Exam Corner

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MCQs and EMQs

1. With regards to decompression for De Quervain's tenosynovitis, which is the most likely complication to have occurred in the following scenarios? Please select from the options below.
   a. Positive Tinel's test - superficial radial nerve (ulnar branch) injury/ entrapment
   b. Extending the proximal phalanx against resistance while in maximal abduction, causes pain - inadequate release of extensor pollicis brevis
   c. Poor flexion of the thumb interphalangeal joint and extension of the thumb metacarpophalangeal joint - tendon adherence of abductor pollicis longus and extensor pollicis brevis due to prolonged immobilisation
   d. Painful snapping sensation - extreme radial release of extensor retinaculum

2. All of the following statements about various orthoses are true except:
   Answer: b. A rocker sole lessens the bending forces on the arthritic midfoot as the foot passes from initial heel strike to mid-stance

   The opponens splint is used to hold the thumb in an appropriate position to allow opposition. It may be used in a patient who lacks opposition due to neurological abnormality or in whom opposition is uncomfortable due to CMCJ degenerative change. It impairs tactile sensation.[1] In an AFO with a medial T-strap, the leather strap arises from the shoe quarter covering the medial malleolus and buckles to the lateral upright, pushing laterally to correct a valgus (eversion) deformity.

3. Which of the following cytokines is not associated with the development of Dupuytren's disease?
   Answer: b. Tumour necrosis factor alpha

   Inflammation is known to play a crucial role in fibrosis, and a variety of proinflammatory cytokines have been implicated, including TNF, IL-1, and IL-6. It was found that cells freshly disaggregated from Dupuytren's tissue released appreciable amounts of TNF, IL-6, GM-CSF, and variable amounts of TGF- þ1.[2] Among the cytokines, transforming growth factor- is thought to be a significant inducer of myofibroblast transdifferentiation because of its ability to up-regulate smooth muscle actin and collagen in fibroblasts, both *in vivo* and *in vitro*.[3] There is evidence of the importance of nerve growth factor in the proliferative pahse of the disease.[4] Both epidermal[5] and fibroblast[6] growth factor have also been shown to be elevated in Dupuytrens tissue.

4. With regards to mature articular cartilage of the knee, which one of the following statements is true?
   Answer: e. Proteoglycans produced by chondrocytes provide compressive strength

   The composition of articular cartilage is 65% to 80% water (wet weight) and the water content decreases with age. Increasing water content such as in osteoarthritis causes a decreased Young's modulus. Proteoglycans do directly provide compressive strength and also indirectly increase compressive strength due to their hydrophilic nature. The main constituent collagen is type II in articular cartilage (with some V, VI, IX, X and XI).

5. Which of the following findings is not associated with Charcot Marie Tooth disease?
   Answer: d. Increased ankle jerk

   CMT is associated with areflexia. Otherwise all are features of the typical cavovarus foot seen in CMT.

6. With regards to the lateral circumflex femoral artery (LCFA), which of the following statements is true?
   Answer: c. The ascending branch of the LCFA anastomoses with terminal branches of the superior gluteal artery

   The LCFA arises from the lateral side of the profunda femoris artery, passes laterally anterior to the psoas between the divisions of the femoral nerve, and behind the sartorius and rectus femoris, and divides into ascending, transverse, and descending branches. The LCFA may occasionally arise directly from the femoral artery. The femoral head in the adult is mainly supplied by the medial femoral circumflex although the LCFA does also form part of the extracapsular arterial ring. The transverse branch anastomoses with the medial femoral circumflex artery and the inferior gluteal vessels. The ascending branch does anastomose with branches of the superior gluteal artery.

Vivas

Adult Pathology

A 60-year-old male presents with back pain, a stiff left hip and poor mobility and function. He suffered a fracture of the neck of the left femur 40 years previously, which was treated surgically. The femoral head collapsed and most of the metalwork was removed.

1. Plain AP pelvis radiographs are shown in Fig. 1a. Describe the appearance of the left hip.
   Answer: This radiograph shows a significantly deformed hip. There is evidence of previous surgery with broken screws visible in the femur. The femoral head is aspherical with evidence of flattening and the acetabulum shows reciprocal change. There is some radiological evidence of ankylosis.

