"...I dream to join the national team"

Case 3, Year 1

Professor Dr Samy Azer
MD, PhD (USyd), MEd (UNSW), FACG (USA), MPH (UNSW)
Professor of Medical Education
Chair of the Curriculum Development Unit
College of Medicine, King Saud University
Saudi Arabia

Key Concepts

- Causes and pathogenesis of knee injury.
- Anatomy of the knee joint.
- Sources of pain from the knee joint.
- Role of investigations in refining your hypotheses.
- Use of basic sciences in interpreting patient's symptoms and signs.
- Pharmacology of NSAIDs and cortisol.
- Differences between COX-1 and COX-2.
- Selection of educationally useful web-site.
- Long-term rehabilitation programs.

Learning Objectives:

This PBL package (Tutorials One and Two) targets the following objectives:

- Discuss the anatomy of the knee joint and the function of each anatomical structure.
- Discuss the possible mechanisms for an injury of the knee.
- Use basic sciences to interpret the patient's symptoms and clinical signs.
- Discuss the pharmacology of NSAIDs and the main differences between COX isoenzymes (COX-1 and COX-2).
- Form a brief management plan showing management options for a patient with a knee injury.
- Discuss the key principles for an educationally useful website.
- Discuss the role of long-term rehabilitation programs in injuries such as knee injury.
-

Trigger

(40 Minutes)

Ahmed Riyan, a 21-year-old medical student comes in to see Dr Othman Shehri in his clinic. Ah med is a member of King Saud University College of medicine football team. Yesterday he was playing in the Riyadh's division semi-final match and his team was in the lead. About 20 minutes before the end of the match, Ahmed was attached by two opponents, one of them fall across Ahmed's weight-bearing left leg. Ahmed was carried out of the field, received first-aid care and was unable to continue the match. The next morning he noticed that his left knee is swollen and painful.

Discussion Questions:

- Are there any difficult words you do not understand?
- List the key information about Ahmed.
- Identify Ahmed's presenting problems.
- For each problem make a list of how it may be caused (generate hypotheses).
- What further information would you like to know to help you differentiate between your hypotheses? (What questions would you like to ask Ahmed?)

Trigger

(40 Minutes)

Ahmed Riyan, a 21-year-old medical student comes in to see Dr Othman Shehri in his clinic. Ahmed is a member of King Saud University College of medicine football team. Yesterday he was playing in the Riyadh's division semi-final match and his team was in the lead. About 20 minutes before the end of the match, Ahmed was attached by two opponents, one of them fall across Ahmed's weight-bearing left leg. Ahmed was carried out of the field, received first-aid care and was unable to continue the match. The next morning he noticed that his left knee is swollen and painful.

New Terms

weight-bearing left leg:

Hypotheses

1. **Painful left knee:**

- Skin/subcutaneous tissue injury.
- Injury of anterior cruciate ligament.
- Injury of the posterior cruciate ligament.
- Injury of the medial collateral ligament.
- Injury of the lateral collateral ligament.
- Injury of the medial meniscus.
- Injury of the lateral meniscus.
- Injury of the articular cartilage.
- Injury of bones (Tibia, fibula, patella, femur).
- Sensory nerve injury.
- Nearby tendon/muscle injury.
- Collection of blood in the joint.
- Collection of fluid (effusion) in the joint.

Hypotheses

2. Swollen knee:

- Bleeding into the knee joint.
    - increased bleeding tendency.
    - trauma to blood supply.
- Knee effusion.
- Damage of the structures forming the knee joint (as above).

Hypotheses

3. Unable to continue the match:

- Severe pain.
- Unstable knee joint.
- Not fit to play.
- Other injuries.
- Psychological impact after the injury.
- He needs urgent medical care.

Facilitation Questions

What are the anatomical structures forming the knee joint?

- Skin and subcutaneous tissue.
- Bones: Tibia, fibula, patella, femur.
- Articular cartilage.
- Anterior cruciate ligament.
- Posterior cruciate ligament.
- Medial collateral ligament.
- Lateral collateral ligament.
- Medial meniscus.
- Lateral meniscus.
- Arterial supply and venous drainage.
- Nerve supply.

