

NON TRAUMATIC MSK PAIN

Facilitators Guide

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Duration **up to 2 hours**

Equipment required **AV to project x-ray images**

OUTLINE (USE THE SECTIONS THAT ARE RELEVANT FOR YOUR LEARNERS)

- Basics (10 Minutes)
- Main session (2x 15 Minutes) case discussions covering the key points and evidence
- Advanced session (2x 20 Minutes) case discussions covering grey areas, diagnostic dilemmas; advanced management and escalation
- Quiz (10 Minutes)
- Infographic sharing (5 Minutes): 5 take home learning points

We also recommend printing/sharing a copy of your local guideline for sharing admission criteria.

PRE READING AND RESOURCES FOR LEARNERS

Expectation is for the learners to have understood the basics before the session.

[Anatomy video](#)

[Assessment tips](#)

If possible or for further resource

[Apophysitis, avulsions, Spondylolysis](#)

[Rheumatology](#)

KEY LEARNINGS OBJECTIVES

- Differential diagnosis of non-traumatic pain
- Diagnoses not to miss
- How to diagnose some of the common causes of non-traumatic MSK pain.
- How to treat these causes
- What diagnosis can cause long term morbidity
- When to seek prompt speciality help.

NON TRAUMATIC MSK PAIN IN CHILDREN: SUMMARY

Non traumatic pain is a common presentation in children and one which has a wide differential. Lower limbs are most commonly involved.

The potential diagnoses range from benign and self-limiting to life and limb threatening.

There is often a history of an innocuous traumatic event which has prompted the attendance for assessment, but this often has little to do with the underlying diagnosis.

Clinicians should have a standardised approach to history and examination of non-traumatic MSK pain to ensure no diagnoses are missed

The underlying cause varies between age groups as children become susceptible to specific conditions as they progress through childhood.

OVERVIEW OF COMMON CAUSES OF ATRAUMATIC MSK PAIN

Diagnosis	Location	Age	History	Exam	X-ray changes
Apophysitis	Any apophysis	F 10-14 M 12-16	Gradual onset Pain worse on activity Eases after rest	Point tenderness over apophysis With or without swelling	Sclerosis and fragmentation
Osteochondrosis	Joints: Commonly elbow/hip/foot	4-18 dependent on site	Gradual onset Pain worse on activity Eases after rest	Mild swelling Stiff and painful joint	Irregular growth of epiphysis Sclerosis Fragmentation
Osteochondritis dissecans	Commonly knee and ankle	>10	Gradual/sudden onset Pain worse on activity Associated Intermittent swelling	Swollen joint in acute phase Tender joint line	Lucency about the cortical surface May be occult
Osteomyelitis	Commonly in areas of high bone turnover such as metaphysis/epiphysis	Any age	Gradual onset Pyrexia	Point tenderness Pyrexia Limp	Soft tissue swelling Local osteopenia Bony lysis or cortical loss Periosteal reaction
Spondylolysis	Lumbar spine	Adolescents	Gradual onset History of repetitive activity involving back extension	Pain on extensions and rotation of lumbar spine	Limited compared to CT Scotty dog sign: oblique view, break in pars interarticularis can have appearance of collar on dog
Avulsion fractures	Anterior knee	Adolescents	Gradual onset Worse on running/jumping and ascending stairs Commonly in young girls	Weak quadriceps Altered tracking of patella Pain on flexion of knee	Normal

Slipped upper femoral epiphysis	Hip/Knee	10-16	Gradual/sudden Limp May be non-weight bearing	Limp Reduced ROM of hip Out toeing Forced external rotation on hip flexion	Displacement of epiphysis from physis.
Inflammatory arthritis	Any joint	Any age	Gradual onset May have multiple joints involved Associated systemic symptoms	Swelling of one or more joints Stiffness Systemic features	Soft tissue swelling Osteopenia Loss of joint space Joint subluxation Irregular growth
Malignancy	Commonly in areas of high bone turnover such as metaphysis/epiphysis	Any age	Gradual onset Systemic symptoms May have pyrexia	May have swelling and tenderness Lethargy Pallor	Bone destruction Irregular borders Wide zone of transition
Septic arthritis	Any joint	Any age	Gradual onset Red hot swollen joint Pyrexia Non weight bearing	Swollen, erythematous painful joint. Pyrexia	Normal in early stages

ASSESSMENT

One of the main priorities in patients presenting with atraumatic MSK pain is to seek out red flag symptoms and signs in order to rule out sinister diagnosis.

