Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chapter 24: The Forearm, Wrist, Hand, and Fingers**

**Guided Notes**

Blood and Nerve Supply

* Most of the flexors are supplied by the median nerve
* Most of the extensor are controlled by the radial nerve
* Blood is supplied by the radial and ulnar arteries

Recognition and Management of Injuries to the Forearm

* Contusion
	+ Etiology
		- Ulnar side receives majority of blows due to arm blocks
		- Can be acute or chronic
		- Result of direct contact or blow
	+ Signs and Symptoms
		- Pain, swelling and hematoma
		- If repeated blows occur, heavy fibrosis and possibly bony callus could form w/in hematoma
	+ Management
		- Proper care in acute stage involves RICE and followed up w/ additional cryotherapy
		- Protection is critical - full-length sponge rubber pad can be used to provide protective covering
* Forearm Fractures
	+ Etiology
		- Common in youth due to falls and direct blows
		- Ulna and radius generally fracture individually
		- Fracture in upper third may result in abduction deformity due pull of pronator teres
		- Fracture in lower portion will remain relatively neutral
		- Older patients may experience greater soft tissue damage and greater chance of paralysis due to Volkmann's contracture
	+ Signs and Symptoms
		- Audible pop or crack followed by moderate to severe pain, swelling, and disability
		- Edema, ecchymosis w/ possible crepitus
	+ Management
		- Initially RICE followed by splinting until definitive care is available
		- Long term casting followed by rehab plan
* Colles’ Fracture
	+ Etiology
		- Occurs in lower end of radius or ulna
		- MOI is fall on outstretched hand, forcing radius and ulna into hyperextension
		- Less common is the reverse Colles’ fracture (Smith fracture)
			* Anterior displacement of distal fragment
		- Intraarticular fracture is referred to as a Barton fracture
	+ Signs and Symptoms
		- Forward displacement of radius causing visible deformity (silver fork deformity)
		- When no deformity is present, injury can be passed off as bad sprain
		- Extensive bleeding and swelling
		- Tendons may be torn/avulsed and there may be median nerve damage
	+ Management
		- Cold compress, splint wrist and refer to physician
		- X-ray and immobilization
		- Severe sprains should be treated as fractures
		- In children, injury may cause lower epiphyseal separation

Blood and Nerve Supply

* Three major nerves
	+ Ulnar, median and radial
* Ulnar and radial arteries supply the hand
	+ Two arterial arches (superficial and deep palmar arches)
* Special Tests
	+ Tinel’s Sign
		- Produced by tapping over transverse carpal ligament
		- Tingling, paresthesia over sensory distribution of the median nerve indicates presence of carpal tunnel syndrome
	+ Phalen’s Test
		- Test for carpal tunnel syndrome
		- Position is held for approximately one minute
		- If test is positive, pain will be produced in region of carpal tunnel
	+ Valgus/Varus and Glide Stress Tests
		- Tests used to assess ligamentous integrity of joints in hands and fingers
		- Valgus and varus tests are used to test collateral ligaments
		- Anterior and posterior glides are used to assess the joint capsule
	+ Circulatory and Neurological Evaluation
		- Hands should be felt for temperature
			* Cold hands indicate decreased circulation
		- Pinching fingernails can also help detect circulatory problems (capillary refill)
		- Allen’s test can also be used
			* Patient is instructed to clench fist 3-4 times, holding it on the final time
			* Pressure applied to ulnar and radial arteries
			* Patient then opens hand (palm should be blanched)
			* One artery is released and should fill immediately (both should be checked)
		- Hand’s neurological functioning should also be tested (sensation and motor functioning)
* Functional Evaluation
	+ Range of motion in all movements of wrist and fingers should be assessed
	+ Active, resistive and passive motions should be assessed and compared bilaterally
		- Wrist - flexion, extension, radial and ulnar deviation
		- MCP joint - flexion and extension
		- PIP and DIP joints - flexion and extension
		- Fingers - abduction and adduction
		- MCP, PIP and DIP of thumb - flexion and extension
		- Thumb - abduction, adduction and opposition
		- 5th finger - opposition

