



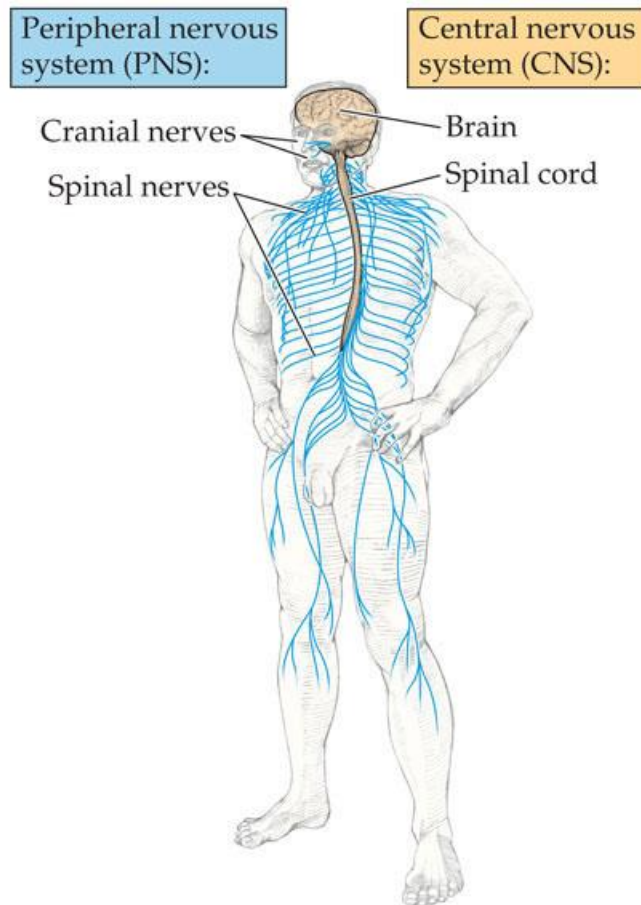
ORTHOPÉDIE DU MEMBRE SUPÉRIEUR

FORMATION CONTINUE SNM – 26.09.2024

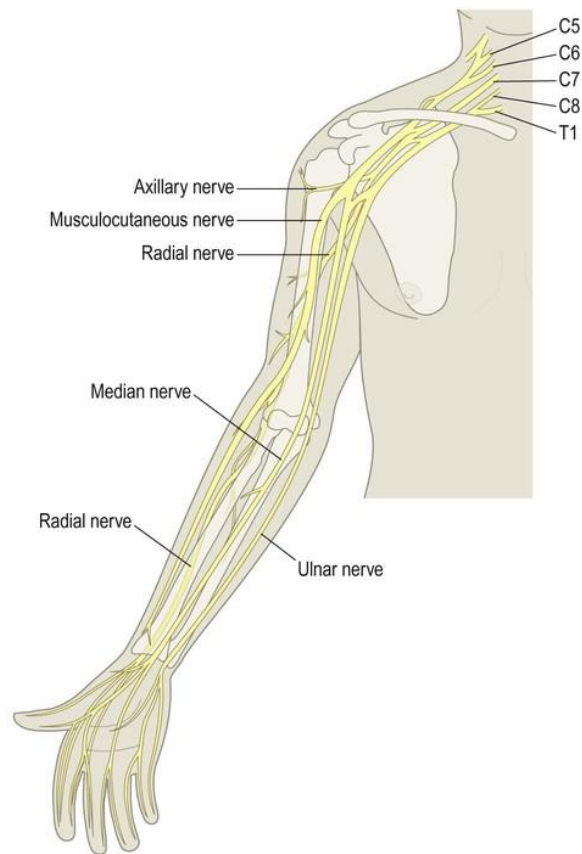
Aspect neurologique périphérique

Dr Thomas Rossel
Neurologue FMH
Centre Médical des Cadolles
Rue du plan 28, Neuchâtel

SYSTÈME NERVEUX PÉRIPHÉRIQUE

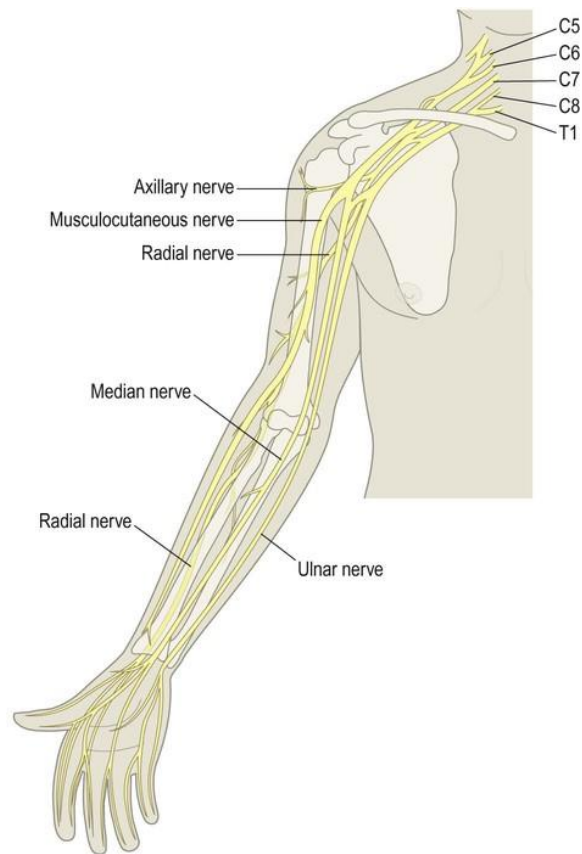


SYSTÈME NERVEUX PÉRIPHÉRIQUE



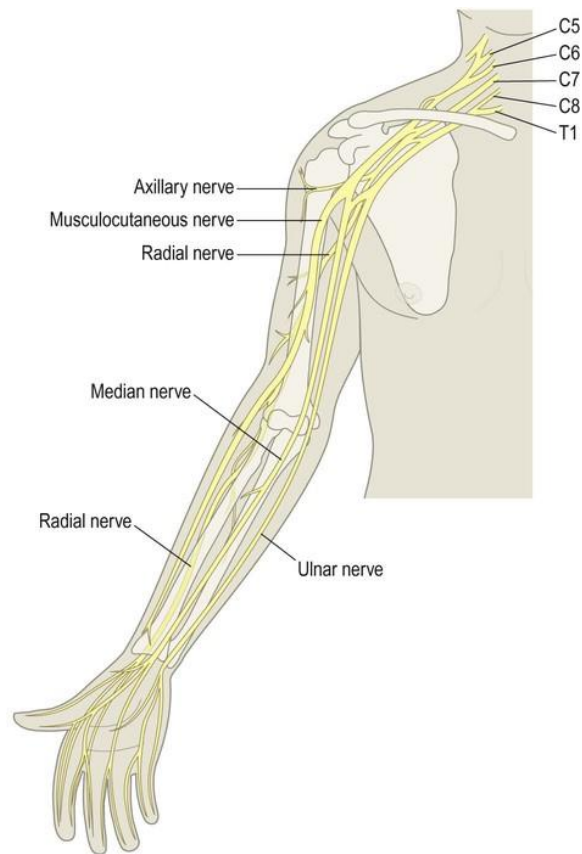
- Racine
- Plexus
- Nerf
- Jonction neuro-musculaire
- Muscle

SYSTÈME NERVEUX PÉRIPHÉRIQUE



- **Racine**
→ radiculopathie
- **Plexus**
→ plexopathie
- **Nerf**
→ neuropathie
- Jonction neuro-musculaire
- **Muscle**

MENU



- Introduction
- ENMG et examens complémentaires
- Atteintes tronculaires :
 - Nerf médian
 - Nerf ulnaire
 - Nerf radial
 - Autres nerfs
- (Plexus et racines)
- Conclusion

ATTEINTE MOTRICE CENTRALE VERSUS PÉRIPHÉRIQUE

1^{er} motoneurone (SNC)

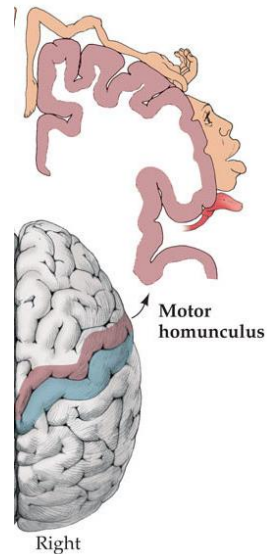
Paralysie spastique

Hyperéflexie

Signe de libération

Clonus

■ Topographie:

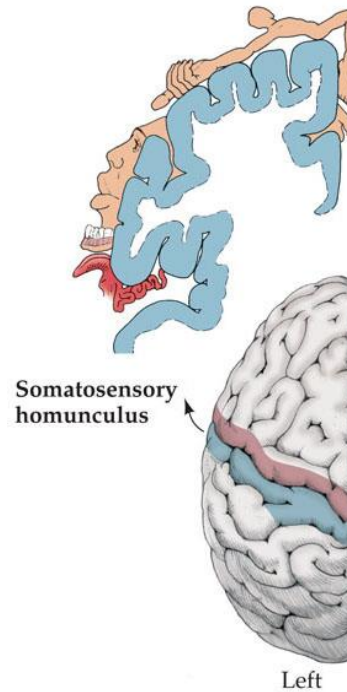


VS

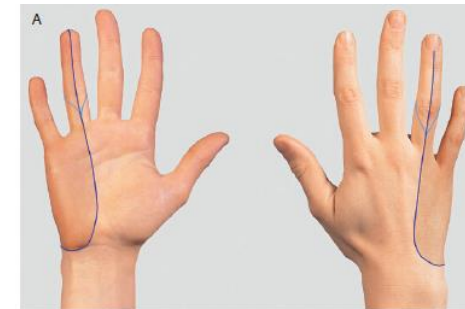


ATTEINTE SENSITIVE CENTRALE VERSUS PÉRIPHÉRIQUE

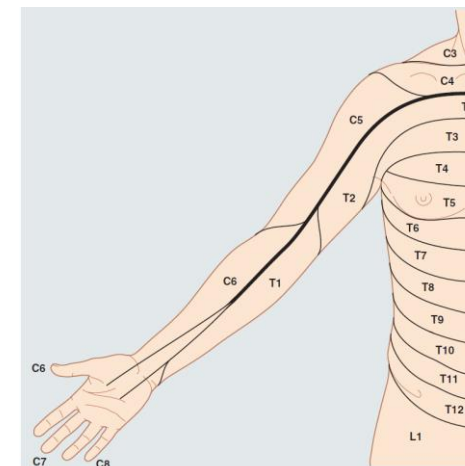
- Topographie:



VS



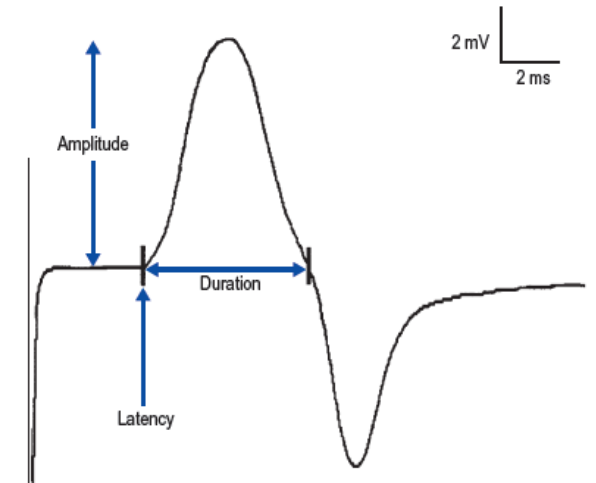
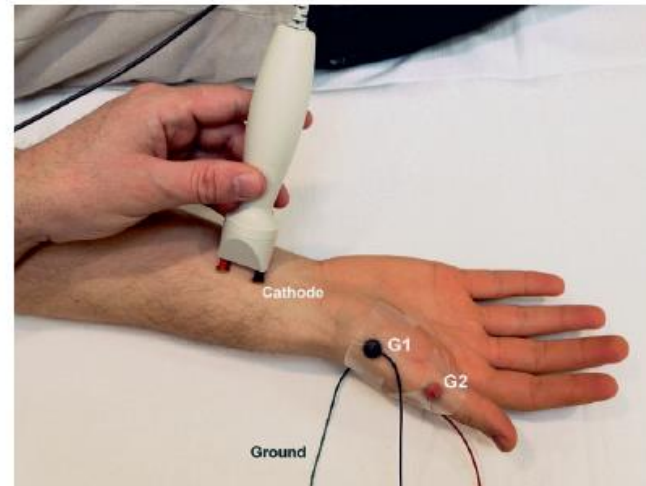
tronculaire



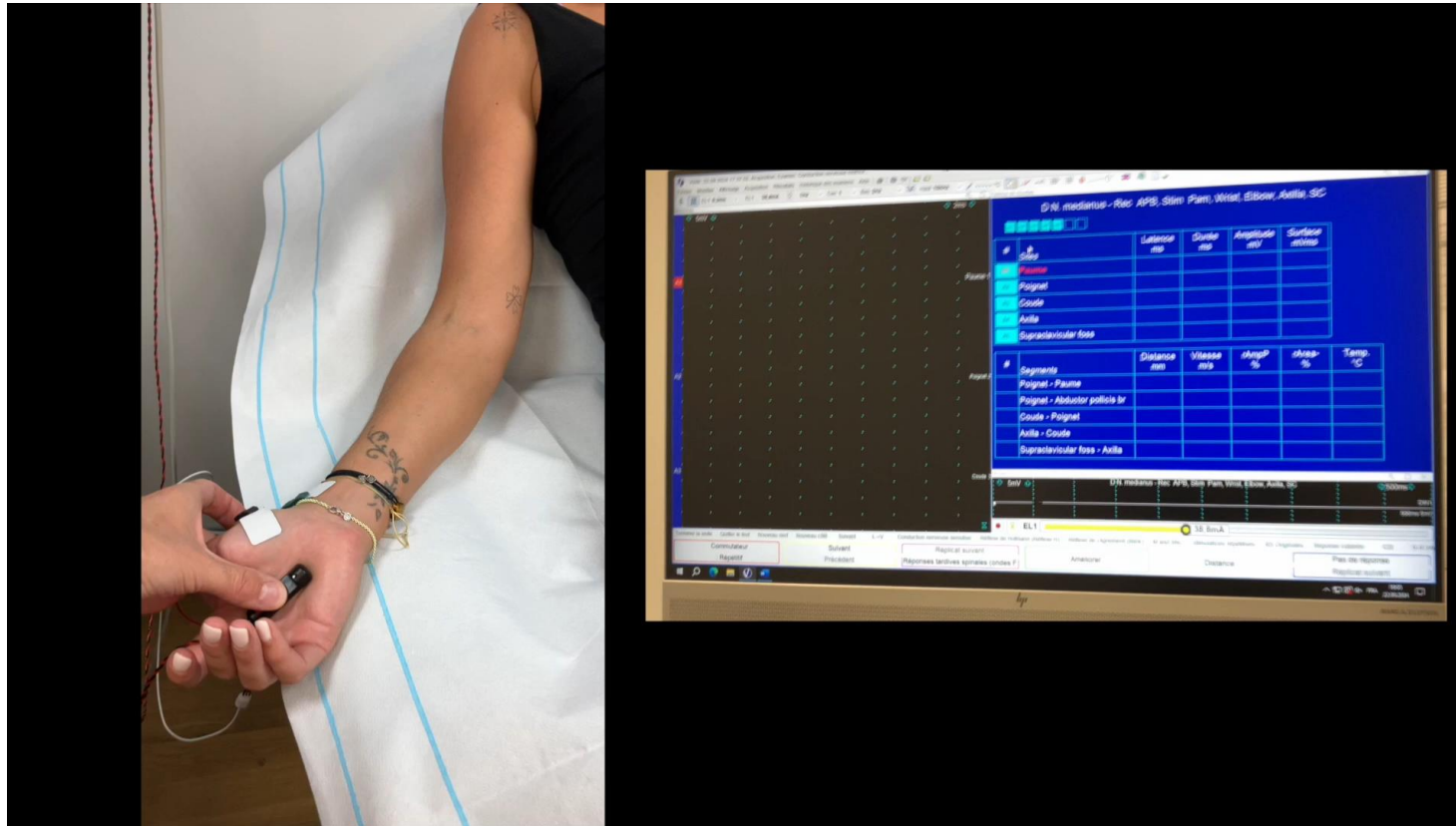
radiculaire

ENMG: ÉLECTRONEUROMYOGRAPHIE

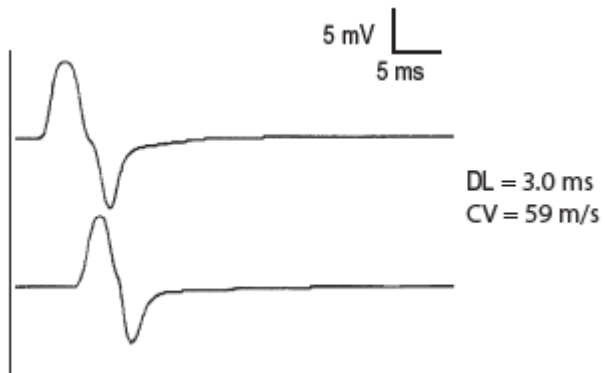
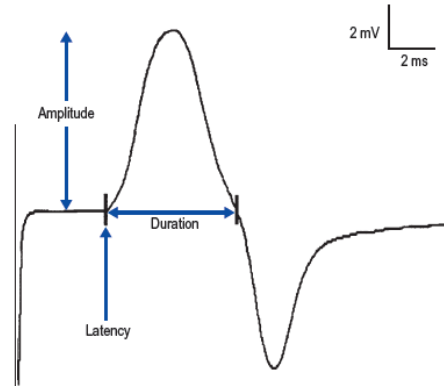
I) Neurographie: étude de conduction nerveuse



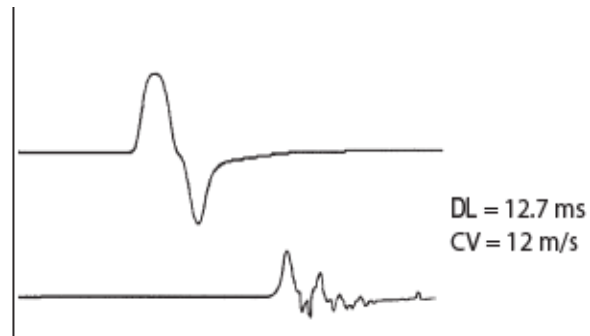
ENMG: ÉLECTRONEUROMYOGRAPHIE



ENMG: ÉLECTRONEUROMYOGRAPHIE

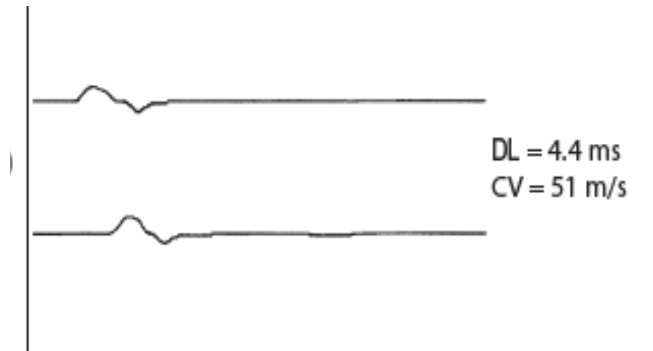


Normal



Démyélinisant

→ Compression

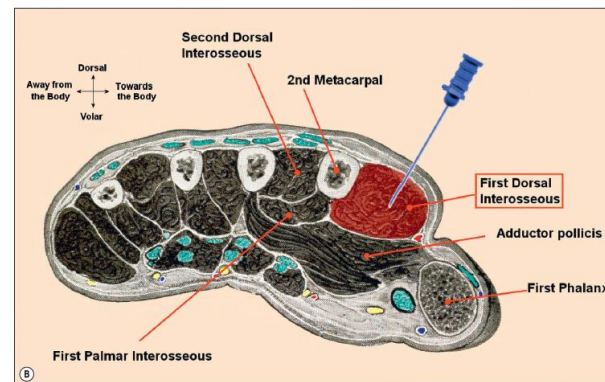
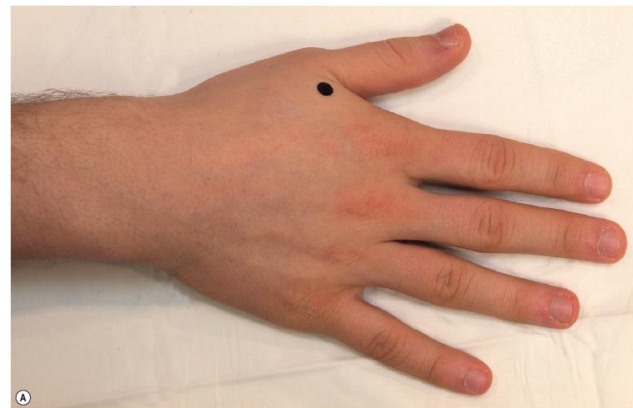


Axonal

→ Souffrance axone

ENMG: ÉLECTRONEUROMYOGRAPHIE

2) Examen électromyographique à l'aiguille (EMG)



ENMG: ÉLECTRONEUROMYOGRAPHIE



ENMG

Douloureux ?



