

Common nerve entrapments

CTS, ulnar nerve, peroneal nerve

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Learning

- EDX recording techniques
- Diagnostic pitfalls
- Common findings
- Therapy

Carpal tunnel syndrome

Incidence [1:100.000year]

CJD	0,1
DM type 1	1
MS	4
Cervical disc problems	20
Brain injury	150
Carpal tunnel syndrome	300
DM type 2	450

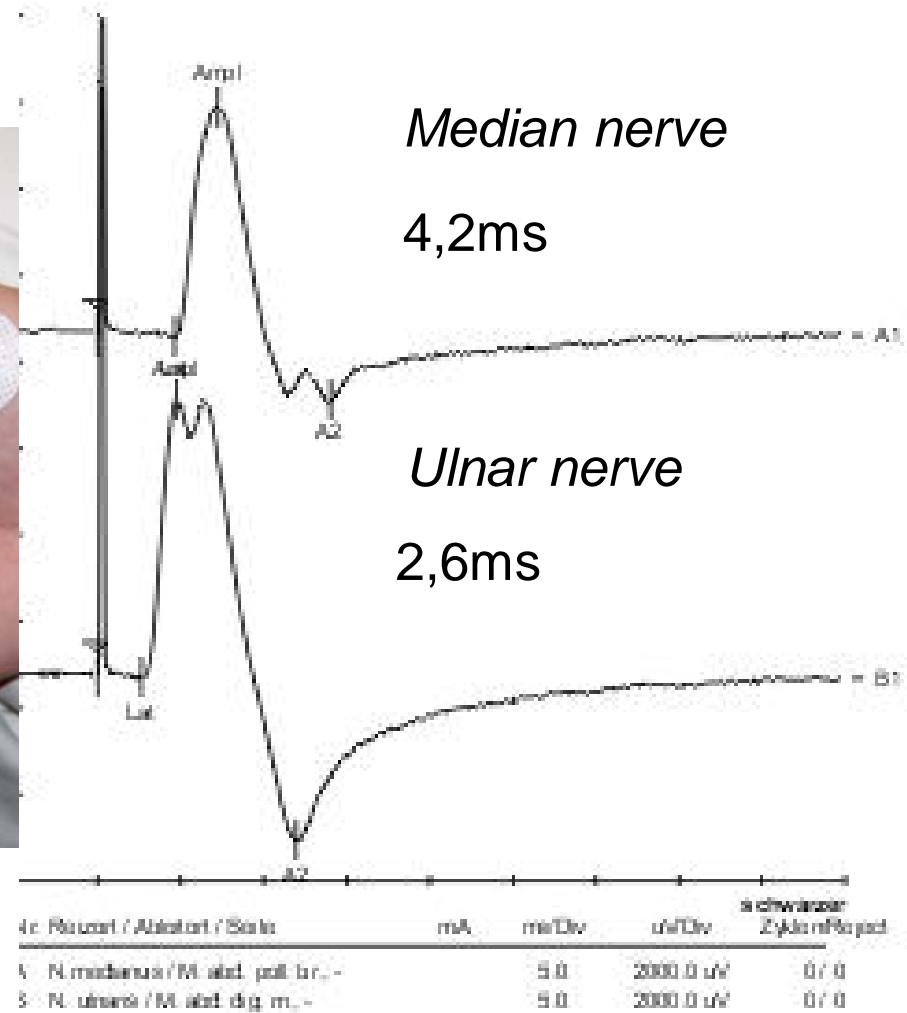
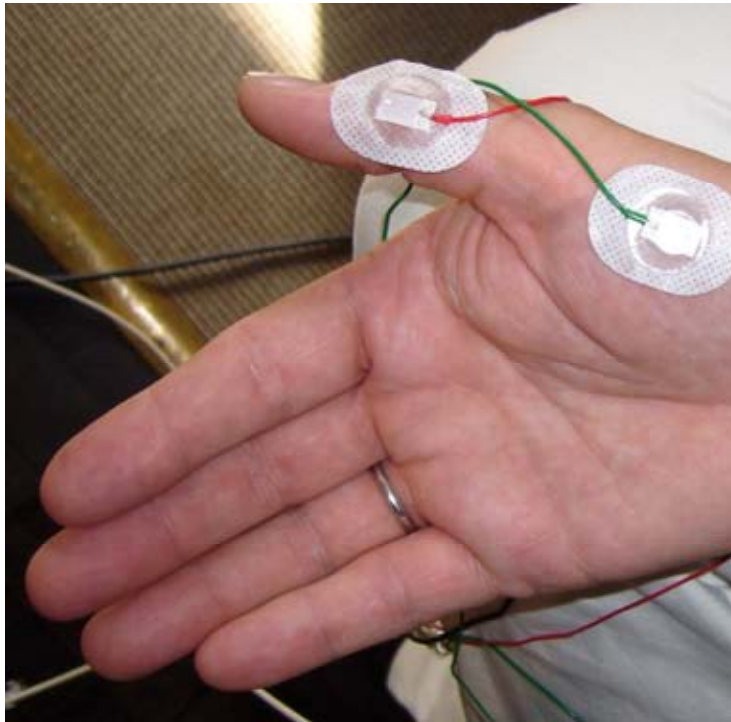
Causes

Idiopathic
secondary

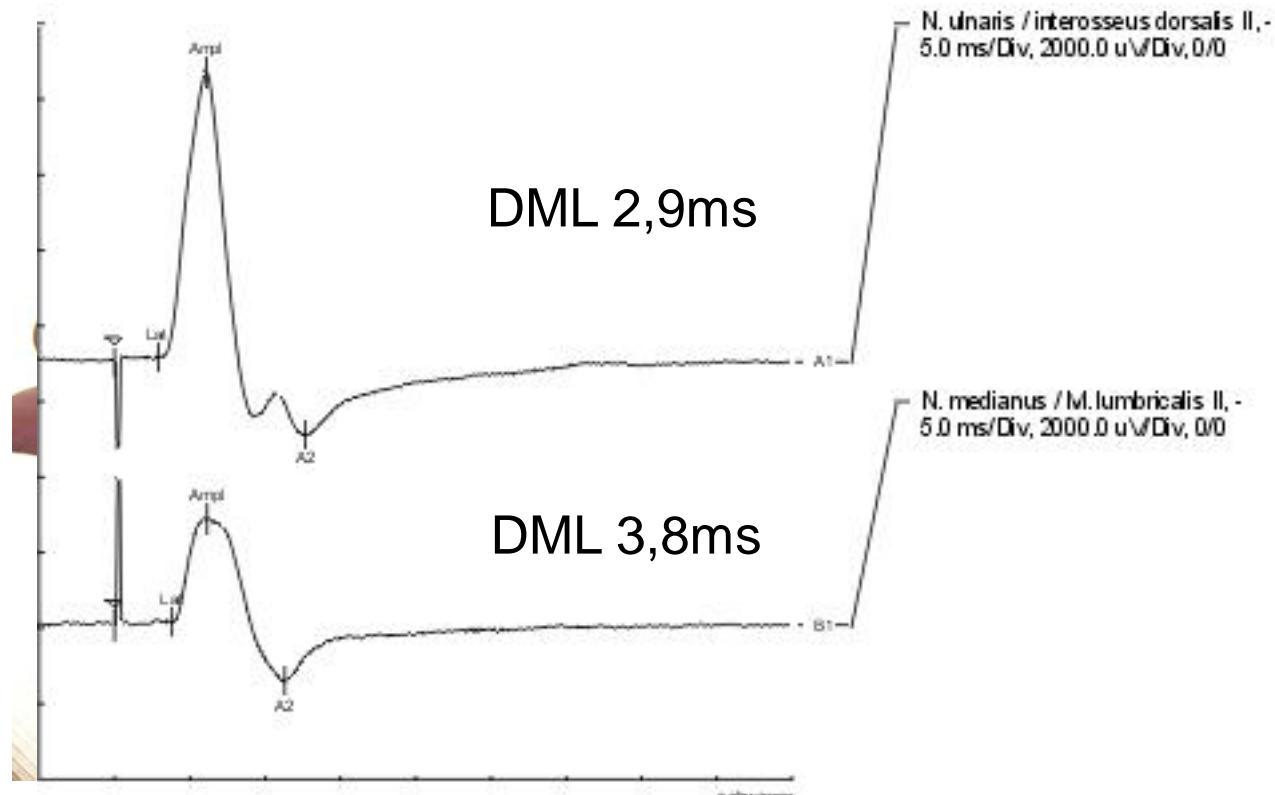
Carpal tunnel syndrome

- Slow progression but sometimes acute
- Somtimes shoulder pain
- Somtimes paraesthesias are difficult to localize
- At the beginning EDX testing may be normal
- Coincidence with cervical spine problems
- Comparison tests are to be preferred

