CASE TWO

Short case number: 3_19_2
Category: Musculoskeletal System & Skin
Discipline: Orthopaedics
Setting: Emergency department_rural
Topic: Joint Pain & Swelling_infection [SDL]

Case

You are an intern in the emergency department in Broken Hill.
Ricky Eggerton is a 5-year-old boy who is a keen AFL player. He presents with a 1-day history of increasing pain and swelling in his left knee. He refuses to walk and is miserable. His mother informs you that he has had a temperature for 2 days and he has not been his usual active self since yesterday.

Questions

1. What are the key features of history in your assessment of Ricky?
2. What the key components of the physical examination?
3. You are concerned that Ricky has septic arthritis, how would you distinguish this diagnosis from osteomyelitis, acute haemarthrosis and transient synovitis clinically?
4. Ricky's mother is very concerned that he has an infection in his knee and asks how bacteria can get into a knee joint, outline your explanation and detail the micro-organisms that may cause septic arthritis.
5. Outline your plan of investigations and explain how the results assist in making a diagnosis.
6. Demonstrate your understanding of the anatomy of the knee joint in explaining the process of joint aspiration to the ED registrar.
7. Ricky's mother asks if the infection could damage his knee, explain the possible complications of septic arthritis.
8. The ED registrar asks you to outline your management plan for septic arthritis.

Suggested reading:

- Solomon L, Warwick DJ, Nayagam S. Apley's Concise System of Orthopaedics and Fractures. 3rd edition. Danvers: CRC Press; 2005.
- Kumar P, Clark ML, editors. Kumar & Clark's Clinical Medicine. 8th edition. Edinburgh: Saunders Elsevier; 2012.
- John L Brusch, MD, FACP; Chief Editor: Michael Stuart Bronze, MD. Septic Arthritis http://emedicine.medscape.com/article/236299-overview
- Knee aspiration http://orthosports.com.sg/tips-for-general-practitioners/knee-aspiration/

ANSWERS

Tutor Note – raise the fact that Ricky is an aboriginal child, how would you know this or find it out...we specifically did not state that he is aboriginal because patients do not always identify. When considering the differential diagnoses the students need to consider that Aboriginal children have a higher incidence of vaccine preventable infections e.g. HiB and also have higher prevalence of rheumatic disease.

Question 1

What are the key features of history in your assessment of Ricky?

- History of presenting symptom
  - Trigger for knee pain (injury at soccer, fall, trauma, twisting)
  - Pain, swelling, redness of knee
  - Time course/progression of symptoms
  - Previous symptoms
  - Previous injury to the knee
  - Cuts/scratches/bruises
  - Fever (measurements e.g. oral/recta/axillary) and treatment
  - Cough/corzyal symptoms/flu like symptoms
  - Diarrhoea or vomiting
  - Rash
  - Lethargy/decreased LOC
  - Reason for not walking - ?Limp, fatigue etc
- Past medical History
- Medications
- Allergies
- Social History

Question 2

What the key components of the physical examination?

- General Appearance
  - Positioning of child
  - Colour
  - Distress
  - Level of consciousness
  - Rash
- Vital signs
  - Fever
  - Heart rate
  - Blood pressure
  - Capillary return
- Examination of the knee
  - Swelling
  - Range of motion

        - Position held in by child
        - Erythema – rarely in septic arthritis
        - Special tests for ligaments
        - Tests for knee effusion (bulge sign etc) – effusion obvious if septic
    - Systems review
        - Chest
        - ENT
        - Abdominal exam
        - Skin changes

Question 3
You are concerned that Ricky has septic arthritis, how would you distinguish this diagnosis from osteomyelitis, acute haemarthrosis and transient synovitis clinically?

Septic Arthritis

Local features include:

- Overlying skin is red and warm
- Swollen, painful joint
- Pain on movement - movements are always diminished and often absent if the joint is rigid due to pain and spasm
- General features include

- Tachycardia and swinging pyrexia.
- May present as irritability in children
- More than one joint may be involved

Osteomyelitis

The patient usually presents with pain, malaise and a fever and in neglected cases toxaemia may be marked. Sometimes a history of preceding skin lesion, an injury or sore throat may be obtained, the limb is held still and there is acute tenderness near the largest joint. Even gentle manipulation is painful and joint movement is restricted. Local bone tenderness, swelling, warmth and oedema are later signs and signify the presence of pus.

Acute Haemarthrosis

Usually follows an injury of a joint and presents with a swollen and tense joint. The patient resists any attempt in moving it.

Transient Synovitis

Transient synovitis, or Irritable hip, is a common disorder of childhood which presents with the acute onset of hip pain and a limp that gradually resolves.

The history is one of an acute onset of hip pain and a limp, followed by knee pain and inability to weight bear. Boys are affected more often than girls by about 2:1. The mean age at presentation is about 6 years with a range from two to twelve years. Both hips are affected equally but it is rare for more than one hip to be involved.

On examination, the affected leg tends to be held in the position of greatest ease, typically, one of flexion, abduction and slight external rotation. The child is otherwise well. Symptoms usually persist for 1-2 weeks then resolve spontaneously. Months may elapse between episodes.

Question 4

Ricky's mother is very concerned that he has an infection in his knee and asks how bacteria can get into a knee joint, outline your explanation and detail the micro-organisms that may cause septic arthritis.

