

FExNet 2026

Collated SAQs: Orthopaedics

ANSWER BOOKLET

Model answers for the 20 orthopaedic SAQs. References cited at the foot of each question. Items marked [core] are required for full marks. Drug doses and protocols confirmed with current eTG Therapeutic Guidelines, ANZ Hip Fracture Registry, RCH CPG, and Australian Immunisation Handbook.

20 questions • 209 marks

ACEM-aligned format. Sub-questions labelled a) b) c). Mark allocations indicative; references cited in the Answer Booklet. Question and answer indexes are clickable.

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Click any entry to jump to its answer. Marks shown right.

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Question 1 | Ankle Trauma — Ottawa Ankle Rules (11 marks)

A 23-year-old woman is brought to your emergency department after falling 5 metres from a balcony. She landed on her feet and is complaining of severe right-ankle pain and inability to weight-bear. She denies hip, knee, or back pain. On examination, there is bruising and tenderness over the lateral malleolus with deformity. A lateral X-ray of the right ankle is shown.



IMAGE — Lateral right ankle X-ray

a) List the 3 indications for an ankle X-ray AND 3 indications for a foot X-ray per the Ottawa rules. (3 marks)

- **Ankle X-ray:** pain in the malleolar zone AND any of: (1) bony tenderness over the posterior edge or tip of the lateral malleolus (or lower 6 cm of the fibula); (2) bony tenderness over the posterior edge or tip of the medial malleolus (or lower 6 cm of the tibia); (3) inability to weight-bear (4 steps) immediately AND in the ED [core]
- **Foot X-ray:** pain in the midfoot zone AND any of: (1) bony tenderness at the base of the 5th metatarsal; (2) bony tenderness at the navicular; (3) inability to weight-bear immediately and in the ED [core]
- **Sensitivity 99 percent** for clinically significant ankle / foot fractures; reduces unnecessary X-rays by approximately 30 percent [core]

b) Describe 2 abnormalities on the radiograph above AND state the diagnosis. (3 marks)

- **Spiral fracture of the distal fibula** (Weber B — at the level of the syndesmosis, starting at the syndesmosis and extending proximally) [core]
- **Possible medial malleolar fracture** or talar shift suggesting bimalleolar / bimalleolar-equivalent injury [core]
- **Diagnosis: bimalleolar ankle fracture** (or Weber B fracture with disrupted syndesmosis); unstable injury requiring operative fixation [core]

c) List 5 other injuries to actively exclude in a patient who has fallen 5 metres landing on feet. (5 marks)

- **Calcaneal fracture** (axial loading injury — measure Boehler's angle on lateral X-ray; normal 20-40°) **[core]**
- **Tibial plateau fracture** **[core]**
- **Hip / femoral neck fracture**; femoral shaft fracture **[core]**
- **Spinal injury (especially thoracolumbar compression / burst fractures)** — axial loading **[core]**
- **Pelvic ring injury**; sacral fracture **[core]**
- Hip dislocation
- Pilon fracture (distal tibia, intra-articular)
- Peripheral nerve injury (sciatic, common peroneal)

References: *Ottawa Ankle and Foot Rules (Stiell)* • *Tintinalli's Emergency Medicine 9e Ch 271* • *ACEM clinical policies and statements*

Question 2 | Mid-Shaft Clavicle Fracture (10 marks)

A 16-year-old male presents to your emergency department after falling from his pushbike and landing on his outstretched right shoulder. He has a sore right shoulder but no other injuries. His X-ray of the right clavicle is shown.



IMAGE — Right shoulder / clavicle X-ray

a) Describe 3 features of the fracture on the X-ray. (3 marks)

- **Mid-shaft (middle-third) clavicle fracture** — most common location (80 percent of clavicle fractures) **[core]**
- **Comminuted** with multiple fragments; **significantly displaced and shortened** **[core]**
- **No associated sterno-clavicular or acromioclavicular dislocation**; lung fields appear normal (no pneumothorax) **[core]**

b) List 3 absolute AND 3 relative indications for operative fixation of mid-shaft clavicle fractures. (4 marks)

- **ABSOLUTE**: open fracture; skin tenting / impending skin compromise; associated neurovascular injury (subclavian vessel, brachial plexus); floating shoulder (concurrent scapular neck fracture) **[core]**
- **RELATIVE**: significant displacement (complete displacement with no cortical contact); shortening >2 centimetres; comminution with butterfly fragment **[core]**
- **RELATIVE**: bilateral clavicle fractures; polytrauma / multiple injuries; associated rib fractures with respiratory compromise; non-union after 4-6 months of conservative management **[core]**
- Patient factors — high-demand athletes (throwing athletes), preference for early return to function

c) List 3 complications of mid-shaft clavicle fractures. (3 marks)

- **Non-union or malunion** (5-10 percent of conservatively managed displaced fractures; cosmetic deformity) **[core]**
- **Neurovascular injury** — brachial plexus injury, subclavian vessel injury (from sharp fragment) **[core]**
- **Pneumothorax / haemothorax** from underlying lung injury **[core]**
- Skin penetration / open fracture
- Frozen shoulder / restricted range of motion
- Refracture

References: Tintinalli's Emergency Medicine 9e Ch 268 • RACGP Musculoskeletal / Orthopaedic Guidelines • ACEM clinical policies and statements

Question 3 | Paediatric Supracondylar Fracture (13 marks)

A 7-year-old boy presents to your emergency department with a deformed and swollen right elbow after a fall from monkey bars 1 hour ago, landing on his outstretched right hand. He is in significant distress. On examination, the right elbow is obviously deformed with marked swelling. The radial pulse is reduced compared with the contralateral side. Lateral and AP X-rays of the right elbow are shown.



IMAGE — Lateral X-ray of the right elbow



*IMAGE — AP X-ray of the right elbow***a) Describe 3 radiographic findings. (3 marks)**

- **Supracondylar humerus fracture** (extension type — Gartland classification) with disruption of the distal humeral metaphysis **[core]**
- **Posterior fat pad sign (sail sign)** — elevated posterior fat pad indicates joint effusion / haemarthrosis from occult fracture; **anterior fat pad** may also be elevated and bowed forwards **[core]**
- **Disruption of the anterior humeral line** — line drawn down the anterior humerus should pass through the middle third of the capitellum on lateral view; displaced posteriorly in extension-type supracondylar fracture **[core]**
- Disruption of the radio-capitellar line
- Posterior displacement and angulation of distal fragment (extension type — most common, 95 percent)

b) List 3 immediate clinical concerns / complications. (3 marks)

- **Vascular injury** (brachial artery kinking or laceration) — 5-15 percent of displaced supracondylar fractures; compare radial pulse, capillary refill and warmth bilaterally; this case has weak radial pulse **[core]**
- **Nerve injury** — anterior interosseous nerve (most common — test by 'OK sign' with thumb and index finger), median, radial, ulnar nerves **[core]**
- **Compartment syndrome** (forearm) — Volkmann's ischaemic contracture if untreated **[core]**
- Open fracture
- Failure of reduction; cubitus varus or valgus deformity (long-term)
- Significant pain and shock

c) Describe the order of ossification of the paediatric elbow (CRITOL mnemonic) AND state the typical age of appearance. (4 marks)

- **C — Capitellum: 1 year [core]**
- **R — Radial head: 3 years; I — Internal (medial) epicondyle: 5 years [core]**
- **T — Trochlea: 7 years; O — Olecranon: 9 years [core]**
- **L — Lateral epicondyle: 11 years**; useful to distinguish a normal ossification centre from a fracture in the paediatric elbow **[core]**
- Note: the medial epicondyle ossifies BEFORE the trochlea — if a 'trochlea' is seen but no medial epicondyle on the X-ray, suspect avulsion of the medial epicondyle into the joint

d) State 3 management priorities. (3 marks)

