NOTES
NEUROPATHIES

GENERALLY, WHAT ARE THEY?

PATHOLOGY & CAUSES

- Peripheral nervous system (PNS) disorders caused by neuronal damage

SIGNS & SYMPTOMS

- Impairment/loss of motor/somatosensory function; "pins and needles" sensation (paresthesia)

DIAGNOSIS

- *History:* characteristic symptoms, sometimes preceding injury

DIAGNOSTIC IMAGING

- Imaging for some conditions

OTHER DIAGNOSTICS

- Electromyography (EMG), nerve conduction studies (NCS)

TREATMENT

MEDICATIONS

- For neuropathic pain

SURGERY

- Surgery to relieve nerve compression

OTHER INTERVENTIONS

- Physiotherapy
  - Helps restore muscle function (if nerves are not severed → may help motor function with partial lesions)
- Splinting (e.g. wrist, ankle)

MNEMONIC: DANG THERAPIST

Peripheral neuropathies common differential diagnosis

Diabetes
Amyloid
Nutritional (e.g. B_{12} deficiency)
Guillain-Barre

Toxic (e.g. amiodarone)
Hereditary (Charcot-Marie-Tooth)
Endocrine
Recurring (10% of Guillain–Barre)
Alcohol
Pb (lead)
Idiopathic
Sarcoid
Thyroid

CARPAL TUNNEL SYNDROME

osms.it/carpal-tunnel-syndrome

PATHOLOGY & CAUSES

- Nerve entrapment disorder → compression of wrist's median nerve
  - Median nerve passes through carpal tunnel
- Carpal tunnel
  - *Floor:* carpal arch
  - *Roof:* flexor retinaculum (transverse carpal ligament)
  - Contains nine flexors, median nerve
- Repetitive stress injury in susceptible people → inflammation → edema → fluid in narrow space compresses structures → nerve injury, impaired neuronal transport/vessel compression, nerve ischemia

CAUSES

- Tendonitis, edema, repetitive stress injury (typing)

RISK FACTORS

- Obesity, pregnancy, other underlying conditions (rheumatoid arthritis), trauma, genetic predisposition, occupation

COMPLICATIONS

- Thenar muscle atrophy

MNEMONIC: TRAMP

Carpal tunnel syndrome common causes

Trauma (occupational)
Rheumatoid arthritis
Acromegaly
Myxoedema
Pregnancy

SIGNS & SYMPTOMS

- Usually unilateral symptoms
- Individual may awake with numbness, tingling (after day of use → worsens at night)
- Initially dull ache, discomfort; paresthesia, sharp pain extending to forearm
- Pain, numbness, tingling in thumb, index finger, middle finger, thumb side of ring finger on palmar side of hand
- Clumsiness, dropping small objects
- No sensation loss in palm's central region
  - Palmar branch of median nerve innervates it, branches off before going through carpal tunnel

DIAGNOSIS

OTHER DIAGNOSTICS

EMG

- Identifies neuropathic changes (sharp waves, ↑ insertional activity)

NCS

- ↓ response amplitude

Physical exam

- Findings that support diagnosis
  - *Phalen maneuver:* pressing of upper hands together while flexing wrists induces pain
  - *Tinel's sign:* tapping on wrist over median nerve elicits pain
  - *Durkan's test:* pressing of median nerve for 30 seconds worsens symptoms
  - Thenar eminence atrophy

TREATMENT

MEDICATIONS

- Corticosteroid injections → ↓ inflammation

SURGERY

- If symptoms persist, cut transverse ligament to relieve pressure

OTHER INTERVENTIONS

- Behavior modification (e.g. adjusting typing position, weight loss)
- Wrist supports, splints
- Physical therapy
  - Helps relieve wrist strain, ↓ symptom severity

