

September 2014 • Answers

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MCQs and EMQs

1. The dorsal approach used during fasciotomy for compartment syndrome of the foot involves which one of the following?
Answer: d. There are generally agreed to be nine compartments within the foot (see figure).¹ The dorsal approach for decompression of the foot described utilises a dorsomedial incision (medial to second metatarsal; first/second interosseous, medial and deep central compartments)² and a dorsolateral incision (lateral to fourth metatarsal; third/fourth interosseous, superficial, lateral and central compartments). A single incision technique is described but reported to be challenging to access all nine compartments.
2. Which of the following statements is true regarding the anatomy encountered during the approach to the cervical spine?
Answer: e. The right recurrent laryngeal nerve loops around the subclavian just inferior to the clavicle and then traverses up to the trachea. It can frequently be encountered in the anterior approach to the cervical spine from the right side and is more at risk of injury than the left more predictable course.³ The cricoid cartilage is found at C6, the hyoid cartilage is at C3. The carotid tubercle is at the anterolateral aspect of C6. The trachea and oesophagus are retracted medially, the carotid shaft is lateral to the approach.
3. Which gene is strongly associated with multiple hereditary exostosis?
Answer: b. Multiple hereditary exostosis (also known as diaphyseal aclasia) is an autosomal dominant condition

characterised by multiple osteochondromas. It is associated with mutations within the EXT1, EXT2 and EXT3 genes.

The SHO-X gene mutations are associated with short stature. XP-21 is associated with Duchenne muscular dystrophy (X-linked recessive inheritance). The short stature homobox (SHO) gene can also be found on the Y chromosome. Marfan's syndrome is autosomal dominant, it is associated with a mutation on the long arm of chromosome 15 in gene for fibrillin-1 (FBN-1) mapped to 15q2112.

4. What is the greatest determinant of the pull out strength of pedicle screws?
Answer: a. Pedicle screw fixation has been well investigated. Cement augmentation, tapering of core diameter and wider thread diameter have all been shown to improve pullout strength.⁴ Pedicle screws are not designed to have purchase on the vertebral body cortex due to risk of damage to vascular structures anterior to the vertebral body.
5. In adults, which of the following are criteria for the diagnosis of Systemic Inflammatory Response Syndrome (SIRS)?
Answer: b. Systemic inflammatory response syndrome is classified as two or more of the following:
1. Fever of more than 38°C (100.4°F) or less than 36°C (96.8°F).
2. Heart rate of more than 90 beats per minute.
3. Respiratory rate of more than 20 breaths per minute or arterial carbon dioxide tension (PaCO₂) of less than 32 mm Hg.
4. Abnormal white blood cell count (>12,000/μL).⁵

Vivas

Adult Pathology

A 45-year-old right hand dominant male with a history of rheumatoid arthritis presents with right elbow pain (Fig. 1a and 1b).

On examination, he has painful flexion from 300 to 600. Painless supination to 200 and painless pronation to 200 as well.



Fig. 1a



Fig. 1b

1. What is the functional arc of the elbow?
Answer: 30° to 130°.
2. How do you grade rheumatoid arthritis at the elbow?
Answer: Mayo Clinic Classification of the Rheumatoid Elbow⁶
Grade Description:

I No radiographic abnormalities except periarticular osteopenia with accompanying soft-tissue swelling. Mild to moderate synovitis is generally present.

- II Mild to moderate joint space reduction with minimal or no architectural distortion. Recalcitrant synovitis that cannot be managed with nonsteroidal anti-inflammatory medications alone.
- III Variable reduction in joint space with or without cyst formation. Architectural alteration, such as thinning of the olecranon, or resorption of the trochlea or capitellum. Synovitis is variable and may be quiescent.
- IV Extensive articular damage with loss of subchondral bone and subluxation or ankylosis of the joint. Synovitis may be minimal.

3. This man fails non-operative management. What are his surgical options?
Answer: Arthroscopic debridement and synovectomy. Arthroscopic radial head excision (contraindicated in elbows with pre-existing instability). Open radial head excision. Total elbow replacement.
4. You decide to proceed to total elbow replacement. What approach will you use?