Facilitation Questions

What could possibly go wrong to each of these structures and produce pain?

- Skin and subcutaneous tissue → injury/ inflammation
- Skeletal muscles → injury/tear/inflammation
- Bones (femur, tibia, fibula, patella) → fracture.
- Joint → injury/collection of effusion/collection of blood.
- Nerve → nerve injury/nerve tear/ nerve inflammation.
- Arterial blood supply → arterial insufficiency, artery spasm
- Venous drainage → thrombosis/blockage
- Ligaments → damage/injury.

Which of the knee joint structures are not supplied by a sensory nerve?

Facilitation Questions

What is the normal range of movement of the knee joint?

What are the possible mechanisms underlying the knee joint?

- Valgus versus varus strain.
- Direct trauma to the knee.
- Twist of the knee.
- Hyperextension of the joint.

Facilitation Questions

What are the main differences between the knee joint and other joints such as hip joint and ankle joint?

Further Questions

- What did he feel at the time of injury?
- Any pain at night?
- When did he first notice the knee swelling?
- Time of injury?
- Describe the severity of pain out of a scale of 1 to 10 (10 is very severe).
- Describe the progression of pain.
- Any past history of knee injury/operations?
- How important is sport to him?

Please Read The History

History

Ahmed says that he felt a sudden pop during the attack from his opponent. He experienced severe pain and felt that something was taken out of place in his left knee. The first-aid personal applied ice and placed a bandage around the knee. This has helped in reducing the pain to some degree and he was able to walk with a little limp. He was unable to continue the match.

About 30 minutes later he noticed a swelling of his left knee. Gradually the swelling increased and he felt pain in his left knee particularly on walking. Although he took 2 tablets of paracetamol, the pain continued. During the night he did not sleep. In the morning he decided to see his general practitioner because of pain and swelling of his left knee.

History

Past Medical History

No past history of knee injuries.

No past history of operations or hospital admission.

No history of blood disease or bleeding tendency

Family History

Nil

Allergy and Medication

Nil

Social History

Ahmed is a third year medical student at King Saud University. He has been playing football since he was in primary school. Sport is very important to him and he dreams to join the national team.

Discussion Questions

- Are there any difficult words you do not understand?
- List the key information in this progress.
- Identify any new problems and add to your list.
- For each new problem, make a list of how it may be caused (generate hypotheses).
- What further information can be obtained via clinical examination?

New Words/Terms

- Opponent:
- Sudden pop:
- Taken out of place:
- First-aid care.
- Bleeding tendency.

Key information

- He felt a pop during the attack.
- He experienced severe pain in his left knee.
- He felt that something was taken out of place in his knee.
- He received first-aid care- less pain.
- He was unable to continue the match.
- He noticed knee swelling 30 minutes later.
- Pain gradually increased.
- Did not sleep- took paracetamol tablets.
- Paracetamol did not help.
- No past history of knee injury or bleeding tendency.
- Family history and medications Nil.
- He is a third year medical students. Likes football and dream to join the national team.

Hypotheses

1. **Painful left knee:**

- Skin/subcutaneous tissue injury.?/+
- Injury of anterior cruciate ligament.?/++
- Injury of the posterior cruciate ligament.?/++
- Injury of the medial collateral ligament.?/++
- Injury of the lateral collateral ligament. ?/++
- Injury of the medial meniscus.?/++
- Injury of the lateral meniscus.?/++
- Injury of the articular cartilage/ ?
- Injury of bones (Tibia, fibula, patella, femur)./?
- Sensory nerve injury.?
- Nearby tendon/muscle injury.??
- Collection of blood in the joint./+++
- Collection of fluid (effusion) in the joint./?/+/++

Hypotheses

2. Swollen knee:

- Bleeding into the knee joint./+++
  - increased bleeding tendency/0.
  - trauma to blood supply/++/+.
- Knee effusion. ?/+
- Damage of the structures forming the knee joint (as above)./+++

Hypotheses

3. Unable to continue the match:

- Severe pain./++
- Unstable knee joint/++.
- Not fit to play./++
- Other injuries.?/0
- Psychological impact after the injury/++.
- He needs urgent medical care /??/+.

