

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

MCQs – Adult Pathology – Single Best Answer

1. Anterior dislocation of a proximal interphalangeal joint in the hand is associated with a great risk of permanent impairment because of:

Answer: b. Development of a Boutonniere deformity
 The most common direction for dislocation of the proximal interphalangeal joint is dorsal. Volar dislocation is associated with rupture of the extensor central slip mechanism, collateral ligaments and rupture of the volar plate.

2. Supracondylar fractures in children are commonly associated with:

Answer: d. Anterior interosseous nerve palsy
 This presents as paralysis of the long flexors of the thumb and index finger with no sensory changes. The incidence of nerve injury ranges from 10 to 20%.¹

3. A 15-year-old boy presents to A & E following a fall while playing football leading to an injury in his left upper limb. Radiographs taken in A & E reveal a minimally displaced fracture of his left proximal humerus through a large, well-defined unicameral bone cyst. The appropriate management at this stage would involve:

Answer: e. Internal fixation with curettage and bone grafting of the cyst
 Various methods have been tried in the treatment of unicameral bone cysts with similar reported results. There is no clear evidence to guide treatment.

However, a recent study has shown improved results using minimally-invasive curettage, ethanol cauterisation and bone grafting.²

4. The most common organism responsible for an epidural abscess is:

Answer: c. *Staphylococcus*
 Epidural abscess is a complication of vertebral osteomyelitis. *Staphylococcus aureus* is the causative organism in 50% to 75% of cases and is usually haematogenous in origin. Older patients and intravenous drug users are at increased risk.³

5. A five-year-old boy presents to A & E with a painful hip associated with a limp for the past 48 hours. He has a temperature of 38.5°C and an elevated CRP with a high white cell count. Radiographs suggest an effusion in the hip. The next best management step would involve:

Answer: d. Emergency aspiration and washout of the hip joint followed by intravenous antibiotics
 Ultrasound is the investigation of choice when imaging a child with a painful hip. The use of diagnostic algorithms is no substitute for careful clinical examination. Microbiological cultures can be unreliable and arthroscopy provides the opportunity to obtain tissue for culture.⁴

Vivas

Adult Pathology

A 58-year-old carpenter presents with a history of progressively worsening pain on the medial aspect of his knee. He is self-employed and his job involves a significant amount of kneeling and climbing. Examination reveals a varus deformity, tender medial joint line, a stable knee and flexion from 10° to 130°. This is his radiograph (Fig. 1).

1. Describe the radiograph.



Fig. 1

Answer: The radiograph shows reduction of medial joint space with bone-on-bone contact. There is evidence of subchondral sclerosis. The lateral joint space is well-preserved.

2. Would you want any other specific views? If so, why?

Answer: I would request a lateral view of the knee and also a skyline view. If these showed no patellofemoral degeneration and mid-sagittal wear, I would consider use of a valgus-stress radiograph. These views would enable me to assess suitability of the patient for either a total knee replacement or a more conservative option such as unicompartmental knee replacement.

3. How would you stage this disease and what classification system would you use?

Answer: I would stage the disease as Grade 4 osteoarthritis.

- a. Grade 0 – Normal appearances
- b. Grade 1 – Osteophytes with normal joint space
- c. Grade 2 – Less than 50% joint space reduction
- d. Grade 3 – More than 50% joint space reduction
- e. Grade 4 – Bone-on-bone contact

Advisor:

■ Mr David Jones, FRCS, FRCSEd (Orth)
 Associate Editor, *the Journal of Bone and Joint Surgery [Br]*

Contributors:

■ Mr Henry Budd, SpR, East of England Rotation
 ■ Mr Malin Wijeratna, SpR, East of England Rotation

4. What treatment would you offer him?

Answer: Conservative treatment consisting of weight-reduction methods, muscle-strengthening exercises and pain control.

5. If conservative management fails what treatment would you offer him?

Answer: I would offer the patient a unicompartmental knee replacement.

6. Discuss the advantages and disadvantages of an osteotomy (HTO) over a unicompartmental knee replacement (UKR) in this situation.

Answer: There is only one prospective randomised controlled study to my knowledge comparing HTO to UKR. This found UKR results were better than HTO in the over 60's. The study recommended HTO for patients under 60. The prosthesis used was inferior to the most commonly used prosthesis at present (Oxford, Biomet).⁵

7. What are the contraindications for a unicompartmental knee replacement?

Answer: Contraindications include:³

- a. Anterior cruciate ligament rupture
- b. Fixed varus deformity
- c. Fixed flexion deformity
- d. Previous meniscectomy in the contralateral compartment
- e. Knee stiffness (flexion < 90°)
- f. Inflammatory arthritis
- g. Tri-compartmental arthritis

8. What are the outcomes for the Oxford medial mobile bearing unicompartmental knee replacement and an opening-wedge osteotomy?