Posterior approach options:
 Triceps-reflecting.
 Triceps-splitting.
 Triceps-reflecting Anconeus Pedicle Flap.
 Paratricipital.

5. (a) What will you do with the radial head? (b) What type of total elbow replacement will you use?

Answer: a) Radial head excision or replacement.
 b) Prosthesis Constrained "sloppy hinge" elbow prostheses allow for a degree of laxity that permits the soft tissues to absorb some of the stresses that would normally be transmitted to the prosthesis-bone interface. Patients with rheumatoid arthritis (RA), results with this type of prosthesis appear to be as good as those obtained with a non-constrained total elbow design > 85% of patients with RA have had good or excellent results with constrained prostheses.

Study:

- 113 semiconstrained total elbow replacements.
- 90% of patients with RA had a satisfactory result at a minimum follow-up of 5 years.⁷
- Recent review of 78 Coonrad-Morrey constrained total elbow replacements, 46 of which were followed for at least ten years.⁸
- 97% of elbows were asymptomatic or minimally painful at final follow-up.
- 86% excellent or good results.
- Authors concluded that patient selection is a very important predictor of clinical outcome and that patients with severe inflammatory disease are the best candidates for total elbow replacement.

Because of the bone loss and soft-tissue involvement in severely involved elbows of rheumatoid patients, a constrained design is the prosthesis of choice for these patients.

Trauma

A 19-year-old presents with a history of a painful left knee after a fall from a height of about five to six feet. The radiographs taken in A&E are shown below (Fig. 2a and 2b).



Fig. 2a



Fig. 2b

1. Describe the radiographs.

Answer: Plain radiograph of the knee demonstrating a tibial eminence fracture with Segond lesion (avulsion fracture on the lateral aspect of the tibia). Segond fractures were described in 1879, the fracture is associated with anterior cruciate ligament (ACL) and meniscal injuries. The fracture is from either avulsion of the medial third of the lateral collateral ligament, insertion of the iliotibial band or oblique attachment to the fibular collateral ligament.

2. What is the diagnosis and how would you classify this fracture?

Answer: This is an avulsion fracture of the ACL. Classified by Meyers and McKeever in 1959:

Type I – undisplaced.

Type II – partially displaced – anterior elevation.

Type IIIa – complete with no contact.

Type IIIb – no contact with rotation.

3. How would you further investigate the patient?

Answer: Appropriate history and clinical examination should be completed. The history suggests a fall from height so other injuries including spinal and pelvic injuries should be excluded. A CT scan will delineate the fracture including degree of displacement. A MRI offers less satisfactory bony visualisation but can be helpful to assess meniscal integrity.⁹

4. How would you manage this injury?

Answer: Multiple surgical techniques have been described. Most studies advocate non-operative management for type I Meyer's and McKeever's fractures and reduction and internal fixation for type II and III fractures. Better long-term results have been reported with arthroscopic surgery compared to open surgery.¹⁰ Arthroscopically assisted fixation is the surgical management of choice in this case. Soft tissue can interpose between the fracture edges increasing risk of mal reduction and non union, direct visualisation reduces this risk. There is no consensus regarding fixation methods screw, wires and sutures have all been described.

5. What are the common complications associated with this injury?

Answer: Complications from this injury include persistent laxity, malunion leading to flexion deformity, nonunion, pain and arthrofibrosis. Early post-operative range of motion exercises have been shown to reduce the incidence of arthrofibrosis.

Hands

A 30-year-old police officer injured his left non-dominant wrist when his motorbike crashed into the back of a car. He was brought in to A&E with a painful swollen wrist.



Fig. 3a



Fig. 3b

1. Please describe the radiographs (Figs 3a and 3b) and how would you classify this injury?

Answer: Anteroposterior and lateral radiographs demonstrating a perilunate dislocation with volar displacement of the lunate and avulsion fracture of the ulnar styloid. This is a Stage IV on Mayfield classification.

