ANSWERS AND ADDITIONAL INFORMATION FOR ORTHOPAEDIC CLINICAL QUIZ

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Answers 1

a) i. Superior migration of humeral head
ii. Subchondral sclerosis
iii. Reduced acromiohumeral distance (interval)
iv. Osteopaenia
b) Rotator cuff arthropathy.
c) Untreated rotator cuff tear leads to proximal migration of humeral head followed by acromial acetabularization and femoralization of humeral head eventually leading to arthritis of the gleno-humeral joint leading to osteoporosis of humeral head and eventual collapse.
d) Scapular and rotator cuff strengthening program.
Hemiarthroplasty of shoulder or reverse shoulder arthroplasty.

Description 1

Cuff deficient arthritis of the glenohumeral joint encompasses several pathologies including rheumatoid arthritis or osteoarthritis without a competent rotator cuff, degenerative joint disease secondary to failed rotator cuff repair and cuff tear arthropathy (CTA). Neer et al estimated that only 4% of patients with a complete tear of the rotator cuff go on to develop CTA. Both mechanical and nutritional factors play a role. Loss of the enclosed joint space leads to extravasation of synovial fluid, altered intra-articular pressure and impaired delivery of nutrients to the articular cartilage. Inactivity of the joint results in disuse osteoporosis and eventually collapse of the subchondral bone of the humeral head. The mechanical factors result from the loss of the dynamic stabilisation and concavity compression normally provided by the rotator cuff.

The initial management of rotator cuff tear arthropathy should begin with conservative measures including activity modification, NSAIDs, scapular and rotator cuff strengthening programmes and intraarticular injections of corticosteroid and hyaluronans. Total shoulder arthroplasty is commonly performed for the treatment of advanced degenerative osteoarthritis in patients older than 60 years where the anterior deltoid is preserved. Reverse shoulder arthroplasty is preferred in patients >70 years with low activity level with functioning deltoid and good bone stock.

References:

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2. Eajazi A, Kussman S, LeBedis C, Guermazi A, Kompel A, Jawa A, et al. Rotator cuff tear arthropathy: pathophysiology, imaging characteristics, and treatment options. *AJR Am J Roentgenol.* 2015; 205(5): W502-11. doi: 10.2214/AJR.14.13815

Answer 2

a) i. Loss of medial longitudinal arch
ii. Hindfoot (calcaneus) valgus
iii. Too many toe sign (forefoot abducted)
b) Congenital flat foot or congenital plano-valgus
c) i. Accessory navicular bone
ii. Tarsal coalition
iii. Congenital vertical talus
d) Prescribe insole with medial arch support
e) i. Lateral column lengthening.
ii. Arthroeresis screw insertion/subtalar implant

Description 2

Flexible flatfoot in children is one of the most common disorders in orthopaedics. Despite numerous papers published in the literature, the definition and etiology of flexible flatfoot; the level of disability that it may cause; and the appropriate time of, and efficacy of its treatment are still debateable. In fact, if the foot is only morphologically flat, characterised by a lower medial arch and a broadening of the footprint, it can be well tolerated throughout the person's life. If, however, the foot is also functionally flat, that is, a foot stays in a prevalent pronation during weight-bearing and walking, can cause secondary problems.

Flexible flatfoot deformities can be corrected by restricting excessive eversion of the subtalar joint by subtalar arthroereisis. Historically, there are several operative techniques described; a calcaneal posterior facet osteotomy, allograft wedges of cortical bone placed in the sinus tarsi, temporary fixation of the subtalar joint with an extraarticular staple, holding the subtalar joint in a corrected position with an extraarticular staple and bone graft (adults), and holding the subtalar joint in a corrected position with an implant placed in the sinus tarsi.

A sinus tarsi implant does not violate the subtalar joint or rest against any articular joint cartilage and can be used for both adolescent and adult flat foot deformities along with other procedures. These implants restrict hindfoot valgus. As a result, the calcaneus is more vertically oriented beneath the ankle joint. The head of the talus is elevated by the sustentaculum tali and is no longer plantarflexed and medially deviated. With correction of the hindfoot deformity, many of the associated midfoot and forefoot deformities can also be corrected. Lateral talonavicular subluxation and forefoot abduction are reduced, allowing the transverse tarsal joints to stabilise during the terminal part of the stance phase of gait.