ENMG

Contre-indication ?

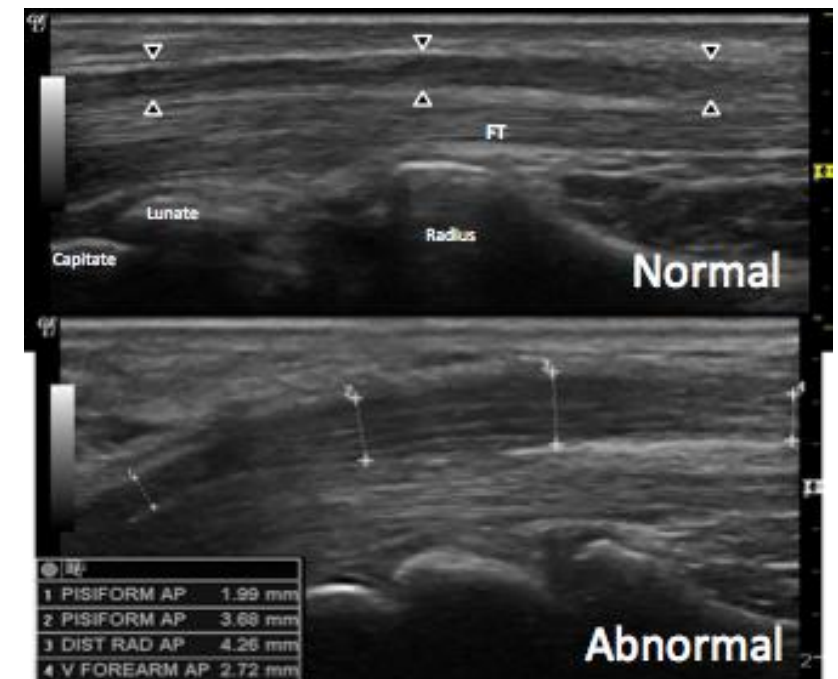
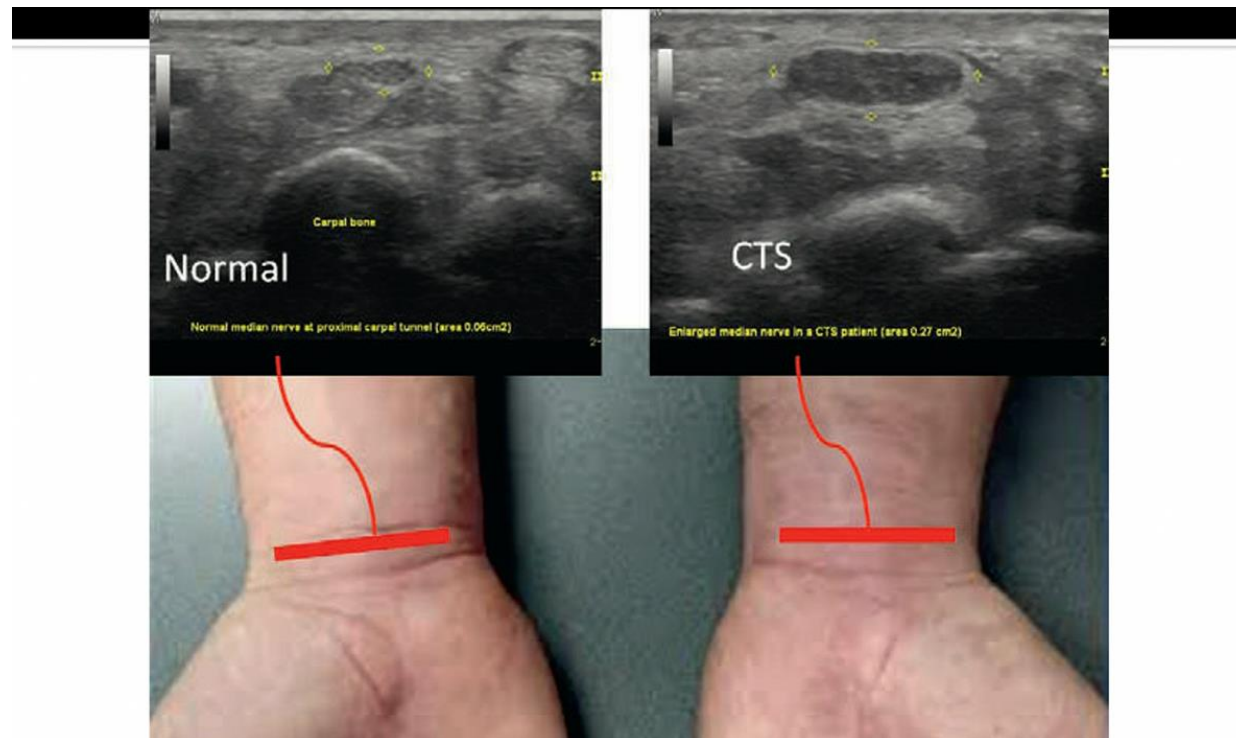


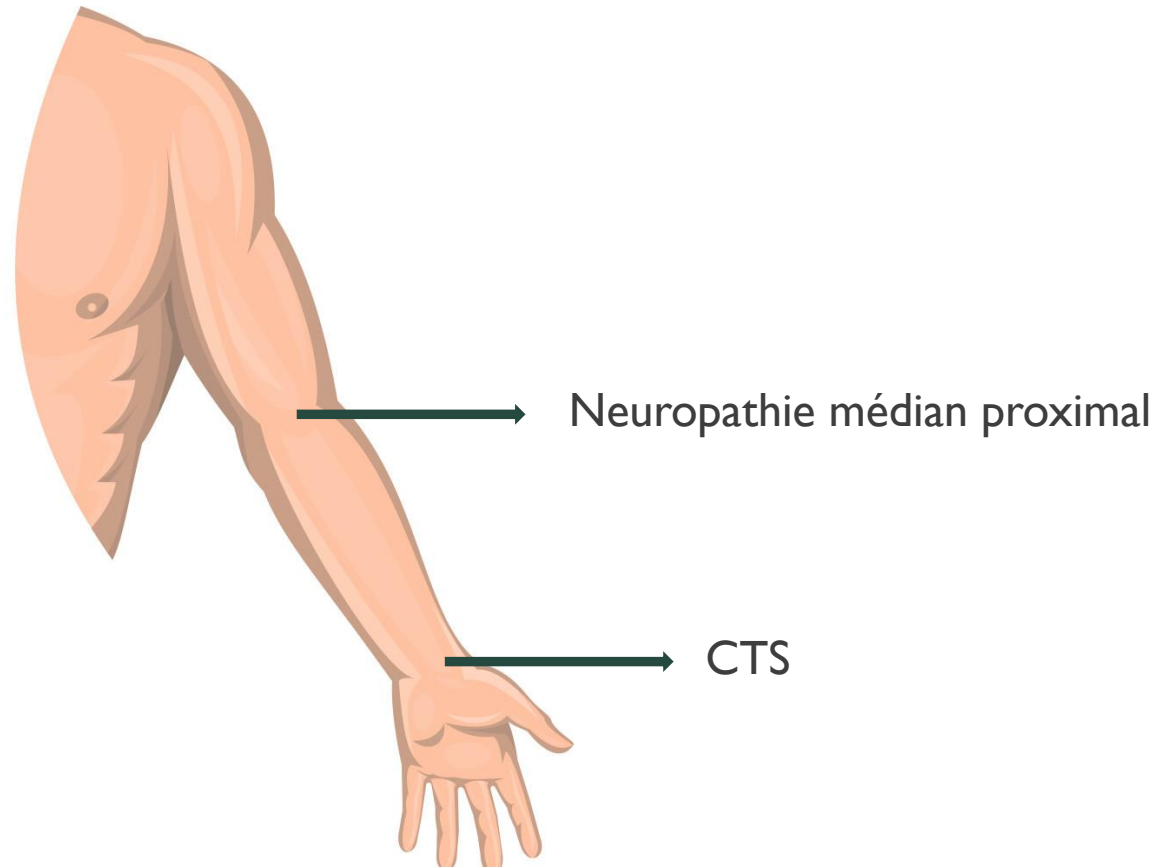
schwarzenegger ✓ Thank you! I've gotten so many kind messages from all over the world, but a lot of people have asked if my pacemaker will cause any problems with FUBAR Season 2.



ULTRASON NEUROMUSCULAIRE

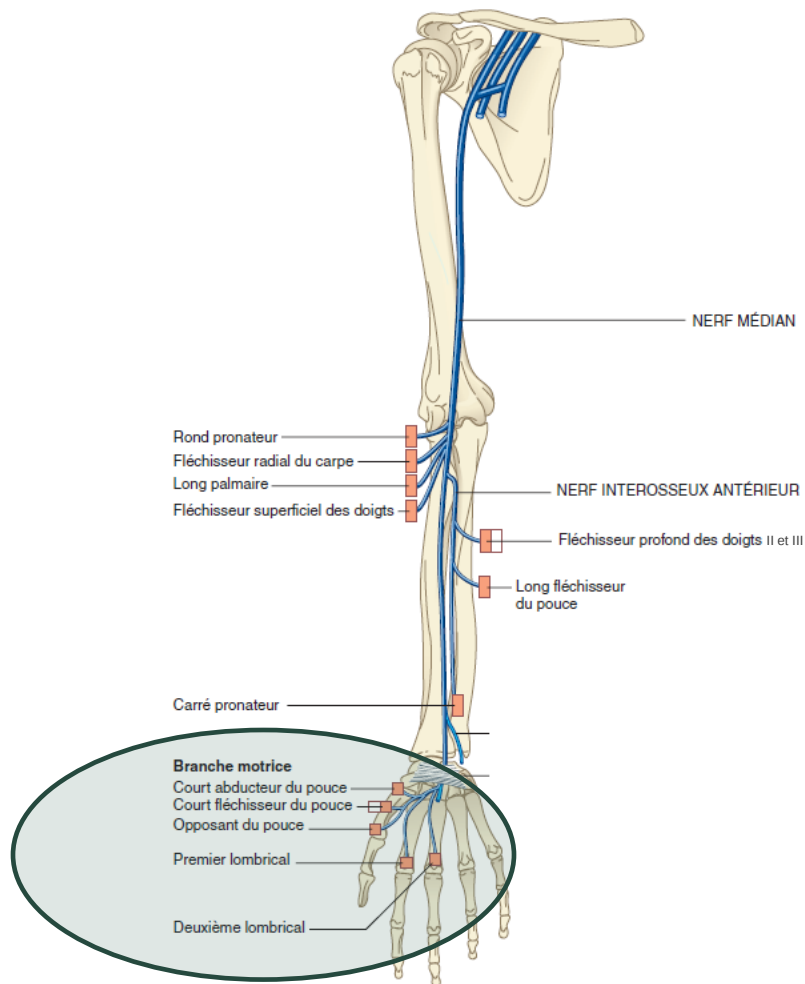
Augmentation de la cross-sectional area (CSA)



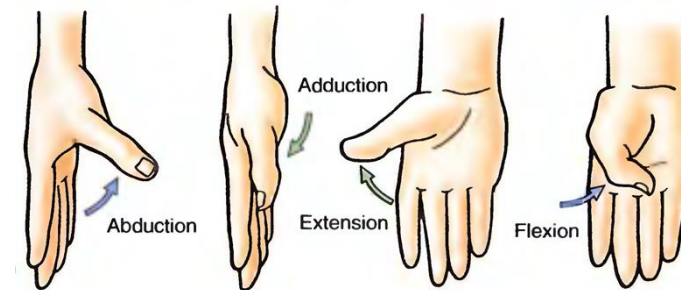


NERF MEDIAN

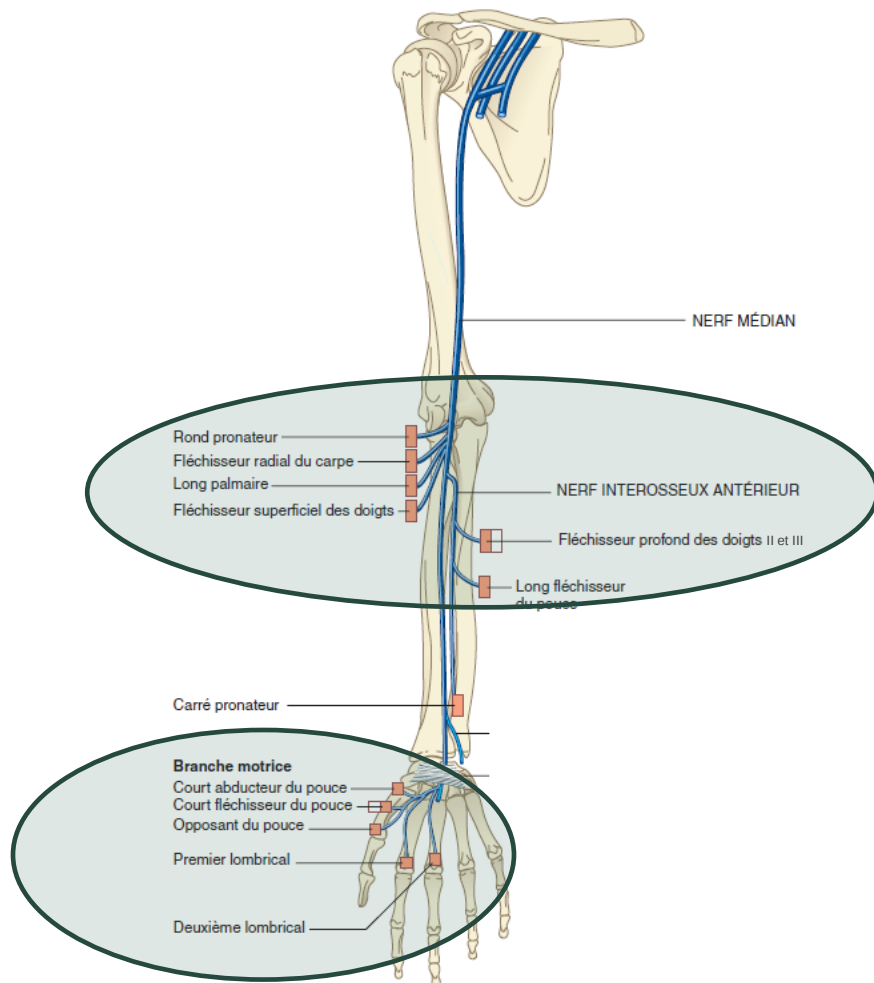
MEDIAN : MOTEUR



Muscle court abducteur du pouce



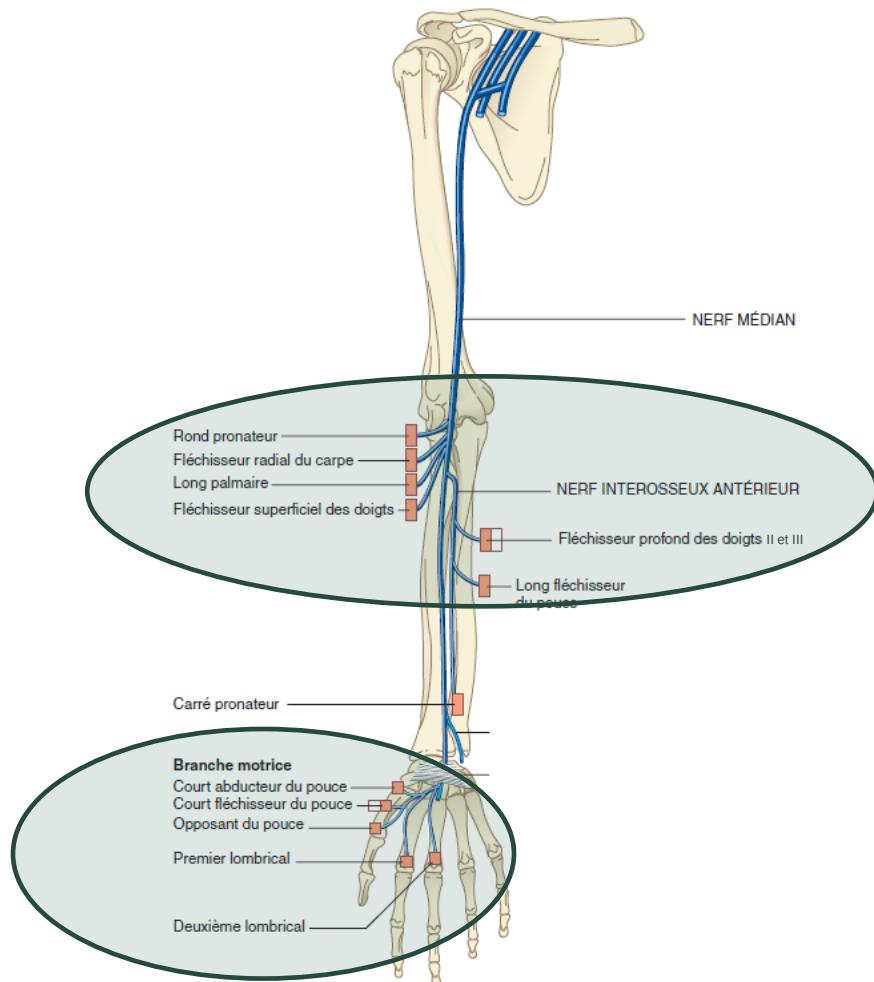
MEDIAN : MOTEUR



- Pronation
- Flexion poignet et doigts



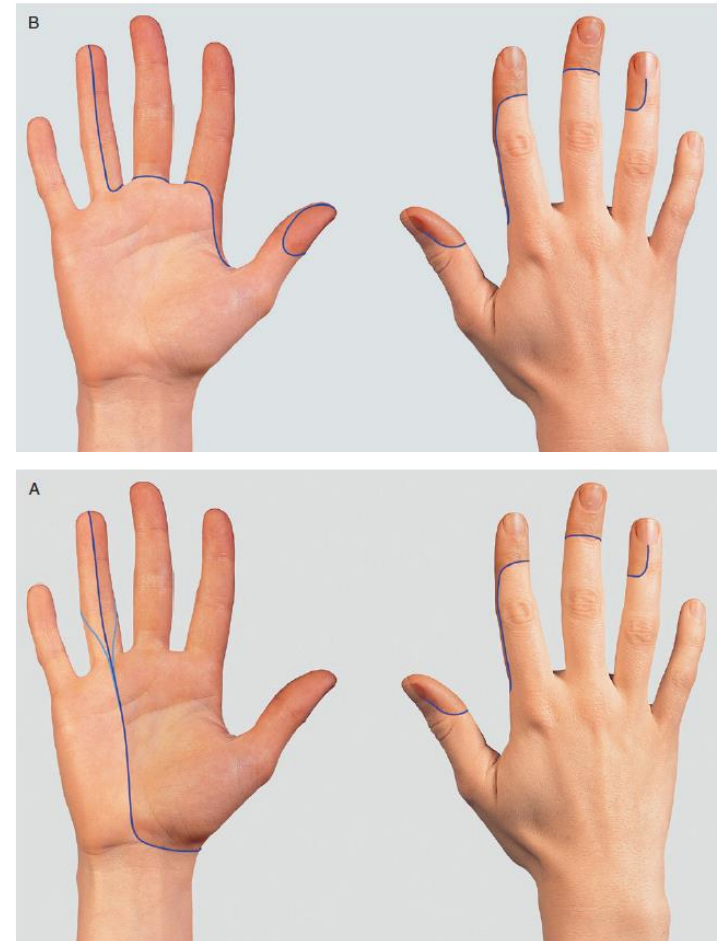
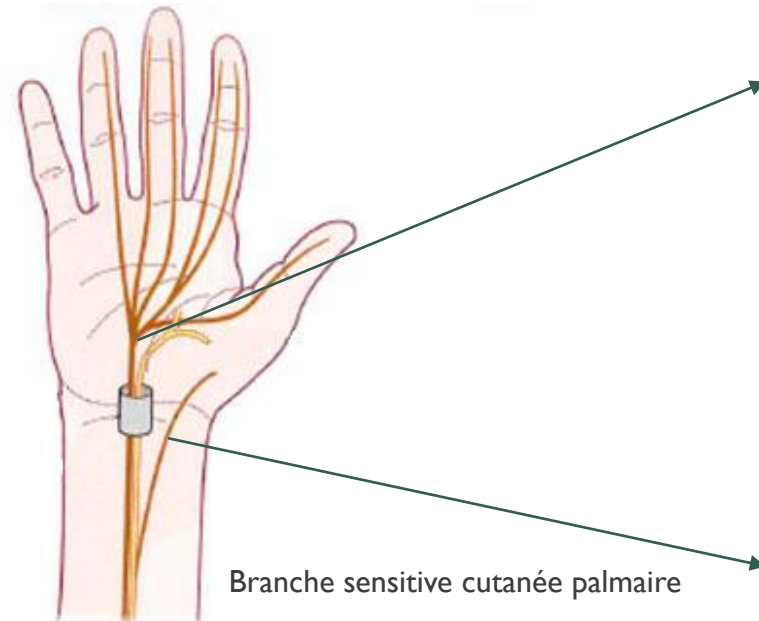
MEDIAN : MOTEUR



