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MCQs – Adult Pathology – Single Best Answer

1. Which of the following investigations is the most specific scanning method to detect infection in a total joint replacement?

Answer: b. A combination of white blood cell scan and a Technetium bone scan

There is no single pre-operative investigation that can reliably diagnose a prosthetic joint infection. Diagnosis is reliant on a thorough history and clinical examination. This can be followed by plain radiographs, blood tests, aspiration of the joint and the use of specialised imaging. In 2010, a working group from the American Academy of Orthopaedic Surgeons released a guideline and evidence report,¹ which gave recommendations for the management of prosthetic joint infections. One of the recommendations was that 'nuclear imaging is an option in patients in whom diagnosis of peri-prosthetic joint infection has not been established and are not scheduled for re-operation.' A combination of white blood cell scan and a Technetium bone scan is the most specific scanning method.

2. What proportion of patients will develop significant back or ipsilateral knee pain 25 years after arthrodesis of their hip?

Answer: d. 60%

Callaghan et al² performed a retrospective study into the long-term outcomes of twenty-eight patients following hip arthrodesis. About 60% of the patients had pain in the ipsilateral knee, with an average time to onset of 23 years. A similar percentage had back pain. Pain in the contralateral hip occurred in approximately 25%.

3. With reference to 'pulled elbow' injury in children, which of the following statements is true?

Answer: c. Recurrence is seen in 5% of cases

Subluxation of the head of radius from the annular ligament is a common elbow injury. It is most common amongst young children, prior to the age of six. It results from traction on the hand with

the elbow extended and the forearm pronated. The annular ligament either tears or slips over the radial head.

After reduction, the elbow joint capsule remains stretched for a few months. Studies have reported recurrence rates up to 5%.

4. During fracture healing, differentiation of the progenitor cells depends on local oxygen tension and strain. Based on this theory, the following promotes formation of woven bone during fracture healing:

Answer: b. Low strain and high oxygen tension

The manner in which mechanical factors influence fracture healing is explained by Perrin's strain theory. Strain is the deformation of a material when a given force is applied. It is the change in length in comparison to original length after a given load has been applied. It is expressed as a percentage. Granulation tissue has a strain tolerance of 100%, whereas bone has a normal strain tolerance of 2%. Bony bridging between the distal and proximal callus can only occur when local strain is less than the forming woven bone can tolerate. A low amount of strain is therefore ideal. Hard callus will not form if movement is too great. Experimental studies have elucidated that an environment with a high oxygen tension is beneficial for osteogenic progenitor cell differentiation.³

5. Which of the following statements regarding the effects of glucocorticoids on bone mineral metabolism is false?

Answer: a. Supraphysiologic glucocorticoid levels do not cause secondary hyperparathyroidism

Glucocorticoid excess can lead to osteoporosis. Glucocorticoids decrease intestinal calcium absorption and decrease renal tubular calcium reabsorption. This in turn raises urinary calcium levels. Diminished calcium absorption and increase of its excretion can lead to secondary hyperparathyroidism.⁴

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Vivas

Adult Pathology

A 32-year-old woman presents with a history of pain and occasional clicking in her right hip. She gives a history of a skiing injury to her right groin seven months earlier. This is her radiograph (Fig. 1).

1. Describe the abnormality on the radiograph in this patient with hip pain.

Answer: The radiograph shows evidence of mild dysplasia with a reduced lateral centre-edge angle of Wiberg and an abnormal femoral head extrusion index. Asphericity of the right femoral head/neck junction consistent with cam type



Fig. 1

femoroacetabular impingement is also noted.

