ANSWERS AND ADDITIONAL INFORMATION FOR ORTHOPAEDIC CLINICAL QUIZ

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Answer 1

a) i. Large wound over the dorsum of the right hand, extending to the distal forearm.
ii. Exposed extensor tendons (not desiccated).
iii. Slough at the base and edges with no surrounding erythema.
b) i. Reduce bioburden (bacterial load and non-viable tissue) through debridement and antimicrobials.
ii. Maintain optimal wound moisture balance and prevent desiccation of tendons.
iii. Avoid excessive granulation.
iv. Reduce local oedema through limb elevation and compression dressing.
v. Maintain supple joints and free tendon glide to prevent joint stiffness and tendon adhesion.
vi. Optimise nutritional status and diabetic control to improve wound healing potential.
vii.Early wound coverage/reconstruction.
c) Flap reconstruction, either free or pedicled.

Description 1

The traditional reconstructive ladder was introduced in 1982 and continues to be the conceptual framework that guides surgeons on the most appropriate reconstructive option for a given defect, which typically begins from the least complex to the most complex method. The ladder starts from healing by secondary intention to simple primary closure, delayed primary closure, split-thickness skin grafting (SSG), full-thickness skin grafting (FTSG), tissue expansion, local flaps, regional flaps and lastly free flaps. However, soft tissue reconstruction of the dorsum of the hand is challenging due to the frequent involvement of tendon and bone. Excessive granulation should be avoided; otherwise, the gliding planes between the skin, tendons and joints will be compromised, leading to adhesion and stiffness. Coverage of vital structures of the hand by SSG or FTSG is not ideal. Skin grafts depend on a well-vascularised wound bed for uptake and therefore are not suitable to cover defects over bare bones or tendons devoid of the periosteum or paratenon respectively. The high contracture potential and limited scar pliability of skin grafts are also unfavourable for the hand. Large, durable and well-vascularised tissue is often important for the preservation of hand function. A newer concept of reconstructive "elevator" gives the surgeon liberty to bypass and select a more complex reconstruction, having considered the functional and aesthetic outcomes. Local perforator flaps, reverse flow forearm flaps, distant flaps like groin and abdominal flaps and free flaps such as anterolateral thigh flap, are some of the possible options, each with its advantages and disadvantages. Ultimately, the key principles of hand reconstruction are aimed to replace 'like with like', restore function, preserve mobility and sensation, while at the same time striving to achieve a good aesthetic outcome and minimise donor site morbidity.

References:

1. Miller EA, Friedrich J. Soft Tissue Coverage of the Hand and Upper Extremity: The Reconstructive Elevator. *J Hand Surg Am.* 2016; 41(7): 782-92.
2. Das De S, Sebastin SJ. Considerations in Flap Selection for Soft Tissue Defects of the Hand. *Clin Plast Surg.* 2019; 46(3): 393-406.

Answer 2

a) Watson's skin grafting knife.
b) A: Locking nut
B: Adjuster nut (Single knurled control knob)
C: Roller guard (smooth and does not rotate whilst in use)
D: Skin graft blade.
c) i. Thigh (commonest, intermediate thickness).
ii. Lumbar and gluteal regions (thick skin).
iii. Arm (thin skin).
d) i. The width between the roller guard and blade.
ii. The contact angle between the blade and the skin during harvesting.
iii. The pressure applied by the surgeon onto the handle during harvesting.

Description 2

Skin grafting is a commonly used technique for wound coverage. The ideal skin graft is of adequate thickness and strength but does not compromise the regeneration of the donor site. Humby, Braithwaite, Watson and Cobbett are some of the hand-held skin grafting knives that have undergone evolution and modification with time. Unlike harvesting the skin graft using an electrical dermatome, the hand-held knife is highly dependent on the operator's experience and skills. Split-thickness skin graft includes the full thickness of the epidermis and a variable thickness of the dermis. The optimum graft thickness is 0.35mm, but a range between 0.25mm to 0.55mm is acceptable. The standard Swann-Morton number 15 and number 10 scalpel blade, which measure 0.39mm and 0.37mm in thickness respectively, can be reliably used as a guide to adjust the width between the roller guard and the skin graft blade for optimal harvest of skin graft.otational stability, a second screw or an anti-rotation k-wire may be necessary.

