**Boutonniere-Swan Neck and Intrinsics**

**Rheumatoid Arthritis**

**Question 190**- A 67-year-old woman with painful rheumatoid arthritis presents for metacarpophalangeal joint arthroplasties of all four fingers. What is the expected functional outcome 1 year after surgery?
1- Increased flexion but no improvement of the ulnar drift
2- Decreased extensor lag and improvement of the ulnar drift
3- Decreased total range of motion but improvement of the ulnar drift
4- Improvement in total range of motion but increased extensor lag
5- No change in total range of motion or extensor lag

Preferred response: 2

Explanation: In a study conducted in 2009 by the J Hand Surg, Sixty-eight RA surgical patients were recruited and were eligible to have SMPA based on measured hand deformities (extensor lag and ulnar drift). Ulnar drift, extension lag, and arc of motion for the MCP joint of each finger were measured at baseline (before surgery) and 1 year after SMPA. All fingers showed an improvement in ulnar drift from baseline to 1 year after surgery. The smallest improvement was in the index finger, and the largest improvement was in the little finger. Similarly, the largest improvement in extension lag was seen in the little finger, and the smallest improvement was seen in the index finger. In terms of MCP joint arc of motion, all fingers moved to a more extended posture and gained an improved arc of motion, but the biggest improvement was observed in the 2 ulnar fingers and less in the 2 radial fingers.

Recommended Readings:

**Compressive Neuropathy**

130
**Figures 130a through 130e are the radiographs of a college baseball player obtained 7 days after sustaining an injury. He is tender to palpation over the carpal tunnel and denies any numbness or tingling in his fingers. What is the next most appropriate step in management?**

1- CT scan of the wrist
2- MRI scan of the carpal tunnel
3- Complete blood count with differential
4- Referral to a neurologist for nerve conduction velocity studies
5- Hand therapy consultation for pain reduction and strengthening exercises
The diagnosis of acute scaphoid fracture is sometimes difficult because initial plain radiographs frequently do not show the fracture. Any contact-sport athlete who has radial wrist pain should be considered to have a scaphoid fracture until proven otherwise. Physical examination in the acute setting reveals tenderness in the “anatomic snuffbox,” decreased range of motion, swelling, and pain with dorsiflexion.

In cases of clinical suspicion of scaphoid fracture that are not shown radiographically, other imaging studies are indicated. MRI studies to determine the presence or absence of a fracture are the most sensitive. Other studies such as bone scan and CT are helpful, but bear in mind that false-negative studies have been reported.

Ninety to 100% of mid third non-displaced scaphoid fractures heal with cast treatment if treatment is initiated within 3 weeks of the injury. A higher risk of non-union ensues beyond this time point, with displacement, and with proximal pole fractures.

Answer 2 is almost correct except that an MR of the carpal tunnel may not show the scaphoid, and the implication is that there is a primary problem within the carpal tunnel, ie median nerve lesion or tendonitis, which is not the case here, which is why number 4 is also wrong. Number 3 is wrong because there is no clinical indication that this is an infectious process, and a CBC is not the most sensitive nor specific test to detect infection anyway. Hand therapy is a no no because you can risk displacing the scaphoid, where immobilization with a long arm thumb spica is the initial non-op treatment of choice.

Recommended Reading(s):

265. According to the American Academy of Orthopaedic Surgeons clinical guidelines, which of the following has the strongest evidence to support its use in the non-surgical treatment of carpal tunnel treatment?

1. Acupuncture
2. Iontopheresis
3. Wrist splinting
4. Heat therapy
5. Massage therapy

Preferred Response: 3

Explanation:
All effective or potentially effective non-surgical treatment for carpal tunnel syndrome has a measurable effect within 2 to 7 weeks after initiation of treatment. Wrist splinting is effective up to 12 weeks in reducing symptoms and improving functional status. Local corticosteroid injections have also been shown to improve patient satisfaction, clinical symptoms, function, and pain as a non-surgical treatment option for carpal tunnel syndrome. Oral steroids and ultrasound are also effective as non-surgical treatment options for carpal tunnel syndrome. However, the clinical evidence supporting these options is not as strong as the evidence supporting splinting and steroid injections.
There is no evidence for or against use of acupuncture, iontophresis, heat therapy, or massage therapy in treating carpal tunnel syndrome.
References:

58. An otherwise healthy 42-year-old woman is scheduled for carpal tunnel release. The physician should adhere to routine sterility protocols

1. without local or systemic antibiotics.
2. and irrigate with cefazolin solution.
3. and irrigate with bacitracin solution.
4. and administer cefazolin within 1 hour before incision.
5. and administer cefazolin within 1 hour before incision and continue dosing up to 23 hours after surgery.

PREFERRED RESPONSE: 1

References:

Question 274

A 37-year-old woman has a 2-month history of weakness in thumb and finger extension, but has normal radial deviation during extension of the wrist. An MRI scan of her forearm shows no abnormality. She does not recall any traumatic event. Needle electromyography findings show fibrillations and reduced recruitment in the extensor pollicis longus, abductor pollicis longus, extensor digitorum communis, and extensor carpi ulnaris muscles. Which nerve is most likely compressed?

1. Median
2. Radial
3. Anterior interosseous
4. Posterior interosseous
5. Lateral antebrachial cutaneous

PREFERRED RESPONSE: 4

This question requires a thorough understanding of the nerve innervation of the extensor muscles and requires a little detective work. We can quickly eliminate choices 1, 3, and 5 and if you cannot please review your anatomy. EPL, APL, EDC and ECU are all affected as per the EMG so we are dealing with radial nerve/PIN. Since she has radial deviation at the wrist we can assumed ECRB/ECRL are intact thus her nerve injury occurs after the radial nerve branches to PIN leaving choice 4 as the best answer. The patient has classic findings of PIN syndrome.
RECOMMENDED READINGS:

A 24 year-old man with weakness and atrophy of the thumb for 12 months has very slight numbness on the radial side of the thumb that is constant and not progressing. He has no other hand or finger numbness. His 2-point static sensory examination is unremarkable in all digits and there is marked atrophy of the thenar muscles. His carpal tunnel provocative tests are negative. He has not symptoms on the opposite hand and otherwise is in excellent health. Which next step will most likely reveal the diagnosis?

1. An MRI scan
2. Muscle Biopsy
3. Carpal Tunnel diagnostic injection
4. Electrodiagnostic testing
5. Carpal Tunnel view radiograph

Preferred Response: 1

References:

Flexor Tendon Injuries

Figure 225

Question 225-Figure 225 is the clinical photograph of a 26-year-old man who fell through a window and sustained alaceration to his thumb 5 days ago. He is unable to flex his thumb. Treatment should include:

1. palmaris longus tendon transfer.
2. reconstruction with a palmaris longus free tendon bridge graft.

3. direct repair of the flexor pollicis longus with core sutures only.

4. repair of the flexor pollicis longus with core and epitendinous sutures.

5. transfer of the flexor digitorum superficialis of the ring finger to the thumb.

PREFERRED RESPONSE: 4

RECOMMENDED READINGS


Question 170

In repairs to finger flexor tendons in adults, immediate controlled active flexion postoperative protocols require which of the following techniques?

a. epitendonous suture only
b. 2-strand core suture repair
c. 4-strand core suture repair
d. 2-strand core suture repair with epitendonous suture
e. 4-strand core suture repair with epitendonous suture

Preferred response: E

From this 1995 JAAOS article, “light active digital flexion carried out with the wrist in extension should be relatively safe for flexor tendons repaired with a four-strand core suture technique augmented by a strong peripheral epitendinous suture”. The strength of the repair is related to the amount of strands used. To move the fingers immediately after tendon repair, you want to make sure you have the strongest repair to prevent the failure of the repair. Therefore, when deciding between 2 strand and 4 strand, you know 4 strand is stronger. Epitendonous repair augments the repair further.

Recommended Reading(s):


Question 75
The least gliding resistance for a flexor tendon laceration at the thumb palmar-digital crease as shown in Figure 75 can be achieved with
1. a 6-strand repair.
2. a division and repair.
3. debridement of the partial laceration.
4. no debridement, motion therapy only.
5. multiple-strand core repair with epitendinous repair.

PREFERRED RESPONSE: 3

RECOMMENDED READINGS

Question 182
In zone II flexor tendon lacerations, repairing only 1 slip compared to repairing both slips of the flexor digitorum sublimis results in
1. a higher rupture rate.
2. profundus bowstringing.
3. improved tendon gliding.
4. improved passive range of motion.
5. proximal interphalangeal joint hyperextension

PREFERRED RESPONSE: 3
Zone II flexor tendon injuries occur between A1 and A4 pulleys. Tendon repair in this zone often requires working around A2 and A4 pulleys to avoid bowstringing. If the laceration occurs at either of these pulleys, the pulleys should be repaired at the end of the procedure.
Studies have shown improved gliding when only one slip of the flexor digitorum sublimis is repaired.

