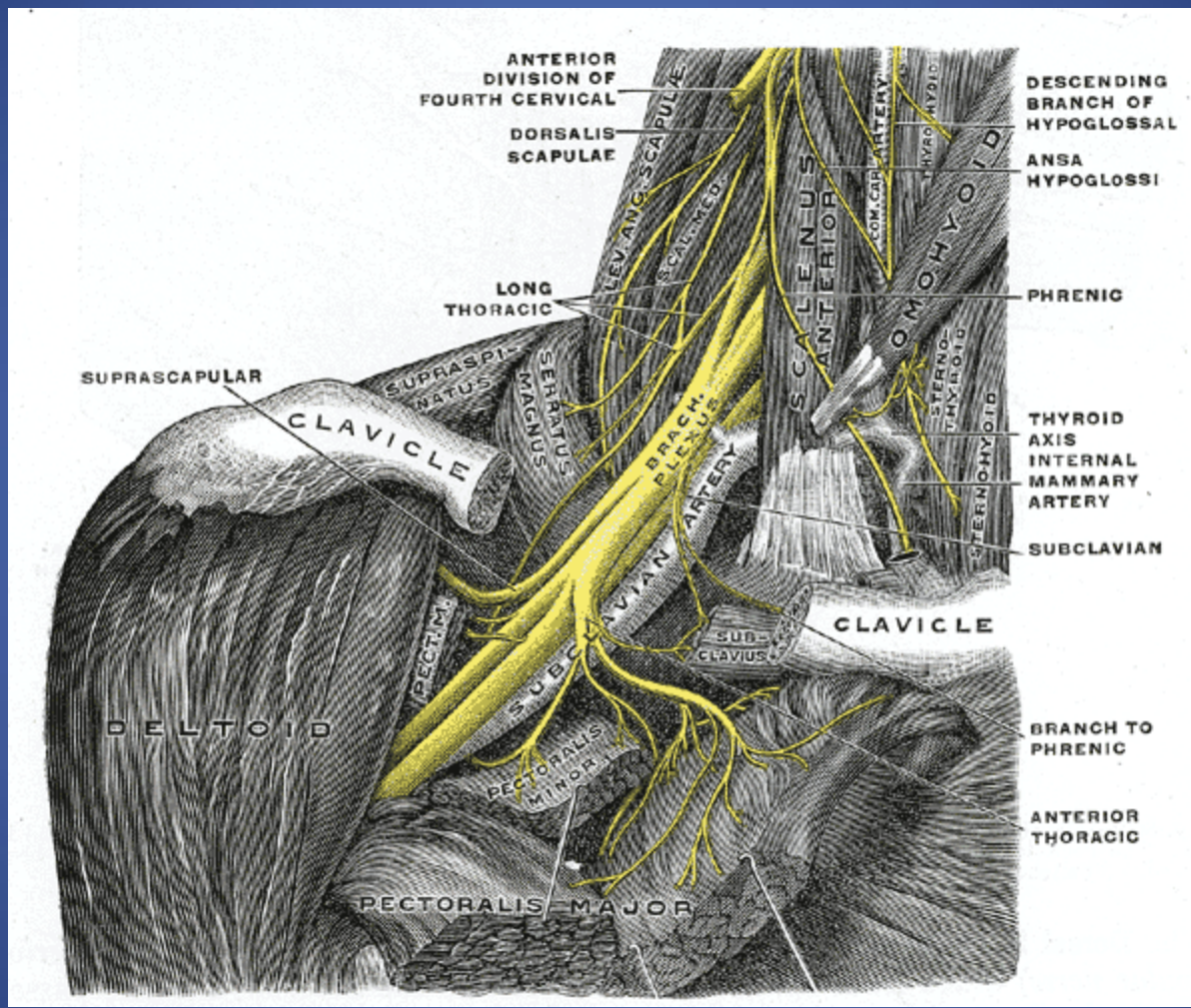


Peripheral Paresis of the Plexus brachialis

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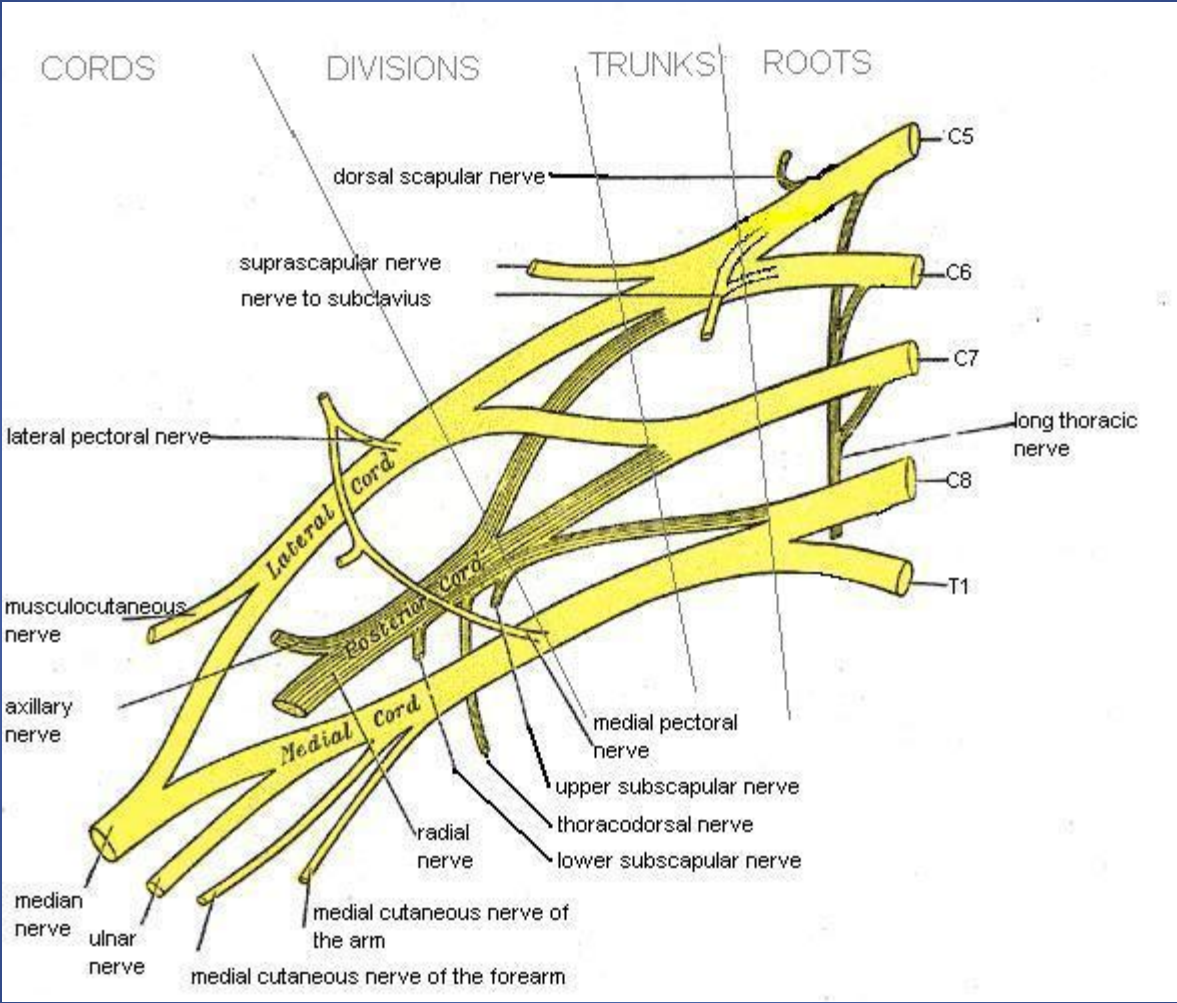
Anatomy

- arrangement of nerve fibers
- running from the spine, formed by the ventral rami of the nerve roots, specifically from above the fifth cervical vertebra to underneath the first thoracic vertebra (C5-T1)
- proceeds through the neck, the axilla and into the arm



The Path of the Plexus brachialis

- **Five roots:** the five anterior rami of the spinal nerves
- **Three trunks:**
 - "superior" or "upper,, trunk (C5-C6)
 - "middle,, trunk (C7)
 - "inferior" or "lower,, trunk (C8-T1)
- **Six divisions:**
 - anterior division of the upper, middle and lower trunks
 - posterior division of the upper, middle, and lower trunks
- **Three cords:**
 - Posterior cord is formed from the three posterior divisions of the trunks (C5-T1)
 - Lateral cord is the anterior divisions from the upper and middle trunks (C5-C7)
 - Medial cord is simply a continuation of the anterior division of the lower trunk (C8-T1)



Function

The brachial plexus is responsible for cutaneous and muscular innervation of the entire upper limb

Two exceptions:

- M. trapezius is innervated by the spinal accessory nerve
- an area of skin near the axilla is innervated by the N. intercostobrachialis

Main Causes

- excessive stretching and avulsion injury
- traumatic injuries are often caused by high-velocity motor vehicle accidents, especially in motorcyclists
- injury from a direct blow to the lateral side of the scapula is also possible

General Signs

- weakness in the arm
- diminished reflexes
- corresponding sensory deficits
- atrophy of the shoulder girdle and M. deltoideus
- the arm sags flaccidly and is internal rotated
- shoulder is lower and protracted
- scapula sticks out

