



Exam Corner

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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.

MCQs and EMQs – Single Best Answer

1. For each of the following patients select the most appropriate diagnosis from the list?

a. A 65-year-old patient presents with right groin and thigh pain without an injury. His knee gives way and he has noticed numbness over the lower anterior thigh and upper shin. He has a mechanical aortic valve.
Answer: 5. Psoas haematoma.
The lumbar plexus is embedded within the psoas major muscle body. Part of the external vertebral venous plexus lies behind the muscle. The femoral nerve emerges from its lateral border. Thus, a haematoma would affect femoral nerve function.

b. A patient has been treated for lateral right hip pain. This was particularly troublesome going up and down stairs and lying on their left side. She was told she had bursitis. Multiple cortisone injections to the outer side of the hip were performed in the clinic over a period and although initially helpful the symptoms have now changed to pain with weight bearing and a limp.
Answer: 7. Gluteus medius avulsion tear.
Gluteus medius tears, also known as the rotator cuff tear of the hip, involve tearing of the gluteus medius muscle from its attachment. Gluteus medius tears may cause persistent pain mimicking trochanteric bursitis. They may also cause weakness and limping.

c. A 54-year-old male had a right total hip replacement but his hip has never felt 100% right since the operation. The severe nocturnal pain that he was having pre-operatively has now been relieved but he now has new annoying groin pain. He has noticed that he has to lift the right leg out of the car following driving to limit the discomfort in the groin.
Answer: 4. Psoas tendonitis.
Clinical findings include pain in the groin and pain when getting in and out of a car or a chair (requires active flexion and rotation of hip). Risk factors include overhang of the cup >8-12mm +/- retroversion (particularly when proud of the anterior acetabular rim), vertical cup placement (exposed inferior lip contacts psoas), low cup placement, decrease horizontal offset causing the lesser trochanter to abut against the ischium, impingement on a femoral collar, protrusion of an acetabular component fixation screw, an excessively large cup.
2. The essential fluoroscopic views used for percutaneous screw fixation of the sacro-iliac joint would be
Answer: d. AP pelvis, inlet, outlet and lateral sacral
3. Which of the following statements regarding spinal tumours is false?
Answer: a. About 15% of all bone tumours are primary spine tumours
Primary nonlymphoproliferative tumours of the spine are uncommon and make up less than 5% of bone tumours.
4. Regarding the use of early *versus* delayed (> one year) total elbow replacements as a treatment of distal humeral fractures in the elderly, which of the following statements is true?
Answer: b. Objective Mayo elbow performance scores is the same in both groups
Prasad and Dent¹ analysed the outcome of the Coonrad-Morrey total elbow replacement used for fracture of the distal humerus in 32 elderly patients with no evidence of inflammatory arthritis and compared the results for early versus delayed treatment. The percentage of excellent to good results based on the Mayo elbow performance score was not significantly different, 84% in the early group and 79% in the delayed group.
The Kaplan-Meier survivorship analysis for the early and delayed treatment groups was 93% at 88 months and 76% at 84 months, respectively. No significant difference was found between the two groups.
5. Which nerve is most commonly injured nerve during internal fixation of fractures of the 5th metatarsal?
Answer: a. Dorsolateral branch of the sural nerve
The standard lateral approach to the base of the fifth metatarsal carries a higher risk for surgical injury to the lateral dorsal cutaneous branch of the sural nerve. A "high and inside" approach that remains superior to the superior border of the PBT is anatomically safe and may decrease the chance of intraoperative nerve injury and irritation postoperatively.²
6. Which of the following treatment options for scoliosis relates to surgical management via a posterior approach?
Answer: b. Cotrel-Dubousset system
This posterior instrumentation system

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comprises of 7 mm rods, a series of pedicular and laminar hooks that can be secured to the rod at any point along its length and in any transverse axis of rotation, and transverse approximators. Pedicle screws can also be used. Post-operatively no bracing is needed for adolescents. Dwyer, et al.³ used anterior instrumentation. They believed that scoliotic deformities could be approached in two ways, either by stretching the concave side of the curved column or by shortening the long convex side. Their patients wore a jacket to restrict movement for up to three months postoperatively.

The Zielke technique utilises ventral convex-side compression to achieve scoliosis correction. This resulted in greater correction of deformities than previous techniques. This method improved on the Dwyer technique by requiring that the VB screws be placed more posteriorly to enhance the derotation effect and reduce the incidence of iatrogenic kyphosis. Although excellent correction of deformity was possible via the anterior approach, significant incidences of pseudoarthrosis, hardware failure, and loss of correction with the single rod technique were reported. Dual rod anterior instrumentation techniques were introduced to improve upon this.