2. Describe the various angles that can be measured to document hip morphology.

Answer: A number of angles can be measured around the hip to help establish pathology.

i) Acetabular inclination (Tönnis angle) – This is the angle between two lines: (a) a line from the most inferior point of the acetabular sourcil to the lateral margin of the acetabular sourcil (b) a horizontal line running through the most inferior part of the sourcil. This latter line is parallel to the transverse pelvic axes that can be determined by a line connecting the base of both acetabular teardrops. A normal Tönnis angle is between 0 and 10°. A decreased Tönnis angle can lead to pincer form of FAI and an increased Tönnis angle can indicate structural instability.

ii) Sharp's angle – This acetabular angle is created by measuring the intersection between the following two lines: (a) a horizontal line from the inferior aspect of one teardrop to the other and (b) a line from the inferior aspect of the teardrop to the superolateral margin of the acetabulum. A normal angle is between 33° and 38°. Higher angles, especially those above 47°, suggest dysplasia.

iii) Lateral centre-edge angle of Wiberg – This assesses the superolateral coverage of the femoral head. It is obtained by calculating the angle between two lines: (a) a vertical line through the centre of the femoral head (perpendicular to the transverse pelvic axis), and (b) a line from the centre of the femoral head to the superolateral margin of the acetabular sourcil. Values of less than 20° indicate dysplasia and values above 40° may notify pincer FAI.

iv) Anterior centre edge angle of Lequesne – This is measured on the false profile view. It is the angle between two lines: (a) a vertical line through the centre of the femoral head and (b) a line from the centre of the femoral head to the most anterior point of the acetabulum. It is a measure of anterior coverage of the femoral head. An angle less than 20° is suggestive of instability.

3. What further investigations should be performed to investigate the hip pain?

Answer: A cross-table lateral and an MRI of the right hip should be performed to investigate the cause of the hip pain. The MRI scan can detect chondral / labral pathology and extracapsular abnormalities that may be causative.

4. What are the surgical options for management?

Answer: Surgical options include a diagnostic hip injection with EUA to confirm the intra-articular origin of pain if in doubt, arthroscopic hip surgery (manage chondro-labral pathology and excision of a cam impingement lesion). Another option is open hip surgery +/- dislocation of the head / periarticular osteotomy.

5. What are the classification systems for more severe cases?

Answer: The Crowe classification of hip dysplasia is based on the extent of proximal migration of the femoral head:

- i) less than 50% subluxation
- ii) 50 to 75%
- iii) 75 to 100%
- iv) greater than 100% subluxation

Trauma

A 70-year-old man fell on his arm while working in his garden and presented to A&E with the following injury (Figs 2a and 2b).

1. Describe the findings on the radiographs.

Answer: There is a comminuted fracture of the midshaft of the right humerus. There is medial translation of the distal fragment and the bone appears osteolytic, particularly at the fracture site. There are also significant osteoarthritic changes at the glenohumeral joint.

2. What else would you like to know about the pre-injury status of the patient?



Fig. 2a



Fig. 2b

Answer: I would be concerned about a pathological fracture, possibly due to secondary metastases from a tumour, and thus would like to know about any constitutional symptoms (weight loss, fever etc) as well as any specific symptoms relating to any possible malignancy if such a diagnosis had not been made previously. I would also like to know about shoulder pain and function prior to the injury in view of significant glenohumeral OA.

3. What are the principles of management of such an injury?

Answer: Obtaining length, alignment and rotational alignment, and relative stability of the fracture with concomitant treatment of the shoulder pathology would be the main principles behind the management of this injury. A long stem hemi-arthroplasty or a shoulder replacement should be considered.

4. What are the pitfalls of the proposed modalities of treatment?

Answer: Pitfalls of

- i. Non-operative treatment – non-union
- ii. Intramedullary nailing – obtaining access to perform the nailing with high risk of iatrogenic causing a proximal humeral fracture
- iii. Plate fixation – shoulder pathology will be left untreated

5. What are the absolute indications for operative treatment in such an injury?

Answer: Open fracture and vascular injury are absolute indications. Nerve injury may be a relative indication for surgical management.⁵

Hands

A 32-year-old electrician presents to the clinic with a history of pain in his elbow, which is radiating down his forearm. He does not give any history of trauma but complains of occasional numbness and tingling in his forearm.

