Exam Corner

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Vikas Khanduja,
MSc, FRCS (Orth)
Consultant Orthopaedic Surgeon,
Addenbrooke's - Cambridge University Hospital NHS Trust, Cambridge
CB2 0QQ, UK.
Associate Editor, *the Journal of Bone and Joint Surgery [Br]*
email: vk279@cam.ac.uk

Contributors:
- Simranjeev Johal SpR East of England Rotation
- Karanjeev Johal SpR, North Thames Rotation

MCQs – Adult Pathology – Single Best Answer

1. A 26-year-old basketball player was noted to have an absent anterosuperior labrum during a shoulder MRI arthrogram. Which of the following would be true for a Buford complex?
   Answer: e. Reattaching the complex will lead to painful restriction of rotation
   The Buford complex is an anatomical variant of the anterosuperior labrum. Williams et al[1] noted that it was present in 1.5% of shoulders arthroscoped and consisted of a "cord-like" middle glenohumeral ligament that originated directly from the superior labrum at the base of the biceps tendon and crossed the subscapularis tendon to insert on to the humerus. There was absent anterosuperior labral tissue present between this attachment and the midglenoid notch. Anatomical variant could be confused with labral detachment. However, if reattached to the glenoid, severe painful restriction of rotation and elevation would occur.

2. Which one of the following exercise regime would you recommend to someone who wishes to improve his/her muscle bulk?
   Answer: a. Isometric
   The following are different types of muscle contraction:
   - isometric - muscle contraction with constant length (e.g. pushing a fixed object)
   - isokinetic - muscle contraction with constant speed
   - plyometric - initial rapid lengthening followed by contraction of muscle (e.g. jumping up and down)
   - isotonic - muscle contraction with constant tension
   - concentric- muscle shortens during contraction (e.g. biceps curl)
   - eccentric - muscle lengthens during contraction

3. With regards to the Bunnel-Littler test, which of the following statements is false:
   Answer: e. Flexor digitorum profundus laceration distal to lumbrical origin may give a false positive test
   An FDP laceration distal to lumbrical origin would lead to a lumbrical plus finger, in which flexion at the MCPJ would lead to PIPJ extension. Therefore a lumbrical plus finger would not give a false positive Bunnell-Littler test.

4. A 13-year-old girl presents with a flexion deformity of the little finger PIP joint (camptodactyly). Which one of the following statements is true?
   Answer: a. The deformity is usually due to an abnormality in the lumbrical or flexor digitorum superficialis insertion
   There is very rarely any compromise in function; therefore operative intervention is usually not indicated. Infantile type camptodactyly can respond to stretching. If multiple digits are involved they can be associated with other syndromes, although this is rare.

5. Which one of the following is true about arthrogryposis?
   Answer: a. Results from a defect in the motor unit
   Arthrogryposis is a rare congenital disorder that is characterised by non-progressive joint contractures. Causes can be extrinsic (severe oligohydramnios or other feto/maternal reasons for reduced fetal movement) or intrinsic (CNS, PNS, connective tissue disorders). Other organ abnormalities can be noted as well.

Vivas

Adult Pathology

A 44-year-old microlight pilot sustained this injury (Fig. 1) in a crash landing.

1. Describe the radiograph.
   Answer: This is a lateral radiograph of the distal tibia/fibula and hindfoot/midfoot. It shows a talar fracture with extrusion of the talus anteriorly. The tibiotalar, subtalar and talo-navicular joint are dislocated.