RECOMMENDED READINGS
Tenosynovitis

Question 56
In a 2-year-old child, what neurovascular structure is most likely to be injured while performing a trigger thumb release?
1- Princeps pollicis artery
2- Ulnar digital nerve
3- Radial digital nerve
4- Thenar motor branch of the median nerve
5- Palmar cutaneous branch of the median nerve

Preferred response: 3
Topic: Hand

Explanation: The radial digital nerve is at greatest risk because it crosses the area of the incision as it makes its way from the carpal tunnel (branch of median nerve) to the radial side of the thumb. The ulnar digital nerve does not cross the field because it stays on the ulnar side. The artery is deeper (more dorsal) than the nerve in general in the hand so less at risk. And the other branches (choices 4,5) come off more proximally than the surgical field.

The A1 pulley is seen at the red arrow in Illustration below. During the dissection, the radial digital nerve crosses the operative field and is at risk. It must be identified and protected.

References:

Fractures of the Hand

Figures 63a+b

**Question 63.** Figures 63a and 63b are the radiographs of a 40-year-old male soldier with a painful middle fingertip. He sustained a fracture 9 months ago and management consisted of a splint for the first 2 months. He has a significant nail deformity and is unable to grip with the fingertip because of pain. Management should now consist of

1- reduction and percutaneous wire fixation.
2- spiral oblique retinacular ligament reconstruction.
3- continued full-time splinting until the fracture heals.
4- application of a pulsed electromagnetic field to the finger.
5- bone grafting and internal fixation of the distal phalanx.

**Preferred Response:** 5

**Explanation:** Because this is an atrophic non-union doing ligament reconstruction will not solve the problem. Neither will reduction and percutaneous fixations or continued bracing. The gold standard would be to bone graft and internally fixate.

Meijs et al describe two patients with non-unions of the thumb distal phalanx treated with a single compression screw using a minimally invasive approach. Both patients healed their fractures using this technique however this was a hypertrophic non-union.

**References:**
Question 74. Figure 74 shows the fracture of a 4-year-old boy with an avulsed nail bed. Treatment should consist of
1- closed reduction and pinning.
2- buddy taping to the fourth digit.
3- application of an aluminiform splint.
4- application of a distal interphalangeal joint extension splint.
5- irrigation, nail bed repair, and reduction

Preferred response: 5

Explanation: This is a displaced fracture through the growth plate of the distal phalanx, with a nail bed injury. The fracture should be reduced, and the nail bed irrigated and closed. It is important that the nail bed be repaired with great attention to detail in order to restore function and prevent annoying or unsightly deformities. A displaced fracture will result in tenting of the nail bed.

References:

Figures 28a and 28b are the pre- and postreduction radiographs of a finger. The rehabilitation protocol indicated is

1. buddy tape and active motion.
2. static splint in full extension.
3. static splint in 45 degrees of flexion at the proximal interphalangeal joint.
4. static splint in metacarpophalangeal joint flexion and proximal interphalangeal joint extension.
5. extension block splint in 90 degrees of flexion at the proximal interphalangeal joint.

PREFERRED RESPONSE: 1

RECOMMENDED READINGS

RECOMMENDED READINGS
Questions 89

Figures 89a through 89c are the radiographs of a 66-year-old man who fell 1 week ago. Examination revealed rotational deformity of his index finger. Treatment should consist of reduction and

1. casting.
2. buddy taping.
3. plate fixation.
4. intramedullary fixation.
5. interfragmentary fixation

PREFERRED RESPONSE: 4

EXPLANATION: This is an unstable proximal phalanx fracture. The extreme flexion and ulnar deviation on these films should clue you in that exclusive closed management for this will be insufficient. The easiest way to hold this is with percutaneous K-wires after a closed reduction.

RECOMMENDED READINGS:
Slade JF III, Oetgen ME. Phalangeal injuries. In: Trumble TE, Budoff JE, eds. Hand Surgery Update IV. Ros

Osteoarthritis of the Hand

Question 95

The deformity caused by long-term arthritis of the first carpometacarpal joint of the hand often leads to a secondary hyperextension arthrosis of which joint?

1. Midcarpal
2. Radiocarpal
3. Scaphotrapezotrapezoidal
4. Thumb interphalangeal
5. Thumb metacarpophalangeal

PREFERRED RESPONSE: 5

RECOMMENDED READINGS
Distal Radius Fractures

Question 85.
A 35-year-old patient has an isolated fracture of the ulnar shaft 10 cm proximal to the distal radioulnar joint. There is 2 mm of displacement. In discussing treatment options, the physician should state that
1- there is no difference in outcomes between surgical and nonsurgical treatment.
2- nonsurgical healing is faster than surgical healing.
3- prolonged immobilization is necessary for proper nonsurgical healing.
4- intramedullary fixation is superior to plate fixation.
5- plate removal is always necessary.

PREFERRED RESPONSE: 1
This scenario describes a nightstick fracture which has been shown to have many healing complications including nonunion/malunion, loss or rotation and pain.
The correct answer is 1, there is no significant difference between surgical and non surgical treatment.
2 is incorrect as there is no significant difference between healing time in surgical versus nonsurgical treatment. Several studies have looked at this. With a defined endpoint for a healed fracture as when the forearm rotation could be performed without pain and when x-rays demonstrated bridging of the fracture fragments by external callus, no statistical differences in healing time were determined. **Depending on the study, healing times between 6.7 weeks and 14 weeks were found with a tendency towards shorter healing times with non-operative fixation and longer healing times with ORIF.** However, no statistically significant difference was seen.
3 is incorrect as early mobilization often leads to satisfactory results. In a report from 1983, Pollock et al published their findings on “The isolated fracture of the ulnar shaft, treatment without immobilization.” The study included 71 such fractures. The initial twelve fractures were immobilized with the standard axilla-to-palm plaster cast. They had an average healing time of 10.5 weeks and a non-union rate of 8 per cent. The remaining fifty-nine fractures were treated without a cast or with a cast or splint for no longer than two weeks after injury and then mobilization as tolerated. In this group the average healing time was 6.7 weeks and there were no non-unions. The motion at the wrist and elbow was always regained, and the average loss of forearm rotation was 5 degrees.
4 is incorrect as intramedullary fixation has worse results than plate fixation with non union rates of 20% and loss of motion in 18percent of patients treated with IM fixation. This compares with nonunion rates of zero to 10.6% in patients treated with plate fixation.
5 is incorrect as the plate does not ALWAYS need to be removed after ORIF

References:
Question 38
Figure 38 is the sagittal CT scan of a 45-year-old woman who injured her wrist after a fall. Appropriate treatment of the fracture should include
1. cast immobilization.
2. closed reduction and percutaneous pin fixation.
3. open reduction and volar locking plate fixation.
4. open reduction and radial styloid column plating.
5. open reduction and internal fixation of the volar fracture fragment

PREFERRED RESPONSE: 5
The image here shows a fracture of the lunate facet of the distal radius – a very distal fracture.
In the article by harness et al, they reported on 7 patients with a volar shearing fracture of the distal part of the radius who were treated with conventional ORIF and then who developed loss of fixation / displacement of that distal piece – the lunate facet fragment. 4 of the 7 patients were revised and they used fragment specific fixation. In the Taylor study, they compared the biomechanics of volar plate vs. fragment specific fixation for osteotomized cadaver limbs (they created two fractures – one between the scaphoid and lunate facet and the second a dorsal crack). They found that the fragment specific fixation was better for the smaller ulnar sided piece, which would comprise the lunate facet. Therefore, you should choose option 5

RECOMMENDED READINGS:
Question 78
A 42-year-old woman has the injury shown in Figures 78a and 78b. The decision to treat the ulnar styloid surgically is based upon which finding?
1. Patient age
2. Displacement of the radius fracture
3. Displacement of the ulnar styloid fracture
4. Position of the ulnar styloid after open reduction and internal fixation of the radius
5. Stability of the distal radioulnar joint after open reduction and internal fixation of the radius
PREFERRED RESPONSE: 5

RECOMMENDED READINGS

Question 230
Figures 230a through 230d are the pre- and postreduction radiographs of a 6-year-old boy who had a fracture of the radius and ulna shafts in the distal diaphyses. Successful reduction of the completely displaced fractures is achieved. To best maintain reduction while minimizing complications, treatment
should include immobilization in a
1. removable splint.
2. sugar-tong splint.
3. short-arm cast.
4. long-arm cast.
5. long-arm thumb spica cast.

PREFERRED RESPONSE: 3

RECOMMENDED READINGS

What is the most appropriate treatment for the injury shown in Figures 117a through 117c?