- **Urgent neurovascular assessment AND reduction**; orthopaedic surgical consultation; closed reduction and percutaneous K-wire fixation under general anaesthesia (Gartland type II/III) **[core]**
- **Adequate analgesia** — intranasal fentanyl 1.5 µg/kg (rapid onset; weight-based — for 25 kg child, 38 micrograms); IV morphine 0.1-0.2 mg/kg (2.5-5 mg) titrated; sling and splint **[core]**
- **Backslab in 90 degrees flexion (NOT >90 — vascular compromise)**; nil by mouth pending theatre; admit; monitor for compartment syndrome **[core]**
- Open reduction if displaced fracture cannot be reduced closed
- Investigate for vascular compromise — Doppler / vascular surgery if pulse remains absent after reduction

References: Tintinalli's Emergency Medicine 9e Ch 109 • RCH CPG • Gartland classification

Question 4 | Paediatric Both-Bone Forearm Fracture (10 marks)

A 6-year-old girl is brought to your emergency department by her mother after falling from a trampoline 2 hours ago. She is supporting her right forearm and is in pain. Lateral and AP X-rays of the right forearm are shown.

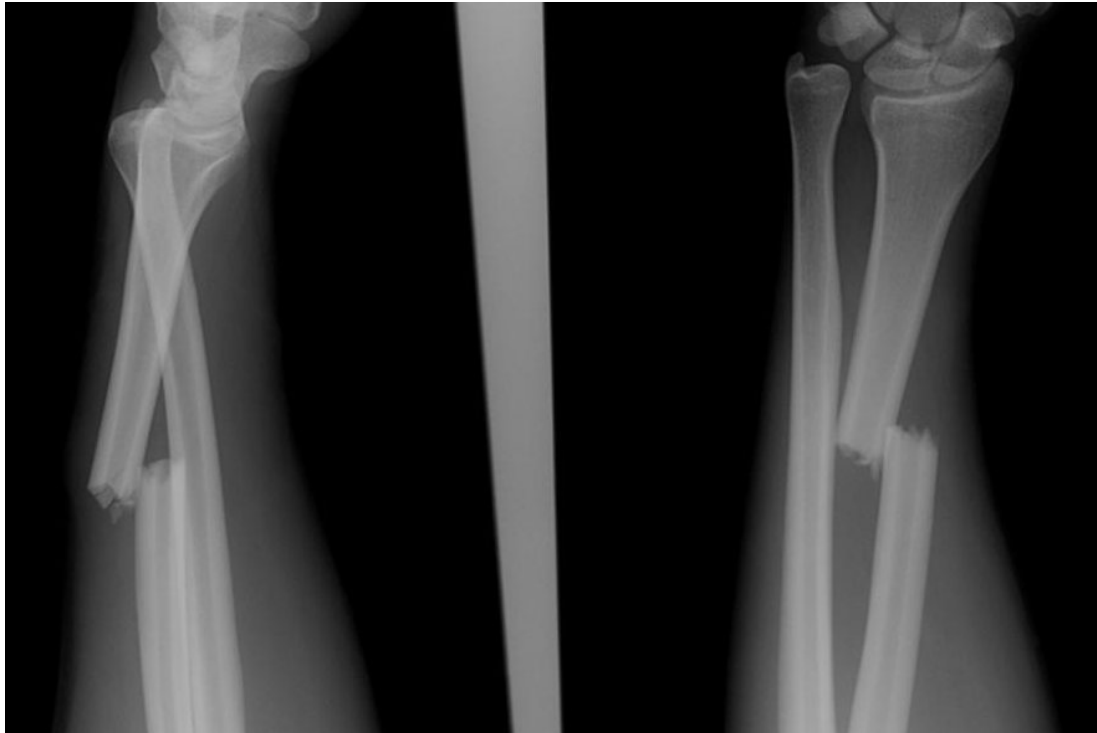


IMAGE — Right forearm X-rays — lateral and AP views

a) Describe 3 radiographic findings. (3 marks)

- **Both-bone forearm fracture** — displaced fractures of both the radius and ulna at the distal third **[core]**
- **Significantly angulated and displaced**; ulnar fracture is comminuted; some shortening / overlap of fragments **[core]**
- **Open growth plates** (this is a paediatric injury); no obvious physeal (growth plate) involvement **[core]**
- No associated wrist or elbow joint disruption (Galeazzi or Monteggia would be excluded)

b) Describe the Salter-Harris classification of physeal (growth-plate) injuries. (4 marks)

- **Type I**: fracture through the physis only (slip) **[core]**
- **Type II**: physis + metaphysis (most common — 75 percent) **[core]**
- **Type III**: physis + epiphysis (intra-articular) **[core]**
- **Type IV**: through metaphysis, physis, AND epiphysis (intra-articular; high risk of growth disturbance);
- **Type V**: crush injury to physis (growth arrest most likely) **[core]**
- **Mnemonic SALTER**: Slipped (I), Above (II), Lower (III), Through (IV), Rammed/cRush (V)

c) State 3 management priorities. (3 marks)

- **Immobilise in above-elbow plaster of Paris backslab** with elbow at 90 degrees; sling; elevate to reduce swelling **[core]**
- **Adequate analgesia** — paracetamol 15 mg/kg + ibuprofen 10 mg/kg; intranasal fentanyl 1.5 µg/kg for moderate-severe pain; opioid for severe pain **[core]**
- **Closed reduction and casting / operative fixation** by orthopaedic / paediatric surgical team — depending on displacement and angulation; closed reduction in ED with procedural sedation possible for

minimally displaced fractures **[core]**

- Neurovascular assessment before and after reduction
- Consideration of non-accidental injury in discrepant history / age-incompatible mechanism

References: *Tintinalli's Emergency Medicine 9e Ch 109* • *Salter-Harris classification* • *RCH CPG*

Question 5 | Wrist Injury — Perilunate Dislocation (11 marks)

A 22-year-old male presents to your emergency department after coming off a motorbike at approximately 60 km/h. He landed on his outstretched left hand with the wrist hyper-extended. He has severe left wrist pain, swelling, and reduced range of motion. He is otherwise uninjured. Lateral and AP X-rays of the left wrist are shown.



IMAGE — Wrist X-rays — lateral and AP views

a) Describe 3 radiographic findings on the lateral view AND state the diagnosis. (4 marks)

- **Disrupted carpal alignment** on lateral view; '**spilled teacup**' sign — the lunate is displaced volarly with the capitate dislocated dorsally **[core]**
- **Loss of normal alignment of the radius, lunate, capitate, and 3rd metacarpal** (should be co-linear on lateral view); '**piece-of-pie**' sign on AP view (triangular lunate) **[core]**
- **Possible scaphoid fracture** (often associated — trans-scaphoid perilunate dislocation is the most common variant) **[core]**
- **Diagnosis: perilunate dislocation** (usually trans-scaphoid perilunate dislocation if scaphoid waist fracture associated) **[core]**

b) List 4 short-term and 4 long-term complications of perilunate dislocation. (4 marks)

- **Short-term:** median nerve compression / acute carpal tunnel syndrome (volar lunate dislocation compresses the nerve) **[core]**
- **Short-term:** open injury, compartment syndrome of forearm **[core]**
- **Long-term:** avascular necrosis of scaphoid or lunate (Kienböck's disease if lunate); SLAC wrist (scapholunate advanced collapse) arthritis **[core]**
- **Long-term:** chronic pain, stiffness, instability **[core]**
- Non-union of associated scaphoid fracture
- Reflex sympathetic dystrophy / complex regional pain syndrome

c) State 3 management priorities. (3 marks)

- **Urgent closed reduction** in the emergency department under sedation OR regional anaesthesia (median nerve / haematoma block); orthopaedic / hand surgical consultation **[core]**
- **Above-elbow backslab** with wrist in slight flexion post-reduction; neurovascular assessment before AND after reduction; check median nerve function (sensation and motor) **[core]**
- **Definitive operative fixation** within 24-48 hours (open reduction and internal fixation OR closed reduction with K-wires) — high failure rate of closed treatment alone **[core]**
- Adequate analgesia (opioid)
- Investigate for associated injuries

References: Tintinalli's Emergency Medicine 9e Ch 268 • RACGP / Hand Surgery Society of Australia

Question 6 | Hip and Pelvic Fracture (12 marks)

A 47-year-old man was enjoying his daughter's birthday party at a trampoline park when he fell awkwardly onto his right knee, with a transmitted axial force up his femur. He has been brought to your emergency department complaining of severe right hip pain and inability to weight-bear. His AP pelvic X-ray is shown.