Answer: A recent study reported results of 1000 unicompartmental knee replacements, with a 96% 10-year survival rate for implant-related revision. High tibial osteotomies have good outcomes initially that deteriorate over time. Arthroplasty is recommended for patients older than 60 and osteotomy for those under 60.⁶

Trauma

A 20-year-old woman fell off her bicycle and landed on her right elbow sustaining this injury (Fig. 2).

1. Describe the abnormality.



Fig. 2a



Fig. 2b

Answer: Lateral dislocation of the elbow with no associated fractures.

2. How would you classify this injury?

Answer: Simple lateral elbow dislocation.

Simpson's classification

Both radius and ulna

Posterior; Lateral; Medial; Divergent

Ulna alone

Anterior; Posterior

Radius alone

Anterior; Posterior; Lateral

3. How would you treat this patient?

Answer: Reduce dislocation and immobilise for one week. Permit range of motion exercises thereafter.

4. What is the expected outcome?

Answer: Satisfactory outcome expected with a flexion contracture of less than 30°.

5. What other structures could have been affected by this injury?

Answer: Medial collateral ligament, elbow capsule, flexor pronator muscle mass, lateral collateral ligament and occasionally brachialis.

6. How would you assess their integrity?

Answer: I would perform an examination under anaesthetic and perform varus/valgus stress radiographs. I would also examine the stability of the elbow in extension.

7. Describe the primary and secondary restraints of the elbow joint.

Answer: ^{7,8}.

Instability	Primary stabiliser	Secondary stabiliser
Valgus stress	Medial collateral ligament	Radiocapitellar joint Ulna-humeral joint
Varus stress	Ulna-humeral joint	Anterior capsule in extension Lateral collateral ligament in flexion

Hands

A 68-year-old man presents with numbness and tingling in the radial three and a half fingers of his left hand for the past six months (Fig. 3).



Fig. 3

1. What is the diagnosis?

Answer: The diagnosis is carpal tunnel syndrome (CTS) with compression of the median nerve as it traverses the tunnel. Sensation over the ulnar one and a half fingers, first dorsal interosseous and thenar eminence is spared due to cutaneous innervation by the ulnar, radial and palmar cutaneous nerve respectively.

2. What is Tinel's sign?

Answer: Tinel reported his eponymous sign in 1915 after noticing that slight percussion of a nerve trunk some time after injury resulted in a tingling sensation in the cutaneous distribution of the nerve percussed depicting the presence of regenerating nerve fibres.⁹ A true Tinel's sign has been shown to only be present when touch fibres are regenerating and is painless, pain would imply neuroma formation and possibly an obstruction to regeneration.¹⁰

3. What investigation would you request and why?

Answer: I would request a nerve conduction test to confirm or exclude the clinical diagnosis. This is crucial since a proportion of those patients with a typical clinical presentation will not have CTS as supported by a study of 112 patients where only 61% with classical symptoms and signs had electrophysiological evidence of CTS.¹¹ This also acts as a useful baseline for those patients with failure to respond to surgical decompression that are subsequently investigated with nerve conduction studies.

4. This is the result of a nerve conduction study (Fig. 4). How would you interpret this?

Sensory NCS					
Nerve / Sites	Rec. Site	Latency ms	Amp.2-3 μ V	Distance cm	Vel. m/s
R MEDIAN - F2					
Wrist	II	4.05	1.4	10.5	25.9
L MEDIAN - F2					
Wrist	II	3.80	1.6	11	28.9
R ULNAR - Digit V					
Wrist	V	1.70	3.5	9	52.9
L ULNAR - Digit V					
Wrist	V	1.70	5.0	9	52.9

Motor NCS					
Nerve / Sites	Latency ms	Amp.1-2 mV	Dur. ms	Dist. cm	Vel. m/s
L MEDIAN - APB					
Wrist	5.00	3.6	6.20		
R MEDIAN - APB					
Wrist	6.95	9.3	6.80		
L ULNAR - ADM					
Wrist	2.30	7.0	5.10		
B.Elbow	5.65	7.0	4.90	24	71.6
A.Elbow	6.40	7.3	4.95	5	66.7
Path A.Elbow - Wrist				29	70.7
R ULNAR - ADM					
Wrist	2.40	6.0	5.40		
B.Elbow	5.70	8.8	5.10	20	60.6
A.Elbow	6.25	9.4	4.95	4	72.7
Path A.Elbow - Wrist				24	62.3

Fig. 4

Answer: The nerve conduction reveals increased latency of the right median nerve, along with decreased amplitudes and velocity, which suggests median nerve compression.

