Injuries of the Brachial Plexus:

Superior parts: C5, C6: Erb-Duchenne Palsy
- caused by an increased angle between neck and shoulder, eg. falling on your head.
- Causes “Waiter’s Tip” position, where the limb hangs limp in a medially rotated position
- Deltoid, biceps, brachialis and brachioradialis are paralysed. Lateral arm loses sensation

Compression of the Cords
- Caused by prolonged hyperabduction, eg. painting the ceiling; cords get pinched between coracoid process and pectoralis minor tendon
- Causes pain radiating down the arm, hand numbness, hand weakness, and erythema

Inferior parts: C8, T1: Klumpke Paralysis
- caused when the arm is suddenly pulled superiorly, eg. when you grab something while falling vertically down
- short muscles of the hand are affected, and you get a “claw hand”
RELATIONSHIPS OF THE BRACHIAL PLEXUS

ROOTS
enter the neck between the bodies of the Anterior Scalene and the Medial Scalene muscles

TRUNKS
enter the apex of axilla through the cervicoaxillary canal

DIVISIONS
form behind the clavicle, in the cervicoaxillary canal

CORDS
Form around the second part of the axillary artery, and are named according to their position in relation to it.

Axillary nerve
Which curves upward to innervate the Deltoid and Teres Minor muscles

Radial nerve
Profunda Brachii: Deep Artery of the arm

Musculocutaneous nerve
Which pierces the coracobrachialis around here, and innervates the anterior compartment of the arm

Median nerve
Which continues down the arm lateral to the brachial artery

Ulnar nerve
Which lies medial to the brachial artery
SUPPLY DISTRIBUTION OF THE BRACHIAL PLEXUS

Lateral cord
- Lateral pectoral nerve
  - Pectoralis major

Medial cord
- Medial pectoral nerve
- Medial cutaneous nerve of arm
  - Skin on the medial surface of arm up to the elbow
- Medial cutaneous nerve of forearm
  - Skin on the medial surface of forearm up to the elbow
- Medial cutaneous nerve of arm
- Medial cutaneous nerve of forearm
- Medial pectoral nerve
  - Pectoralis minor and sternocostal part of pectoralis major

Posterior cord
- Upper subscapular nerve
- Lower subscapular nerve
- Superior half of subscapularis
- Inferior half of subscapularis AND teres major
- Glenohumeral joint
- Teres minor
- Deltoid
- Skin over the deltoid
- ALL MUSCLES IN THE POSTERIOR COMPARTMENT OF THE ARM AND FOREARM
- Skin over posterior and inferolateral forearm
- Some of the dorsum of the hand

RADIAL NERVE
- Thoracodorsal nerve
  - Latissimus Dorsi

ULNAR NERVE
- Intrinsic muscles of the hand, EXCEPT for the ulnar part of flexor digitorum profundis
- Thenar muscles: EXCEPT adductor pollicis and the deep part of flexor pollicis brevis
- First and second lumbricals
- Flexor carpi ulnaris
- Ulnar half of the flexor digitorum profundis to the pinky and ring fingers

ANTERIOR COMPARTMENT OF THE ARM:
- Biceps, coracobrachialis, brachialis
- Skin over the lateral forearm, once it becomes cutaneous in the cubital fossa

EXCEPT:
- The ulnar part of flexor digitorum profundis
- The thenar muscles
- Adductor pollicis
- Deep part of flexor pollicis brevis
- First and second lumbricals

INFRASPINATUS
GLUTEUS MINOR
OBLIQUES
GLUTUS MAXIMUS
EXTERNAL OBSCURIS
RECTUS ABDOMINIS
SERRATIANTERIOR

Rhomboïd; levator scapulae
- Subclavius and sternoclavicular joint
- Supraspinatus
- Infraspinatus
- Glenohumeral joint
Course of the Median Nerve

Forms from the MEDIAL and LATERAL cords of the brachial plexus

Runs lateral to the brachial artery

Sits on top of the coracobrachialis muscle

Crosses anteriorly over the brachial artery when it encounters the brachialis muscle

Then, runs medial to the brachial artery

Runs under the biceps into the cubital fossa

Cubital fossa

Gives a branch to the elbow joint; THERE ARE NO OTHER BRANCHES ABOVE THE ELBOW

Gives branches to the anterior compartment muscles of the forearm

Gives rise to the ANTERIOR INTEROSSEOUS NERVE

The ANTERIOR INTEROSSEOUS NERVE Runs between the flexor digitorum profundis and the flexor pollicis longus, on top of the interosseous membrane, until it hits pronator quadratus.