1- Closed reduction and long arm casting with weekly radiographs and cast changes
2- Closed reduction, percutaneous pinning of the radiocubital articulation, and casting
3- Open reduction and internal fixation of the distal radioulnar articulation, followed by open reduction and internal fixation of the radius
4- Open reduction and internal fixation of the radius, followed by intraoperative evaluation of the distal radioulnar articulation
5- Open reduction and internal fixation of the radius, followed by open repair of the ulnar styloid and triangular fibrocartilaginous complex
Preferred Response: 4
This is a Galeazzi fracture (distal 1/3 radius w/ DRUJ injury). As we talk about in fx conference, this is an unstable fracture that requires ORIF of the radius. Also, the 8cm rule for the position of the DR fx is important. Studies demonstrate that if the fx line is more than 7.5 -8cm from the distal joint line, the DRUJ is most likely to be stable. If it is within that margin, the DRUJ may be injured and require additional fixation (either perc pinning of DRUJ or repair of TFCC). The best answer choice is to fix the distal radius fx and then check for DRUJ instability.

Recommended Reading(s):

Question 127.
A 30-year-old man undergoes open reduction and locked volar plate fixation of a displaced distal radius fracture. The surgery was uncomplicated and performed under supraclavicular regional anesthesia. After the block has worn off, the patient reports dense numbness in the palmar aspect of the thumb, index, and middle fingers with severe wrist pain. Management should consist of
1- loosening all the dressings and follow-up in 1 week.
2- emergent nerve conduction velocity studies.
3- forearm compartment pressure monitoring.
4- open carpal tunnel release.
5- exploration of the supraclavicular brachial plexus.

Preferred response: 4

With these symptoms, this patient is suffering from acute CTS, which is alleviated with a CTR. None of the other options make sense and could cause these specific symptoms in the isolated median nerve distribution. In the cited article, the prevalence of acute CTS among patients with a surgically treated fracture of the distal radius was 5.4%. Only fracture translation was a significant predictor of acute CTS. On the basis of these data, the authors suggested that prophylactic CTR might be appropriate in women less than 48yo with greater than 35% fracture translation.

Recommended Readings:


Question 253. A 43-year-old woman who is right-hand dominant fell onto her outstretched arm while rollerblading 1 day ago. She reports a painful wrist. Examination reveals swelling and tenderness dorsally. Radiographs reveal a nondisplaced transverse fracture of the distal radius. She is placed in a short arm cast. What can be done to reduce the risk of type 1 complex regional pain syndrome?
1- Transcutaneous electrical nerve stimulation
2- Occupational therapy treatment for finger dexterity
3- Strict elevation above the heart for 72 hours
4- Alpha adrenergic blockers for 2 weeks after injury
5- Daily oral vitamin C for 2 months
Preferred Response: 5

This question tests your knowledge on one fact: Vitamin C has been shown to reduce complex regional pain syndrome after wrist fractures. The paper is a blinded RCT recommending 500mg daily for 50 days.


Figure 273

273. Figure 273 are the radiographs of a 50-year-old man who sustained a wrist injury after a motorcycle accident. There is no distal radioulnar joint instability after radius fixation. Management should include fixation of the radius 1- alone.
2- and ulnar styloid excision.
3- and repair of the triangular fibrocartilage complex.
4- and percutaneous fixation of the ulnar styloid.
5- and open reduction and internal fixation of the ulnar styloid.
Preferred Response: 1

Explanation:
The radiographs show distal radius and ulnar styloid fractures. The ulnar styloid does not need to be addressed in distal radius fractures with DRUJ stability, thus fixation of the distal radius fracture (Answer 1) is sufficient. Ulnar styloid excision (Answer 2), percutaneous fixation (Answer 4), and ORIF (Answer 5) are unnecessary. A level II study by Kim et al in JBJS 2010 found that the level of ulnar styloid fracture and amount of displacement had no impact on functional outcomes of distal radius fractures. Similarly, repair of the triangular fibrocartilage complex (TFCC) does not affect outcomes and is unnecessary (Answer 3).

Recommended readings:
Wrist Instability

Figure 163

Question 163
Figure 163 is the radiograph of a 68-year-old man with dorsal radial wrist pain. He rated his pain as 8 on the 0-10 Numeric Pain Rating Scale and said that his pain has bothered him constantly despite splinting, steroid injections, and administration of nonsteroidal anti-inflammatory drugs. Surgical treatment for wrist pain should consist of
1. scaphoidectomy.
2. radial styloidectomy.
3. proximal row carpectomy.
4. complete wrist arthrodesis.
5. four-corner fusion with scaphoidectomy

PREFERRED RESPONSE: 5

The most common cause of wrist arthritis is a SLAC wrist (scapholunate advanced collapse). Pathophysiology: injury to SL ligament --> Dorsal intercalated segment instability (scaphoid is flexed and lunate is extended) --> incongruency of joint surfaces --> arthrosis of radiocarpal joint --> arthrosis of capitolunate joint, while radiolunate typically spared. Watson classification describes predictable progression of degenerative changes from the radial styloid to the entire scaphoid facet and finally to the unstable capitolunate joint, as the capitate subluxates dorsally on the lunate. Scaphoid excision and four corner fusion is indicated in Stage II or III. It provides relative preservation of strength and motion (wrist motion occurs through the preserved articulation between lunate and distal radius).

Radial styloidectomy and scaphoid stabilization is indicated in Stage I to prevent impingement between proximal scaphoid and radial styloid. Proximal row carpectomy is indicated in Stage II - excising entire proximal row of carpal bones (scaphoid, lunate and triquetrum) while preserving radioscaphocapitate ligament (to prevent ulnar subluxation after proximal row carpectomy), but contraindicated in capitolunate arthritis (Stage III). Wrist fusion indicated in Stage III or in patients with any form of pancarpal arthritis (gives best pain relief and good grip strength at the cost of wrist motion).

Figures 74a and 74b show the radiographs of a right-hand dominant 25-year-old woman who underwent arthroscopic examination of her painful left wrist. Examination reveals patchy grade II and III chondromalacia at both the proximal and distal articular surfaces of the lunate. The cartilage surfaces are stable to probing and no fractures are visualized. What is the most appropriate management to reduce the patient's pain symptoms?

1. Arthroscopic débridement to stable surfaces with microfracture technique
2. Radial shortening osteotomy
3. Ulnar shortening osteotomy
4. Proximal row carpectomy
5. Scaphoid excision and four-corner fusion

Preferred answer: 2

Explanation: Kienböck's disease is a form of osteonecrosis affecting the lunate. Morphological variations, such as negative ulnar variance, high uncovering of the lunate, abnormal radial inclination and/or a trapezoidal shape of the lunate and the particular pattern of its vascularity may be predisposing factors. A history of trauma is common. In stage I, the density of the lunate and its shape are normal. The diagnosis may be made by MRI. Stage II is characterized by densification of the lunate, without significant alteration of its shape. Stage III, the most common stage at initial presentation, is defined by collapse of the lunate (III-A: without carpal collapse and stage III-B: with diminished carpal height and fixed palmar flexion of the scaphoid). In stage IV, there are extensive carpal degenerative changes. In regards to treatment, if there is negative ulnar variance, particularly in association with marked uncovering of the lunate, the aim is to restore a more favorable biomechanical situation, either by shortening the radius or by lengthening the ulna. Several studies have suggested that the clinical outcome of radial shortening is better than that of ulnar lengthening, which has a higher rate of nonunion and problems with the distal radioulnar joint. In regards to Stage III, collapse of the lunate, the goals of intercarpal fusion are to preserve carpal height, to maintain the scaphoid in its proper position, to prevent degenerative arthritis, and to relatively unload the lunate. Because intercarpal fusion causes marked loss of movement and may be complicated by nonunion, other complications or late arthritis, progressive capitate lengthening after excision of the lunate in order to restore carpal height is increasingly more common. In symptomatic stage IV, salvage options include wrist denervation, proximal row carpectomy (if the articular surfaces of the capitate and radius are preserved), or total wrist fusion. Scaphoid excision and four-corner fusion is typically done for scapholunate advanced collapse a specific pattern of osteoarthritis and subluxation which results from untreated chronic scapholunate dissociation, chronic scaphoid nonunion or severe radioscaphoid arthrosis.

Recommended readings:
Figures 52 a+b

Figures 52a and 52b are the radiographs of a right-hand dominant 17-year-old girl with wrist pain that began insidiously 3 months ago. It is aggravated by writing. There is an audible clunk when her wrist is passively moved from radial to ulnar deviation under axial load. She is ligamentously lax. What is the most likely diagnosis?