Distal motor latency

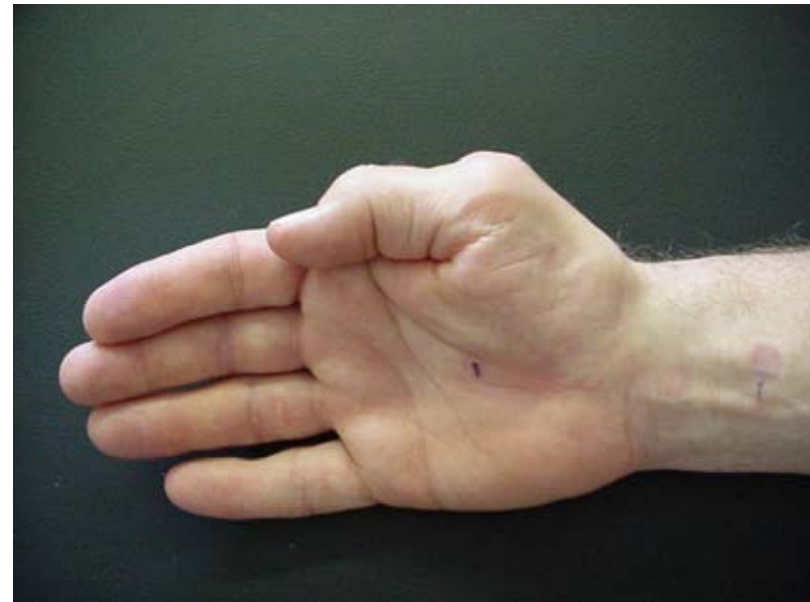


Distal motor latency comparison IOD 2 vs lumbrical 2

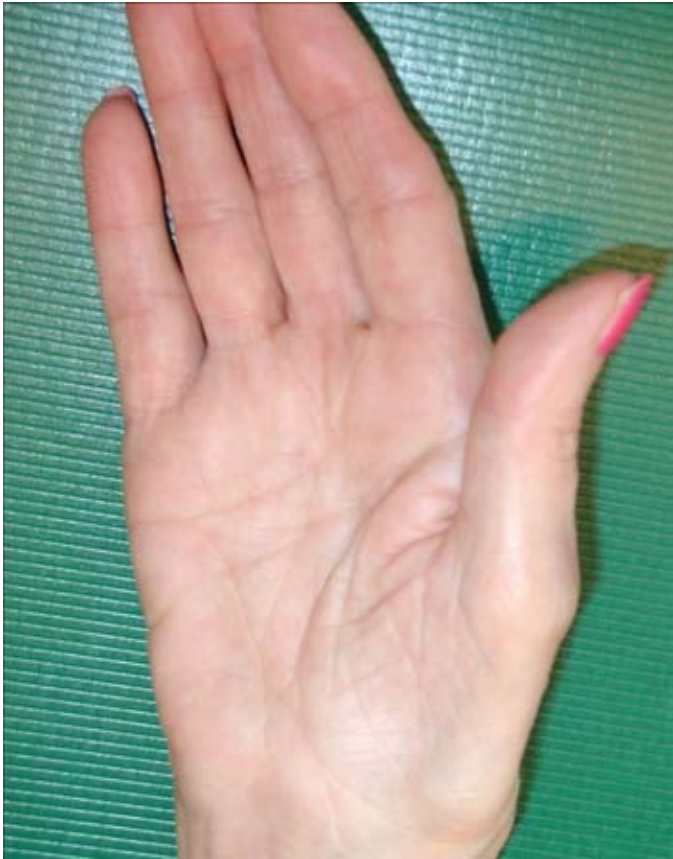


Pitfalls

- methodology
 - recording
 - temperature
 - stimulation
- problems of early diagnosis
- Reference values
- Anatomic variants



Pitfall – muscular atrophy



- High stimulus intensity necessary to evoke a CMAP
- Coactivation of the ulnar nerve
- Recording from the ulnar innervated adductor pollicis
- CMAP may be very similar
- Regard the movement of the hand during stimulation

Distance measurement



DML 5.1 ms

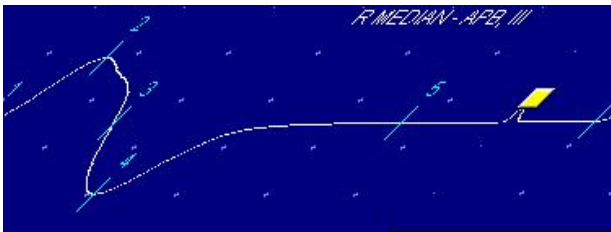


0.2...0.4ms/cm

Temperature

25°

DML 5.1 ms

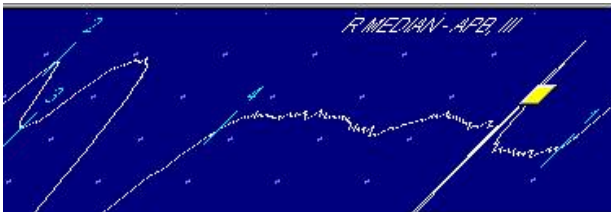


31°

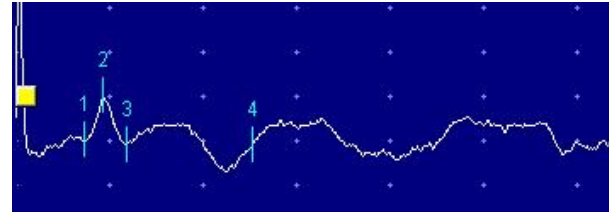
DML 4.1 ms



sCV 35 m/s

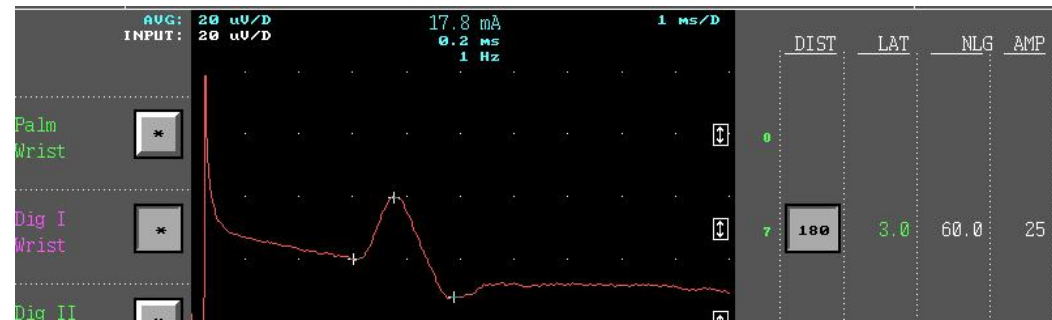
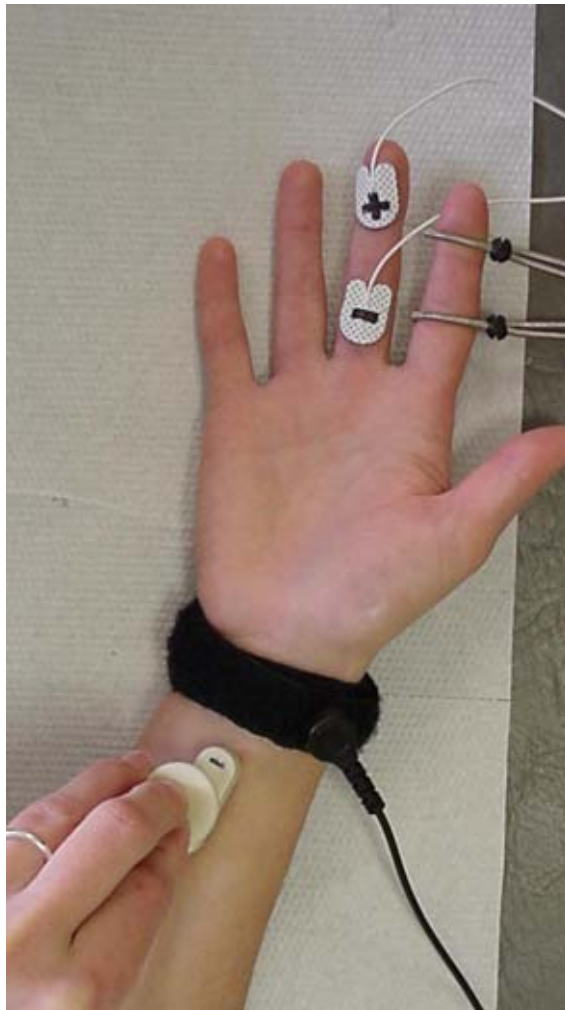