Please Read The Clinical Examination

Clinical Examination

Ahmed looks unwell. He limps on walking. His vital signs are summarized in the table below:

Vital signs	Ahmed	Normal range
Pulse rate	89	60-100 /min
Blood pressure	120/80	100/60- 135/80 mmHg
Temperature	37.0 °C	36.6-37.2 °C
Respiratory rate	20	12-16/min

Clinical Examination (continue)

Knee Examination:

- No bruises or external wound
- Left knee is swollen, tense and the range of movement is limited by pain.
- Palpation of the left knee reveals moderate tenderness over medial joint line.
- Lachman test (this test aims at assessing the integrity of the anterior cruciate ligament)
- (*Watch the YouTube video for performing Lachman test: http://youtu.be/XyiAdBytmRw*)
- McMurray's test (this test helps in assessing the integrity of mensci) (*Watch the YouTube for performing McMurray's test: http://youtu.be/fkt1TOn1UfI*).
- Both tests were of limited value because of severe pain and swelling.
- Right knee is normal. No other musculoskeletal joints.

Examination of the Cardiovascular and Respiratory Systems:

- Normal

After the examination, Ahmed asks Dr Shahri, "Yesterday night, I read on the web about cortisol injection in treating knee conditions. They state cortisol fixes knee problems. Could I have corisol injection?"

Discussion Questions

- List the key information in this progress.
- Identify any new problems and add to your list.
- For each new problem make a list of how it may be caused (generate hypotheses).
- What are your learning issues?

New Words

- Limps on walking.
- Range of movement.
- Bruises.
- Palpation.
- Lachman test
- Tenderness
- Anterior cruciate ligament.
- McMurray test.
- Menisci
- Cortisol injection

Key information

- He looks unwell.
- He limps on walking.
- Not feverish. Haemodynamics are stable.
- No bruises or external wounds.
- Left knee is swollen, tense. Range of movement is limited.
- Palpation of left knee: tenderness over medial side.
- Lachman test and McMurray test are of limited value because of pain.
- Cardiovascular and respiratory systems: Normal. cLimps on walking.

Hypotheses

1. **Painful left knee:**

- Skin/subcutaneous tissue injury./o
- Injury of anterior cruciate ligament. /++/+++
- Injury of the posterior cruciate ligament. /++/+++
- Injury of the medial collateral ligament./-/o
- Injury of the lateral collateral ligament. /-
- Injury of the medial meniscus./++/+++
- Injury of the lateral meniscus. /++/+++
- Injury of the articular cartilage. /?
- Injury of bones (Tibia, fibula, patella, femur). ?/o
- Sensory nerve injury./?/o
- Nearby tendon/muscle injury. /-
- Collection of blood in the joint./+++
- Collection of fluid (effusion) in the joint.?+/o

Hypotheses

2. Swollen knee:

- Bleeding into the knee joint.+++
  - increased bleeding tendency./0
  - trauma to blood supply./+++
- Knee effusion./?-
- Damage of the structures forming the knee joint (as above)./+++

Hypotheses

3. Unable to continue the match:

- Severe pain./++
- Unstable knee joint./++
- Not fit to play./+++
- Other injuries./0
- Psychological impact after the injury./?
- He needs urgent medical care.??/++

Refining Hypotheses

Most likely:

- Anterior cruciate ligament tear +/- meniscus damage.
- Patellar dislocation.
- Posterior cruciate ligament tear.
- Damage of structures + tear of blood supply causing bleeding into the knee joint.

Less likely:

- Bone fracture.
- Patellar tendon injury/rupture.
- Muscle tear.
- Bleeding tendency.
- Medial collateral ligament damage.
- Meniscus damage alone.
- Nerve injury.
-

Learning Issues

Learning Issues

- What are the possible causes for the knee swelling?
- What are the anatomical structures forming the knee joint?
- What are the functions of each anatomical structure?
- Which of these structures could be the source of pain?
- What are the mechanisms by which knee injury may occur?
- Why cortisol injection is not helpful in Ahmed's case?
- What is the pathogenesis for a ligament/meniscus injury?
- Which knee anatomical structures are more susceptible to injury? Why?
- What is the bases behind examination of the knee?
- What are the investigations needed to assess a knee injury?
- What are our management goals and management options?