1- Dorsal wrist ganglion
2- Mid-carpal instability
3- Osteoid osteoma of the hamate
4- Scapholunate interosseous ligament tear
5- Lunotriquetral interosseous ligament tear

Preferred response: 2
Explanation: Midcarpal instability is between the proximal and distal rows (contrast with radiocarpal btw radius and proximal row). It is often seen in pts with ligamentous laxity. Symptoms include:

- subluxation that may or may not be painful
- complain of wrist giving way
- irritating clunking sign
  - “clunk” when wrist is moved ulnarly from flexion to extension with an axial load

Carpal instability is complex condition marked by abnormal kinematics in the carpus. Carpal instability dissociative (CID) is marked by intrinsic ligamentous disruption. Carpal instability non-dissociative (CIND) is marked by extrinsic ligamentous disruption between carpal rows or between the proximal row and distal radius. Included in CIND is midcarpal instability (MCI) and radiocarpal instability. Radiographs typically show a mild VISI deformity or no abnormalities as in this case.

Dorsal wrist ganglion would be detected by a palpable mass on PE, which is not mentioned. There is no evidence of osteoid osteoma on the xrays. And there is no abnormal widening of the SL or LT intervals to suggest ligament tear there.

Recommended Readings:
Question 256. Following a fall, a 67yo Medicare patient is seen for a new wrist deformity at the request of the primary care physician. The patient was seen by your partner 5 years ago for treatment of a compression spine fracture. After evaluation, documenting your findings, and sending communication to the requesting physician, the most appropriate category for your services is which of the following

1. New patient (CPT code 99203): Medicare no longer recognizes consultation codes
2. Return patient (CPT code 99213): the patient is known to your practice
3. Consultation (CPT code 99243): the requirements for consultation are met
4. Postoperative visit (CPT code 99024): the patient is post spine fracture treatment
5. Second opinion confirmatory (CPT code 99273): you are the second opinion after that of the primary care physician

Preferred Response: 1
Explanation:
New patients are those who have not received medical care from you or anyone in your specialty practice group over the past three years, so this patient would be classified as a new patient visit. Some practitioners would also consider this patient to be a consultation since they had been specifically requested this patient to be seen for this condition. However in 2010 Medicare eliminated this definition from its CPT codes in a push towards simplicity and more accurate billing, so (3) can be eliminated. Decreased reimbursement is given for these visits now that they are no longer termed consultations, however Medicare increased reimbursements for other types of visits such as initial and follow-up visits for Medicare patients, thereby intending to make this change budget-neutral. Many commercial payors have not followed Medicare in this decision to eliminate consultation codes.

Since this patient had not been last seen by you or your group within the last three years, the patient is not a Return Patient (2). Post-operative classification can only be used for planned follow-up scheduled 90 days or less after surgery so this would not qualify (4). (5) would be inappropriate since this patient is not seeing you in order to see if you agree with the opinion of another physician about management of a current issue.

Recommended Readings:
http://www3.aaos.org/product/productpage.cfm?code=05213

Hand Infection
Question 48
A mechanic sustained a high-pressure injection of cleaning solvent into the tip of his index finger 2 hours ago. The finger has good capillary refill and his 2-point discrimination is 7 mm. Initial treatment should include
1. a corticosteroid injection.
2. elevation and observation.
3. elective surgical treatment within 7 days.
4. oral clindamycin for 10 days.
5. emergent surgical debridement.
PREFERRED RESPONSE: 5
RECOMMENDED READINGS:
Question 133
Figures 133a and 133b are the clinical photographs of a 34-year-old woman with increasing pain in her index finger for 3 days. The pain is worse with passive extension. Appropriate treatment should consist of
1. observation.
2. hand therapy.
3. oral antibiotics.
4. intravenous antibiotics.
5. irrigation and debridement of the flexor tendon sheath.
PREFERRED RESPONSE: 5
RECOMMENDED READINGS

Question 256
An 84-year-old patient who has been hospitalized for pneumonia has developed isolated wrist pain and swelling with an effusion. The wrist is aspirated, the nucleated cell count is 75,000 cells/mm3, and urate crystals are identified. What is the most important next treatment step?
1. Begin allopurinol.
2. Begin nonsteroidal anti-inflammatory drugs.
3. Administer a corticosteroid wrist injection.
4. Obtain cultures and begin empiric antibiotics.
5. Obtain radiographs to evaluate for a wrist fracture.
PREFERRED RESPONSE: 4
RECOMMENDED READINGS
**Question 97.** A 22-year-old man reports pain in his left index finger for the past hour after cleaning his spray paint gun. He recalls feeling a sharp pain at the tip, but now his entire finger is painful. Examination reveals a small puncture-type wound on the volar pulp of the distal phalanx. A radiograph reveals no fracture. What is the most appropriate management?

1- Tetanus immunization, oral antibiotics, and follow-up in 2 days
2- Referral to a hand surgeon the next day
3- Admission for IV antibiotics and warm soaks
4- Immediate surgical intervention
5- Incision and drainage in the emergency department under local anesthesia

Preferred Response: 4

Explanation:
A high-pressure injection injury may cause an initial small puncture wound with minimal swelling of the surrounding tissues resulting in delayed referral with significant inflammation and necrosis of the affected tissues. Immediate surgical exploration and debridement with removal of the injected material is the preferred treatment. However, this often results in significant tissue loss requiring reconstruction. Tetanus toxoid and abx addresses a non-pressurized injury involving contamination of the soft tissue. Referral for the following day would not be preferred because the material may spread widely along the neurovascular bundles and tendon sheaths through the compartments of the hand resulting in necrosis. IV abx and warm soaks would be more appropriate for a draining soft tissue abscess. I+D under local is not preferred because digital and local blocks would result in increasing tissue edema and worsening the outcome. Additionally I+D alone without surgical exploration and debridement would not be sufficient.

**RECOMMENDED READINGS:**

**Question 83.** Of the following possible risk factors, what is the most significant one for a community-acquired methicillin-resistant Staphylococcus aureus hand infection?

1- Inmate
2- Homeless
3- IV drug use
4- Diabetes mellitus
5- Human immunodeficiency virus

PREFERRED RESPONSE: 3

EXPLANATION:
Imahara et al retrospectively reviewed 159 hand infections treated in the operating room over an 11-year period. The examined data included known risk factors for MRSA, including human immunodeficiency virus infection, diabetes mellitus, intravenous drug use, incarceration, and homelessness. Intravenous drug use was the only independent risk factor for CA-MRSA infections.

**RECOMMENDED READINGS:**
Ulnar Sided Wrist Pain

Figures 65a+b

Question 65
Figures 65a and 65b are the magnetic resonance arthrogram and wrist arthroscopic photograph of a 25-year-old man who has wrist pain during extension and ulnar rotation. Treatment should consist of
1. synovectomy.
2. ulnar shortening osteotomy.
3. diagnostic arthroscopy only.
4. triangular fibrocartilage complex tear debridement.
5. triangular fibrocartilage complex repair dorsal ligament.

PREFERRED RESPONSE: 4

RECOMMENDED READINGS:

Question 1
For an otherwise healthy carpenter with symptoms of dominant-hand ulnar-sided pain, hand pallor, and coolness, the preliminary work-up should include
1. a CT scan.
2. a MRI scan.
3. a bone scan.
4. sonography.
5. angiography.

PREFERRED RESPONSE: 4
The above question describes the hypothenar hammer syndrome. It is a post-traumatic occlusive vascular disease that is caused by thrombosis of ulnar artery at Guyon’s canal. It is thought to be due to repetitive impact on hypothenar eminence, which is seen in carpenters and baseball catchers. In rare cases it can lead to embolization of a digit. Ring finger is the most common to be embolized in the hypothenar hammer syndrome. Ultrasound is a primary modality to evaluate for ulnar artery thrombosis. Thus, the answer is 4. Angiography can be also used; however it is not a preferred diagnostic modality. MRI is of limited utility in evaluation of ulnar artery thrombosis as well as CT, and bone scan.
RECOMMENDED READINGS:

Figures 59a+b

Question 59.
Figures 59a and 59b show the radiographs of a 15-year-old girl with bilateral mild wrist pain and increasing limitation of motion for many years. She has no family history of deformity. This deformity is transmitted via what genetic mechanism?
1- Autosomal dominant
2- Autosomal recessive
3- Sex-linked dominant
4- Sex-linked recessive
5- Mitochondrial

Preferred response: 3

Explanation:
These xrays demonstrate a Madelung’s deformity – in 1878 Madelung described a growth deformity of the distal radius; for reasons that remain unknown the volar, ulnar aspect of the distal radial physis slows or stops growing prematurely. The continued growth of the ulnar physis and the remaining dorsal radial aspect of the radial physis results in ulnar overgrowth, carpal subluxation and radial articular deformity. It usually occurs in girls, is often bilateral and may not become clinically apparent as in this case until the adolescent growth spurt when most cases present. Categories include post-traumatic, dysplastic (associated with bone dysplasias such as multiple hereditary osteochondromatosis, Ollier disease, achondroplasia, etc), chromosomal in nature – associated with Turner syndrome, and idiopathic. Turner syndrome is sex-linked, narrowing it to answers 3 and 4, although it is neither dominant nor recessive by strict definition as it is due to girls having only one X chromosome not two X chromosomes.

