Exam Corner

December 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. Regarding sterilisation techniques in surgery, match each description with the correct answer:

a. Physical means of killing bacteria by breaking down DNA and inhibiting division. An industrial process used for sterilising large batches of similar products such as catheters and syringes. **v**

b. Chemical method of sterilising heat sensitive objects such as endoscopes and electrical equipment. It should not be used for ventilatory equipment. **iii**

c. Potent antibacterial agent acts by disrupting the cell membrane, but it is not sporicidal. Rapidly active with a cumulative effect. **ii**

i. Autoclave
ii. Chlorhexidine Gluconate 4%
iii. Ethylene Oxide
iv. Flaming
v. Gamma Irradiation
vi. Ozone
vii. Pasteurization
viii. Povidone-Iodine
ix. Ultraviolet light

2. What is the reported rate of dislocation following hemiarthroplasty for an intra-capsular neck of femur fracture?
Answer: c. 4%

3. The dorsal approach used for fasciotomy in compartment syndrome of the foot involves:
Answer: d. A double incision immediately medial to the 2nd metatarsal and immediately lateral to the 4th metatarsal.[1-3]

4. Which one of the following is true with regards to talar neck fractures
Answer: b. Type II requires ORIF if greater than 3 mm to 5 mm of dorsal displacement and any rotational deformity

5. Which technique for occipital cervical fusion has been shown to have the highest incidence of failure?
Answer: c. Wires and *in-situ* bone graft.[4]

References

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2. **Frink M, Hildebrand F, Krettek C, Brand J, Hankemeier S.** Compartment Syndrome of the Lower Leg and Foot. *Clin Orthop Relat Res* 2010;468:940-50
3. **Prior GA.** Complications of hip fractures. *Curr Orthop* 2000;14:86-92.
4. **Winegar CD, Lawrence JP, Friel BC, et al.** A systematic review of occipital cervical fusion: techniques and outcomes. *J Neurosurg Spine* 2010;13:5-16.

Vivas

Adult Pathology

A 45-year-old female underwent a total hip replacement for significant end stage arthritis secondary to dysplasia. An anterolateral approach was used for the surgery with cemented implants in the femur and acetabulum. On the ward round the day after surgery she was noted to have a painless drop foot and loss of sensation in the lower leg.

1. What is the diagnosis and how common is this?
Answer: Sciatic nerve palsy. This is likely to be a traction injury due to excessive lengthening rather than any direct trauma in this case (antero-lateral approach). Incidence of nerve palsy is 1% to 2% of primary total hip replacement, 3% to 4% after revision, and 5% to 6% in THR for congenitally dislocated hips.

2. Is this patient at higher risk of the complication than a standard patient? What are the other risk factors?
Answer: Yes the complication rate is higher in patients with hip dysplasia. Due to both alterations in the anatomy[1] and also due to lengthening. The maximum acceptable lengthening (before shortening osteotomy should be undertaken) is 4 cm.[2] Other risk factors include revision surgery, limb lengthening, female gender, anticoagulation and vascular insufficiency.

3. What specific features should be looked for on the post-operative radiograph of the hip?
Answer: I would want to assess the amount of lengthening. I would also want to ensure that

the reduction was congruent with no evidence of soft tissue interposed between femoral head and acetabulum. Finally I would assess for cement extrusion (and possible thermal damage).

4. What other features should be examined for and what investigations should be considered?
   Answer: I would want to carry out a full lower limb neurological examination. The most common branch injured is the peroneal division of the sciatic nerve and I would examine specifically for that. I may consider arranging an USS of the hip to assess for haematoma or a CT scan which may help identify both haematoma and the presence of extruded cement. EMG studies may be used to assess the level of the lesion and also to monitor recovery but may not show any abnormalities for several weeks. The acute management is to detension the sciatic nerve by extending the hip and flexing the knee. I would also provide an ankle foot orthosis (foot-drop splint).

5. When should exploratory surgery be undertaken?
   Answer: Surgery should be undertaken acutely if the nerve may be entrapped or compressed (by haematoma or cement). Similarly if there is a risk the nerve has been surgically transected or ligated with an ill placed suture.