2. There is an 8 cm clean laceration overlying the injury with a pale foot and no pulses. Describe your treatment strategy for this patient.
   Answer: The mechanism of injury and the radiograph are consistent with an extremely high energy injury and therefore I would manage this patient according to ATLS protocol, identifying life and then other limb-threatening injuries. If this

Fig. 1

is deemed to be an isolated injury, the extruded talus and vascular compromise is a surgical emergency and would need emergent treatment in theatre. I would also assess for signs of compartment syndrome and contact plastic surgical and vascular surgical teams to assess the patient and to be present in theatre. The fracture would be treated as any open fracture in the emergency department with intravenous antibiotics, tetanus cover, irrigation if any gross contamination, pictorial documentation and temporary splintage.
In theatre, a thorough debridement and washout of the laceration would be performed by joint orthopaedic and plastic surgical teams and an open reduction of the extruded fragment performed. A vascular surgeon would be present to assess restoration of pulses post reduction and consideration of an on-table angiogram would be made. A negative pressure vacuum dressing would be applied to the open wound. Consideration could be made at the time for definitive fixation and soft-tissue coverage, but given the high energy injury and associated swelling, I feel a spanning external fixator would be the treatment of choice. This would be combined with foot fasciotomies if indicated. At a later stage, further CT imaging of the injury would be performed to plan definitive fixation. Of note, if the extruded fragment was significantly contaminated and had no soft-tissue attachments, then consideration could be made to removal of the fragment and the use of a cement spacer, with a view to a later pan-talar fusion. This is because of the high infection rates associated with retained contaminated, denuded extruded fragments.

3. What is the common classification of talar fractures and what is the likely risk of nonunion in this case?
Answer: Talar fractures can be classified anatomically into head, neck, body, lateral and posterior process fractures. The most common fracture is one of the talar neck, for which the Hawkins classification is prognostic. Delayed union rates of up to 15% have been noted but non-union is rare. The more common problem is that of avascular necrosis (AVN) and this varies according to the Hawkins classification as follows.

Hawkins I – undisplaced neck fracture – AVN risk 0 to 13%
Hawkins II – displaced with subtalar subluxation / dislocation AVN 20 to 50%
Hawkins III – displaced with subtalar and tibiotalar dislocation AVN 50 to 100%
Hawkins IV – displaced with subtalar/tibiotalar/ talonavicular dislocation 80 to 100%

4. What is Hawkin's sign and what is the pathogenesis of this phenomenon?
Answer: Hawkin's sign is the appearance of reduced subchondral bone density in the talar dome six to eight weeks following injury. This subchondral resorption indicates that vascularity to the talus is sufficient to allow normal resorption associated with disuse osteopaenia.

5. Discuss the blood supply to the talus.
Answer: Talar blood supply is from various sources:
1. Artery of the tarsal canal (dominant supply to body) – branch of posterior tibial artery
2. Deltoid branch of posterior tibial artery (may be only remaining supply and must be preserved during fixation)
3. Anterior tibial artery – supplies head and neck
4. Perforating peroneal arteries via the artery of the tarsal sinus (head and neck)

Trauma

A 26-year-old motorcyclist was involved in a road traffic accident at a speed of 50 mph and sustained this injury (Figs 2a and 2b).

1. How would you classify this injury?
Answer: The radiographs shows a displaced, comminuted, segmental and intra-articular fracture of the tibia with an associated fibula fracture. Using the Schatzker classification this is a type VI injury and according to AO this would be a 41-C3 multifragmentary complete articular fracture.

Fig. 2a

Fig. 2b

2. How do you classify soft-tissue injuries with closed fractures?
Answer:

Grade 0	• Minimal soft-tissue damage • Indirect injury to limb (torsion) • Simple fracture pattern
Grade 1	• Superficial abrasion or contusion • Mild fracture pattern
Grade 2	• Deep abrasion • Skin or muscle contusion • Severe fracture pattern • Direct trauma to limb
Grade 3	• Extensive skin contusion or crush injury • Severe damage to underlying muscle • Compartment syndrome • Subcutaneous avulsion

3. How would you manage this injury, assuming that the initial ATLS guidelines have been followed and the patient is stable?
Answer: Assuming that this is an isolated injury in a haemodynamically stable patient and is closed, initial management would also involve assessment of compartment syndrome with compartment pressure monitoring. I would inform the patient that this is a limb-threatening injury and limb salvage may not eventually be possible. Consultation with consultant vascular / plastic surgeons would aid in this decision making process. However, assuming that the injury was closed, isolated and vascularity was intact to a sensate foot in a physiologically stable patient, I would discuss the options with the patient. One option is to immediately have an above knee amputation, which would lead to a quicker return to function but with the inherent problems of an above- knee amputation. The other option would involve temporary spanning external fixator +/- fasciotomies and then definitive treatment with a fine wire external fixator aiming to achieve a mechanically aligned, united and non-infected tibia. This would be a long process potentially taking months / years of surgical intervention and compliance by the patient.

