A teenager with an unstable knee

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A 19-year-old girl presents with a swollen and painful knee after a netball injury.

What diagnoses should be considered and what is appropriate management?

Case presentation

History and examination

A 19-year-old student presented to her GP with a right knee that was painful and swollen. She reported that she had been playing netball when the knee had given way while she was landing from a jump. Questioning revealed that a previous injury had occurred while playing netball 10 weeks earlier.

The first injury had been more severe and occurred while the girl was running at speed, with her right foot planted on the ground and her body twisted. The knee had given way with a noise, and she had collapsed. She was helped from the court and was unable to continue to play. The knee had been iced immediately and was swollen within hours.

Five days after the first injury, the pain and swelling began to subside. Within 10 days, she was walking and the knee was improving. Six weeks later she was able to jog, and after two more weeks she successfully attempted netball training. The second injury occurred 10 minutes into her first game back.

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Examination revealed an effusion, quadriceps wasting and lateral joint line tenderness. She was able to extend the knee fully. The Lachman test for anterior cruciate deficiency was positive, and the pivot shift test for anterolateral rotatory instability was also positive. The anterior drawer test for anteroposterior laxity (in 90º of flexion) was negative. The other ligaments and the patellofemoral joint were normal. X-rays revealed no fracture.

Diagnosis and management

On the basis of the patient's history, the GP suspected a ruptured anterior cruciate ligament (ACL); this was supported by examination findings. She was also suspicious of a lateral meniscal tear or lateral ligament strain.

The GP advised rest, ice and compression, along with use of crutches as needed. She also referred the patient to a physiotherapist for management of the acute injury, including advice about maintaining quadriceps and range of motion exercises. A specialist opinion was sought regarding surgical management, and the GP queried whether an MRI would be appropriate.

The orthopaedic surgeon confirmed the diagnosis of a ruptured ACL clinically and discussed management options with the patient. An MRI scan was not required.

The patient opted for ACL reconstruction, which was appropriate in view of her age and desired level of activity. Examination under anaesthesia confirmed the diagnosis. The ruptured ligament was visible on arthroscopy (Figure 1). A stable partial tear of the lateral meniscus was present that did not require treatment (Figure 2).

Classic history of ACL rupture

- Participation in a running ball sport or skiing
- A pivoting or deceleration manoeuvre
- Collapse, sometimes with a sound heard or felt
- Inability to continue the activity
- Significant swelling (haemarthrosis)
- Settling of the swelling and apparent knee recovery over several weeks
- Instability with pivoting and jumping

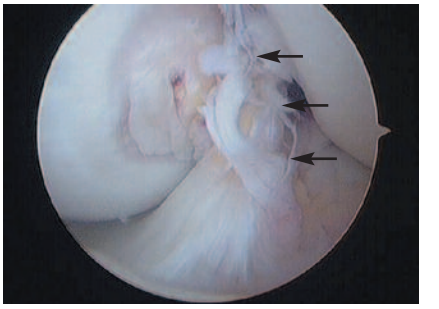

Figure 1. The ruptured ACL appears as a 'frayed' area in this case.

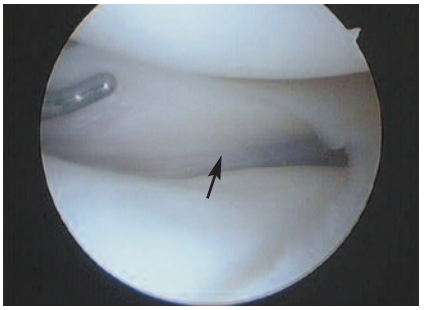

Figure 2. Stable partial tear of the lateral meniscus.

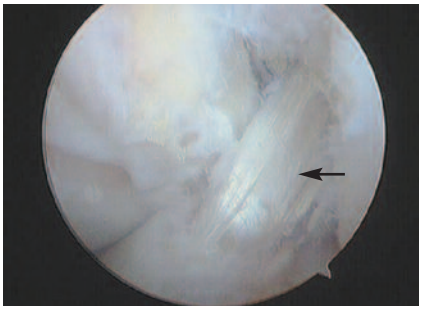

Figure 3. The hamstring tendon graft *in situ* appears as a shiny bundle.

continued

The ligament was reconstructed with a hamstring tendon graft using interference screw fixation (Figure 3). Bracing was not required. The surgery was performed as a day procedure, and physiotherapy was begun the next day.