Red flag symptoms and signs include:

- Weight loss
- Night sweats
- Pyrexia
- Nocturnal pain
- Non weightbearing
- Rash
- Eye pain

A standardised assessment should be performed depending on the body area/ areas involved. Look for any swelling, bruising, erythema or cellulitis. Determine if there is any point tenderness which may give indicate a possible fracture.

Assess joint function for range of motion (passive / active / resisted), weight bearing status, additional stiffness and stability.

Always ask yourself, is the story really atraumatic?

Has there been any

possibility of non-accidental injury?

INVESTIGATIONS

Some level of investigation is required for each of the potential diagnoses. You may make the diagnosis of apophysitis based on an accurate history and exam alone but even then, one study found that 5% of management plans were altered following baseline x-ray in patients with Sever's disease (apophysitis of the calcaneus).

A low threshold for a baseline x-ray is sensible in all paediatric patients presenting to secondary care with atraumatic MSK pain. They can be helpful to identify bony lesions, signs of osteomyelitis and unexpected fractures.

Inflammatory markers are useful when the patient's presentation is concerning an infective or inflammatory process.

SPECIFIC CONDITIONS THAT MAY BE COVERED FURTHER

Apophysitis:<https://dontforgetthebubbles.com/apophysitis/>

JIA:www.pmmonline.org/doctor/child-with-a-swollen-joint/diagnosis-of-jia

Osteochondrosis: <https://dontforgetthebubbles.com/osteochondrosis/>

Avulsion fractures:<https://dontforgetthebubbles.com/pelvic-avulsion-injuries/>

Osteomyelitis and septic arthritis:

www.rch.org.au/clinicalguide/guideline_index/Osteomyelitis_and_septic_arthritis/

Patellofemoral pain:

<https://pedemmorsels.com/patellofemoral-pain-syndrome-anterior-knee-pain/>

CASE SCENARIO 1

Marie is a 12-year-old girl who presents to you complaining of anterior knee pain. She is an active volleyball player and is trying hard to make her school team. The pain is getting worse over the past month and is now affecting her ability to train. She denies any trauma.

What are your differential diagnoses?

Patello-femoral pain

Apophysitis of tibial tuberosity (Osgood Schlatter disease) or inferior pole of patella (Sinding-Larsen-Johansson)

Osteochondritis dissecans

Arthritis

Malignancy

Osteomyelitis

Hip pathology

What factors in the history and exam would you like to elicit in order to narrow the diagnosis?

Apophysitis has a typical history of gradual onset localised pain in a child from 10-16 years of age. Pain is exacerbated by activity and initially improves with rest. The typical patient is highly active and may be overtraining. Examination will typically reveal point tenderness over the area involved with possibly some mild swelling.

Important factors to exclude are pyrexia, trauma, weight loss and systemic symptoms.

You feel she has apophysitis of her tibial tuberosity.

What is the pathophysiology of apophysitis?

An apophysis is an area of bony growth in children separate to ossification centres. It is the site of tendon or ligament attachment and fuses with the bone as the body matures. Rapid growth and repetitive movements combined with relative bone weakness, cause increased traction forces at the point of tendon attachment. This leads to micro-separation and bone fragmentation which is

known as apophysitis. This clinically presents as an insidious onset focal pain, worsened by activity and eased by rest. There may be point tenderness and swelling on exam.

Can you name any other common sites affected by apophysitis?

Apophysitis commonly affects:

Tibial Tuberosity: Osgood Schlatter disease

Inferior Pole of the Patella: Sinding-Larsen-Johansson disease

Calcaneal Tuberosity: Sever's disease

Medial Condyle of elbow: Little leaguers' elbow

What investigations would you like to perform?

Apophysitis is described as a clinical diagnosis and as such patients do not require any investigations.

Despite this, it is reasonable with the above differentials in mind to perform a baseline x-ray in all patients presenting with possible apophysitis.