References:

1. Ameer F, Singh AK, Kumar S. Evolution of instruments for harvest of the skin grafts. *Indian J Plast Surg.* 2013; 46(1): 28-35.
2. Nnene CO, Abu-Seido H, Isbister ES. Harvesting split skin grafts of appropriate thickness using the hand-held knife. *Ann R Coll Surg Engl.* 2000; 82(5): 339-40.

Answer 3

a) Bunion / Medial eminence.
Hallux in valgus and pronation.
b) a: Intermetatarsal angle (IMA).
b: Hallux valgus angle (HVA).
c: Distal metatarsal articular angle (DMAA).
c) i. Pes planus.
ii. Lesser toe deformities.
d) i. Recurrence.
ii. Avascular necrosis of first metatarsal head.
iii. Hallux varus.

Description 3

Hallux valgus is a common pathology, characterised by lateral deviation of the big toe and medial deviation of the first metatarsal. It has a female predilection, and bilateral involvement is seen in most cases. The aetiology is usually multifactorial – genetic, footwear and pes planus. HVA is the angle between the longitudinal axis of the first metatarsal and the proximal phalanx of the big toe. An HVA of greater than 15° is considered pathological. IMA is the angle between the longitudinal axis of the first and second metatarsals. A value greater than 9° is abnormal. DMAA is the angle formed by the distal articular surface of the first metatarsal and the perpendicular line to the longitudinal axis of the first metatarsal. DMAA of more than 10° is pathological. Non-operative management such as footwear modifications (wide toe-box), padding over medial eminence, splints and insoles, should always be considered first. Although these methods do not produce deformity correction per se, it can help relieve symptoms. Operative treatment can be considered if these conservative methods fail. There are more than a hundred different surgical correction techniques described involving metatarsophalangeal soft tissue reconstruction, osteotomy of a proximal or distal end of the metatarsal, cuneiform osteotomy, arthrodesis of first metatarsophalangeal joint and excisional arthroplasty. Nevertheless, the surgical strategies take into consideration the degree of deformity, the presence of degenerative changes at the first metatarsophalangeal joint, the size and shape of the metatarsal and the congruency of the joint.

References:

1. Fraissler L, Konrads C, Hoberg M, Rudert M, Walcher M. Treatment of hallux valgus deformity. *EFORT Open Rev.* 2016; 1(8): 295-302.
2. Coughlin MJ. Hallux valgus. *J Bone Joint Surg Am.* 1996; 78(6): 932-66.

Answer 4

a) i. Lytic lesion involving the distal half of the proximal phalanx of the right middle finger.
ii. Narrow zone of transition.
iii. Expansile lesion, causing deformity to the proximal phalanx in the anteroposterior plane.
iv. Cortical break at the distal radial and ulnar cortex.
b) i: Scattered multinucleated osteoclast-like giant cells in the background of round to spindle-shaped mononuclear cells with hyperchromatic nuclei and ill-defined cytoplasmic border.
ii: No nuclear pleomorphism or aberrant mitotic figures.
c) i. Brown tumour.
ii. Giant cell tumour.
iii. Aneurysmal bone cyst.
iv. Mycobacterium tuberculosis infection.

Description 4

Brown tumour is a rare clinical manifestation of prolonged hyperparathyroidism. The main cause of primary hyperparathyroidism is parathyroid adenoma in about 80% of the cases. The increased PTH secretion from the parathyroid adenoma triggers increased osteoclastic activity, hence leading to multiple osteolytic bone lesions. Brown tumour is merely a reparative cellular response, and there is no neoplastic behaviour. However, it shares similar clinical, radiological and histological features with giant cell tumour of the bone. Treatment for these two separate conditions is very different. A high clinical suspicion is required, especially in cases with multiple lytic bone lesions, in order to avoid unnecessary and harmful intervention. Serum calcium, phosphate and parathyroid hormone level may help to differentiate these diagnoses.

Spontaneous regression of the brown tumour is expected following the resection of the parathyroid adenoma.