1. What is your differential diagnosis?

Answer: Local - Ulnar nerve entrapment in the cubital tunnel

- Lateral / medial epicondylitis
- Radial / median nerve entrapment at the elbow
- Elbow arthropathy
- Brachial plexus lesion (Pancoast lung tumour)
- Cervical radiculopathy

Systemic - Peripheral Neuropathy

- Mononeuritis multiplex
- Multiple Sclerosis
- Leprosy
- Lyme Disease

2. How will you confirm your diagnosis clinically?

Answer: History – do symptoms come on at night, does patient sleep with elbows bent (ulnar nerve compression). Is the pain affected by movement?

Examination – evidence of claw hand, looking for evidence of ulnar nerve dysfunction (weakness of small muscles of hand, Froment's sign). Sensory deficit in ulnar 1.5 fingers. Tapping over nerve in cubital tunnel may re-create symptoms. Also assess elbow range of movement and look for tenderness over epicondyles to rule out other pathology.

3. What are the common sites of entrapment of the ulnar nerve along its course in the upper arm and forearm?

Answer: Cubital tunnel – the ulnar nerve becomes commonly compressed in the cubital tunnel which has the aponeurotic attachment of the two heads of flexor carpi ulnaris (FCU) as a roof with the arcuate (Osborne's) ligament and the floor of the tunnel is formed by the medial collateral ligament. Guyon's canal – pisiform and hamate and roof is the volar carpal and pisiform ligament - both ulnar nerve and artery travel through here.

4. What investigation would you request if any and why?

Answer: Investigation would depend on clinical history and examination. If the patient was experiencing mild discomfort and there were few clinical signs, simple measures such as avoiding aggravating positions of the elbow may help. Nonetheless it would be useful to establish a clear diagnosis and therefore I would obtain nerve conduction studies.

5. How would you treat him at this stage?

Answer: Avoid excessive elbow flexion and any aggravating manoeuvres. Consider elbow splintage, particularly at night. Non-steroidal anti-inflammatories unless otherwise contra-indicated. Further follow up in 3 months.

6. If conservative management fails, what kind of surgical intervention would you perform for this condition?

Answer: Simple decompression of the ulnar nerve (Cubital tunnel decompression)

- i) The incision is 8cm in length and is made over the medial aspect of the elbow. An attempt to identify the medial antebrachial cutaneous nerve is made (often crossing FCU).
- ii) The ulnar nerve is identified and tagged proximally.
- iii) The nerve is followed upward and released at the intermuscular septum
- iv) The aponeurosis of the cubital tunnel and FCU are then incised.
- v) Submuscular or subcutaneous transposition of the ulnar nerve maybe considered prior to closure

7. What is the expected prognosis following surgical intervention?

Answer: Keith & Wollstein⁶ showed that overall 90% of the patients reported improvement in function following cubital tunnel decompression. Complete recovery is less frequent than in carpal tunnel syndrome. Poor prognostic factors include:

- a) Symptoms existing for over one year before surgery
- b) Severe existing atrophy
- c) Alcoholism
- d) Absence of response to electrical stimulation of the nerve

Children's Orthopaedics

Here is the radiograph of an infant who presented with a history of a fall from a chair and inability to move her right arm (Fig. 3a).

1. What is the diagnosis and how would you manage the case?

Answer: The radiograph shows an undisplaced spiral fracture of the humerus. This would be unexpected from the history and raises the suspicion of non-accidental injury.

The child should be referred to the paediatricians and, if further investigations are indicated, these should include a skeletal survey and a bone scan to look for injuries at different times elsewhere.

In this case the chest x-ray showed healing fractures of the ribs (Fig. 3b) and the bone scan (Fig. 3c) showed evidence of activity in several areas, compatible with earlier trauma.



Fig. 3a



Fig. 3b



Fig. 3c

Here is a photograph and radiograph of a child who presented with an unstable right knee and foot deformities (Figs 4a and 4b).