Classification of the Brachial plexus injury

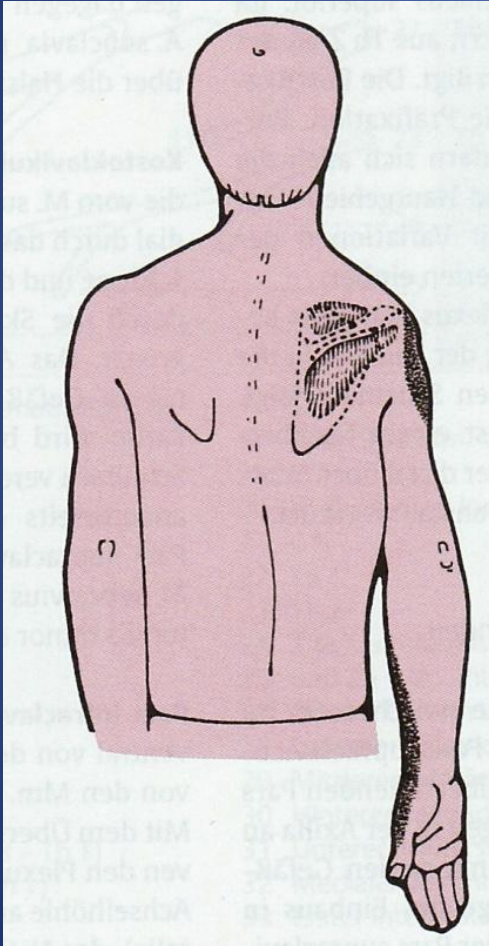
Upper brachial plexus lesion

- Lesion of C5 – C7
- also called a waiters tip deformity or Erb's palsy

Causes

- forceps delivery
- excessive lateral neck flexion away from shoulder (e.g. falling on the neck at an angle)

Upper brachial plexus lesion



Signs

- Paresis of:
 - Scapula muscles
 - lateral rotators of the shoulder
 - Elbow flexors and extensors and supinators and pronators
 - hand and finger extensor muscles
- Diminished sensitivity or complete loss:
 - Lateral side of the humerus
 - Radial side of the forearm
 - Radial half of the hand

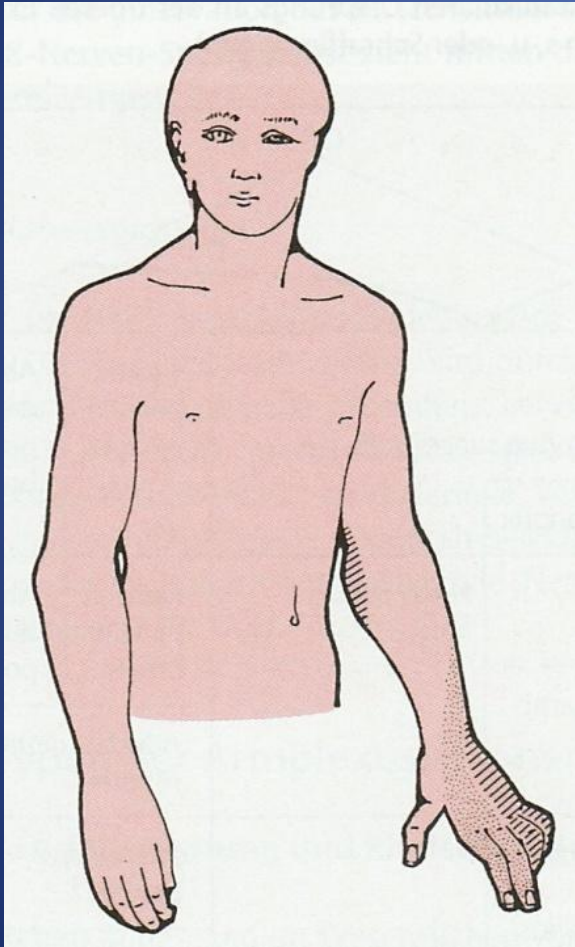
Lower brachial plexus lesion

- Lesion of C8 and T1
- results from hyperabduction of the arm leading to a claw hand deformity
- also called Klumpke's palsy

Causes

- sudden upward pulling on an abducted arm

Lower brachial plexus lesion



Signs

- Diminished sensibility around the ulnar side of the hand and ulnar side of the forearm
- Paresis of:
 - Intrinsic muscles of the hand
 - long fingerflexors

Clinical Diagnostics

- Tests for muscular strength
- Measurement of sensibility
- Electromyography

Therapy

Conservative treatment

- keeping the arm safe in 60° flexion and abduction
- physiotherapy including electrotherapy

Surgery

- nerve suture
- nerve transplantation
- neurotization

specific clinical problem

A 55 year old male patient with peripheral paresis of the plexus brachialis through 6 hours lying trauma after heart attack with coma. He shows weak grasping and reaching of the left arm.