References:

1. Panagopoulos A, Tatani I, Kourea HP, Kokkalis ZT, Panagopoulos K, Megas P. Osteolytic lesions (brown tumors) of primary hyperparathyroidism misdiagnosed as multifocal giant cell tumor of the distal ulna and radius: a case report. *J Med Case Rep.* 2018;12(1):176.
2. Rossi B, Ferraresi V, Appetecchia ML, Novello M, Zoccali C. Giant cell tumor of bone in a patient with diagnosis of primary hyperparathyroidism: a challenge in differential diagnosis with brown tumor. *Skeletal Radiol.* 2014; 43(5): 693-7.

Answer 5

a) i. Fracture of proximal third ulna.
   ii. Anterior dislocation of radial head.
b) Monteggia fracture-dislocation.
c) Bado classification.
d) i. Proximal interosseous nerve (PIN) neuropathy.
   iii. Lateral collateral ligament (LCL) injury.
e) i. Open reduction and stable internal fixation of ulnar shaft.
   ii. Closed reduction of radial head.
   iii. If radial head remains irreducible or unstable, recheck the ulnar fixation for shortening or lengthening.
   iv. If anatomic reduction of ulnar shaft is confirmed, check for interposition of ligamentous tissue using a lateral approach.

Description 5

The Monteggia fracture-dislocation accounts for approximately 1- 2% of all forearm fractures. There are few postulated mechanisms of injury based on the experimental works on cadaveric specimens. A fall forward onto an outstretched hand with the hand fixed to the ground while the forearm pronates and the arm and upper body supinate will result in an ulnar fracture as it resists rotation and longitudinal compression. The radius, on the other hand, is relatively mobile and rotates around the ulna. The fractured ulnar fragment then acts as a fulcrum that pushes the radial head outward. Open reduction and internal fixation of the ulnar fracture and closed reduction of the radial head is the recommended treatment for acute Monteggia fracture-dislocation in adults. The first step is to restore ulnar length, resist ulnar angulation and ensure structural stability. Reduction of the radial head often follows the anatomic reduction of the ulna. Persistent dislocation of the radial head is usually the complication of the poorly reduced ulna.

References:

1. Johnson NP, Silberman M. Monteggia Fractures. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan [updated 2019 Jul 30]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470575/
2. Rehim SA, Maynard MA, Sebastin SJ, Chung KC. Monteggia fracture-dislocations: A Historical Review. *J Hand Surg Am.* 2014; 39(7): 1384-94.

Answer 6

a) i. Anterior dislocation of total hip arthroplasty.
   ii. Increased acetabular inclination.
   iii. Excessive anteversion of cup.
b) Right total hip arthroplasty dislocation.
c) i. Patient risk factors - Neuromuscular disorder, cognitive disorder, female gender, non-compliance and alcoholism.
   ii. Surgical risk factors - Malpositioning of components, impingement, wear, inadequate soft tissue tension and surgical approach.
   iii. Implant factors - Decreased head-to-neck ratio (e.g. small femoral head size) and skirted head component (risk of impingement).
d) i. Identify and correct the underlying aetiology of the instability.
   ii. Revise malpositioned components to a proper position.
   iii. Upsize the head and liner to achieve optimal soft tissue tension with regards to the offset and leg length.
   iv. Soft tissue tensioning by exchange of modular components, capsulorrhaphy or trochanter advancement.
   v. Girdlestone resection arthroplasty is the last resort for salvage.

Description 6

One of the most common reasons for revision surgery following total hip arthroplasty (THA) is dislocation, and most of the dislocations occur within the first five weeks of surgery. The chances of recurrent dislocation are higher if the first episode occurs later. In comparison with THA for degenerative arthritis, the risk of dislocation is twice for avascular necrosis, three times for congenital dislocation, four times for fracture, five times for non-union, malunion or a failed THA and eleven times for THA instability. There is usually a complex interplay of multiple factors culminating in THA dislocation. With regards to component positioning, cup abduction should ideally be within the range of 40° ± 10°, cup anteversion of 15° ± 10° and femoral stem anteversion of 20° ± 10° for lowest dislocation risk. Dislocation more than five years post THA, is usually due to acetabular wear, and thus is best addressed with acetabular revision.

References:

1. Ullmark G. The unstable total hip arthroplasty. *EFORT Open Rev.* 2017; 1(4) :83-8.
2. Soong M, Rubash HE, Macaulay W. Dislocation after total hip arthroplasty. *J Am Acad Orthop Surg.* 2004; 12(5): 314-21.