Vivas

Adult Pathology

A 38-year-old man presented with a history of an injury to his knee after being involved in a tackle whilst playing rugby. He was unable to continue playing and had to be carried away from the field. Radiographs did not reveal any fractures and this is the MRI scan obtained at the time (Fig. 1).

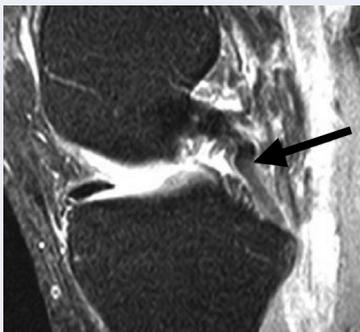


Fig. 1

1. Comment on the MRI Scan.

Answer: The MR image is a sagittal T2 weighted fat suppression sequence. It shows an abnormal posterior cruciate ligament (PCL) with attenuation, abnormal contour and increased signal. This is indicative of a PCL tear. The posterior capsular structures also have an increased signal, indicating injury. There is an effusion within the knee.

2. What is the diagnosis and what is known about the mechanism of injury of this condition?

Answer: The diagnosis is a torn PCL. The most common mechanisms of injury are:

- Direct blow to the anterior tibia (dashboard injury).
- Hyperflexion (non contact).
- Hyperextension (bicruciate injury).
- A fall onto the ground with a plantar-flexed foot.

3. What are the associated injuries with this condition and with what frequency do they occur?

Answer: Associated injuries include those of the anterior cruciate (ACL), lateral collateral (LCL) and medial collateral (MCL) ligaments. The Schenck classification grades multiple ligament injuries (Table 1).

| Class | Involved ligaments |
|---------|--------------------|
| KD I | ACL+MCL or LCL |
| KD II | ACL+PCL |
| KDIII M | ACL+PCL+MCL |
| KDIII L | ACL+PCL+LCL |
| KD IV | ACL+PCL+MCL+LCL |

Table 1. Schenck classification.

PCL injuries are commonly associated with posterolateral corner (PLC) injuries (popliteus, popliteofibular ligament, posterolateral capsule, biceps femoris tendon, iliotibial band). According to Mink⁴, combined injuries to the PCL and other structures of the knee are much more common (97%) than isolated PCL injuries (3%). The ACL is injured most commonly (65%), followed by the MCL (50%), the medial meniscus (30%), the posterior capsule, and lateral collateral ligament.

Sonin et al.⁵ also found that the ACL was the most commonly associated injured ligament (Table 2).

| Associated structure | Percentage |
|----------------------|------------|
| ACL | 27 |
| MCL | 20 |
| LCL | 7 |
| Medial meniscus | 35 |
| Lateral meniscus | 28 |
| Bone injury | 35 |
| Effusion | 65 |

Table 2. Associated MRI findings in 71 patients with PCL injury⁵.

Posterior tibial dislocations resulting from PCL disruption can damage the tibial and peroneal nerves. Peroneal nerve injury is more common in combined injuries involving the arcuate complex of the posterolateral corner of the knee. The incidence of vascular injury can be as high as 14%. Multiple knee ligament injuries may be associated with vascular injuries in 30%-50% of cases.

4. What is the treatment if this was an isolated injury and why?

Answer: Nonoperative treatment is usually favoured for most isolated grade I and grade II injuries. This is because the PCL has the ability to heal and therefore the knee is likely to be stable and asymptomatic after rehabilitation. This involves the use of an extension brace for two to four weeks and physiotherapy concentrating on quadriceps strengthening to compensate for posterior translation.

The risk of treating grade III PCL injuries non-operatively is the late development of chondrosis of the medial femoral condyle and patellofemoral joint.

5. When are the indications for surgical intervention?

Answer: The indications for surgical intervention after acute PCL injury are:

- Failed rehabilitation of an isolated grade I or II injury.
- Isolated grade III injury.
 - Active athlete.
 - Young patient.
 - Development of chondrosis on follow-up.
 - Continued pain or instability despite rehabilitation.
- Displaced bone avulsion with intact PCL.
- Combined injury (associated ACL, MCL, LCL and/or PLC injury).

6. Discuss the rehabilitation regime following treatment?

Answer: Postoperative rehabilitation is dependent to a degree on the technique used to reconstruct the PCL and the fixation method used.

Generally the patient is instructed to 50% weight-bear for the first four weeks.