Fig. 4a

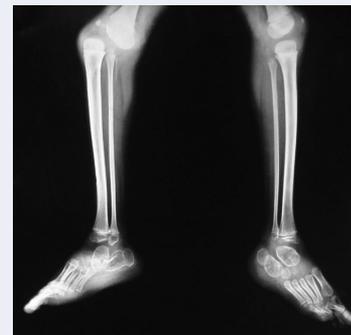


Fig. 4b

2. What is the diagnosis and how would you manage this child?

Answer: The diagnosis is Larsen's syndrome, the orthopaedic features of which are hypermobility with multiple joint dislocations, usually present at birth, and extra bones in the wrist and tarsus. The diagnosis can be confirmed by the double ossification centre of the os calcis, as seen in this case (Fig. 4c)

Function is usually good and most surgeons would not try to

reconstruct the joints, as operative treatment is likely to fail. The child may therefore be helped by knee and foot orthoses. He should also be monitored through growth for spinal deformity, which can be severe with neurological problems.



Fig. 4c

Basic science

1. What is your thromboprophylaxis regime for a 72-year-old man who is scheduled for a total hip replacement?

Answer: For patients undergoing elective hip replacement surgery.

- Start mechanical prophylaxis at admission. Choose any one of the following, based on individual patient factors:
 - anti-embolism stockings
 - foot impulse devices
 - intermittent pneumatic compression devices

Continue mechanical prophylaxis until the patient no longer has significantly reduced mobility or 4 weeks.

- Provided there are no contraindications, start pharmacological prophylaxis after surgery. Choose any one of:
 - dabigatran etexilate
 - fondaparinux sodium
 - low molecular weight heparin (LMWH)
 - rivaroxaban
 - unfractionated heparin (UFH)

Continue pharmacological prophylaxis for 28 to 35 days, according to the summary of product characteristics for the individual agent being used.

2. What is your thromboprophylaxis regime for a 72-year-old man who is scheduled for a total knee replacement?

Answer: For elective knee replacement surgery the same protocol as above should be followed but need only be continued for 10-14 days.

3. What is the evidence for your answers in 1 and 2?

Answer: NICE guidelines – as above⁷

4. Is there a role for routine chemical thromboprophylaxis in patients with ankle fractures? If yes, what is your regime for the same?

Answer: Consider offering pharmacological VTE prophylaxis to patients with lower limb plaster casts after evaluating the risks and benefits based on clinical discussion with the patient. Offer LMWH until lower limb plaster cast removal.

Following ankle fracture surgery LMWH is generally given until the

plaster is removed. For ankle fractures treated non-operatively this is not normally the case.

5. What is the mechanism of action of aspirin, low-molecular-weight heparin and warfarin?

Answer: Aspirin is non-selective and irreversible COX (cyclooxygenase) inhibitor. Normally COX produces prostaglandins, most of which are pro-inflammatory, and thromboxanes, which promote clotting. Low-dose, long-term aspirin use irreversibly blocks the formation of thromboxane A₂ in platelets, producing an inhibitory effect on platelet aggregation.

LMWHs inhibit the coagulation process through binding to antithrombin via a pentasaccharide sequence. This binding leads to a conformational change of antithrombin which accelerates its inhibition of thrombin (factor IIa) and activated factor X (factor Xa). Once dissociated, the LMWH is free to bind to another antithrombin molecule and subsequently inhibit more thrombin.

Warfarin inhibits the vitamin K-dependent synthesis of biologically active forms of the calcium-dependent clotting factors II, VII, IX and X.

6. Do you know of any oral anticoagulant that can be used as a thromboprophylactic agent in joint replacement surgery? What is the mechanism of action of this agent?

Answer: Dabigatran acts by directly inhibiting the enzyme thrombin, the enzyme which converts fibrinogen into insoluble strands of fibrin (part of the clotting cascade).

7. What are the contraindications to the use of chemical thromboprophylaxis in joint replacement surgery?

Answer: Contraindications to chemical thromboprophylaxis include;

- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with international normalised ratio [INR] higher than 2)
- Lumbar puncture/epidural/spinal anaesthesia expected within the next 12 hours
- Lumbar puncture/epidural/spinal anaesthesia within the previous 4 hours
- Acute stroke
- Thrombocytopenia (platelets less than $75 \times 10^9/l$)
- Uncontrolled systolic hypertension (230/120 mmHg or higher)
- Untreated inherited bleeding disorders (such as haemophilia and von Willebrand's disease)

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