

MCQs and EMQs – Single Best Answer

1. When considering spinal infection, which of the following is false?
Answer: d. There is no difference in the pathophysiology of spinal infection between children and adults
2. A 35-year-old chef sustains a wound to the volar surface of her left index finger while cutting an object with a sharp knife. Exploration of the wound shows complete division of both FDS and FDP tendons over the proximal phalanx. With respect to flexor tendon repair, which one of the following statements is true?
Answer: b. The number of core suture strands affects the repair strength.
A key factor determining the strength of repair of a flexor tendon at the time of surgery is the grip of the suture in the tendon, and a 'gripping' core suture (such as a modified Kessler suture) prevents the suture pulling out of the tendon. The strength of the repair can also be increased by increasing the number of core strands that cross the repair site.¹
3. What best describes a monopolar cutting diathermy?
Answer: c. Works by producing a continuous current.
In monopolar diathermy an electrical plate is placed on the patient and acts as indifferent electrode, current passes from the instrument and this indifferent electrode. The surface area of instrument is an order of magnitude less than that of the plate causing localised heating at the tip of instrument. Minimal heating effect is produced at the indifferent electrode. The effect of diathermy depends on the current intensity and wave-form used. Cutting diathermy is produced by continuous current and has a sinus wave form whereas coagulation is a pulsed current with a square wave form.
4. Which of the following proximal femur fractures classified as per the AO classification is most likely to be successfully treated with a dynamic hip screw-style device?
Answer: e. 31-A1.
The proximal femur is 31 in the AO classification. A refers to pertrochanteric, B is a neck fracture and C refers to head fracture. A DHS device is most appropriate for extracapsular fractures (Group A). The subclassification A1 simple, A2 multifragmentary, A3 reverse obliquity or subtrochanteric.
5. Dynamic radio-ulnar impingement following Darrach's procedure correlates with:
Answer: e. Increased length of excision of the distal ulna.
In a study from 1996 the presence of dynamic radio-ulnar convergence did not correlate with grip strength, pinch strength, range of movement or wrist score, but was associated with increased length of excision of the distal ulna.²
6. Which treatment option from the list below (1 to 8) is best for the following cervical spine pathologies:
 1. Anterior excision of the odontoid peg with C1-C2 fusion;
 2. Application of Halo;
 3. C5/C6 anterior discectomy and fusion;
 4. C6/C7 anterior discectomy and fusion;
 5. Occiput to C2 posterior instrumentation and fusion;
 6. Posterior atlantoaxial arthrodesis with wire and bone graft;
 7. Reduction of the peg fracture and Odontoid screw fixation;
 8. Skeletal traction
 - a. A 50-year old female with rheumatoid arthritis presented with neck pain. Her imaging demonstrated C1-C2 instability (> 9 mm of movement) and a posterior atlanto-dens interval < 14 mm. There is also superior migration of the dens.
Answer: Occiput to C2 posterior instrumentation and fusion
 - b. A 30-year old patient was involved in a road traffic accident and sustained cervical spine injury with persistent signs of complete C5 level quadriplegia after the return of bulbocavernosus reflex. CT confirms undisplaced C5 lamina fracture and MRI shows C5/ C6 disc herniation causing cord compression.
Answer: 5. C5/C6 anterior discectomy and fusion.
 - c. A 35-year old patient with persistent painful radiculopathy for > 6 months with progressive weakness of elbow flexion, forearm supination and decreased biceps jerk.
Answer: 3. C5/C6 anterior discectomy and fusion.
 - d. A 50-year old patient presents with an acute odontoid peg fracture following a fall, which is displaced > 5 mm. No neurological symptoms were found on examination.
Answer: 7. Reduction of the peg fracture and Odontoid screw fixation.

Vivas

Adult Pathology

A 63-year-old female underwent a reverse hybrid left total hip replacement 18 months ago. Since surgery she has complained of pain in her groin on flexion. The right hip replacement was performed some three years previously and remains asymptomatic (Fig. 1a).