Recognition and Management of Injuries to the Wrist, Hand, and Fingers

* Wrist Sprains
	+ Etiology
		- Most common wrist injury
		- Arises from any abnormal, forced movement
		- Falling on hyperextended wrist, violent flexion or torsion
		- Multiple incidents may disrupt blood supply
	+ Signs and Symptoms
		- Pain, swelling and difficulty w/ movement
	+ Management
		- Refer to physician for X-ray if severe
		- RICE, splint and analgesics
		- Have patient begin strengthening soon after injury
		- Tape for support can benefit healing and prevent further injury
* Triangular Fibrocartilage Complex (TFCC) Injury
	+ Etiology
		- Occurs through forced hyperextension, falling on outstretched hand
		- Violent twist or torque of the wrist
		- Often associated w/ sprain of UCL
	+ Signs and Symptoms
		- Pain along ulnar side of wrist, difficulty w/ wrist extension, possible clicking
		- Swelling is possible, not much initially
		- Patient may not report injury immediately
	+ Management
		- Referred to physician for treatment
		- Treatment will require immobilization initially for 4 weeks
		- Immobilization should be followed by period of strengthening and ROM activities
		- Surgical intervention may be required if conservative treatments fail
* Tendinitis
	+ Etiology
		- Repetitive pulling movements of (commonly) flexor carpi radialis and ulnaris; repetitive pressure on palms (cycling) can cause irritation of flexor digitorum
		- Primary cause is overuse of the wrist
	+ Signs and Symptoms
		- Pain on active use or passive stretching
		- Isometric resistance to involved tendon produces pain, weakness or both
	+ Management
		- Acute pain and inflammation treated w/ ice massage 4x daily for first 48-72 hours, NSAID’s and rest
		- When swelling has subsided, ROM is promoted w/ contrast bath
		- PRE can be instituted once swelling and pain subsided (high rep, low resistance)
* Carpal Tunnel Syndrome
	+ Etiology
		- Compression of median nerve due to inflammation of tendons and sheaths of carpal tunnel
		- Result of repeated wrist flexion or direct trauma to anterior aspect of wrist
	+ Signs and Symptoms
		- Sensory and motor deficits (tingling, numbness and paresthesia); weakness in thumb
	+ Management
		- Conservative treatment - rest, immobilization, NSAID’s
		- If symptoms persist, corticosteroid injection may be necessary or surgical decompression of transverse carpal ligament
* Dislocation of Lunate Bone
	+ Etiology
		- Forceful hyperextension or fall on outstretched hand
	+ Signs and Symptoms
		- Pain, swelling, and difficulty executing wrist and finger flexion
		- Numbness/paralysis of flexor muscles due to pressure on median nerve
	+ Management
		- Treat as acute, and sent to physician for reduction
		- If not recognized, bone deterioration could occur, requiring surgical removal
		- Usual recovery is 1-2 months
* Scaphoid Fracture
	+ Etiology
		- Caused by force on outstretched hand, compressing scaphoid between radius and second row of carpal bones
		- Often fails to heal due to poor blood supply
	+ Signs and Symptoms
		- Swelling, severe pain in anatomical snuff box
		- Presents like wrist sprain
		- Pain w/ radial flexion
	+ Management
		- Must be splinted and referred for X-ray prior to casting
		- Immobilization lasts 6 weeks and is followed by strengthening and protective tape
		- Wrist requires protection against impact loading for 3 additional months
* Wrist Ganglion
	+ Etiology
		- Synovial cyst (herniation of joint capsule or synovial sheath of tendon)
		- Generally appears following wrist strain
	+ Signs and Symptoms
		- Appear on back of wrist generally
		- Occasional pain w/ lump at site
		- Pain increases w/ use
		- May feel soft, rubbery or very hard
	+ Management
		- Old method was to first break down the swelling through distal pressure and then apply pressure pad to encourage healing
		- New approach includes aspiration, chemical cauterization w/ subsequent pressure from pad
		- Ultrasound can be used to reduce size
		- Surgical removal is most effective treatment method
* Extensor Tendon Avulsion (Mallet Finger)
	+ Etiology
		- Caused by a blow to tip of finger avulsing extensor tendon from insertion
		- Also referred to as baseball or basketball finger
	+ Signs and Symptoms
		- Pain at DIP; X-ray shows
		avulsed bone on dorsal
		proximal distal phalanx
		- Unable to extend distal end
		of finger (carrying at 30
		degree angle)
		- Point tenderness at sight of injury
	+ Management
		- RICE and splinting for 6-8 weeks
* Boutonniere Deformity
	+ Etiology