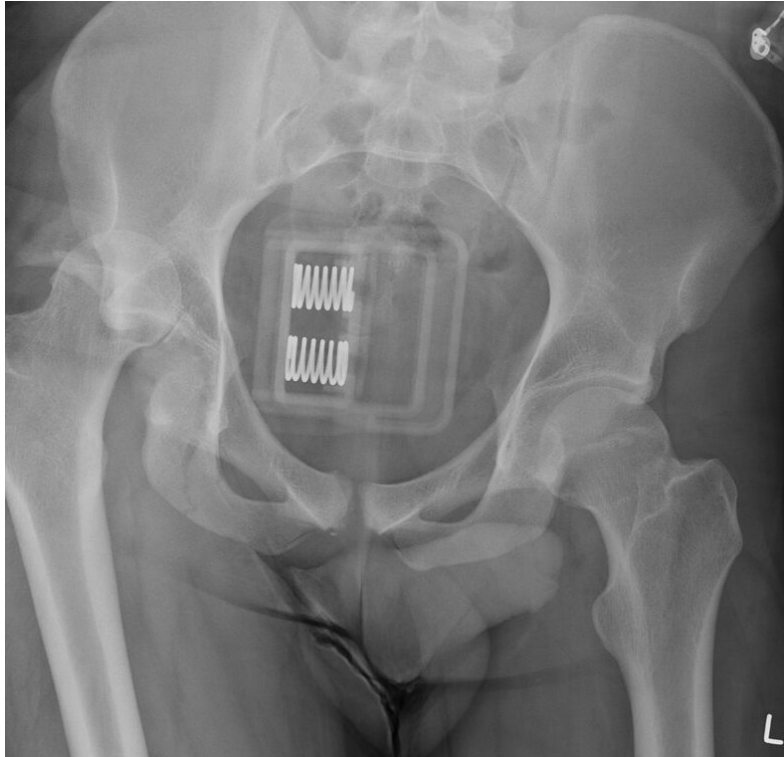


IMAGE — AP pelvic X-ray

a) Describe 4 radiographic findings. (4 marks)

- **Right intracapsular (subcapital / femoral neck) fracture** with breach of Shenton's line [core]
- **Disruption of Shenton's line** (continuous arc from medial femoral neck to inferior border of superior pubic ramus); shortening / displacement of the right femoral head [core]
- **External rotation of the right femur** compared to the left (positioning artefact also possible); asymmetric obturator foramen and pelvic ring [core]
- **Contraceptive intrauterine device or other foreign body** visible in pelvis (incidental finding); pelvis otherwise intact (no acetabular or sacroiliac joint disruption) [core]

b) Describe the Garden classification of intracapsular femoral neck fractures. (4 marks)

- **Garden I:** incomplete, valgus impacted; minimal displacement; good prognosis [core]
- **Garden II:** complete, undisplaced fracture (no varus angulation) [core]
- **Garden III:** complete, partially displaced (angulated) [core]
- **Garden IV:** complete, fully displaced — femoral head returns to anatomic alignment within the acetabulum but is dissociated from the neck [core]
- **Garden III/IV** have higher risk of avascular necrosis (40 percent) — typically managed with hemi-arthroplasty or total hip arthroplasty rather than internal fixation

c) State 4 ED management priorities for this patient. (4 marks)

- **Adequate analgesia** — **fascia iliaca compartment block** with 30-40 mL of 0.25 percent ropivacaine OR 0.25 percent bupivacaine; IV opioids (morphine 0.1 mg/kg) titrated; AVOID NSAIDs in renally impaired **[core]**
- **Investigations:** full blood count, urea and electrolytes, coagulation, ECG, chest radiograph (pre-operative workup); group and save; bedside echocardiogram if cardiac concerns; calcium / vitamin D **[core]**
- **Orthopaedic consultation** for operative management within 24-48 hours (per ANZ Hip Fracture Registry standards); cardiac / anaesthetic review; falls risk and bone health review **[core]**
- **Position with traction (skin traction or pillow under leg)**; nil by mouth pending theatre; pressure-area care; monitor for delirium **[core]**
- Tranexamic acid 1 g IV if active bleeding
- Investigate cause of fall — syncope, mechanical, neurological, drug-related

References: Tintinalli's Emergency Medicine 9e Ch 270 • ANZ Hip Fracture Registry • RACGP Falls in Older Adults Guideline

Question 7 | Patella Fracture (9 marks)

A 23-year-old man comes to your emergency department after a direct blow to the right knee (struck by a car door) approximately 2 hours ago. He has significant right knee pain and is unable to actively extend the knee. There is a palpable gap over the patella. The lateral X-ray of the right knee is shown.



IMAGE — Lateral X-ray of right knee

a) Describe 3 radiographic findings. (3 marks)

- **Transverse displaced patella fracture** with separation of the superior and inferior poles [core]
- **Significant displacement** with a gap (suggests rupture of the patellar retinaculum bilaterally) [core]
- **Suprapatellar effusion / lipohaemarthrosis** (if visible — fat-fluid level in joint indicates intra-articular fracture); no associated tibial / femoral fracture [core]
- Possible avulsion fragment of inferior pole
- Joint surfaces otherwise preserved

b) List 3 indications for operative fixation of patella fracture. (3 marks)

- **Significant displacement >3 mm OR articular surface step >2 mm** [core]
- **Inability to actively extend the knee** (rupture of the medial and lateral retinaculum or quadriceps mechanism) [core]
- **Open fracture** [core]
- Comminuted fracture with separation
- Failure of closed treatment

c) State 3 ED management priorities. (3 marks)

- **Knee immobilisation in extension** (Zimmer / above-knee plaster of Paris splint); adequate analgesia (opioid titrated) [core]
- **Orthopaedic consultation for operative fixation** — typically tension-band wiring or cerclage wiring with K-wires; partial / total patellectomy for severely comminuted fractures [core]
- **Nil by mouth pending theatre**; anaesthetic review; consent; investigations (FBC, coags, group and save) [core]

- Tetanus update if open injury
- Aspirate haemarthrosis for analgesia (controversial; usually not needed)
- Crutches and weight-bearing as comfort, post-op non-weight-bearing for 4-6 weeks

References: *Tintinalli's Emergency Medicine 9e Ch 271* • *RACGP Musculoskeletal / Orthopaedic Guidelines*

Question 8 | Tibial Shaft Fracture with Compartment Syndrome (13 marks)

A 28-year-old male was a motorcycle rider involved in a high-speed crash. He presents with a closed left lower-leg injury. Initial X-ray of the left tibia and fibula is shown. He has been placed in an above-knee cast (split laterally) and is awaiting orthopaedic admission. After 4 hours, the nurses are concerned about increasing pain and distress. The orthopaedic registrar has been delayed in theatre. On your assessment, the patient has severe pain disproportionate to the visible injury, tightly tense calf, and pain on passive dorsiflexion of the toes.



