Exam Corner

July 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 – Single Best Answer

1. A young athlete undergoes arthroscopy for an isolated meniscal tear. The surgeon performs a meniscal repair. Which one of the following factors is most important in determining the rate of healing?
   Answer: c. Width of the meniscal rim.
   80-90% success rates have been reported. It is generally accepted that the success of the repair depends on the location, the type of tear and the chronicity. Results are best with acute peripheral tears in young patients with concurrent anterior cruciate ligament (ACL) reconstruction. The vascular supply of the meniscus is the primary determinant of healing potential, and this is highest for tears in the peripheral 1/3.[1]

2. Which one of the following characterises open chain exercises?
   Answer: c. Muscle contracts with distal end of extremity free.
   Open kinetic chain exercises or open chain exercises are exercises that are performed where the hand or foot is free to move. Examples in the upper limb are biceps curls, triceps extensions and bench press. In the lower limb examples are leg extensions and leg curls. Closed kinetic chain exercises or closed chain exercises are physical exercises performed where the hand or foot is fixed in space and cannot move. The extremity remains in constant contact with the immobile surface, usually the ground or the base of a machine. Examples in the upper body are push-ups and in the lower body squats.

3. A polytrauma patient with suspected disseminated intravascular coagulopathy has started bleeding significantly from his surgical wounds two days after major surgery. Which one of the following interventions is not appropriate for this patient?
   Answer: e. Immediate wound exploration and surgical haemostasis.
   Disseminated intravascular coagulation (DIC) is characterized by systemic activation of blood coagulation, which results in generation and deposition of fibrin, leading to microvascular thrombi in various organs and contributing to multiple organ dysfunction syndrome (MODS). Consumption and subsequent exhaustion of coagulation proteins and platelets may induce severe bleeding.
   DIC is most commonly observed in severe sepsis and septic shock. DIC is more frequently observed in trauma patients manifesting systemic inflammatory response syndrome (SIRS). In a bleeding patient FFP and platelets may be indicated. The underlying cause should also be addressed.[2]

4. What is the frequency of deep-vein thrombosis as diagnosed by venography following a pelvic fracture?
   Answer: c. 60%.
   In their prospective study Geerts et al. found venographic evidence of lower extremity deep vein thrombosis DVT in 61% of patients with pelvic fractures.[3] Prophylaxis against thromboembolism was not used in this cohort. Thrombi were detected in 61 of the 100 patients with pelvic fractures (61%).

5. The nerve most at risk during the Latarjet procedure for shoulder instability is the:
   Answer: b. Musculocutaneous nerve.
   The nerve that is most at risk is the musculocutaneous nerve due to its close relationship to the coracobrachialis muscle and risk of injury during coracoid transfer. Warner et al. reported that palsy of the musculocutaneous nerve and the axillary nerve occurred on an equal basis in their recent paper.[4]

6. Which one of the following structures is at a greater risk of injury during a left-sided approach to the cervical spine?
   Answer: e. Superior thyroid artery.
   This artery may need to be ligated during the approach. On the left side the recurrent laryngeal nerve is less likely to be injured than on the right due to its more medial course.

Vivas

Adult Pathology

A 38-year-old man presents with a five-year history of gradual-onset right hip pain. He complains of catching and locking type symptoms.

1. Comment on the anteroposterior pelvis radiograph (Fig. 1a – see next page) and discuss what further investigations would be appropriate.

Answer: The right hip shows minor superior narrowing of the joint space with an osteophyte at the superior margin of the acetabulum and some subchondral sclerosis. There is a central osteophyte in the acetabulum. There are multiple rounded opacities with central lucencies within the joint inferiorly, consistent with multiple loose bodies.