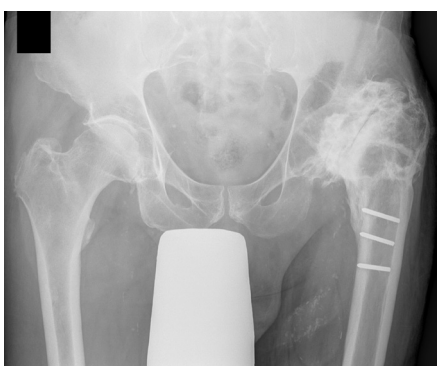

Fig. 1a

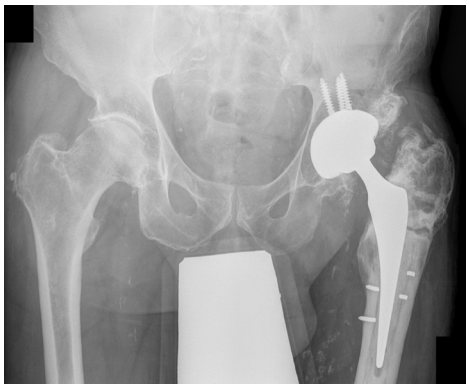

Fig. 1b

2. Describe the most appropriate position for hip fusion.
   Answer: The hip should be fused in 0° of abduction, 0° to 5° of external rotation and 25° to 30° of flexion.[7] This gives the best compromise between ambulation and positioning the limb for sitting. The most important thing is to avoid abduction as this makes gait very awkward, however, some would suggest slight adduction is preferable.

3. In what patient groups might fusion of the hip be an appropriate treatment?
   Answer: The classical indications for hip arthrodesis are a young male patient with a high-demand physical job with unilateral degenerative disease. It leads to a 30% increase in energy expenditure and approximately two to three patients will develop degenerative change in adjacent joints within 25 years.

4. What difficulties would be expected while performing an arthroplasty in this patient?
   Answer: I would divide these problems into intra-operative and post-operative issues. As part of my planning I would ensure that I had EMG evidence of functioning hip abductors and would also arrange an MRI scan to assess for fatty infiltration and also a CT to assess for ankylosis. If the abductors are non functional then I would plan for a more constrained acetabulum. The approach may be complicated by previous surgery and the distortion of the bony anatomy may make the femoral bone cuts more difficult. I would expect to cut the neck *in situ*. The acetabulum will require reconstruction and I would pay particular care to ensure that I medialise the component adequately to restore the centre of rotation. There may be some bony defects but I these would most likely be contained and I would therefore aim to use the reamings as bone graft but would also have reconstruction rings and frozen allograft available. The broken screws in the femur would obviously need to be removed prior to any femoral preparation. The other slight concern is that in restoring the native anatomy I would be lengthening him slightly but this is less than 2.5 cm and therefore is unlikely to cause problems with the sciatic nerve post-operatively. The other concerns in the post operative period are related to the poor gluteal function and consist of increased risk of dislocation and a slower rehabilitation.

Trauma

A 74-year-old cachetic gentleman (BMI-15) has been referred to you with hip pain by the medical team with the following radiographs (Fig. 2). He has a long-standing history of inflammatory arthropathy.

Fig. 2

1. Describe the radiographs.
   Answer: This is an AP radiograph of both hips showing bilateral displaced intracapsular fractures of the proximal femurs.

2. What is the differential diagnosis?
   Answer: These fractures are likely to be pathological and may therefore be related to local areas of weakness (e.g. metastases) or more likely be related to a systemic condition such as osteoporosis. A generalised reduction
   in bone density in this gentleman may either be related to the treatment of his inflammatory arthropathy (e.g. steroids), a malnourished state, or possibly to a systemic condition such as hyperparathyroidism or renal failure. The final consideration is that bilateral fractures such as this may be related to seizures.

3. How would you further investigate the patient?
   Answer: After taking an appropriate history I would initially investigate this gentleman with simple blood tests. I would ensure that I had a liver profile and urea and electrolytes to assess his renal function and nutritional status. His bone profile would provide important information and help exclude systemic causes. I would obtain full length femoral views to ensure there were no areas of lysis distally and governed by the history may arrange a CT chest/abdomen/pelvis to see if any primary tumour could be found. A bone scan would also form a part of my work-up.