sCV 43 m/s

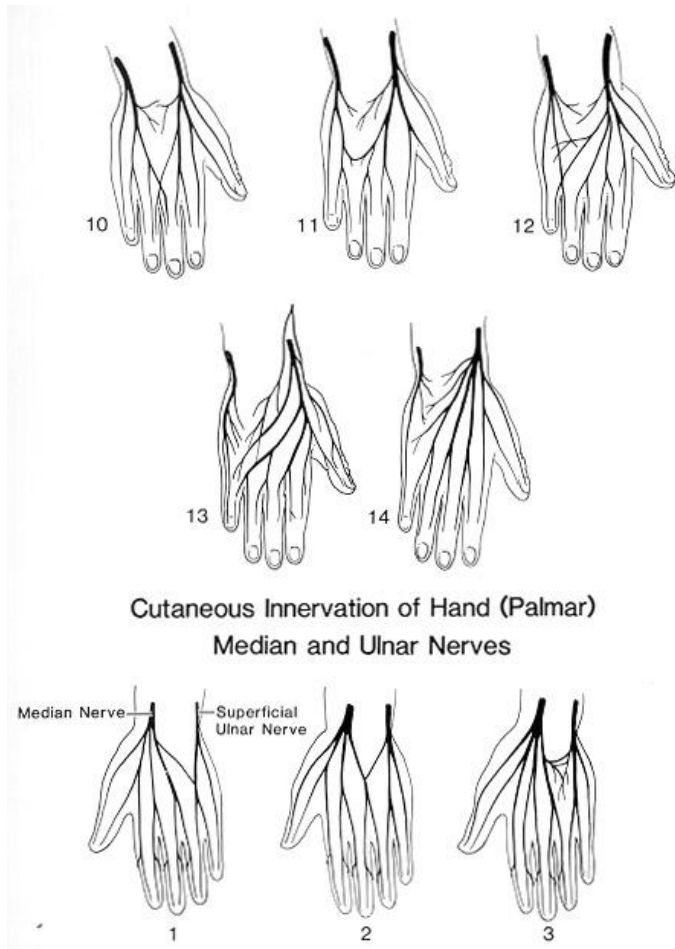


Decrease by 2m/s/°C

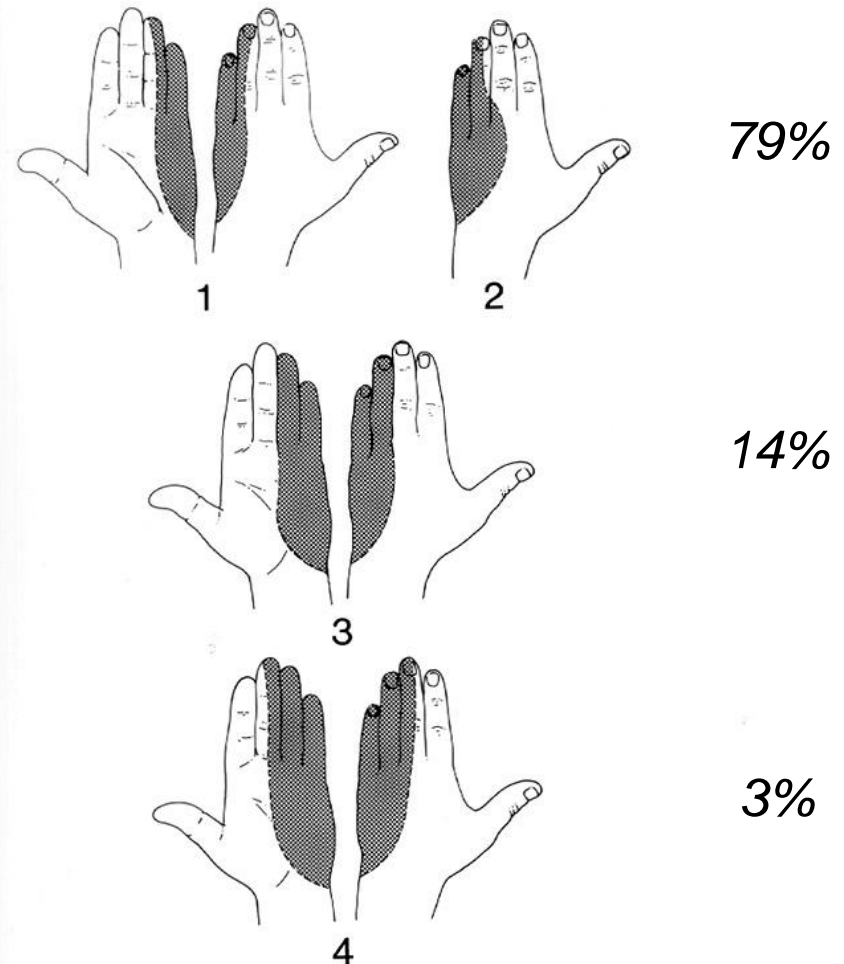
Sensory nerve conduction



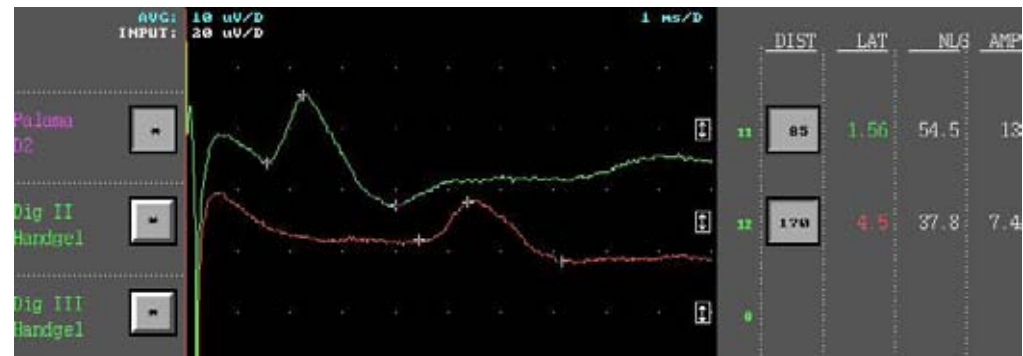
Variation in cutaneous nerves of the hand