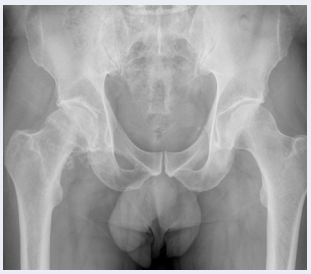

Fig. 1a

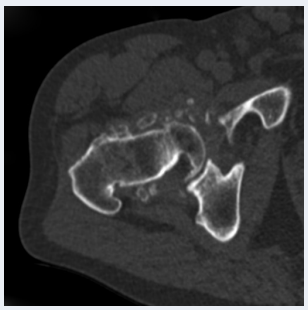

Fig. 1b

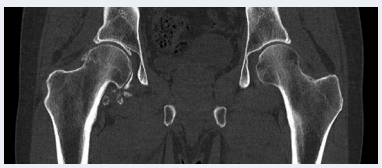

Fig. 1c

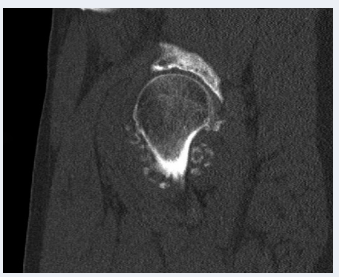

Fig. 1d

I would request a lateral radiograph of the right hip in the first instance. In order to gain more information about the size, number, location of the loose bodies I would request either a CT or MRI scan of the pelvis. An MRI scan would provide more information about chondral lesions and also any cartilage component to the loose bodies, as well as demonstrating synovial proliferation. CT would better show the bony architecture.

2. Comment on the further imaging findings (Figs 1b to 1d).
   Answer: These are axial, sagittal and coronal reformatted CT images. They show osteoarthritis of the hip joint, with osteophytes at the margin of the femoral head, medial and lateral sourcil and asymmetric joint space narrowing. There are multiple intra-articular loose bodies that are calcified peripherally and have a central lucency.

3. What is the diagnosis and what is known about the aetiology of this condition?
   Answer: The diagnosis is synovial chondromatosis.

   Synovial chondromatosis (also called synovial osteochondromatosis) is a rare benign metaplasia of the synovial membrane resulting in the formation of multiple intra-articular cartilaginous bodies (that may or may not calcify). This self-limiting and non-aggressive condition occurs most commonly in the knee followed by the hip, shoulder and elbow. It presents during the third to fifth decade, twice as often in men than women and is extremely rare in children.
   Synovial chondromatosis occurs spontaneously. There are no known causes and the condition is not inherited.
   Synovial chondromatosis occurs as either a primary or secondary form.
   Secondary synovial chondromatosis is more common than primary disease. It occurs in the setting of preexistent osteoarthritis, rheumatoid arthritis, osteonecrosis, osteochondritis dissecans, neuropathic osteoarthropathy, tuberculosis, or osteochondral fractures.

4. Discuss possible treatment options.
   Answer: Treatment options are non-operative or operative. Non-operative treatments are unlikely to be of great value if symptoms are primarily mechanical.
   Non-operative
   Non-steroidal anti-inflammatories (NSAIDs).
   Operative
   Removal of loose bodies with or without a synovectomy can be performed either open or arthroscopically. Good results have been reported after surgical hip dislocation and after arthroscopic management.
   Currently most authors agree that arthroscopic removal of loose bodies for mechanical symptoms is the best surgical treatment. This strategy minimizes postoperative stiffness associated with open procedures and successfully achieves synovectomy and loose body removal. Outcomes for patients with severe, symptomatic arthritis and secondary synovial chondromatosis are less predictable.

Trauma

A 76-year-old woman presents after a fall on her left non-dominant hand. The radiographs reveal the following injury (Figs 2a and 2b).

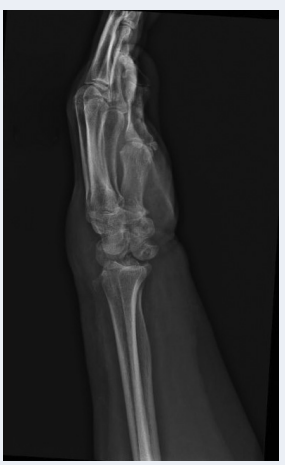

Fig. 2a

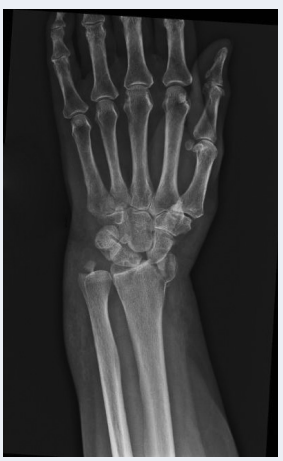

Fig. 2b

1. Describe the radiographs.
   Answer: These anteroposterior (AP) and lateral radiographs of the wrist show a perilunate fracture dislocation. There are displaced fractures of the ulna styloid and radial styloid. The carpus is dislocated in a dorsal direction and the radiolunate joint is subluxed, with the lunate lying volarward.