IMAGE — Initial X-ray of left tibia and fibula (prior to immobilisation)

a) Describe 4 radiographic findings. (4 marks)

- **Comminuted spiral fracture of the tibial shaft** at the mid to distal third level [core]
- **Fracture of the fibula** at a different level (typical pattern in high-energy spiral injury) [core]
- **Significant angulation and displacement**; multiple fragments with overlap [core]
- **No obvious open wound on imaging** (no air in soft tissues — closed injury); high-energy mechanism [core]

b) List the 5 P's of compartment syndrome AND state which is the most reliable. (5 marks)

- **Pain** out of proportion to injury, particularly on passive stretch of the muscles in the affected compartment (most reliable and earliest sign) [core]
- **Pallor** (loss of capillary refill) [core]
- **Paraesthesiae** (sensory disturbance) in the distribution of nerves traversing the compartment [core]
- **Pulselessness** (very late — often after irreversible damage; pulses are preserved in early compartment syndrome) [core]
- **Paralysis** (late — irreversible damage) [core]
- Compartment pressures >30 millimetres of mercury OR delta pressure (diastolic blood pressure – compartment pressure) <30 mandate fasciotomy

c) State 4 immediate management priorities given the orthopaedic registrar is unavailable. (4 marks)

- **Bivalve / split the cast or remove constricting bandages** immediately; elevate the limb to AT level of heart (NOT above — reduces perfusion) **[core]**
- **Compartment pressure measurement** with intracompartmental pressure monitor (Stryker pressure monitor) — measure all 4 compartments of the leg (anterior, lateral, deep posterior, superficial posterior) **[core]**
- **Urgent escalation** — call the orthopaedic consultant on call; if unavailable, contact the on-call general / vascular surgeon; consider transfer to tertiary centre **[core]**
- **Prepare for emergency 4-compartment fasciotomy** — limb-saving operation; ideally performed within 6 hours of symptom onset (irreversible damage by 8 hours) **[core]**
- Adequate analgesia (opioid IV titrated)
- Bloods — FBC, U&E, CK, urinalysis (for rhabdomyolysis); fluid resuscitation if myoglobinuria
- Document time-stamped clinical findings, compartment pressures, and time decision made

References: Tintinalli's Emergency Medicine 9e Ch 269 • eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements

Question 9 | Lisfranc Injury (Tarsometatarsal Dislocation) (11 marks)

A 35-year-old male presents to your emergency department after his right foot was crushed by a heavy object that fell on it during a workplace accident 1 hour ago. He has severe midfoot pain and is unable to weight-bear. There is significant swelling and bruising over the dorsum of the foot, with bruising visible on the plantar surface. AP X-ray of the right foot is shown.



IMAGE — AP X-ray of right foot

a) Describe 3 features supporting Lisfranc injury on imaging. (3 marks)

- **Loss of alignment between the medial border of the 2nd metatarsal and the medial border of the middle (intermediate) cuneiform** on AP view (most reliable sign) **[core]**
- **'Fleck sign'** — small bony fragment in the space between the 1st and 2nd metatarsals (avulsion of the Lisfranc ligament from the medial cuneiform) **[core]**
- **Diastasis (widening) between the 1st and 2nd metatarsal bases**; loss of alignment of the lateral border of the 4th metatarsal with the cuboid on oblique view **[core]**
- Plantar ecchymosis on clinical examination (specific for Lisfranc injury)
- Weight-bearing X-rays may unmask a subtle injury missed on non-weight-bearing films

b) List 4 management priorities. (4 marks)

- **Urgent orthopaedic / foot surgical consultation** for definitive management — typically operative fixation (open reduction and internal fixation, screws or wires, or arthrodesis) within 1-2 weeks **[core]**
- **Immobilise in below-knee plaster of Paris backslab**, non-weight-bearing; elevate to reduce swelling **[core]**
- **Adequate analgesia** — opioid IV titrated; tetanus update if any open wound **[core]**
- **Investigate for associated injuries** and compartment syndrome of foot — examine vascular status (dorsalis pedis, posterior tibial pulses) **[core]**
- Computed tomography of foot for definitive characterisation (often missed on plain radiograph)
- Weight-bearing radiograph if X-ray initially negative but high clinical suspicion

- Counsel re: chronic disability — high rate of post-traumatic osteoarthritis even with optimal treatment

c) List 4 long-term complications. (4 marks)

- **Post-traumatic osteoarthritis** (common — 40-94 percent depending on treatment) → chronic pain, stiffness **[core]**
- **Loss of arch / planovalgus deformity** from chronic instability **[core]**
- **Nonunion / malunion**; chronic swelling **[core]**
- **Compartment syndrome of foot** (acute → chronic neurological / motor deficit) **[core]**
- Chronic pain syndrome / complex regional pain syndrome
- Need for arthrodesis (fusion) due to ongoing symptoms

References: Tintinalli's Emergency Medicine 9e Ch 271 • Lisfranc Injury Society Guidelines

Question 10 | Septic Arthritis (12 marks)

A 6-year-old girl is brought to your emergency department by her parents with a 2-day history of right knee pain and refusal to weight-bear. She has had a low-grade fever (38.2 degrees Celsius) and appears unwell. On examination, the right knee is warm, swollen, and acutely tender; there is significant restriction of range of motion. Her vital signs: heart rate 130 beats per minute, blood pressure 100/60 millimetres of mercury, respiratory rate 28 breaths per minute, temperature 38.6 degrees Celsius. Joint aspiration of synovial fluid microscopy is shown.

CELL COUNT / WET PREPARATION (per HPF)		
White Cells	137200	$\times 10^6/L$
Red Cells	140	$\times 10^6/L$
Polarised Light Film	+ Urate crystals	
GRAM STAIN (per OIF) / WET PREPARATION (per OIF)		
Gram Positive Cocci	+++	
Gram Positive Bacilli	Nil	
Gram Negative Cocci	Nil	
Gram Negative Bacilli	Nil	
Fungal Yeast	Nil	

IMAGE — Synovial fluid microscopy

a) List the 4 Kocher criteria for septic arthritis of the hip in children AND state how to apply them. (3 marks)

- **Non-weight-bearing on the affected limb [core]**
- **Erythrocyte sedimentation rate >40 mm/h; white cell count $>12 \times 10^9/L$ [core]**
- **Fever >38.5 degrees Celsius [core]**
- **Probability of septic arthritis:** 0 criteria = 0.2 percent; 1 = 3 percent; 2 = 40 percent; 3 = 93 percent; 4 = 99 percent → 3 or 4 criteria mandate joint aspiration and treatment for septic arthritis [core]

b) List 4 indications for urgent joint aspiration. (4 marks)

- **Suspected septic arthritis** (fever, warm swollen joint, restricted range, raised inflammatory markers) — joint aspirate is diagnostic [core]
- **Acute crystal arthropathy diagnosis** — gout (urate crystals — needle-shaped, negatively birefringent under polarised light) versus pseudo-gout (calcium pyrophosphate dihydrate — rhomboid, positively birefringent) [core]
- **Differentiation between inflammatory and non-inflammatory effusion** — WBC <200 normal; 200-2000 mechanical / osteoarthritis; 2000-100,000 inflammatory (crystal, RA); $>50,000$ (especially $>100,000$) septic [core]
- **Therapeutic — relief of acute haemarthrosis or large effusion** (infrequently performed for analgesia only) [core]
- Note: image shows urate crystals — NOT septic arthritis but acute gout (this is a teaching point — gout can mimic septic arthritis clinically)

c) State 5 management priorities for septic arthritis. (5 marks)