1. Describe the radiograph.



Fig. 1a

Answer: AP radiograph of both hips showing bilateral reverse hybrid total hip replacements with metal on polyethylene articulations. On the right the femoral component is of a metaphyseal fit design whereas on the left it is a collared calcar loading device. Both acetabuli are cemented. Also, there is a slight increase in offset and leg length on the left.

2. Concentrating on the acetabular components, discuss the difference in quality of cementation and position.
Answer: On the right it looks well fixed with no obvious lucencies. It seems well positioned with adequate medialisation and also is well aligned. The acetabular component inclination is within the safe range (30° to 50°)³ and the degree of anteversion is best measured from a lateral view. On the left however there is evidence of loosening with lucent lines in all the three DeLee/Charnley zones. It is also lateralised with a thicker cement mantle medially and relatively high inclination angle.

3. Discuss possible reasons for the ongoing left groin pain.
Answer: The radiograph shows signs of loosening around the acetabulum. I would ideally like previous radiographs for comparison to assess if the position of the component has changed. However in the presence of groin pain the cup must be assumed to be loose. My initial differential diagnosis is therefore between aseptic loosening and periprosthetic joint infection. One must also be aware of other causes like psoas impingement and non-orthopaedic causes of groin pain like hernias and to rule out pain secondary to pathology in the lower back.

4. What further investigations would you arrange?
Answer: In order to assess for any deep infection I would arrange screening blood tests to include inflammatory markers particularly CRP.⁴ I am aware that the addition of IL-6 levels⁵ may improve the diagnostic accuracy but this is not routine in my institution. If there was clinical suspicion of infection then I would arrange an aspiration for micro-biological analysis.⁶ I would then arrange further imaging in the form of a CT scan to assess for bone loss and confirm implant positioning.

5. A CT scan was performed, and an axial image produced (Fig. 1b). What does this show and what is the likely diagnosis?

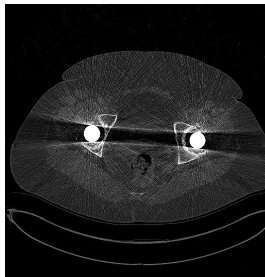


Fig. 1b

Answer: The CT scan confirms uncoversion of anterior acetabular component, measured at about 1 cm of uncoversion. This is likely to be resulting in psoas tendon impingement.

6. Discuss the risks and benefits of the management options for this patient.
Answer: This patient's management depends on the severity of the symptoms and her co-morbidities. Assuming that there is no suspicion of infection then it would be reasonable to proceed with conservative management including physiotherapy, ultrasound guided psoas tendon sheath injections initially. If these measures fail then a psoas tenotomy could be attempted and if this fails then ultimately a revision of the acetabular component would be required.⁷⁻⁹

Trauma

A 27-year-old man slipped on ice and presented with an injury to his non-dominant left elbow. Radiographs were obtained in A&E (Fig. 2a and 2b).

1. Describe the radiographs.



Fig. 2a



Fig. 2b

Answer: These are AP and lateral radiographs of an elbow showing a complex intra-articular fracture of the distal humerus.

2. How would you classify this injury?
Answer: There are several methods of classifying distal humeral fractures. The AO classification is 13 (for humerus, distal segment) then A, B or C depending on the involvement of the articular surface. Intra-articular fractures have also been described by Jupiter and Mehne. They are all type I fractures in their classification scheme and then divided into bi-column or single column.

Bicolumn fractures such as this are then described as, 1. High T intercondylar, 2. Low T intercondylar, 3. Y intercondylar, 4. H intercondylar, 5. Lambda pattern (lateral), 6. Lambda pattern (medial). I would describe this as Y intercondylar.

3. What are the principles of management and principles of fixation in these injuries?

Answer: This represents a high energy injury and as such I would approach this patient according to ATLS principles. Assuming it is an isolated, closed, neurovascularly intact injury I would suggest operative management in order to minimise medium and long term morbidity. As with all intra-articular injuries the overriding principle is of anatomic reduction and absolute stability. Furthermore the elbow is particularly prone to post-operative stiffness and heterotopic ossification and so rigid fixation to allow early range of movement is also important. I would use two pre-contoured distal humeral locking plates applied to reconstruct the medial and lateral columns with the aim of reconstructing the 'gothic arch' of the distal humerus.