2. How would you classify these injuries?
Answer: I would classify them in three ways.

- This is a greater arc injury (lesser arc injuries are purely ligamentous in the carpus).
- The type of carpal instability is CIC (carpal instability complex)
- I would classify the injury using the Mayfield classification.[5, 6]

Most carpal dislocations around the lunate are the consequence of a similar pathomechanic event – so-called progressive perilunate instability (PLI). According to this concept, four stages of progressive carpal destabilisation exist:
Stage I. Scapholunate dissociation / scaphoid fracture.
Stage II. Lunocapitate dislocation.
Stage III. Lunotriquetral disruption / triquetrum fracture.
Stage IV. Lunate dislocation.

This patient has a stage 4 injury, although the lunate is not fully dislocated from the distal radius, but subluxed.

3. What is the mechanism of these injuries and the pathoanatomy?
Answer: Two mechanisms of injury may result in a carpal dislocation – direct and indirect.
Direct – the force is applied directly to the dislocating bone.
Indirect – the force is applied at a distance from the injured joint.

Most dorsal perilunate dislocations are as a result of indirect injury mechanisms. This is usually in the form of extreme extension of the wrist. There may also be ulnar deviation and radiocarpal / midcarpal supination.

Pathoanatomy:
Stage I. Extension of the scaphoid is transmitted to the lunate via the scapholunate ligaments (SL). The lunate is closely constrained by the radiolunate ligaments. There is progressive tearing of the SL interosseous membrane and ligaments from volar to dorsal.
Stage II. If hyperextension persists then the distal carpal row translates dorsally and dislocate relative to the capitate. This is usually associated with a capsular rent across the space of Poirier.
Stage III. As the capitate displaces dorsally, the triquetrum experiences extension and a dorsal translation vector. This results in either lunotriquetral disruption or triquetrum fracture.
Stage IV. When all perilunate ligaments are torn only the dorsal capsule and palmar RL ligaments hold the lunate in place. The dorsally displaced capitate may exert a palmar translation force to the lunate resulting in palmar extrusion. The lunate may rotate into the carpal tunnel on its intact palmar ligamentous hinge.

4. How would you manage this patient?
Answer: My immediate management would consist of the following:

- Full history, including neurovascular symptoms. Co-morbidities and normal function.
- Examination of the hand – neurovascular (median and ulnar nerves in particular) and for signs of compartment syndrome.
- Look for any open wound indicating an open fracture dislocation.
- If there were signs of neurovascular compromise I would attempt to reduce the lunate urgently in the emergency department using appropriate sedation. This could be performed in the operating theatre if possible / available.
- Place into a below elbow backslab, elevate the hand in a Bradford sling.
- Request regular neurovascular observations.

In the literature three methods of managing carpal dislocations have been suggested:

- **Closed reduction and cast immobilisation**.
- **Closed reduction and percutaneous pinning**.
- **Open reduction and internal fixation**.

This is an inherently unstable injury and therefore I would perform an open reduction and internal fixation in order to ensure anatomical alignment and stabilisation of the carpus. This also allows management of any of the frequently associated osteochondral defects / loose bodies.
Providing the patient's condition permitted this I would manage the patient with open reduction and internal fixation via a combined dorsal and palmar approach in the acute setting. This is regardless of the quality of reduction achieved by closed means.
This comprises:

- Exposure of the dorsal capsule between the 3rd and 4th extensor compartments.
- Palmarly a carpal tunnel decompression extended across the wrist in a zigzag fashion.
- Flexor tendons and median nerve are retracted radially, revealing a transverse rent in the palmar capsule.

If unreduced, the distal articular surface of the lunate can be seen through this rent.
The lunate is reduced under direct vision form the palmar approach whilst longitudinal traction is applied to the hand.
The capsular rent is repaired with nonabsorbable sutures.
The carpal bones are viewed from the dorsum and with the aid of fluoroscopy the joints are reduced and stabilised by K-wire fixation as follows: 1. Radiolunate joint. 2. Lunotriquetral joint. 3. SL joint. 4. Lunocapitate joint using one K-wire across the scaphoid and one across the triquetrum.
If possible I would attempt to repair the dorsal SL ligament and the dorsal lunotriquetral ligament. This can be achieved using bone anchors. However the damage to the ligaments may render repair difficult or impossible. Some authors have recommended tendon reconstruction of the SL ligament in this situation.
I would also fix the radial styloid fracture in order to restore joint congruity and stability with either a cannulated screw or radial column plate, depending on the bone quality and comminution.