- Pronation
- Flexion poignet et doigts
- ⇒ Fléchisseur profond des doigts II et III



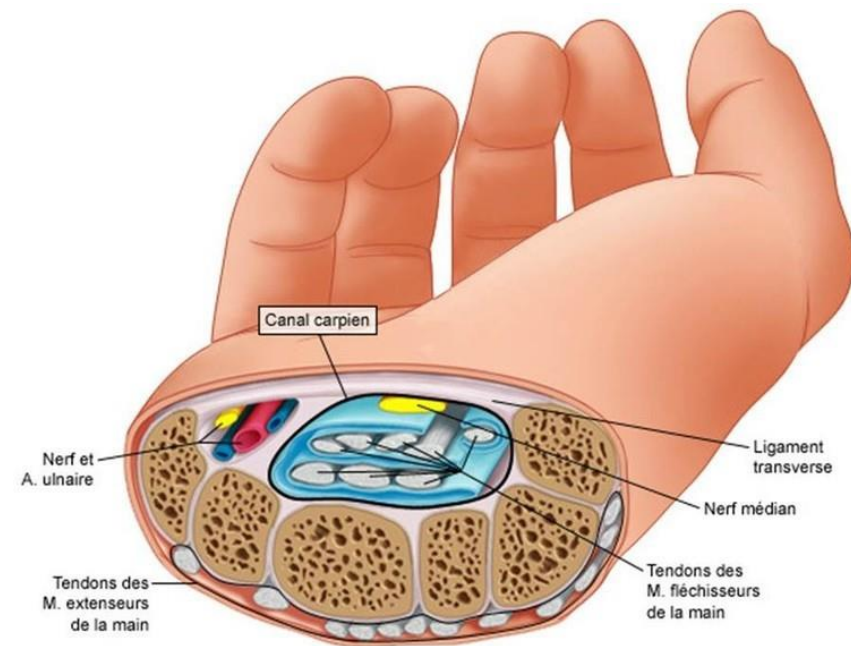
MEDIAN : SENSITIF



SYNDROME DU CANAL CARPIEN (CTS)

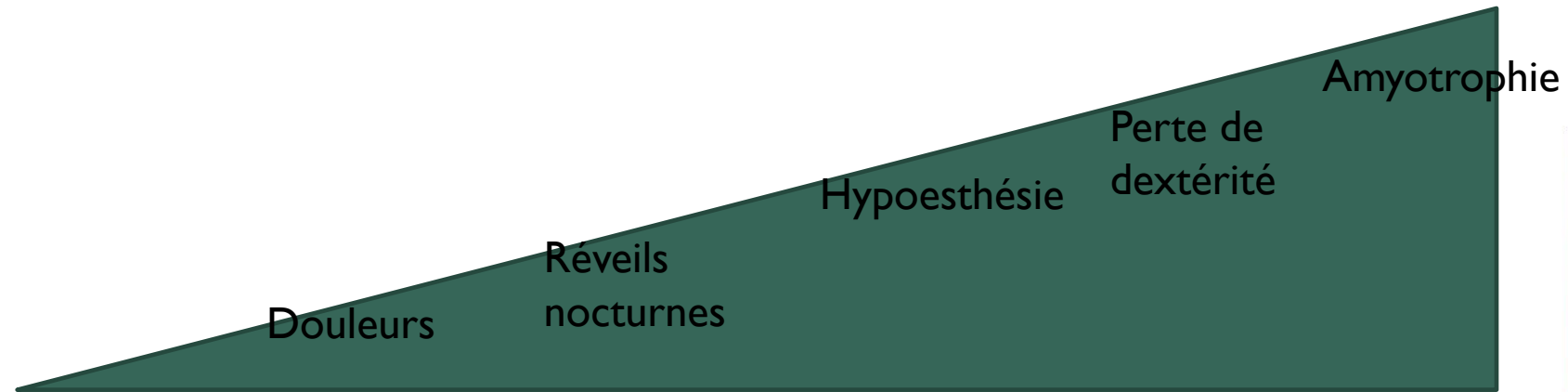
- Fréquence +++
- Epidémiologie^{1,2}:
 - 10% des gens au cours de leur vie
 - Prévalence entre 3-5% dans la population générale

1. Atroshi et al. JAMA 1999
2. Bland JD et al. JNNP 2003



SYNDROME DU CANAL CARPIEN (CTS)

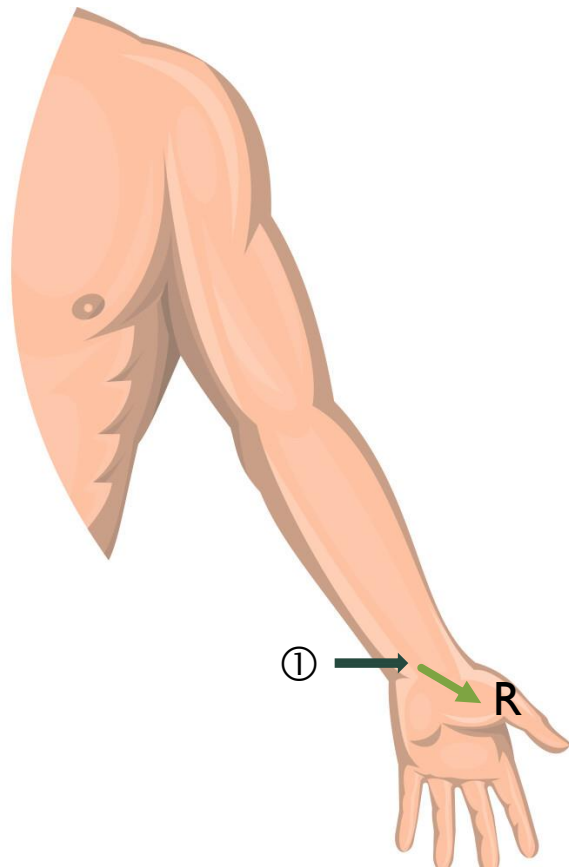
■ Symptômes:



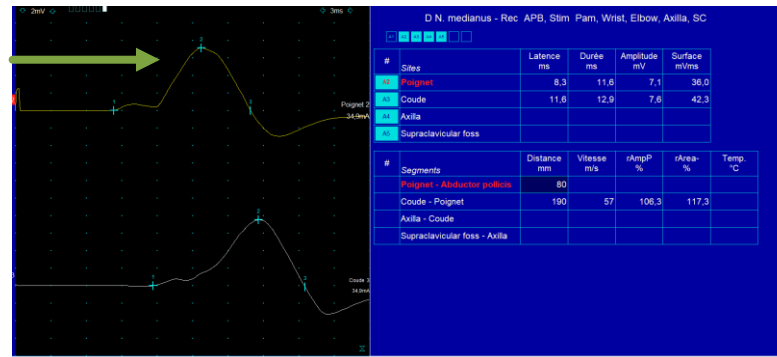
Paresthésies intermittentes



ENMG DANS LE CTS: ETUDE DE CONDUCTION MOTRICE

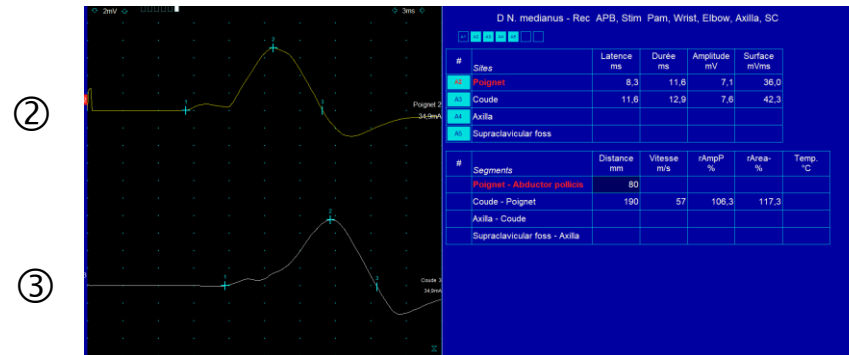
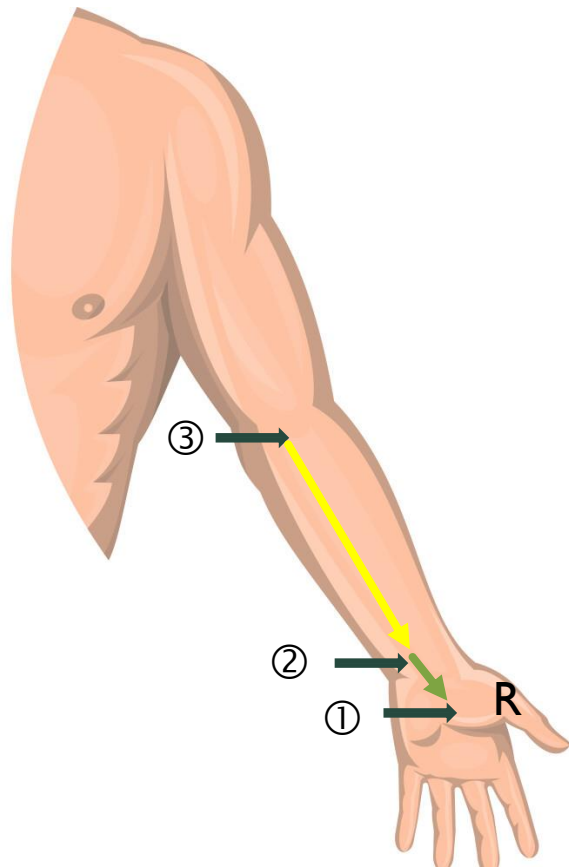


①

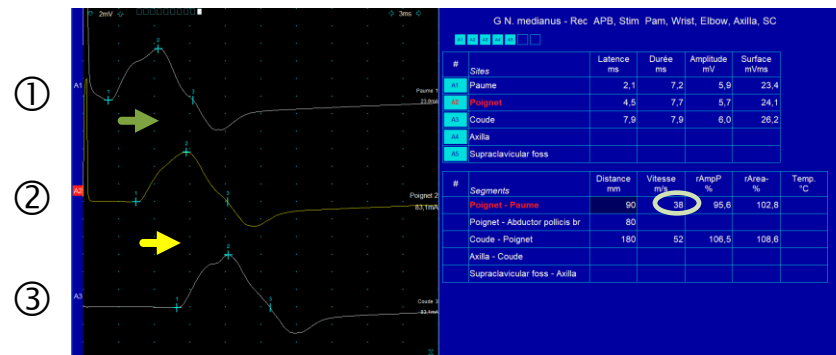


Augmentation de la latence distale

ENMG DANS LE CTS: ETUDE DE CONDUCTION MOTRICE

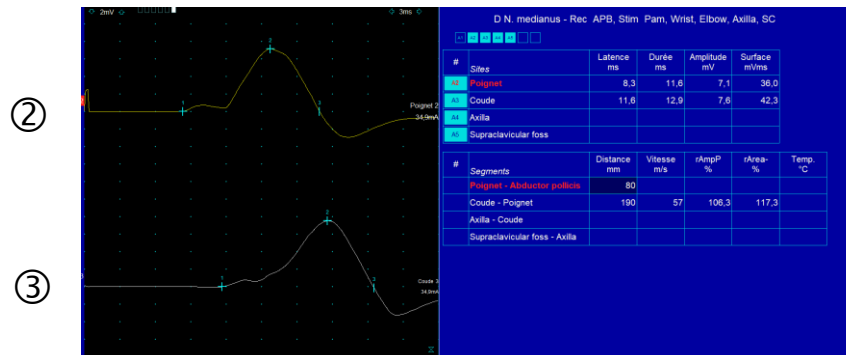
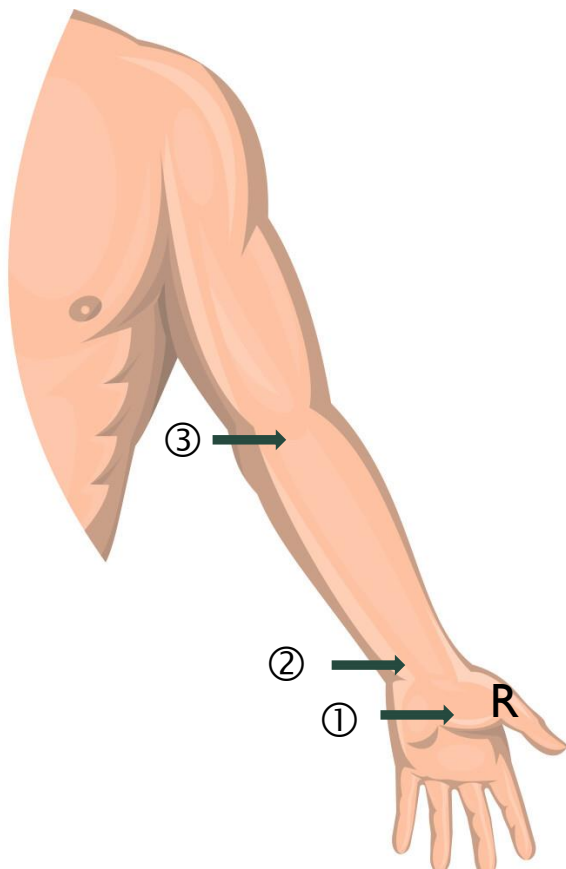


Augmentation de la latence distale



Ralentissement de la vitesse de conduction au poignet

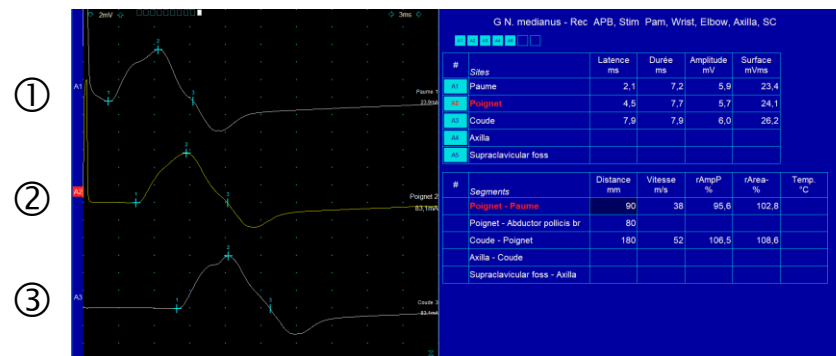
ENMG DANS LE CTS: ETUDE DE CONDUCTION MOTRICE



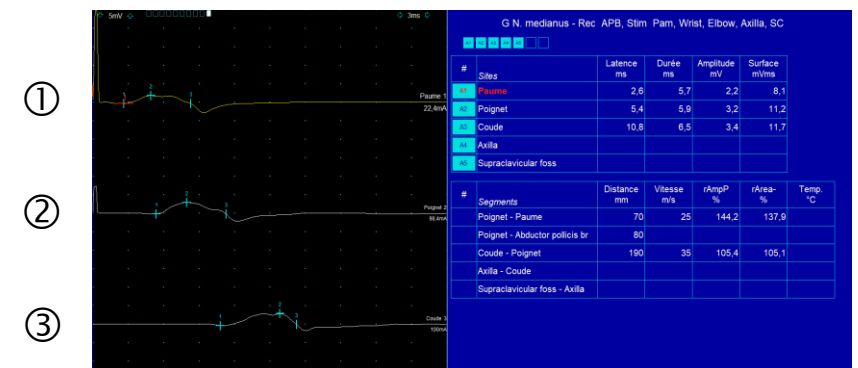
Augmentation de la latence distale



Bloc de conduction



Ralentissement de la vitesse de conduction au poignet

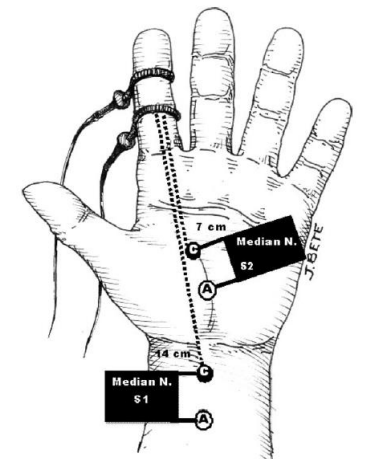
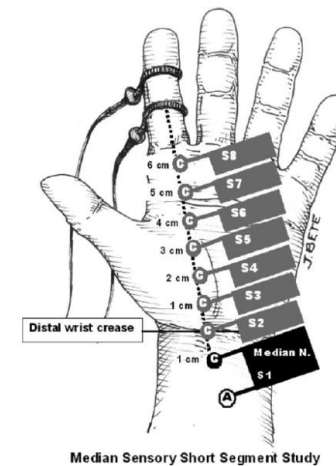
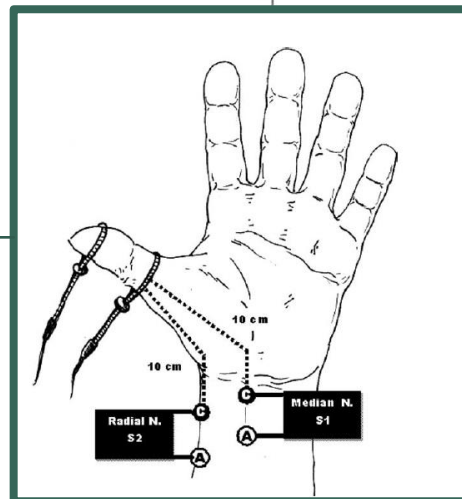
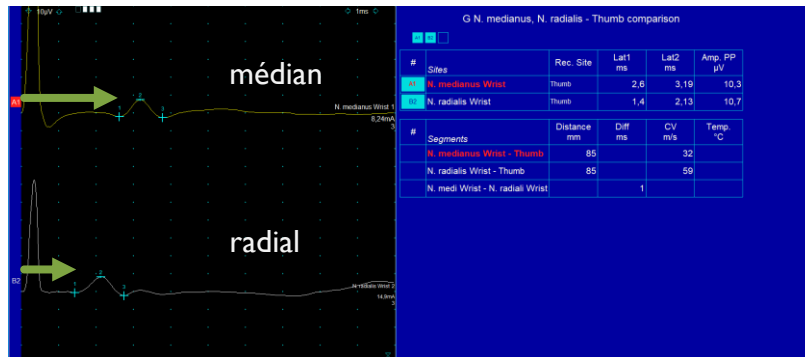
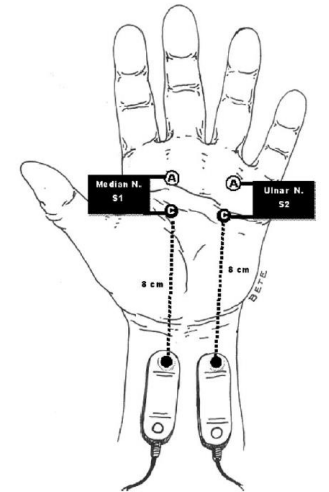
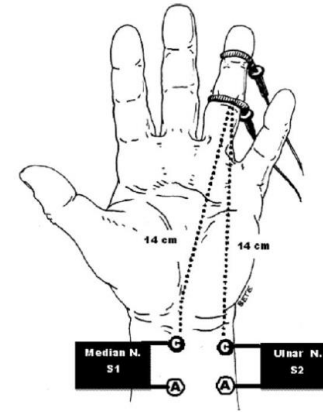
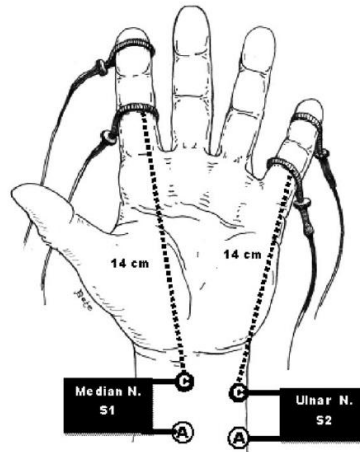


Perte axonale

ENMG DANS LE CTS : ÉTUDE DE CONDUCTION SENSITIVE

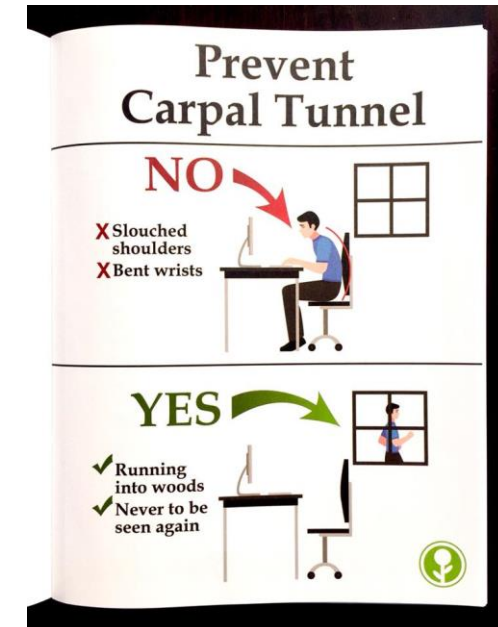
Conduction sensitive:

- En microvolt (μV)
- Technique:
 - Orthodromique
 - Antidromique



ENMG DANS LE CTS

- Diagnostic :
 - Confirmer le diagnostic clinique
 - Exclure une autre neuropathie
 - Valeurs départ pré-interventionnelle
- Pronostic:
 - Sévérité de l'atteinte
 - Bon prédictateur pour l'efficacité de la prise en charge conservatrice
 - Si électrophysiologie normale (5-10%) ou sévère (perte axonal), moins bon pronostic de la chirurgie



CTS: TRAITEMENT

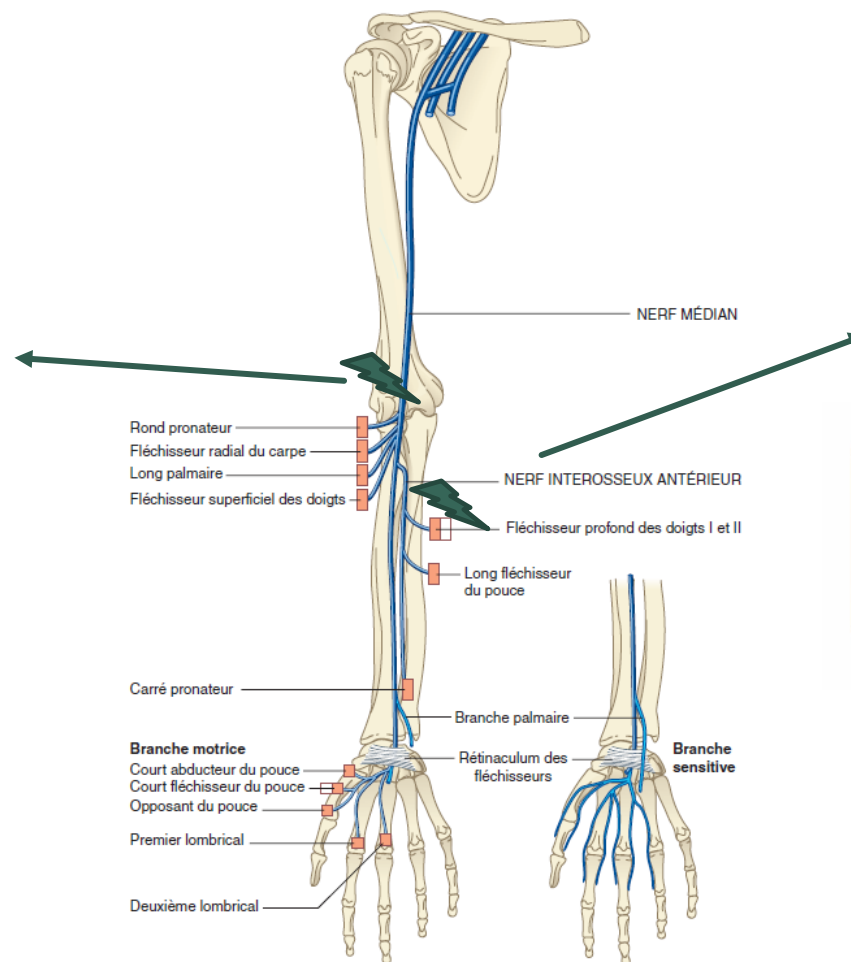
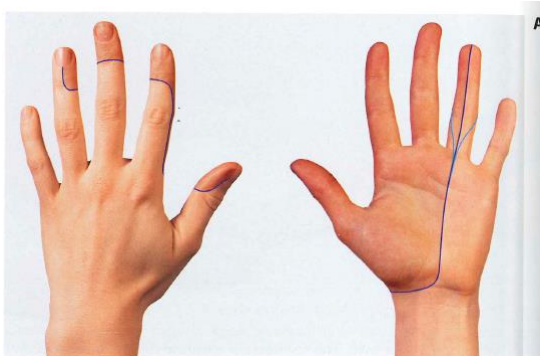
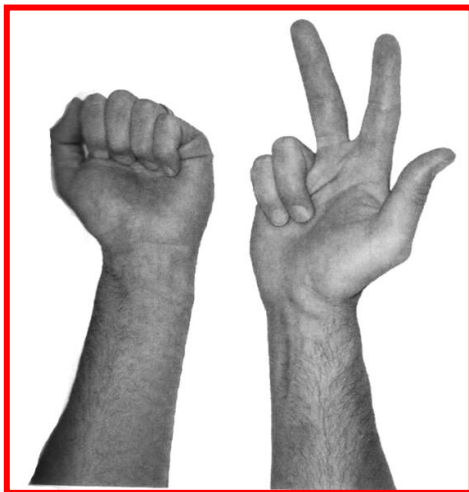
- Conservateur:
 - Orthèse: port d'une attelle d'extension du poignet toutes les nuits pendant 6-8 semaines
 - Amélioration 54% à 3 mois¹
- Injection de corticoïdes locale
- Neurolyse
 - Ouverte VS endoscopique – efficacité similaire



1. Bininger et al. 2007

NEUROPATHIE MEDIAN PROXIMAL

Median proximal



Nerf interosseux antérieur

Branche motrice pure :

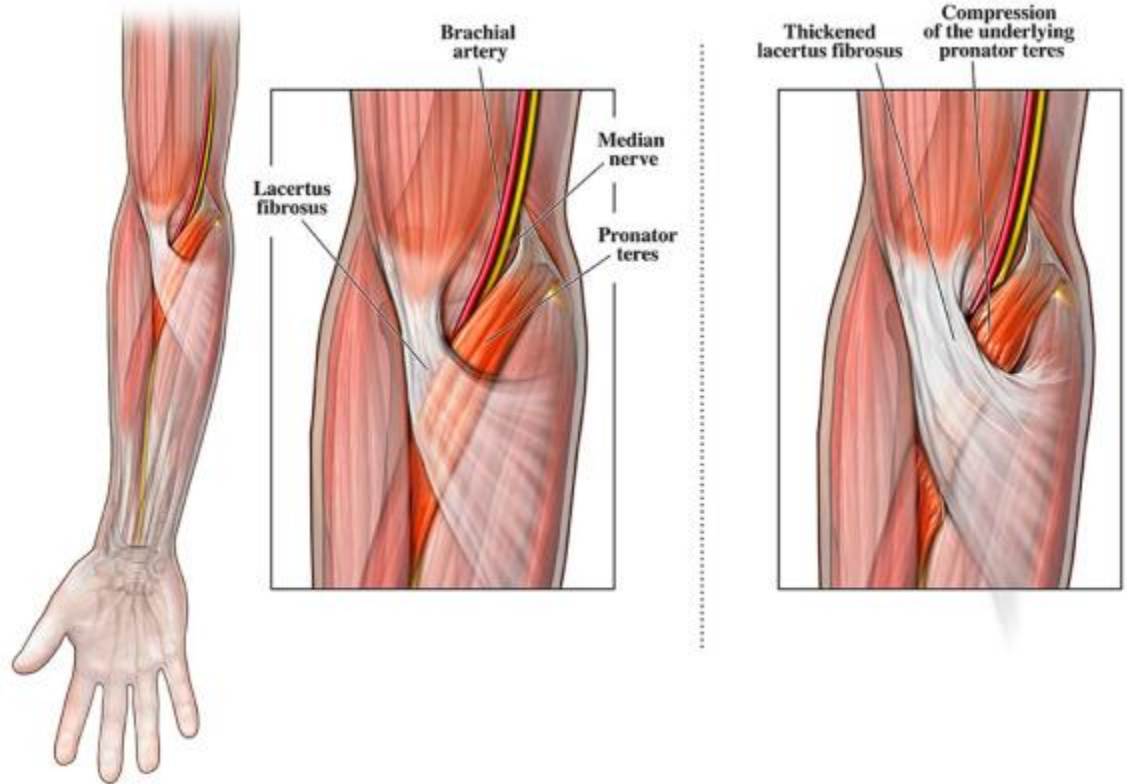
- FPD II-III
- Long fléchisseur du pouce



NEUROPATHIE MEDIAN PROXIMAL

Syndrome du rond pronateur:

- 100x moins fréquent que CTS
- Douleurs profonde/inconfort +/- trouble sensitif
- Signe de Tinel possible
- 4 sites de compressions:
 - Lacertus fibrosus
 - Ligament de Struthers
 - Bandes fibreuse du rond pronateur
 - Arcade du fléchisseur superficiel des doigts

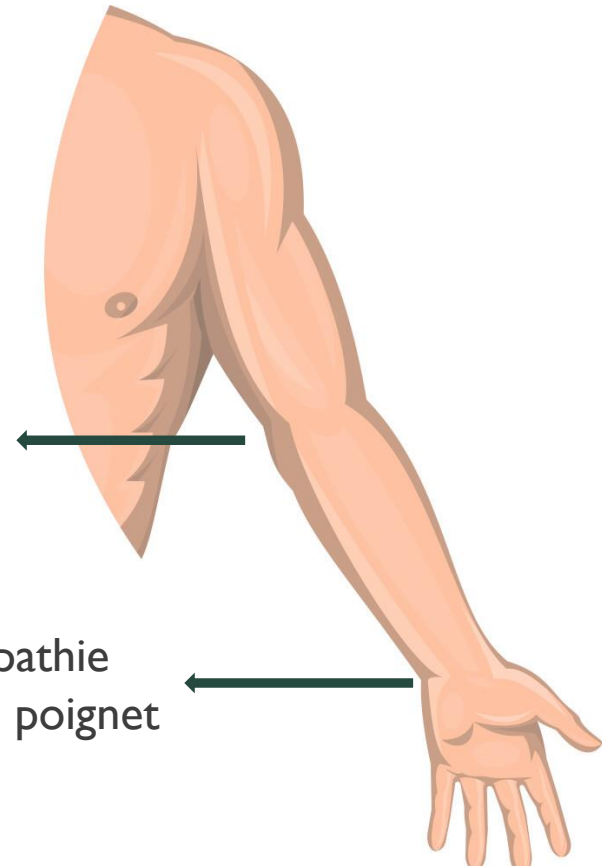




Moutet F. Chirurgie de la main 2004

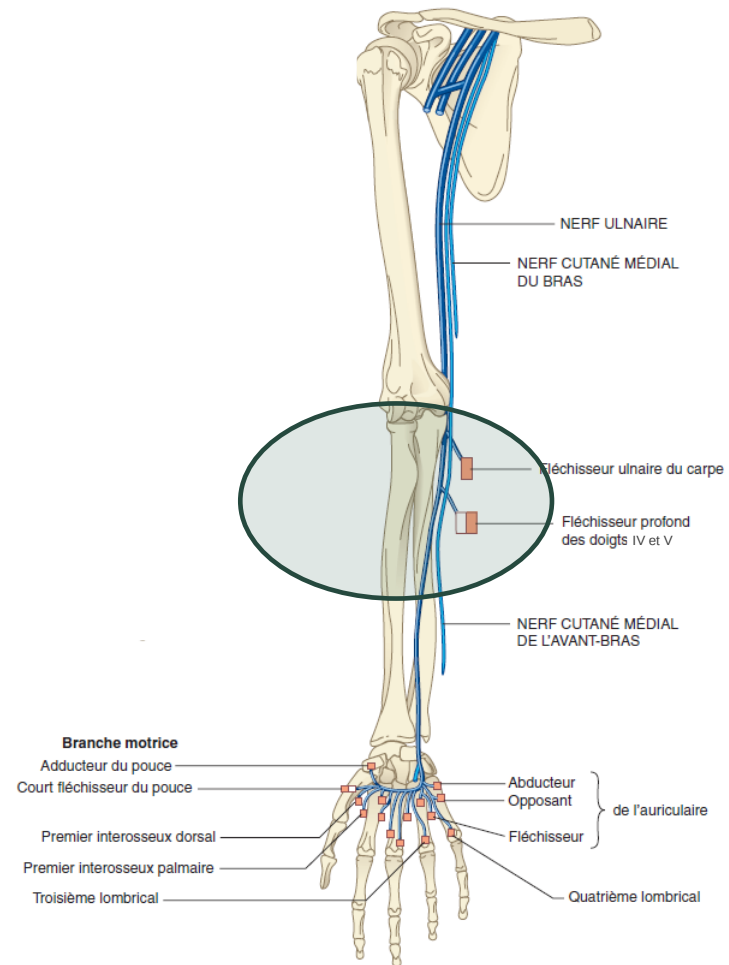
Neuropathie
ulnaire au coude

Neuropathie
ulnaire au poignet

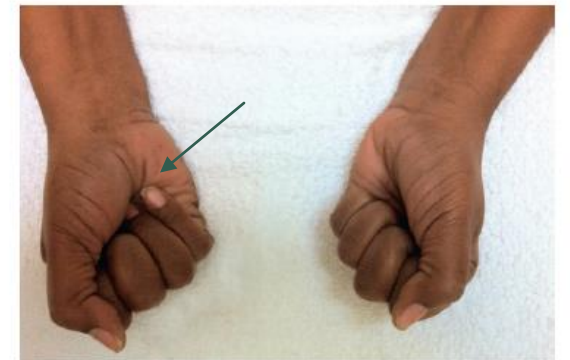


NERF ULNAIRE

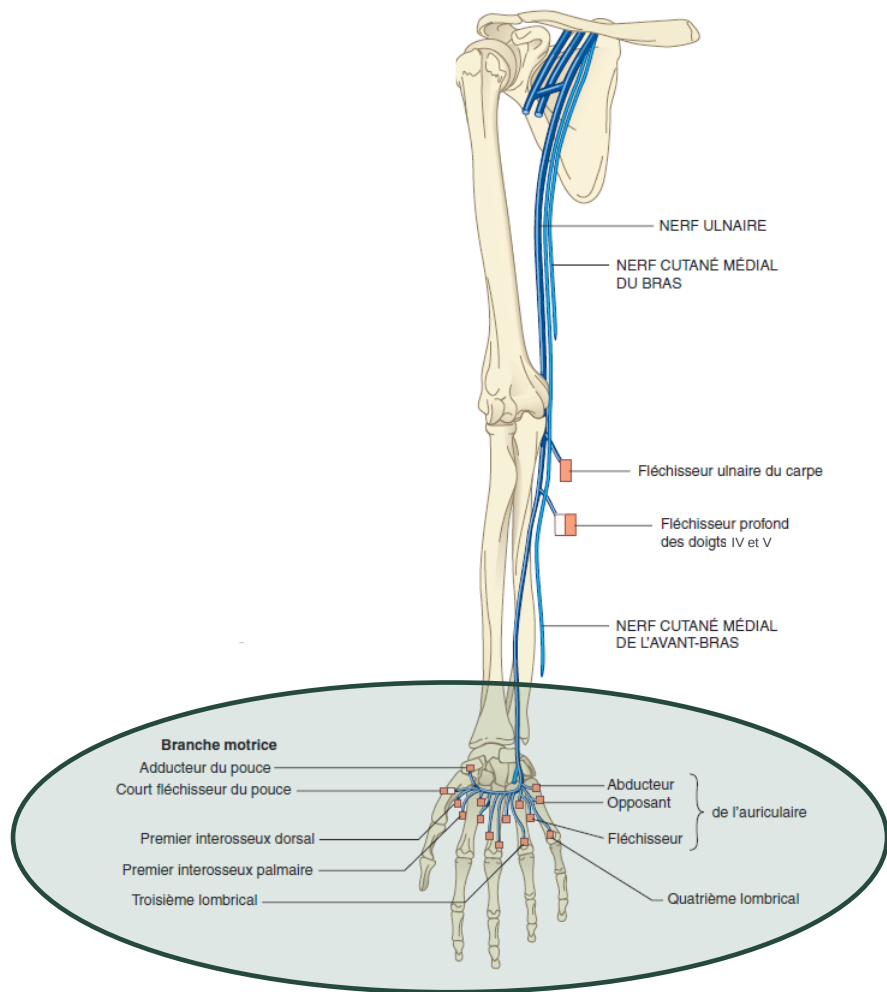
ULNAIRE : MOTEUR



Fléchisseurs profonds des doigts IV et V



ULNAIRE : MOTEUR



- Interosseux dorsaux
- 1^{er} interosseux dorsal (FDI)
- Abducteur du V (ADM)



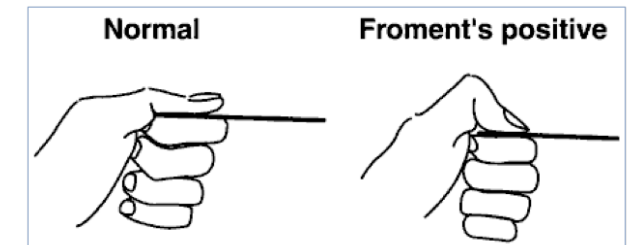
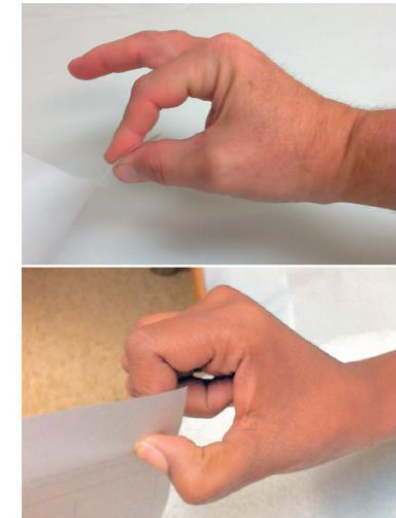
ULNAIRE : MOTEUR



