

Exam Corner

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MCQs and EMQs

1. Which class of antibiotic acts by inhibiting protein synthesis (via binding to cytoplasmic ribosomal ribonucleic acid RNA)?

Answer: e. Oxazolidinones

Beta lactam antibiotics and Glycopeptides (vancomycin) act on cell wall synthesis, quinolones act on DNA gyrase, oxazolidinones (e.g. linezolid) act on the 50s subunit of RNA and aminoglycosides act on the 30s subunit.

2. Heterotopic bone formation is usually painless. Which approach to the acetabulum does it most commonly follow?

Answer: e. Extended iliofemoral approach

3. A patient has developed a large area of skin necrosis following a total knee replacement. There is a large tissue defect at the distal end of the wound near the tibial tubercle, with underlying extensor mechanism visible. What would be the most appropriate choice of flap to consider for coverage of this defect?

Answer: e. Medial gastrocnemius

A local myocutaneous flap would be a logical choice; there is no need for a free flap in this instance.¹ The medial gastrocnemius flap rotation² flap,³ is the most common choice for this situation⁴ but if the defect is more lateral then a laterally based flap may be more appropriate.⁵

4. A middle age man undergoes occipito-cervical fusion (C0-C3) for a fracture of the atlas. Which would be the best

estimate of how much rotation of the cervical spine that he will lose?

Answer: c. 40 to 60%

The rotation of the cervical spine mainly takes place at two levels: 58% between C1 and C2 and 24% between C3 and C6 with the remaining levels contributing small amounts.⁶

5. Which ligamentous structure is the primary restraint to inversion when the ankle is in a dorsiflexed position?

Answer: e. Calcaneo fibular ligament (CFL)

The ATFL mainly acts with the foot plantar flexed it is the CFL which acts as the primary restraint to inversion with the foot dorsiflexed.

6. An 81-year-old female presents after a fall with a painful left hip and is unable to mobilise. She underwent a left cemented total hip arthroplasty 11 years previously. Plain radiographs show a spiral fracture of the proximal femur distal to the lesser trochanter. The cement mantle is disrupted and the stem is loose but there is good proximal bone stock. How would you classify this fracture?

Answer: d. Vancouver B2

The Vancouver classification is appropriate in this situation. The fracture is at the level of the stem (B), the stem is loose but the proximal bone is adequate hence this is a B2 fracture.⁷ The Paprosky classification is usually used for classification of femoral⁸ bone defects for elective revision arthroplasty.

Vivas

Adult Pathology

Please have a look at this radiograph (Fig. 1) and answer the questions that follow.



Fig. 1

1. What is the diagnosis?

Answer: This lateral skull radiograph shows numerous lytic lesions consistent with a diagnosis of multiple myeloma.

2. What causes this disease and how do you diagnose it?

Answer: Myeloma arises because of genetic changes that occur during the terminal differentiation of B lymphocytes

into plasma cells. In around half of cases, a chromosomal translocation occurs, which places an oncogene into

the immunoglobulin heavy chain gene on chromosome 14. This results in overexpression of the oncogene and dysregulated cell proliferation. The remaining cases are characterised by trisomies of several odd numbered chromosomes—that is, chromosomes 3, 5, 7, 9, 11, 15, 19, and 21.⁹

For symptomatic myeloma, there are 3 diagnostic criteria, >10% monoclonal plasma cells in marrow, monoclonal protein in serum or urine (may be IgA or IgG) and evidence of myeloma related organ impairment (hyperkalaemia, Renal insufficiency, anaemia or lytic lesions). For asymptomatic myeloma, there needs to be monoclonal protein ≥ 30 g/L or monoclonal plasma cells in marrow $\geq 10\%$ and absence of myeloma related organ or tissue impairment.¹⁰

3. Why do you examine the urine?

Answer: To examine for Bence Jones proteins and IgA. 20% of cases of multiple myeloma involve light chain secretion. The light chains are filtered into the urine by the kidney and therefore are not detectable in the blood with standard techniques (modern techniques can allow

detection but this is not routinely available). If urine is not tested then up to 20% of cases will be missed.

4. Why are the lesions lytic?

Answer: Osteolysis occurs due to direct actions of the multiple myeloma on the RANK/RANKL pathway in favour of activating osteoclasts. Additionally multiple myeloma is able to down-regulate OPG further amplifying this effect.¹¹

5. What medical problems are associated with this condition?

Answer: The condition may directly cause hypercalcaemia by the osteolysis outlined above. Renal impairment is also common and is related to cast nephropathy from the excess light chains precipitating out in the renal tubules. The excess light chains may also cause hypercoagulable states with increased risk of thromboembolism. Finally pathological fractures of the vertebral column may be associated with spinal cord compression.¹² Anaemia is also a common finding in these patients.

Trauma

A 68-year-old male presents with an injury to his right thigh following a fall from a height of three feet. These are the radiographs obtained in A & E (Fig. 2a & 2b).