This is especially important if the patient presentation or clinical course is atypical. One study found that 5% of management plans were altered following baseline x-ray in patients with Sever's disease.



Knee x-ray of a 12-year-old female volleyball player.

She is presenting with progressive pain over her tibial tuberosity.

Her pain is exacerbated by jumping.

The x-ray shows fragmentation of apophysis with overlying soft tissue swelling.

Some isolated fragmentation can be normal at the tibial tuberosity.

Case courtesy of Dr Hani Salam, Radiopaedia.org, rID: 9740

<https://radiopaedia.org/articles/osgood-schlatter-disease?lang=gb>



Plain ankle radiograph of an 11-year-old male basketball player complaining of heel pain. There is increased density of the calcaneal apophysis, typical for ages between 7 and 14 years. There is loss of fat/soft tissue planes in the region of the [retrocalcaneal bursa](#) in keeping with acute inflammation. This may be seen in

the context of the clinical diagnosis of [Sever's disease](#).

<https://radiopaedia.org/cases/sever-disease-5>

Case courtesy of Dr Dinesh Brand, Radiopaedia.org, rID: 60324

What is your treatment plan?

- There is sparse evidence looking at appropriate type and length of treatment for apophysitis. This has led to guidance on treatment being expert opinion only.
- Traditional treatment plans have involved activity cessation until symptoms free with a gradual return.
- Most of the research that is available focuses on Osgood Schlatter and Severs disease.
- One RCT looking at management of Osgood Schlatter disease looked at the effectiveness of dextrose injections vs steroids injection vs normal therapy. This study showed small benefits of dextrose injections. But this is unlikely to be a sensible treatment plan due to possible adverse effects in a self-limiting condition
- There have been recent developments looking at active treatment pathways. These are moving away from total rest and sport cessation. Instead the aim is to move towards active and monitored treatment plans. Rathleff et al (2020) have a good infographic describing different treatment options for Osgood Schlatter's.
- There is some weak evidence that treatment of Sever's disease with heel raises can improve symptoms when compared to physiotherapy or doing nothing.
- The type of heel raise does not need to be customised, but whatever is comfortable and available to the patient.
- Principles can be adopted to all forms of apophysitis with the main aims of treatment being
 1. Altering current activity to prevent worsening symptoms
 2. Stretching and strengthening programmes as appropriate
 - 3 Cross training
 4. Graduated return to sporting activity
 5. Prevention of recurrence

- Although apophysitis is self-limiting. One study found that up to 40% of patients will continue to suffer from intermittent pain even 2 years after diagnosis. This pain might not necessarily prevent a return to sporting activities.

Exercise programmes

<https://bjsm.bmj.com/pages/wp-content/uploads/sites/17/2019/06/OSD-table.pdf>

Good podcast for extended learning

<https://soundcloud.com/bmjpodcasts/osgood-schlatter-not-the-self-limiting-condition-we-once-thought-episode-384>

CASE SCENARIO 2

Katie is a 9-year-old complaining of left foot pain. The pain has been getting worse over the past month and she is now beginning to develop some stiffness. She is a keen athlete and trains five times per week. She denies any trauma and is systemically well.

What are some of the differential diagnosis?