Aetiology

In all age groups, the most common infecting organism for septic arthritis is *Staphylococcus aureus*. Other common pathogens include *Streptococcus* species, *Pseudomonas aeruginosa,* pneumococci, *Neisseria meningitidis* (with or without an associated meningitis), *Escherichia coli, Klebsiella* species, and *Enterobacter* species. Newborns can acquire *Neisseria gonorrhoeae* from an infected birth canal. Gonococcal arthritis is more common in sexually active teenagers, and it may be seen in younger children in association with sexual abuse.[1]

A neonate aged 5 weeks or younger is susceptible to infection as a result of a wide range of organisms that are unlikely pathogens in children with more developed immune systems. *S aureus* is still the most common pathogen in this age group; group B streptococcus is the next most common pathogen. Gram-negative organisms may be seen in as many as 15% of joint infections affecting neonates in a neonatal intensive care setting.[2] *Candida albicans* may also be present in these patients, as well as in patients who have received prolonged antibiotic therapy.

Pathogenesis

Although it is uncommon, a penetrating wound may result in septic arthritis. It also may develop by contiguous spread from an adjacent cellulitis. Most commonly, however, the pathogenesis of septic arthritis is hematogenous. Transient episodic bacteraemia is common, even in healthy individuals. It may occur with something as simple as tooth brushing. In almost all cases, the body's defence mechanisms rapidly eliminate the threat; occasionally, bone or joint infection may result.

Hematogenous septic arthritis may develop directly through the synovial blood vessels. Another common route is from an adjacent hematogenous metaphyseal osteomyelitis. Just under the metaphyseal side of the growth plate in a growing child, vascular loops nourish the bone that forms in association with enchondral ossification. Blood flow in these loops is thought to be relatively slow, and this region is somewhat poorly defended by the reticuloendothelial system. These loops form the site of origin for hematogenous osteomyelitis in infancy and childhood.

Whatever the mechanism, once bacteria enter the joint; the space effectively becomes a closed abscess. A variety of enzymes capable of degrading articular cartilage are released by leukocytes

and by certain bacteria, such as *S aureus* and some gram-negative organisms. Significant articular damage can occur in as little as 8 hours. Increased pressure within the joint can interrupt the blood supply to the epiphysis, causing bone destruction and loss of the adjacent growth plate. If the infection remains untreated, the ligaments of the capsule will be destroyed and the joint may dislocate. For example, the extreme result in a septic hip would be complete destruction of the femoral head, dislocation of the proximal femur from the acetabulum, and loss of 30% of all future growth of the affected femur.

Question 5
Outline your plan of investigations and explain how the results assist in making a diagnosis.

Important investigations in infective arthritis include:

- Blood cultures
- Full blood count for leucocytosis
- Erythrocyte sedimentation rate
- C-reactive protein
- Aspiration of synovial fluid - usually purulent with a neutrophil count above 50,000 per mm3, and low glucose concentration
- Anti-streptolysin O titre

Patients with suspected septic arthritis should be referred urgently and immediately for hospital specialist review

Question 6
Demonstrate your understanding of the anatomy of the knee joint in explaining the process of joint aspiration to the ED registrar.

<u>Equipment</u>

• Use a 20 mL syringe and a 21-Gauge needle.
• A small amount of Lignocaine can be used to make the procedure more comfortable for the patient. Generally, 2mg per kg bodyweight provides adequate analgesia within safe limits for an average adult.
• Aseptic techniques should be strictly adhered to.
• Sterile containers for culture and crystal cytology

Location

The most important landmark for aspirating the knee is the lateral edge of the patella.

1. Start off by identifying the superior pole and lateral edge of the patella (Figure 1)

2. Identify the soft spot approximately 1 cm below the lateral edge of the patella. This is the landmark for aspirating the knee (Figure 2).

3. Lightly hold the patella between the thumb and index finger. The needle should be introduced into the soft spot just under the patella. (Figure 3)

Figure 3

4. There should be no resistance to flow and the patient should be comfortable throughout the procedure. Occasionally the needle may need to be withdrawn or angled slightly to maximize extraction of the effusion or blood.
Frank blood is aspirated from this patient's knee suggesting the likelihood of an Anterior Cruciate Ligament tear. (Figure 4).

Post op advice for patients

Avoid strenuous activity for the following 24 hours.

Contraindications

• Skin abrasions or infections (cellulitis).
• Known allergy to local anesthetics.

Question 7
Ricky's mother asks if the infection could damage Ricky's knee, explain the possible complications of septic arthritis.

- Dislocation – a tense effusion may cause dislocation of a joint.
- Epiphyseal destruction. In neglected infants, the largely cartilaginous epiphysis may be destroyed, leaving unstable psudeoarthrosis.
- Growth disturbance. Physeal damage may result in shortening or deformity.
- Ankylosis. If articular cartilage is eroded, healing may lead to ankylosis.

Question 8
The ED registrar asks you to outline your management plan for septic arthritis.

Patients with suspected septic arthritis should be referred urgently and immediately for hospital specialist review

Synovial fluid should be obtained - for gram-staining, culture and crystal analysis

Following joint aspiration, empirical IV antibacterial therapy should be commenced - coverage should be for staphylococci and streptococci in adults, and, additionally, Haemophilus in children; the regimen can be modified in the light of culture and sensitivity results. Treatment should be given for several weeks but the optimal duration of therapy is unknown

Where the joint is accessible - needle aspiration should be used to decompress the joint. Surgical drainage is indicated, using either arthroscopy (particularly useful for the knee) or arthrotomy (particularly useful for the shoulder or hip) if aspiration is required more than 3 times per day, or if adjacent soft tissue is affected, or if there is no response to 5 days of aspiration plus antibacterial therapy, or if the joint is difficult to aspirate.