Tutorial Two

TUTORIAL TWO

Students will discuss their learning issues for 50 minutes. Then:

- What is your refined hypothesis? Justify your view.
- What would you like to do for Ahmed at this stage?

Please Read Progress 1

Progress 1

Dr. Shehri arranges for Ahmed to have a plain X-ray and an MRI scan of the left knee. The results of Ahmed's investigations are shown below:

Plain X-ray of the left knee

- No fractures or any other pathology noted.

MRI scan of the left knee

- The left knee is swollen with evidence of tear of the medial meniscus and damage of the anterior cruciate ligament (ACL). There is also blood collection in the left knee cavity (haemarthrosis). http://youtu.be/z26VF3mXIiw
- This URL is for a video showing an MRI scan- tear of meniscus and damage to the anterior cruciate ligament.

Discussion Questions

- Are there any terms that you do not understand?
- Summarise the key information that you have obtained from this progress.
- Use the results of these investigations to refine your hypothesis.
- What are your management goals and management options?

New Words/Terms

- Anterior cruciate ligament
- Medial meniscus
- Haemarthrosis
- Fracture

Facilitation Questions

- What do you know about cruciate ligaments? What are their functions?
- What do you know about collateral ligaments? What are their functions?
- What do you know about knee menisci? What are their functions?

Please Read Progress 2

Progress 2

Dr. Shehri arranges for Ahmed to see an orthopaedic surgeon Dr Zwad Ali. The next morning Ahmed accompanied by a friend come to see Dr Ali. Dr Ali reviews Ahmed's investigations, takes medical history. and examine him. He discusses with Ahmed the investigations, by saying "...the findings indicate that there are two main structures in your left knee that were damaged. There is a need for a surgical procedure called arthroscopic surgery by which I can look into the inside of your knee through a small tube; fix any damage and reconstruct your knee." Ahmed and his friend ask Dr Ali a number of questions about the surgical procedure and Dr Ali answers their questions.

The next morning, Ahmed undergoes left knee arthroscopic surgery under general anesthesia. Dr Zwad finds a tear of the medial meniscus. He washes out the joint from debris, perform meniscectomy, and reconstruct the left knee joint.

Discussion Questions

- Are there any terms that you do not understand?
- Summarise the key information that you have obtained from this progress.
- Use the results of these investigations to refine your hypothesis.
- What are the further management options needed for Ahmed after surgery?

Please Read the Closure

Case Closure

Ahmed is placed in a limited motion knee brace for two weeks. He is encouraged on the second day after surgery to do weight-bearing activities. He is referred for physiotherapy to reduce the swelling around the left knee. He is also placed on a lengthy rehabilitation program to restore the strength of his quadriceps and hamstring muscles. The doctor from the Rehabilitation Unit explains to Ahmed, " rehabilitation varies depending on the injury, the type of surgery, your orthopedic surgeon's recommendations, health status, and activities. The time period of rehabilitation also varies, but meniscus surgery is usually followed by a period of rest, walking, and selected exercises.

Case Closure (Continue)

Most people who have arthroscopic meniscectomy, like in your case, can return to full activity within 2 to 4 weeks. The time schedule to return to walking, driving, and doing more vigorous activities will depend on the type and extent of the surgery and your success in rehab. It is difficult at this stage to predict whether you will be able to play football again or not. You have to work hard with us on achieving the targeted goals as explained in your rehabilitation program . Our team will also train you during your hospital stay on a number of exercises that you can do at home, with Dr Ali's approval.

Case Closure (continue):

Over the next few days the swelling and pain decreases and Ahmed feels much better. He continues working on his rehabilitation program hoping to return again to the playground.

Facilitator's note:

In the last 10 minutes of this tutorial, you should encourage your group to discuss how would they work better as a group. What are the things they need to change and what are the things they need to improve? This discussion is very useful and will help the group to function better as they work on the next PBL case.