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Disorders of the Upper Extremity

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Because of the functional importance of the upper extremity to human activity, patients with injuries in this region frequently require diagnostic and therapeutic assistance from the family physician. A working knowledge of basic anatomy is helpful for establishing a differential diagnosis for upper extremity complaints. This chapter discusses common disorders in this region, but there are many unusual problems that may also present in an office situation.

Clavicle

The clavicle is the connecting strut that links the arm and shoulder with the axial skeleton. The clavicle is anchored medially by the sternoclavicular and costoclavicular ligaments, and the acromioclavicular and coracoclavicular ligaments anchor it to the scapula. A thorough examination of any shoulder injury should include palpation of the clavicle and evaluation of the acromioclavicular (AC) and the sternoclavicular (SC) joint motion.

Clavicular Fractures

Fractures of the clavicle are often due to a direct blow on the shoulder or occasionally to a fall on an outstretched arm.¹ They account for 5% of all fractures. Eighty percent of clavicular fractures occur in the middle third of the clavicle, especially at the junction of the middle and distal thirds.² Even when significant displacement or angulation

is present, these fractures heal well with minimal intervention. A figure-of-eight sling or commercial clavicular strap, worn for three to four weeks by children and six weeks by an adult, provides effective immobilization and allows bony union.¹ The patient is advised that a permanent bump may become noticeable at the site of callus formation. Unless there is initial neurovascular injury, operative intervention or reduction is almost never required for fractures in the middle of the clavicle. Fractures of the distal third (15% of clavicular fractures) sometimes require surgery. Nondisplaced fractures that do not involve the AC joint heal without difficulty using the treatment outlined above. When a displaced or intra-articular fracture causes persistent pain, resection of the distal clavicle may be needed to alleviate discomfort. Fractures of the medial head of the clavicle (5% of fractures) or posterior dislocations at the sternoclavicular joint are fortunately rare. These injuries, caused by a direct blow to that region, may create a medical emergency by compressing the great vessels or compromising the airway. Immediate elevation of the impacted segment and urgent cardiothoracic or orthopedic consultation are recommended.

AC Joint Dislocations

Dislocations of the AC joint result from a direct fall onto the anterior shoulder. Management of this condition is determined by the extent of the dislocation. Specific treatment for this problem is covered in Chapter 9.

AC Joint Arthritis

With advancing age, there is an increased risk of AC joint arthritis, which may be interpreted as shoulder pain. Careful questioning frequently reveals a prior injury such as a grade I or II AC joint dislocation. Another potential source of injury is with extensive weight lifting. Degeneration of the cartilaginous meniscus may contribute to loss of AC joint integrity. On physical examination the patient is point tender over the AC joint. Forward flexion of the arm to 90 degrees followed by adduction of the shoulder, so the hand touches the contralateral shoulder (the crossed arm adduction test) compresses the AC joint and therefore reproduces the pain.

Initial treatment of AC joint arthritis includes rest, ice, and nonsteroidal anti-inflammatory drugs (NSAIDs). A corticosteroid injection into the AC joint using an anterior and superior approach may provide some benefit.³ For cases unresponsive to conservative management, resection of the distal clavicle can alleviate persistent pain.

Scapula

Isolated injuries to the scapula are rare, but occasionally a direct blow over the involved area results in a fracture.⁴ Because of the high impact involved, scapular fractures are frequently associated with other thoracic injuries such as rib fractures and pneumothorax. Treatment for fractures of the body of the scapula include immobilization with a sling until subsidence of pain within two to four weeks, followed by progressive exercises. If the acromion or glenoid is fractured, orthopedic referral is necessary because of potential implications to shoulder mobility and function.⁴

Shoulder

As the pivotal connection between the upper extremity and the axial skeleton, the shoulder is a frequent source of musculoskeletal problems. Its great range of motion is available only at some compromise to bony stability. Most shoulder stability is provided by the periarticular soft tissues. A careful physical examination attempts to identify which components are contributing to a specific problem. Disorders extrinsic to the shoulder may also cause referred pain to this area. An evaluation of the cervical spine should be included for any problem presenting as shoulder pain.