MNEMONIC: WRIST

Carpal tunnel syndrome treatment

Wear splints at night
Rest
Inject steroid
Surgical decompression
Take diuretics

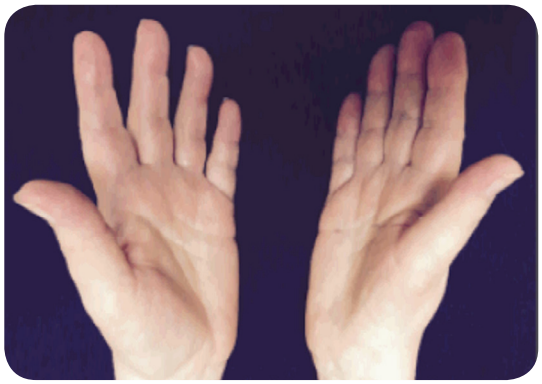

Figure 86.1 Relative wasting of the right thenar eminence in a case of carpal tunnel syndrome.

ERB–DUCHENNE PALSY

osms.it/erb-duchenne-palsy

PATHOLOGY & CAUSES

- Type of neonatal brachial plexus palsy
  - Caused by upper part of brachial plexus injury
  - AKA Erb's palsy
  - *Brachial plexus:* group of nerves provide movement, feeling to shoulder, arm, hand, fingers; roots included in plexus are C5–T1 forming superior, middle, inferior trunks which form lateral, posterior, medial cords
- Nerves affected
  - Axillary
  - Musculocutaneous (biceps brachii, brachioradialis)
  - Suprascapular
- Upper brachial plexus stretching → nerve damage

TYPES

- Brachial plexus injuries
  - Neuropraxia (most common, nerve stretched but not torn)
  - Avulsion (most severe, roots torn from spinal cord)
  - Rupture (nerve torn)
  - Neuroma (nerve torn → healed, scar puts pressure on injured nerve)

RISK FACTORS

- Shoulder dystocia, macrosomia, malpresentation, maternal obesity, cephalopelvic disproportion, prolonged/

difficult labor, precipitous delivery

COMPLICATIONS

- Affected arm grows shorter than other
- Limited range of motion
- Muscle weakness

SIGNS & SYMPTOMS

- "Waiter's tip"
  - Hanging arm rotated medially, extended forearm, fixed wrist
- Affected arm may be held against body; flaccid, flexed at elbow
- Lateral part of forearm sensation loss, circulatory disturbances, paralysis
- Asymmetric Moro reflex
  - Infant spreads only one arm (instead of two) when it feels like it's falling

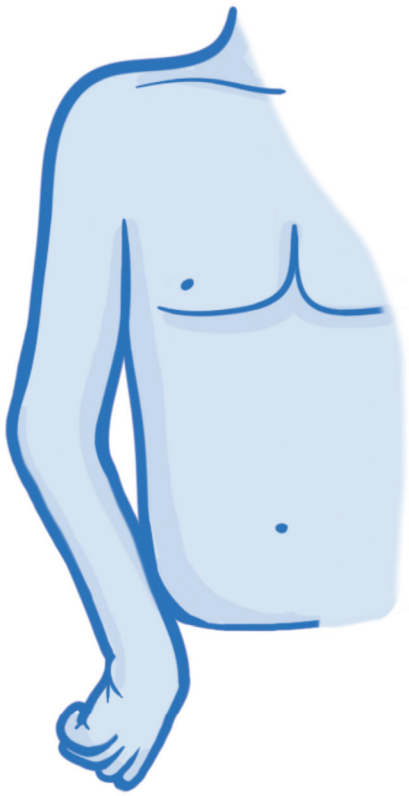

Figure 86.2 An illustration of the "waiter's tip" position.