5. How would you manage this condition?

Answer: I would manage painless carpal tunnel syndrome conservatively with night splints and investigate/treat any secondary underlying cause including diabetes mellitus and hypothyroidism. I would treat a patient with a painful nerve conduction test proven carpal tunnel syndrome that has failed conservative management with carpal tunnel decompression.

6. What are the boundaries of the carpal tunnel?

Answer: The carpal tunnel is bound by the flexor retinaculum superficially attached between the hook of hamate and scaphoid tubercle, the hamate and pisiform medially with the scaphoid and trapezium laterally.

7. Describe your surgical approach and procedure.

Answer: I would make a longitudinal incision in the skin crease where possible in line with the radial border of the ring finger from beyond the distal palmar crease up towards Kaplan's cardinal line. I would incise the superficial palmar fascia and use a self retainer to clear the palmar fat exposing the flexor retinaculum. I would divide this carefully over a MacDonaldis elevator gently inserted underneath. I would decompress proximally up to the proximal flexor crease and distally to until fully released. I would also document the appearance of the nerve.

8. What is the expected outcome?

Answer: I would expect the patient's pain and function to improve following surgical decompression. A recent randomised parallel group trial comparing surgical decompression with non-surgical management of carpal tunnel syndrome without denervation reported a modest advantage of surgery in terms of function and symptom relief.¹² A previous Cochrane review including the four previous randomised controlled trials comparing surgical and conservative management concluded that surgical decompression relieves symptoms of CTS significantly better than splinting.¹³

Children's Orthopaedics

A 14-year-old boy presents with this appearance of the lower limbs (Fig. 5). There is no previous history of illness or injury.



Fig. 5

1. What is the likely diagnosis?

Answer: The likely diagnosis is adolescent Blount's disease (tibia vara).

2. What are the radiological features?

Answer: The radiological features of Blount's disease are widening of the upper tibial growth plate on the medial side, a metaphyseal-diaphyseal angle of greater than 11° and scalloping of the epiphysis medially.

3. Explain the cause of the condition.

Answer: Blount's disease is a growth disorder of the proximal posteromedial epiphysis secondary to a combination of hereditary and developmental factors. Repetitive trauma to the knee in the overweight child when ambulating may lead to overloading of the growth plate (Heuter Volkmann principle) causing infantile genu varum.



Fig. 6

4. What four observations explain this radiograph (Fig. 6)?

Answer: The radiograph demonstrates a distal femoral epiphysiodesis. The medial staples were inserted to correct genu valgum and were successful. The lateral staples were inserted when correction was achieved. The lateral staples are approximately 1 cm. below the medial

ones, indicating that the correction took place over a year (growth from lower femur approx 1 cm/year). The medial upper tibial physis is overloaded (see previous question), indicating a heavy child.

5. These radiographs are typical of which skeletal dysplasia (Fig. 7)?

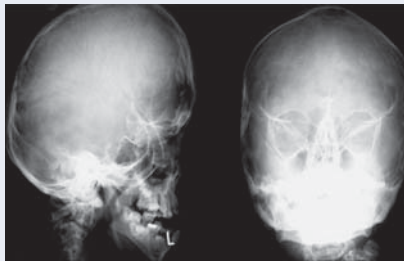


Fig. 7a



Fig. 7b

Answer: Apert Syndrome (Acrocephalosyndactyly). In the skull radiographs there has been craniosynostosis leading to turricephaly (tower-shaped) and the anteroposterior (AP) view shows the harlequin mask appearance of the orbits. The feet show complex syndactyly, typical of the condition.

6. In the diagnosis of bone dysplasia what radiographs constitute a skeletal survey?

Answer: The skeletal survey for bone dysplasia should include the following X-rays: Skull (AP and lateral), Chest, Cervical and Thoracolumbar spine (AP and lateral), Pelvis, Tubular bones one side (AP only) and a lateral if needed or if there is asymmetry, hands and feet.

Basic Science

1. Illustrate the histological appearance of the normal physis.

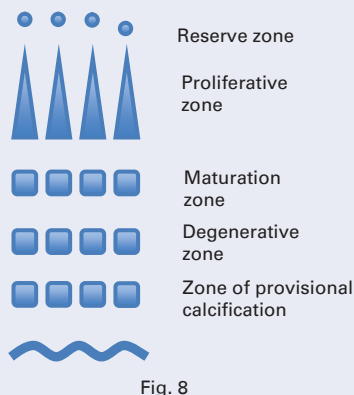


Fig. 8

Answer: The basic histological appearance of the physis is demonstrated above, where the top of the diagram is nearest the joint surface.