4. What would be your definitive management and why?
   Answer: Assuming the patient is fit for surgery I would manage these fractures operatively to improve his pain control, mobility and ease of nursing. I would treat them both with cemented hip hemiarthroplasty as I feel that the degree of displacement and his metabolic derangement that fixation is unlikey to succeed. I would aim to do this under a single anaesthetic.[8] I am most familiar with cemented systems and the outcomes of cemented systems are historically better,[9] although the newer cementless systems also have good results.[10]

Hands

A 38-year-old lady presents with pain in the region of her index finger pulp, which is worse on exposure to the cold and associated with exquisite discomfort when she knocks it against anything. Physical examination reveals tenderness on one side of the pulp on the radial side with a full range of movement of the distal interphalangeal joint. She underwent an exploration of the finger and a minute lesion, which was difficult to identify, was excised, with complete resolution of symptoms (Figs 3a to 3c).

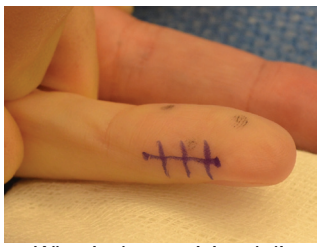

Fig. 3a

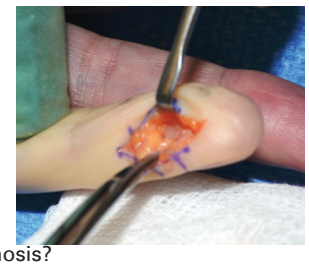

Fig. 3b

1. What is the provisional diagnosis?

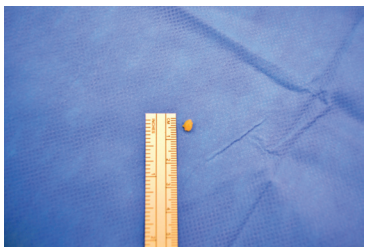

Fig. 3c

Answer: Glomus tumour

2. How do these tumours classically present?
   Answer: A glomus tumour is described as a benign vascular hamartoma that contains all the neuromyoarterial cells of the glomus apparatus within the dermis. Due to the high concentration of glomus bodies in the subungual region, 75% to 90% of glomus tumours are found in this region.
   Diagnosis is based on the classical clinical triad of severe pain, pinpoint tenderness and cold sensitivity.
   A positive Love test consists of applying pressure to the suspected area with a pinhead, which elicits exquisite localised pain.
   The Hildreth test produces a reduction of pain and tenderness and also reduction or abolition of tenderness with the Love test using a digital tourniquet to produce transient ischaemia. On releasing the tourniquet there is a sudden increase in pain in the affected area.
   The Joseph Posner test involves the use of ethyl alcohol spray to demonstrate cold provocation of pain in the affected area.

3. What investigations can you perform to confirm the diagnosis?
   Answer: Ulltrasonography, particularly Colour duplex Doppler sonography is preferred over standard ultrasonography, with a near 100% pick up rate and can identify tumours as small as 2 mm in diameter.
   Glomus tumours on MRI have a low signal intensity on T1-weighted images, marked hyperintensity on T2-weighted images, and enhancement on T1-weighted scans after injection of contrast (gadolinium). It has been stated that MRI scans should be used in the detection of multiple tumours.

4. What is the treatment and prognosis of this condition?
   Answer: Although laser ablation and sclerotherapy have been described in the management of glomus tumours, surgery is the gold standard and a meticulous dissection and excision is inevitably associated with an excellent clinical result.
   A lateral subperiosteal approach can be used as shown and this is suitable for more proximal subungual lesions and reduces chances of damage to the nail matrix as compared with the more traditional transungual approach in which the nail plate is removed, the nail bed is incised over the lesion and the tumour is removed.
   As regards prognosis the incidence of multiple synchronous lesions is reported to be as high as 25%, hence the need for a thorough pre-operative evaluation. The rate of recurrence is reported to be as high as 20%, with a range of 4% to 15%. Thus, due to the high recurrence rate and the high incidence of synchronous tumours, it is recommended that if symptoms persist at three months following an excision, repeat imaging and re-exploration is strongly recommended.
   Marginal excision is usually curative with very low chance of recurrence. There have been case reports of malignant glomus tumours, though these are very rare.[11]

Children's Orthopaedics

Here are the AP and lateral radiographs of a boy who fell off a trampoline and injured his left elbow (Figs 4a and 4b)

Fig. 4a

Fig. 4b

1. What is the injury and how would you treat it?
   Answer: The diagnosis is a fracture of the lateral condyle of the humerus (Salter-Harrris Type IV growth plate injury). Although the displacement is mild, the injury is prone to non-union and progressive displacement, as happened in this case.
   Therefore, the injury should undergo open reduction and fixation.
   If K-wires are used, these should be crossed rather than parallel, otherwise the fragment may re-displace.[12]

Here is a radiograph of a 13-year-old boy who presented with a painful limp and a stiff left hip (Fig. 5).