Mayfield classification:

Stage I - scapholunate dissociation.

Stage II - + lunocapitate disruption.

Stage II - + lunotriquetral disruption, "perilunate"

Stage IV - Lunate dislocated from lunate fossa (usually volar).

This classification describes the stages of disruption of the lunate found when the wrist is hyperextended, pronated and ulnar deviated.

Initially the radio-scapho-capitate ligament and the scapholunate interosseous ligament rupture, then the capitulunate joint dislocates as the injury progresses through the space of

Poirier. Following this the lunotriquetral interosseous ligament ruptures and finally the lunate becomes dislocated.

Lesser arc injuries refer to purely ligamentous wrist injuries, Greater arc are bony with involvement of the radial styloid and/or scaphoid.

2. What other concerns will you have when examining this patient?

Answer: These are significant soft tissue injuries to the wrist. They have a high association with median nerve injury (up to 25% association).

Compartment syndrome is described – watch for increasing pain on passive movements.

Often high energy mechanisms look for other injuries.

3. What is the immediate management of this patient?

Answer: Immediate management:

ATLS, full secondary survey.

Assessment of left wrist, distal neurovascular status – median nerve injuries are common as the lunate compresses the median nerve in the carpal tunnel. Assessment of skin integrity, if open fracture then antibiotics and tetanus. Skin necrosis can occur due to pressure of the lunate on the skin.

Emergent closed reduction should be performed. In line traction or fingertraps for reduction in A&E with weights applied. If closed reduction fails in the emergency department or there is not appropriate analgesia available the patient should be taken to the operating theatre.

Prolonged dislocation increases swelling to the area and is associated with a higher rate of nerve injuries.

Open reduction can be undertaken via volar or dorsal approaches. Dorsal approach is favoured by many as it provides access to the midcarpal joints so that intrinsic ligaments can be repaired. Incision is centred over listers tubercle. A v-shaped flap is created along the edge of the dorsal intercarpal ligament and the dorsal radiocarpal ligament. This can be satisfactorily closed post fixation. Volar approach is via an extended carpal tunnel approach. The benefit the approach allows fixation of the volar capsule and decompression of the carpal tunnel, however it does not allow the same exposure as found in the dorsal approach. A combined approach can also be undertaken.

Following reduction a backslab or sugar tongs cast should be applied. Careful neurological assessment should be undertaken.

4. Please describe his definitive management plan?

Answer: The definitive management in these injuries is surgical.¹¹ Open reduction if required, ligamentous fixation and stabilisation of fractures. Dorsal or combined volar dorsal approaches. Fixation of radial styloid, triquetrum, lunate and scaphoid fractures. K-wire fixation is still routinely used. Scaphoid fractures are generally fixed with a headless compression screw. Stabilisation of the lunate and reconstruction of the scapholunate ligament, suture anchors and frequently used. Multiple techniques have been described.

Patients should be counselled following this injury that there is a high risk of long-term problems of pain and post-

traumatic arthritis (36%). Carpal instability is often linked with this.

Scapholunate instability and chronic perilunate dislocations can be treated with proximal row carpectomy or total wrist arthrodesis. Both these result in reduced range of movement in the wrist which can be unsatisfactory for the active patient.¹²

Children's Orthopaedics



Fig. 4a



Fig. 4b

1. What type of fracture is this (Figs 4a and 4b)?

Answer: Salter Harris II fracture of the distal tibia and a greenstick fracture of the fibula.

2. What longer-term complication should you forewarn the parents about?

Answer: Premature physeal closure of the distal tibia, with rates as high as 43% reported in the literature.

3. What is the significance of a large residual gap in the physis following reduction with respect to this complication?

Answer: A residual physeal gap of over 3 mm may represent entrapped periosteum, which has been associated with a higher rate of premature physeal closure (60%).^{13,14}

4. Does surgically correcting the residual gap improve the outcome?

Answer: A recent study by Russo et al¹⁵ has suggested that this is possibly not the case; cases with 2mm to 4mm residual gap treated with long leg casts had lower rates of premature physeal closure than those treated by open reduction. But, surgery to reduce the physeal gap may be necessary to restore the joint alignment, which is also very important.¹⁵

5. What other factors have been implicated in the development of the complication mentioned in question 2?

Answer: There is no real consensus in the literature, but other factors implicated are initial displacement, number of attempted reductions and mechanism of injury.