2. Which layer of the physis is affected in a physal fracture?

Answer: The provisional calcification zone (part of the hypertrophic layer) is thought to be most affected in a physal fracture but this is dependant on the type of load applied. It is in this zone that the extracellular matrix content is less due to chondrocyte hypertrophy resulting in relative weakness.⁸

3. Describe the Salter-Harris classification for grading physal fractures.

Answer: The Salter Harris classification grades fractures according to their involvement of the epiphysis, physis and metaphysis and originally included five types. In type I there is separation of the metaphysis and epiphysis without any bone fracture, the growing

cells of the epiphyseal plate remaining with the epiphysis.¹⁴

In type II the fracture extends along the epiphyseal plate a variable distance then exits through the metaphysis producing the triangular shaped fragment of metaphysis referred to as Thurston Holland's sign.¹⁴ In type III fractures the fracture is intra-articular extending from the joint surface to the weak zone of the metaphyseal plate then extending along the plate to its periphery, as opposed to type IV which extends from the joint surface and crosses the physis exiting via the metaphysis.¹⁴ Finally type V was described as a severe crush applied through the epiphysis to one area of the epiphyseal plate, such as when a hinge joint has a severe abduction or adduction force applied to it.¹⁴

4. How does rickets affect the physis?

Answer: In rickets there is failure of mineralisation leading to changes in the physis in the zone of provisional calcification and the bone. This results in increased width and disorientation of the physis since little or no provisional calcification occurs, and cortical thinning with bowing of the bone.³

5. How is the physis affected in the case of achondroplasia?

Answer: In achondroplasia there is a physal dysplasia involving the cartilaginous proliferative zone of the physis with reduced chondrocyte proliferation and column formation.

6. What other conditions affect the physis and how?

Answer: The following conditions affect the physis:³

Lysosomal storage disorders: reduce oxygen tension in the reserve zone.

Mucopolysaccharide disorders: lead to chondrocyte degeneration in the hypertrophic zone.

Diastrophic dwarfism is possibly due to a type II collagen synthesis disorder affecting the reserve zone in addition to defects in other zones.

References

1. Omid R, Choi PD, Skaggs DL. Supracondylar humeral fractures in children. *J Bone Joint Surg [Am]* 2008;90-A:1121-32.
2. Hou HY, Wu K, Wang CT, et al. Treatment of unicameral bone cyst: a comparative study of selected techniques. *J Bone Joint Surg [Am]* 2010;92-A:855-62.
3. Mark D, Miller MD. *Review of orthopaedics*. Fifth ed. Philadelphia: Saunders Elsevier, 2008.
4. Kang SN, Sanghera T, Mangwani J, Paterson JM, Ramachandran M. The management of septic arthritis in children: systematic review of the English language literature. *J Bone Joint Surg [Br]* 2009;91-B:1127-33.
5. Stukenborg-Colsman C, Wirth CJ, Lazovic D, Wefer A. High tibial osteotomy versus unicompartmental joint replacement in unicompartmental knee joint osteoarthritis: 7-10-year follow-up prospective randomised study. *Knee* 2001;8:187-194.
6. Pandit H, Jenkins C, Gill HS, et al. Minimally invasive Oxford phase 3 unicompartmental knee replacement: results of 1000 cases. *J Bone Joint Surg [Br]* 2011;93-B:198-204.
7. Mehlhoff TL, Noble PC, Bennett JB, Tullos HS. Simple dislocation of the elbow in the adult: results after closed treatment. *J Bone Joint Surg [Am]* 1988;70-A:244-9.
8. Ramachandran M. *Basic orthopaedic sciences: the Stanmore guide*. London: Hodder Arnold, 2007:195.
9. Tinel, J. Le signe du "fourmillement" dans les lesions des nerfs peripheriques. *Presse Med* 1915;23:388-9.
10. Moldaver J. Tinel's sign: its characteristics and significance. *J Bone Joint Surg [Am]* 1978;60-A:412-14.
11. Buch-Jaeger N, Foucher G. Correlation of clinical signs with nerve conduction tests in the diagnosis of carpal tunnel syndrome. *J Hand Surg Br* 1994;19:720-4.
12. Jarvik J, Comstock BA, Kliot M, et al. Surgery versus non-surgical therapy for carpal tunnel syndrome: a randomised parallel group trial. *Lancet* 2009;374:1074-81.
13. Verdugo RJ, Salinas RA, Castillo JL, Cea JG. Surgical versus non-surgical treatment for carpal tunnel syndrome. *Cochrane Database Syst Rev* 2008;4: CD001552.
14. Salter RB, Harris WR. Injuries involving the epiphyseal plate. *J Bone Joint Surg [Am]* 1963;45-A:587-62.