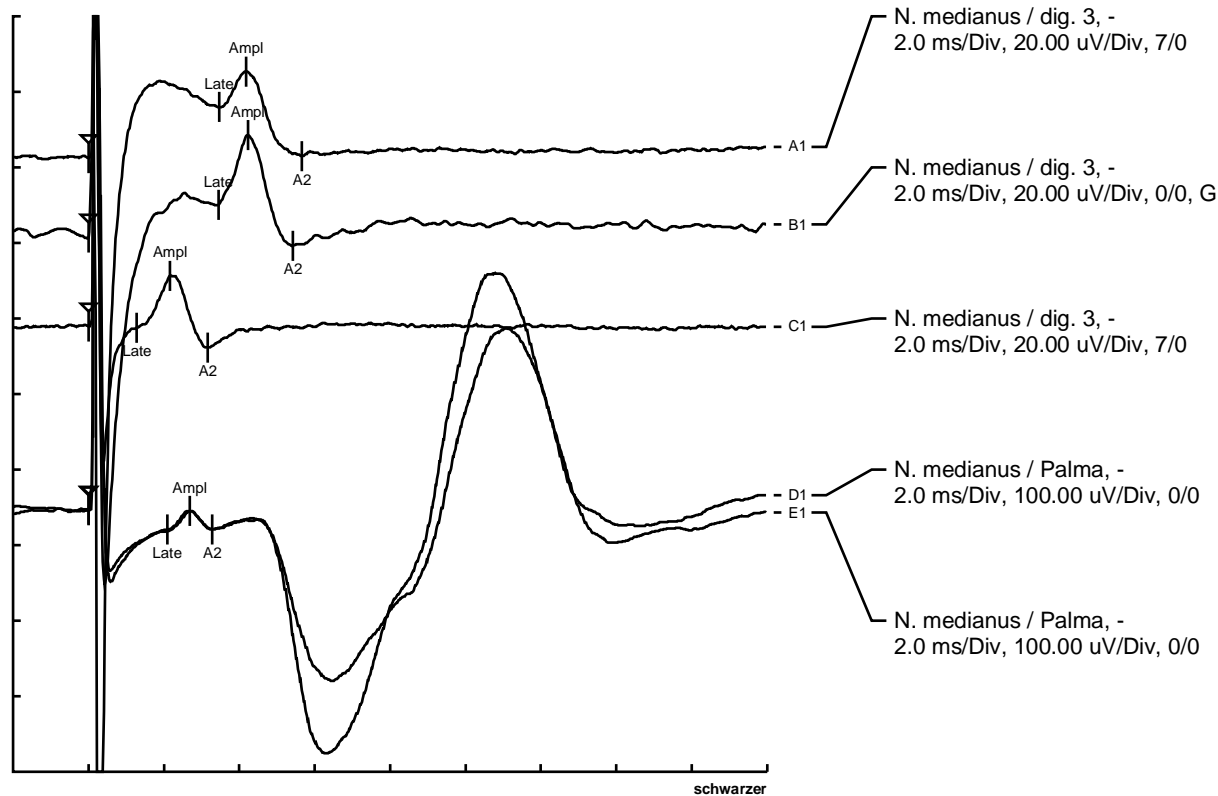
Variations In Cutaneous Nerves of Forearm and Hand



Segment study (7/14cm)



Short segments study



<i>N. medianus</i>	3.46	22.34	47.7
<i>N. medianus</i>	3.44	29.22	48.0
<i>N. medianus</i>	1.28	18.96	58.6
<i>N. medianus</i>	---	---	---
<i>N. medianus</i>	2.08	24.18	36.1

EDX testing in CTS

AAEM review 1999

Test	Sensitivity	Specificity
• DML	95-99%	60-74%
• sCV (wrist)	97,5-100%	49-66%
• sCV (7/14)	97%	69-84%
• Inching	81%	54%
• Comp. ulnar	95%	66%
• Comp. to radial	99-100%	60-69%

EMG and CTS

- Proof of axonal loss
- Due to denervation of the muscle
- Poor correlation CMAP/EMG
- Exclusion of a C6 radiculopathy
- Necessary for the decision to make a surgery?

Carpal tunnel syndrome Therapy 1

- Non-surgical
 - splinting
 - corticosteroids
 - others
- Surgical
 - open surgery
 - endoscopic

Carpal tunnel syndrome

Therapy 2

- Overall, there is limited evidence that a splint worn at night is more effective than no treatment in the short term, but there is insufficient evidence regarding the effectiveness and safety of one splint design or wearing regimen over others, and of splint over other non-surgical interventions for CTS. More research is needed on the long-term effects of this intervention for CTS. (Cochrane database systematic review 2012)
- Indication
 - acute CTS
 - swelling
 - pregnancy

Carpal tunnel syndrome

Therapy 3

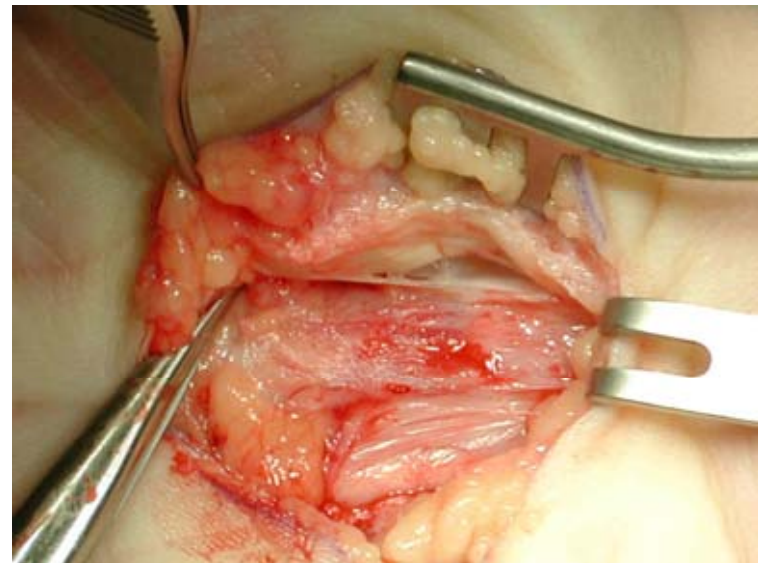
- Local corticosteroid injection for carpal tunnel syndrome provides greater clinical improvement in symptoms one month after injection compared to placebo. Significant symptom relief beyond one month has not been demonstrated. *Local* corticosteroid injection provides significantly *greater clinical improvement than oral* corticosteroid for up to three months. Local corticosteroid injection does not significantly improve clinical outcome compared to either anti-inflammatory treatment and splinting after eight weeks or Helium-Neon laser treatment after six months. Two local corticosteroid injections do not provide significant added clinical benefit compared to one injection.
(Cochrane database systematic review 2007)

Carpal tunnel syndrome

Therapy 4

- Surgical treatment of carpal tunnel syndrome relieves symptoms significantly better than splinting. Further research is needed to discover whether this conclusion applies to people with mild symptoms and whether surgical treatment is better than steroid injection.
(Cochrane systematic review 2008)

- Indication sensory signs
 persistent pain
 and paraesthesias



Carpal tunnel syndrome

Therapy 5

- There is no strong evidence supporting the need for replacement of standard open carpal tunnel release by existing alternative surgical procedures for the treatment of carpal tunnel syndrome.
- There are conflicting results concerning
 - side effects
 - quality of life
 - duration of inability to work
 - pain in the scar following surgery
 - long term results
- Open carpal tunnel release is the procedure of choice in cases of
 - second surgery
 - masses in the carpal tunnel

Carpal tunnel syndrome Therapy 6

- Other nonsurgical therapies used in CTS

therapeutic ultrasound	poor evidence
exercise and mobilisation	poor and low evidence
NSAD	conflicting evidence
Vit B6	ineffective
laser therapy	conflicting results
- All studies are short term studies,
no data are available for middle and long term results