		- Rupture of extensor expansion dorsal to the middle phalanx
		- Tendon slides below axis of PIP joint
		Forces DIP joint into extension and PIP into flexion
	+ Signs and Symptoms
		- Severe pain, obvious deformity and inability to extend DIP joint
		- Swelling, point tenderness
	+ Management
		- Cold application, followed by splinting
		- Splinting must be continued for 5-8 weeks
		- Athlete is encouraged to flex distal phalanx
* Flexor Digitorum Profundus Rupture (Jersey Finger)
	+ Etiology
		- Rupture of flexor digitorum profundus tendon from insertion on distal phalanx
		- Often occurs w/ ring finger when athlete tries to grab a jersey
	+ Signs and Symptoms
		- DIP can not be flexed, finger remains extended
		- Pain and point tenderness over distal phalanx
	+ Management
		- Must be surgically repaired
		- Rehab requires 12 weeks and there is often poor gliding of tendon, w/ possibility of re-rupture
* Gamekeeper’s Thumb
	+ Etiology
		- Sprain of UCL of MCP joint of the thumb
		- Mechanism is forceful abduction of proximal phalanx occasionally combined w/ hyperextension
	+ Signs and Symptoms
		- Pain over UCL in addition to weak and painful pinch
	+ Management
		- Immediate follow-up must occur
		- If instability exists, athlete should be referred to orthopedist
		- If stable, X-ray should be performed to rule out fracture
		- Thumb splint should be applied for protection for 3 weeks or until pain free
		- Splint should extend from wrist to end of thumb in neutral position
		- Thumb spica should be used following splinting for support
		- If a complete tear occurs, surgical repair is necessary to allow normal function to return
* Swan Neck Deformity and PsuedoBoutonniere Deformity
	+ Etiology
		- Distal tear of volar plate may cause Swan Neck deformity; proximal tear may cause PsuedoBoutonniere deformity
	+ Signs and Symptoms
		- Pain, swelling w/ varying degrees of hyperextension
		- Tenderness over volar plate of PIP
		- Indication of volar plate tear = passive hyperextension
	+ Management
		- RICE and analgesics
		- Splint in 20-30 degrees of flexion for 3 weeks; followed by buddy taping and then PRE
* Metacarpal Fracture
	+ Etiology
		- Direct axial force or compressive force
		- Fractures of the 5th metacarpal are associated w/ boxing or martial arts (boxer’s fracture)
	+ Signs and Symptoms
		- Pain and swelling; possible angular or rotational deformity
	+ Management
		- RICE, analgesics are given followed by X-ray examinations
		- Deformity is reduced, followed by splinting - 4 weeks of splinting after which ROM is carried out
* Bennett’s Fracture
	+ Etiology
		- Occurs at carpometacarpal joint of the thumb as a result of an axial and abduction force to the thumb
	+ Signs and Symptoms
		- CMC may appeared to be deformed - X-ray will indicate fracture
		- Patient will complain of pain and swelling over the base of the thumb
	+ Management
		- Structurally unstable and must be referred to an orthopedic surgeon
* Fingernail Deformities
	+ Changes in normal appearance of the fingernail can be indicative of a number of different diseases
		- Scaling or ridging = psoriasis
		- Ridging and poor development = nutritional deficiencies
		- Clubbing and cyanosis = congenital heart disorders or chronic respiratory disease
		- Spooning or depression = thyroid problems, iron deficiency anemia

Rehabilitation of the Forearm, Wrist, Hand, and Fingers

* General Body Conditioning
	+ Must maintain pre-injury level of conditioning
	+ Cardiorespiratory, strength, flexibility and neuromuscular control
	+ Many exercise options (particularly lower extremity)
* Joint Mobilizations
	+ Wrist and hand respond to traction and mobilization techniques
* Flexibility
	+ Full pain free ROM is a major goal of rehabilitation
	+ The program should include active assisted and active pain free stretching
* Strength
	+ Exercises should not aggravate condition or disrupt healing process
	+ A variety of exercises are available for strength (wrist and hand)
* Neuromuscular Control
	+ Hand and fingers require restoration of dexterity
		- Pinching, fine motor activities (buttoning buttons, tying shoes, and picking up small objects)
	+ It is important to incorporate functional activities designed to restore patient’s ability to perform daily activities
* Return to Activity
	+ Grip strength must be equal bilaterally, full range of motion and dexterity
	+ Thumb has unique strength requirements
	+ A variety of customizable bracing and splinting devices are available to protect injured wrist and hand