Anterior cruciate ligament injury

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Learning objectives

- Understand the clinical presentation and examination findings of anterior cruciate ligament (ACL) injuries.
- Recognise additional injuries commonly associated with ACL injuries.
- Learn about the appropriate imaging and management strategies for ACL injuries.

Introduction

ACL injuries remain a prevalent knee injury, particularly among young athletes. In this chapter you will be provided with a comprehensive approach to understanding ACL injuries, their clinical findings, risk factors and diagnostic approaches. As this is such a prevalent injury, it is important to have good knowledge of the management and treatment of ACL injuries in order to improve patient outcomes.

The ACL is an integral stabilising structure within the knee joint. It consists of a dense fibrous band that connects the femur to the tibia. It is located within the joint and plays a crucial role by preventing excessive anterior translation of the tibia during rotational movements and weight-bearing activities.

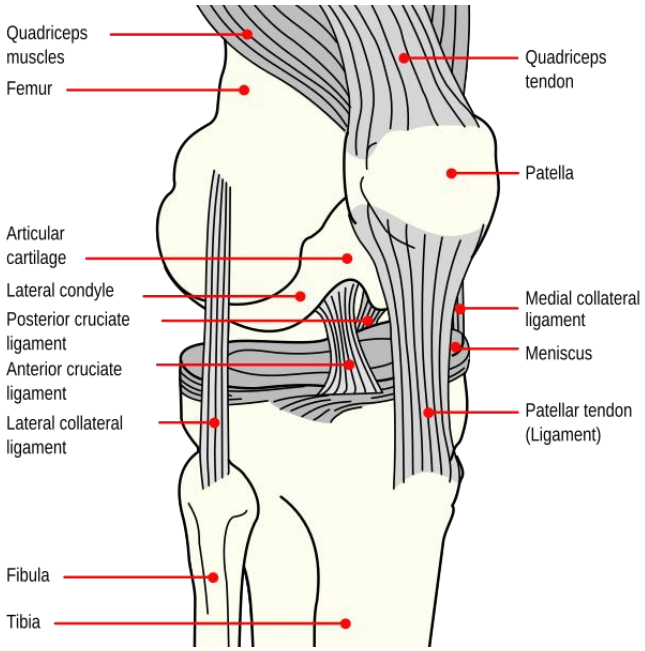

***Figure 1**: Schematic illustration of the knee joint anatomy (Source: Mysid, CC0)*

Clinical findings

History

The majority of ACL injuries happen during sport movements involving sudden stops, jumping manoeuvres or unplanned sidestepping.

Patients can often recall a specific event and are mostly unable to continue to compete. Patients frequently present complaining of swelling, a sensation of

instability and knee pain. ACL injuries are more common in male athletes.

Risk factors

Risk factors for ACL injuries can be broken up into intrinsic and extrinsic risk factors.

Intrinsic risk factors include an increased tibial plateau slope and a narrow intercondylar notch. Additional factors of an increased body mass index (BMI), hyperlaxity and family history have also been linked to increased rates of ACL injuries.

Extrinsic risk factors involve types of sport and positioning of play that predisposes a player to a pivoting motion or a shoe-surface interface causing increased ground friction.

Examination

Inspection

- Antalgic gait.
- Rapid swelling due to a large effusion.

Palpation and special tests

- Considerable tenderness in the knee joint.
- Positive Lachman test, which is the most reliable test for confirming ACL injury. The Lachman test assesses sagittal knee stability.
- Anterior drawer test, which looks for excessive anterior movement of the tibia relative to the femur, which would be indicative of an ACL injury.

Figure 2: *Anterior drawer test (see video showing difference between positive and negative anterior drawer test)*

Additional injuries to note

ACL injuries can occur with other injuries, such as:

- Medial collateral ligament (MCL) tears.
- Meniscal tears.
- Bone bruises.

These injuries, if present, may influence the treatment approach and prognosis and therefore should be carefully assessed.

Differential diagnosis

Knee instability can be caused by conditions other than ACL injuries, so it is important to keep the following conditions in mind for a differential diagnosis:

- MCL injury.
- Meniscus tear.
- Patellar dislocation.
- Fractures.

Special investigations

Imaging

X-rays appear normal, since the ligament does not appear on x-rays. They are mainly performed to rule out differentials like a fracture. MRI is therefore the imaging modality of choice, since it provides detailed images

of the knee's soft tissues, allowing for the accurate identification of ACL injuries and any associated injuries.

Figure 3: *Sagittal T2 MRI image showing a mid-substance ACL tear with disrupted fibres*

Management

Non-surgical

- Rest, ice, compression and elevation (RICE)
- Physiotherapy is extremely valuable for rehabilitation and gradual return to activity. Patients can focus on improving their range of motion, strengthening exercises and balance training to regain knee stability and function.

Surgical

Surgery is considered when non-surgical management fails or in patients who are competitive athletes or engage in high-demand activities.

The surgical technique typically involves reconstructing the torn ACL using a graft from the patient's or a donor's tissues (such as the patellar or hamstring tendons), to restore stability to the knee joint.

Arthroscopic ACL reconstruction is the preferred surgical approach, as it is less invasive and allows for faster recovery compared to traditional open surgery. The torn ACL is removed and tunnels are drilled through the bones to place the graft accurately. The graft is then secured in place using screws, staples or other fixation devices. Post-surgery, patients undergo a structured rehabilitation programme to gradually regain knee strength and function.