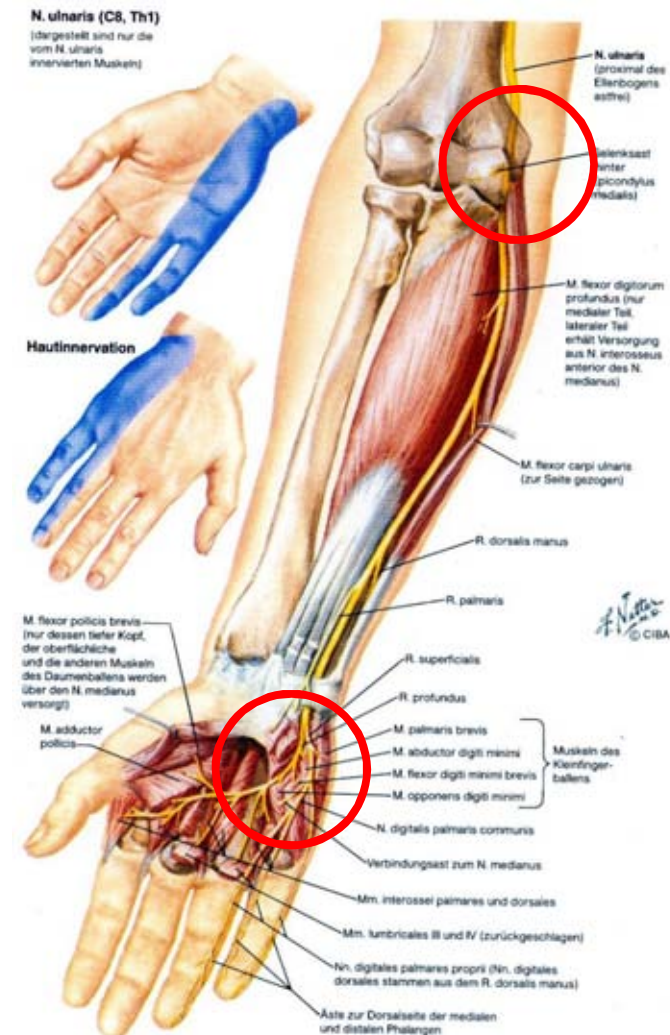
Carpal tunnel syndrome

Therapy 7

- Surgery is helpful in coexisting diabetic neuropathy
- In pregnant women surgery is mostly unnecessary unless permanent sensory signs start early in pregnancy
- In patients with long lasting sensory problems surgery may relieve the pain but not the sensory loss or muscle atrophy
- Coexisting radiculopathy is no conflict for surgery
- In acute CTS urgent surgery is required

Ulnar nerve compression

- Distal compression
Loge de Guyon (3 types)
- Compression at the elbow
2° most nerve compression
- Sometimes difficult to discriminate
note: sensory of the dorsal hand
- Often pain and paraesthesias are
the only symptoms



Aims of edx testing

- Show lesion of the ulnar nerve
 - exclude
 - plexopathy (TOS)
 - radiculopathy
- Try to localize the lesion
- Try to find out the type of the lesion



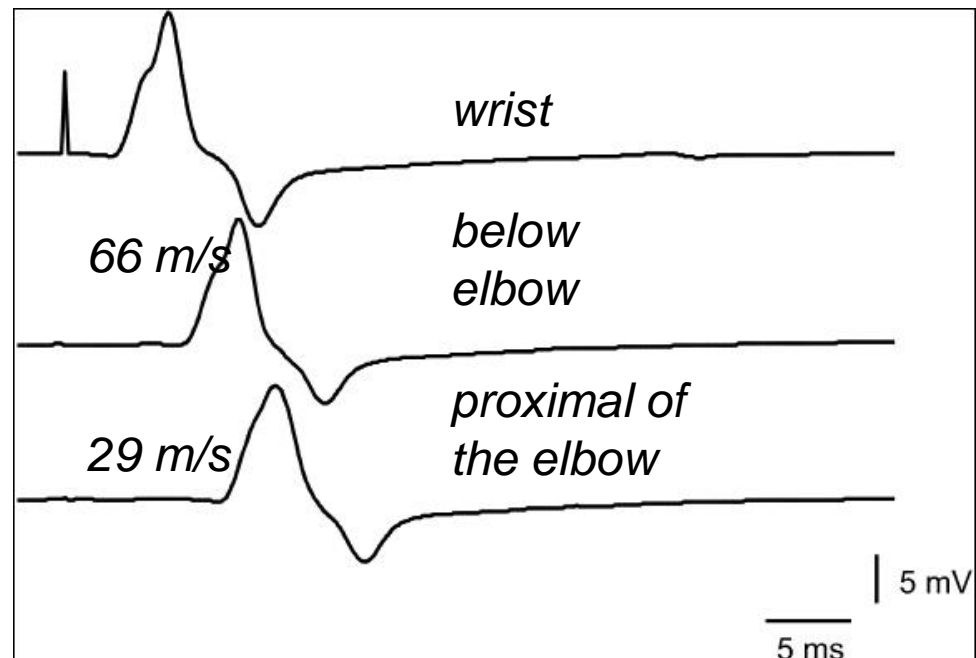
Ulnar nerve compression at the elbow

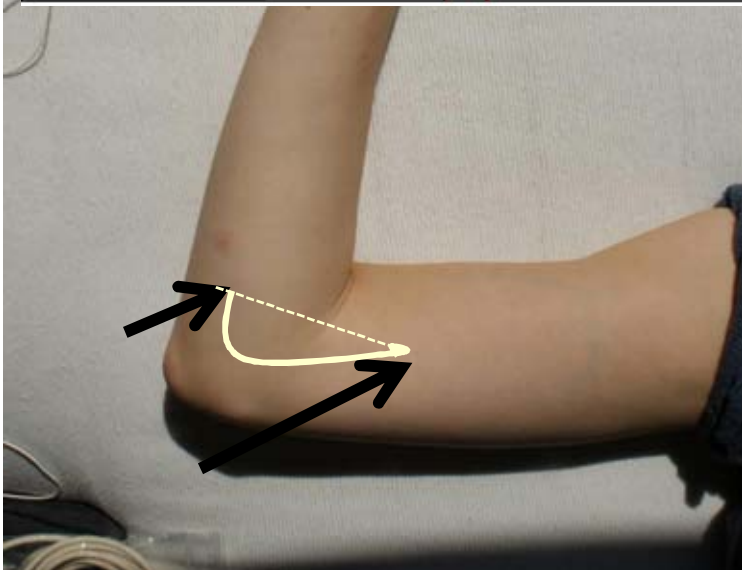
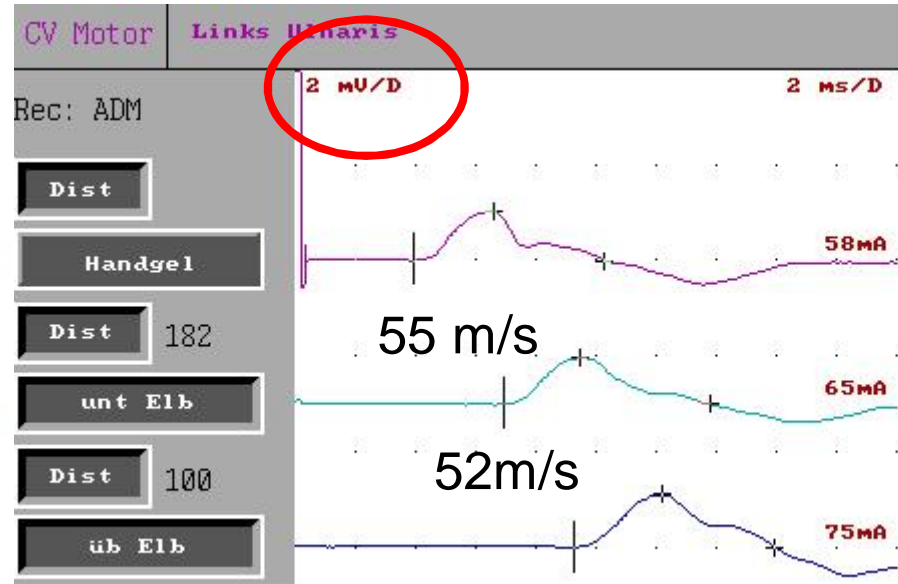
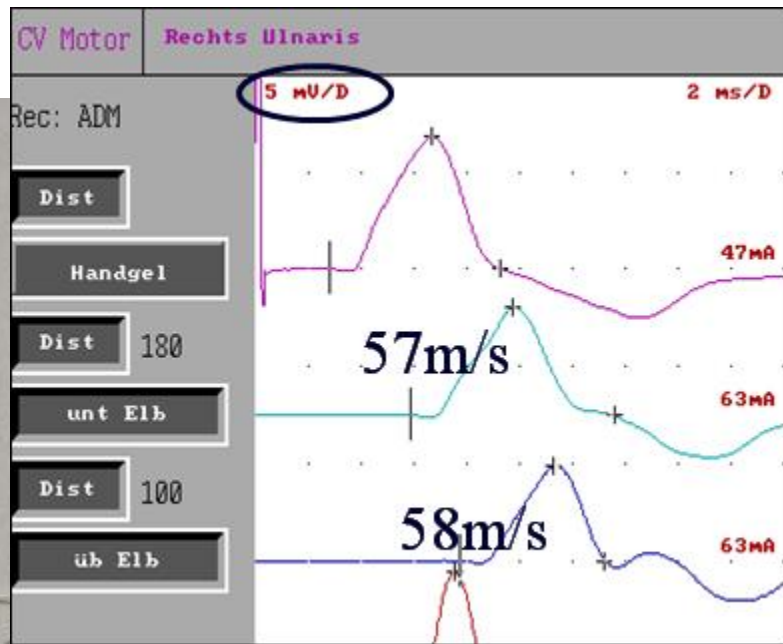
- Trauma
- External pressure
 - prolonged repetitive elbow flexion
 - perioperative
- Bony deformity
- Tumors
- Idiopathic