DIAGNOSIS

DIAGNOSTIC IMAGING

X-ray

- Rule-out fracture

Ultrasound

- May show shoulder dislocation

OTHER DIAGNOSTICS

- Neurological exam
  - Difficult due to limited child movement
  - Involves evaluation of arm range of movement, motility

Electromyoneurography (EMNG)

- Shows damage extent

TREATMENT

SURGERY

- Nerve repair/reconstruction

OTHER INTERVENTIONS

- Physical therapy
  - Promotes muscle strengthening, normal function

KLUMPKE PARALYSIS

osms.it/klumpke-paralysis

PATHOLOGY & CAUSES

- Type of brachial plexus palsy affecting lower brachial plexus nerve roots C8–T1
- Abducted arm during childbirth → arm traction, pulling → nerve stretching in inferior brachial plexus area → brachial plexus damage

CAUSES

- Obstetric injury in adulthood
  - Caused by grabbing things when falling from height

RISK FACTORS

- Birth injury
  - Macrosomia, cephalopelvic disproportion, shoulder dystocia, prolonged/difficult labor, precipitous delivery, abnormal presentations
- Adult trauma
  - Car crashes, falls, contact sports

COMPLICATIONS

- Severe pain, arm immobility

SIGNS & SYMPTOMS

- Claw hand
  - Intrinsic hand muscle atrophy → flexion of interphalangeal, extension of metacarpophalangeal joints
- Sensation loss in appropriate dermatome (medial side of arm), upper-arm weakness

Horner's syndrome

- Ptosis (drooping eyelid)
- Enophthalmos (deep-set eye)
- Miosis (constricted pupil)
- ↓ sweating on one side of face

Figure 86.3 An illustration of the claw hand position.

DIAGNOSIS

OTHER DIAGNOSTICS

- Clinical diagnosis through neurological exam
  - Testing mobility, sensation, Horner's syndrome symptoms

EMG/NCS

- Confirms lesion location, assesses severity

TREATMENT

OTHER INTERVENTIONS

- Physiotherapy, electrical nerve stimulation, occupational therapy
- Repositioning, splinting (extreme damage cases)

SCIATICA

osms.it/sciatica

PATHOLOGY & CAUSES

- Type of neuralgia following sciatic nerve along its distribution path
- Lumbosacral radiculopathy (spinal nerve root disorder) → radicular (radiating, shooting) pain
- Most commonly caused by spinal disc disease → narrowing of neural foramen/intraspinal space → disc profusion outside spinal column border → lumbar/sacral nerve root compression → nerve irritation

CAUSES

- Spinal disc herniation (most common)
- Spinal stenosis (spinal canal narrowing)
- Piriformis syndrome
  - Rare variation of sciatic nerve passing through piriformis muscle → symptoms
- Pregnancy
  - Due to ligament loosening, shifting of center of gravity pressure on nerve
- Nerve tumors (schwannoma), trauma
- Younger individuals
  - Infection

RISK FACTORS

- Preexisting spinal disorders
- Age: ↑ risk
- Biologically-male individuals

COMPLICATIONS

- Nerve damage, muscle atrophy, immobility, permanent sensation loss

SIGNS & SYMPTOMS

- Sudden shooting pain onset radiating from lumbar spine → down leg → areas innervated by sciatic nerve (side, back)
  - Mostly unilateral
- Pain may involve lower back, hip, foot
- Numbness, muscle weakness, burning sensation

DIAGNOSIS

DIAGNOSTIC IMAGING

X-ray, MRI

- Confirms disc herniation, stenosis, tumors as etiology; determines management

OTHER DIAGNOSTICS

- Clinically diagnosed
  - *Straight leg raise test:* passive straight leg raising between 30–70° while lying down, produces Lasègue's sign (positive if pain present); not very specific
  - *Crossed straight leg raising test:* has higher specificity, not very sensitive

TREATMENT

MEDICATIONS

- Pain management (nonsteroidal anti-inflammatory drugs (NSAIDs), opioids)

SURGERY

- Spinal disc repair (severe symptoms)

OTHER INTERVENTIONS

- Recommend normal activity

THORACIC OUTLET SYNDROME

osms.it/thoracic-outlet-syndrome

PATHOLOGY & CAUSES

- Compression of neurovascular bundle in space between clavicle, first rib; traverses thoracic outlet
  - Can result from combination of developmental abnormalities, injuries, physical activities that predispose neurovascular compression