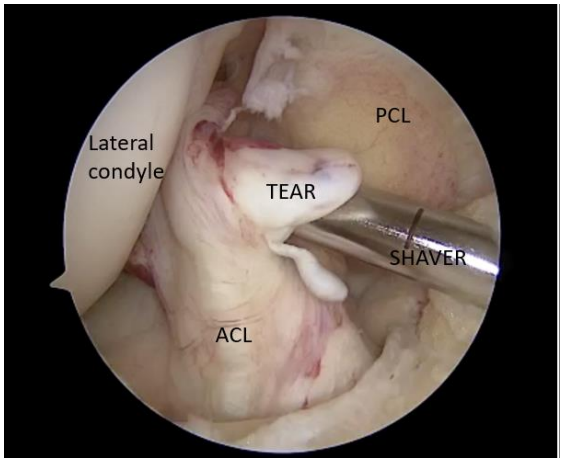

Figure 4*: Arthroscopic view of a partial ACL injury. The arthroscopic shaver marks the torn structure of the ACL.*

Prevention strategies

Prevention is extremely important due to potentially serious long-term sequalae, as well as an increased risk of re-injury. Neuromuscular training programmes have been shown to be effective in preventing ACL injuries. These focus on improving strength, balance and coordination to enhance knee stability during sport activities.

Proper warm-up exercises, stretching and ensuring athletes use appropriate footwear and sport equipment also play a role in reducing injury risk.

Key takeaways

- ACL injuries are common knee injuries, often seen in young athletes.
- History and clinical examination, such as the Lachman test and the anterior drawer test are essential for diagnosis.
- MRI is the imaging modality of choice to identify and evaluate ACL injuries.
- Non-surgical management such as RICE, nonsteroidal anti-inflammatory drugs (NSAIDs) and physiotherapy is the initial approach for most patients.
- For active individuals or when non-surgical management is insufficient, surgical reconstruction may be required. The preferred approach is arthroscopic ACL reconstruction.
- Early rehabilitation is crucial for optimal recovery and functional outcomes.
- Preventive measures, including neuromuscular training and proper warm-up, can help reduce the risk of ACL injuries in athletes.

Assessment

1. A 25-year-old male rugby player presents to the clinic with a history of sudden stops and changes in direction during a rugby game. He complains of knee pain, swelling and a feeling of knee instability. On examination, there is significant tenderness in the knee joint, and the Lachman test and anterior drawer test confirm the diagnosis of an ACL tear. What additional injury is commonly associated with ACL tears?

A. Medial meniscus tear

B. Posterior cruciate ligament tear

C. Patellar tendon rupture

D. Quadriceps muscle strain

The answer is (A). A medial meniscus tear is most commonly associated with an ACL tear.

2. A 20-year-old female soccer player presents to the emergency department after sustaining a knee injury during a match. She describes sudden pain and swelling in her knee after a jumping manoeuvre. On examination, there is antalgic gait, tenderness in the knee joint and pain on resisted adduction of the hip. MRI reveals an ACL tear. What is the most appropriate initial management strategy for this patient?

A. Immediate surgical reconstruction

B. NSAIDs and physiotherapy

C. Complete bed rest for one week

D. Continuous ice pack application for 48 hours

The answer is (B). NSAIDs and physiotherapy are the most appropriate initial treatment; surgical reconstruction is only done if necessary.

3. A 28-year-old male soccer player with a known history of ACL tear is being evaluated for surgical reconstruction. The surgeon plans to use a graft from the patient's own tissues. Which of the following graft options is commonly used in ACL reconstruction?

A. Allograft from a cadaver

B. Autograft from the contralateral knee

C. Xenograft from a pig’s tendon

D. Synthetic mesh material

The answer is (B).

4. A 9-year-old basketball player suffers from an ACL tear and undergoes arthroscopic ACL reconstruction. The surgeon removes the torn ACL and secures the graft using screws. Post-surgery, the patient is advised to undergo a structured rehabilitation program. What is the primary goal of this rehabilitation programme?

A. Regaining full range of motion in the knee

B. Gradually returning to high-demand activities

C. Achieving maximum knee stability within a week

D. Strengthening of the ankle and hip muscle only

The answer is (A).

5. A sport coach wants to implement preventive measures to reduce the risk of ACL tears in the team. Which of the following strategies has been shown to be effective in preventing ACL injuries among athletes?

A. Using appropriate footwear and sports equipment

B. Applying ice packs after each training session

C. Administering NSAIDs before every match

D. Implementing high-intensity interval training during the season

The answer is (A).

References and further reading

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ABOUT THE BOOK

This is the second edition of the *Orthopaedics for Primary Health Care* textbook edited by Michael Held, first published in 2021.

Most patients with orthopaedic pathology in low- and middle-income countries are tested by non-specialists. This book was based on a Delphi consensus study* with experts from Africa, Europe and North America to identify topics, skills and cases concerning orthopaedic trauma and infection that need to be prioritised in order to provide guidance to these health care workers.

The aim of this book is to be student-centred.

*Held et al. Topics, Skills, and Cases for an Undergraduate Musculoskeletal Curriculum in Southern Africa: A Consensus from Local and International Experts. JBJS. 2020 Feb 5;102(3):elO.

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The information in this book is meant to supplement, not replace, orthopaedic primary care training.

The authors, editor and publisher advise readers to take full responsibility for their safety and know their limits. Before practicing the skills described in this book, be sure that your equipment is well maintained, and do not take risks beyond your experience, aptitude, training or comfort level.

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This chapter was authored as part of a supervised student co-authorship initiative, in which students made use of ChatGPT as an aid in the authorship process.

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