Stress fracture

Arthritis

Osteochondrosis

Apophysitis

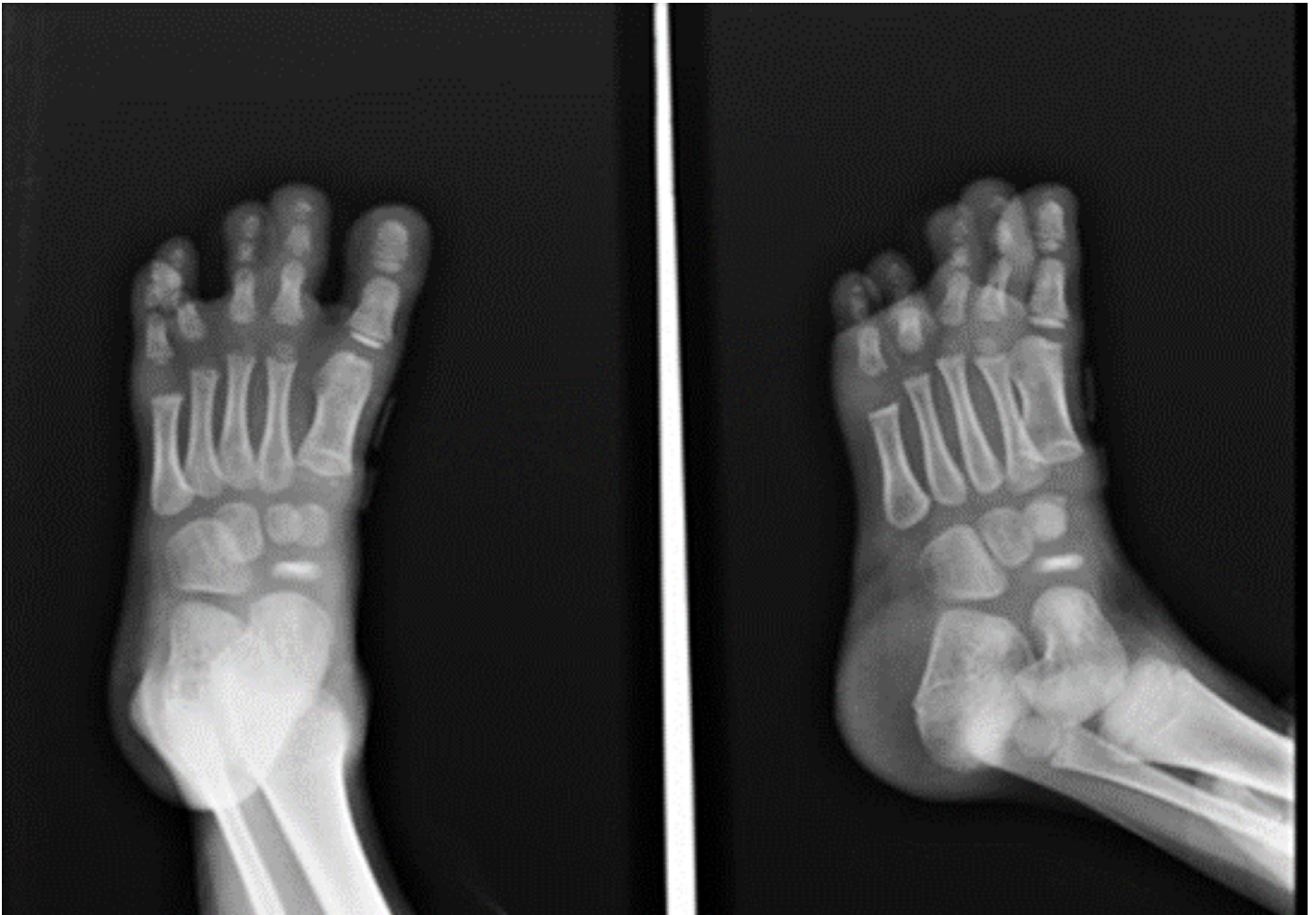
Arthritis

Osteomyelitis

Malignancy

Retained foreign body

You organise an x-ray. What x-ray changes do you see?



Case courtesy of Dr Maulik S Patel, Radiopaedia.org. From the case rID: 18657
Flattening and sclerosis of the navicular bone. Mild soft tissue swelling.
No fracture seen.

What is the diagnosis?

Kohler disease: Osteochondrosis of the navicular bone.

Typical x-ray Findings of osteochondrosis:

Early: Potentially normal

Initial radiological findings

- Irregular epiphyseal growth
- Flattening of the epiphysis
- Soft tissue swelling

Radiological findings as disease progresses

- Sclerosis
- Fragmentation
- Joint destruction

What is the pathophysiology of osteochondrosis?

Osteochondrosis

- Osteochondrosis is often described as idiopathic osteonecrosis.
- It is a disorder of bone growth primarily involving the ossification centres at the epiphysis.
- It leads to altered bone and cartilage formation beyond the growth plate.
- There are some links showing genetic factors and high activity levels can increase a person's risk of developing osteochondrosis.
- You should always ensure the osteonecrosis is not from a secondary cause such as sickle cell disease or leukaemia!!!

Can you name any other anatomical sites that can be affected by osteochondrosis?