- **Joint aspiration BEFORE antibiotics** — send for cell count, Gram stain, culture, sensitivity, crystal analysis [core]

- **Empirical intravenous antibiotics** — flucloxacillin 50 mg/kg every 6 hours (children) or 2 g IV every 6 hours (adults) + cefotaxime 50 mg/kg every 6 hours (covers Staphylococcus aureus and Kingella in children, gram-negatives in adults) **[core]**
- **Urgent orthopaedic consultation for operative joint washout** (arthroscopic or open) within 24 hours; delay risks irreversible cartilage damage **[core]**
- **Analgesia and immobilisation** (rest splint); blood cultures before antibiotics (50 percent positive); investigate source **[core]**
- **Continue intravenous antibiotics for minimum 2 weeks, then oral for additional 2-4 weeks** based on culture results; physiotherapy for joint range preservation **[core]**
- Common organisms in children: Staphylococcus aureus, Streptococcus pyogenes, Kingella kingae (<5 years)
- Common organisms in adults: Staph aureus, Streptococcus, gram-negatives (especially in diabetes); gonococcal in young adults

References: eTG Therapeutic Guidelines — Antibiotic • eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Kocher criteria • Tintinalli's Emergency Medicine 9e Ch 109

Question 11 | Anterior Shoulder Dislocation (10 marks)

A 27-year-old man presents to your emergency department after dislocating his right shoulder while playing rugby 30 minutes ago. He had a previous shoulder dislocation on the same side 18 months ago. On examination, he is in significant pain holding his arm in slight abduction and external rotation. There is an obvious anterior deformity with a 'squared-off' shoulder contour and a palpable humeral head anteriorly. Sensation over the regimental badge area is reduced compared with the contralateral side.

a) List 3 components of pre-reduction assessment. (3 marks)

- **Neurovascular examination** — axillary nerve sensation over deltoid (regimental badge area; reduced in this case); radial, ulnar, median nerve function; brachial / radial pulses **[core]**
- **Imaging** — AP and axial (scapular Y or trans-thoracic) views; exclude associated fracture (Hill-Sachs lesion, greater tuberosity fracture, Bankart lesion) **[core]**
- **Mechanism and timing** of dislocation; previous dislocations; predisposing conditions (Marfan, Ehlers-Danlos) **[core]**
- Documentation of regimental badge sensation, deltoid contraction, capsular function (post-reduction abduction)
- Post-reduction imaging is mandatory

b) List 4 reduction techniques for anterior shoulder dislocation (with brief description). (4 marks)

- **Stimson technique (prone hanging)** — patient prone on couch with affected arm hanging over the edge with a 5-10 kg weight strapped to wrist; spontaneous reduction occurs over 15-30 minutes; minimal force required **[core]**
- **Cunningham (massage / hugging) technique** — patient sitting upright; operator gently massages tense biceps and trapezius; pain-free reduction in cooperative patient **[core]**
- **Hippocratic (modified) — operator's foot in axilla with longitudinal traction** — historic; effective but requires force; risk of axillary nerve or vascular injury **[core]**
- **External rotation / Kocher** — with arm adducted and elbow flexed at 90°, slowly externally rotate the affected arm; useful for first-time dislocators **[core]**
- Scapular manipulation — patient prone with arm hanging; manipulate the scapula medially and inferiorly
- Milch technique — patient supine; abduct, externally rotate, then forward flex with longitudinal traction

c) State 3 post-reduction priorities. (3 marks)

- **Repeat neurovascular examination** — documented before AND after reduction **[core]**
- **Post-reduction X-ray** to confirm reduction and exclude associated fracture (Hill-Sachs, Bankart lesions, humeral neck fracture) **[core]**
- **Sling immobilisation** for 1-3 weeks; orthopaedic outpatient review for ongoing management; physiotherapy **[core]**
- Counsel re: recurrence (highest in young, active individuals — up to 80 percent in <20 years; consider surgical stabilisation in recurrent / active patients)
- Adequate analgesia for ongoing management

References: Tintinalli's Emergency Medicine 9e Ch 268 • RACGP Musculoskeletal / Orthopaedic Guidelines

Question 12 | Achilles Tendon Rupture (10 marks)

A 45-year-old male recreational tennis player presents to your emergency department after a sudden 'pop' in his right calf during a forehand stroke. He felt as though he had been struck on the back of his calf. He is unable to plantar-flex his right foot. On examination, there is bruising in the popliteal fossa and a palpable gap in the right Achilles tendon approximately 5 centimetres above the calcaneal insertion.

a) Describe the Thompson (calf-squeeze) test AND explain the basis. (3 marks)

- **Procedure:** with the patient prone and feet hanging over the edge of the bed (relaxed), squeeze the calf (gastrocnemius and soleus) of the affected side **[core]**
- **Normal response:** passive plantar-flexion of the foot (intact Achilles tendon transmits the squeeze into the foot) **[core]**
- **Positive Thompson test:** NO plantar-flexion of the foot — confirms complete Achilles tendon rupture; highly sensitive (95 percent) **[core]**
- Compare with contralateral side; gap in tendon (palpable) is also useful clinical sign

b) List 4 risk factors for Achilles tendon rupture. (4 marks)

- **Age 30-50** (most common); male predominance **[core]**
- **Previous Achilles tendon injury / tendinopathy;** chronic Achilles tendinitis **[core]**
- **Fluoroquinolone antibiotics** (ciprofloxacin, levofloxacin) — tendinopathy is a known adverse effect; risk especially in >60 years and concurrent corticosteroid use **[core]**
- **Corticosteroid use** (oral or intra-tendinous injection) **[core]**
- Sudden eccentric loading — sport-related (tennis, basketball, racquet sports)
- Diabetes mellitus, gout, hypercholesterolaemia
- Increased BMI, occupational factors

c) State 3 management options. (3 marks)

- **Immobilisation in equinus (plantar flexion)** with below-knee plaster of Paris cast OR controlled-motion (CAM) boot; non-weight-bearing 4-6 weeks then graduated weight-bearing **[core]**
- **Operative repair** (open or percutaneous) — favoured for active patients (athletes); reduces re-rupture rate (4 percent vs 12-13 percent for non-operative) **[core]**
- **Functional rehabilitation** with early controlled motion in functional brace — equivalent results to surgery in less active patients (Achilles Tendon Society / Cochrane data) **[core]**
- Refer to orthopaedic outpatient (within 1-2 weeks; treat as urgent — stretches and partial healing if delayed)
- Analgesia, anti-inflammatory if no contraindication, mechanical thromboprophylaxis
- Discuss with patient — shared decision-making between operative and non-operative paths

References: Tintinalli's Emergency Medicine 9e Ch 271 • RACGP Musculoskeletal / Orthopaedic Guidelines • ACEM clinical policies and statements

Question 13 | Common Peroneal Nerve Injury (9 marks)

A 40-year-old woman presents to your emergency department with a 2-week history of foot drop and lateral foot pain following an ankle sprain (severe lateral ligament injury) sustained during trekking 3 weeks ago. She is now finding it difficult to walk because her right foot 'slaps' the ground and she cannot lift her toes.

a) Describe the sensory and motor disturbance expected in a common peroneal nerve injury (4 elements). (4 marks)