4. What decision making tools are available for predicting limb salvage after high-energy trauma to the lower extremity? Describe them in detail.
Answer:
The mangled extremity severity score (Johansen et al[2])
The mangled extremity severity score is probably the most well known limb salvage scoring system and is as follows:

Skeletal / soft-tissue injury
Low energy (stab; simple fracture; pistol gunshot wound): 1
Medium energy (open or multiple fractures, dislocation): 2
High energy (high speed MVA or rifle GSW): 3
Very high energy (high speed trauma + gross contamination): 4
Limb ischaemia
Pulse reduced or absent but perfusion normal: 1*
Pulseless; paresthesias, diminished capillary refill: 2
Cool, paralysed, insensate, numb: 3*

Shock
Systolic BP always > 90 mm Hg: 0
Hypotensive transiently: 1
Persistent hypotension: 2
Age (years)
< 30: 0
30 to 50: 1
> 50: 2

It has been stated that a MESS score of greater than 7 equates to a poor limb viability prognosis.

Limb Salvage Index (LSI) (Russell et al[3])
Limb trauma associated with vascular injury. Absolute indications for amputation included a score of 6 or more. Retrospective analysis of 70 limbs. 26 had pulse deficits requiring revascularisation.

Seven components related to injury:
- Arterial
- Nerve
- Bone
- Skin
- Muscle
- Deep venous injury
- Warm ischaemia time

Predictive Salvage Index (PSI) (Howe et al[4])
Combined orthopaedic and vascular injuries. Intent to help prevent the attempted salvage of a doomed or useless limb. Retrospective, 21 limbs, studied to determine which variables influenced salvage or loss.
A limb-salvage score was developed that weighted:
- Level of the vascular injury
- Degree of osseous injury
- Degree of muscle injury
- Warm ischemia time

5. What is the evidence to support the use of these tools?
Answer:

	MESS	LSI	PSI
Bosse (n-556) (all limbs, subgroups analysed in original paper)	0.46 (sensitivity)	0.46 (sensitivity)	0.46 (sensitivity)
	0.91 (specificity)	0.97 (specificity)	0.87 (specificity)

Bosse et al[5] in a prospective study of 556 limbs found that all the above lower-extremity injury-severity scoring systems have limited usefulness and cannot be used as the sole criterion by which amputation decisions are made. Overall, the lower-extremity injury-severity scores lack sensitivity, although in some cases they were very specific. The high specificity of the scores confirms that low scores could be used to predict limb-salvage potential. The converse, however, was not true. The low sensitivity of the indices failed to support the validity of the scores as predictors of amputation. The LSI perormed better than the MESS or PSI scores overall, especially when only Grade IIIb open tibial fractures were considered.

Hands

A 32-year-old weightlifter presents with this injury (Figs 3a and 3b).

1. What is your diagnosis?
Answer: The diagnosis is a right-sided distal biceps tendon rupture. In addition due to the obvious retraction of the biceps muscle belly it is likely that the bicipital aponeurosis is also not intact.

2. How does this injury usually occur?
Answer: This occurs due to eccentric loading of the flexed elbow during activity such as weight lifting. Almost solely in middle-aged males, with steroid and tobacco use being risk factors.

3. What are the treatment options?
Answer: Treatment options are non-operative but this leads to

Fig. 3a

Fig. 3b

achievement of 50% normal supination strength and 70% normal flexion strength at one year. Surgical intervention is recommended for active individuals and can be performed through a single/dual incision technique. Fixation techniques using suture anchors / interference screws and an endobutton have all been described.