Common Location	Eponymous name	Age of onset
Femoral head	Legg-Calve-Perthes (Perthes)	4-8
Capitellum	Panner	10-16
Navicular	Kohler	4-10
Head of metatarsals (2nd most commonly)	Freiberg	13-18

What is your treatment plan for this patient?

Treatment in this case will involve activity modification. This will entail reduced overall activity but and specifically avoiding activity which stresses the foot. Immobilisation in a walking boot may be beneficial if there is significant pain or inability to weight bear comfortably.

- Osteochondrosis is self-limiting and the bone will eventually revascularise.
- The goal of therapy is to facilitate maximal revascularisation while minimising long term affects.

Three broad treatment strategies exist for osteochondrosis

Conservative: This will involve modified activity to ensure no further stress is placed on the area involved. A physio programme can help to strengthen the area and improve joint function. This approach is suitable for patients with minimal symptoms and early changes of disease progression on x-ray.

Immobilisation: Immobilisation can be beneficial for patients with significant pain or more advanced changes on x-ray.

This may be in the form of a cast, walking boot or splint depending on the area involved. This needs to be weighed up against the risk of worsening joint stiffness.

Surgery: It is very rare, if ever, that patients will require surgery.

When used it is only in advanced stages of disease and when appropriate conservative management has proved ineffective.

Surgical options include osteotomy, arthroplasty and physeal drilling.

ADVANCED DISCUSSION (20 MINS PER CASE)

This is an opportunity to cover grey areas, diagnostic dilemmas and advanced management and escalation if there are more experienced trainees or senior registrars in your group.

ADVANCED CASE SCENARIO 1

A 15-year-old girl attends with intermittent pain and swelling to her left knee for the past two months. She is a keen soccer player but pain on the medial aspect of her knee is affecting her ability to run. She complains that after every game her knee swells and is now taking increasingly longer to subside. On exam she is walking with a limp, her knee is swollen and she has pain to the medial joint line. Her knee feels stable with all ligaments intact on testing.

You decide to do an x-ray:



Case courtesy of Dr Gagandeep Singh:

<https://radiopaedia.org>

From the case

<https://radiopaedia.org/cases/8883>

Describe the x-ray findings.

Largely normal knee x-ray. Subtle lucency to chondral surface of medial femoral condyle. Findings consistent with osteochondritis dissecans.

- Osteochondritis Dissecans is a focal injury disruption of articular cartilage and subchondral bone.
- It is largely idiopathic, but some theoretical causes are genetics, trauma or vascular phenomenon.
- There is a juvenile and adult form. The juvenile version is most common and present in patients between 10 and 16 with open physis.
- The knee is the most common joint involved with >70% of knee lesions being in the posterolateral aspect of the medial femoral condyle. The ankle and elbow are other joints that are regularly affected.

Presentation depends on the stage of lesion. Initially nonspecific pain with or without swelling. As the process progresses, patients can develop mechanical symptoms such as reduced range of movement (ROM) and locking of joints.

Are you aware of any grading system used for Osteochondritis dissecans?

Clanton Classification of Osteochondritis (Clanton and DeLee)

Type I	Depressed osteochondral fracture
Type II	Fragment attached by osseous bridge
Type III	Detached non-displaced fragment
Type IV	Displaced fragment

What would you like to do with the above patient?

Further investigations? Treatment? Specialist opinion?

- Bilateral x-rays should be obtained as up to 30% of patients can have bilateral lesions.
- An additional notch view x-ray can help to get a better image of the femoral intercondylar spaces. This is taken with the patient supine and knee flexed to 40 degrees.
- MRI is widely used in patients with high suspicion for osteochondritis dissecans or to assess stability of a lesion diagnosed on X-ray.
- MRI has superior capabilities for assessing stability of cartilage and subchondral bone when compared to standard radiographs.
- Arthroscopy is the gold standard for assessing stability and may be used if questions remain following MRI

Treatment:

- There is a lack of consensus on appropriate type and length of treatment.
- The latest American Academy of Orthopaedic surgeons' guidelines were unable to recommend any conservative treatment regime.
- [Masquijo and Kothari \(2019\)](#) illustrate their preferred treatment algorithm in a flowchart
- Modern protocols recommend patients should have a three to 6 months trial of conservative management.
- Conservative management involves
 - o Immobilisation phase with minimal weight bearing followed by
 - o A phase of partial weightbearing and
 - o Lastly a gradual supervised return to activity.