PNF TREATMENT

- **Positive approach** (what he can do)
The goal is to find out what the patient can do, to help him stimulate the weaker part with a stronger part of the body.
- **Functional work** (ADL)
Help with irradiation (amount of impulse that we recognize in nerve system), find a connection with ADL, use of reinforcement (time and space).
- **Unpainful** (motivation, homework)
- **The whole patient** (not a part of the body)
It`s always a reaction of the whole body and not only a part of the patient. Considering the whole patient for a good result.

PNF Principles

Exteroceptive stimuli

- Tactile stimulation (space orientation , skin, muscle reflexes, safeness, sensor input for PT and the patient)
- Verbal stimulation (communication with the patient, friendly, short, clear and understandable)
- Visual stimulation (important for patients with a loss of sensor stimulus, helpful for irradiation)

PNF Principles

Proprioceptive stimuli

- Optimal resistance (more motor units, self awareness of the function, optimal resistance leads to good irradiation in other parts of the body).
- Joint stimulation (approximation for stabilization, not traction for movement)
- Stretch reflexes for muscle stimulation (at the beginning and during the movement)

In the groove

Irradiation

- A large amount of stimuli in order to activate as much motor units as possible to influence on the motor-nerve system and sensor influence on the whole body.
- Activation of the stronger body parts in order to get a reaction in a weaker part
- On the same diagonal in opposite direction
- A response to the movement against the resistance
- For nerve facilitation
- For better body awareness

Reinforcement

The goal is to increase afferent input from different parts of the body, to enlarge the sum of information to the CNS. On that way we activate more motor units and there is an optimal muscle response.

- Space summation (inputs on more neurons)
- Time summation (more inputs on one neuron)

Timing for emphasis

- To reinforce a weaker part of the movement in a pattern
- Two stable joints and dynamic work in the hand
- Agonist reversal and/or re-stretch

Activity to improve

- To help to grasp an object
- To help to put a sleeve on the left arm

Impairment

- Bad perception
- Bad nerve activity
- Not enough strength
- Decreased coordination

Pre-treatment test

- Ability to hold an object (time, size).
or
- Measuring the strength of the hand with a power meter.
or
- The distance (how high) to raise an arm.
or
- The distance (how high) to raise an arm with an object in a hand.

Treatment

Lying on the back

1. Ext-abd-ir with knee ext of the right leg while holding a bed with left hand and oposite pattern, dinamic reversal, indirect treatment



Treatment

Lying on the back

2. Ext-add-ir of the arm with elbow flexion, timing for emphasis, flex of the hand, repetitive stretch, direct treatment



3. Flex-add-er with elbow flexion, timing for emphasis, arm in a position 90° flex, in front of the eyes, rhythmic initiation, direct treatment



Side lying on the right arm on the bed

1. Left arm on the overball, stabilizing reversal of scapula indirect treatment
2. Left arm on the overball, scapula AE, agonist reversal, indirect treatment
3. Pelvis PD/AE, while holding the bed with a left arm, dynamic reversal, indirect treatment



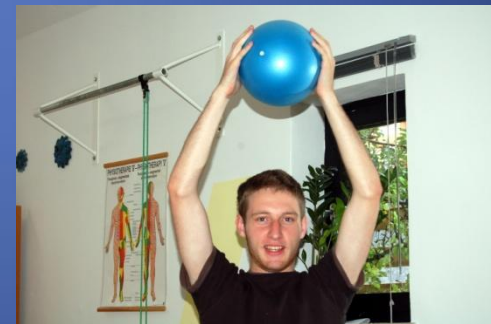
Sitting

1. Patient is holding a chair with his left hand, ext-add-ir with the right arm, agonist reversal, indirect treatment
2. Flex-abd-er with the left arm with elbow flexion, combination of isotonics, direct treatment
3. Bilateral symmetric arm pattern flex-add-er, combination of isotonics



standing

1. On a balance pad, holding to the wall bars, ext- abd-ir with the elbow ext of the right arm, agonist reversal, indirect treatment
2. Standing near the wall, with a left hand on the ball on the wall, flex-add-er with knee flex of the right leg, agonist reversal, indirect treatment
3. Holding overball with both hands, trying to raise up both hands, bilateral symmetric pattern, flex-add-er rhythmic initiation, direct treatment



The treatment plan mentioned above is only an example of treatment and needs to be flexible according to the patient abilities, general and specific goals, progress,...

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