Fig. 5

2. Discuss the treatment of such a case in relation to classification of the condition and clinical presentation.
Answer: The diagnosis is a late chronic slipped upper femoral epiphysis with the growth plate open (Dunn classification). The buttressing and other attempts at remodelling confirm the chronicity.
The patient is likely to have had intermittent symptoms for many months. Although the radiograph shows an extreme slip with a corresponding external rotation, adduction and extension deformity of the hip, the symptoms may not be bad enough to prevent walking.
If operative treatment is indicated because of pain or loss of flexion, the deformity should be corrected by osteotomy through the growth plate (Dunn or Fish). These procedures carry the risk of avascular necrosis.
It maybe wiser to wait until the physis fuses naturally, then correct the deformity by a combined flexion, internal and flexion (triplane) osteotomy.

Basic Science

1. Describe the structure and composition of tendons.
Answer: Tendons contains mainly type I collagen (90%) with about 10% type III and small amounts of type IV. Type I collagen forms a right handed helical structure which then can combine in a quarter stagger array to form microfibrils. Microfibrils aggregate to form fibres, which in turn form bundles. Fibroblasts are arranged between these bundles in parallel layers.
A group of bundles is termed a fascicle and each fascicle is bounded by a layer called the endotendon. The epitenon is a synovium-like membrane, which is only found in certain tendons in which there is high friction (eg wrist) and produces a synovial fluid to aid lubrication. The outermost layer is termed the paratenon, which contains abundant blood vessels and cells. In avascular tendons the paratenon is replaced with a true synovial sheath. 90% of the dry weight of tendon is made up of collagen with the remainder from cells and also ground substance consisting mainly of proteoglycans, which form a gel like substance to help bind the collagen together.[13]

2. Compare and contrast the structural properties of both tendons and ligaments.
Answer: Ligaments are similar in composition to tendons, again predominantly type I collagen. However, they have a higher concentration of elastin. Furthermore the arrangement of the collagen fibres is less uniform in ligaments. Rather than all fibres essentially lining up along the long axis (as in tendons) the fibres in ligaments are arranged in layers, which allows the ligament to resist forces well in several planes. The disadvantage of this arrangement is that in general ligaments have a lower ultimate tensile strength. The fibres in ligaments are also crimped slightly which allows the ligament to absorb more tension without an increase in stress (the toe region of the stress-strain curve).

3. Describe the structure of insertion of ligaments and tendons into bone.
Answer: Ligaments and tendons insert into bone both directly via blending into the perisoteum and indirectly via four distinct zones. The stiffness gradually increases across the zones preventing any stress concentration, which would leave the area prone to injury. Zone 1 is closest to the tendon and consists of parallel collagen fibres, these internesh with unmineralised fibrocartilage in zone 2 and this fibrocartilage becomes mineralised in zone 3 before merging with cortical bone in zone 4. All the four zones are traversed by Sharpey's fibres.

4. Describe the structure of collagen.
Answer: See answer above

5. What do you understand by the term 'creep' in relation to the tendon?
Answer: Creep is a visco-elastic property. It relates to the time dependant increasing deformation that a material undergoes under constant load.

6. Describe the healing process in ligaments and tendons.
Answer: Healing of ligaments and tendons is a similar process to other connective tissues with three main phases. The initial haemorrhagic phase lasts a few days and is characterised by haematoma formation and rapid inflammatory response. The key cell is the macrophage. The second phase (the proliferative stage) mainly involves angiogenesis and fibroblasts, which produce mainly type III collagen. The final stage of remodelling starts after a few weeks and involves the conversion of the disorganised type III collagen into type I collagen in a more physiological orientation.
It is worth noting that the actual healing response of actual ligaments/ tendons depends significantly on the particular ligament or tendon. This may be due to blood supply (vascular or avascular tendons), intra-articular positioning, intrinsic biological differences e.g. number of fibroblasts or alterations in the mechanical environment. It is also generally true that both ligaments and tendons have slower and more limited healing responses when compared to skin or bone.

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