References:

1. Giannini BS, Ceccarelli F, Benedetti MG, Catani F, Faldini C. Surgical treatment of flexible flatfoot in children: a four-year follow-up study. *J Bone Joint Surg Am.* 2001; 83-A Suppl 2 Pt 2:73-9. doi: 10.2106/00004623-200100022-00003
2. Wenger DR, Mauldin D, Speck G, Morgan D, Lieber RL. Corrective shoes and inserts as treatment for flexible flatfoot in infants and children. *J Bone Joint Surg Am.* 1989; 71(6): 800-10.
3. Needleman RL. Current topic review: subtalar arthroereisis for the correction of flexible flatfoot. *Foot Ankle Int.* 2005; 26(4): 336-46. doi: 10.1177/107110070502600411

Answer 3

a) i. Absence of talus
ii. Loss of tibio-talar, subtalar joints
iii. Loss of talo-navicular joint space
iv. Consolidation and remodelling of bone fragments
v. Disease involving both ankle and mid foot joints
vi. Calcaneal spur (not related to the current condition)
Any of the three (3)
b) Charcot arthropathy of ankle and mid foot joints
c) i. Diabetic neuropathy
ii. Leprosy
iii. Alcoholism
iv. Tabes Dorsalis/Syphilis
Any of the four (4)
d) i. Brodsky – anatomical classification
ii. Eicnhenholtz – physiological classification
e) i. CROW (Charcot-Restraint- Orthotic-Walker) shoe
ii. Fusion with internal fixation (hindfoot nail and screws/plates) – no infection and good skin condition
iii. Fusion using external fixator (Illizarov/TSF) – infection, poor skin condition

Description 3

Charcot arthropathy is poorly understood. The effects of Charcot arthropathy are commonly seen in the foot and ankle, and the diagnosis is commonly missed upon initial presentation. It is a deforming and destructive process that can lead to increased patient morbidity due to gross instability, recurrent ulcerations, or amputation. Charcot arthropathy has been associated with leprosy, toxic exposure, syringomyelia, poliomyelitis, rheumatoid arthritis, multiple sclerosis, congenital neuropathy, and traumatic injury. However, diabetes mellitus has become the most common etiology in the modern era. Eichenholtz (1966) published a landmark article on Charcot arthropathy based on radiographic appearance and its physiologic course. The treatment of Charcot arthropathy depends on many factors, including the course or stage of disease, location(s) of involvement, presence of ulcers, and ability to achieve a stable and plantigrade foot. Other factors that could affect treatment options are comorbidities such as cardiovascular disease, morbid obesity, nephropathy, or infected ulcer. The goals for every patient undergoing treatment for an acute or quiescent Charcot process

should be to maintain or achieve structural stability of the foot and ankle, prevent ulceration, and preserve a plantigrade foot.

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1. Wukich DK, Sung W. Charcot arthropathy of the foot and ankle: modern concepts and management review. *J Diabetes Complications.* 2009; 23(6): 409-26. doi: 10.1016/j.jdiacomp.2008.09.004
2. Rosenbaum AJ, DiPreta JA. Classifications in brief: Eichenholtz classification of Charcot arthropathy. *Clin Orthop Relat Res.* 2015; 473(3): 1168-71. doi: 10.1007/s11999-014-4059-y

Answer 4

a) Hindfoot arthrodesis nail
b) i. Lateral bend
   - Allows entry site in the center of the lateral column of the calcaneus
   - Restores hindfoot alignment to 3° to 5° valgus for better gait

   ii. Distal and talar locking options – screw orientation from calcaneum into cuboid. and talus into navicular (allows calcaneo-cuboid and talo-navicular)
   iii. Cannulated – easy insertion with guide wire
c) i. Osteoarthritis of ankle joint (hindfoot)
   ii. Avascular necrosis of talus
   iii. Charcot arthropathy of ankle
   iv. Failed total ankle arthroplasty
   v. Inflammatory arthropathy of ankle joint
   Any of the five (5)
d) Neutral flexion, slight (zero to 5°) valgus angulation of the hindfoot, 5° to 10° of external rotation, and 5mm posterior talar translation

Description 4

Tibiotalocalcaneal arthrodesis is a salvage option for severe ankle and hindfoot deformities, arthritis of the ankle and subtalar joints, avascular necrosis of the talus, failed total ankle arthroplasty, and Charcot arthropathy. Ideal position for fusion of the ankle is neutral flexion, slight (zero to 5°) valgus angulation of the hind part of the foot, and 5° to 10° of external rotation. This position allows the greatest compensatory motion at the foot and places the least strain on the knee. The rate of superficial wound infection is 2.4%. No deep soft tissue or bone infections were reported. The overall union rate is 84%2. Other complications include lateral plantar and superficial peroneal nerve injuries.