Posture de bénédiction
ou Griffe ulnaire

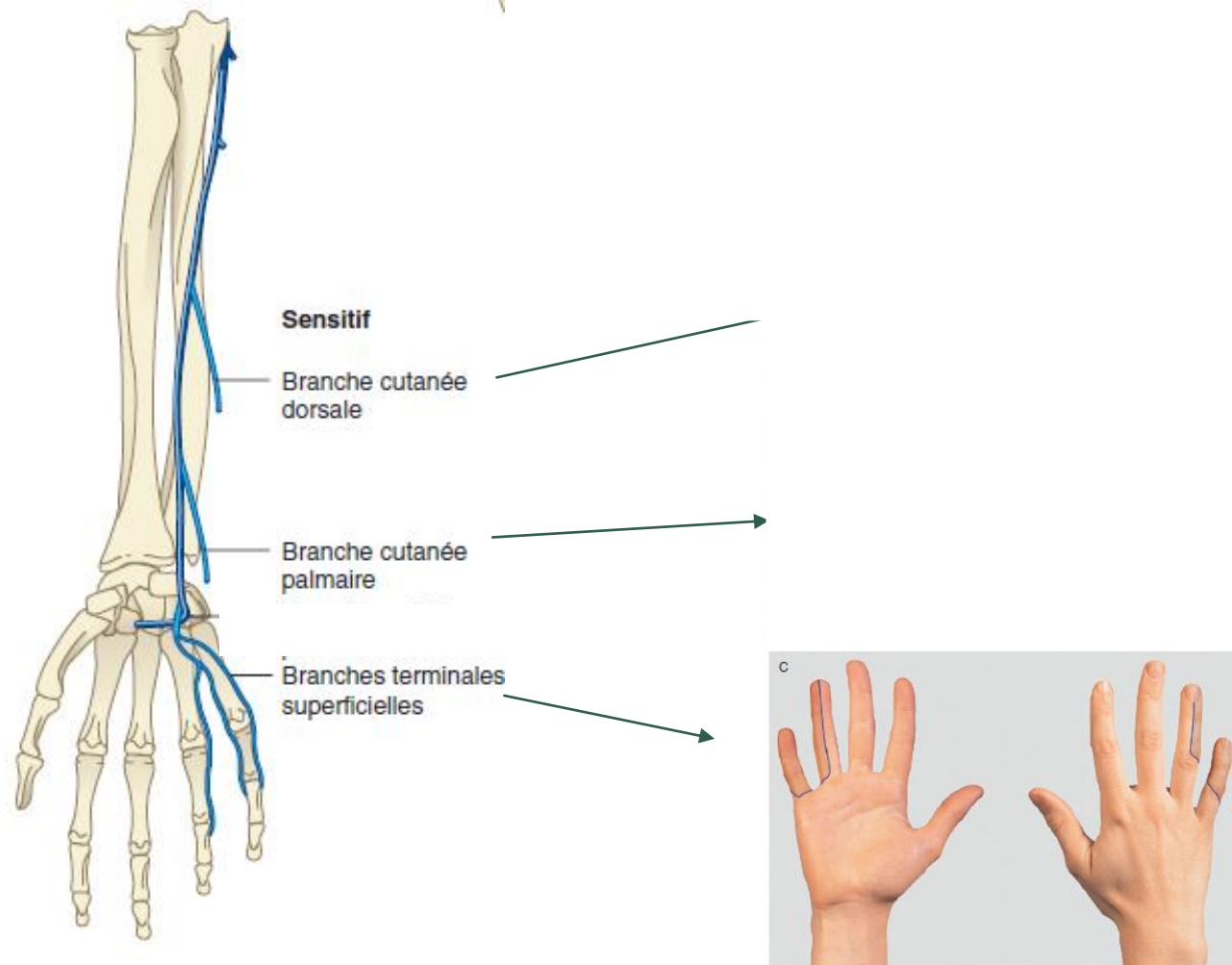


Signe de Wartenberg



Signe de Froment

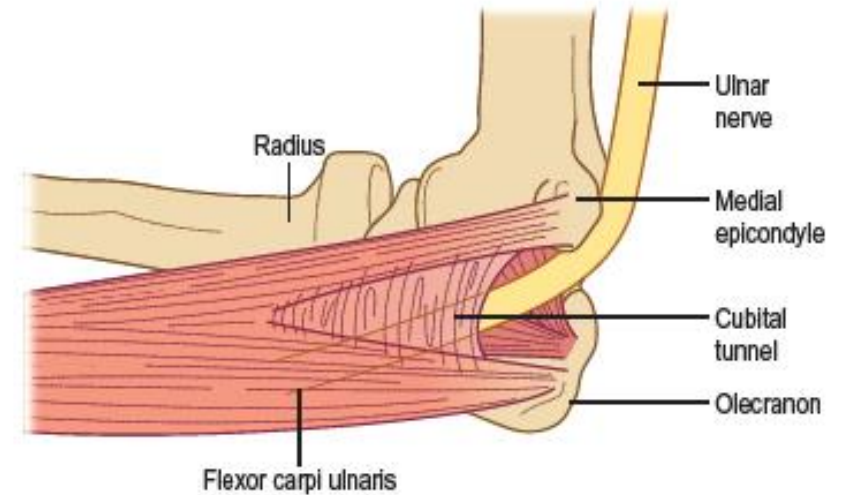
ULNAIRE : SENSITIF



COMPRESSION ULNAIRE AU COUDE

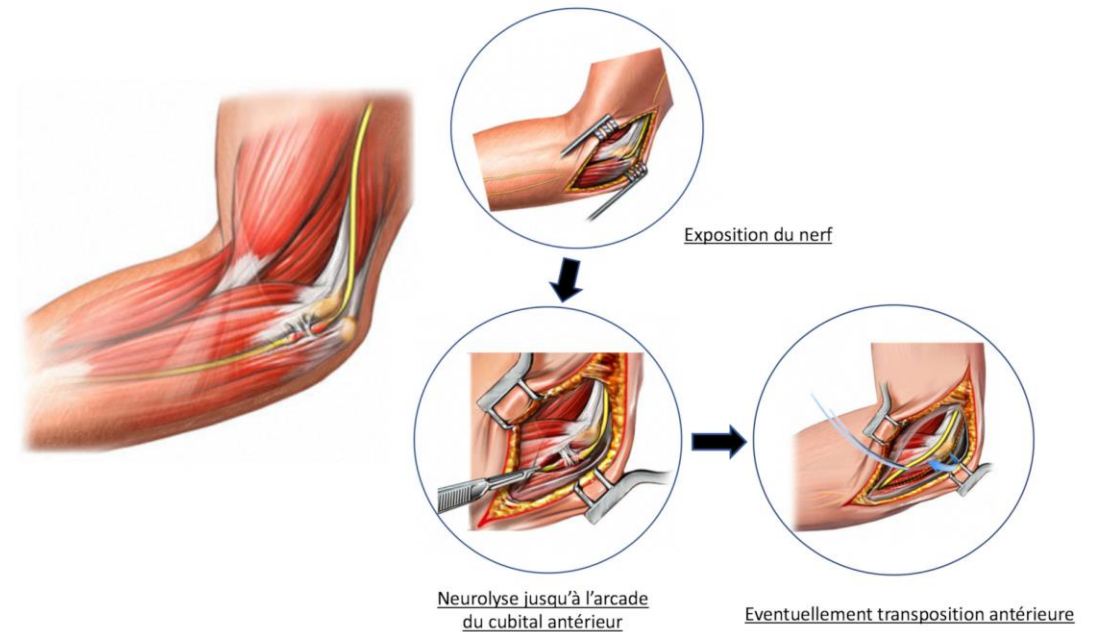
Etiologies:

- Compression externe (microtrauma répétés)
- Luxation du nerf
- Par le tunnel cubital
- Muscle anconé accessoire (variant anatomique)
- Autre: ganglion, arthrose, tumeur...



ULNAIRE AU COUDE: TRAITEMENT

- Conservatrice +/- immobilisation nocturne ¹
- Chirurgicale ² :
 - Libération in situ (endoscopique ou ouverte)
 - Transposition antérieure (sous-cutané versus sous-musculaire)
 - Epicondylectomie médial



1. Nakashian et al. *Current Reviews in Musculoskeletal Medicine* 2020
2. Said et al. *J Hand Microsurg* 2019

ULNAIRE AU POIGNET

- Beaucoup plus rare

Plusieurs sites de compression:

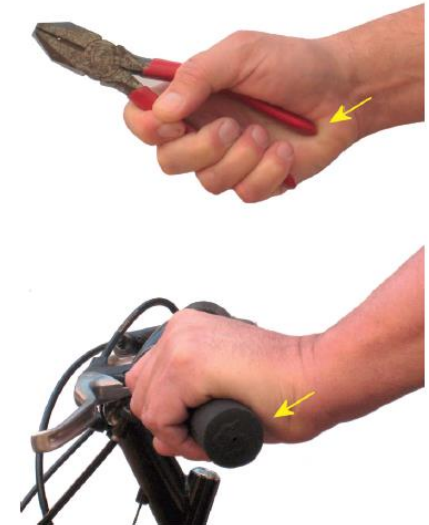
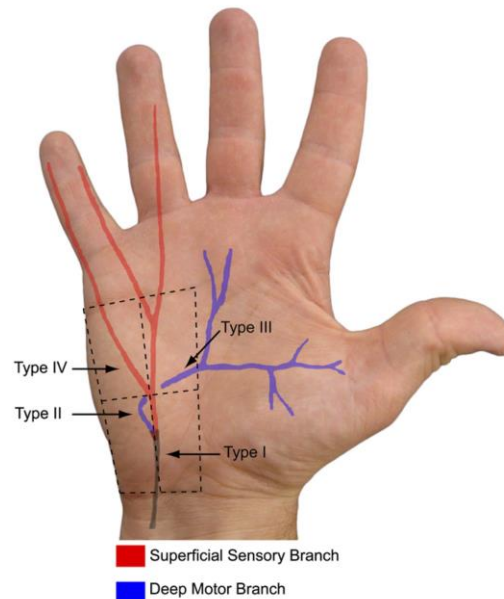
- Canal de Guyon
- Atteinte branche motrice palmaire isolée
- Atteinte branche sensitive superficielle isolée

Etiologie:

- Trauma/fracture
- Ganglion ou masse autre
- Microtrauma répété (vélo, outils...)

Traitement:

- Conservateur versus chirurgical

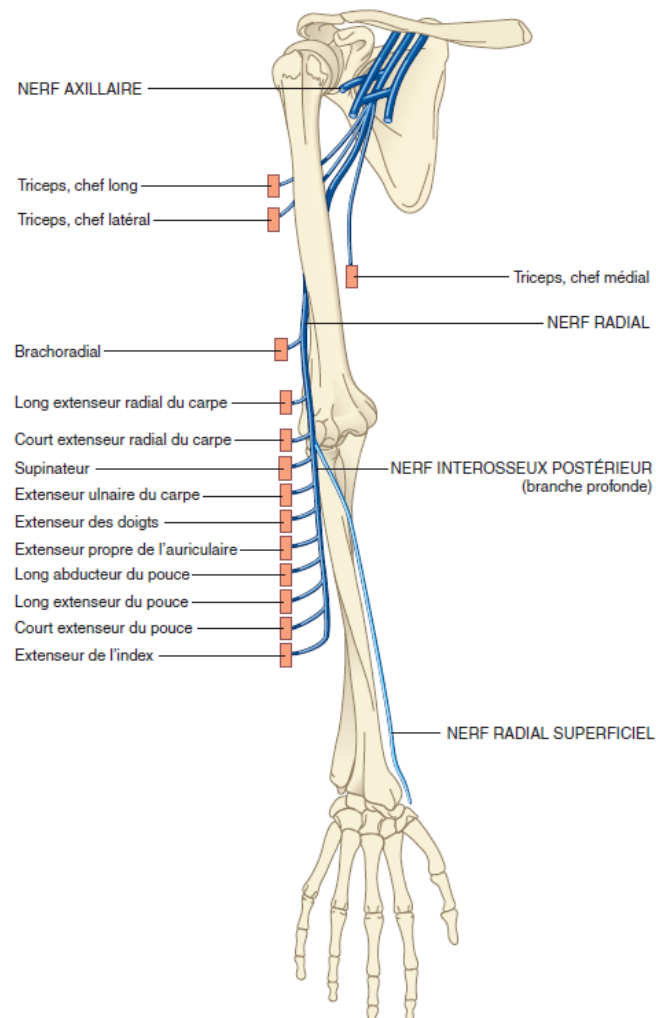


Slane et al. Clinical Biomechanics 2011



NERF RADIAL

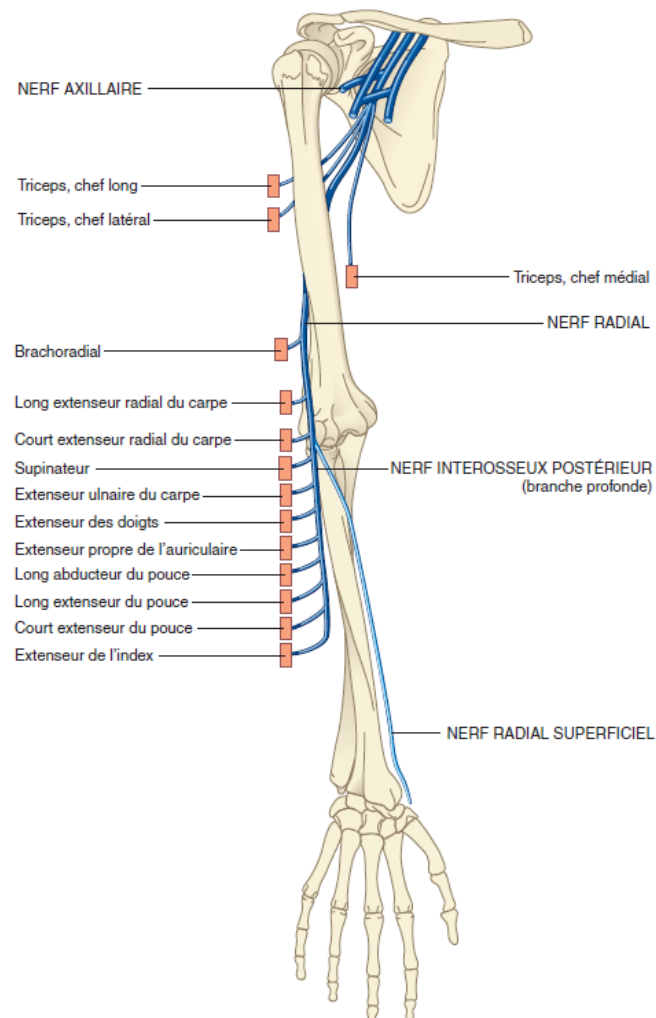
RADIAL : MOTEUR



Supination
Extension bras, poignet et doigts



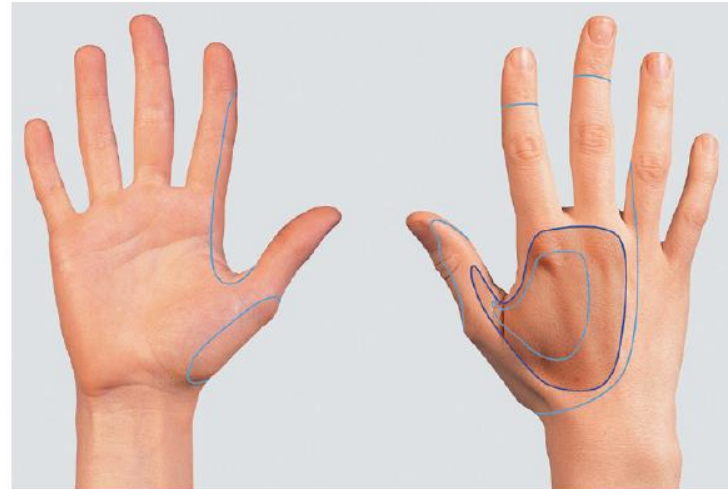
RADIAL : MOTEUR



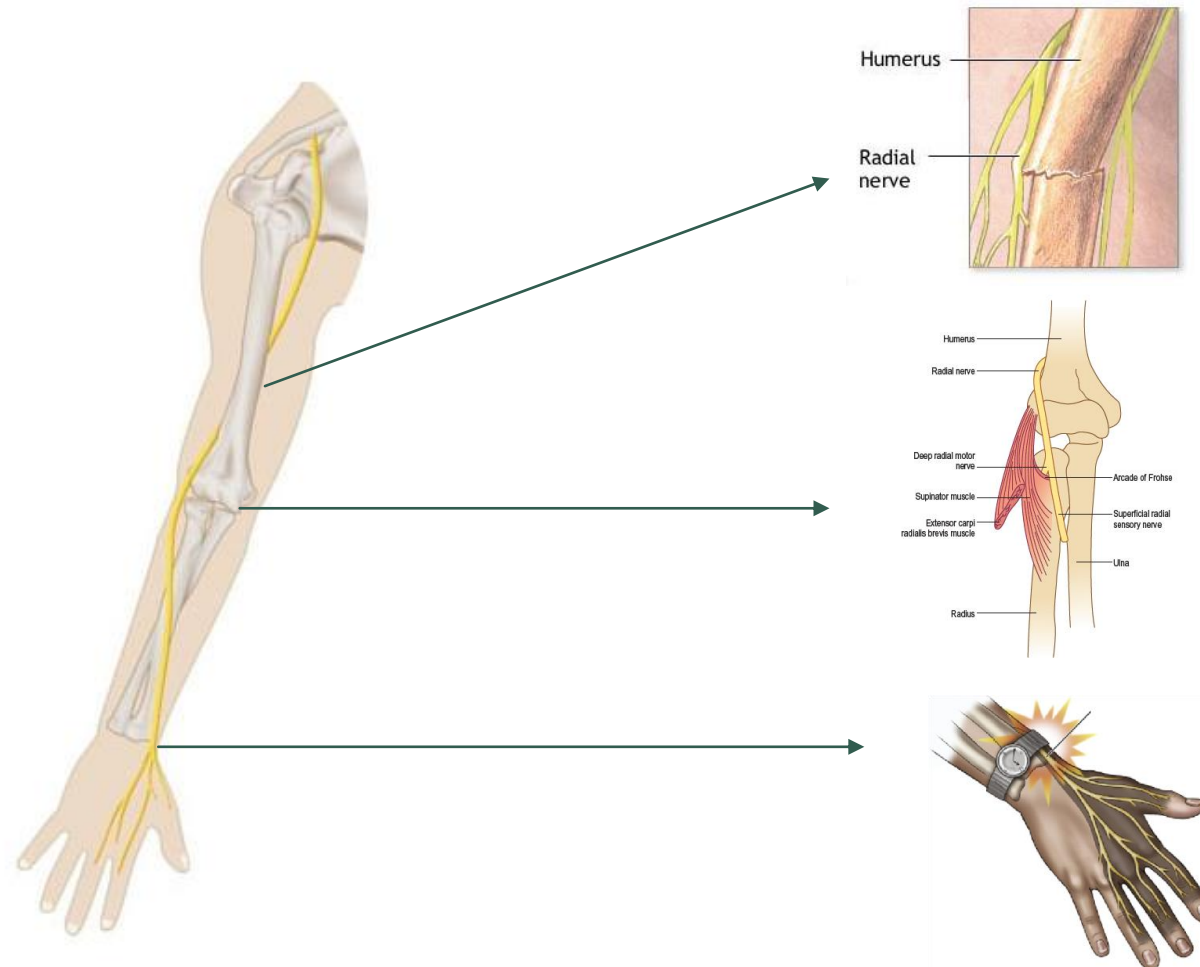
Supination
Extension bras, poignet et doigts



RADIAL : SENSITIF



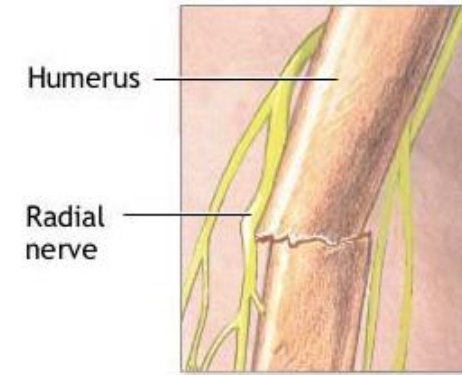
RADIAL: SITE DE COMPRESSION



RADIAL : SPIRAL GROOVE

Spiral groove :

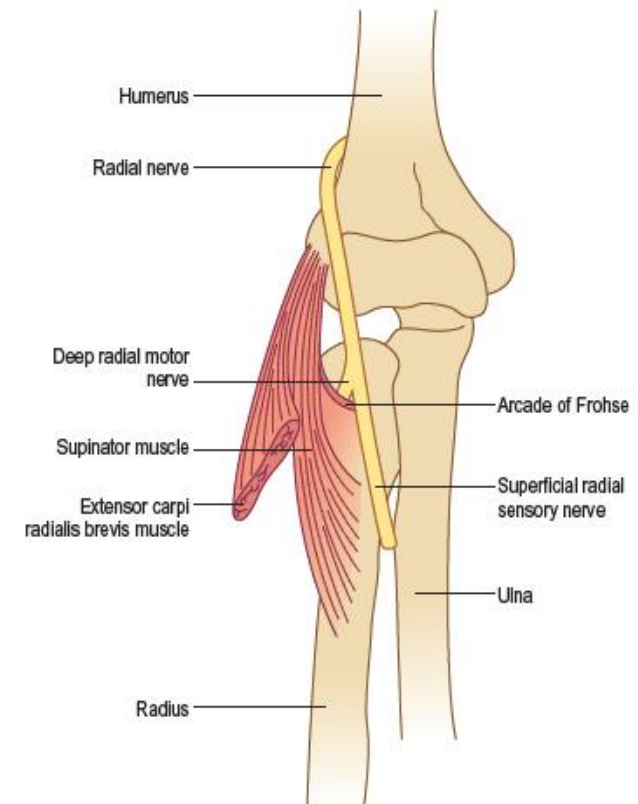
- Fracture
- Compression positionnelle: « Saturday night palsy»
- Clinique : radial complet avec épargne du triceps



RADIAL: AVANT-BRAS

Syndrome du canal radial = syndrome du supinateur

- Compression dans l'arcade de Frohse ou supinateur
- Atteinte déficitaire du nerf interosseux postérieur (moteur pur)
- Irritation non déficitaire: douleurs profondes

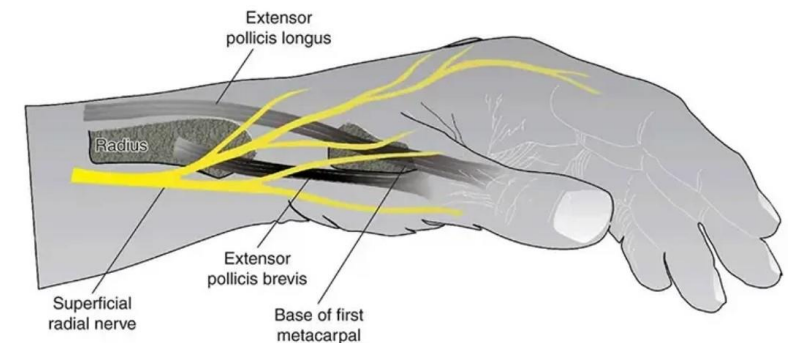
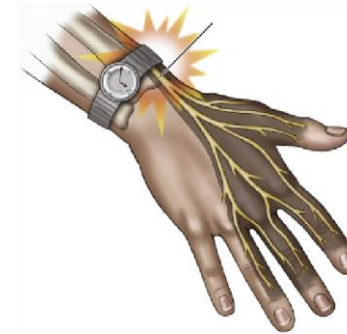


RADIAL: POIGNET



Syndrome de Wartenberg ou Cheiralgia Paresthetica

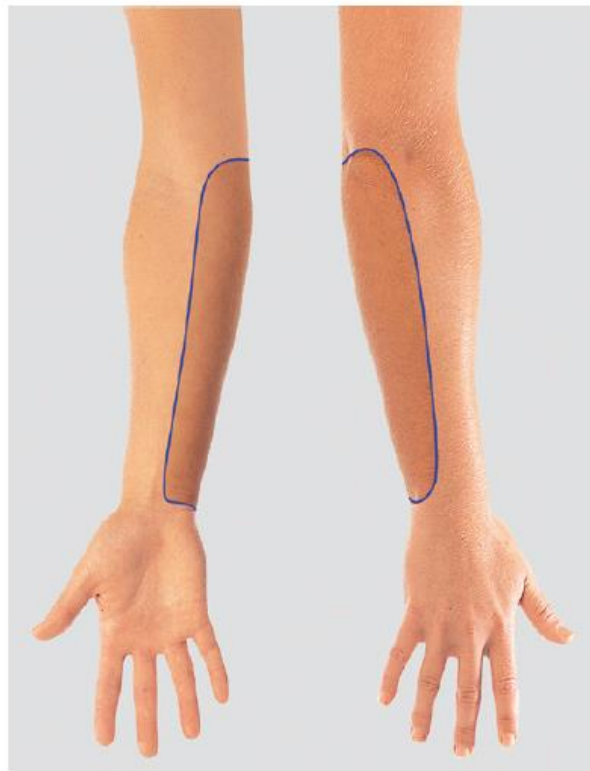
- Neuropathie de la branche sensitive superficielle au poignet
- Sensitive pure
- Douleurs associée, augmentée par préhension et mouvement poignet
- Cause:
 - Compression menotte/montre/bracelet
 - Mouvement répétitif d'extension
 - Associé à ténosynovite de De Quervain
- Traitement: conservateur +/- infiltration





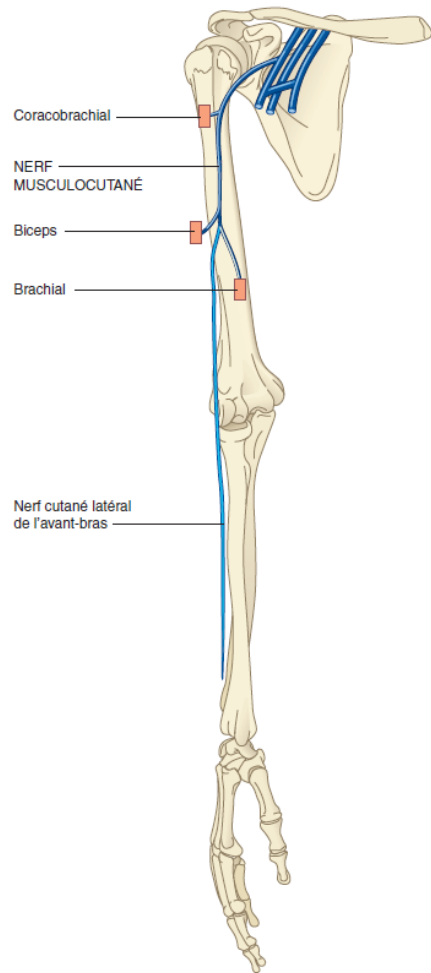
ET LES AUTRES NERFS?