TYPES

Structures involved

- Neurogenic
  - Brachial plexus compressed
  - Most common
- Venous
  - Subclavian vein
- Arterial
  - Subclavian artery

Obstruction areas

- Anterior scalene
  - Inflammation/structural anomaly (multiple attachments) → scalene muscle presses down onto structures, brachial plexus compressed
  - Most common
- Cervical rib
  - Congenital abnormality of additional rib, subclavian vein compressed
  - More common in biologically-female individuals
- Costoclavicular
  - All structures may be involved
  - Second most common

CAUSES

- Repetitive motion → chronic inflammation
- Congenital
  - Cervical rib, supernumerary muscle insertions
- Neck hyperextensions

RISK FACTORS

- Coagulation disorders, pregnancy, tumors, trauma
- Repetitive movement sports (swimming, handball)

COMPLICATIONS

- Stroke (arising from retrograde thrombi); deep venous thrombosis; arterial thromboembolism; atrophy; neural damage, paralysis; limb ischemia

SIGNS & SYMPTOMS

- Differ according to structure involved, unilateral presentation more common
- Neurogenic
  - Pain, numbness, paresthesia (tingling), weakness when raising arm, muscle atrophy (thumb muscles)
- Venous
  - Swollen, painful, cyanotic (blue) arm; spontaneous edema, may cause paresthesia
- Arterial
  - Cold, painful, pale arm; ↓ systolic blood pressure in affected arm, diminished distal pulses, aneurysmal change in artery after compression may → thrill over subclavian artery; thromboembolism → worsening symptoms, ischemia

DIAGNOSIS

DIAGNOSTIC IMAGING

Upper-extremity ultrasound, angiography

- Shows blood clot formation in vessels; distinguishes between arterial, venous etiology

Chest X-ray
- Identifies bone abnormalities

CT scan
- Identifies compression areas in greater detail

MRI
- Identifies brachial plexus compression, contrast displays vessel occlusion level

OTHER DIAGNOSTICS

Physical exam
- Examine limbs for signs of neural, venous/arterial insufficiency
- Blood pressure difference between arms indicates arterial involvement
- *Adson test:* raising arms above head induces further compression → distal pulse diminishment

EMNG
- Confirms neurological dysfunction

TREATMENT

MEDICATIONS
- Local corticosteroid, anesthetic injections (symptom relief)
- Thrombolysis (in vascular clot cases)

SURGERY
- Decompression techniques

OTHER INTERVENTIONS
- Physical therapy
  - Stretching, exercise

ULNAR CLAW

osms.it/ullnar-claw

PATHOLOGY & CAUSES

- Two medial fingers (fourth, fifth) become flexed at interphalangeal level, extended at metacarpophalangeal level
  - Due to ulnar nerve damage, hand resembles "claw"
- Prolonged ulnar nerve pathway pressure → nerve injury → hand muscle wasting (except thenar, two lateral lumbricals); flexor carpi ulnaris, flexor digitorum profundus → fourth, fifth finger flexion at interphalangeal joint, extension at metacarpophalangeal joint

Injury level
- Low
  - Wrist, damage usually more severe
  - Lesion site of nerve within wrist area doesn't influence symptoms
  - *Cause:* usually trauma/repetitive movement
- High
  - *Cause:* regularly leaning against elbows

CAUSES
- Prolonged pressure on Guyon's canal (where ulnar nerve passes)
- Trauma

RISK FACTORS
- *Biologically-male individuals:* ↑ BMI
- *Biologically-female individuals:* ↓ BMI
- Cubitus valgus (forearm at pathological angle)
- Cycling
- Leaning against desk

- Tool use requiring downward pressure (musical instruments)

COMPLICATIONS

- Nerve palsy

SIGNS & SYMPTOMS

- Range in severity from mild intermittent paresthesia to complete sensation loss, atrophy
- Flexion at interphalangeal joints, extension at metacarpophalangeal
- Weakness, dexterity loss

