

Plexopathies

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BRACHIAL PLEXUS BIRTH TRAUMA → see p. Ped9 >>	

ETIOLOGY

- 1) *trauma*
- 2) *neoplastic* compression / infiltration (early prominent **pain** is characteristic!).
- 3) *radiation* (**painless** and progressive weakness, usually bilateral but asymmetrical).
- 4) *immunologic attack* (e.g. *brachial neuritis*, s. PARSONAGE-TURNER syndrome).
- 5) *diabetes mellitus*.
- 6) *neurofibromatosis*.

CLINICAL FEATURES

- **anatomy is complex** (difficult to recognize and localize) - different patterns of **motor** and **sensory** loss - depending on which portion of plexus is affected.
- best clue is motor & sensory deficit that involves more than one spinal or peripheral nerve.
 - **motor signs** (weakness, tendon jerk loss, atrophy) are much more prominent than **sensory changes** (often patchy and incomplete).
 - diffuse aching **pain** (sometimes quite severe) is often present!
- **plexus avulsion pain** is usually severe and immediate in onset: constant burning, crushing + intermittent shocklike pain.

DIAGNOSIS

- **imaging**: N.B. **high-resolution MRI** is modality of choice!
 - 1) **empty enlarged nerve root sleeve**, often with contrast **extravasation** through rent in dura
 - 2) **pseudo-meningoceles** (meninges pulled through intervertebral foramina) at levels of root avulsion.
 - 3) **failure to visualize avulsed intradural roots** in cervical* region when uninvolved rootlets are clearly visible.
 - *roots usually seem intact in lumbosacral plexus avulsion injuries
 - 4) look for **neuroma** at stumps of avulsed roots
- **EMG** is fundamental in localizing lesion (usually EMG is done 4 weeks after acute injury).
- plexus stretch injuries vs. avulsion injuries (avulsion injuries respond well to DREZ lesioning vs. stretch injuries).
 - pure root injuries leave dorsal root ganglion intact - distal **nerve conduction velocities** are intact.
 - **evoked potential** (after median nerve stimulation) shows delay at Erb's point.
 - N9 dorsal root ganglion **evoked potential** is preserved in pure root avulsion.
- **CSF** may contain blood.

TREATMENT

- **acute transections** (lacerations with knife or glass) → rapid **primary repair**.
- **closed stretch injuries** with severe axonal degeneration 3-5 months after injury → **surgical exploration and repair**.
- **missile wounds** (usually leave nerve in continuity) - initial management is often **conservative**.
- **avulsion of roots** - **untreatable injury**; implantation of ventral roots into spinal cord may lead to recovery of motor function in animal and human studies.
- not improving **obstetrical palsy** → **surgery** at 3-9 months of age.

Pain management:

- **plexus avulsion pain** → DREZ lesioning.
- **distal stretch injuries** → spinal cord or deep brain stimulation.

PROGNOSIS

- because of long regeneration distances, **intrinsic hand muscles** and **muscles below knee** reinnervate poorly after axon loss lesions.

BRACHIAL PLEXOPATHIES

Trauma* is most common cause! other causes → see above >>

*stretching (motorcycle accidents, football injuries, breech delivery), penetrating

1. **COMPRESSIVE injuries**
 - **neoplastic** plexopathies are characteristically painful; > 70% involve **lower trunk** and are due to axillary lymph node infiltration.
2. **OPEN injuries** most often affect **infraclavicular** plexus; often associated with injuries to major vessels and lung.
3. **CLOSED injuries**: birth trauma → see p. Ped9 >>
 - a) **supraclavicular** - usually occur after high-speed motor vehicle accidents, often when rider is thrown from motorcycle, resulting in severe stretch injuries or avulsion of roots from cord.
 - Horner's syndrome strongly suggests avulsion.
 - b) **infraclavicular** - better prognosis (result of bony injuries in shoulder region; clavicular callus may compress plexus).

CLINICAL SYNDROMES

COMPLETE BRACHIAL PLEXUS lesion – **flail, anesthetic upper extremity** (except for medial strip along arm supplied by intercostobrachial branch of 2nd intercostal nerve).

DUCHENNE-ERB palsy (C₅₋₆ roots or **upper trunk** lesion)

Causes:

- 1) most common cause – **downward arm displacement**: fall from horse or motorcycle, obstetrics (*shoulder dystocia*).
- 2) **direct pressure** by carrying heavy objects (KNAPSACK PALSY), heavy backpacks; prolonged firing of shotguns; shoulder restraints in motor vehicles.
 - long necks, droopy shoulders, pendulous breasts may be contributing factors.
- 3) **idiopathic brachial neuritis** (s. PARSONAGE-TURNER syndrome, neuralgic amyotrophy).
- 4) **radiation-induced** plexopathy.

Clinical features – mainly **shoulder & upper arm** muscles (deltoid, biceps, brachialis anticus, brachioradialis, pectoralis major, supraspinatus, infraspinatus, subscapularis, teres major) - “waiter’s tip” position:

- upper arm hangs adducted (m. deltoideus – n. axillaris) and internally rotated (m. infraspinatus – n. suprascapularis).
- can’t flex elbow; forearm is pronated (m. biceps brachii – n. musculocutaneus).
- can’t reach with hand contralateral shoulder (*clavicular head of m. pectoralis major – n. pectoralis lat.*).
- *sensory loss* is incomplete (hypesthesia on outer surface of shoulder, arm and forearm).