Recommended Reading(s):
Peripheral Nerve Repair

**Question 255.** The anterior interosseus nerve innervates which of the following muscles?

1. Flexor digitorum profundus to the index and middle fingers, flexor pollicis longus, pronator quadratus
2. Flexor digitorum profundus to the index, middle, ring, little fingers, flexor pollicis longus, pronator quadratus
3. Flexor digitorum profundus to the ring, little fingers, flexor pollicis longus, flexor pollicis brevis
4. Flexor digitorum profundus to the index, middle fingers, flexor pollicis longus, abductor pollicis brevis
5. Flexor digitorum profundus to the index, middle fingers, flexor pollicis longus, lumbricals to the index and middle fingers

Preferred Response: **1**

**Explanation:**
The radial aspect of the median nerve gives off the anterior interosseous nerve (AIN) 5-8 cm distal to the medial epicondyle. This exclusively motor nerve provides innervation to the pronator quadratus, flexor pollicis longus, and the medial aspect of the flexor digitorum profundus of the index and middle fingers, so (1) is correct. A complete palsy of the AIN leads to a characteristic pinch deformity due to the inability of the FPL and FDP of the index finger to flex these two digits.

The FPB is innervated by the ulnar nerve and the recurrent branch of the median nerve. The recurrent branch also innervates the APB, therefore (3) and (4) are incorrect. The lumbrical to the third and fourth fingers are innervated by the ulnar nerve, making (5) incorrect.

**Recommended Readings:**

Brachial Plexus

**Question 115**
A 50-year-old man sustained a clavicle fracture after a motorcycle collision. He has no sensation or motor function in the biceps and triceps; however, he has very weak thenar and finger flexion and extension. Which finding would suggest a postganglionic as opposed to a preganglionic injury?

1. Preservation of C8, T1 function
2. Preserved sensory nerve action potential
3. Pseudomeningocele on CT myelogram
4. Ptosis and miosis on the same side as the injury
5. The cervical paraspinal muscle is normal on electromyography

**Preferred Response: 5**

**Recommended Readings**
**Question 114**
A 22-year-old man is unable to raise his arm above shoulder level during forward flexion since being involved in a motorcycle collision 4 months ago. Examination revealed scapular winging on forward flexion of the shoulder. Electromyography confirmed serratus anterior muscle palsy. The nerve involved branches off from cervical roots 1. C3-4, 2. C4-5, 3. C5-7, 4. C6-8, 5. C7-T1.

**PREFERRED RESPONSE:** 3
This question is just rote memorization. The serratus anterior is innervated by the long thoracic nerve which comes from nerves roots of C5-7.

**RECOMMENDED READINGS:**

**Question 232.** A 1-month-old girl has weakness of the right upper extremity that has been present since birth. In the work-up, which of the following findings would suggest a favorable outcome?
1 – Ptosis
2 – Twitch biceps activity
3 – Periscapular muscle atrophy
4 – Motor activity on electromyography
5 – Meningoceles on magnetic resonance imaging

**Preferred response:** 4
Obstetric brachial plexus injuries have been grouped into 4 categorical groups. The mildest group (I) represents a classic Erb’s palsy (C5-6) with initial absence of shoulder abduction, external rotation, and forearm supination. Successful spontaneous recovery is as high as 90% in this group. Group IV, the most involved group, consist of a flail extremity and a Horner’s syndrome (ptosis, myosis, enophthalmos, and anhidrosis). This group had the lowest rate of spontaneous recovery. Other negative factors for the outcome of obstetric brachial plexus palsy include muscle atrophy, which lowers minimal activity, and meningoceles.

**Recommended Reading(s):**
Principles of Tendon Transfers

Figure 103

Question 103
Figure 103 is the clinical photograph of a 62-year-old man with numbness and weakness that has been progressing for 10 years. What is the most appropriate treatment to improve thumb function?
1. Functional splinting
2. Neurotization of the thenar muscles
3. Hypothenar muscle transfer to thumb intrinsic
4. Arthrodesis of the thumb carpometacarpal joint in abduction
5. Transfer of the extensor indicis proprius around the ulnar wrist
PREFERRED RESPONSE: 5

RECOMMENDED READINGS

Figure 140

Question 140
A 38-year-old woman had a distal radius fracture treated with a short-arm cast 3 months ago. The fracture healed in good alignment. Figure 140 shows her attempt to extend her thumb. What is the best treatment option?
1. Static splinting
2. Dynamic splinting
3. Transfer of the extensor pollicis brevis
4. Transfer of the extensor indicis proprius
5. Arthrodesis of the interphalangeal joint
PREFERRED RESPONSE: 4
RECOMMENDED READINGS

Figures 14a+b

Question 14

Figures 14a and 14b show the radiographs of a 45-year-old farmer whose right arm was caught in a grain auger with a resultant open fracture of the proximal radius. The extensor carpi ulnaris and supinator muscles have been destroyed and the posterior interosseous nerve has a 6-cm segmental loss distal to the bicipital tuberosity. After multiple surgical débridements, the radius is plated and the bone and soft-tissue envelope go on to heal at 3 months. A complete posterior interosseous nerve palsy remains. What is the next most appropriate step in surgical reconstruction?
1- Neurotization of the radial nerve to the posterior interosseous nerve
2- Wrist fusion with transfer of the flexor carpi radialis to the finger extensors
3- Transfer of the pronator teres to the wrist extensors and the flexor carpi radialis to the finger extensors
4- Transfer of the flexor carpi radialis to the wrist extensors, the flexor digitorum superficialis to the finger extensors, and the palmaris longus to the extensor pollicis longus
5- Transfer of the flexor carpi radialis to the finger extensors and the palmaris longus to the extensor pollicis longus

Answer: 5

Tendon transfers have been used for radial nerve palsy for more than one century when hope of spontaneous or surgical recovery appears to be unlikely. Nerve grafting may restore sensation and motor function but, even when this procedure is possible, the result is not always good enough to give complete extension of the wrist and digits. Under such circumstances, tendon transfers are an alternative means of restoring good wrist and digital function. A delay of 6 months is recommended before transfers are carried out when there is a possibility of spontaneous nerve recovery because tendon transfers will never achieve the same finger extension as that following nerve recovery and are always partially dependent on the wrist tenodesis effect. The low radial nerve palsy here (PIN) preserves wrist extension. Therefore we would like to restore finger and thumb extension, of which the preferred transfers are described by answer #5. We do not have to transfer for wrist extension as the radial n supplies ECRL and ECU.
“The FCR is our preferred option as the motor for finger extension. Its excursion is equal to that of the EDC, with power only slightly inferior. Its use maintains the natural equilibrium of the wrist in both the frontal and the sagittal planes.”

Recommended readings:

Dupuytren’s Disease

Question 245
During the preoperative evaluation of a man with Dupuytren’s disease who is about to undergo partial fasciectomy, it is noted that he has a contracture at the metacarpophalangeal joint level with a pit in the skin denoting a possible ‘spiral cord.’ This cord displaces the neurovascular bundle in which direction?
1. Dorsal
2. Medial
3. Midline
4. Dorsolateral
5. Midline and volar

PREFERRED RESPONSE: 5
Explanation: There are different named cords present in Dupuytren’s disease, but the spiral cord is clinically the most important. This cord travels under the neurovascular bundle and the bundle is displaced midline and volar – right in the path of surgical dissection. The fascial components involved in the disease include the pretendinous bands, spiral bands, natatory bands, lateral digital sheets, and Grayson’s ligament. The offending cell is the myofibroblast which causes the normal structures to become fibrosed. Of note, Cleland’s ligament is not involved in this disease process. Below is a picture of the spiral cord (white) and the displaced neurovascular bundle (blue).

Recommended Readings:
Benign Tumors of the Hand and Wrist

Figure 1

Question 1
A 33-year-old woman has left index fingertip pain that is severely exacerbated by reaching movements. An intense T2 signal under the nailbed is visible on the MRI scan seen in Figure 1. What is the best treatment option?
1. Tumor excision
2. Sympathetic digital block
3. Oral calcium channel blockers
4. Tuft amputation with nail ablation
5. Activity modification and glove wear
PREFERRED RESPONSE: 1
RECOMMENDED READINGS

Figure 213 a+b

Question 213
Figures 213a and 213b are the clinical photograph and biopsy specimen of a 65-year-old man with a lesion under his thumbnail that was biopsied by a dermatologist. Appropriate treatment should consist of 1. observation.
2. local excision.
3. marginal excision.
4. thumb ray resection.
5. amputation at the interphalangeal joint.