Flexor pollicis longus

Becomes superficial at the wrist

Flexor Retinaculum

Supplies the 1st and 2nd lumbrical muscles

Recurrent branch to the thenar muscles

Palmar cutaneous branch to the skin of the palm
**Course of the Radial Nerve**

- Starts as the direct continuation of the posterior cord
- Runs posterior to the brachial artery
- On top of the long head of the triceps
- Gives branches to innervate the long head and the lateral head of triceps brachii BEFORE it crosses the humerus
- Crosses the humerus in the RADIAL GROOVE with the deep artery of the arm
- Inside the radial groove, behind the triceps, it gives rise to the posterior cutaneous nerve of the arm and the posterior cutaneous nerve of the forearm, which pierce the lateral head of the triceps
- The branch to the medial head of the triceps also branches off behind the humerus
- After crossing the humerus, it pierces the lateral intermuscular septum and descends between the brachialis and the brachioradialis
- At the level of the lateral condyle, in the cubital fossa, it divides into the deep and superficial branches

**RADIAL NERVE LESIONS**

**Fracture of the Humerus:**
- Wrist drop due to extensor paralysis, as well as a loss of sensation on the dorsum of the hand

**Damage to the Deep Branch:**
- Inability to extend the thumb and to extend the MCP joints of the digits - but no sensory loss

**Damage to the superficial branch:**
- Usually only results in a tiny area of anesthesia because of the overlap in median and ulnar nerve territories

The **SUPERFICIAL BRANCH**
- Runs under brachioradialis all the way down the arm
- Eventually becomes superficial when it emerges from beneath brachioradialis, crosses the roof of the anatomical snuffbox, and innervates the dorsal skin of the hand
- The **DEEP BRANCH** pierces the supinator
- Beyond the supinator, the DEEP BRANCH becomes the POSTERIOR INTEROSSEOUS NERVE
- Winds laterally behind the radius and enters the posterior compartment of the forearm
- In the posterior compartment, it runs along the interosseous membrane to innervate the extensor muscles

The **DEEP BRANCH** also branches off behind the humerus to innervate the brachialis muscle.
Course of the Ulnar Nerve

- Arises from the medial cord of the brachial plexus
- Runs medial to the brachial artery
- Together with the superior ulnar collateral artery, it pierces the medial intermuscular septum – around the middle of the humerus – and then continues down the arm on top of the medial head of triceps brachii.
- Travels behind the medial epicondyle, where it is superficial and vulnerable (“funny bone”)
- Gives a branch to the elbow joint
- Enters the arm between the two heads of flexor carpi ulnaris
- Gives branches to innervate the two heads of flexor carpi ulnaris
- The Palmar Cutaneous Branch of the ulnar nerve arises midway along the arm, and travels under the antebrachial fascia – directly above the ulnar artery
- Then, travels down the arm between the flexor carpi ulnaris and the flexor digitorum profundis
- Gives a branch to innervate the ulnar 2 digits worth of flexor digitorum profundis
- Travels on the radial side of the flexor carpi ulnaris tendon
- Then, travels down the arm between the flexor carpi ulnaris and the flexor digitorum profundis
- Crosses under the flexor carpi ulnaris tendon together with the ulnar artery at the level of the wrist
- Passes between the hook of hamate and the pisiform (in Guyons canal) to enter the hand

- Antebrachial fascia
- Pisiform
- Hook of Hamate
- Ulnar artery
- Flexor carpi ulnaris
- Medial intermuscular septum
- Triceps brachii: medial head
- Superior ulnar collateral artery
Arteries of the Arm

The AXILLARY ARTERY begins at the border of the 1st rib as a continuation of the subclavian artery.

The FIRST PART stretches between the 1st rib and the medial border of pectoralis minor. It has only one branch – the superior thoracic artery.

The SECOND PART lies under the pectoralis minor; it has 2 branches:
- The Thoracoacromial artery
- The Lateral Thoracic artery

The THIRD PART stretches from the lateral border of pectoralis minor to the inferior border of Teres Major; it has 3 branches:
- The Anterior circumflex humeral artery
- The Posterior circumflex humeral artery
- The Subscapular artery

**Posterior circumflex humeral artery**
Travels through the quadrangular space together with the axillary nerve. It's the larger of the two.

**Anterior circumflex humeral artery**
Passes laterally deep to the coracobrachialis and the biceps brachii.

**Profunda Brachii- deep artery of the arm**
Passes through the lateral triangular space (with the radial nerve) into the posterior compartment of the arm. It is the largest branch of the Brachial artery.

