Therefore, he fit these criteria for a referral to an orthopaedic surgeon in order to prevent delays in assessment for surgical intervention.

Early and accurate diagnosis is vital to ensure timely and appropriate treatment to improve both immediate (e.g., return to work, return to sport) and long-term (e.g., physical activity) outcomes (30). Misdiagnosis can lead to reduced mobility, physical inactivity, delayed return to work/sport, obesity, and an increased risk of subsequent knee pathologies such as meniscal tears or post-traumatic osteoarthritis (10,31-35). Therefore, primary care physicians have an active role in accurate diagnosis of ACL tears early after an injury, or to establish a high degree of suspicion in order to refer to specialists. This case report demonstrates the importance of developing and implementing a primary care clinical decision protocol to improve the

efficiency of ACL and meniscal injuries diagnosis, and triaging patients to the most appropriate diagnostic or therapeutic modality.

Conclusion

Missed or falsely diagnosed ACL tears may result in delayed or misdirected rehabilitation, physician visits, or diagnostic imaging. Skilled clinical assessment, appropriate imaging, and diagnostic arthroscopy, if indicated, facilitate the early detection of ACL and meniscal injuries. Therefore, it is essential to develop and implement primary care decision protocols, regular follow-up protocols, and clear referral criteria to diagnose ACL and meniscal injuries promptly and accurately in order to minimize individual patient and healthcare system burden.

Limitations and Recommendations

The foremost limitation of this case report is the inability to make specific diagnostic guidelines, follow-up protocols, and referral criteria in primary care settings based on a single patient's experience. Further studies are required to design these standardized tools for patients with ACL and/or meniscal injuries.

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Conflicts of Interest

The author declares no conflict of interest regarding this case report.

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