4. What is the prognosis if the patient opted for surgical intervention?
Answer: Peeters et al[6] found that at 16 months following fixation using an endobutton showed excellent functional outcomes with an almost full range of movement. 80% of flexion strength and 91% of supination strength was regained. One out of 26 patients required removal of the endobutton and there were no other significant complications. Other reported complications in other series are heterotopic ossification, radioulnar synostosis, infection and neurological injury.

Children's Orthopaedics

This 11-year-old girl presented with a painless swelling of her right ring finger (Figs 4a and 4b). The swelling was noted several months ago and it is slowly increasing in size. She is concerned about the appearance.

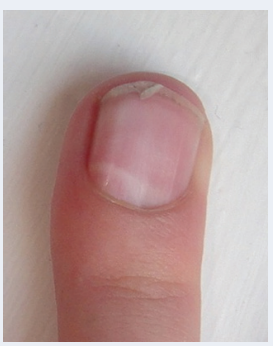

Fig. 4a

Fig. 4b

1. What is the condition and how would you manage the case?
Answer: The condition is a benign subungual exostosis. It is causing minor distortion of the nail bed but there is no angular deformity and the growth plate is intact.
The exostosis will grow in proportion to the rest of the phalnx
Because of the risk of damage to the growth plate with subsequent angulation it would be wise to postpone removal of the exostosis for several years until the physisis is closed or closing. At that time the nail bed could be carefully raised intact to allow excision of the exostosis and replacement of the nail bed in order to prevent distortion of the nail.

Here is the radiograph of a baby who has spontaneously developed an increasingly swollen left forearm (Fig. 5). The infant is generally well but is irritable when the arm is moved.

2. What is the diagnosis and how would you manage the condition?
Answer: The condition is Caffey's disease (Infantile cortical

Fig. 5

hyperostosis). There are no laboratory tests to confirm the diagnosis which is usually reached by exclusion of other possible conditions, such as osteomyelitis, neoplasm, scurvy, hypervitaminosis A and child abuse.

The age at presentation is typical and, although the swelling may increase alarmingly, the condition is self-limiting and will usually resolve spontaneously over 6 to 9 months and leave no long-term sequelae.

Basic Science

1. What are the basic principles behind the use of a tourniquet in upper and lower limb surgery?

   Answer: Tourniquets help provide a bloodless field during surgery, by eliminating arterial flow distal to the tourniquet. They can be non-pneumatic (used for digits) or pneumatic which can be automatic (operate from an air line or electric pump) or non-automatic (hand-operated pump). They should be well padded, of appropriate size and shielded from the surgical prep, which could lead to a burn.

2. How do you decide on inflation pressures in upper and lower limb surgery?

   Answer: There is no absolute value, but a combination of patient age, soft-tissue condition, circumference of limb and comorbid medical conditions should be used to guide inflation pressures. As a rule of thumb in the upper limb, a pressure of 50 mmHg more than systolic is used and in lower limb surgery a value double the systolic is used.

3. When would you not use a tourniquet?

   Answer: A tourniquet is contraindicated in severe crushing injuries or poor skin quality, sickle cell disease and in significant peripheral vascular disease. Also the use of tourniquets during the treatment of infection, open fractures and intramedulllary nailing is often avoided.

4. What are the complications of the use of a tourniquet?

   Answer: Complications can be divided into local and systemic:

   Local
   - Compression neurapraxia
   - Bone and soft-tissue necrosis
   - Direct vascular injury
   - Post-operative swelling / stiffness
   - Wound haematoma / infection

   Systemic
   - Cardiorespiratory decompensation
   - Increased CVP
   - Deep-vein thrombosis
   - Cerebral infarction
   - Altered acid-base balance

5. What do you understand by the term *post-tourniquet syndrome*? How is it treated?

   Answer: This is a tourniquet-induced skeletal muscle ischaemia. Oedema, stiffness, pallor, weakness and numbness can be noted. It is treated with removal of the tourniquet and supportive measures such as ensuring that the patient is well hydrated and haemodynamically stable.

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