Under the bicapital aponeurosis, the brachial artery divides into the Radial and Ulnar arteries.

**Radial Artery**
Travels down the arm under the brachioradialis, along with the radial nerve. Lies lateral to the flexor carpi radialis tendon. Gives a recurrent branch.

**Flexor carpi radialis tendon**
Brachioradialis

The Radial Artery winds around dorsally, crosses the floor of the anatomical snuffbox and pierces the 1st dorsal interossei to enter the palm between the two heads of adductor pollicis.

**Ulnar Artery**
Gives some recurrent branches, and then travels down the arm under the superficial muscles of the forearm (deep to the pronator teres, palmaris longus, and flexor digitorum superficialis).

**Common interosseous artery** is very short, because it bifurcates immediately.

**Anterior interosseous artery** travels down the arm along the interosseous membrane, and when it reaches pronator quadratus, it pierces the interosseous membrane and becomes dorsal (where it joins the dorsal carpal arch).

**Posterior interosseous artery** travels down the arm along the interosseous membrane, and anastomoses with the anterior interosseous artery when they meet.

**Superficial palmar arch**: anastomosis of the palmar carpal branches of the ulnar and radial arteries

**Dorsal carpal arch**: anastomosis of the dorsal carpal branches of the ulnar and radial arteries

**Deep palmar arch**: the more proximal arch
- A continuation of the radial artery

**Superficial palmar arch**: the more distal arch
- A continuation of the ulnar artery
This point is labored because: If the axillary artery is cut or ligated, an adequate collateral blood supply will arrive to the arm via the dorsal scapular artery, and its anastomosis with the circumflex scapular artery.

However, if the axillary artery is ligated BELOW the third part of the axillary artery, there will not be any collaterals, and the arm will become ischaemic.
Arterial Arches of the Hand

**Ulnar Artery**
- Enters the hand via Guyon's canal, between the hook of hamate and the pisiform.

**Guyon's canal**
- Ulnar artery divides into the SUPERFICIAL and the DEEP Palmar arches.

**Palmar metacarpal arteries**
- Arise from the deep arch.

**Common palmar digital arteries**
- Arise from the superficial arch.

**Proper palmar digital arteries**
- Arise from the superficial arch.

**Arterial arches**
- Palmar metacarpal arteries arise from the deep arch.
- Proper palmar digital arteries arise from the superficial arch.

**Radial Artery**
- Hooks around the scaphoid and trapezium and enters the palm between the 1st and 2nd metacarpals.

**Superficial branch of the radial artery**
- Joins the superficial palmar arch.

**Dorsal branch of the radial artery**
- Joins the deep palmar arch.

**Perforating branches**
- Which join the deep palmar arch.

**Dorsal carpal arch**
- Branches to anterior interosseous artery.

**Anatomical snuffbox**
- Superficial branch of the radial artery.

**Princeps Pollicis artery**
- Radial Artery.

**Branch to anterior interosseous artery**
- Radial Artery.
Veins and lymphatic drainage patterns of the upper limb

**Cephalic vein:**
- Spends all of its time in subcutaneous tissues
- Drains the radial dorsum of the hand

**Basilic vein:**
- Is subcutaneous right up until the middle of the biceps; then it dives deep and runs parallel to the brachial artery
- Drains the ulnar dorsum of the hand
**Both merge to form the axillary vein**

**Median cubital vein:**
- Communicates between the two in the cubital fossa

**Antebrachial vein:**
- Highly variable
- Begins at the dorsum of the thumb
- Sometimes divides into a median basilic vein, which joins the basilic vein, and a median cephalic vein, which joins the cephalic vein.

- **DRAINAGE OF THE PALM PASSES INTO THE DORSUM OF THE HAND**
- **Vessels converge mainly on the basilic, but also the cephalic vein**

- **Piercing the costocoracoid membrane - part of the clavipectoral fascia**

- **Piercing the brachial fascia**

- **Subclavian lymphatic trunk**
- **Apical axillary nodes**
- **Humeral (lateral) nodes**
- **Basilic vein**
- **Basilic**
- **Cubital lymph nodes**
- **Cephalic vein**
- **Deltoid lymph nodes**
- **The superficial lymphatics follow the superficial veins, mainly the basilic. This also the deep lymphatic system, which follows the deep veins, and this system of lymph vessels terminates at the humeral lymph nodes. The deep system drains all the joints tendons and nerves.**