5. What is the expected outcome?
Most of these patients have some permanent loss of motion. Several months of hand therapy will be required to regain range of motion and grip strength. Return to heavy manual work usually takes six months to one year.
Herzberg et al. reported that the average wrist functional score in 10 acute perilunate dislocations that underwent ORIF was 86/100 for stage II or III and 79/100 for stage IV.[7]

Hands

During wrist arthroscopy in a patient with ulnar-sided pain the following lesion is seen over the triangular fibrocartilage complex (TFCC) (Fig. 3).

1. What is the diagnosis?
   Answer: The diagnosis is a central perforation of the TFCC.

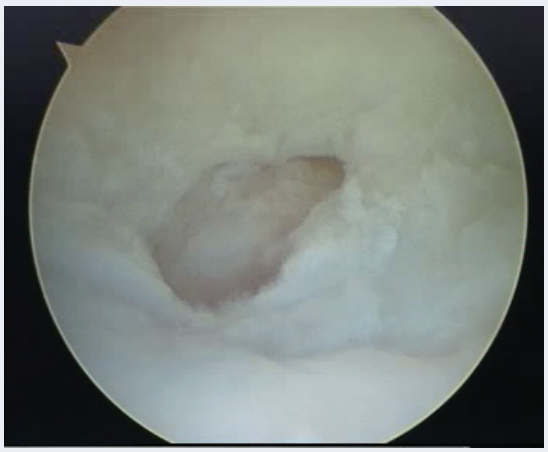

Fig. 3

2. What name is given to the test used to check for TFCC tears?
   Answer: The trampoline test can be performed intra-operatively to check for a TFCC tear. This involves using a probe to press on the centre of the fibrocartilage disc. Good tension in the disc and the ability to 'bounce back' show that the disc is attached normally and is not torn or damaged. Clinical tests would include the TFC compression test (axial load, ulnar deviation and pronation-supination) and the 'piano key' sign for distal radioulnar joint (DRUJ) instability.

3. How do you classify tears of the TFCC?
   Answer: I would classify TFCC tears according to the Plamer classification:[8]
   Type 1 are traumatic lesions.
   Type 2 are degenerative lesions.

Class	Description
1A	Central perforation or tear (Usually in the volar-dorsal direction).
1B	Avulsion from ulna +/- ulna styloid fracture.
1C	Avulsion from carpus; exposes pisiform (Avulsion from the UL and UT ligaments).
1D	Avulsion from sigmoid notch (+/- distal radius fracture, not in the original description).
2A	Thinning of TFC without perforation or chondro-malacia.
2B	Thinning of TFC with lunate and / or ulna chondro-malacia.
2C	Perforation of the TFC with lunate and / or ulna chondromalacia.
2D	2C + lunotriquetral ligament perforation. No carpal instability pattern such as VISI is present.
2E	2C + perforation of the lunotriquetral ligament, ulnocarpal (and DRUJ) degenerative joint disease.

4. Which tears are repairable?
   Answer: Degenerative type 2 lesions are not repaired. The following types of traumatic lesions can be repaired:
   - 1B lesions can be repaired arthroscopically or open, these may also require open reconstruction of the extensor carpi ulnaris (ECU) sub sheath (around 50% will be associated with ECU subluxation).
   - 1C lesions can be repaired arthroscopically or open depending on the size of the tear.
   - 1D lesions can be repaired arthroscopically or open. Some authors report that these have a poor potential for healing due to the cartilaginous insertion site of the TFC at the sigmoid notch.

