Exam Corner

September 2013 - Answers

The FRCS (Tr & Orth) examination has three components: MCQs, Vivas and Clinical Examination. The Vivas are further divided into five sections comprising Basic Science, Adult Pathology, Hands, Children's Orthopaedics and Trauma. The Clinical Examination section is divided into upper- and lower-limb cases. The aim of this section in the Journal is to focus specifically on the trainees preparing for the exam and to cater to all the sections of the exam every month. The vision is to complete the cycle of all relevant exam topics (as per the syllabus) in four years.

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MCQs and EMQs – Single Best Answer

1. For each of the following description of hand function, select the most appropriate type of grip from the list.

I. In this grip, the pads of the thumb and index finger are apposed. *Answer:* **e**
II. In this grip, the pad of the thumb is against the pads of the index and middle fingers. *Answer:* **d**
III. In this grip, the pad of the thumb is apposed to the lateral aspect of the index finger. *Answer:* **b**
IV. In this grip, the small joints of the finger are flexed, and the thumb is extended. *Answer:* **c**

a. **Spherical** a power grip; All of the fingers and the thumb are adducted around an object, and unlike the cylindrical grip, the fingers are more spread apart. The palm of the hand is often not involved.
b. **Lateral** a precision grip; the pad of the thumb is apposed to the lateral aspect of the index finger.
c. **Hook** power a power grip; Involves the second through fifth fingers flexed around an object in a hook-like manner. The thumb is usually not involved.
d. **Tripod** a precision grip; used to hold a pen.
e. Precision a class of grips with several variants. Tend to hold the object between the tips of the fingers and thumb. No palm involvement, no movement of proximal joints.
f. **Grasp** a power grip also known as a cylindrical grip. All fingers are flexed around the object, which is usually at a right angle to the forearm.
g. **Claw** a combination grip e.g. for holding a putter.
h. **Opposition** any grip which involves the thumb.
i. Percussion a combined grip e.g. holding a drumstick.
j. **Pincer** a precision grip with tip to tip contact.

2. During manufacturing, mechanical properties of an alloy can be altered by annealing; which one of the following statements is false about this process?

d. Decreases ductility
Answer: Annealing is the process of heating a material to below its melting point. It has the effect of decreasing free radicals. It relieves internal stress and increases ductility. When combined with cold working it can decrease grain size which leads to increase strength and fatigue resistance.[1]

3. All of these can be used to restore thumb adduction after a low ulnar nerve palsy, except:
Answer: d. ECRL to first dorsal interosseous
Low ulnar nerve palsy causes loss of power pinch, abduction of the small finger (Wartenberg sign) and clawing results from imbalance between intrinsic and extrinsic muscles.
Principles of tendon transfers; match muscle strength; force proportional to cross-sectional area greatest force of contraction exerted when muscle is at resting length amplitude proportional to length of muscle work capacity = (force) x (amplitude) motor strength will decrease one grade after transfer donor must be expendable and of similar excursion and power one tendon transfer performs one function synergistic transfers rehabilitate more easily it is optimal to have a straight line of pull.
ECRB is a good motor for transfer for thumb adduction in a low ulnar nerve palsy but does require a free tendon graft to add length[1].
Transfer of EIP to either the adductor tubercle or the adductor pollicis tendon is also well recognised.[2] The use of FDS to ring has been described by Littler[3] as a varient of the classical opponensplasty described by Bunnel. The proposed advantage of barchioradialis as the motor is related to its increased amplitude. This allows thumb action regardless whether the wrist is flexed or extended[4]. The use of ECRL has not been described to restore adduction of the thumb as an isolated transfer but it has been used in a combined transfer with APL.[6]

4. Which one of the following is true with regards to the Watson-Jones approach to the hip joint?
Answer: c. There is no true interneural plane
There is no true internervous plane utilised in this approach as it utilises the interval between Tensor fascia lata and gluteus medius both of which are innervated by the superior gluteal nerve. The abductor mechanism is detached either via osteotomy or by partial split. The reflected head of rectus femoris is detached. The main neurovascular structures at risk are the femoral nerve and artery, which may be injured during the retraction of psoas.[7]