Initial bracing in extension relaxes the anterolateral component of the PCL and minimises gravitational forces.

Early motion is emphasised. Initially flexion exercises should be done in the prone position to prevent an increased gravitational stress on the graft.

Loss of full extension can be a problem and this regime should be emphasised from the beginning of treatment. Quadriceps strengthening can begin immediately with straight leg raises and quad sets.

Hamstring isometric exercises should be avoided for the first six weeks postoperatively.

Trauma

A 41-year-old woman presented with a history of fall on her left non-dominant arm during a night out. After assessment in A&E an acute rotator cuff tear of the shoulder was diagnosed and referral made for the trauma clinic. She was also complaining of pain and stiffness of the elbow joint. The radiographs of the left elbow are as below (Figs 2a and 2b).



Fig. 2a



Fig. 2b

1. Describe the radiographs.

Answer: The radiographs are AP and lateral views of the elbow. On the AP view there is slight incongruence and widening of the radiocapitellar joint with soft tissue swelling medially and laterally. The lateral view shows incongruence of the radiocapitellar and ulnohumeral joints. The radial head is subluxed posteriorly and there is a drop sign.⁶

2. What is the diagnosis and what are the possible causes for this radiological feature?

Answer: Opening of the radiocapitellar joint and posterior subluxation is due to injury of the lateral collateral ligament complex. O'Driscoll described the stages of elbow instability. Stage 1 involves partial or complete disruption of the LCL, which may result in posterior subluxation of the radial head.⁷

3. Describe simple and complex dislocations of the elbow joint?

Answer: Simple dislocations of the elbow joint are those that occur without an associated fracture. Complex elbow dislocations occur with an associated fracture.

4. What is the pathoanatomy of simple dislocations?

Answer: Simple dislocations result from injury to the capsuloligamentous stabilisers of the elbow joint. Failure of structures usually progresses from lateral to medial. There is a variable degree of injury to the common flexor and extensor musculature. The LCL fails first, usually by avulsion from the lateral epicondyle. The stages have been described by O'Driscoll et al:⁷

- Stage 1 – Partial or complete disruption of LCL.
- Stage 2 – Injury to the lateral ligamentous complex and osseous / ligamentous supporting structures anteriorly and/or posteriorly.
- Stage 3A – Injury to all soft tissue support except the anterior band of MCL.
- Stage 3B – Injury to the entire medial ligamentous complex.
- Stage 3C – Complete soft tissue disruption from the distal humerus.

5. How would you manage this patient?

Answer:

- Full history – including medical history, occupation and hobbies.
- Examination – neurovascular examination of the limb, signs of compartment syndrome, presence of any skin defects, tenderness on the medial side over the MCL.
- Adequate analgesia.
- I would not place the elbow into a cast, as the weight may cause the elbow to dislocate. I would provide a collar and cuff or polysling for comfort. If the elbow is very unstable or the patient cannot tolerate these I would use a hinged elbow brace / cast brace.
- If an above elbow POP backslab is used the elbow should be re-imaged soon afterwards and the backslab should be discarded at two weeks to prevent stiffness.
- Encourage early active flexion and extension in neutral rotation / pronation. The action of the elbow flexors / extensors will provide dynamic stability. Slight subluxations may only require this treatment.
- If the elbow failed to remain concentrically reduced with active movements, re-dislocated or was symptomatically unstable I would counsel the patient regarding operative stabilisation.
- I would screen the elbow under GA using fluoroscopy (varus / valgus / PLRI).
- I would perform an open repair of the lateral ligament complex and common extensor origin either through drill holes in the humerus or using suture anchors.
- I would repeat elbow screening and repair the MCL / common flexor origin / anterior capsule if the elbow remained unstable.
- If the elbow continued to be unstable I would apply a hinged external fixator.
- If stability is restored with soft tissue repairs alone the elbow can be mobilised within a few days of surgery +/- hinged brace.

Hands

1. What is the diagnosis of the condition (Fig. 3)?

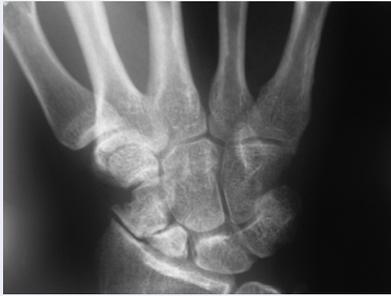


Fig. 3

Answer: This is a PA radiograph of the hand and wrist showing a scaphoid waist non-union (fracture gap and sclerosis / cysts). There is narrowing of the radioscaphoid joint space with an osteophyte at the tip of the radial styloid. This is a SNAC wrist (scaphoid nonunion advanced collapse).