Favourable prognostic factors are:

- Younger age
- Open distal femoral physis

Poor prognostic factors include

- Lesions involving the patella
- Sclerosis on x-ray

Approximately 50-75% of lesions will heal in 6-12 months following conservative management.

Conservative management is not suitable for displaced or loose fragments.

Surgical treatment

- Surgical treatment is preserved for large or unstable lesions, displaced fragments and those not responding to conservative therapy
- Three broad surgical options
 - o Stimulate growth by retroarticular drilling,
 - o Reducing and fixing displaced fragments
 - o Osteochondral grafts.

Drilling and fixation are usually successful surgical options with minimal complications. Up to 90% of patients can expect radiographic resolution of lesions. Unfortunately, grafts are usually seen as salvaging surgeries and outcomes can be variable.

ADVANCED CASE SCENARIO 2

Judith is a 10-year-old girl who is attending with pain and stiffness to bilateral wrists with intermittent swelling to fingers. She has no history of trauma. You think she may have arthritis.

What will you want to decipher during your history and exam?

Length of symptoms: This is important as JIA can only be diagnosed once the patient has had symptoms for over 6 weeks without any other cause found.

Effect on activities: Has the patient stopped playing a sport they previously enjoyed. Is the patient regressing at physical activity or schoolwork such as handwriting?

Pattern of symptoms: Important to elicit if any stiffness or worsening of symptoms in the morning. Ask about symptoms associated with malignancy such as leukaemia.

Illicit any associated symptoms which may help discover a cause such as multisystem condition (Lupus/Vasculitis/psoriasis) or a reactive arthritis from a satellite infection (UTI/STI)

You should also enquire about symptoms which may indicate complications such as eye pain caused by uveitis or tendon pain caused by enthesitis.

Pattern of joint involvement.

Monoarthropathy: Single joint. Can still be JIA but infection, trauma and malignancy would be higher on your list and need to be consciously out ruled.

Oligoarthritis: Four or fewer joints involved

Polyarthritis: Over four joints involved.

Typical patterns include:

- Asymmetric, small and large joints and distal interphalangeal joint involvement is typical of psoriatic arthritis.
- Symmetric, small and large joints is typical of polyarticular JIA.
- Hip involvement and enthesitis is typical of Enthesitis-Related Arthritis.
- Large joint and intermittent / flitting involvement is typical of acute rheumatic fever.
- Fever, rash and serositis and later symmetrical involvement of small and large joints (including distal small joints of the hands, ankle or wrist involvement) are typical of systemic JIA.

Examination:

- Trauma: Bruising, wound, bleeding, deformity.
- Infection: Guarding joint and refusing to move/weight bear. Hot red and swollen. Temperature
- Malignancy: Secondary signs of anaemia, thrombocytopenia. Cachexia in advanced stages. Unusual swelling i.e. not involving a joint and not in an area typically injured.
- Rashes: look for signs of psoriasis, vasculitis rashes, rheumatological rashes as seen in lupus, skin changes produced by Kawasaki.
- Joints: As previously mentioned look for patterns of swelling, record joints involved, assess range of motion and function of joints.
- Review of systems: Assess for any other signs of systemic disease, distant infection or complications which may give you a clue to the aetiology of the arthropathy.

Our patient has bilateral wrist, metacarpophalangeal and proximal interphalangeal joints involvement. She complains of some morning stiffness but denies any previous medical problems. She cannot remember any trauma and has not had any temperatures or rashes.

What are your differentials?

The most likely diagnosis is JIA but there are also some other reasonable differentials.

Psoriatic arthritis

Post viral arthritis

Rheumatic fever

Malignancy

Metabolic disease (rickets/osteomalacia)

You think this patient has Juvenile idiopathic arthritis what is JIA?

JIA comprises a group of inflammatory disorders that begins before the 18th birthday and persists for at least 6 weeks and other known conditions are excluded.