Fig. 2a

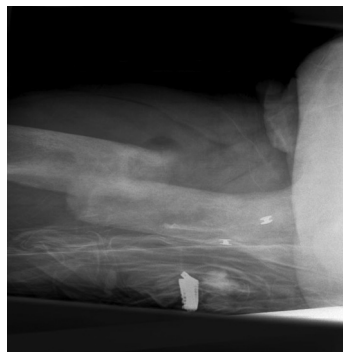


Fig. 2b

1. Describe the radiographs (Fig. 2a & 2b).

Answer: This AP and lateral radiograph show a short oblique fracture of the proximal femoral shaft approximately 8 cm distal to the lesser trochanter. The appearance of the bone is abnormal with poorly defined areas of relative radiolucency.

2. What is the differential diagnosis?

Answer: The differential is broad; this fracture is likely to be pathological based on its location and the low energy injury. It may therefore be related to local areas of weakness (e.g. metastases) or be related to a systemic condition such as osteoporosis or Paget's disease. A generalised reduction in bone density in this gentleman may be related medication (e.g. steroids), a malnourished state, or possibly to a systemic condition such as hyperparathyroidism or renal failure. The appearance of the bone here makes a neoplastic condition likely and this is most likely a metastatic process although primary disorders of bone, e.g. Paget's should be considered.

3. How would you manage this patient?

Answer: Assuming the patient is fit for surgery this fracture

requires operative stabilisation. In a patient of this age I would aim to do this in as timely and safely a manner as possible in the same manner as a neck of femur patient. I would ensure the patient is admitted to a joint orthopaedic/ orthogeriatrics ward and managed under joint care in a multidisciplinary environment. There are two important aspects to the work up, firstly to aid surgical planning and secondarily to diagnose the underlying pathology. I would arrange routine haematological and biochemical investigations including FBC, inflammatory markers and a bone profile. I would ensure that I had plain film radiology of the entire length of femur to assess for skip lesions and areas of weakness distally that may correspond with a possible stress riser at the tip of a possible intramedullary nail. The patient may then require further local imaging in the form of an MRI scan if there is clinical concern regarding a primary bone lesion. In this case I feel that this is most likely metastatic disease or Paget's and therefore I would arrange a CT chest/abdomen/pelvis both to try to find a primary site and also to assess for liver metastases. A bone scan would provide evidence of other skeletal metastases and other foci of disease and other haematological investigations (myeloma screen and PSA) could also be added. My surgery would aim to provide an implant to span the length of the femur to allow early mobilisation, I would use a long intramedullary nail. Intraoperatively I would send the reamings for histology to provide my oncology colleagues a tissue diagnosis.

4. What are the possible difficulties that you can encounter during surgery?

Answer: The technical issues specific to subtrochanteric fractures (compared to other femoral nails) are related to difficulties achieving and maintain a reduction. These are due to the tendency of the proximal fragment to flex related to the intact iliopsoas. This position may make the entry point more difficult to define correctly and may cause problems related to passage of the guidewire. For this reason I have a low threshold of opening these fractures via a lateral incision and holding them reduced with a Haygrove's clamp. In this case I have concerns regarding the possibility of Paget's disease. Pagetoid bone may be harder and therefore there may be challenges passing the guidewire and is certainly more vascular and therefore I would expect increased blood loss and therefore have cross-matched blood available.

Hands

A 48-year-old lady presents with an undisplaced fracture of the distal end of the radius. She is treated conservatively and at the 6-week stage on removal of the plaster, she complains of weakness in her thumb.

1. What is the likely diagnosis and which movement is likely to be compromised?

Answer: The most likely diagnosis is rupture of the EPL tendon. Therefore extension of the distal phalanx of the thumb will be impaired.

2. Justify why these problems are more common in undisplaced fractures?

Answer: It is not clear why this complication occurs more frequently in undisplaced fractures¹³ however there are two main theories. The first is simple abrasion against the minimally displaced fracture edge. The second is related to an avascular zone of the tendon¹⁴ that is felt to be more susceptible to an attrition rupture. This avascular zone may be rendered more susceptible by local factors related to the

fracture (e.g. damage to mesotenon), which may explain the chronology. In reality it is likely to be a combination of these factors.

3. What investigations will you perform?

Answer: Ultrasound scan would be my initial investigation. This allows the dynamic assessment of the EPL tendon and is reliable and usually easily accessible.¹⁵

4. If the tendon is found to be intact, how will you proceed surgically?

Answer: If the tendon is intact but its function is impaired then it is possible that the tendon is fixed by adhesions or even entrapped in fracture callus.¹⁶ I would aim to perform tenolysis to allow the free running of the tendon.

Children's Orthopaedics

A 13-year-old girl presents with an aching pain affecting the medial aspect of the foot, aggravated by activity. On examination you find that she has a valgus deformity of the hindfoot that does not correct on tip-toeing. She has a noticeable restriction in subtalar movement on the affected



Fig. 3a



Fig. 3b

side compared with the contralateral side. Radiographs and MRI of the patient are shown (Fig. 3a & 3b).

1. What does the plain radiograph show, and what are the relevant radiographic signs?

Answer: The lateral radiograph shows talar beaking and a "C sign" consistent with a diagnosis of talocalcaneal coalition. This is confirmed by MRI, which reveals an osseous bar.