PREFERRED RESPONSE: 5

RECOMMENDED READINGS

Figure 258

Question 258
Figure 258 shows the clinical photograph of a 54-year-old woman with a painful mass over her middle finger. To prevent recurrence of the mass, treatment should consist of

1- needle aspiration.
2- liquid nitrogen application.
3- topical application of salicylic acid.
4- surgical excision of the mass.
5- surgical excision of the mass and marginal osteophyte.

Preferred Response: 5

Explanation:
The above figure shows a mucoid cyst which occur around the DIP usually in a joint with some djd. All treatment options listed have been tried but surgical excision with osteophyte excision has been shown to be the most effective with the lowest rate of recurrence. The JBJS paper cited noted a 25-50% recurrence rate in patients undergoing surgical excision of the mass alone compared with recurrence in just 1 pt of 44 who underwent excision of the mass + osteophyte in their series. The Journal of Hand Surgery article cited retrospectively reviewed 164 patients treated with either needle aspiration or surgical excision + joint debridement. The aspiration group had a 40% recurrence rate at an average of 6 months compared with 0 recurrences in the surgery group.

Recommended readings:
**Question 269**

Figures 269a and 269b are the MRI scans of a 60-year-old man who has pain and loss of elbow flexion strength. In addition to the distal biceps tendon injury, what is the most likely diagnosis?

1. Soft-tissue sarcoma
2. Intraneural ganglion cyst
3. Denervation of the biceps muscle
4. Benign peripheral nerve sheath tumor
5. Malignant peripheral nerve sheath tumor

**PREFERRED RESPONSE:** 4

**RECOMMENDED READINGS:**


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**Question 64**

Figure 64 is a T2-weighted MRI scan of a 64-year-old man who has had a right volar radial mass for the past 2 years. What is the most likely diagnosis?

1. Lipoma
2. Ganglion
3. Schwannoma
4. Radial artery aneurysm
5. Giant-cell tumor of tendon sheath

**PREFERRED RESPONSE:** 2
EXPLANATION: The T2 MRI shows a fluid filled mass (increase intensity of fluid) adjacent to the radial artery on the volar-radial aspect of the wrist. Typically these arise from the radiocarpal joint or FCR tendon sheath. They tend to be present for months, painless unless “bumped”, compressible, slightly mobile, and transilluminate. They are nonpulsatile but often intimate with the radial artery which is palpable adjacent to the lesion and should be differentiated via MRI from a radial artery aneurysm or auscultation may reveal a bruit. When excising these ganglions, care must be taken to avoid injury to the palmarcutaneous branch of the median nerve as well as the superficial branch of the radial artery. It is important to distinguish these masses from giant-cell tumors which are the 2nd most common type of hand tumor and are slow growing, do no transilluminate, are more firm than ganglia, and on xray show soft tissue mass and sometimes bone erosion. These require marginal excision. Lipomas are superficial masses that do not transilluminate and on MRI have signal that is isointense to adipose tissue. Schwannomas are nerve lesions that also do not transilluminate and have a positive tinels sign. Biopsy would show spindle cells arranged in intersecting bundles.

RECOMMENDED READINGS:

Figure 213

Question 213

Figure 213 is the clinical photograph of a 70-year-old woman with squamous cell cancer on her thumb. Resection and reconstruction is planned and requires soft-tissue coverage. Thumb region coverage is best obtained with
1. the Moberg flap.
2. a third dorsal metacarpal artery flap.
3. a first dorsal metacarpal artery flap.
4. a full-thickness skin grafting.
5. a reverse cross-finger flap from the index finger with full-thickness skin grafting.

PREFERRED RESPONSE: 3

The dorsal index skin has been used for thumb resurfacing as cross-finger flaps based on the first dorsal metacarpal artery or its dorsal digital branches. Holevich et al. originally described the first dorsal meta-carpal artery (FDMA) island flap in 1963 for resurfacing of the thumb. The flap has since been applied to a broad array of dorsal hand defects and is based on perforators that arise at the level of the metacarpal head. The FDMA arises from the radial artery at the apex of the angle between the first and second metacarpals (see below). The artery divides into the radial branch to the thumb, the intermediate branch to the first web space, and the ulnar branch to the index finger.

RECOMMENDED READINGS:
Amputations and Replantations

Figure 235

**Question 235.** Figure 235 shows the clinical photograph of a 26 year old man who amputated the tip of his non-dominant thumb while working with a table saw. The tuft of his distal phalanx is exposed. The most appropriate management at this time is definitive debridement and:

1. daily saline soaks and dressing changes
2. cross finger flap closure
3. volar advancement (Moberg) flap closure
4. first dorsal interosseous flap closure
5. interphalangeal joint disarticulation and primary closure

Preferred Response: 3

Explanation: Goals of treatment for finger amputations: sensate tip, durable tip, bone support for the nail. If no bone or tendon is exposed then the wound can be allowed to heal by secondary intention (if <2cm) or may require a full thickness skin graft (if >2cm). If bone or tendon is exposed there are two options: rongeur bone back and close primarily or do a flap reconstruction. With the thumb if you rongeur back any more of the distal phalanx than is already gone then the patient will not have effective use of his thumb IP joint and have difficulty with pinching and grasping activities.

A volar advancement (Moberg) flap is most indicated for amputations of the distal to thumb IP joint where a V-Y flap cannot be used. Moberg flaps can only be used to cover <2cm wounds. If the wound is any larger a different flap is needed.
Choice 1 is wrong because with exposed bone this wound will not heal with soaks and dressing changes. This would be the correct answer for a soft tissue amputation of the tip of any finger if there was no bone exposed. Cross finger flap – heterodigital flap for digital wounds with primarily volar tissue loss such as in this picture:

First dorsal interosseous flap – more commonly called a first dorsal metacarpal artery flap – used to cover larger (>2cm) soft tissue defects on the volar aspect of the thumb or dorsal thumb wounds such as in this picture: If our patients volar thumb wound were bigger than 2cm then this would be the indicated flap.

Interphalangeal joint disarticulation and primary closure - amputation is only chosen if there is inadequate circulation concomitant with bone, tendon, or nerve injury. None of these are true of our patient in this question stem so an amputation is not indicated.

Recommended Reading(s):
**Question 166.** Figure 166 is the clinical photograph of a 38-year-old woman who sustained an injury to her right dominant hand in a manufacturing plant. Treatment should include:

1. Revision amputation of all digits because of the avulsion nature of the injury
2. Revision amputation because amputations through zone II should not be replanted
3. Replantation of all digits with forearm exposure for tendon reattachment
4. Replantation of the selected digit(s) based on anatomic site match (index to index, long to long, etc)
5. Replantation of the selected digit(s) based on best intact parts proximally and distally, even if mismatched

Preferred response: 5

Explanation:

Replanting multiple amputated digits add complexity to an already complicated problem. The generally agreed-upon order of importance is thumb, then middle finger (for functional pinch), then index, then ring, then small finger. The papers here support the use of non-anatomic replantation (called transpositional microsurgery) based on matching the most viable amputated part with to the most important digit. So, 5 (non-anatomic / mismatched replantation) is the correct answer.

Recommended Reading(s):

**Figures 135a,b,c**

**Question 135** Figures 135a through 135c are the radiograph and clinical photographs of a 15-year-old left-hand-dominant boy who amputated his left hand through the midcarpal joint with a saw. The hand and patient arrived within 1 hour of the injury. The hand was wrapped in a moist saline dressing, put in a plastic bag, and placed in a cooler on top of ice. The next treatment step should include

1. replantation of the hand.
2. free-flap coverage of the wound.
3. radial artery flap coverage of the wound.
4. revision of the amputation wound to a distal forearm amputation.
5. revision of the amputation at the wrist to preserve the distal radioulnar joint.
Images 135a-c show a trans-carpal amputation. The patient presented well within the appropriate time for replantation (proximal to carpus, warm ischemia time <6 hrs and cold ischemia time <12 hrs, distal to carpus, warm ischemia time <12 hrs and cold ischemia time <24 hrs). The injury is a sharp injury, and thus is also more amenable to reimplantation than a broad crush or avulsion injury. The hand was appropriately wrapped in a saline dressing and placed on ice for transport. Since there are no apparent contraindications to replantation, every effort should be made to perform replantation to preserve patient function. Answers 2-5 are various flap coverage or revision amputation procedures that will not preserve patient function.