4. What are the various approaches that you can use for this?

Answer: The important factor when considering the approach is the requirement to assess the anatomic reduction of the joint surface. Traditionally this could be achieved with a posterior approach using an olecranon osteotomy. This gives good exposure and allows the inspection and reconstruction of the articular surface. However, there have been concerns raised regarding nonunion of the osteotomy¹⁰ and symptomatic hardware from the osteotomy in over 5% of cases¹¹ and therefore the TRAP approach has been suggested.

5. What do you understand by the TRAP approach and discuss its advantages and disadvantages?

Answer: The TRAP approach is a triceps reflecting anconeus pedicle approach. It allows adequate fracture visualisation and stable fracture fixation even in comminuted AO type C3 fracture of the distal humerus, with the advantage of intact olecranon that does serve as a template around which critical intra-articular fracture reduction is afforded. The approach permits aggressive postoperative elbow rehabilitation without elbow instability.

However, wound related complications and residual triceps weakness may be of concern in some cases. Accurate and strong reattachment of the reflected extensor mechanism is absolutely critical for post-operative elbow rehabilitation and good functional outcome.¹²

Hands

An 82-year-old retired former headmistress who lives on her own, presents with gradually deteriorating function of the left hand because of pain in the region of the thumb. These are her radiographs (Fig. 3)

1. What would you advise in terms of treatment?

Answer: These radiographs show significant 1st CMCJ degenerative change with subluxation and associated adduction of the metacarpal, there is also compensatory hyperextension of the MCPJ. The initial management would consist of appropriate analgesics and activity modification. However, given the extent of the deformity I would expect this patient to proceed to surgical intervention if she is fit for surgery. I would offer a trapeziectomy.



Fig. 3

2. Would you combine your procedure with a LRTI or a suitable sling procedure?
Answer: No. I would expect good outcomes in about 80% at five years with or without an additional soft tissue procedure.¹³
3. How would you try to address the:
 - a. Adduction deformity of the thumb?
Answer: The adduction of the thumb is related to the radial subluxation of the metacarpal base and may be associated with a soft tissue contracture. A complete excision of the trapezium will shorten the radial column and may improve the deformity. If however there is ongoing deformity and unacceptable reduction in hand span following trapeziectomy then I would consider an extension osteotomy¹⁴ of the 1st metacarpal.
 - b. Hyperextension at the MCP joint?
Answer: The hyperextension is greater than 30 degrees¹⁵ and therefore if left untreated may cause a secondary swan-neck deformity of the thumb. The options for treatment are either soft-tissue procedures such as volar capsulodesis or EPB tendon transfer or a fusion of the MCPJ. I would treat this with a volar capsulodesis using a suture anchor.¹⁶
4. What are the complications of trapeziectomy?
Answer: As with all surgery there is a risk of infection, bleeding and damage to surrounding structures. Approximately 20% of patients following simple trapeziectomy suffer a degree of subluxation which doesn't seem to affect outcomes. A recent paper suggests that the overall complication rate is 24%. Mainly this relates to ongoing pain at the base of the thumb (13%), 5% have symptoms related to the superficial branch of the radial nerve.¹⁷
5. How would you manage symptomatic metacarpal collapse if it occurred after a trapeziectomy?
Answer: I would attempt to continue managing the patient non-surgically initially with splintage and possible image guided injection. If the patient remained symptomatic then I would consider interposition suspensoplasty using half of FCR.

Children's Orthopaedics

Here are the photographs of a four-month-old infant (Figs 4a and 4b). There is active movement of the hips and knees but none in the feet.