- **Motor: weakness of dorsiflexion** (tibialis anterior, extensor digitorum longus, extensor hallucis longus) — results in foot drop **[core]**
- **Motor: weakness of foot eversion** (peroneus longus and brevis) **[core]**
- **Sensory: reduced sensation over the lateral leg** (superficial peroneal nerve distribution) and dorsum of foot (except the first dorsal web space — deep peroneal) **[core]**
- **Preserved sensation over plantar foot** (tibial nerve), preserved inversion and plantar-flexion (tibial nerve / posterior tibial muscle) **[core]**
- Foot-slap gait (during walking)

b) Name the most common anatomical site of injury. (2 marks)

- **The fibular head / neck** — the common peroneal nerve winds around the fibular neck, where it is superficial and vulnerable to direct compression, stretch (severe inversion / external rotation injury), or laceration **[core]**
- Other sites: knee dislocation, peroneus longus tunnel

c) List 3 differential diagnoses for foot drop (other than common peroneal nerve injury). (3 marks)

- **L5 radiculopathy** (lumbar disc prolapse) — sensory loss extends along L5 dermatome (lateral leg AND dorsum of foot AND great toe), positive straight-leg-raise test, back pain often present **[core]**
- **Sciatic nerve injury** (more extensive — affects tibial division as well; whole foot weakness and sensory loss; typically post-trauma or post-operative) **[core]**
- **Stroke / corticospinal tract lesion** (upper motor neurone — hyperreflexia, spasticity, Babinski sign) **[core]**
- Multiple sclerosis with focal demyelination
- Anterior horn cell disease (motor neurone disease)
- Compartment syndrome (anterior compartment of leg)
- Guillain-Barré syndrome (typically bilateral)

References: Tintinalli's Emergency Medicine 9e Ch 173 • RACGP Musculoskeletal / Orthopaedic Guidelines

Question 14 | Posterior Hip Dislocation (10 marks)

A 35-year-old female restrained driver is brought to your emergency department after a head-on motor vehicle collision. She is complaining of severe right hip pain and is unable to move her right lower limb. On examination, the right leg is held in flexion, adduction, and internal rotation. AP X-ray of the pelvis shows the right femoral head displaced superiorly and laterally to the acetabulum.

a) List 3 features supporting posterior hip dislocation (the typical type). (3 marks)

- **Affected leg held in flexion, adduction, internal rotation, and shortened** (typical posture) **[core]**
- **Mechanism:** knee strikes the dashboard with hip flexed (typical in unrestrained or front-seat passenger MVC); axial loading of the femur with hip flexed **[core]**
- **X-ray:** femoral head displaced superiorly and posterior to the acetabulum; loss of Shenton's line; associated acetabular wall fracture common (40-60 percent) **[core]**
- Sciatic nerve injury in 10-20 percent (test function — common peroneal portion most often affected)

b) State 4 management priorities for hip dislocation. (4 marks)

- **Urgent reduction within 6 hours** of injury — risk of avascular necrosis of femoral head increases markedly with delay; performed under procedural sedation in ED OR under general anaesthesia in theatre **[core]**
- **Pre- and post-reduction neurovascular examination** — sciatic nerve (most common — common peroneal division), femoral nerve, vascular compromise rare; document **[core]**
- **Reduction techniques:** Allis manoeuvre (patient supine; assistant stabilises pelvis; flex hip and knee to 90°, apply axial traction with internal/external rotation), Stimson (prone hanging), Bigelow **[core]**
- **Post-reduction CT** to assess associated injuries (acetabular fracture, femoral head fracture, loose bodies in joint); orthopaedic consultation **[core]**
- Adequate analgesia and procedural sedation
- Bed rest in skin traction or knee immobiliser post-reduction; partial weight-bearing for 4-6 weeks

c) List 3 complications. (3 marks)

- **Avascular necrosis of femoral head** (disruption of medial femoral circumflex artery — 8-25 percent; increases with delay in reduction) **[core]**
- **Sciatic nerve injury** (10-20 percent — usually common peroneal portion); femoral nerve injury (rare) **[core]**
- **Post-traumatic osteoarthritis** (common over time) **[core]**
- Acetabular fracture (often associated)
- Recurrent dislocation
- Vascular injury (rare)

References: Tintinalli's Emergency Medicine 9e Ch 270 • RACGP Musculoskeletal / Orthopaedic Guidelines • ATLS 10th edition (current)

Question 15 | Acute Gout (10 marks)

A 55-year-old man with a history of hypertension (treated with hydrochlorothiazide), type 2 diabetes mellitus, and chronic kidney disease (eGFR 50) presents to your emergency department with a 2-day history of severe pain, swelling, and redness of his right great toe. He woke this morning unable to bear weight on the toe. He has no recent trauma. On examination, the right first metatarsophalangeal joint is exquisitely tender, warm, swollen, and erythematous. Vital signs are stable, with no fever. Synovial fluid microscopy is shown.

CELL COUNT / WET PREPARATION (per HPF)		
White Cells	137200	$\times 10^6/L$
Red Cells	140	$\times 10^6/L$
Polarised Light Film	+ Urate crystals	
GRAM STAIN (per OIF) / WET PREPARATION (per OIF)		
Gram Positive Cocci	+++	
Gram Positive Bacilli	Nil	
Gram Negative Cocci	Nil	
Gram Negative Bacilli	Nil	
Fungal Yeast	Nil	

IMAGE — Synovial fluid microscopy

a) Interpret the synovial fluid microscopy AND state the diagnosis. (3 marks)

- **Markedly elevated white cell count** ($137,200 \times 10^6/L$ on the report) — consistent with inflammatory effusion; above 100,000 raises concern for septic arthritis but seen in severe crystal arthropathy **[core]**
- **Urate crystals present** — needle-shaped, negatively birefringent under polarised light (yellow when parallel to compensator axis, blue when perpendicular); pathognomonic of gout **[core]**
- **Diagnosis: acute gout** (podagra — first metatarsophalangeal joint involvement; classic presentation) **[core]**
- Negative Gram stain (no organisms — distinguishes from septic arthritis)

b) List 4 risk factors for gout in this patient. (4 marks)

- **Diuretic use (hydrochlorothiazide)** — promotes hyperuricaemia **[core]**
- **Chronic kidney disease** — reduced renal urate excretion **[core]**
- **Type 2 diabetes mellitus and hypertension** (metabolic syndrome — associated with hyperuricaemia) **[core]**
- **Male sex, >40 years** **[core]**
- Excessive purine intake (red meat, seafood, beer)
- Alcohol use (especially beer)
- Family history
- Obesity

c) State 3 immediate treatment options (with considerations for this patient). (3 marks)

- **Non-steroidal anti-inflammatory drugs** — naproxen 500 mg orally twice daily for 5-7 days OR indomethacin 50 mg orally three times daily; **caution** in this patient with CKD (eGFR 50 — relative contraindication; may worsen renal function); also avoid in heart failure, peptic ulcer disease, anticoagulation **[core]**

- **Colchicine** 1 mg orally then 0.5 mg 1 hour later (max 1.5 mg in 24 hours); adjusted for CKD (lower doses); avoid if eGFR <30 OR with strong CYP3A4 inhibitors **[core]**
- **Corticosteroids** — prednisolone 30-50 mg orally daily for 5-7 days OR intra-articular injection; **preferred** in patients with CKD, anticoagulation, GI risk **[core]**
- Avoid starting urate-lowering therapy (allopurinol) DURING acute attack — may worsen; wait until acute attack settled, then start with prophylactic colchicine
- Cessation of alcohol; review thiazide use
- Adequate analgesia (paracetamol)

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 282 • Australian Rheumatology Association

Question 16 | Acute Lower Back Pain — Red Flags (10 marks)