DEJERINE-KLUMPKE palsy (C8-Th1 roots or lower trunk lesion)Causes:

- 1) **upward arm displacement**: obstetrics (*breech delivery*), shoulder dislocation.
- 2) **metastatic** plexopathy (axillary lymph nodes), infiltrating **tumor** from lung apex (Pancoast tumor).
- 3) true neurogenic **thoracic outlet syndrome**, cervical rib, scalene syndrome.
- 4) coronary artery bypass surgery (associated with sternal retraction).

Clinical features – mainly **forearm & hand** muscles:

- n. ulnaris + n. medianus (flexor carpi ulnaris, flexor digitorum, interossei, thenar and hypothenar) – can’t flex wrist, “claw hand”, “simian (flattened) hand”.
- n. pectoralis med. – can’t adduct upper arm.
- lesion to communicating branch to inferior cervical ganglion → *Horner's syndrome*.
- *sensory* - hypesthesia on inner arm / forearm / hand.

Middle Radicular Syndrome (C7 root or middle trunk lesion) - paralysis of n. radialis muscles (except brachioradialis, which is spared entirely).

- *sensory loss* is inconstant (hypesthesia over dorsal forearm surface and external part of dorsal hand surface).

“BURNERS” / “STINGERS” - symptoms following sudden shoulder depression in contact sports, usually football.

- burning dysesthesias going down ipsilateral upper extremity (often into thumb) ± weakness of biceps and shoulder girdle muscles.
- symptoms resolve within few minutes (occasional cases last for weeks).

Root avulsions more commonly involve C7-Th1 roots, whereas **extraforaminal ruptures** more commonly affect C5-6 roots.

DIAGNOSIS

- **plain cervical films** - fractured cervical transverse processes - presumptive evidence of nerve injury.
- **cervical myelography** or **MRI** (2-4 weeks* after injury) - **traumatic pseudomeningoceles** at site of avulsed nerve roots.

*root avulsion is generally *not investigated radiologically* in acute stage

TREATMENT

- flail or weak arm should be supported (immobilized across upper abdomen) against gravity to prevent additional damage!
- injury by **sharp object** (knife, glass, needles) → **early surgical intervention**.
 - **lost neural tissue** during initial exploration (for repair of other injuries) → **early grafting** (after allowing local edema to resolve).
- **blunt injuries** → **observation** (duration depends on proximal or distal location of injury).
- **gun shot wounds** → **observation** for up to 3 months (to help establish degree of neural injury); if serial examinations demonstrate 4-5° lesions → **surgical intervention**.
- **root avulsions** (flail arm) → **grafting of intercostal nerves to distal end of musculocutaneous nerve** (gives useful elbow flexion when combined with distal limb prosthesis).

NEURALGIC AMYOTROPHY (s. brachial plexitis, PARSONAGE-TURNER syndrome, shoulder-girdle syndrome)

Similar disorder may affect LUMBOSACRAL plexus!

- unknown cause (sporadic >> familial) - viral or immunologic inflammatory processes?
- typically young men.
- often preceded by some **antecedent event** (e.g. upper respiratory infection, hospitalization, vaccination, non-specific trauma, intravenous heroin, **general anesthesia!!!**).
- may be **bilateral** and asymmetric.
- **upper trunk** suffers most (actually, multiple proximal mononeuropathies):
 - sudden onset of **severe pain** (usually about shoulder; often begins at night).
 - soon followed by **weakness & wasting** of various forequarter muscles (esp. shoulder girdle); weakness is maximal within few days then regresses.
- **nerve conduction studies** - **axonal** neuropathy (**demyelination** may play role in rare instances).
- CSF is normal.
- establish diagnosis - EMG
- corticosteroids have no proven benefit.
- clinical recovery takes 2 months ÷ 3 years (so don’t rush to operate!!!): good in 66%, fair in 20%, poor in 14%; if no improvement by 18-24 months, may recommend tendon transfer surgery.

LUMBOSACRAL PLEXOPATHIES**ETIOLOGY**

- 1) most frequently - **penetrating** injuries.
 - N.B. plexus is better protected in its *retroperitoneal & pelvic location* - injury is not as common as brachial plexus injury!
- 2) hip **surgery**, pelvic **fractures**, pelvic **hematomas** in psoas muscle (e.g. due to anticoagulation).
- 3) **labor & delivery** (pressure by fetal head or forceps).
- 4) direct **neoplastic** infiltration.
- 5) **radiation** induced fibrosis (painless and progressive weakness, usually bilateral but asymmetrical)
- 6) **idiopathic plexitis**.

CLINICAL FEATURES

- most of motor output of **lumbar plexus** is in *femoral nerve*; of **sacral plexus** in *sciatic nerve* - it may be difficult to distinguish lumbosacral plexus lesions from lesions of their respective nerves.
 - weakness of thigh adduction or sensory loss in inguinal region or over genitalia, are outside distribution of *femoral nerve*.
 - weakness of thigh abduction & internal rotation and of hip extension, or sensory loss on posterior thigh are lacking in *sciatic nerve* palsy.

BIBLIOGRAPHY for ch. "Peripheral Neuropathies" → follow this [LINK](#) >>