Fig. 4a



Fig. 4b

1. What is the likely diagnosis and in what general terms would you advise the parents on the long term outcome?
Answer: The diagnosis is sacral agenesis. The calves are thin and the feet are likely to need surgical and orthotic treatment but the child will be able to walk. The major long-term problem is lack of bladder and bowel control.
2. What is demonstrated by Figs 5a and 5b respectively and what is the relationship between them?

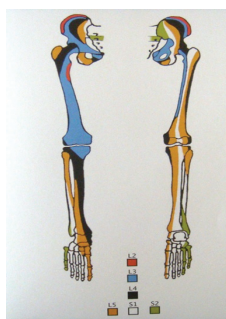


Fig. 5a



Fig. 5b

Answer: Figure 5a shows the sclerotome map of the lower limb. This relates to the development of the limb and sclerotome subtraction was postulated as an explanation for the pattern of longitudinal bone loss seen in dysmyleias.¹⁸ The radiograph shows a dysmyleia of the right lower limb with a longitudinal deficiency of the tibia.

Basic Science

1. Describe the natural knee kinematics from full extension to full flexion.
Answer: The knee is not a simple hinge joint but rather undergoes a more complex 'slide and roll' type movement. This movement is polycentric, i.e- the instant centre of rotation of the knee changes (moving posteriorly). This plots a J shaped curve about the femoral condyles and allows deep flexion. There is also sliding which may be related to the relative tension of the ACL and PCL in a four bar linkage model combined with the different anatomy of the medial and lateral condyles.
 The differing anatomy of the medial and lateral compartments of the knee also helps to explain the second major feature of knee kinematics, the screw home mechanism. The shorter more highly curved lateral condyle exhausts its articular surface before the medial condyle and is therefore checked by ACL.
 This causes relative external rotation of the tibia by 5° during the terminal 15° of extension. This stabilises the knee in full extension allowing the quadriceps to relax thus conserving energy. Popliteus acts to unlock the knee at the start of flexion.
2. What do you understand by femoral rollback?
Answer: See above
3. What are the different designs of knee replacements that you are aware of?
Answer: The two main designs of non-constrained knee replacement are the single radius and the medial pivot. The single radius design attempts to simplify knee kinematics to a single radius of curvature. This relies on the concept that during a functional range of movement the instant centre of rotation doesn't alter significantly from the interepicondylar axis. The design of the femoral component is therefore relatively simple with both femoral condyles being equal. The medial pivot knee attempts to recreate more normal biomechanics with a relatively fixed medial side creating almost a ball and socket joint whereas the lateral condyle is longer and flatter to allow more sliding

4. What do you understand by the concept of a single radius design?

Answer: See above

5. How would you compare the two different types of knee replacements, with different design concepts in a laboratory?

Answer: There would be several stages to the comparison. The first would be using a suitable ex-vivo model to establish the behaviour of the implants as regards wear and range of movement. Subsequently *in-vivo* analysis of appropriately randomised and

matched patients using both gait analysis and 3D fluoroscopic analysis.

6. What do you understand by 3D Fluoroscopic Analysis and what does it involve?

Answer: 3D fluoroscopic analysis involves taking 2D fluoroscopic images and using a computer to overlay a previously generated 3D model of the implants. It allows the *in-vivo* dynamic modelling of implants from simple fluoroscopic images.¹⁹