5. How would you treat this patient?
   Answer: This image shows a degenerate perforation of the disc with loss of cartilage and visible bone (of the ulna). This makes the lesion at least 2C. The patient is symptomatic with ulnar-sided wrist pain. I would therefore debride the unstable edges of the degenerate disc and cartilage back to a stable / healthy edge.
   The primary goal of treatment of ulnar impaction is to decompress or unload the ulnar carpus and ulnar head. I would perform a partial ulnar head resection ("wafer procedure") to remove a few millimetres (2 mm - 3 mm) of the distal ulna whilst leaving the DRUJ intact. Fluoroscopy can be used as an adjunct to guide the level of resection. I would evaluate the LT ligament for perforation and look for LT instability (grade 2D and 2E). If LT instability is noted an ulnar shortening osteotomy is preferred to a partial head resection (as it tightens the ulnar extrinsic ligaments). Further significant instability can be treated with K-wiring of the LT interval.
   If there is significant arthritic change at the DRUJ a salvage procedure may be required.

Children's Orthopaedics

1. What is shown on this ultrasonic image (Fig. 4) and how would you advise the patient?

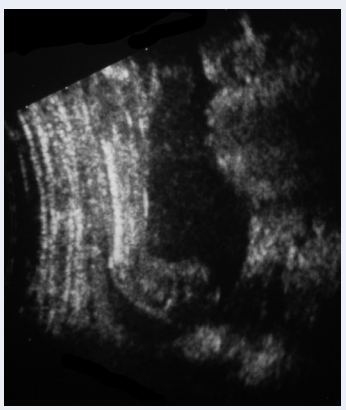

Fig. 4

Answer: The image is a prenatal ultrasound scan showing a talipes equinovarus. I would first ascertain if there were any other associated congenital abnormalities identified on the ultrasound scan and also if the contralateral foot was normal. The differentiation between isolated and complex clubfoot at prenatal ultrasonographic diagnosis is very important, as the latter may be associated with other more serious conditions. I would inform the parents about the limitations of prenatal diagnosis in this condition. The reported accuracy of the specific diagnosis of postural deformity, isolated or complex club foot or normal feet varies widely between

43% and 100%, with a mean of around 79%. Bar-On et al. reported a false positive rate in of 17% when scanning at a mean gestational age of 22 weeks.[9] This can be reduced by performing serial scans.

I would council the parents regarding the condition of clubfoot and the need for treatment. Equally I would tell them that there is a chance that this could be a postural deformity that does not require any treatment.

I would recommend a further scan in order to increase the accuracy of the diagnosis.

The need for amniocentesis and karyotyping after prenatal diagnosis of isolated club foot is controversial. This may not render any information that was not already picked up on the fetal anomaly scan. This was the experience of Bar-On et al. as well as that of other studies.[9]

In the absence of evidence of anomalies elsewhere or a family history of neuromuscular disease it is likely the baby will be born with idiopathic congenital talipes equinovarus (CTEV).

In that event the parents should be reassured that the condition can nowadays be treated with the expectation of a very good outcome. In particular, it should be stressed that the child should walk on time and be fully active.

Here are the clinical photographs (Figs 5a and 5b) of a three-year-old boy who is of normal intelligence.

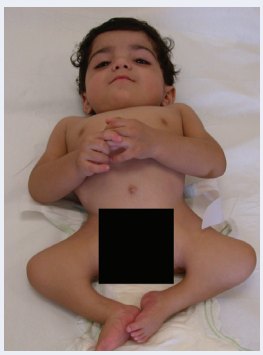

Fig. 5a

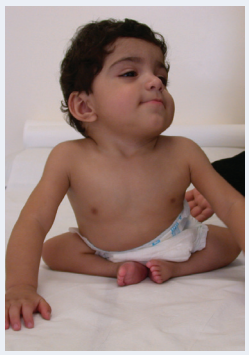

Fig. 5b

2. What is the likely diagnosis and how would you manage the condition?
   Answer: The popliteal webs and 'Buddah' position are typical of lumbo-sacral agenesis. This is shown in the antero-posterior radiograph (Fig. 5c) and sagittal MRI (Fig. 5d).
   The management is multidisciplinary and similar to that for myelo-meningocele. This includes involvement of urologist and paediatric surgeon. Independent walking is not a reasonable goal and he should be rehabilitated for wheelchair mobility, outwith which bottom-shuffling is practical and efficient. The feet should be splinted to avoid equinus deformity.
   Later in childhood or adolescence, soft tissue releases may need to be considered for wheelchair seating.
   These children can develop to excel mentally and in paralympic activities.