6. What would you look for on follow-up radiographs to alert you to this complication developing?

Answer: Close monitoring of the ankle clinically, assessing varus/valgus and deformity such as prominence of the fibula is essential. Plain radiographs of the physis may demonstrate evidence of a bony bar, or deformity might become apparent if a partial growth arrest occurs creating a malalignment of the ankle.¹⁶

Growth disturbance lines crossing the width of the distal tibial metaphysis, parallel to the physis would suggest that there has not been any growth disturbance.¹⁷

Basic Science

A 40-year-old postman presented to an upper limb sub-speciality clinic with recurrent clicking and locking of his left non-dominant

shoulder for four to five years. His main complaint was that he felt apprehensive to move his shoulder as he was worried that it may lock and become painful. He can manage to unlock his shoulder by wriggling his arm. Lately he has noticed that the shoulder gets sore after a days work. He gives no history of trauma or any other joint affection.

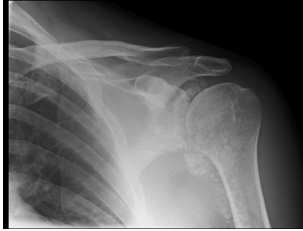


Fig. 5a

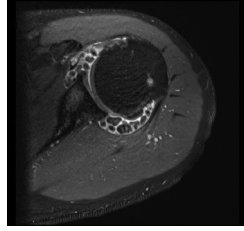


Fig. 5b

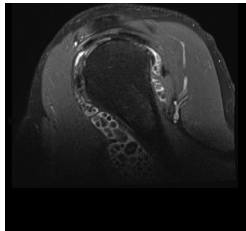


Fig. 5c

1. Please describe the radiographs (Fig. 5a) and the MRI (Figs 5b and 5c) presented to you and what is your provisional diagnosis?

Answer: Plain radiographs of the left shoulder demonstrate diffuse calcification within the glenohumeral joint, extending distally around the proximal humerus. These opacities are well circumscribed, small in size and located around the joint. The glenoid and humerus are unaffected with normal morphology. The axial and sagittal T2 weighted views of the proximal humerus glenohumeral joint shows multiple cartilage based foci.

2. What is the cause of the above disorder?

Answer: The imaging is classical for synovial chondromatosis.¹⁸ Differential diagnosis include infection, inflammatory arthropathy such as rheumatoid arthritis, osteochondritis desiccans. Chondrosarcoma should be considered. Synovial chondromatosis is the process of ectopic cartilage forming within bursa, joints and tendon sheaths. It is thought to be synovial metaplasia, although it can be secondary to other joint pathologies such as rheumatoid and osteoarthritis. High levels of BMP 2 have been found in this condition which could be the cause of increased cartilage formation.

3. What other joints can be involved in this disease process other than the shoulder?

Answer: Generally large joints are involved and it is usually monoarticular. The knee is most frequently described followed by the shoulder, elbow and hip. Case reports published mention temporomandibular joint, spinal facet joints, the acromioclavicular joint, metatarsophalangeal joint,

interphalangeal joint, wrist joint, ankle joint, biceps tendon sheath, and extra-articular locations.

4. What is the treatment of this condition?

Answer: Presentation of synovial chondromatosis:

Locking/clicking of joints.

Swelling.

Atraumatic reduction in range of movement.

Treatment:

Conservative:

Non-steroidal anti-inflammatory drugs – can help improve inflammation/pain.

Ultrasound – improve inflammation.

Surgical:

Arthroscopic or open excision of chondroma. Care to avoid damaging surrounding structures. Often extensive disease precludes complete resection. Recurrence rates quoted around 20%.¹⁹

Radiotherapy described as a satisfactory primary therapy in one case report.²⁰

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