NERF CUTANÉ ANTÉBRACHIAL MÉDIAL



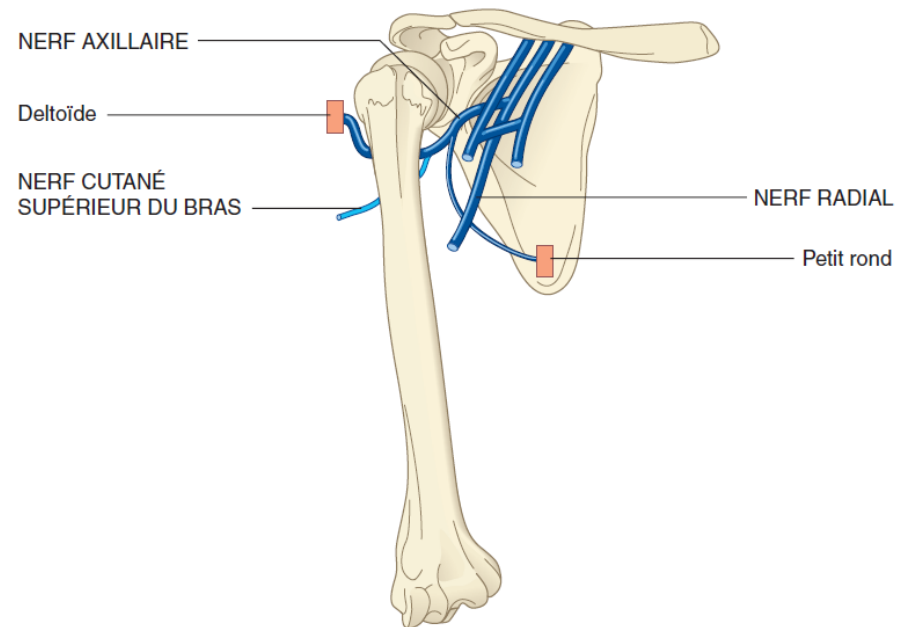
Nerf cutané antébrachial médial

NERF MUSCULOCUTANÉ

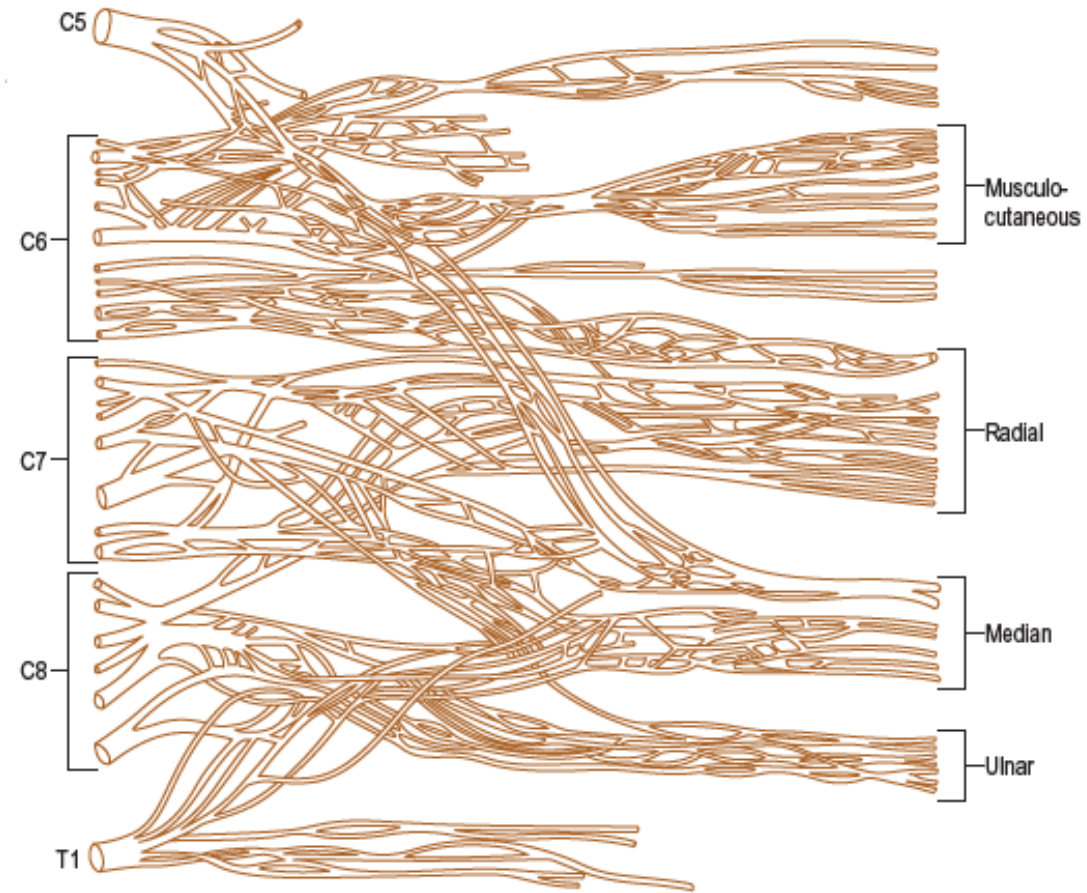


Nerf cutané antébrachial latéral

NERF AXILLAIRE

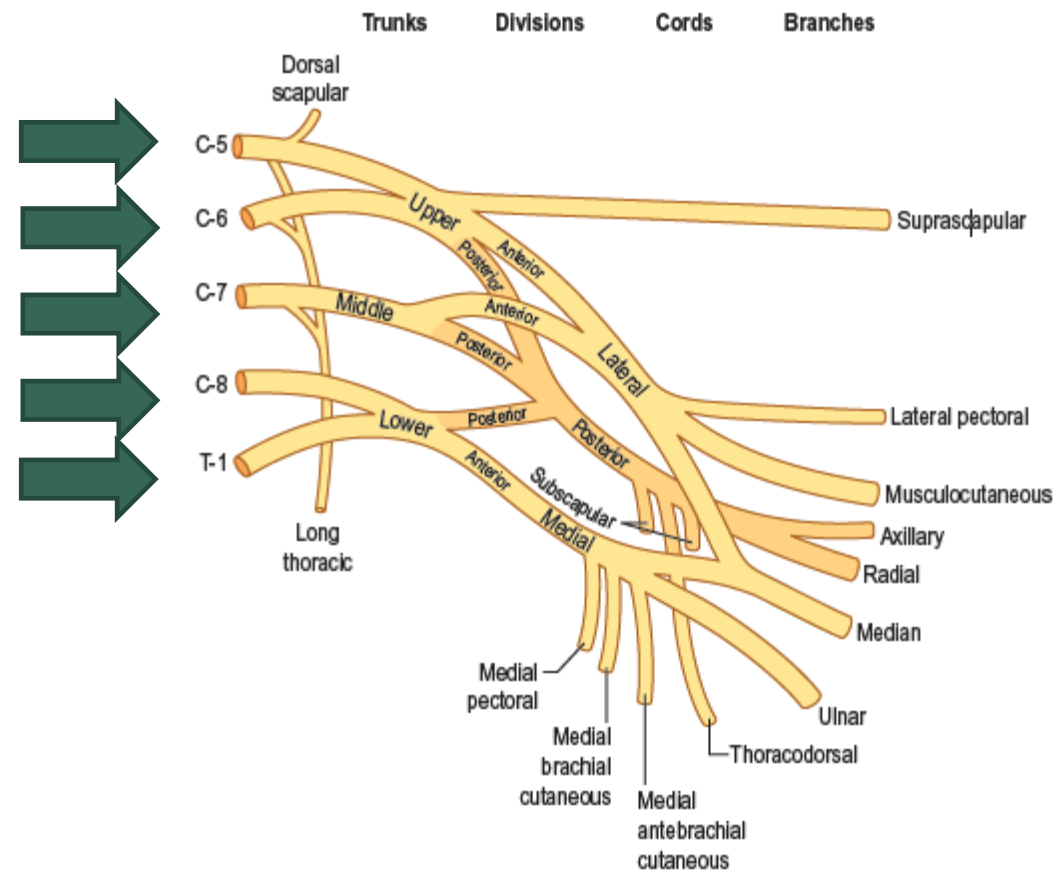
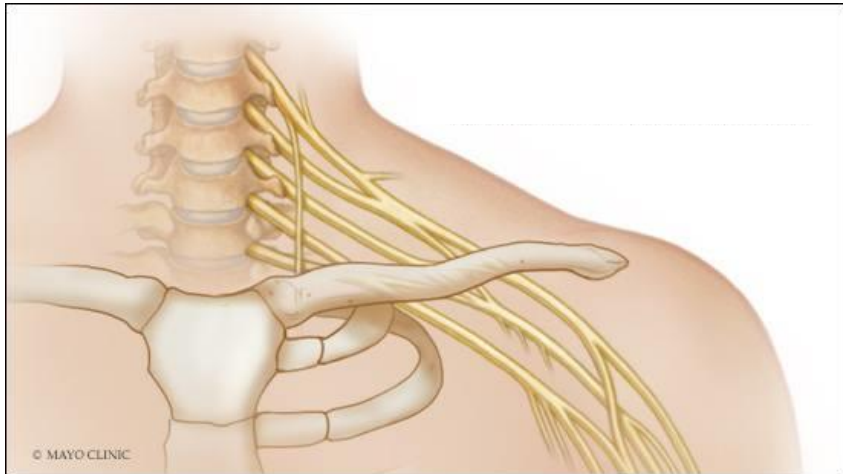


Nerf cutanée supérieur du bras

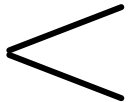


PLEXUS BRACHIAL

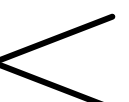
PLEXUS BRACHIAL

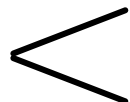


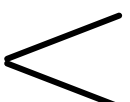
PLEXUS BRACHIAL

Tronc supérieur  C5
C6

Tronc moyen — C7

Tronc inférieur  C8
Th1

Faisceau postérieur  Radial
Axillaire

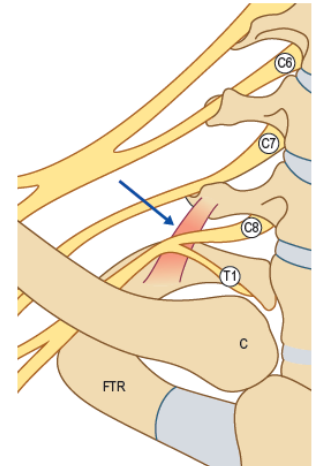
Faisceau latéral  Musculocutané
Médian C6-C7

Faisceau médial  Ulnaire
Médian C8-Th1
Cutané antébrachial
médial

TOS

Thoracic Outlet Syndrome = syndrome du défilé thoracobrachial

- Bande fibreuse partant d'une côte cervicale rudimentaire à la première côte thoracique
- Rare
- Vasculaire ou neurogène
- Atteinte motrice Th1 > C8 avec atrophie

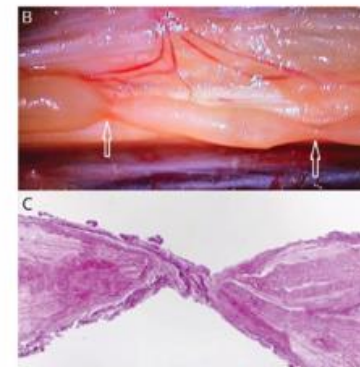


Bouche et al. La lettre du neurologue 2012

SYNDROME DE PARSONAGE-TURNER

= Névralgie amyotrophiante

- Douleurs aigues de l'épaule insomniantes
- Développement de l'atteinte patchy du plexus avec amyotrophie (prédominance du plexus supérieur)
- 10% infection aiguë à hépatite E
- Forme génétique récidivante (mutation SEPT9)
- Déformation en sablière

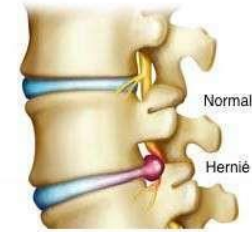


Mittas, Neurology 2019



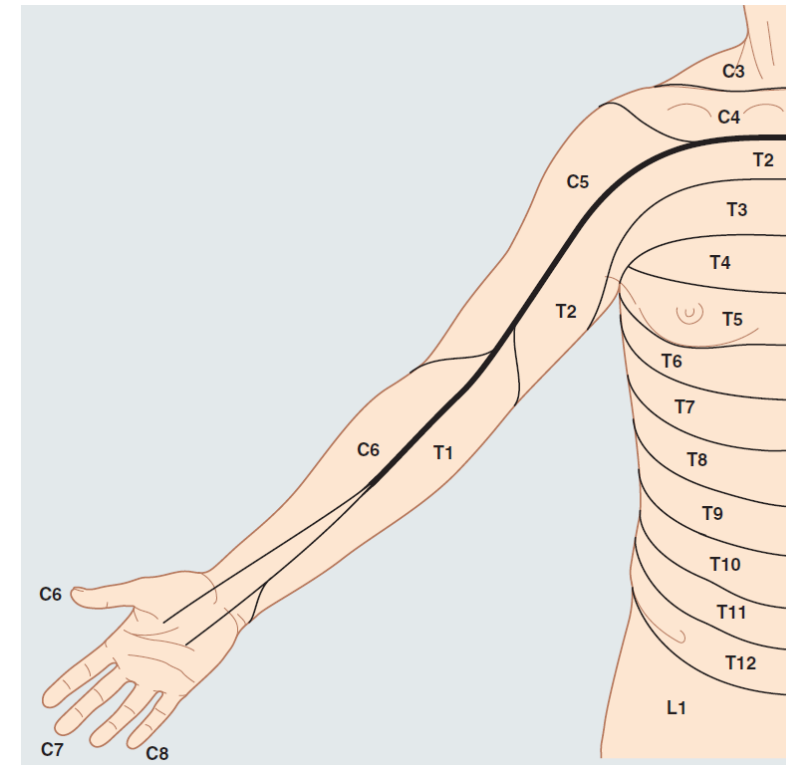
Pan, Neurosurgery 2014

RACINE



	C5	C6	C7	C8	T1
<i>Dorsal scapular nerve</i>					
Rhomboid major/minor					
<i>Suprascapular nerve</i>					
Supraspinatus					
Infraspinatus					
<i>Axillary nerve</i>					
Deltoid					
<i>Musculocutaneous nerve</i>					
Biceps brachii					
<i>Median nerve</i>					
Pronator teres					
Flexor carpi radialis					
Flexor pollicis longus					
Abductor pollicis brevis					
<i>Ulnar nerve</i>					
Flexor carpi ulnaris					
Flexor digitorum profundus (V)					
Abductor digiti minimi					
First dorsal Interosseous					
<i>Radial nerve</i>					
Triceps					
Brachioradialis					
Extensor carpi radialis					
Extensor digitorum communis					
Extensor carpi ulnaris					
Extensor indicis proprius					

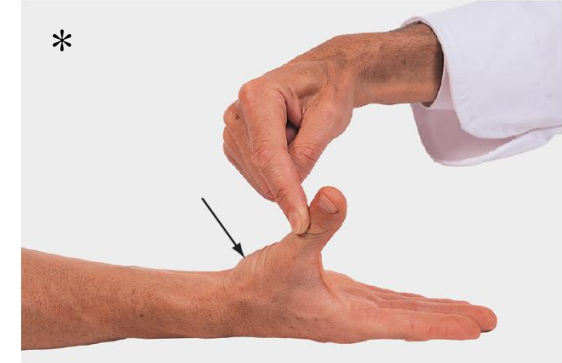
Note: Green squares indicate "marker" muscles that are most often abnormal for that root in an isolated radiculopathy. Blue squares indicate muscles that may be involved, but are abnormal less frequently. This chart shows those muscles that are most helpful in making the electrodiagnosis of radiculopathy but does not indicate the entire myotomal representation of the individual muscle (see Table 29-3).
From Wilbourn, A.J., 1993. Radiculopathies. In: Brown, W.F., Bolton, C.F. (Eds.), Clinical electromyography, 2nd ed. Butterworth, Boston, with permission.



TAKE HOME MESSAGE



- Atteinte périphérique (SNP): répartition tronculaire ou radiculaire
- Médian:
 - Poignet: court abducteur du pouce *
 - Avant-bras : pronation, fléchisseur profond doigts II et III
- Ulnaire:
 - Poignet: muscles interosseux dorsaux (abduction des doigts)
 - Coude : fléchisseur profond doigts IV et V
- Radial:
 - Supination
 - Extension: bras, poignet, doigts
- Atteinte de plusieurs racine ou plusieurs nerf ⇒ Plexus?



MERCI POUR VOTRE
ATTENTION !



SOURCES

- PRESTON D ET SHAPIRO B. *ELECTROMYOGRAPHY AND NEUROMUSCULAR DISORDERS*. W.B. SAUNDERS 2013

- BERTORINI T. *NEUROMUSCULAR DISORDERS: TREATMENTS AND MANAGEMENT*. ELSEVIER 2021.

- BLUMENFIELD H. *NEUROANATOMY THROUGH CLINICAL CASES*. OXFORD UNIVERSITY PRESS 2010.