History

- Female violinist, 27 years old
- 3 weeks ago she noticed a weakness of the small hand muscles (MRC2/5) on the left
- Numbness of the 4th and 5th finger
- Tingling but no pain
- No Tinel's sign





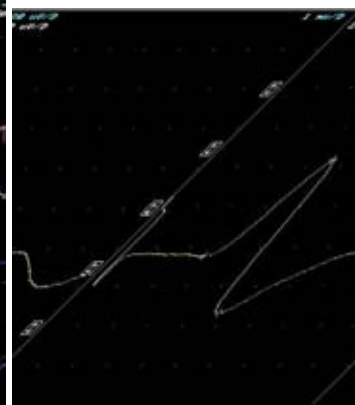
Distance 10cm
 Along the course of the nerve

Ulnar sensory neurography

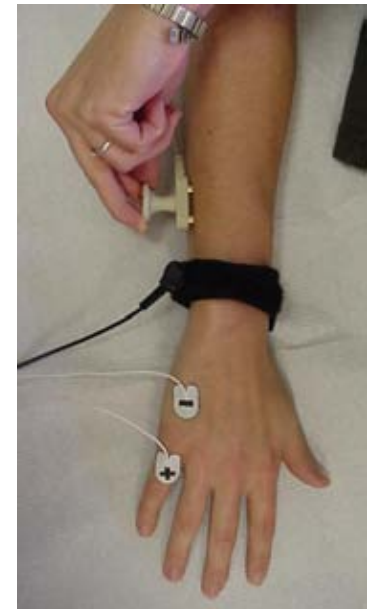
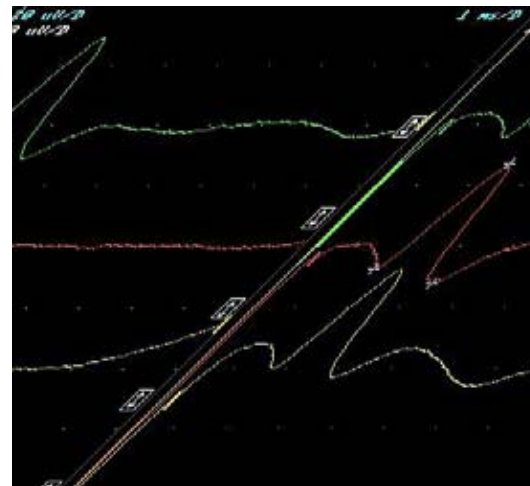
left



right

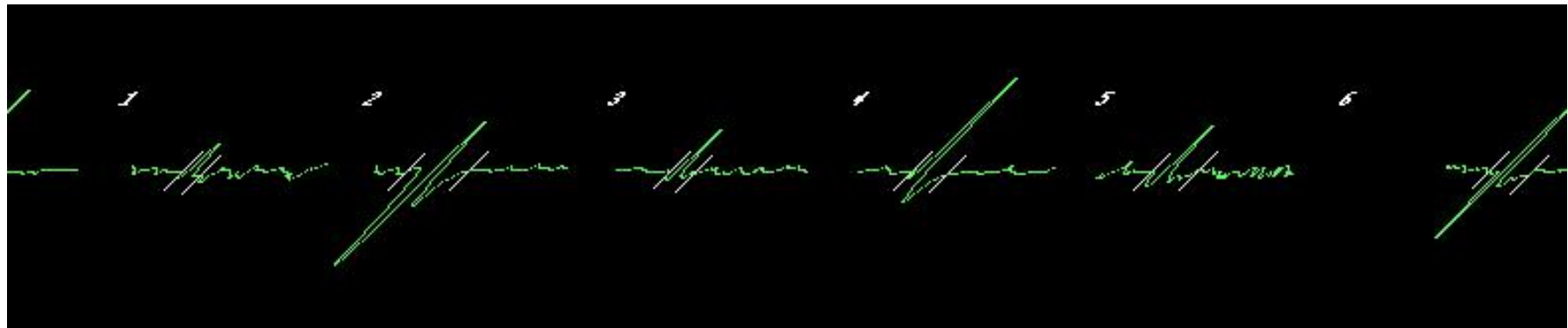


*right dorsal branch
right*



EMG findings

No fibs

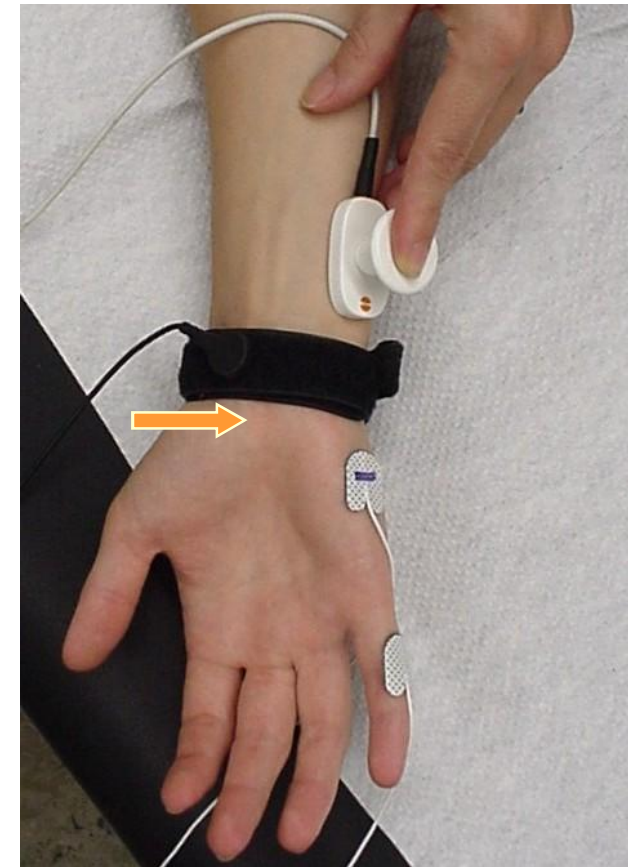
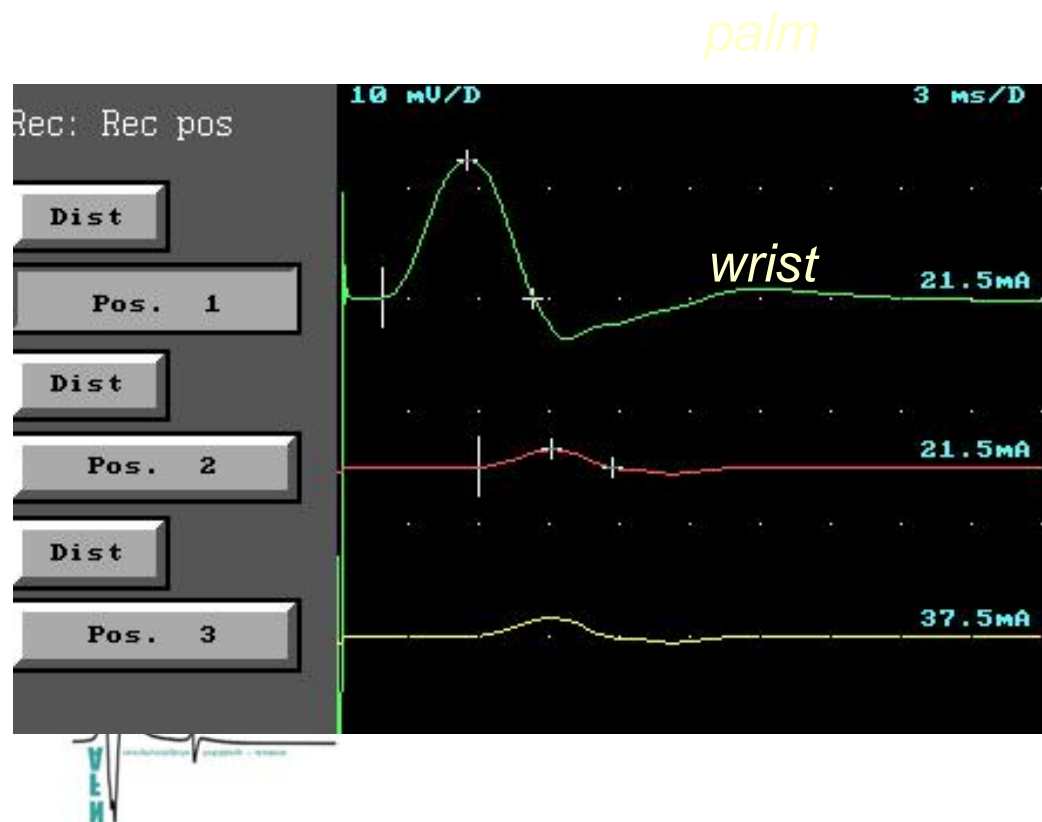