5. Which one of the following is FALSE with regards to risk of nerve injury secondary to the use of tourniquet?
Answer: d. Single cuffs are better than double cuffs
The use of tourniquets to provide a bloodless field is routine in orthopaedic and trauma surgery. Classical teaching suggests that a minimum effective pressure at the thigh is 90 to 100 mm Hg above systolic BP, and in a normotensive, non obese patient, pressure of 250 mm Hg is sufficient. Similarly, an arm

tourniquet pressure of 200 mm Hg is recommended.[8] However the limb occlusion pressure required is often significantly lower and this lower pressure does not affect the bloodless field[2] Nerve injury is related to direct pressure and therefore a wider cuff is safer. EMG abnormalities have been shown to occur in over 70% of patients.[3] The prevalence of abnormalities is strongly correlated to duration of tourniquet use and may last several months. Double cuff tourniquets have been previously used in regional anaesthesia (Bier's Block) and there is little evidence for their use in orthopaedics.

6. Which one of the following statements is true with regards to the synovium?
   Answer: c. Type A cells resemble macrophage
   The synovium mediates nutrient exchange between blood and joint fluid and is composed of vascularized connective tissue. It is porous and lacks basement membrane. It has no epithelial component.[11] There are 3 cell types. Type A cells are phagocytic and resemble macrophages. Type B cells resemble fibroblasts and produce synovial fluid. Type C cells are of unknown function and origin and may serve as a multi-potent precursor to either type A or B synovial cells. Synovium is richly supplied with blood vessels, lymphatics, and nerves. The nerves entering the synovium appear to be distributed primarily to blood vessels, probably as vasomotor and vasosensory nerves. The large number of capillaries and their proximity to inner surface account for haemorrhage into joints following minor injuries.

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Vivas

Adult Pathology

A 56-year-old female presents with new onset pain in a previous asymptomatic right total hip replacement (Fig. 1).

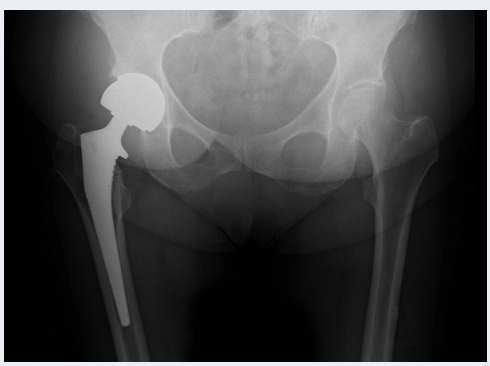


Fig. 1

1. Comment on the AP pelvis radiograph. What type of bearing surface is present?
   Answer: This AP radiograph shows an un-cemented total hip replacement. The leg length appears equal bilaterally. The femoral stem appears well seated, well fixed and appropriately aligned. The acetabular component looks to be slightly mal-positioned. The inclination looks to be suboptimal, the acetabulum is likely to be too open with an abduction angle of greater than 50°. The bearing surface is metal on metal and the head size looks to be in excess of 38 mm.

2. Discuss what further investigations would be appropriate.
   Answer: The problem here is likely to be related to the bearing surface but other baseline investigations should also be sent including inflammatory markers. All symptomatic patients with this bearing surface should have either a MARS (metal artefact reducing sequence) MRI or an ultrasound scan. Additionally whole blood metal ion levels should be assessed (in an appropriate laboratory). If levels on the initial blood test are in excess of seven parts per billion then additional blood tests are required after an interval of three months. If imaging is abnormal or if blood metal ions are rising then revision surgery is warranted. This protocol also applies for asymptomatic patients who have undergone large head (over 38 mm) metal on metal-stemmed replacements and all patients in whom the Depuy ASR has been implanted. For asymptomatic patients with resurfacing (except ASR) or head size under 38mm then no investigation is specified.[1]

3. Comment on two design issues in this class of hip replacement that may contribute to metal reactions.
   Answer: Shallow actabular component and lower clearance margins.