2. What is a tarsal coalition? When do they present and why?

Answer: A tarsal coalition is an autosomal dominant disorder of mesenchyme causing fusion of tarsal bones. They are caused by a failure of segmentation and differentiation. The two most common coalitions are calcaneonavicular and talocalcaneal. The C-N coalition presents between the ages of 8-12 when ossification occurs and is associated with the anteater sign on lateral radiographs. It causes a rigid flat foot. The T-C coalition presents later (12-15) with pain on the medial border of the foot and recurrent sprains.

3. What are the most common coalitions?

Answer: See above answer.

4. What conditions are associated with tarsal coalitions?

Answer: The main associations are Apert syndrome and fibular deficiency.

5. What does this MRI image show? What is the purpose of MRI scanning in cases of coalition?

Answer: The MRI confirms that the coalition is osseous and that on this particular slice is approximately one third of the joint (although CT scan may be able to quantify this more). The main role of MRI is to identify fibrous and cartilaginous coalitions.

6. What are the surgical options in this case, and what specific factors would influence your management?

Answer: The surgical options are broadly either resection and interposition graft or fusion. The factors influencing this are related to the size of the coalition (<50% of the middle facet), the age and functional demands of the patient, and the presence of arthritic change on imaging or examination. I would aim to perform resection in this case via a medial Cincinnati approach with the interposition of half of the FHL tendon.

Basic Science

1. This is a slide of a sample that has been treated with a gram stain (Fig. 4). What do you see?

Answer: This slide shows clumps of gram-positive cocci typical of Staph aureus.

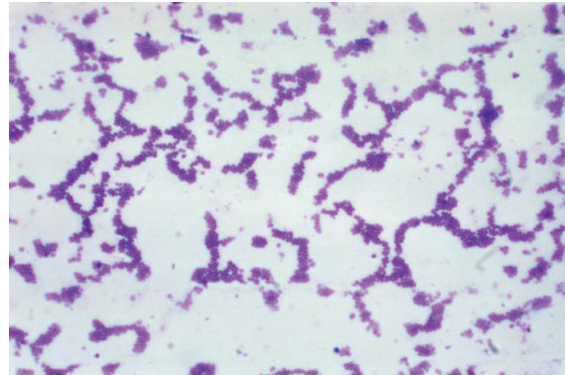


Fig. 4

2. How is a gram stain performed?

Answer: Firstly a cell smear must be produced. This is then initially stained by crystal violet. This is then washed and then iodine is added. The iodine is left in contact for between 10 and 60 seconds before a decolouriser is added and the slide rinsed a second time. This essentially causes staining of gram-positive cells. A counterstain with basic fuchsin solution is then added for 40-60 seconds before a final rinse.

3. What are the differences between S. aureus and S. epidermidis?

Answer: Staphylococcus aureus (the most pathological member of the staph family) and staph epidermidis (a common skin commensal organism) are similar in many respects and distinguishing them may be difficult. However there are differences in both their appearance and behaviour, which may allow their identification. Macroscopically Staph aureus forms gold colonies whereas staph epidermidis forms white colonies. Staph aureus is both

catalase and coagulase positive and furthermore has beta haemolysis, staph epidermis has none of these features. If the clinical features are equivocal then the most reliable way to distinguish them is via in situ hybridisation.¹⁷

4. What is MRSA?

Answer: MRSA stands for methicillin resistant staphylococcus aureus. This family of bacteria actually have resistance to all beta-lactam containing antibiotics (penicillins and cephalosporins). The resistance is due to the acquisition of the mecA gene. This acquisition may occur via plasmid or by de novo mutation. MecA encodes a different phenotype of penicillin-binding protein (the site of action of beta lactam antibiotics), which allows the ongoing peptidisation of the cell wall even in the presence of antibiotic.

5. You are an arthroplasty surgeon. How are you going to reduce the risk of infection for your patients?

Answer: I would aim to reduce my risk of infection by optimising the pre-op, intra-op and post-op conditions. I would ensure that all of my patients were screened for the presence of MRSA pre-operatively and if positive,

treated with eradication therapy. I would also offer my arthroplasty patients pre-admission chlorhexidine skin preparation.^{18,19} On the day of surgery I would ensure that there were no concurrent infections. The patient's medical status must be optimised throughout the pre-, peri- and post-op periods, which includes management of anaemia, oxygenation and blood glucose. Intra-operatively I would ensure I was operating in an ultra-clean air environment²⁰ and would ideally be in a vertical laminar flow²¹ (although I am aware of some more recent controversy regarding this from the new Zealand joint registry).²² I would give pre-operative antibiotics according to local guidelines and based on local resistance patterns under advice from my microbiology department and I would continue these antibiotics for 24 hours. I would use an alcohol-based²³ chlorhexidine²⁴ for my skin preparation and patient warming should be via conduction not convection²⁵ (i.e. fluid based warming mats to reduce the effect of forced warm air currents on the laminar flow). My surgical time should be kept to a minimum and I would tissue carefully to minimise trauma. I use antibiotic impregnated cement whenever I use cemented components. I ensure that I have achieved good haemostasis and achieve watertight

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