Interference pattern:
MUP discharge frequency:

reduced
>20Hz

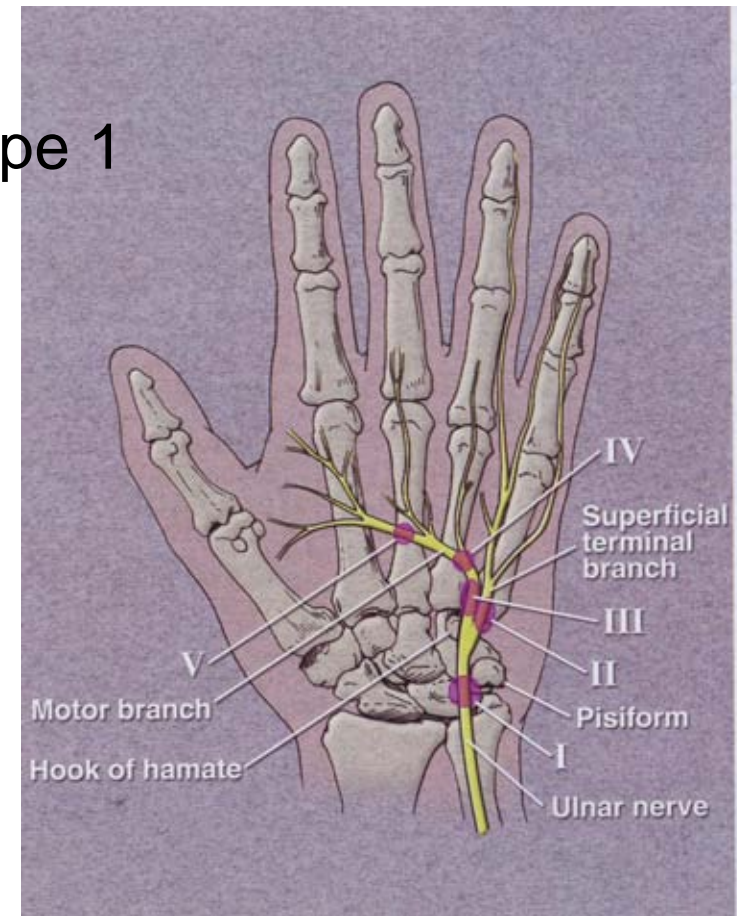
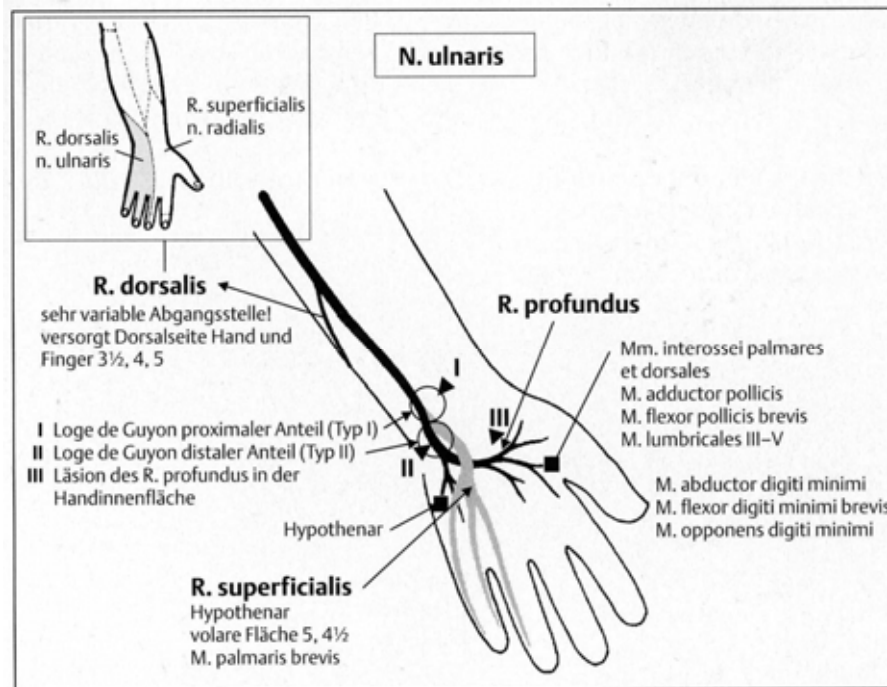


Distal stimulation of the ulnar motor nerve in the hand



Loge de Guyon Pitfall

- Comparison of distal motor latency between IOD1 and hypothenar may be normal in type 1



Bischoff, Schulte-Mattler, 2011

Take home messages

- No fibs in a weak muscle –
remember
 - neuromuscular transmission disorder
 - or conduction block
- Low CMAP amplitude does not automatically indicate axonal loss
- Type of the lesion should be clearly demonstrated before therapy/surgery
- Clinical signs and symptoms and CVS should



CV studies across the elbow pitfalls

- Measurement error – length measurement
- Significant CV difference $> 16\text{m/s}$
- Problems in patients with demyelinating neuropathies
- CV studies with recording from IOD 1 are more often pathologic than from hypothenar
- In compression distal of the sulcus a Martin Gruber anastomosis has to be ruled out



Pitfall

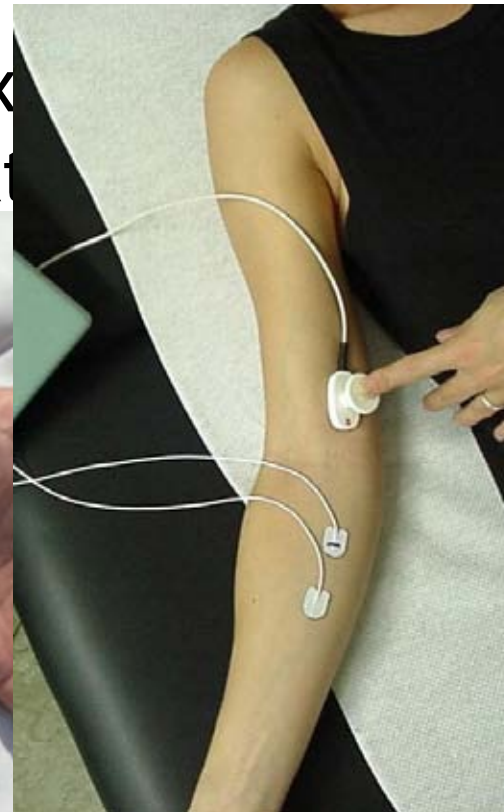
Martin Gruber Anastomosis

- CTS may be overlooked
- A conduction block of the ulnar nerve at the elbow may be faked
- counteraction:
 additional stimulation of the median nerve at the elbow and recording from IOD1 or hypothenar in each subject with small CMAP at proximal stimulation site