4. The patients blood metal ions are raised above the MHRA reference ranges, what are the ranges and how does that influence management?
   Answer: The quoted reference range is seven parts per billion in whole blood. This correlates to 199 nmol/L cobalt or 134.5 nmol/L chromium. If the initial result is in excess of this then a second blood test at three months is recommended. If levels are rising on this second sample then revision is recommended.

5. Is the revision rate for resurfacings higher or lower than that for large head metal-on-metal hip replacements?
   Answer: Lower

6. What are the common terms that are used to described metal reactions?
   Answer: ALVAL, Metallosis

Trauma

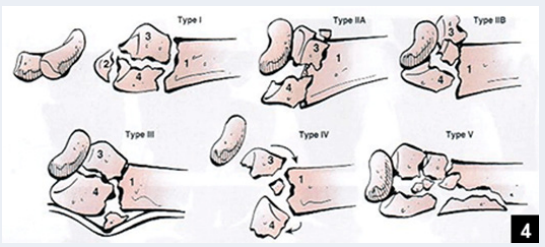
A 34-year-old female presents after a fall onto her dominant right hand. Radiographs were obtained in A&E (Fig. 2).

Fig. 2a

Fig. 2b

1. Describe the radiographs.
   Answer: Comminuted intra-articlular fracture of right distal radius with radial translation, shortening and dorsal angulation.

2. How would you classify this injury?
   Answer: The Frykman classification[2] may be used for all distal radial. It classifies fractures according to intra-articular involvement of either the radio-carpal joint or the radio-ulnar joint. Further classification is according to the presence of an associated fracture of the ulnar styloid. This is a relatively simple system but is purely descriptive. The Melone classification[3] is more specific for intraarticular fractures and is designed to guide treatment. It splits the distal radius into four pieces, the shaft, the radial styloid, the dorsal lunate facet and the palmar lunate facet. The classification is from I – V and describes increasingly comminuted fractures.



   The Type I stable injury can be managed by short-term immobilization. The type IIa unstable die-punch fracture requires stabilization provided by external fixation, frequently coupled with percutaneous internal fixation, to maintain an accurate reduction. Restoration of articular congruity in an irreducible type IIB dorsal die-punch fracture, in contrast, can only be accomplished by open treatment, usually comprising a limited exposure for reduction and internal fixation of the radiocarpal articular surface, supplementary external fixation, and adjunctive iliac bone grafting. The irreducible type IIB articular fracture with volar displacement is most suitable for stabilization by plate and screw fixation; however, in patients with excessive comminution, Kirshner wires provide a satisfactory alternative method of fixation.
   The type III spike fragment is secured with either small screws or wires in conjunction with closed or limited open articular restitution and appropriate nerve and tendon surgery. The irreducible type IV fracture demonstrating wide separation of articular components always requires extensive open treatment for restoration of articular congruity as well as repair of associated skeletal and soft tissue injuries. In the type V explosion injury, provisional stabilization employing, external fixation provides a sturdy framework for critical revascularization or resurfacing procedures and serves to maintain radial alignment before definitive articular reconstruction. In more severe injuries, early detection and repair of frequent periarticular injuries are essential for a favourable recovery. In those fractures requiring open reduction with internal fixation, supplementary external fixation and iliac bone grafting have proved to be increasingly beneficial adjuvants to management.
   No single classification system is universally accepted regarding reproducibility, treatment planning or prediction of outcome.[3,4] Instead it may be simpler to divide fractures of the distal radius into 'stable' and 'unstable' groups.
   A more inherently stable fracture is less likely to require surgical intervention beyond simple closed manipulation. Stability may be assessed using a variety of radiological criteria. These factors include initial dorsal angulation of greater than 20 degrees, shortening of greater than 5mm, 1mm intra-articular displacement, an associated fracture of the ulnar, significant dorsal comminution, or loss of reduction following closed manipulation.[5]These factors have recently been re-assessed and expanded[6] and the most important predictors seem to be patient age, metaphyseal comminution and ulnar variance.