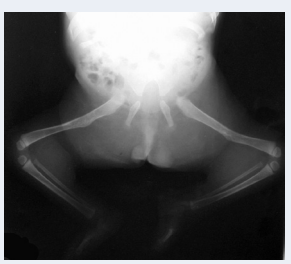

Fig. 5c

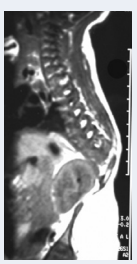

Fig. 5d

Basic Science

An 82-year-old woman with mild dementia presents with a history of persistent groin pain ten weeks following a pubic ramus fracture. This is the anteroposterior pelvis radiograph obtained at the time of admission (Fig. 6a).

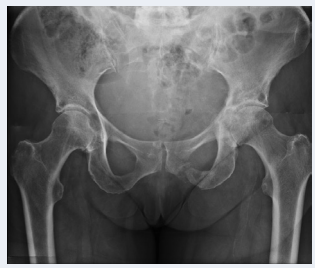

Fig. 6a

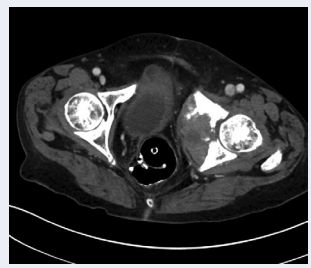

Fig. 6b

1. Describe the radiograph.
   Answer: The main abnormality on this AP pelvis radiograph is a lesion in the left inferior pubic ramus. There is discontinuity of the bone with rounded off ends. There is new bone formation in the gap.

2. What is the provisional diagnosis on the basis of this radiograph?
   Answer: The provisional diagnosis would include:
   - Healing fracture / delayed union.
   - Neoplastic lesion – primary or secondary.
   - Osteomyelitis.
   - Osteomalacia.
   - Ischiopubic hypoplasia.

3. How would you manage the patient?
   Answer: I would manage the patient as follows:
   - History – constitutional symptoms, fever, weight loss, night sweats, GU symptoms, respiratory symptoms, GI symptoms, breast lumps, thyroid symptoms. As the patient has dementia I would seek a collateral history.
   - Examination – general, breasts, thyroid, chest.
   - Blood tests – FBC, UE, LFT, Ca, bone profile, ESR, CRP, serum and urine electrophoresis.
   - Urine dip for blood.
   - Further imaging:
     - Plain radiographs of any other sites of bone pain.
     - CT to assess union and bone architecture.
     - MRI of the pelvis if suspicion of malignancy / infection.
     - Nuclear bone scan for other lesions.
     - CT chest / abdomen / pelvis if looking for a primary tumour.
     - If suspecting infection CT guided biopsy and histology, gram stain, ziehl-Neelsen stain, culture for bacteria, TB and fungi.
   - Plain radiographs of any other sites of bone pain.
   - Analgesia and mobilise with crutches / frame as comfortable.

4. What medical treatment would you offer this patient?
   Answer: Calcium and vitamin D supplements and a Bisphosphonate in line with NICE guidance on the secondary prevention of osteoporotic fractures.

5. A CT scan for colorectal screening has revealed the following pathology (Fig. 6b). What is the presumed diagnosis now and what is the further management of this patient?
   Answer: The CT image shows a destructive lesion in the left superior pubic ramus and acetabulum with destruction of

bone and a large soft tissue component. This is presumed to be a neoplastic process.

The principle of management is now to define if this is a primary or secondary lesion and define the source. My management would be as per answer number three above:

- History – constitutional symptoms, fever, weight loss, night sweats, GU symptoms, respiratory symptoms, GI symptoms, breast lumps, thyroid symptoms. As the patient has dementia I would seek a collateral history.
- Examination – general, breasts, thyroid, chest, abdomen, PR examination.
- Blood tests – FBC, UE, LFT, Ca, bone profile, ESR, CRP, serum and urine electrophoresis.
- Urine dip for blood.
- Further imaging:
    - Plain radiographs of any other sites of bone pain.
    - MRI of the pelvis.
    - Nuclear bone scan for skeletal lesions.
    - CT chest / abdomen / pelvis if looking for a primary tumour.
- Plain radiographs of any other sites of bone pain.
- Analgesia.
- Protected weight bearing with crutches / frame as comfortable.
- Discussion with an oncologist once the primary has been identified and referral to the Bone tumour unit.
- Discussion with the patient and family regarding further management as appropriate.

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