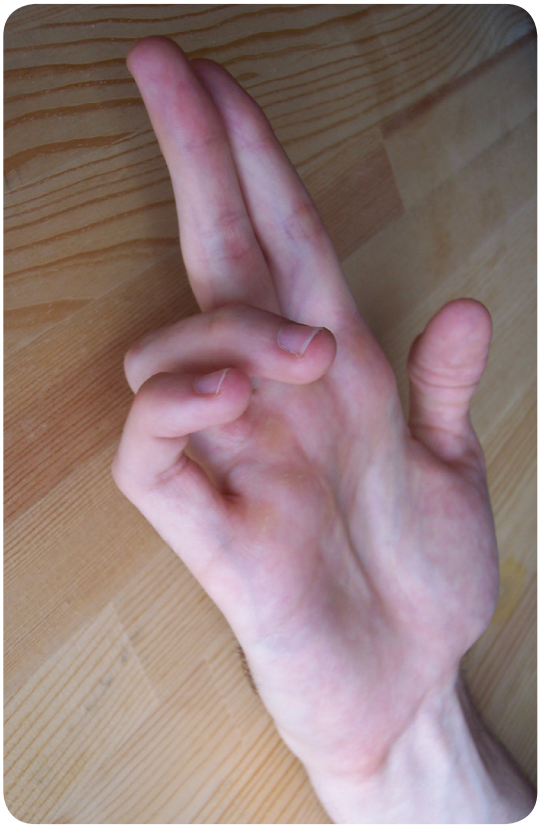

Figure 86.4 A left hand demonstrating an ulnar claw.

DIAGNOSIS

DIAGNOSTIC IMAGING

Ultrasound

- Identifies local inflammation in Guyon's canal (where ulnar nerve passes)

MRI

- Identifies nerve thickening

OTHER DIAGNOSTICS

Clinical exam

- Identify injury level
  - Elbow has different muscles involved (flexor carpi ulnaris, flexor digitorum profundus)
  - *Froment's sign:* card gripped using interphalangeal joints (abductor pollicis weak)
  - Finger abduction, pressing hands together causes one side to collapse

EMNG

- Identifies neural damage level in fingers

TREATMENT

SURGERY

- Severe injury
  - Nerve decompression at level of Guyon's canal

OTHER INTERVENTIONS

- Lighter injury
  - Physical therapy, occupational therapy
- Splints, avoiding exacerbation

WINGED SCAPULA

osms.it/winged-scapula

PATHOLOGY & CAUSES

- Abnormal scapula protrusion from back of chest wall, usually unilateral
  - AKA scapula alata
- Caused by muscle weakness
  - Serratus anterior: damage either to brachial plexus, long thoracic nerve (most common)
  - *Trapezius:* damage to accessory nerve
  - *Rhomboid:* damage to dorsal scapular nerve
- Nerve damage, irritation/muscular dystrophy → muscle weakness → scapula elevation from thoracic wall → scapula winging

RISK FACTORS

- Neck lymphadenectomy
- Neuromuscular disorder
- Idiopathic
- Traumatic
  - Neck injury, repetitive movement, backpack straps, sleeping in bad position, surgery
- Non-traumatic
  - Viral neuritis (influenza), allergy, toxic; neuromuscular disorders (facioscapulohumeral muscular dystrophy)

COMPLICATIONS

- Compensatory back muscle imbalance

SIGNS & SYMPTOMS

- Fatigue
- Neck, shoulder pain
- Scapular winging, shoulder asymmetry
- Muscle weakness, difficulty lifting objects, difficulty raising arm above head

DIAGNOSIS

DIAGNOSTIC IMAGING

X-ray

- Confirms absence of fractures, structural irregularities

OTHER DIAGNOSTICS

- Scapular asymmetry, winging

TREATMENT

SURGERY

- Nerve transfer, scapular fixation

OTHER INTERVENTIONS

- May resolve spontaneously
- Massage therapy
  - Muscle relaxation
- Physical therapy
  - Improves shoulder weakness

Figure 86.5 Winged scapula in an individual with a long thoracic nerve palsy.