3. What are the principles of management of this injury?
   Answer: It is an intraarticular injury and therefore requires anatomical reduction of the articular surface. For distal radius fracture in particular the medial fragments (ie the lunate fossa fragments) should be specifically reduced.

4. What are the pros and cons of using an external fixator *versus* internal fixation in these injuries?
   Answer: An external fixator has the advantage of disrupting the fracture site significantly less than internal fixation. This may protect the blood supply of the fragments. External fixation of the distal radius may be bridging or non-bridging. When a bridging external fixator is used care must be taken not to overdistract the injury as this may cause significant stiffness. Recent meta-analysis has shown that internal fixation of unstable distal radius fractures yields significantly better functional outcomes, forearm supination, and restoration of anatomic volar tilt. However, external fixation results in better grip strength and wrist flexion,[7] other studies have found that internal fixation led to significantly better functional outcome throughout the entire follow-up. However, this difference was only clinically relevant during the early postoperative period (three months).[7]

5. What are the prognostic indicators of functional outcome following displaced intra-articular distal radial fractures?
   Several patient factors have been used to predict functional outcome following distal radius fracture. At one year post-injury both only age and income had significant effects. Increased age and decreased income were associated with lower Michegan Hand Questionaire scores.[6] At three months however the quality of the reduction was significant.

Mcqueen et al recommend that in order to maximise functional outcome the articular reconstruction be achieved with less than 2 mm of gap or step-off, the radius be restored to within 2 mm of its normal length, and that carpal alignment be restored.[6]

Hands

A 28-year-old motorcycle rider presents with asymmetry of the scapulae and global weakness of the left upper extremity (Fig. 3) following a high speed road traffic accident.

Fig. 3

1. What is the likely diagnosis?
   Answer: The clinical photograph shows medial winging of the scapula. When view in conjunction with the history this is likely to represent a traction injury to the brachial plexus.

2. Ptosis is a common associated phenomenon with the above condition and is associated with other features. What are these features and what is the cause of the ptosis?
   Answer: A pre-ganglionic injury to the brachial plexus causes medial scapula winging due to paralysis of the long thoracic nerve of Bell (pre-clavicular branch) and resultant serratus anterior dysfunction. The ptosis is part of a Horner's syndrome caused by injury to the stellate ganglion. Horner's syndrome is characterised by the classic triad of miosis (ie, constricted pupil), partial ptosis, and loss of hemifacial sweating (ie, anhidrosis)

3. What is the differential diagnosis of the above condition? Can this be caused by paralysis/weakness of any other peri-scapular muscles?
   Answer: Injury to the long thoracic nerve is not necessarily associated with brachial plexus injury and may be an isolated finding. It may be due to repetitive stretch injury increased risk with head tilted away during overhead arm activity e.g., weight lifters, volleyball players. Direct compression injury may also be seen. Iatrogenic injury may be associated with axillary nerve dissection. In the context of trauma a scapula fracture may injure the long thoracic nerve however this would not account for the global weakness in this case. A very rare cause of medial scapular winging is rhomboid dysfunction due to dorsal scapular nerve injury.

4. Can the above condition be clinically mistaken for another unrelated pathology? If yes, what is it?
   Answer: Parsonage turner syndrome (brachial plexus neuritis) may cause medial scapular winging in the absence of trauma by the same mechanism.