- *AIDS TO THE EXAMINATION OF THE PERIPHERAL NERVOUS SYSTEM*, 5TH. EDITION ELSEVIER MASSON 2011



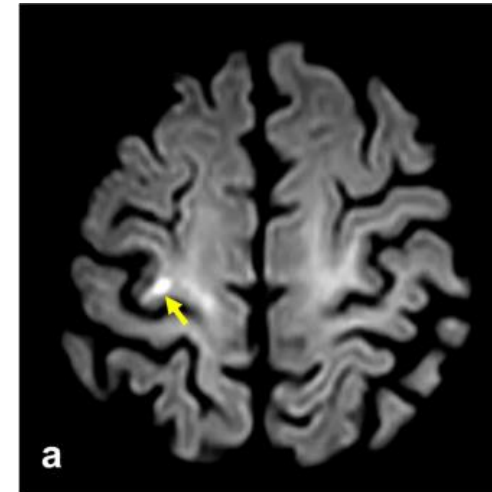
DIAGNOSTIC DIFFÉRENTIEL

Central (hand knob):

- Atteinte des muscles de la main d'innervation ulnaire et médian
- Atteinte sensitive non territoriale
- Atteinte visage ipsilatéral
- Dans un second temps: hyperéflexie et autres signes de libération

Radiculopathie C7

- Epargne du muscle brachioradial (neuropathie radial proximale)
- Atteinte du Triceps (neuropathie radiale en dessous de la spirale groove)
- Atteinte des muscles C7 non radial:
 - Rond pronateur: faiblesse de la pronation
 - Fléchisseur radial et ulnaire du carpe: faiblesse de la flexion du poignet



MUSCLE BRACHIORADIAL



SYSTÈME NERVEUX PÉRIPHÉRIQUE

- **Racine**

→ radiculopathie

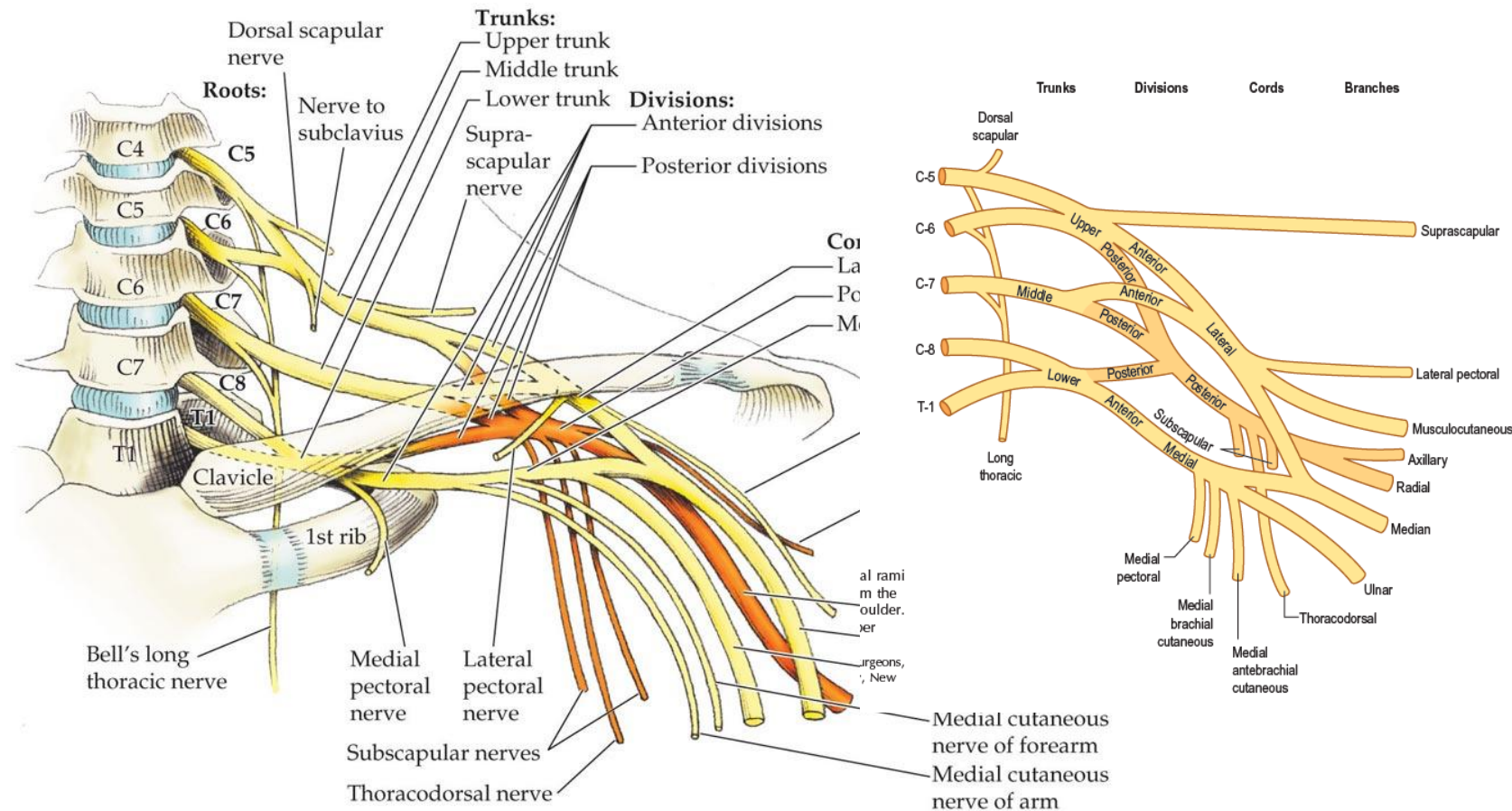
- **Plexus**

→ plexopathie

- **Nerf**

- **Jonction neuro-musculaire**

- **Muscle**



SYSTÈME NERVEUX PÉRIPHÉRIQUE

- Racine

→ radiculopathie

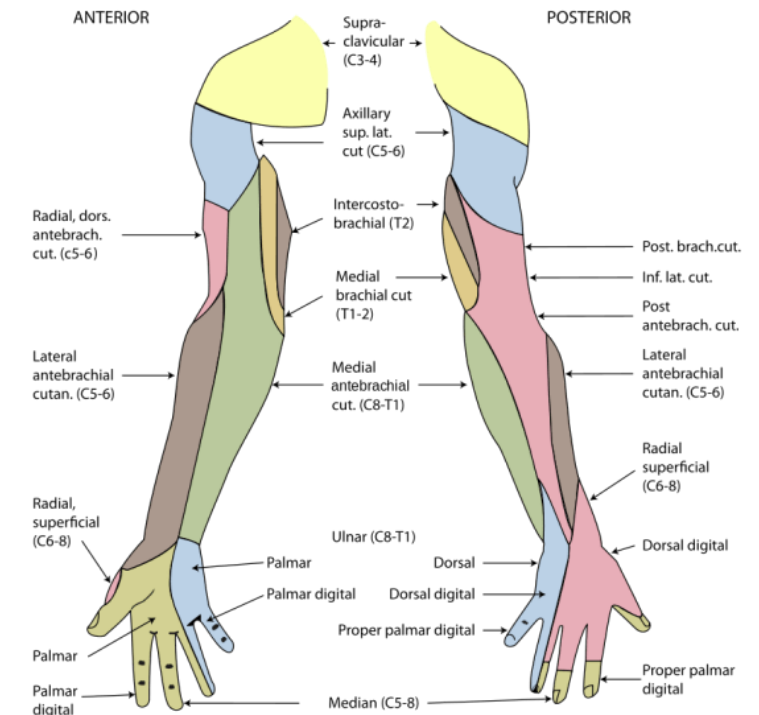
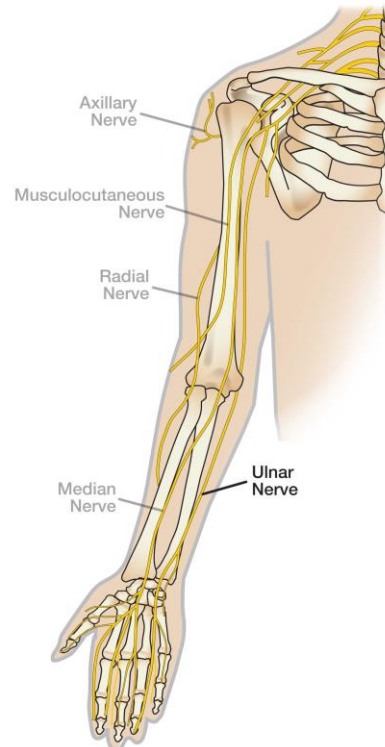
- Plexus

→ plexopathie

- **Nerf**

- Jonction neuro-musculaire

- Muscle



Chaque muscle dispose d'une innervation par un nerf et plusieurs racines

ANTERIOR PRIMARY RAMI	C5	C6	C7	C8	T1
PROXIMAL NERVES					
Rhomboid major/minor (dorsal scapular)					
Supraspinatus (suprascapular)					
Infraspinatus (suprascapular)					
Deltoid (axillary)					
Biceps brachii (musculocutaneous)					
Brachialis (musculocutaneous)					
RADIAL NERVE					
Triceps					
Anconeus					
Brachioradialis					
Extensor carpi radialis					
Extensor pollicis brevis					
Extensor indicis proprius					
MEDIAN NERVE					
Pronator teres					
Flexor carpi radialis					
Flexor pollicis longus					
Pronator quadratus					
Abductor pollicis brevis					
ULNAR NERVE					
Flexor carpi ulnaris					
Flexor digitorum profundus (med)					
Abductor digiti minimi					
Adductor pollicis					
First dorsal interosseous					
POSTERIOR PRIMARY RAMI					
Cervical paraspinals					
High thoracic paraspinals					

Often predominant contribution	Sometimes significant contribution
Minor/equivocal contribution	

ANTERIOR PRIMARY RAMI	L2	L3	L4	L5	S1	S2
PROXIMAL NERVES						
Iliacus (lumbar plexus)						
Adductor longus (obturator)						
Vastus lateralis/medialis (femoral)						
Rectus femoris (femoral)						
Tensor tascia lata (superior gluteal)						
Gluteus medius (superior gluteal)						
Gluteus maximus (inferior gluteal)						
SCIATIC NERVE						
Semitendinosus/membranosus (tibial)						
Biceps femoris (sht. hd.)(peroneal)						
Biceps femoris (long. hd.)(tibial)						
PERONEAL NERVE						
Tibialis anterior						
Extensor hallucis						
Peroneus longus						
Extensor digitorum brevis						
TIBIAL NERVE						
Tibialis posterior						
Flexor digitorum longus						
Gastrocnemius lateral						
Gastrocnemius medial						
Soleus						
Abductor hallucis						
Abductor digiti quinti pedis						
POSTERIOR PRIMARY RAMI						
Lumbar paraspinals						

Often predominant contribution	Sometimes significant contribution
Minor/equivocal contribution	

Mark A Ferrante. Comprehensive Electromyography.
Cambridge university press 2018

CIDP: CHRONIC INFLAMMATORY

DEMYELINATING POLYRADICULONEUROPATHY

J'ai fait mes recherches sur Internet.

Alors pour me rassurer, je voudrais ...



Une fibroscopie, une coloscopie, une radio thoracique, une échographie abdominale, un électrocardiogramme, un scanner cérébral...

Sinon je change de médecin.



KARL GORCE-

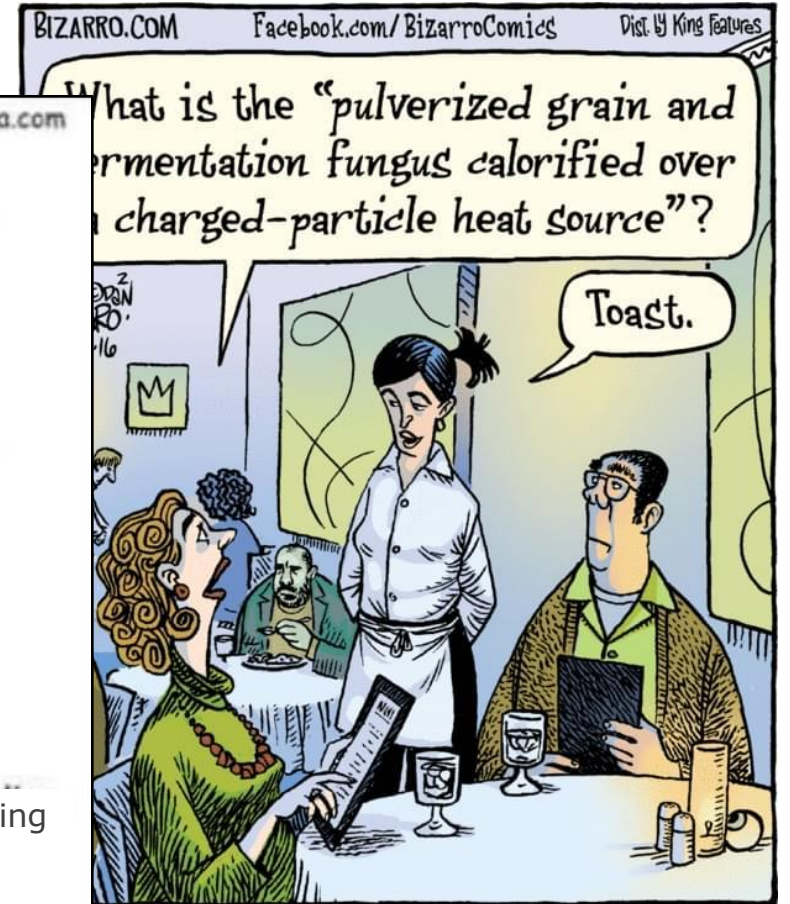


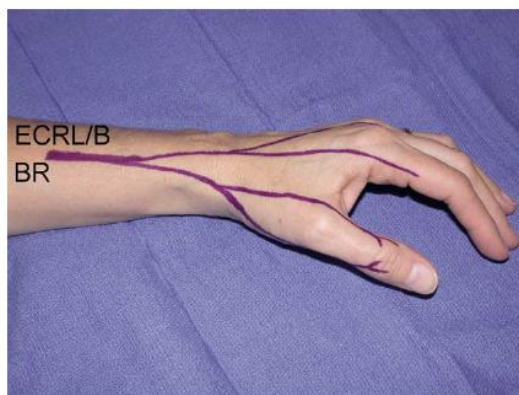
©Marty Bucella

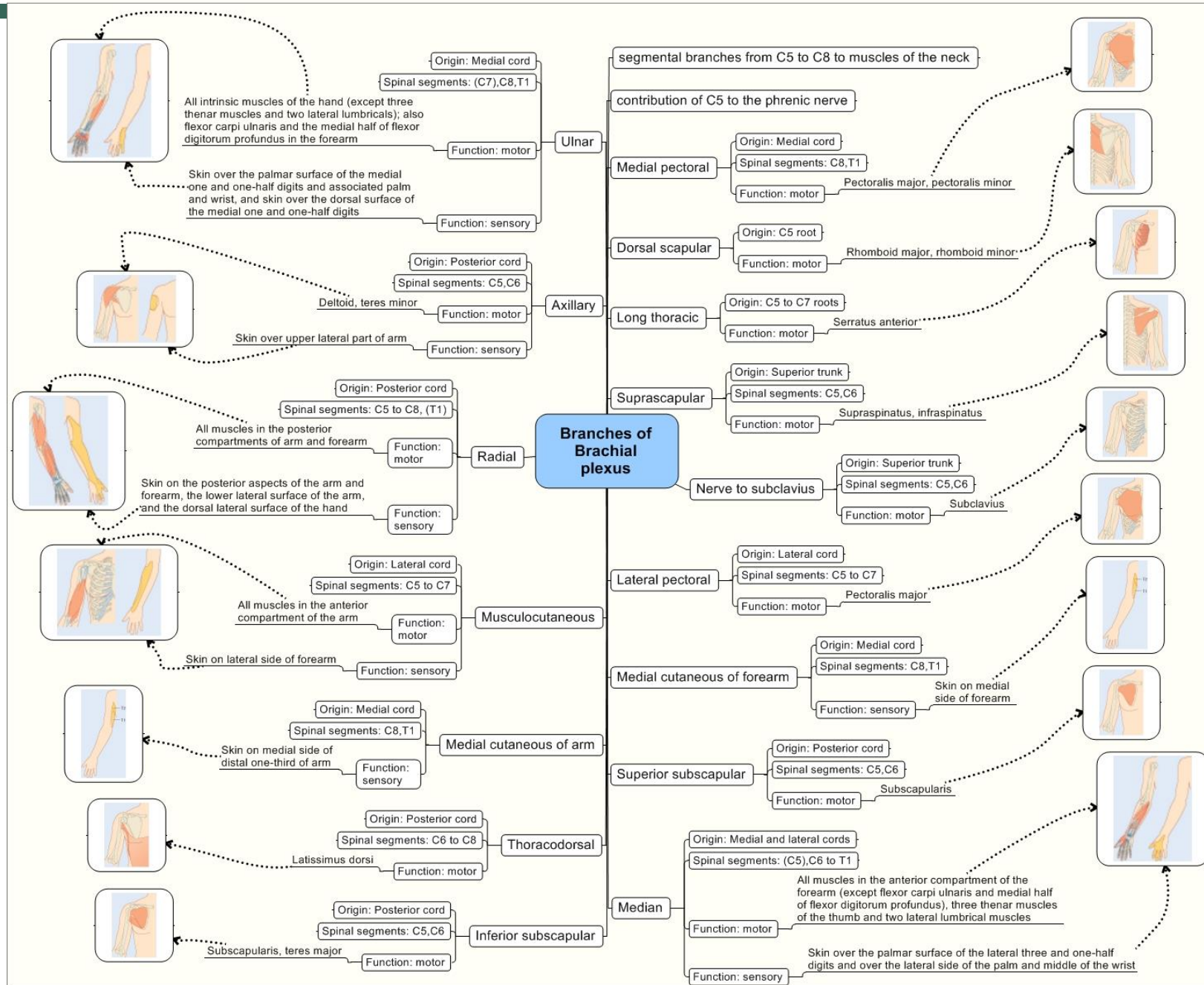
www.martybucella.com



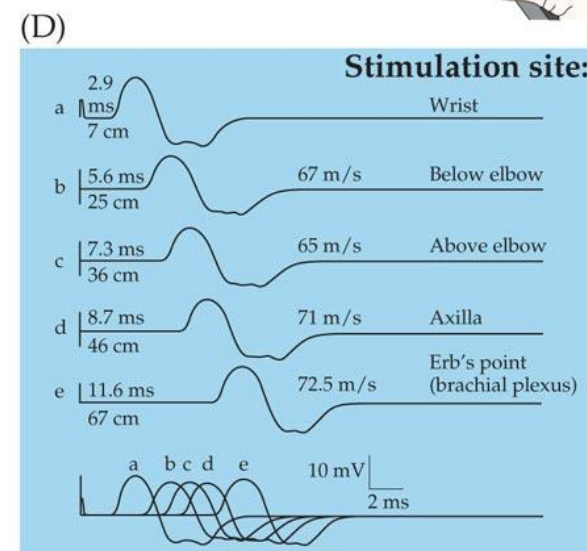
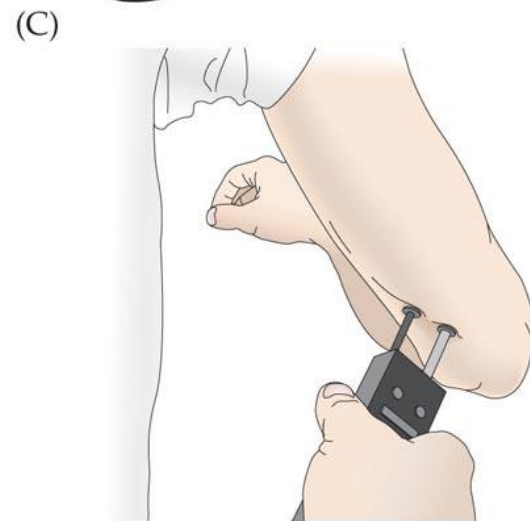
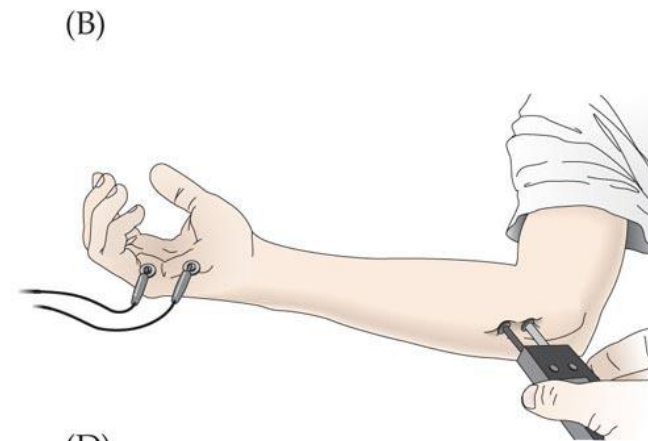
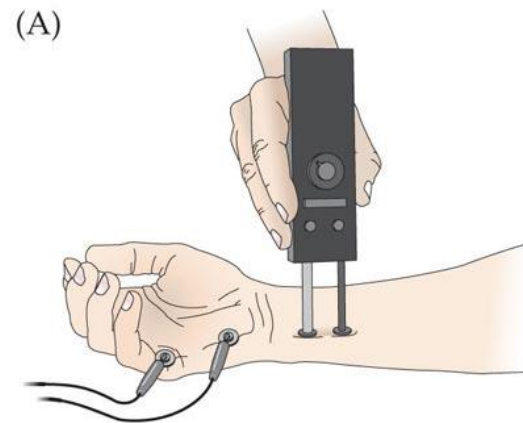
« You don't need an ENMG, but I'm sending you for one because, quite frankly, I don't like you. »



