

# 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

- **myelography**:
  - 1) **empty enlarged nerve root sleeve**, often with contrast **extravasation** through rent in dura; **pseudo-meningoceles** (meninges pulled through intervertebral foramina) at levels of root avulsion.
  - 2) **failure to visualize avulsed intradural roots** in cervical\* region when uninvolved rootlets are clearly visible.
    - \*roots usually seem intact in lumbosacral plexus avulsion injuries

N.B. **high-resolution MRI** is becoming imaging modality of choice!
- **EMG** is fundamental in localizing lesion.
- **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 2<sup>nd</sup> intercostal nerve).

**DUCHENNE-ERB palsy** (C<sub>5-6</sub> 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** (C<sub>8</sub>-Th<sub>1</sub> 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** (C<sub>7</sub> 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 C<sub>7</sub>-Th<sub>1</sub> roots, whereas **extraforaminal ruptures** more commonly affect C<sub>5-6</sub> 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).
- 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.
- corticosteroids have no proven benefit.
- clinical recovery takes 2 months ÷ 3 years: good in 66%, fair in 20%, poor in 14%.

**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](#) >>