Discussion

Diagnosis

This patient gave a classic history of a ruptured ACL (see the box on page 71). The most common causes are running ball sports and skiing, with the injury usually occurring during a change of direction with momentum. Patients usually remember the injury, even many years later, and they can rarely continue the activity.

As the body reabsorbs the haemarthrosis the knee joint settles, and with time it appears to make a full recovery; however, a linkage that is needed for certain activities is missing. The patient is able to undertake activities that require movement in a linear direction, such as walking, jogging, cycling, swimming, driving and most normal activities of daily living and most occupations. However, it is important to remember that a functional ACL is necessary for pivoting, side-stepping and landing from a jump, and it is often a return to sport that unmasks the deficit.

Clinicians should have a high level of suspicion for a ruptured ACL in any patient whose knee is swollen after an injury that involved momentum – even if the knee shows apparent improvement over time. Note that approximately 75% of acute haemarthroses after a sporting injury are due to a ruptured ACL.

Lateral sided pain and tenderness are very common after an acute ACL rupture because the lateral compartment subluxes during the injury. These findings are often misdiagnosed as an injury to a lateral structure.

Tests used to examine the knee in the case of suspected ACL rupture include the Lachman, anterior drawer and pivot shift tests; these are described in the box shown below. The acutely swollen knee can be difficult to examine and it may

Clinical signs of a ruptured ACL

Three tests for anterior cruciate ligament (ACL) deficiency are described below.

Lachman test

The Lachman test is both sensitive and specific for a ruptured ACL.

To perform the test, the knee is flexed to approximately 25°. It is important that the muscles be relaxed. The tibia is then translated anteriorly relative to the femur. Two ways of holding the leg are shown in Figures 4a and b.

A normal knee has a small degree of anteroposterior movement and a firm endpoint or 'twang' (negative result). A knee with a ruptured ACL has increased anteroposterior displacement compared with the other knee and a soft endpoint (positive result).

Figure 4a. One method of performing the Lachman test. The examiner holds the femur in one hand (confirming muscle relaxation) and then gently grips the tibia and elicits anterior and posterior movement with the other hand.

Figure 4b. Another method of performing the Lachman test. The examiner supports the patient's thigh on his or her own thigh (which aids muscle relaxation), while gently gripping the tibia and eliciting anterior and posterior movement with the other hand.

Anterior drawer test

The anterior drawer test is not sensitive or specific for ACL deficiency. False negatives commonly occur after a rupture, and the test often only becomes positive later when secondary restraints are attenuated. False positives may occur in posterior cruciate ligament insufficiency.

Pivot shift test

This test requires practice, and is best learned in the clinical setting. It can be uncomfortable for the patient, and it is important that he or she is relaxed.

There are various ways of eliciting the sign. It begins with the knee extended, a valgus force on the knee and gentle internal rotation torque on the tibia. If the anterior cruciate ligament is ruptured, the lateral tibial condyle subluxes forward and then is

be appropriate to prescribe rest, ice, compression and physiotherapy, with re-assessment several days later.

Diagnostic arthroscopy is not necessary for diagnosing or assessing a suspected ACL rupture. MRI is not needed to make the diagnosis but may be useful for assessing other suspected injuries to the menisci, osteochondral surfaces, or other ligaments.

Management

The aim of treatment for an ACL-deficient knee is to protect the joint. When returning to sporting activity the unstable knee will sublux under load, with shearing forces imparted to the chondral surfaces and the menisci. Injury to the chondral surfaces leads to premature osteoarthritis, as does damage to (and surgical removal of) menisci.

There are two ways to prevent re-injury:

- avoidance of pivoting, side-stepping and jumping sports
- reconstruction of the ACL.

Nonoperative management involves patient education to avoid pivoting, side-stepping and jumping sports (i.e. to live within the 'envelope of stability' of the joint). This is suitable for a patient who does not wish to return to sport. It is usually inappropriate, however, to expect younger active patients to give up all ball sports and other running, turning and jumping activities. It is not appropriate to rehabilitate patients with an unstable knee and then allow them to return to sports because they will suffer re-injury. Bracing has not been shown to prevent re-injury.

Consideration for reconstruction of the ACL is advised for patients who do not wish to live within the envelope of stability of the joint, and for those who have symptomatic instability while performing normal activities of daily living or their occupation. MT

DECLARATION OF INTERESTS: None.