2. Is there a classification associated with the same and what is the stage of the above wrist?

Answer: Scaphoid nonunion advanced collapse is classified into three stages:^{8,9}

- Stage I – Beaking of radial styloid.
- Stage II – Radioscaphoid joint arthrosis.
- Stage III – Arthrosis extended to the midcarpal joint (capitulate and scaphocapitate joints).

This patient has stage II disease.

3. What is the natural history of this condition?

Answer: In their original paper Vender and Watson⁹ reported that for nonunions of four years duration, 75% of patients had radioscaphoid changes, and for those of nine years duration 60% of the patients had midcarpal changes. The pattern of arthritis in scaphoid nonunion is that of scapholunate advanced collapse (SLAC) wrist resulting from rotary subluxation of the distal scaphoid fragment. The radius-proximal scaphoid fragment joint and the radiolunate joint were consistently spared from degenerative changes, even with severe arthritis. Instability was progressive and associated with an earlier onset of arthritis. Patients with symptomatic scaphoid nonunions appear to have a significant likelihood of arthritis developing.

4. What are the treatment options for this wrist in a symptomatic young patient with a physical job?

Answer: The treatment options are broadly:

- Nonoperative
 - Analgesia, splintage, injections.
- Operative
 - Four corner fusion (4CF) +/- scaphoid excision.
 - Proximal row carpectomy (PRC).
 - Wrist denervation.
 - Wrist fusion.

There are no studies of the long term success of nonoperative treatment of SNAC wrist or any true natural history studies. There are limited studies comparing PRC and 4CF. A systematic review by Mulford et al¹⁰ found that that there was a lack of high quality trials. Both procedures give improvements in pain and subjective outcome measures for patients with symptomatic and appropriately staged SLAC or SNAC wrists. PRC may provide better postoperative

range of movement and lacks the potential complications specific to 4CF (nonunion, hardware issues and dorsal impingement). However, the risk of subsequent osteoarthritis is significantly higher in PRC patients despite the majority being asymptomatic at the time of review. Grip strength, pain relief and subjective outcomes are similar in both treatment groups.

One retrospective study recommended 4CF for patients who do heavy manual work because better grip strength was achieved.¹¹

A long-term (minimum of ten-year follow-up) assessment of PRC by DiDonna et al. noted that all patients who were older than 35 years of age at the time of surgery were satisfied and maintained satisfactory wrist ROM, grip strength, and pain relief. At a minimum of 20-year follow-up the same group recommended a minimum age for PRC between 35 and 40 years. They concluded that young patients should not be excluded as PRC candidates; these patients should undergo appropriate preoperative counselling of their increased failure risk secondary to their young age.¹²

5. What are the common complications following the two main surgical options used for the treatment of this condition?

Answer: Common complications specific to four corner fusion are nonunion, hardware issues and dorsal impingement. Common complications specific to proximal row carpectomy are the development of further osteoarthritis, however this may or may not be symptomatic.

Children's Orthopaedics

Here is an ultrasound scan (Fig. 4a) and plain radiograph (Fig. 4b) of a four-year-old boy who presented with a one-day history of a limp and painful restriction of movements in the right hip. He is afebrile and clinically well.

1. What is the likely diagnosis and how would you manage the condition initially?



Fig. 4a



Fig. 4b

Answer: The diagnosis is irritable hip. This is usually caused by a transient synovitis, as shown on the ultrasound scan. In the great majority of cases, this settles within a week or so, with no long-term effects.

In the absence of fever and abnormal WCC and CRP the child should be managed symptomatically with rest and analgesics. With loss of symptoms and a normal radiograph, the child could be discharged.

However, in this case, the radiograph shows flattening of the right capital epiphysis, suggestive of an early Perthes disease, as confirmed in later radiographs (Fig. 4c,d). This possibility of Perthes disease needs to be explained to the family at the outset and the child kept under regular review. The management of Perthes is another debate but it is important to make families aware of the diagnosis as early as possible.



Fig. 4c



Fig. 4d

Here is the pelvic radiograph (Fig. 5) of a two-year-old girl with hypermobile joints who presented with a painless waddling gait. She had no family history of hip disease and her developmental milestones were normal.



Fig. 5

2. How would you manage the case?

Answer: The diagnosis is bilateral congenital hip dislocations. A syndromic condition needs to be excluded, especially with the history of hypermobile joints and the radiographic appearance of high dislocations and poorly developed capital epiphyses.