6. Patients may present with a painful drop foot. Would your management differ in this instance?
   Answer: A painful neuropathy is more likely to represent ongoing compression and therefore I would be much more likely to offer surgical exploration.

7. What further investigations should be considered in the outpatient setting?
   Answer: Nerve conduction studies may be used to monitor renervation and referral to a Peripheral Nerve Injury Unit.

Trauma

A 68-year-old lady presents with an injury to her left elbow following a fall. These are the radiographs obtained in A&E (Figs 1a and 1b).

Fig. 1a

Fig. 1b

1. Describe the radiographs.
   Answer: Anterio-posterior and lateral views of a left elbow showing a short oblique fracture at the metaphyseal-diaphyseal junction. The distal fragment is translated 50% and angulated by 30° in the valgus plane and 60° of extension. I have concerns regarding a possible lucency at the fracture site.

2. What is the course of radial nerve in this region?
   Answer: The radial nerve courses over the spiral groove posteriorly between lateral and medial heads of triceps. 14 cm proximal to the lateral epicondyle, 20 cm proximal to the medial epicondyle. It passes through the Lateral intermuscular septa never less than 7.5 cm above the distal articular surface amd then runs between brachialis and brachioradialis (anterior to lateral epicondyle)

3. What is the incidence of radial nerve injury with humeral fractures?
   Answer: The reported incidence is between 8% and 15% of closed fractures. This is increased in distal one-third fractures (the Holstein lewis lesion). A neuropraxia is the most common injury in closed fractures, whereas in open fractures a neurotmesis is more likely.

4. What is the prognosis for radial nerve injury with these fractures and what are the prognostic factors?
   Answer: 85% to 90% of patients improve with observation over three months, spontaneous recovery found at an average of seven weeks, with full recovery at an average of six months. I would want to get EMG at three to four months to ensure that renervation was occurring (fibrillations indicative of denervation would be an indication for surgical exploration). I would expect wrist extension in radial deviation is to be regained first and extensor indicis to be the last. Prognosis is improved in younger patients and in those with a neurapraxia.

5. What are the indications of surgery in patients with humeral fractures?
   Answer: Absolute indications include open fracture, vascular injury requiring repair and brachial plexus injury. Relative indications include ipsilateral forearm fracture (floating elbow), bilateral humerus fracture, polytrauma or associated lower extremity fracture (to allow early weight bearing through humerus), pathologic fractures (intra-medullary nail) burns or soft-tissue injury that precludes bracing, fracture characteristics (distraction at fracture site, long oblique or spiral proximal fracture, intra-articular extension).

Hands

A 16-year-old girl presents with difficulty at pronating and supinating her left hand. She says she recently noticed this after she started typing. She also has difficulty in carrying trays and other objects. There is no history of any injury to the elbow and there is no history of any problems with any other joints in her body. A plain radiograph of the elbow was performed (Figs 2a and 2b).

Fig. 2a

Fig. 2b

1. What is the diagnosis?
   Answer: Radio-ulnar synostosis

2. What type of congenital defect is this due to?
   Answer: It occurs due to a defect in longitudinal segmentation during the 7th week of development. It is inherited in an autosomal dominant inheritance in some cases but often occurs sporatically and is bilateral in 60%.

3. Are there any classifications associated with this problem?
   Answer: This condition may be classified as congenital or acquired following trauma. The congenital variety may also be classified as fibrous or osseous.

4. What syndromes/skeletal anomalies are associated with this condition?
   Answer: About one third of cases are associated with general skeletal abnormalities, such as hip dislocation, knee anomalies, clubfoot, polydactyly, syndactyly, Madelung deformity, ligamentous laxity, thumb hypoplasia, carpal coalition, and problems of the cardiac, renal, neurologic, and GI systems.
   Some associated abnormalities and syndromes are genetically determined, including acrocephalosyndactyly, Apert syndrome, Carpenter syndrome, arthrogryposis, mandibulofacial dysostosis, William syndrome, Klinefelter syndrome, Holt-Oram syndrome, microcephaly, multiple exostoses, and fetal alcohol syndrome.