A 65-year-old woman presents to your emergency department with a 2-week history of progressive lower back pain. She has a history of breast cancer (treated 5 years ago — currently on anastrozole). She has had no trauma. Her pain is constant, worse at night, and not relieved by rest. She has noticed bilateral lower-limb weakness over the past 24 hours. On examination, she has tenderness over the L3 vertebra, mild bilateral lower-limb weakness (Medical Research Council 4/5), and reduced sensation in the saddle area. Her ankle reflexes are reduced bilaterally.

a) List 4 'red flags' on history and examination that suggest serious pathology requiring urgent investigation. (4 marks)

- **Age >50 with new onset back pain; history of malignancy** (this case — breast cancer) **[core]**
- **Constant pain not relieved by rest, worse at night**; weight loss, fever, constitutional symptoms **[core]**
- **Neurological deficits** — bilateral weakness, saddle anaesthesia, urinary / faecal incontinence or retention (suggests cauda equina syndrome) **[core]**
- **Risk factors for fracture** — osteoporosis, long-term steroid use, trauma; **risk factors for infection** — intravenous drug use, diabetes, immunocompromise, recent surgery **[core]**
- Recent significant trauma
- Progressive neurological symptoms

b) List 3 most likely differential diagnoses for this patient. (3 marks)

- **Spinal metastases with cord / cauda equina compression** — most likely given history of breast cancer + neurological deficit **[core]**
- **Pathological vertebral fracture** — from metastatic disease or osteoporosis **[core]**
- **Spinal epidural abscess** — fever / infection; risk factors **[core]**
- Discitis / vertebral osteomyelitis
- Lumbar disc prolapse with cauda equina syndrome
- Lumbar canal stenosis with acute decompensation

c) State 3 immediate management priorities. (3 marks)

- **Urgent magnetic resonance imaging of the lumbar spine** (whole spine if metastatic disease) — definitive diagnosis; identifies extent of cord / cauda equina compression **[core]**
- **Urgent neurosurgical consultation** — for surgical decompression (target within 24-48 hours to preserve neurological function); radiation oncology consultation if metastatic **[core]**
- **Dexamethasone 16 mg intravenous loading dose, then 8 mg every 12 hours** (metastatic spinal cord compression — reduces oedema) **[core]**
- Adequate analgesia (opioid titrated; nonsteroidal anti-inflammatory drugs cautious if anti-platelet/anticoagulation or AKI)
- Urinary catheterisation for retention; document post-void residual
- Investigate cause of weakness — bloods (FBC, U&E, LFTs, calcium, alkaline phosphatase, tumour markers)

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 274 • NICE Cauda equina syndrome guidelines

Question 17 | Slipped Upper (Capital) Femoral Epiphysis (11 marks)

A 13-year-old obese boy is brought to your emergency department by his parents with a 2-week history of progressive right hip and knee pain with limping. There has been no acute trauma. He weighs 90 kilograms (BMI 33). On examination, he holds the right leg in slight external rotation; passive flexion of the right hip causes obligatory external rotation. There is mild decreased range of internal rotation. His vital signs are normal.

a) List 3 risk factors for slipped capital femoral epiphysis. (3 marks)

- **Obesity** (most strongly associated — mechanical loading) **[core]**
- **Adolescent age** (10-15 years; growth spurt; physis is weakest), **male sex** **[core]**
- **Endocrine abnormalities** — hypothyroidism, hypopituitarism / growth hormone deficiency (consider in non-obese / atypical presentation) **[core]**
- Race — higher in Pacific Islander, Polynesian, African-American populations
- Bilaterality in 25-50 percent (consider screening the contralateral hip)
- Renal failure (renal osteodystrophy)

b) Describe the imaging findings AND the Klein/Trethowan line. (4 marks)

- **X-rays of both hips** (AP and frog-leg lateral views — frog-leg is most sensitive; AP can be subtle) **[core]**
- **Klein/Trethowan line** — drawn along the SUPERIOR border of the femoral neck on AP view; should normally cross or intersect the lateral aspect of the femoral epiphysis **[core]**
- **In SUFE**: the line passes lateral to the epiphysis (the epiphysis 'falls off' inferiorly and posteriorly relative to the femoral neck) — analogous to 'ice cream falling off the cone' **[core]**
- **Other features**: widening of the physis; abnormal angle of the head relative to the neck; loss of normal epiphyseal slope; bilateral changes in 25-50 percent **[core]**

c) State 4 management priorities. (4 marks)

- **Strict non-weight-bearing** and bed rest immediately — prevents further slip; use crutches / wheelchair **[core]**
- **Urgent paediatric orthopaedic consultation** for definitive operative fixation (typically single-screw fixation in situ — percutaneous; aim within 24-48 hours) **[core]**
- **Imaging of contralateral hip** — screen for asymptomatic SUFE (25-50 percent); consider prophylactic pinning **[core]**
- **Investigate for endocrine causes** if non-obese OR atypical age OR bilateral — thyroid function, growth hormone, renal function, parathyroid **[core]**
- Adequate analgesia
- Counsel on long-term complications — avascular necrosis, chondrolysis, premature osteoarthritis

References: Tintinalli's Emergency Medicine 9e Ch 109 • RCH CPG • Loder classification

Question 18 | Hip Trauma in the Patient with Bilateral Hip Replacements (9 marks)

A 75-year-old woman presents to your emergency department after a fall onto her left hip 2 hours ago. She has bilateral total hip arthroplasties (performed 5 and 8 years ago). She is now unable to weight-bear on the left side. On examination, the left lower limb is shortened and externally rotated. The AP pelvic radiograph is shown.

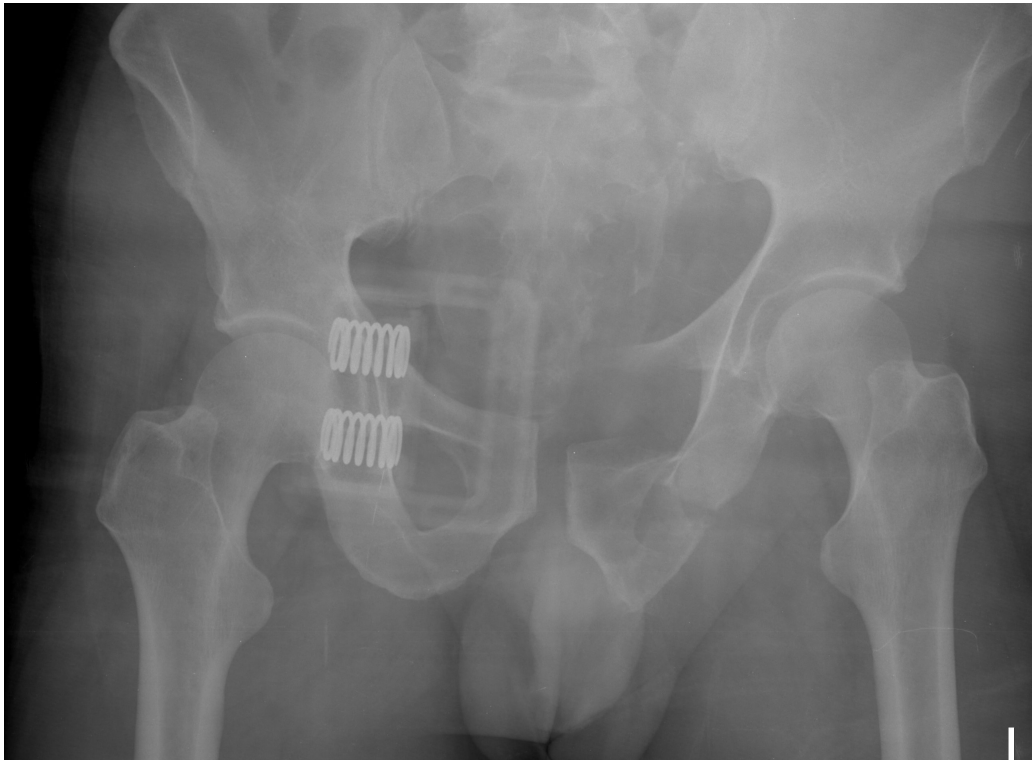


IMAGE — AP pelvic X-ray showing bilateral hip prostheses

a) Describe 3 radiographic findings. (3 marks)