Functionally, the shoulder is composed of four joints: sternoclavicular, acromioclavicular, glenohumeral, and scapulothoracic articulation. The major joint is the glenohumeral joint, in which the humeral head is three times larger than the glenoid socket. A fibrocartilaginous glenoid labrum provides depth to the socket and adds stability. During overhead motion of the arm the humeral head is maintained in the socket by the four muscles of the rotator cuff. Originating from the scapula, these muscles maintain fixation of the humeral head and, based on their humeral insertion, assist in various arm motions. The supraspinatus assists in abduction and forward flexion, the infraspinatus and teres minor create external rotation, and the subscapularis causes internal rotation. Also vital for proper shoulder motion are the scapulothoracic muscles (rhomboid, trapezius, serratus anterior) and the deltoid.⁵

Traumatic Dislocation of the Shoulder

Anterior Dislocation

The major traumatic injury to the shoulder is dislocation of the humerus from the glenohumeral joint. About 95% of such dislocations are anterior,⁶ caused by resisted force to the arm when the

shoulder is abducted and externally rotated. Examination of this injury reveals a squaring of the shoulder, loss of the roundness of the deltoid muscle, prominence of the acromial edge, and an anterior mass, which is the humeral head. The arm is held in slight external rotation and abduction. Before reduction is attempted, a neurovascular examination assesses function of the anterior axillary nerve, which can be demonstrated as absent sensation over the deltoid region and loss of deltoid contraction. This injury, present with up to 30% of dislocations, is usually a transient neuropraxia that requires several weeks for neurological recovery.

If neurological evaluation of the dislocation reveals no other abnormality, immediate reduction is acceptable. A number of maneuvers have been described to relocate the shoulder.⁴ Initial attempts emphasize gentle longitudinal traction on the arm while passive abduction and external rotation is performed. If there has been delay since the dislocation, narcotic analgesia is usually required to overcome muscle spasm. Most important with any maneuver is the caution that excessive torquing of the humerus must be avoided, as it may lead to brachial plexus injury or humeral fracture.

After relocation and repeat neurovascular evaluation, the patient is placed in a sling for a period of immobilization. A rehabilitation program is then instituted to strengthen the supportive musculature, restore motion, and prevent recurrent dislocation. Young patients, especially those under age 20, are at increased risk of recurrence (75–95%)⁷ and require two to three weeks of immobilization before rehabilitation. For adolescents and young adults, failure to undergo and continue a satisfactory rehabilitation program is a frequent cause of recurrent dislocations. A shoulder stabilization procedure is often necessary for recurrent dislocators. In those over age 50, the risk of recurrent dislocation is much less (10%), but the increased risk of adhesive capsulitis and frozen shoulder requires that early shoulder motion be emphasized.⁸ In this population an exercise program should be instituted after only one week of immobilization. Occasionally, especially in the elderly, there is an associated avulsion fracture of the greater tuberosity.

Subluxation

A more subtle problem is transient subluxation of the humerus, where the humeral head comes partially out of the anterior glenoid rim but then spontaneously reduces. Roentgenographic findings are negative, but the patient describes a transient “dead arm” feeling for several minutes after the initial injury. Later there may be persistent pain in

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the posterior shoulder due to a tear in the glenoid labrum. On physical examination a positive apprehension sign is noted, with pain when the shoulder is passively placed in abduction and externally rotated. A tear in the glenoid labrum may be a reason for chronic instability of the shoulder.

Those who experience a subluxation should undergo an aggressive rehabilitation program to prevent progression to dislocation. The advent of shoulder arthroscopy has improved the evaluation of patients with this problem.

Posterior Dislocation

Posterior dislocations comprise only 3% of shoulder dislocations but are missed on initial roentgenograms as often as 60% to 80% of the time.⁶ They should be particularly suspected if there is a history of seizures, alcohol use, or electrical injury. On physical examination the arm is held in internal rotation, rather than the external rotation of anterior dislocation. Orthopedic consultation should be obtained if this injury is suspected.

Periarticular Shoulder Problems

Most shoulder problems involve the soft tissue periarticular shoulder structures rather than the glenohumeral joint. Because these supporting structures are vital to shoulder stability, a small injury to one component may cause significant problems in the motion and function of the shoulder. Classification is made difficult by the frequent overlap of these problems. At times one of the following specific periarticular shoulder problems is identified.

Rotator Cuff Injuries

Problems associated with the rotator cuff are the most frequent causes of shoulder problems. Impingement occurs chiefly in the supraspinatus as it courses underneath the acromion and coracoacromial ligament. Although this injury is most common in young athletes who engage in throwing or racquet sports, impingement may occur in anyone involved with overhead work or repetitive upper extremity motion. Evaluation of impingement syndromes is discussed in Reference 35, Chapter 52.

As a result of chronic impingement, the rotator cuff may tear. Cuff tears are more common in middle-aged or elderly individuals, often due to a hypovascular supply of the supraspinatus tendon as it inserts on the humerus.⁹ One hallmark of cuff tears is continuous pain, especially at night, which may radiate down the lateral humerus.