References

1. **Savage R, Risitano G.** Flexor tendon repair using a "six strand" method of repair and early active mobilisation. *J Hand Surg [Br]* 1989;14B:396-399.
2. **McKee M.D, RICHARDS R.R.** Dynamic radio-ulnar convergence after the darrach procedure. *J Bone Joint Surg [Br]* 1996;78-B:413-8.
3. **Dorr LD, Wan Z.** Cementless hemispheric porous-coated sockets implanted with press-fit technique without screws: average ten-year follow-up. *Udomkiat P1, J Bone Joint Surg Am.* 2002 Jul;84-A(7):1195-200
4. **Mabry T, Tsaras G, Spangehl M, Erwin PJ, Murad MH, Steckelberg J, Osmon D.** Inflammatory blood laboratory levels as markers of prosthetic joint infection: a systematic review and meta-analysis. *J Bone Joint Surg Am.* 2010 Sep 1;92 (11):2102-9.
5. **Tanoira I, Comba F, Piccaluga F.** Combining C-reactive protein and interleukin-6 may be useful to detect periprosthetic hip infection. *Clin Orthop Relat Res.* 2010 Dec;468(12):3263-7.
6. **Morawietz L, Hasart O, Strube P, Perka C, Tohtz S.** Diagnosis of periprosthetic infection following total hip arthroplasty—evaluation of the diagnostic values of pre- and intraoperative parameters and the associated strategy to preoperatively select patients with a high probability of joint infection. *J Orthop Surg Res.* 2008 Jul 21;3:31
7. **Dora C, Houweling M, Koch P, Sierra RJ.** Iliopsoas impingement after total hip replacement: the results of non-operative management, tenotomy or acetabular revision. *J Bone Joint Surg [Br]*. 2007 Aug;89(8):1031-5.
8. **Lachiewicz PF, Kauk JR.** Anterior iliopsoas impingement and tendinitis after total hip arthroplasty. *Orthop Surg.* 2009 June;17(6):337-44.
9. **Nunley RM, Wilson JM, Gilula L, Clohisy JC, Barrack RL, Maloney WJ.** Iliopsoas bursa injections can be beneficial for pain after total hip arthroplasty. *Clin Orthop Relat Res.* 2010 Feb;468(2):519-26
10. **Ring D, Gulotta L, Chin K, Jupiter JB.** Olecranon osteotomy for exposure of fractures and nonunions of the distal humerus. *J Orthop Trauma.* 2004 Aug;18(7):446-9.
11. **Coles CP, Barel DP, Nork SE, Taitsman LA, Hanel DP, Bradford Henley M.** The olecranon osteotomy: a six-year experience in the treatment of intraarticular fractures of the distal humerus. *Coles CP1. J Orthop Trauma.* 2006 Mar;20(3):164-71.
12. **Mishra P, Aggarwal A, Rajagopalan M, Dhammi I, John AK.** Critical analysis of triceps-reflecting anconeus pedicle (TRAP) approach for operative management of intra-articular distal humerus fractures. *J Clin Orthop Trauma* 2010;1:71-80.
13. **McKenna H, Burke FD, Davis TR.** Five- to 18-year follow-up for treatment of trapeziometacarpal osteoarthritis: a prospective comparison of excision, tendon interposition, and ligament reconstruction and tendon interposition. *Gangopadhyay S1. J Hand Surg Am.* 2012 Mar;37(3):411-7
14. **Linscheid RL, Amadio PC.** Long-term outcomes of first metacarpal extension osteotomy in the treatment of carpal-metacarpal osteoarthritis. *Parker WL1. J Hand Surg Am.* 2008 Dec;33(10):1737-43.
15. **Poulter RJ, Davis TR.** Management of hyperextension of the metacarpophalangeal joint in association with trapeziometacarpal joint osteoarthritis. *J Hand Surg Eur Vol* May;36(4): 280-284
16. **Miller NJ, Davis TR.** Palmar plate capsulodesis for thumb metacarpophalangeal joint hyperextension in association with trapeziometacarpal osteoarthritis. *J Hand Surg Eur Vol.* 2014 Mar;39(3):272-5
17. **J. Fischer, Shivarathre.D, Quinton.D,** Management of long term complications following trapeziectomy. *J Bone Joint Surg Br* 2011 vol. 93-B no. SUPP III 301
18. **McCredie J, Willert HG.** Longitudinal limb deficiencies and the sclerotomes An analysis of 378 dysmelic malformations induced by thalidomide. *J Bone Joint Surg [Br]* 1999;81(11):9-23.
19. **Bellemans. J, Banks. S, Victor. J, Vandenneucker. H, Moemans. A.** Fluoroscopic analysis of the kinematics of deep flexion in total knee arthroplasty INFLUENCE OF POSTERIOR CONDYLAR OFFSET *J Bone Joint Surg [Br]* 2005;87(5): 646-655