- **Bilateral total hip arthroplasties (THA)** in situ with intact acetabular and femoral components [core]
- **Left periprosthetic femoral fracture** (subtrochanteric / around the femoral stem) OR **dislocation** of the left femoral head from the acetabular cup [core]
- **Foreign body** visible in pelvis (intrauterine contraceptive device — incidental); pelvic ring otherwise preserved [core]
- Compared to right hip — left has lost congruity / alignment of femoral head with acetabular cup

b) List 3 causes of pain and instability in patients with hip prostheses. (3 marks)

- **Periprosthetic fracture** (Vancouver classification — A: trochanter; B: at / around stem; C: below stem); B fractures are most common and complex [core]
- **Prosthetic dislocation** — most common in first 3 months post-operatively; recurrent dislocations may occur with loose components [core]
- **Aseptic loosening of components** — gradual onset of pain with loading; associated with revision surgery [core]
- Periprosthetic infection — fever, raised inflammatory markers; investigate with aspiration
- Heterotopic ossification, bursitis, referred pain from spine

c) State 3 management priorities for periprosthetic fracture. (3 marks)

- **Adequate analgesia** — fascia iliaca compartment block (with ropivacaine 0.25 percent 30-40 mL); opioid titrated; AVOID NSAIDs in elderly with renal impairment **[core]**
- **Urgent orthopaedic consultation** — periprosthetic fractures are complex; may require revision surgery, stem exchange, plate / cable fixation, depending on Vancouver classification **[core]**
- **Pre-operative workup** — bloods, ECG, anaesthetic review; investigate for fall cause (syncope, mechanical, neurological); fracture-specific imaging (CT) **[core]**
- Bone health review — DEXA scan, calcium / vitamin D, bisphosphonate / denosumab
- Multi-disciplinary care — orthopaedic surgery, geriatric medicine, social work

References: *Tintinalli's Emergency Medicine 9e Ch 270* • *Vancouver classification (Brady 2000)* • *ANZ Hip Fracture Registry*

Question 19 | Pulled Elbow (Radial Head Subluxation) (8 marks)

A 3-year-old girl is brought to your emergency department by her mother after she 'pulled her arm' lifting her up by the wrists onto a curb. The child is now refusing to use her right arm and is holding it slightly flexed and pronated by her side. There is no swelling, deformity, or tenderness over the right elbow on gentle examination, although she becomes distressed when the area is touched.

a) Describe the anatomy and mechanism of pulled elbow. (3 marks)

- **Subluxation of the radial head out of the annular ligament** at the proximal radio-ulnar joint **[core]**
- **Mechanism:** longitudinal traction on the extended, pronated forearm (typical scenario — child being lifted by the wrists or hand) **[core]**
- **Common in children <5 years** (annular ligament is loose; resolves with age as ligament thickens); predominantly in females **[core]**

b) Describe 2 reduction techniques. (3 marks)

- **Hyperpronation technique:** with elbow flexed at 90°, forearm in neutral to supinated position; firmly hyperpronate the forearm (often felt or heard 'click'); ~93 percent first-attempt success rate (preferred per Cochrane evidence) **[core]**
- **Supination-flexion technique:** with elbow flexed at 90°, supinate the forearm fully, then flex the elbow (palpable 'click'); ~85 percent first-attempt success **[core]**
- Following reduction, the child should use the arm normally within 5-15 minutes (often quicker) **[core]**

c) List 2 indications for X-ray (rather than attempted reduction). (2 marks)

- **Inconsistent history (suggests alternative pathology / non-accidental injury);** mechanism of trauma other than longitudinal traction (fall, twisting injury) **[core]**
- **Localised tenderness, swelling, bruising, deformity** (suggests fracture); failure of reduction after 2 attempts; persistent pain or refusal to use arm after attempted reduction **[core]**
- Age >5 years (atypical)
- Concern for non-accidental injury — bruises in different stages, multiple injuries

References: Tintinalli's Emergency Medicine 9e Ch 109 • RCH CPG • RACGP Musculoskeletal / Orthopaedic Guidelines

Question 20 | Open Fracture Management (10 marks)

A 35-year-old male motorcyclist is brought to your emergency department after a high-speed crash 30 minutes ago. He has an obvious open fracture of the right tibial shaft with bone visible through a 5-centimetre wound. There is moderate bleeding from the wound. He is otherwise haemodynamically stable. Vital signs: heart rate 100 beats per minute, blood pressure 130/85 millimetres of mercury, peripheral oxygen saturation 99 percent on room air, temperature 36.8 degrees Celsius. Tetanus status: last booster 10 years ago.

a) Describe the Gustilo-Anderson classification of open fractures. (4 marks)

- **Type I:** clean wound <1 cm with minimal soft-tissue damage; simple fracture pattern; minimal contamination **[core]**
- **Type II:** laceration >1 cm but no extensive soft-tissue damage / flap / avulsion; moderate contamination **[core]**
- **Type IIIA:** extensive soft-tissue damage but bone coverage adequate; comminuted fracture; high-velocity injury; this case (5 cm wound with exposed bone) — IIIA **[core]**
- **Type IIIB:** extensive soft-tissue loss, periosteal stripping, bone exposure requiring local or free flap for coverage; **Type IIIC:** associated arterial injury requiring vascular repair **[core]**
- Increasing type associated with increased infection and amputation risk

b) List 5 immediate management priorities. (5 marks)

- **Empirical intravenous antibiotics WITHIN 1 HOUR** — cefazolin 2 g IV every 8 hours for Gustilo I/II; add gentamicin 5 mg/kg + metronidazole 500 mg every 12 hours for III; clindamycin if penicillin-allergic **[core]**
- **Tetanus prophylaxis** — booster (adsorbed diphtheria-tetanus, dTpa) AND tetanus immunoglobulin 250 IU IM (last booster >5 years ago AND tetanus-prone wound) **[core]**
- **Wound care** — gross contamination removal with sterile saline; cover with sterile saline-soaked gauze; do NOT scrub or pressure-irrigate in ED (formal debridement in theatre); photograph wound with consent **[core]**
- **Reduction and splint / immobilisation** of fracture; check neurovascular status before AND after; analgesia (opioid titrated) **[core]**
- **Urgent orthopaedic consultation** for operative debridement and stabilisation within 6-24 hours (depending on Gustilo grade); bloods, group and save, anaesthetic review **[core]**
- Identify other injuries (full trauma series); fluid / blood resuscitation if shocked

c) State the time target for definitive surgical debridement. (1 mark)

- **Within 24 hours of injury** for Gustilo I/II (some advocate <6 hours; evidence supports timing <24 hours is more important than <6 hours); Gustilo III requires more urgent (within 6-12 hours where possible) and antibiotics should never be delayed **[core]**
- Multiple debridements often required for Gustilo III injuries

References: Tintinalli's Emergency Medicine 9e Ch 269 • eTG Therapeutic Guidelines — Antibiotic • eTG (Therapeutic Guidelines, current) • Australian Immunisation Handbook