References:

Question 15
A contraindication for attempting a replantation by an experienced surgeon in an appropriately equipped facility includes
1. amputation through flexor zone I.
2. major limb amputation in a child.
3. absence of athrosclerotic disease.
4. crush or avulsion mechanism of amputation.
5. sharp transection of the thumb at the metatarsophalangeal joint level

PREFERRED RESPONSE: 4
Relative contraindications to replantation include prolonged warm ischemia time, a single border digit, a crush or avulsion injury, and inadvertent freezing of the amputated part. Prolonged warm ischemia time, defined as more than 12 hours for digits where muscle is absent or more than 6 hours for more proximal sites where muscle is present, is often associated with replantation failure. As mentioned previously, a single-border digit is often a poor candidate for replantation; a resultant stiff and/or insensate index finger is often bypassed by the thumb to the long finger, and a stiff little finger may detract from good grip strength. Crush injury results in severe local damage to all tissue components and often precludes satisfactory function postoperatively, especially with respect to formation of adhesions and consequent limitation of motion. Avulsion injury is commonly associated with extensive damage to vessels, nerves, and musculotendinous junctions for great distances beyond the injury site; such damage may be undetectable at the time of surgery, militating against successful restoration of viability and function. Placement of the amputated digit directly onto ice may result in freezing. Permanent tissue damage, precluding a successful result, is a consequence of direct cellular injury due to the formation of ice crystals, capillary damage with thrombus formation, and vasoconstriction due to increased sympathetic tone. Contraindications to replantation include multilevel or segmental injury, a single digit proximal to the FDS insertion, a severe crush or mangled injury, extreme contamination, prior impaired function, concomitant life-threatening injury, severe medical problems, anesthetic risk, and major psychiatric disorder. The ability to successfully reconstruct multilevel or segmental injury is severely limited due to the amount of tissue damage involved. Replantation of a single digit proximal to the FDS insertion (a zone II flexor tendon injury) is associated with poor results related to the loss of PIP joint motion due to flexor sheath adhesion formation. A severe crush or mangled injury is associated with serious damage to tissues, which are at risk for infection, problematic healing, and scarring, thereby contributing to a poor outcome. Extreme contamination from injuries occurring on the farm and/or in the barnyard in particular may result in serious, sometimes life-threatening, infection. Prior impaired function due to previous damage or concurrent disease affecting the amputated limb may further contribute to functional limitations after replantation. With concomitant life-threatening injury, first priority should be given to the survival and well-being of the patient in general, with replantation efforts playing a secondary role. In patients
with severe medical problems, the risk of increased morbidity resulting from hemorrhage, metabolic disturbances, further hospitalization, or additional surgery must be weighed against the benefits of replantation. Additionally, the anesthetic risk of a prolonged procedure, particularly in a patient with severe cardiac and/or pulmonary disease, must be assessed. Patients who exhibit a major psychiatric disorder, are unable to comply with initial postoperative instructions (e.g., maintenance of elevation and relative sedation and avoidance of smoking and caffeine), and are unable or not motivated to follow through with intensive therapy are generally unsuitable candidates for replantation.

RECOMMENDED READINGS:

Congenital Anomalies

Question 6

A 6-month-old child has a hypoplastic thumb on the left hand. Which of the following is considered the most important factor when deciding to reconstruct the thumb?
1. Intact sensation
2. Stability of the carpometacarpal joint
3. Stability of the metacarpophalangeal joint
4. First web space contracture
5. Absence of thumb opposition

Preferred Response: 2

Explanation: The incidence of thumb hypoplasia is 1 in every 100,000 births and associated anomalies including radial aplasia, thrombocytopenia, and renal/cardiovascular/CNS anomalies are frequent. Stability of the carpometacarpal joint is essential for success of thumb reconstruction procedures. If CMC stability is deficient, then ablation and pollicization is preferred. Light et al describe the evaluation and surgical technique involved in treating the hypoplastic thumb.

Recommended Reading(s):

Question 151.

An otherwise healthy 1-year-old girl has an extra little finger on both hands. In which of the following ethnic groups is the incidence of this condition much higher than average?
1. Polynesians
2. African-Americans
3. Native South Americans
4. North American Indians
5. Caucasians of northern European descent

Preferred Response: 2

According to Green’s Operative Hand Surgery (6th edition) pages 1316-7, polydactyly can occur on the radial (preaxial) or ulnar (postaxial) side of the limb. Postaxial polydactyly is inherited in an autosomal dominant pattern with variable penetrance. It is more common in Africans and African-Americans. Preaxial polydactyly is more frequent in the Caucasians. The prevalence of postaxial polydactyly in African-Americans is 1 in 143 live births, compared to 1 in 1339 in Caucasians.
Postaxial polydactyly in a white person is often indicative of an underlying syndrome (chondro-ectodermal dysplasia or Ellis-van Creveld syndrome). Supernumerary digits are classified as well developed (type A) or rudimentary and pedunculated (type B).

Recommended Reading(s):

Figure 8

**Question 8:** Figure 8 shows the clinical photograph of a 3-month-old girl who has a circumferential crease around her arm. She is neurovascularly intact. The hand appears to function normally, but she has significant swelling of the forearm when it is dependent. Treatment should consist of

a. above-elbow amputation.
b. through-elbow amputation.
c. resection of the redundant skin.
d. circumferential band excision and z-plasty.
e. radical skin resection and reconstruction at age 18 months.

Preferred Response: **D**

Explanation:

The key for answering this question is recognizing what the disease process this is: amniotic band constriction syndrome. Even if you don’t know what the answer is, you can pretty much eliminate any type of amputation. The baby’s hand is pink and well perfused so there is no reason to jump to an amputation, which obviously is not reversible. Per the references below: A one-stage release of circumferential congenital constriction bands was performed in four extremities (three patients). No wound problems occurred, even when there had been marked swelling of the extremity distal to the band. The one-stage release facilitated postoperative care, and there was no need for additional periods of anesthesia or for additional operations, which are necessary when this problem is treated with a release performed in two or three stages. Therefore, constriction releases can be safely performed in a one stage procedure.
Recommended Readings:

Question 125. A 12-month-old boy undergoes surgical release and full-thickness skin grafting for the congenital condition shown in Figures 125a and 125b. What is the most common postoperative complication that could negatively affect long-term function?

1- Web creep
2- Nail deformity
3- Digital nerve injury
4- Flexor tendon adhesions
5- Infection of the graft harvest site

Preferred response: 1
Explanation: This patient has syndactyly, the most common congenital hand anomaly. It is an autosomal dominant condition with variable penetrance if it is an isolated condition. Web creep is the most common complication of this procedure. It is the distal migration of the web commissure seen in surgically corrected syndactyly patients. It is caused by abnormal scar tissue formation and increasing growth of underlying osseous structures. Below is a photo of web creep. Other complications can occur but are less common.
Question 143. Fanconi anemia is associated with what congenital deformity?

1. Brachydactyly
2. Preaxial polydactyly
3. Postaxial polydactyly
4. Ulnar longitudinal deficiency
5. Radial longitudinal deficiency

Preferred response: 5

Explanation:
Fanconi anemia was initially described in 1927 in a family of boys with pancytopenia and birth defects – it is an autosomal recessive disease characterized by a severe refractory anemia, pancytopenia, brown pigmentation of the skin and a variety of congenital malformations. The congenital malformations typically affect the hands; radial ray deformities are seen in 49-66% of patients (De Kerviler citation below), thumbs involved in 39-55% of cases. Common examples of the radial deficiency deformities are absent thumb, hypoplastic thumb, sometimes supernumary or bifid thumb, carpal bone hypoplasia, hypoplastic thenar eminence, absent or hypoplastic radius. Preaxial polydactyly is classified according to the Wassel classification, usually unilateral and sporadic. Important to note postaxial polydactyly is 10 times more common in African Americans. Brachydactyly is seen Albright hereditary osteodystrophy.
Figure 149 shows the clinical photograph of a 4-month-old child who has a deformity of the left hand and forearm. The thumb is absent. The right hand and forearm are normal. Laboratory studies show a normal CBC with platelets. What is the most appropriate surgical procedure?