5. How would you treat this patient?
   Answer: I would take a full history in order to assess the impact of this congenital condition. I would also want to assess the contralateral side. If the condition is unilateral and the patient is able to cope with her symptoms then I would offer a non-surgical management in the form of observation. If the condition was bilateral or if the syptoms were too troublesome then a rotational osteotomy with fusion may be considered to place the hand in a more functional position (usually 10° of pronation for unilateral or if bilateral one in pronation (40°) and one in supination (30°)).

Children's Orthopaedics

Here is an intra-operative photograph (Fig. 3) of a child undergoing corrective osteotomy for a deformity of the tibia.

Fig. 3

1. What is the likely diagnosis and how do you explain the operative findings?
   Answer: The diagnosis is osteogenesis imperfecta. The child has been on bisphosphonate therapy with Pamidronate. The inhibition of osteoclasts has resulted in a cortex thickened with hard sclerotic bone and a narrow intramedullary canal which make reaming for an intramedullary rod difficult.

Here is the lateral radiograph of the elbow of a ten-year-old boy (Fig. 4).

Fig. 4

2. What are the features which indicate the diagnosis and treatment of this case?
   Answer: The diagnosis is a missed Monteggia injury which has been treated by open reduction and stabilisation with a triceps sling, the free end of which has been wrapped around the radial neck and attached to the ulna through a drill hole (the Bell-Tawse procedure).
   The drill hole and impression of the sling on the radial neck are obvious. Additional stability in this case was achieved by an osteotomy of the proximal ulna.
   The ectopic calcification is a recognised feature of a missed Monteggia injury and is more clearly seen on the pre-operative radiograph (Fig. 5a). A clinical photograph at that time showed a valgus deformity and a prominence anteriorly (Fig. 5b).

Fig. 5a

Fig. 5b

Basic Science

1. Describe the structural anatomy of an intervertebral disc.
   Answer: See next answer

2. Describe the histology of an intervertebral disc.
   Answer: Outer portion is the annulus fibrosus consisting of fibrocartilage and type I collagen. The fibres run obliquely and are arranged in concentric layers with the orientation of the fibres varying in successive layers by approximately 45°. This provides good tensile strength. The inner nucleosus pulposus is predominantly type 2 collagen and has a high water content to allow it to resist compressive loads.

3. What is the nerve supply to the intervertebral disc?
   Answer: Nerve fibers are found in the outer rings of annulus only. Dorsally they are branches of the sinu vertebral nerve and ventrally they arise from the sympathetic chain that courses anterolaterally over the vertebral bodies.

4. Describe the natural history of a lumbar disc prolapse.
   Answer: Recurrent torsional strain leads to tears of outer annulus which leads to herniation of nucleus pulposis. Size of herniation decreases over time due to reabsorption via macrophage phagocytosis. Sequestered disc herniations show the greatest degree of spontaneous resorption. 90% of patients will have improvement in symptoms by three months.

5. What are the risk factors for developing a disc prolapse?
   Answer: Disc prolapse is related to failure of the annulus fibrosus due to either increased load/pressure or decreased mechanical strength. Pressure within the disc is maximised by forward flexion in a seated position. Torsional movement increases this further. There is also a role of aging causing degeneration of the annulus increasing the predisposition to tear. Disc aging also leads to an overall loss of water content within the nucleosus and conversion to fibrocartilage which causes a generalised stiffening of the nucleosus pulposus. This means the annulus is less well supported and more prone to tearing.

6. What are the suggested theories for the mechanism of production of pain in disc disease?
   Answer: There are several possible mechanisms for development of pain in disc disease. The first is due to simple nerve compression and accounts for the radicular pain seen in disc prolapse. There is also a degree of compression in degenerative disc disease due to reduced disc height causing foraminal stenosis. The second type of pain is mechanical in nature and is due to the degenerative disc reducing in height and therefore providing a reduced structural role which causes increased load through the posterior elements (e.g. facet joints) and their subsequent degeneration. The annulus has nociceptors in its outer third and therefore the micro tears due to trauma may be directly painful. Finally there is an altered cytokine profile within the degenerative disc with increase IL-1 which may be implicated in discogenic pain.

References

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2. **Edwards BN, Tullos HS, Noble PC.** Contributory factors and etiology of sciatic nerve palsy in total hip arthroplasty. *Clin Orthop Relat Res* 1987;218:136-41.