Examination of the patient with a rotator cuff injury reveals painful or limited active abduction (between 60 and 120 degrees), where the cuff comes in greatest contact with the overlying acromial arch.⁹ With a significant cuff tear, the patient is frequently unable to hold the arm in 90 degrees of abduction. Atrophy may develop in the supraspinatus or infraspinatus muscles of the scapula. If a cuff tear is suspected, orthopedic referral with arthroscopy or magnetic resonance imaging (MRI) is indicated to delineate potential surgical cases. With any cuff injury an extensive rehabilitation program of three to six months is needed to gain full motion and strength.

Subacromial Bursitis

The subacromial bursa separates the deltoid muscle from the underlying rotator cuff. Irritation of adjacent structures, most commonly impingement of the rotator cuff, results in inflammatory bursitis. Often there is a history of overuse or trauma followed by pain and limited active motion. Aspiration of excessive bursal fluid followed by corticosteroid injection using a subacromial lateral or posterior approach can provide dramatic relief of this problem.³ Adequate volume of injection [5 to 10 cc lidocaine (Xylocaine) plus corticosteroid] should be used to optimize injection results.

Calcific tendonitis, usually within the supraspinatus insertion, may cause an acute inflammatory reaction of the overlying subacromial bursa. Roentgenograms demonstrate a calcific deposit superior and lateral to the humerus. The severe pain can be relieved by needle aspiration of the calcific mass along with a lidocaine and corticosteroid injection of the bursa. Occasionally surgical excision of the calcific deposition is required.¹⁰

Bicipital Tendonitis and Rupture

The long head of the biceps tendon, which is palpable in the bicipital groove, may be irritated as it courses through the glenohumeral joint and below the supraspinatus tendon to its attachment at the superior sulcus of the glenoid. Isolated pain over the long head of the biceps tendon suggests this problem, although usually there is more diffuse tenderness involving the entire subacromial region. The short head of the biceps tendon attaches to the coracoid process and is rarely involved in inflammatory problems of the shoulder. In most cases rupture of the long head of the biceps tendon occurs as a result of advanced impingement in middle-aged or elderly patients. There is a sudden pop associated with a heavy isometric flexion of the arm such as lifting a heavy object with that arm. The patient experiences mild

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discomfort with ecchymosis in the upper arm and a palpable bulge of the biceps muscle mass. Because the short head remains intact, treatment is symptomatic as little functional loss occurs.¹¹ Surgical repair is a rare consideration. Rupture of the distal insertion of the biceps tendon can also occur, with pain in the antecubital region. In contrast to proximal long head tear, this injury does warrant surgical repair.¹¹

Glenohumeral Disorders

As a non-weight-bearing area, the true glenohumeral joint is subject to less mechanical stress than the lower extremity. When arthritic changes occur, there may have been a prior local injury. Inflammatory arthritis, with erosive changes of the glenohumeral joint and joint effusion, may occur, especially with severe rheumatoid arthritis.¹² Treatment for any degenerative arthritis is primarily aimed at relief of pain and inflammation. Surgical intervention with joint replacement is possible, but functional results are not as satisfactory as with knee and hip joint replacement, and the major goal should be relief of pain.

Adhesive Capsulitis

A poorly understood entity, adhesive capsulitis (also termed frozen shoulder or periartthritis) is characterized by a progressive, painful restriction of shoulder motion. A primary frozen shoulder has no apparent initiating event, is more common in the nondominant shoulder of women ages 40 to 60, and is bilateral in 20% of cases.¹³ When there is a secondary cause of shoulder stiffness, such as immobilization, cuff injury, or trauma, the prognosis may not be as good, with permanent loss of shoulder motion. Initial treatment for either kind includes NSAIDs, joint injection, and an aggressive physical therapy program. For refractory cases other management options include manipulation under anesthesia or shoulder arthroscopy to lyse adhesions and enhance shoulder motion.¹⁴

Osteonecrosis

Although less common than osteonecrosis (avascular necrosis) of the femoral head, osteonecrosis of the humeral head may be caused by a number of illnesses such as alcoholism, sickle cell disease, systemic lupus erythematosus, and long-term steroid use.¹⁵ Bone scan or MRI may be used for early diagnosis, as radiographs do not show subchondral collapse and humeral head flattening until later in the disorder. Treatment includes rest, analgesics, physical therapy for motion, and in severe cases joint replacement.

Humerus

Proximal humeral fractures occur in elderly patients who fall on an outstretched arm, with the fracture line at the surgical neck of the humerus. Although these fractures are frequently impacted, 80% of proximal humeral fractures are nondisplaced.⁴ Because brachial plexus injury is possible, neurovascular examination is important with special attention to the axillary nerve. If there is less than 1 cm displacement and less than 45 degrees angulation, treatment is nonoperative (Fig. 2.1). A shoulder immobilizer is provided for one to two weeks, after which a sling is worn for another two weeks.¹⁶ The major complication of these fractures in the elderly is loss of joint mobility, and an early exercise program beginning during the second week is important to maximize shoulder function. Even with rehabilitation some loss of shoulder abduction can be expected.

When a fracture involves the greater or lesser tuberosity or is associated with a humeral head dislocation, there is greater risk of long-term sequelae due to rotator cuff malfunction, and orthopedic consultation should be obtained. With trauma to the humeral shaft, which occurs in young active patients, the integrity of the adjacent radial nerve should be tested.



Fig. 2.1. This impacted humeral fracture in an elderly women is neither displaced nor severely angulated. It was successfully managed with an arm sling for a week followed by range of motion exercises and a course of physical therapy.

Elbow

Fractures of the Radial Head

One common uncomplicated elbow injury is a fracture of the proximal radial head. The history of a fall on an outstretched hand accompanies a patient who is reluctant to pronate the hand or to flex the elbow beyond 90 degrees.¹⁷ Radiological examination of the radial head, especially on the lateral film, is important when the patient is unable to move the elbow through a complete range of motion. The only roentgenographic evidence for fracture may be a posterior fat pad sign, which occurs when blood that has entered the joint space displaces the fat pad posteriorly (Fig. 2.2).

Management of a nondisplaced radial head fracture emphasizes pain relief and, in adults, early mobilization. A sling and posterior elbow splint are worn for one to two weeks, after which range of motion (ROM) exercises are begun while the protective sling is worn for another week.¹⁶ Follow-up of the patient is important for this seemingly trivial problem, as it may take several months for the patient to regain full elbow motion. If displacement of the head or severe angulation has occurred in a child, operative repair may be necessary because the radial head is necessary to provide adequate lengthening of the radius. In adults with radial head displacement or comminution, excision of the radial head is possible to permit adequate pain-free motion at the elbow.

Epicondylitis

Epicondylitis, a frequent elbow complaint, is caused by inflammation of the lateral or medial epicondyle. Although its diagnosis and treatment are covered in Reference 35, Chapter 52, the clinician must understand that epicondylitis is not always related to sports participation. Obtaining an accurate history usually identifies a causative action related to the patient's vocational or recreational activities.

Radial Head Subluxation

The most common elbow complaint in children, known as nursemaid's elbow, occurs when sudden longitudinal traction on the wrist or arm causes the annular ligament to become partially entrapped in the radiohumeral joint. The child younger than four years old presents with a painful elbow held in pronation. Gentle rotation of the hand to a supinated position while pressure is applied over the radial head results in a palpable "click" as the radial head is reduced.¹⁸ There is immediate pain relief with full use of the elbow. Radiographs are not



Fig. 2.2. Fat pad signs. A nondisplaced radial head fracture with both a posterior (P) and a prominent anterior (A) fat pad evident on this lateral view. The posterior fat pad is indicative of blood in the joint space from an occult fracture, displacing the fat from the joint space.

necessary; positioning for the radiograph may actually cause reduction of the subluxation. To prevent recurrence, parents and caregivers should be educated about the injury mechanism for this benign entity.

Olecranon Bursitis

Either a single traumatic blow to the elbow or repetitive microtrauma such as leaning on the elbow may result in swelling over the posterior aspect of the elbow. When there is marked inflammation, a septic bursitis is suspected. Treatment for a septic bursitis includes surgical

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drainage of the bursal fluid and intravenous antibiotics. *Staphylococcus aureus* is the most common infecting organism. For a simple noninfected bursitis, aspiration of clear, straw-colored fluid can be followed by a tight pressure dressing applied to prevent fluid reaccumulation.¹⁹ When recurrent bursitis results in a thickened fibrotic mass, the only recourse may be surgical excision of the entire bursa.

Wrist

Fractures of the Distal Radius

Because of the close proximity to the radiocarpal joint, fractures of the distal radius are considered wrist injuries. In children the most common injury is the buckle, or torus, fracture, which occurs with a fall onto an outstretched hand. Radiographic findings may be subtle, with only a slight cortical disruption of the extra-articular radius seen on the lateral film (Fig. 2.3). Treatment is a short arm cast for three weeks; functional return is excellent.²⁰



Fig. 2.3. Buckle (torus) fracture. A small cortical disruption is visible in the metaphysis of the distal radius.

When a child presents with a “sprained wrist,” evaluation must be done carefully, as the growth plates are weaker than ligaments during this period of rapid growth. With normal roentgenograms and tenderness over the epiphyseal plate, a Salter I fracture is presumed, and a short arm cast is applied for two to three weeks.²⁰

In adults the most common radial fracture is a Colles’ fracture, which occurs when patients over age 50 fall onto an outstretched hand. The “silver fork” deformity is caused by dorsal displacement of the distal fragment. The ulnar styloid may also be fractured. Reduction of a Colles’ fracture may be attempted, but the physician must be aware of potential complications of this fracture, including median or ulnar nerve compression, damage to the flexor or extensor tendons, and radioulnar joint arthritis.

Nondisplaced distal radial fractures that are nonarticular can usually be treated with cast immobilization for six weeks in adults. Low-impact intra-articular nondisplaced fractures in the elderly may also require only cast immobilization, although the patient is advised that some residual arthritis may occur.¹⁶ For other displaced fractures or intra-articular radial fractures in young patients, treatments such as percutaneous pinning or open reduction internal fixation may be required to minimize long-term problems in the joint.

Carpal Fractures

Sixty percent of carpal bone fractures involve the scaphoid (or carpal navicular) bone. The injury mechanism is a fall on an outstretched hand, usually in an adolescent or young adult. The location of the fracture determines the likelihood of complications. Distal (5%) and middle (waist) scaphoid fractures (80%) carry a good prognosis for healing, whereas proximal (15%) fractures have an incidence of nonunion or avascular necrosis as high as 30% to 50% due to a poor blood supply.

Although a scaphoid fracture is usually identified on a posteroanterior view with the wrist in ulnar deviation, occasionally the fracture is not evident on the initial films. Patients with a “wrist sprain” who have tenderness over the scaphoid tubercle (palmar hand surface) or pain in the anatomic snuffbox, located between the extensor pollicis brevis and extensor pollicis longus tendons, should be immobilized in a short arm cast or splint for seven to ten days, at which time repeat films usually demonstrate the fracture. If tenderness continues but plain films remain negative, a bone scan or tomograms may be needed to confirm a suspected fracture. Because of the high risk of nonunion, scaphoid fractures require prolonged immobilization. Clinical opinion

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varies regarding use of a long arm cast versus a short arm cast, but in general a short arm cast applied for 8 to 12 weeks is acceptable for uncomplicated nondisplaced middle or distal fractures of the scaphoid.¹⁶ The longer time frame is necessary to allow adequate bone healing and to prevent nonunion or avascular necrosis. For patients with a proximal fracture or for those with a treatment delay, orthopedic consultation may be wise because of the high incidence of long-term sequelae.²¹ Any scaphoid fracture with displacement more than 1 mm or angulation more than 20 degrees is regarded as unstable and should also be referred for surgical treatment.

Other fractures of the carpal bones are uncommon and frequently require special radiographic views or tomograms for identification. A meticulous examination of the painful area indicates which carpal bones are likely to be involved. Because serious sequelae are common, including ulnar or median neuropathy and chronic wrist stability, orthopedic intervention is usually needed.

Wrist Instability

Although fractures of the carpal bones are unusual, sprains and other minor traumatic wrist injuries are common. A number of serious wrist injuries and carpal instabilities have been described as physicians have gained greater appreciation for the complex interactions of other ligaments and multiple articulations within the carpal complex. Roentgenography may be helpful for delineating certain problems, such as lunate and perilunate dislocations and scapholunate dissociations.¹⁰ More sophisticated procedures, such as arthrography or MRI, may be required to identify other complex problems. Because there may be difficulty distinguishing a serious wrist injury from a minor sprain, the physician should be suspicious of wrist injuries that fail to resolve within a three- to four-week period. In these circumstances an orthopedic consultation is wise to ensure that no significant injury has been overlooked.

TFCC Injuries

The triangulofibrocartilage complex (TFCC) is a small meniscus located distal to the ulna. This tissue serves to absorb impact to forces on the ulnar aspect of the wrist. Injuries can be acute, due to a sudden impact, or chronic, due to repetitive loading such as gymnastics. As with carpal instability, the physician should be suspicious of TFCC injuries when ulnar wrist pain does not respond to three to four weeks of splinting. Orthopedic consultation, frequently with MRI, may be required to identify the specific problem.²²

De Quervain's Tenosynovitis

A stenosing tendonitis, de Quervain's tenosynovitis, occurs in the first extensor compartment of the wrist, comprising the abductor pollicis longus and extensor pollicis brevis. As these tendons cross the radial styloid, thickness and swelling may occur. The patient complains of radial wrist pain, and there is often an occupational or vocational history of repetitive hand motion, such as knitting or sewing.

The diagnosis is confirmed by the Finkelstein test, as follows. After passive adduction of the thumb into the palm, ulnar deviation of the wrist elicits a sharp pain that reproduces the patient's symptoms. Initial treatment should include a corticosteroid injection into the tendon sheath. Other treatment options include rest, anti-inflammatory medications, and a thumb spica splint. On occasion, surgical release of the tendon sheath is required for symptomatic relief.²³

Intersection Syndrome

Inflammation can also occur at the crossover of the first and second extensor compartments of the wrist, located 4 to 8 cm proximal to the distal radius.²⁴ Pain and tenderness are noted in this region, and the problem occurs as an overuse syndrome from repeated wrist extension. This anatomy should be distinguished from the more distal de Quervain's tenosynovitis. Initial treatment should include a thumb spica splint and anti-inflammatory medications. Corticosteroid injection is useful for those who do not respond to splinting.²⁵ This is a contrast to de Quervain's tenosynovitis where injection is the preferred initial treatment.

Carpal Tunnel Syndrome

The most common compression neuropathy of the upper extremity, carpal tunnel syndrome, is discussed in Reference 35, Chapter 67.

Hand

Metacarpal Fractures

The most common hand fracture is a "boxer's fracture" caused by impaction force and resulting in a fracture of the distal neck of the fifth metacarpal. Because of the mobility of the fourth and fifth metacarpals, volar angulation of the distal fragment of less than 40 degrees is acceptable without the need for bone manipulation.²⁵

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Whereas angulation is acceptable, a rotation injury around the longitudinal axis of any metacarpal necessitates orthopedic referral for surgical pinning. For a boxer's fracture with mild angulation, an ulnar gutter or volar splint with the metacarpophalangeal (MCP) joint at 90 degrees is applied for three to six weeks.²⁵ Midshaft fractures of the fifth metacarpal may be handled in a similar manner if angulation is less than 20 degrees. Nondisplaced fractures of the second and third metacarpals can be treated with a short arm cast, but careful physical examination must be performed to ensure that there is no rotation or angulation present, as these bone problems necessitate surgical correction. The unusual fracture that involves either the articular surface of the metacarpal base or metacarpal head mandates orthopedic consultation because of the potential for later arthritic complications.¹⁶

Fractures of the thumb metacarpal require surgical correction if they are intra-articular, such as Bennett's fracture (with proximal dislocation of the metacarpal) or Rolando's fracture (a comminuted intra-articular fracture of the metacarpal base). These injuries are less common than the extra-articular metacarpal fracture of the thumb, which if not angulated more than 30 degrees may be treated with a short arm thumb splint cast with the thumb in a flexed position.²⁶

Infections

Palmar Hand Infections

Infections of the palmar hand surface are potential disasters. Bacteria can get underneath the dermal layer and then track along the flexor tendon sheaths. In this high glucose medium, the infection can spread rapidly and damage the flexor tendons with subsequent permanent hand impairment. Pain, tenderness, or swelling of the palmar surface suggests a deep hand infection, as does a recent history of minor trauma. Evidence of a palmar space infection mandates tetanus prophylaxis and intravenous antibiotic treatment with early orthopedic consultation for possible drainage.²⁷ Many physicians believe that animal bites to the palmar region of the hand warrant prophylactic antibiotic treatment to prevent complications (see Reference 35, Chapter 47).

Dorsal Hand Infections

Infections of the dorsal hand may appear worse than palmar infections because of the dramatic swelling within the loose connective tissue, but the prognosis is good. Oral antibiotics and outpatient drainage are usually satisfactory. Before treatment, however, the palmar space is inspected to ensure that the dorsal infection is not originating from a

deep palmar infection that has ruptured to the dorsal surface.²⁷ Lacerations near the MCP joints warrant special precautions, especially those of the fourth or fifth metacarpal. The usual history for this injury is an altercation in which the patient has punched another person in the teeth and sustained a human bite, which may extend into the joint space. The patient frequently denies this history on initial questioning. If unrecognized, the subsequent infection may lead to joint destruction. When this injury is suspected, a hand surgeon should be contacted to consider operative debridement. A good rule to remember is that *all* lacerations over the MCP joints are human bites until proved otherwise.

Dupuytren's Contracture

Dupuytren's contracture, with thickening of the palmar fascia, results in asymptomatic contractures of the fingers primarily of the MCP joint.²⁸ The problem often starts with the ring finger and progresses slowly to include other fingers. Although the etiology is unknown, there is a familial tendency with Dupuytren's contracture occurring more frequently in middle-aged men of northern European descent. Pathologically, there is inflammation and subsequent contracture of the palmar aponeurosis, which may progress over years.²⁸ Although many treatment modalities have been attempted, surgical excision of the contracted region has been the most effective approach. Excision is reserved for those who have some functional hand impairment due to contracture formation.

Finger

Fractures

Distal Tip Fractures

Crush injuries to the tip of the finger cause pain because of the closed space swelling. Even when the fracture is comminuted, the fibrous septa provide stability during bone healing. Protective splinting of the tip for several weeks is usually satisfactory.²⁹ When fracture fragments are severely displaced, soft tissue interposition may prevent adequate healing unless surgical correction is performed. For any fracture associated with a nail bed injury, the nail bed or matrix must be repaired to minimize aberrant nail growth. Subungual hematomas, with or without an underlying fracture, can be decompressed with an electrocautery device or heated paper clip, creating a hole at the distal tip of the lunula. For any open fracture, such as a nail bed

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injury or drained subungual hematoma, antibiotic coverage with a cephalosporin is indicated to minimize the risk of osteomyelitis.

Middle and Proximal Phalangeal Fractures

All phalangeal fractures are examined carefully for evidence of angulation (by roentgenography) or rotation (by clinical examination).²⁶ Angulated or rotated phalangeal fractures are inherently unstable and require orthopedic intervention (Fig. 2.4). Nondisplaced extra-articular fractures of the middle or proximal phalanx can be managed by one to two weeks of immobilization followed by dynamic splinting with “buddy taping” to an adjacent finger.¹⁶ Large intra-articular fractures involving the middle or proximal phalanx are usually unstable fractures. Small (<25%) avulsion fractures of the volar middle phalangeal base are frequent problems seen in the office that occur with a hyperextension injury (Fig. 2.5). In addition to the fracture is disruption of the distal insertion of the volar plate, a structure that prevents hyperextension of the proximal interphalangeal (PIP) joint. These injuries are managed by two to three weeks of immobilization with 20 to 30 degrees of flexion at the PIP joint, which allows maximal length of the collateral PIP joint ligaments and permits early finger rehabilitation. A buddy-taping program during activity or sports should continue for an additional four to six weeks. A gauze pad should be placed between the fingers in order to prevent skin maceration. Failure of the volar plate to heal properly may result in a swan-neck deformity at the PIP joint.

PIP Joint Dislocations

With sudden hyperextension the middle phalanx may dislocate dorsal to the proximal phalanx. This dislocation is easily reduced by gentle traction on the finger followed by flexion of the PIP joint. Because dislocation results in disruption of the distal volar plate, the PIP joint should then be immobilized for three to six weeks and managed as a volar plate injury as described above.³⁰ Lateral joint sprains with mild instability (<15 degrees of deviation) can also be managed with flexion splinting and subsequent buddy taping. Treatment of complete lateral dislocations and volar dislocations is more complex and controversial.

Tendon Injuries

Mallet Finger Injuries

Forced flexion of the distal interphalangeal (DIP) joint on an extended finger avulses the extensor tendon as it inserts into the distal phalanx, and the patient cannot extend the distal phalanx. Orthopedic referral



A



B

Fig. 2.4. Rotation deformity of the ring finger (A) indicates that surgical fixation is necessary to reduce the fracture. The radiograph (B), with only mild angulation, demonstrates why clinical examination for rotation is necessary for evaluating a finger injury.

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Fig. 2.5. This fracture of the middle phalanx implies that the distal volar plate has been disrupted. A combination of splinting and buddy taping for several weeks is required to allow the volar plate to heal.

is indicated only if there is subluxation of the DIP joint or if there is a large bone fragment involving more than 25% of the articular surface. Usually the roentgenogram demonstrates either no fracture or a small avulsion fragment. This injury is treated by placing the DIP joint in extension for six to eight weeks while the PIP joint is permitted to move freely.²⁹ A number of commercial or homemade splints are available for application to either the dorsal or volar surface of the DIP joint. Constant prolonged splinting is vital to permit tendon healing. The patient is advised that flexion of the DIP joint even once before adequate repair will result in tendon avulsion and necessitate

reinitiation of the entire process. During any splint change, care is exercised to maintain finger extension. Hyperextension of the joint is also avoided, as this position may lead to necrosis of the dorsal skin.

Central Slip Injuries

A laceration or crush of the extensor tendon over the dorsum of the PIP joint or a volar dislocation damages the central portion of the extensor tendon. When this central slip is damaged, subsequent flexion of the PIP joint results in a contracture termed a boutonniere deformity. Tenderness of the central slip region is an injury of this structure until proved otherwise. A dorsal avulsion of the middle phalanx requires orthopedic pinning.³⁰ A potential central slip injury without fracture is treated by maintaining the PIP joint in extension for two to six weeks. The stiffness that results from collateral ligament tightening is much easier to treat than is correction of an established boutonniere deformity.

Trigger Fingers

As the flexor tendon courses through the hand, a nodular thickening at the MCP level may prevent free passage of the tendon. The cause is inflammation of the A₁ pulley, the first of five pulleys that guide the flexor tendon into the finger. Although the problem is located at the MCP level, the patient frequently complains of more distal pain at the interphalangeal (IP) joint of the thumb or PIP joint of the finger. During extension of the finger, there is a catching or locking of the PIP joint as the stenosed tendon becomes trapped in the pulley. Initial management is a tendon sheath injection with a small amount of glucocorticoid (e.g., 10 mg triamcinolone) directly into the stenosed area (Fig. 2.6). If the trigger finger persists, surgical release is necessary.³¹

Gamekeeper's Thumb

Damage to the ulnar collateral ligament that occurs with sudden hyperabduction is termed a gamekeeper's or skier's thumb. This ligament is vital for open grasp and pinch action of the hand. Swelling and tenderness of the ulnar side of the MCP joint suggest this injury. A roentgenogram of the thumb is obtained to ensure there is no fracture before the MCP joint is tested. To examine for instability, the MCP joint is stressed with the IP joint of the thumb in both extension and flexion.¹⁶ An unstable joint or a roentgenogram that shows a large avulsion fragment necessitates orthopedic referral for possible

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Fig. 2.6. Injection of a trigger finger is performed into the A_1 pulley at the MCP level. The needle can be directed proximally (as shown) or distally.

surgical exploration. Often the interposition of an adductor aponeurosis between the ends of the torn ligament (termed a Stener lesion) prevents ligament healing unless surgery is performed. Early repair of the ligament, within one to two weeks, optimizes return of hand function. If there is tenderness but the MCP joint is stable, a thumb spica splint or cast is applied for two to four weeks and the joint then reassessed for instability.

Infections

Paronychia

A nail bed infection, paronychia is often introduced by minor trauma such as manicuring or nail biting. Redness and swelling occur along the nail folds, and fluctuance is common. Treatment involves a scalpel incision between the nail fold and the nail plate with evacuation of pus; a finger block before incision is optional. The incision is made parallel to the nail plate to avoid damage to the germinal nail matrix. In the unusual event of a subungual abscess, more extensive surgery with partial nail removal is required to drain the abscess. Because an acute paronychia usually involves *Staphylococcus aureus* a short course (five to seven days) of an antistaphylococcal antibiotic is often included. Chronic paronychia is often associated with occupational

water exposure, such as by dishwashers or bartenders.³² The infecting organism is usually *Candida albicans*. Treatment usually includes nail excision.

Felon

Infection of the distal pulp space, or felon, is usually painful because of swelling within a closed space. Minor trauma often provides the nidus for infection. Surgical drainage is required to prevent loss of the entire pulp tissue or to prevent other complications such as osteomyelitis or tenosynovitis. Following a digital block, the felon is drained using one of several surgical techniques.³³ A lateral incision or longitudinal palmar incision is the most common. Incision of the radial side of the index and ulnar side of the thumb and little fingers is avoided to prevent sensory problems in these sensitive areas. Packing material is placed and changed frequently over the next several days, and oral antistaphylococcal antibiotics are administered while the infection resolves.

Tenosynovitis

Infection of a flexor tendon sheath, although an uncommon injury, requires early recognition to prevent serious complications. A position of finger flexion, swelling of the entire finger, and tenderness along the tendon sheath are common findings. The most specific physical finding is severe pain with passive extension of the finger, which leads one strongly to suspect flexor tenosynovitis. In sexually active patients disseminated gonorrhea may also present as tenosynovitis. Emergency orthopedic consultation is suggested for suspected tenosynovitis, as early debridement and aggressive care may allow salvage of the hand, whereas treatment delay of even 24 hours may result in a dramatic loss of finger or hand function.³⁴

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