1- Centralization of the ulna only
2- Pollicization of the index finger only
3- Pollicization of the index finger and centralization of the ulna
4- Rotational osteotomy and lengthening of the ulna
5- Vascularized transfer of the fibula to the forearm

Preferred response: 3

Explanation:
The image and vignette are consistent with non-syndromic radial longitudinal deficiency (RLD). He has no thumb therefore the treatment of choice is pollicization of the index finger and centralization of the ulna to re-establish balance across the wrist. The goal of centralizing the carpus on the ulna is to improve reach and to stabilize tendons and muscle balance across the wrist.
The decision for surgery is based on the range of motion of the elbow. In the case of a stiff elbow, a centralization should not be performed as doing so would prohibit the patient from reaching his/her face for dentition and feeding. RLD is commonly associated with Thrombocytopenia absent radius (TAR), Holt-Oram and Fanconi’s anemia. Classification of RLD is based on the Bayne and Klug system and takes into account the amount of remaining radius present:
Type I: short distal radius
Type II: short distal radius with residual growth plates
Type III: small proximal radius
Type IV: absent radius

Recommended Reading(s):
**Vascular Disorders of the Hand**

**Question 37**
A 27-year-old jackhammer operator has a 4-month history of hand coldness and severe ischemia that spares his thumb and index finger. Systemic illnesses have been ruled out. Doppler workup reveals aneurysmal changes, and digital subtraction arteriogram confirms the findings. Intervention should consist of
1. excision and vein graft.
2. surgical thrombectomy.
3. systemic anticoagulation.
4. intravascular fibrinolysis.
5. interventional embolectomy.

**PREFERRED RESPONSE:** 1

**RECOMMENDED READINGS**


**Question 61.**
Core decompression of the distal radius for the treatment of Kienböck’s disease is thought to work through which of the following mechanisms?

1- Increase force distribution
2- Decrease distal radius stiffness
3- Decrease excessive intraosseous pressure
4- Incite local vascular healing response
5- Unload the lunate fossa

**Preferred Response:** 4

**Explanation:**
Core decompression has failed to demonstrate significant unloading of the lunate. Thus, there is no increase in force distribution, or change in intraosseous pressure, or unloading of the lunate fossa from core decompression. Sherman et al. failed to show a change in distal radius stiffness. It is radial shortening osteotomy and radial wedge osteomies that have been shown in biomechanical studies to unload the radiolunate articulation, but this has not been directly linked to the case of the clinical improvement in these patients. Illarramendi et al. suggested that the clinical effect observed was likely due to the increased vascularity in the region of the lunate.

**Recommended readings:**

Question 144. Core decompression of the distal radius for the treatment of Kienböck's disease is thought to work through which of the following mechanisms?

1. Unload the lunate fossa
2. Increase force distribution
3. Decrease distal radius stiffness
4. Decrease excessive intraosseous pressure
5. Incite local vascular healing response

Preferred response: 5

Explanation:
Kienbock’s disease is avascular necrosis of the lunate. Core decompression of the distal radius is an accepted treatment for Kienbocks’ disease during the pre-collapse stage. The question requires having read a source that describes decompression as effective due to facilitating healing via a local vascular response. Force distribution changes would be accomplished by treatment options involving osteotomies, carpectomy or fusion. In order for a decrease in intraosseous pressure to be the mechanism the core decompression would likely have to be performed in the lunate itself.

Recommended Reading(s):

Elbow
Question 42: Figures 42a and 42b show the radiographs of a 3-year-old girl who sustained an injury to her right upper extremity. The preferred management of this injury is closed reduction and immobilization in a long arm cast with the elbow and forearm in which of the following positions?

1. Elbow flexed; forearm in pronation
2. Elbow flexed; forearm in supination
3. Elbow extended; forearm in neutral
4. Elbow extended; forearm in pronation
5. Elbow extended; forearm in supination

Preferred Response: 2

Explanation:
The important thing to recognize is the radial head dislocation which confirms a Monteggia fracture-dislocation. After reducing the ulna (which in the case of plastic deformity can require significant force), the reduction maneuver for the radial head is flexion, supination, and direct pressure over the head. Immobilization is done in 110 degrees of flexion and full supination in order to enhance stability by tightening the interosseous membrane and relaxing the biceps.

Recommended readings:

Question 84.
The floor of the cubital tunnel is composed of what structure?

1. Intermuscular septum
2. Ligament of Struthers
3. Osborne’s ligament
4. Medial collateral ligament
5. Flexor carpi ulnaris

Preferred Response - 4

The cubital tunnel extends from medial epicondyle to olecranon and houses the ulnar nerve as it passes behind the elbow. With flexion the cubital tunnel becomes taut, and with extension the cubital tunnel becomes lax. The aponeurotic roof of the cubital tunnel becomes maximally taut during flexion because the 2 points of attachment (the medial epicondyle and the olecranon) are farthest apart during this position. The floor of the cubital tunnel includes the MCL, the joint capsule, and olecranon.
Recommended readings:

Question 147. A 36-year-old woman sustains an oblique, closed fracture of the humeral shaft 11 cms proximal to the lateral epicondyle with associated radial nerve palsy. The fracture is treated closed with the nerve injury treated expectantly. Which of the following is the first muscle expected to demonstrate evidence of reinnervation?

1. Supinator
2. Brachioradialis
3. Extensor pollicis longus
4. Extensor indicis proprius
5. Extensor carpi radialis brevis

Preferred response: 2
Explanation:
This is a basic anatomy question; the radial nerve spirals around the humerus moving from posterior to anterior 10-13cm proximal to the lateral epicondyle (spiral groove) – it then pierces the intermuscular septum. The first muscle it innervates as it comes around is the brachioradialis – therefore as the nerve function returns due to a likely traction injury to the nerve in this location the brachioradialis will also be the first muscle re-innervated. Abrams et al. in reference below dissected 20 cadavers to identify the motor branches of the radial nerve. They determined the innervation order from proximal to distal was brachioradialis, extensor carpi radialis longus, supinator, extensor carpi radialis brevis, extensor digitorum communis, extensor carpi ulnaris, extensor digiti quinti, abductor pollicis longus, extensor pollicis longus, extensor pollicis brevis, and extensor indicis proprius.

Recommended Reading(s):
Question 228. Figure 228a and 228b are the AP radiographs of a 17 year old boy with an elbow deformity. He has a range of motion from 0o to 110o of flexion and is neurologically intact with no pain. If the deformity is treated surgically, which of the following procedures would help in achieving a cosmetically and functionally pleasing result

1 - Medialize the distal fragment
2 - Lateralize the distal fragment
3 - Close the capitellar epiphysis
4 - Transpose the ulnar nerve anteriorly
5 – Excise the growth arrest zone medially

Preferred Response: 1

Common surgical techniques which have been described for the correction of cubitus varus include lateral closing wedge, medial opening wedge, step cut, and dome-shaped osteotomies. Translation of the distal fragment is a frequent cause of a lateral prominence, resulting in a poor cosmetic result. However, medial displacement of the distal humerus decreases the prominence of the lateral humeral condyle. Dome osteotomy for post-traumatic cubitus varus also provides good result with no prominent lateral humeral condyle. However, the extent of translation required is based on the surgeon’s intraoperative assessment. There is no provision for pre-operative calculation, and there is always a chance that over- or under-translation may occur.

Recommended Reading(s):
Question 261. A 62-year-old right-hand dominant man who has a history of rheumatoid arthritis underwent a primary total elbow arthroplasty one year ago. He continues to report elbow pain since the initial surgery. He has both rest and night pain and denies any drainage from the wound although he does state that at times “my elbow feels hot.” He denies any systemic symptoms. A plain radiograph is seen in Figure 261. His peripheral white blood cell count is 5,500/mm³ (normal 3,000-15,000/mm³) with 80% neutrophils. His C-reactive protein level is 15. Aspiration was performed and cultures grew out proprionibacterium acnes. Treatment should now consist of which of the following?

1. Resection Arthroplasty
2. Staged Exchange Arthroplasty
3. Single Stage Exchange Arthroplasty
4. Arthroscopic Irrigation and Debridement
5. Open Irrigation and Debridement with Bushing Exchange

Preferred Response: 2

Explanation:
Based on clinical presentation and cultures positive for Propionibacterium acnes, the patient has an infected total elbow arthroplasty requiring revision surgery.

Yamaguchi et al. reviewed three treatment strategies for 25 cases of an infected total arthroplasty: irrigation and debridement, staged reimplantation, and resection arthroplasty. A single stage exchange arthroplasty was utilized in only one case based on surgeon preference (thus eliminating choice (3)).

Resection arthroplasty was deemed the treatment of choice for medically frail who could not tolerate multiple procedures or a high risk of complication and demonstrated loosening of one or both components. Based on the radiograph, loosening is not evident in this patient. Thus, choice (1) is eliminated.

Irrigation and debridement was found to be successful in cases in which Staphylococcus epidermidus was not the infecting organism. Propionibacterium acnes can be thought of as being very similar to S. epidermidus given that both are gram-positive and typical skin flora. Therefore, irrigation and debridement is not likely to be successful in treating this patient. Thus, choices (4) and (5) can be eliminated.

Based on patient’s initial diagnosis, good bone stock, lack of loosening, and infection with Propionibacterium acnes, staged exchange arthroplasty is the best answer.

Recommended readings: