Case Studies—Module 1

SPORTS RELATED INJURY
One of the most common injuries of the knee is a tear of the anterior cruciate ligament (ACL). Currently, the estimated incidence of ACL injuries is approximately 200,000 each year.

Reconstructions of the ACL occur in about half of these cases. High risk sports for an ACL injury include basketball, football, skiing, and soccer. Through this case we’ll look at the process of diagnosing and repairing an ACL tear.
Derrick Williams was living out his dream, playing college football as a receiver. He had just caught a 35 yard pass, and was running between the defenders, heading for the goal line. As he turned sharply to avoid being tackled, he felt a pop in his knee and fell sharply to the ground in pain.

The team athletic trainer ran to the field to assess the situation. The trainer started with a routine field exam to rule out injuries that would prevent the athlete from being moved, such as back, head injuries or fractures. After deciding the injury was isolated to the knee, Derrick was able to stand with help and be assisted from the field.
Case Questions

1. What are the steps to evaluating an unconscious athlete?

2. What are the steps to evaluating a conscious athlete?

3. What are the responsibilities of a first responder at the scene of an athletic injury?
Quadriiceps muscle
Patella
Femur
Articular cartilage
Lateral collateral ligament
Lateral meniscus
Fibula
Tibia
Patellar ligament
Medial collateral ligament
Posterior cruciate ligament
Medial meniscus
Anterior cruciate ligament
Knee In Extension

- Patella
- Femur
- Articular Cartilage
- ACL
- Meniscus
- Collateral Ligament
- Patella Fibula Tendon Tibia

Knee In Flexion
Anterior Cruciate Ligament

http://genou.com/anglais/ACLanatomy.htm
Case Question

4. Describe the location of the anterior cruciate ligaments (ACL) and list 2 functions.
The trainer continued to work on assessing the injury. After ruling out other knee injuries, the trainer performed testing to confirm his suspicions of a tear in the anterior cruciate ligament.

**ACL Exam**

The above testing may be difficult for the non-trainer to understand. The important points you need to understand are:

1. The three tests are called Lachman, Anterior Drawer, and Pivot Shift tests
2. The testing is done to assess the proper movement of the knee
3. An athletic trainer can diagnose an ACL tear through this testing.

You also need to understand the following terms:

- **Valgus**
  - The distal position of a body part that is bent outward.
- **Varus**
  - The distal position of a body part that is bent inward.
The testing confirmed the trainer's suspicion of a tear in the ACL (anterior cruciate ligament). Derrick was referred to an orthopedic surgeon. Physical exam showed swelling in the knee and hemarthrosis.

The physician ordered an MRI (magnetic resonance imaging) on the knee to confirm the diagnosis and assess the extent of the injury.
Case Questions

5. What is an MRI scan?

6. What health professional would perform an MRI scan?
MRI Imaging Results

Normal ACL ligament on MRI
MRI Imaging Results

MRI of knee showing torn ACL ligament
After evaluating the MRI results, the orthopedic surgeon recommended surgery to reconstruct the ACL tendon. Derrick was a young athlete who had dreams of playing professionally, and would need the full function of his knee. Derrick would definitely not return to play this season, but if all went well, would return the following season.

Instructor's Note: A conservative, non-surgical approach of treating an ACL tear is also an option. The patient undergoes extensive physical therapy to strengthen the knee. Although the knee will not function as well as it once did, this is often the best approach for an older or nonathletic patient.

The surgery would not take place for 3-6 weeks. The swelling in the knee would need to subside as well as the hemarthrosis for the surgery to be successful. The presurgery goal would be to reduce swelling and pain and restore a full range of motion. Derrick would begin physical therapy as soon as possible. The goals of the first phase of physical therapy were to minimize swelling, pain, and hemorrhage after surgery; establish and maintain full knee extension; achieve good quadriceps control; and to begin working on regaining knee flexion and neuromuscular control.*

The orthopedic surgeon preformed surgery one month after the initial injury. At this point the swelling and hemarthrosis had subsided and Derrick’s knee was stronger due to physical therapy. The surgeon explained that he would perform the surgery arthroscopically. The surgeon would use a graft from Derrick's patellar tendon to replace the torn ACL ligament. The other graft options are the hamstring or a cadaver graft.

_Instructor's Note: You may wonder why the torn ACL ligament is replaced, and simply not sutured together. Surgeons have found that attempting to repair a torn ligament by stitching is ineffective. The ligaments do not heal or function as they should._

ACL Reconstruction
Case Questions

7. What is an arthroscope?

8. What are some advantages of arthroscopic surgery?

9. Describe the surgical method used to replace a torn ACL.
Although Derrick's surgery was a success, he still had a long road of physical therapy in front of him. The reconstructed ligament would take at least 6 months to regain adequate strength. He began Phase 2, or the repair phase of physical therapy. Goals of this phase included achieving a normal gait pattern; maintaining full extension; strengthening quadriceps and hamstrings; increasing knee flexion; maintaining cardiorespiratory endurance; and improving neuromuscular control.*

At 4 months Derrick began Phase 3 of physical therapy in which concentration was placed on functional progressions and return to high-demand activity.* Therapy consisted of electrical muscle stimulation, ultrasound massage (massage using sound waves), and incorporating sport-specific activities.

Case Questions

10. What is electrical muscle stimulation (EMS)?

11. How can EMS prevent or reduce muscle atrophy?
At 6 months Derrick was released to full activity, but still maintained his weight lifting exercises to keep his knee healthy. Next football season was definitely looking up!
Professionals

- Nursing
- Physician
- OR Nurse
- Orthopaedic Surgeon
- Surgical Technologist (OR Technician)
- Anesthesiologist
- Athletic Trainer
- Radiologist
- Physical Therapist
- Radiology technician
Evaluating an Injured Athlete: Field Exam

- Do not move the athlete.
- Do not remove the helmet.
- Do not use ammonia inhalants, which may cause the head to jerk from the noxious stimulus.
- Do not give liquids or food.
- Do not rush the evaluation.
- Do not worry about delaying the game.
- If the athlete is unresponsive, alert other medical personnel and coaches, and call for an ambulance. The medical staff should then proceed with CPR steps as necessary. If the athlete is not breathing, start rescue breathing.
- Evaluate mental status, symptoms, mechanism of injury, rule out neck injury, give a physical exam of injured area, slowly have athlete sit up, reevaluate, help athlete walk to sidelines.
- The first responder at the scene of an athletic injury needs to be able to recognize a life-threatening condition, provide emergency care, and facilitate transportation to a medical facility when indicated. An orderly, logical primary assessment on the field can help identify serious conditions promptly and guide further evaluation and treatment.

Courtesy of Ohio State University [http://amp.osu.edu](http://amp.osu.edu)
Factors to consider in treatment of ACL Injuries

- **Age**
  - The younger the patient the greater the need for surgical reconstruction. Nevertheless, the knee can be reconstructed at any age. One is only as old as one feels!

- **The specifics of anticipated sport**
  - The twenty-year-old handball athlete is a much better candidate for an ACL reconstruction than a fifty-year-old weekend bicyclist. Sports involving jumping, twisting and pivoting require a knee with intact ACL. It is strongly contraindicated to resume such sports without an ACL even if you feel no instability. Without the protection of the ACL, you’re at risk for eventually damaging other structures within your knee and you may hasten the onset of arthritis.

- **The degree of initial laxity**
  - The tests described above allow us to determine quantitatively the amount of instability present in a given patient with an ACL tear. There appears to be a correlation between the instability that we detect on our test and the instability that the athlete will note him or herself.

- **The build of the athlete**
  - Different people have different tolerances to an ACL tear. In a muscular subject whose leg is slightly bowed (varus) and who is not loose-jointed, an ACL tear may be well tolerated. On the other hand, in a young woman with considerable joint laxity and genu valgum (knock knee’d) a tear of the ACL can lead to instability even in the absence of specific athletic activities.

- **The pre-injury status of the knee**
  - The more damaged the knee prior to the injury, the greater the chance that the ACL tear will be symptomatic and harmful.
Valgus Stress Test

Medial
Collateral
Ligament

Perform maneuver twice:
1. Knee flexed 0°
2. Knee flexed 30°

Examiner applies inward pressure at lateral thigh with one hand.

Examiner applies outward pressure from medial ankle with other hand.
Varus Stress Test

Lateral Collateral Ligament

Perform maneuver twice:
1. Knee flexed 0°
2. Knee flexed 30°

Examiner applies outward pressure at medial thigh with one hand.

Examiner applies inward pressure from lateral ankle with other hand.
Hemarthrosis

Blood that has accumulated inside a joint due to hemorrhage from injury.
What is an MRI?

Magnetic resonance imaging, or MRI, is a radiology technique using magnetism, radio waves, and a computer to produce images of body structures without the need for x-rays or "ionizing" radiation.

Instead, MRI uses a powerful magnetic field, radio waves, rapidly changing magnetic fields, and a computer to create images that show whether or not there is an injury, disease process, or abnormal condition present.

A radiology techniques using magnetism, radio waves, and a computer to produce images of body structures

The single steps of an MR examination can be described quite simply:
• the patient is placed in a magnet
• a radio wave is sent in,
• the radio wave is turned off,
• the patient emits a signal which is received and is then
• reconstructed into a picture
Hemorrhage

- Severe bleeding, either internally or externally
Knee Flexion

- The act of bending the knee, in contrast to the act of extending the knee.
Graft Options

- Autograft
  - Auto = Self
    - Comes from the affected patient
  - Patellar tendon (most common)
  - Hamstring tendon
  - Quadriceps tendon

- Allograft
  - Allo = Other or Different
    - Comes from a cadaver
  - Patellar tendon
  - Achilles tendon
Electrical Muscle Stimulation (EMS)

EMS is the elicitation of muscle contraction using electric impulses. The impulses are generated by a device and delivered through electrodes on the skin in direct proximity to the muscles to be stimulated. The impulses mimic the action potential coming from the central nervous system, causing the muscles to contract.

Studies have found that the addition of electro-stimulation initiated four days after anterior cruciate ligament reconstruction surgery can provide more decreases in effusion (accumulation of fluid in the knee joint), swelling, pain, extension deficit and can prevent muscle volume loss (atrophy) greater than exercise alone.