There are six main disorders of JIA with their own individual diagnostic criteria

- Systemic JIA
- RF-Positive JIA
- Enthesitis/Spondylitis-related JIA
- Early onset ANA positive JIA
- Other JIA: does not meet

For further background on the individual criteria.

<http://www.jrheum.org/content/46/2/190>

What investigations will help with this diagnosis?

No blood or radiological test can definitively make a diagnosis of JIA.

The diagnosis is based on careful clinical assessment, exclusion of other possible causes and aided by blood and radiology.

pGALS screen has the benefit of quickly assessing all joints. pGALS is a standardised musculoskeletal (MSK) basic examination. Free educational resources to demonstrate pGALS are available online. www.pmmonline.org.

- CRP and ESR give an indication of total body inflammation. But you cannot rule out the diagnosis if inflammatory markers are normal. These markers are more useful in disease monitoring.

- Antinuclear antibodies (ANA) are positive in roughly 50% of oligoarticular JIA, however positive ANA can be seen in healthy children also. A positive ANA can indicate a higher risk of uveitis once JIA is diagnosed.

- HLA-B27 is positive in 27% of patients with JIA and up to 80% of patients with enthesitis related arthropathy.

- Rheumatoid factor can help with diagnosis of RF-positive JIA. It also provides a worse prognosis if positive.

- Radiographs are useful for investigating alternative causes. They rarely show any changes in the early stages of arthropathy but are important to get a baseline condition of the joints.

What is your chosen treatment for JIA?

QUIZ QUESTIONS:

Question 1.

Which of these conditions and age of onset do not match

A - Apophysitis	10-14 F 12-16 M
B - Osteochondrosis	12-18
C - SUFE	10-16
D - Osteochondritis dissecans	>10
E - Septic arthritis	Any age

Answer:

B: Osteochondrosis, the usual age of onset is anywhere between 4 and 18. There have even been some Kohler diseases documented as young as 3.

Question 2.

Which of these anatomical areas do you not commonly see apophysitis

A - Capitellum	D - Medial condyle of elbow
B - Inferior pole of Patella	E - Calcaneal tuberosity
C - Tibial tuberosity	

Answer:

A :Capitellum. Apophysitis only occurs at site of apophysis formation.

Question 3.

Which of these statements about osteochondritis dissecans is not true

- A - Osteochondritis is a focal disruption of articular cartilage and subchondral bone
- B - Most commonly seen on the medial femoral condyle
- C - The aetiology is largely unknown
- D - Recovery can take 6-12 months
- E - A closed physis is a good prognostic factor

Answer:

E : An open physis is seen as a good prognostic factor

Question 4.

Which of these is not a radiological finding of osteochondrosis

- A - Sclerosis
- B - Fragmentation
- C - Flattening of epiphysis
- D - Lytic lesion
- E - Irregular epiphyseal growth

Answer:

D :Lytic lesions. There may be no radiographic changes in the initial stages of osteochondrosis.

You will then begin to see epiphyseal changes, soft tissue swelling, fragmentation and sclerosis.

Lytic lesions would help point you towards another possible differential diagnosis depending on its location and characteristics. Lesions can be caused by infections, malignancy or simple cysts.

Question 5.

Which one of these is in the group of inflammatory disorders comprising JIA

A - Early onset ANA-positive

D - Systemic

B - RF-positive

E - Enthesitis related

C - Psoriatic

Answer:

C : Psoriatic arthritis is an alternative diagnosis to JIA and is not one of its subgroups.

Take home

- 1 A Focused history and exam are essential for all patients with atraumatic MSK pain.
- 2 Do not be fooled by an innocuous traumatic event. Patient's tend to only think injuries can cause limb pain and will try hard to associate their pain with an event.
- 3 Important differentials to consider are infection, malignancy and systemic disease.
- 4 Apophysitis and Osteochondrosis are self-limiting processes but require prompt diagnosis and treatment to prevent morbidity.
- 5 Baseline x-ray is useful in all patients to investigate potential diagnosis and to assess the stage of disease.
- 6 Osteochondritis dissecans can be subtle and require long and careful rehabilitation.
- 7 JIA should be considered in patients with joint symptoms for over 6 weeks and no other cause. Normal bloods and radiographs do not rule out JIA. A Prompt referral to rheumatology for treatment consideration is advised.

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