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1. Trnka HJ. Hindfoot Fusions. *Tech Foot Ankle Surg.* 2007; 6(4): 209. doi: 10.1097/01.btf.0000247189.98017.87
2. Rammelt S, Pyrc J, Agren PH, Hartsock LA, Cronier P, Friscia DA, *et al.* Tibiotalocalcaneal fusion using the hindfoot arthrodesis nail: a multicenter study. *Foot Ankle Int.* 2013; 34(9): 1245-55. doi: 10.1177/1071100713487526

Answer 5

a) Lateral condyle humerus fracture.
b) i. Arthrogram - To see joint surface/fracture configuration, also assist with wire placement in cartilaginous structure during closed reduction
   ii. MRI or ultrasound is also acceptable – To see joint surface/fracture configuration
c) Anterolateral approach over lateral condyle, realign/flip out lateral periosteum from fracture site, directly visualise intra-articular reduction, compress fracture with Kirschner wire/screw
d) Posterior lateral condyle dissection can result in osteonecrosis (source of vascularisation to distal humerus lies posterior)
e) i. Stiffness
   ii. Delayed union or non-union
   iii. Lateral overgrowth/prominence/spurring
   iv. Cubitus valgus that may result in tardy ulnar nerve palsy
   v. AVN lateral condyle or trochlea
   vi. Growth arrest
   Any of the six (6)

Description 5

Lateral humeral condyle fracture in children is difficult to diagnose and is rare, at 5% to 20% of paediatric elbow fracture, in second place between supracondylar and medial epicondylar fracture. Such Salter III or IV fractures sometimes show little or no displacement, which may be misleading. Complications include secondary displacement, non-union and epiphysiodesis of the distal extremity of the humerus. Majority of the poor results reported in literature relate to inadequate initial treatment. The clinical aspect of lateral humeral condyle fracture is often characteristic (ecchymosis facing the head of the radius). Nondisplaced or minimally displaced lateral humeral condyle fracture can be managed conservatively under close observation. However, secondary displacement in the cast is difficult to detect. Type II and III fractures on the Lagrange and Rigault classification should be managed by pinning under open surgery. A systemic review revealed increasing resort to surgery for lateral humeral condyle fracture in children, with conservative management reserved for fractures in which the gap between bone fragments did not exceed 1mm.

References:

1. Mirsky EC, Karas EH, Weiner LS. Lateral condyle fractures in children: evaluation of classification and treatment. *J Orthop Trauma.* 1997; 11(2): 117-20. doi: 10.1097/00005131-199702000-00009
2. Marcheix PS, Vacquerie V, Longis B, Peyrou P, Fourcade L, Moulies D. Distal humerus lateral condyle fracture in children: when is the conservative treatment a valid option?. *Orthop Traumatol Surg Res.* 2011; 97(3): 304-7. doi: 10.1016/j.otsr.2010.10.007

Answer 6

a) i. Osteo-chondral detachment over the medial talar dome (medial shoulder)
   ii. Surrounding oedema within the talus (bone bruise/oedema)
   iii. Bone depression over medial talar dome
b) Osteochondral lesion of the talus
c) Medial malleolar osteotomy, debridement of the osteochondral lesion and osteochondral grafting (osteochondral autograft transplantation, autologous chondrocyte implantation, allograft, biodegradable scaffold with mesenchymal stem cells)
d) i. Mid-foot rocker bottom shoe to offload hindfoot
   ii. Non-steroidal anti-inflammatory drugs (NSAIDs)
   iii. Proprioception training
   iv. Physiotherapy (strengthening and range of motion exercises)
e) Osteoarthritis of the ankle joint

Description 6

Osteochondral fractures refer to lesions affecting the articular cartilage of the talar dome and the underlying subchondral bone. These fractures should be suspected in patients with chronic ankle pain with effusion, especially with a history of ankle injury. Early diagnosis is crucial because of the functional significance of the talus and its limited capacity to repair. Compressive injury to an ankle positioned in dorsiflexion and inversion may crush the subchondral bone of the lateral talar dome, with or without overlying cartilage damage. Alternatively, subjecting the plantarflexed ankle to impact forces of inversion and external rotation can produce osteochondral injuries to the medial talar surface. Plain radiography should be used for initial evaluation of acute ankle injury with hemarthrosis. Persistence of pain despite normal appearance on plain radiographs warrants further investigation, such as MRI or bone scintigraphy. The MRI allows multiplanar evaluation of articular cartilage, subchondral bone, oedema and associated soft tissue. It also allows to detect early subchondral damage (stage I lesions).

Early (Berndt and Hartly radiographic classification grade I or II) lesions may be amenable to nonsurgical treatment; more severe (grade III or IV) lesions or those for which nonsurgical management has failed may necessitate surgical intervention. Subchondral drilling is done for stable lesions to encourage fibrocartilage growth, and osteochondral grafts may be used to restore the talar articular surface for unstable or larger defects. Advances in osteochondral grafting has allowed reconstruction of the talar dome thus alleviating pain, and improving function.

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