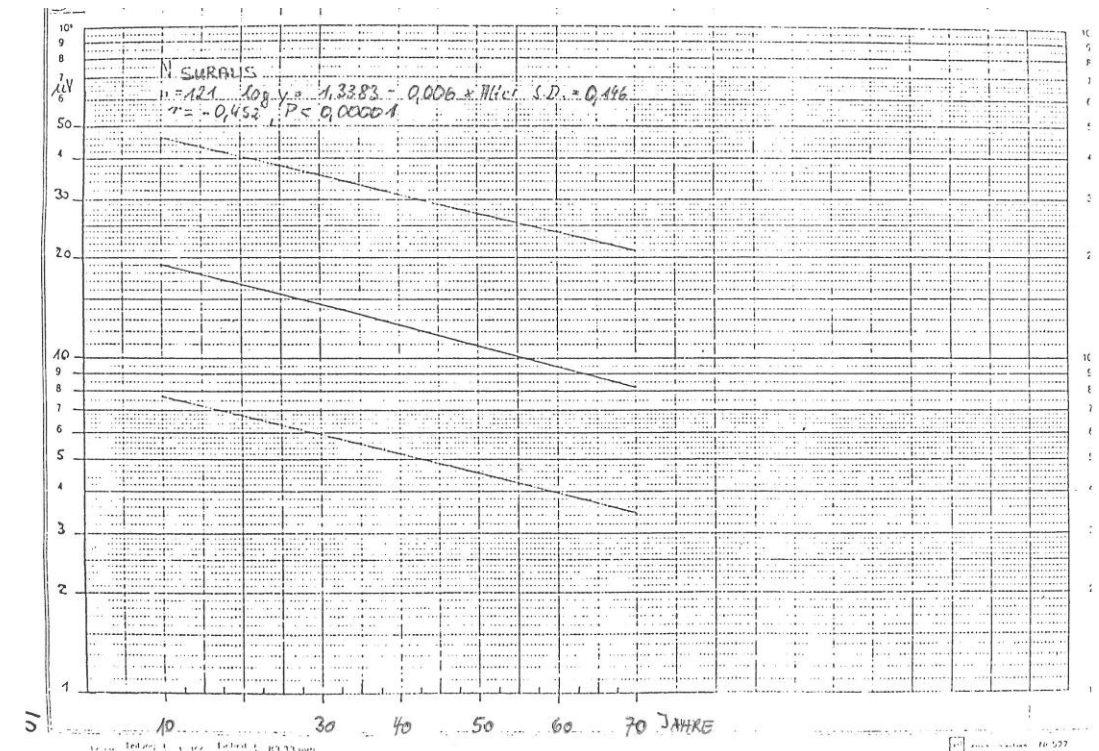
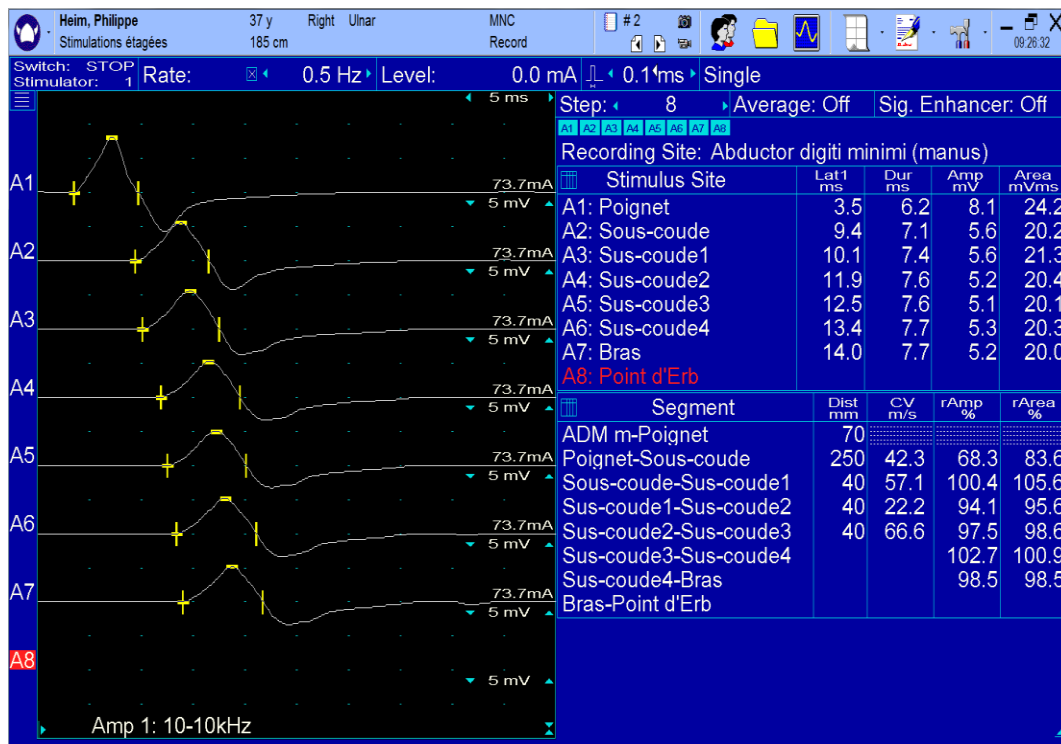




ENMG



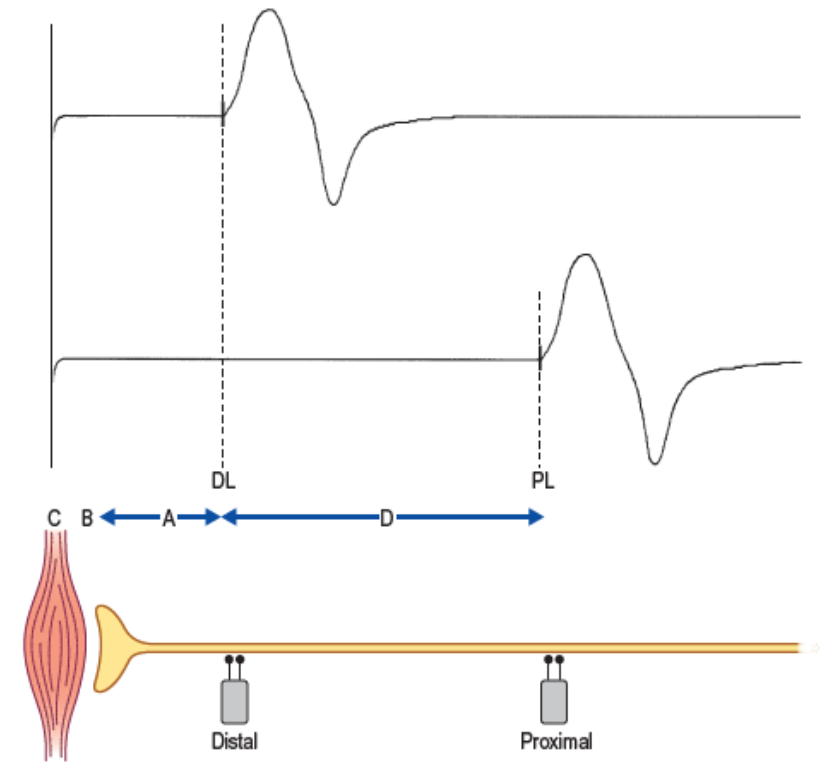
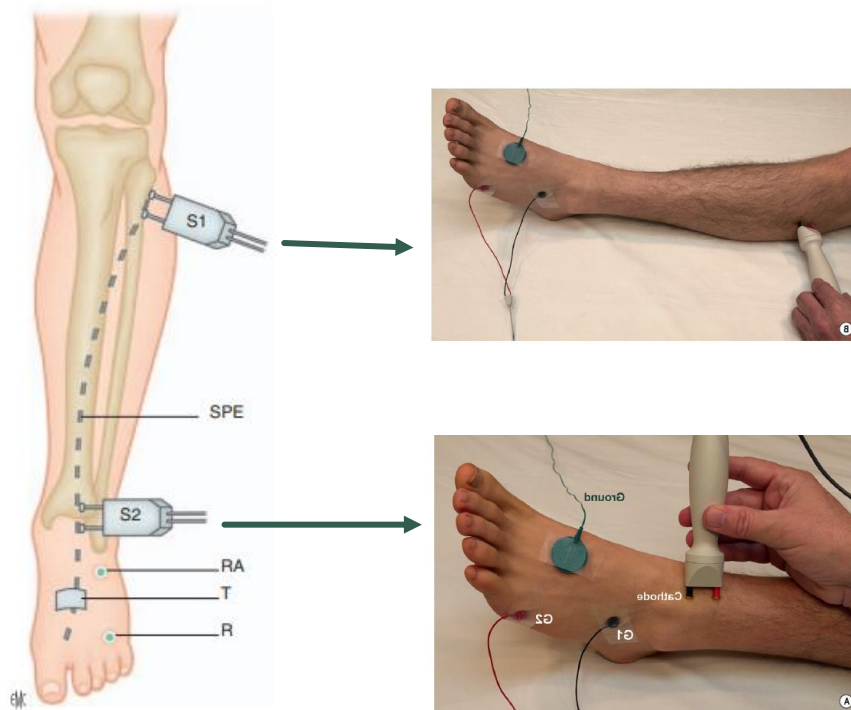
4) ENMG: ÉLECTRONEUROMYOGRAPHIE



- Limitations: Grosses fibres, étude distale

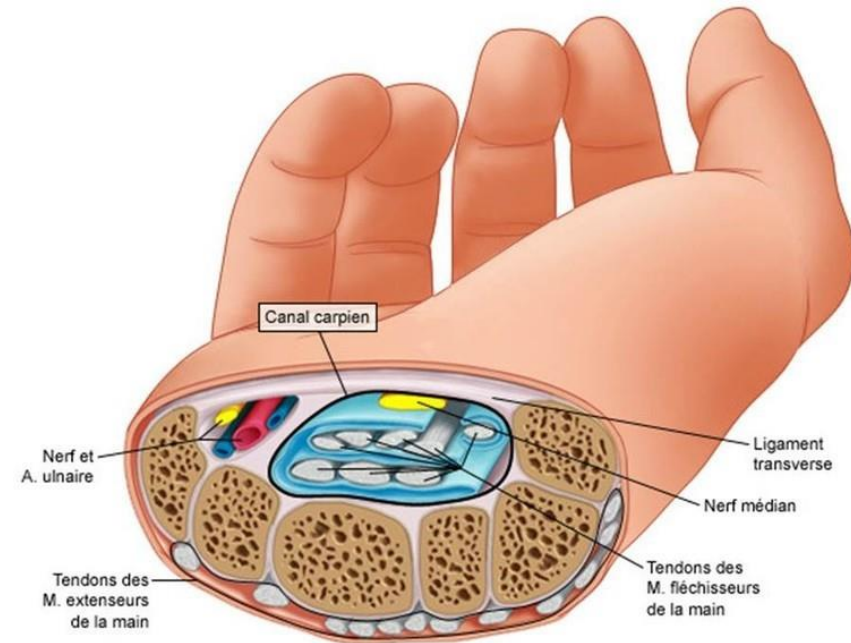
4) ENMG: ÉLECTRONEUROMYOGRAPHIE

- Neurographie; étude de conduction nerveuse étagée



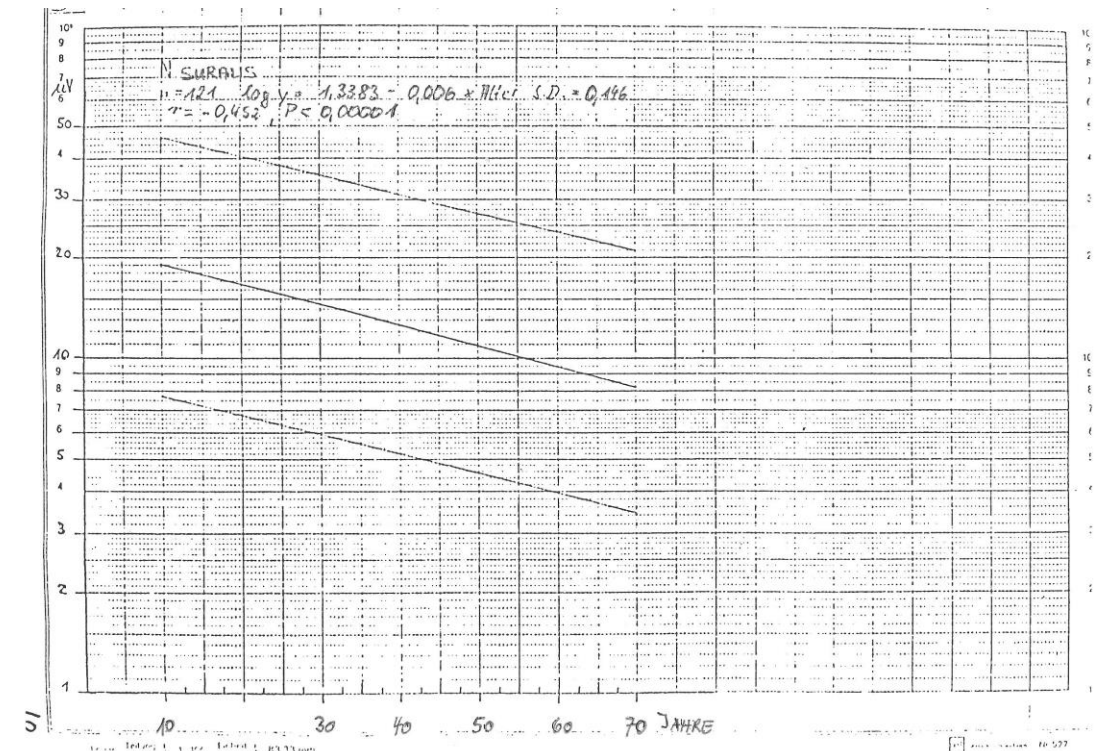
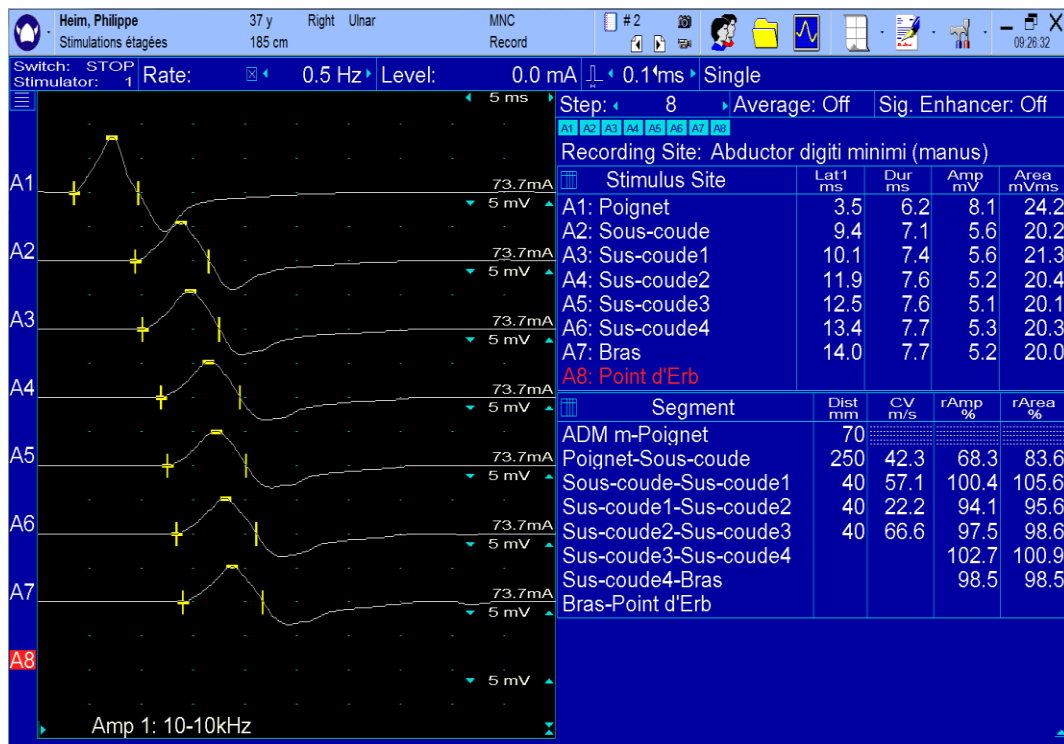
SYNDROME DU CANAL CARPIEN (CTS)

- Fréquence +++
- Epidémiologie^{1,2}:
 - 10% des gens au cours de leur vie
 - Prévalence entre 3-5% dans la population générale
 - Pic à 50 ans, F>H
 - 2ème pic à 70 ans F=H
- Facteurs favorisants:³
 - Diabète
 - Hypothyroïdie
 - Arthrite
 - Obésité
 - Grossesse



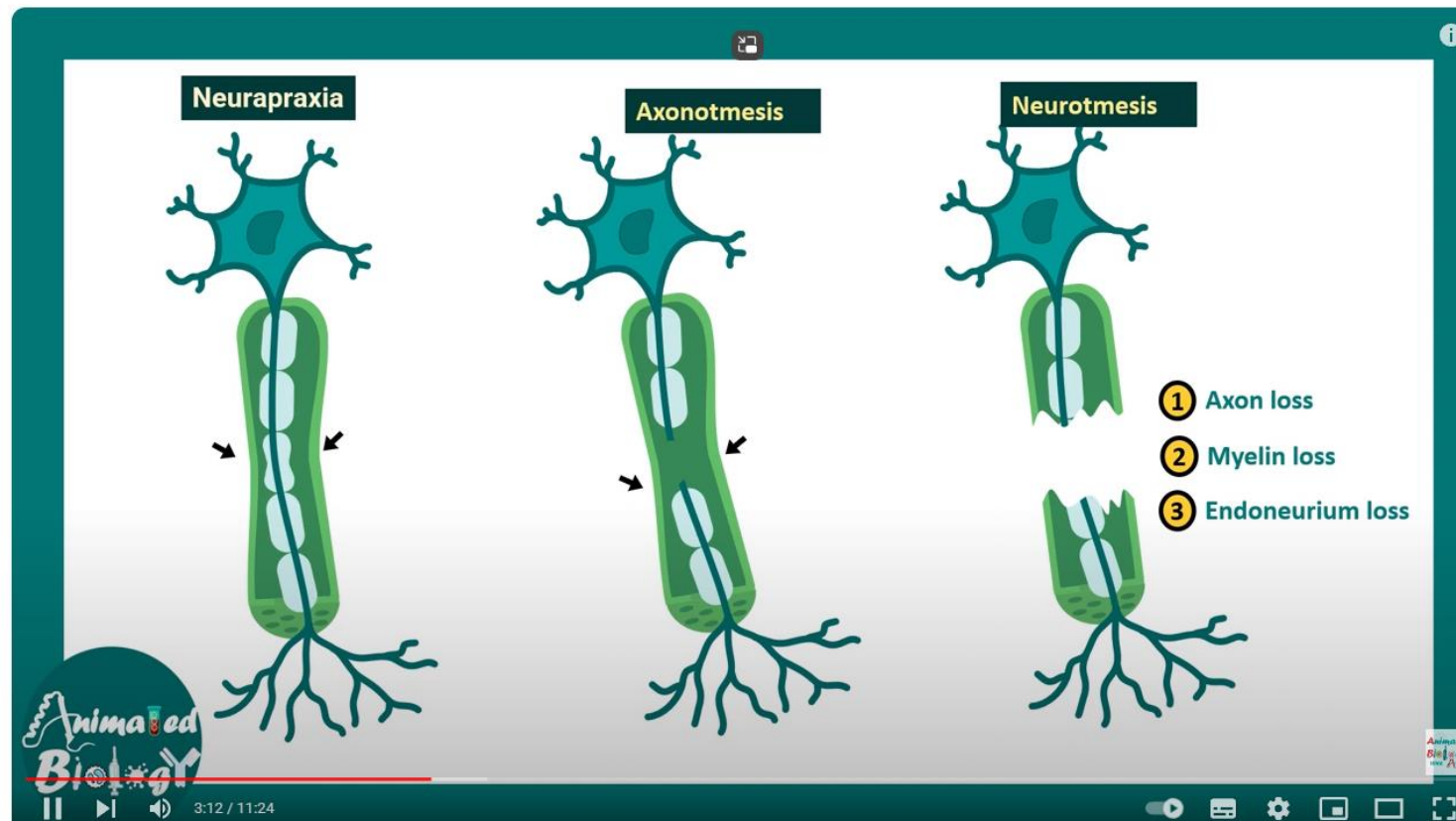
1. Atroshi et al. JAMA 1999
2. Bland JD et al. JNNP 2003
3. Padua et al. Lancet Neurol 23

ENMG: ÉLECTRONEUROMYOGRAPHIE



- Limitations: Grosses fibres, étude distale

MÉCANISME DE LÉSION



DÉGÉNÉRESCENCE WALLÉRIENNE