Children's Orthopaedics

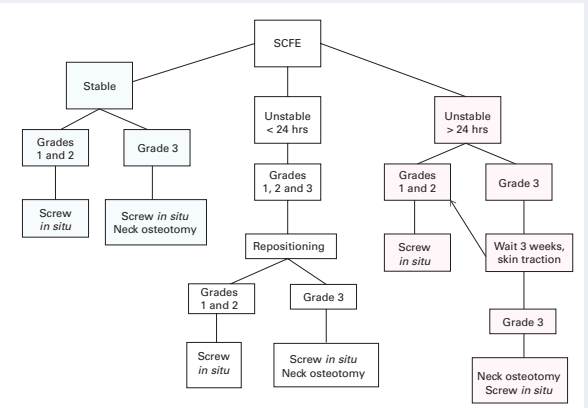
Here is a radiograph of a 13-year-old girl who can walk but has a painful, deformed and stiff left hip (Fig. 4).

1. What is the diagnosis?
   Answer: The diagnosis ia a late chronic (note posterior metaphyseal buttressing) slipped upper femoral epiphysis with the growth plate open.
2. Describe the deformity.

Fig. 4

Answer: The deformity is adduction, external rotation and extension, of which extension is the most important.

3. Discuss the treatment options and which would you advise?
   Answer: The management of SUFE depends on the stability and chronicity of the slip.



Thus in this case, the girl is too disabled to advise non-operative treatment and the slip too severe for pinning *in situ*.
In this case a realignment osteotomy through the growth plate (Dunn) was undertaken (Fig. 4b) and, fortunately, AVN was avoided.
If the symptoms were mild, it would be reasonable to wait until the growth plate fused then raelign the upper femur by a triplane osteotomy, which would avoid the risk of AVN but make a subsequent hip replacement more difficult.

Here is the photograph of an 11-year-old syndromic boy of normal intelligence who has foreshortened upper limbs and unstable knees (Fig. 5).

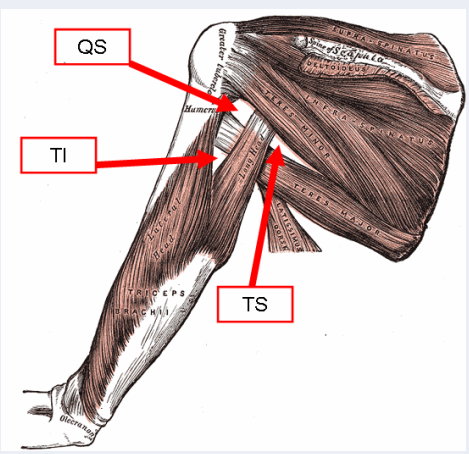
1. What is the likely diagnosis and what aspect of the syndrome

Fig. 5

dominates management in early life?
Answer: The condition is Thrombocytopaenia Absent Radius (TAR) Syndrome.
Through infancy and early childhood the treatment of the thrombocytopaenia is the most important issue. Fortunately this usually resolves spontaneously to allow surgical treatment to be considered.
In this case the radial club hands were improved with surgery.
However, the knees in TAR syndrome are extremely difficult to treat operatively. This child was helped by orthoses in earlier childhood and has progressed to a functional gait without them absent.

Basic Science

1. Describe the anatomy of the quadrangular space in the shoulder?
   Answer: The quadrangular space (or quadrilateral space [of Velpeau] or Foramen Humerotricipitale) is an axillary space in the arm. It is bounded by: the subscapularis and teres minor superiorly and the teres major inferiorly. Its medial border is the long head of triceps and it is bordered laterally by the surgical neck of the humerus.



2. What are its contents?
   Answer: Axillary nerve and posterior humeral circumflex artery.

3. Describe the anatomy of the triangular space in the shoulder?
   Answer: Defined by teres minor superiorly, the teres major inferiorly and the long head of the triceps laterally

4. What are its contents?
   Answer: Scapular circumflex vessels.

5. Describe the boundaries of the triangular interval in the shoulder?
   Answer: Superiorly bounded by teres major with the long head of triceps medially and the lateral head of triceps or the humeral shaft laterally.

6. What is its importance?
   Answer: Radial nerve and profunda brachii artery pass through the triangular interval, on their way to the posterior compartment of the arm. The nerve may be compressed by either hypertropy of the muscular boundaries of the space or by vascular abnormailities effecting the profunda brachii. This results in Triangular Interval Syndrome (TIS).

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