In the absence of a condition such as Ehlers-Danlos syndrome or neuromuscular disease the great majority of orthopaedic surgeons would reduce these hips. Closed reduction is unlikely to be successful and the likely treatment would be open reduction with femoral shortening and a realignment osteotomy on the femoral or pelvic side.

Basic Science

1. Describe the anatomy of the medial and lateral meniscus.

Answer: Each meniscus covers approximately the peripheral two-thirds of the corresponding articular surface of the tibia. They are Triangular cross section with a thick outer border

tapering to a thin free edge. The proximal surfaces are concave and in contact with the femoral condyles. The distal surfaces are flat and rest on the tibial plateau. The transverse ligament is a variable band that connects the anterior convexity of the lateral meniscus (LM) to the anterior horn of the medial meniscus (MM).

Medial meniscus:

- Semicircular in shape.
- Posterior horn is wider than the anterior horn.
- Posterior attachment to the posterior intercondylar fossa of the tibia, anterior to the PCL attachment.
- Anterior attachment approximately 7mm anterior to the ACL attachment, in line with the medial tibial tubercle.
- Peripherally continuously attached to the capsule, most firmly at the deep MCL.

Lateral meniscus:

- Almost circular in shape (four fifths of a circle).
- Covers a larger area than the medial meniscus (MM).
- Uniform width.
- Anterior horn attachment to the intercondylar fossa adjacent and behind the ACL.
- Posterior horn attachment to the intercondylar fossa adjacent and anterior to the posterior horn of the MM.
- Attachment to the capsule is interrupted by the popliteus tendon.
- Only a loose peripheral attachment to the joint capsule and no attachment to the LCL.
- Some fibres of the popliteus are attached to the posterior convexity of the LM.

2. Describe the anatomy of the ligaments of Wrisberg and Humphrey.

Answer: Ligaments run from the convexity of the posterior horn of the lateral meniscus to the medial femoral condyle either in front of (anterior menisiofemoral ligament of Humphrey) or behind (posterior menisiofemoral ligament of Wrisberg) the PCL.

3. Discuss the blood supply of the meniscus.

Answer: The menisci are relatively avascular structures. The blood supply to the medial and lateral menisci is derived from the medial and lateral genicular arteries respectively. Branches of these vessels give rise to the perimeniscal capillary plexus within the synovial and capsular tissues of the knee joint. These perimeniscal vessels are orientated predominantly in a circumferential pattern with radial branches directed towards the centre of the joint. The degree of vascular penetration is 10%-30% of the meniscal width (the red zone). The clinical relevance of this fact is that peripheral meniscal tears (red zone) are suitable for repair due to their good healing potential. Central tears have no blood supply and therefore poor healing potential and may be unsuitable for repair.

4. Describe the histology of the meniscus.

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5. Discuss the biomechanics of the meniscus especially in relation to the development of osteoarthritis.

Answer: The menisci have several functions:

- Transmit load across the knee.
 - 50% of compressive load in extension.
 - 85% of compressive load in 90° flexion.
 - Severe degenerative cartilage changes are seen following meniscectomy.
 - In the meniscectomised knee the contact area is reduced to around 50%, therefore load per unit area increases dramatically, resulting in articular cartilage degeneration.
 - Partial meniscectomy of only 15-34% of the meniscus increases contact pressures >350%.
- Enhance articular conformity.
 - In flexion both menisci displace in an AP direction (LM>MM).
 - They deform to remain in constant congruity with the tibial and femoral surfaces.
 - Play a role in shock absorption.
- Distribute synovial fluid across the articular surface.
 - Conformity promotes fluid-film lubrication.
- Prevent soft tissue impingement during joint motion.
- AP stabilisation of the knee.
 - MM is a secondary AP stabiliser of the knee.

6. What are factors influencing repair of a meniscus rather than resection?

Answer: Meniscal preservation is usually the best course of action whenever possible. The best results of repair are seen with acute peripheral tears in young patients performed in conjunction with ACL reconstruction.

Factors that affect the decision to repair a meniscal tear are:

- Location.
 - The red zone (0 mm - 3 mm from the periphery).
 - Some tears in the red-white zone (3 mm - 5 mm from the periphery).
- Tear pattern.
 - Vertical longitudinal tears > 1 cm length.
 - Radial tears extending into the red zone.
- Tissue quality.
 - Repair is not indicated in macerated or degenerate tissue.

85% healing rates have been reported following the above criteria.

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