Differential diagnosis

- Sensory nerve conduction study of the median cutaneous antebrachii nerve
 - plexopathy
- EMG of the long thumb flexor
 - plexopathy/radiculopathy
- Paraspinal EMG
 - radiculopathy



Differential diagnosis of hand weakness

	CS DML IOD1	DML ADM	mCV elbow	sens dist	sens dorsal	sens med. cut antebr	EMG IOD1	ADM	Flex. poll. long	Para spinal
Loge 3	p	n	n	n	n	n	p	b	n	n
Loge2	p	p	n	n	n	n	p	n	n	n
Loge 1	p	p	n	p	n	n	p	p	n	n
Elbow	n	n	p	(p)	p	n	p	p	n	n
plexopathy	n	n	n	p	p	p	p	p	p	n
C8	n	n	n	n	n	n	p	p	p	p

Therapy

- Surgical vs. non-surgical
- Avoid further compression
- Surgery was often disappointing and worsened the disability
- Try to find out the underlying pathology
- Surgery should be considered in patients with weakness and/or significant sensory signs
(however outcome can not be predicted)
- endoscopy with extended nerve compression at the elbow may be more advantageous
(further studies to prove are necessary)

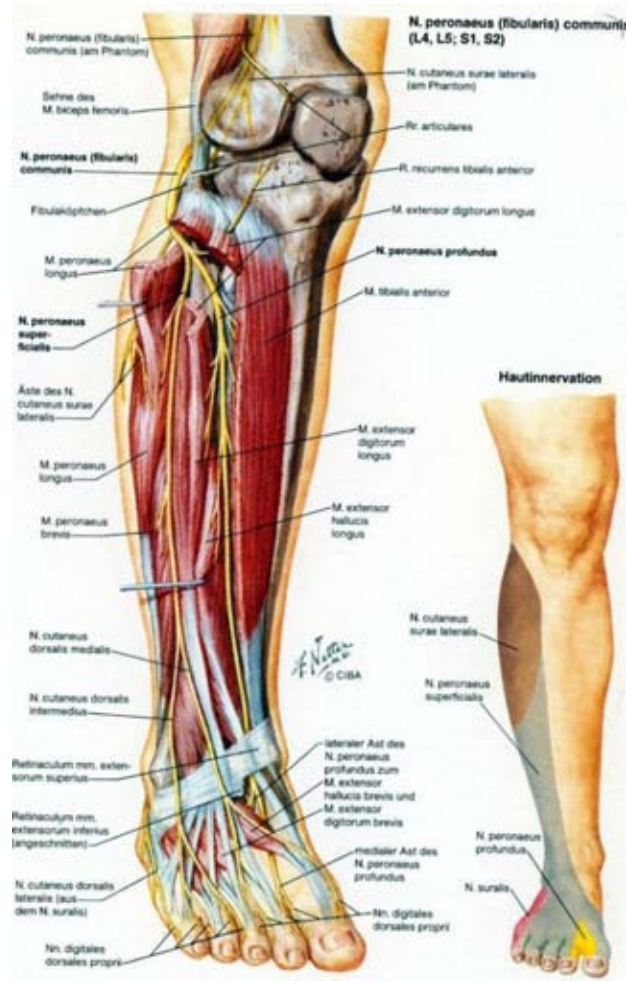


Therapy of ulnar nerve compression at the elbow

- A luxation itself is to be operated on
- The available evidence is not sufficient to identify the best treatment for idiopathic ulnar neuropathy at the elbow on the basis of clinical, neurophysiological and imaging characteristics. We do not know when to treat a patient conservatively or surgically. However, the results of our meta-analysis **suggest that simple decompression and decompression with transposition are equally effective** in idiopathic ulnar neuropathy at the elbow, including when the nerve impairment is severe. In mild cases, evidence from one small RCT of conservative treatment showed that information on movements or positions to avoid may reduce subjective discomfort.



Peroneal (fibular) nerve



Peroneal entrapments

- Local compression
- HLPP
- Weight loss
- Local ganglia/cystic processes
- Trauma (dislocation, fracture)
- Traction due to ankle injury
- Tumor
- Entrapment in the fibular tunnel
- Mononeuropathy multiplex



Aims of EDX testing

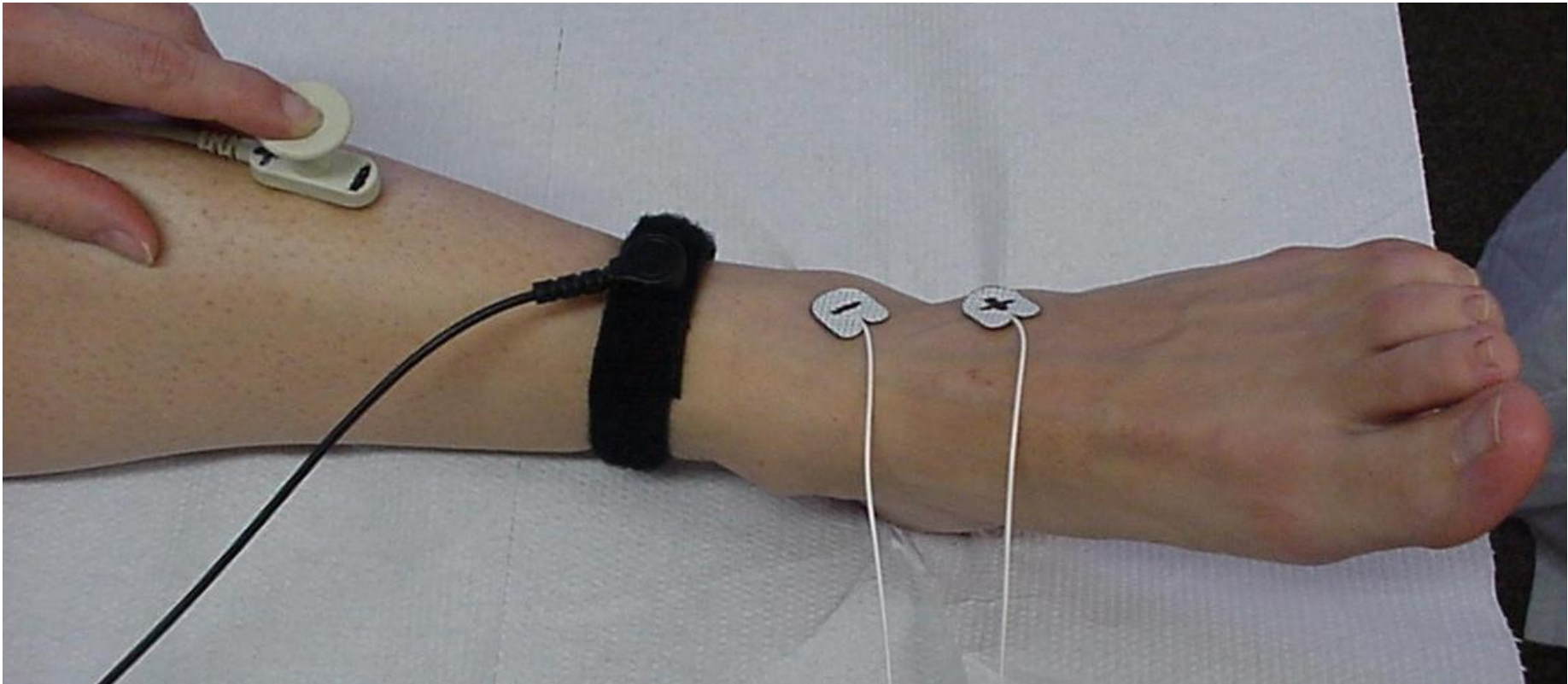
- Show the peroneal nerve lesion
 - exclude plexopathy and radiculopathy
- Localize the lesion
 - distal, fibular head, proximal
- Try to figure out the type of the lesion
 - conduction block, axonopathy
- Consider prognosis



Peroneal motor conduction study



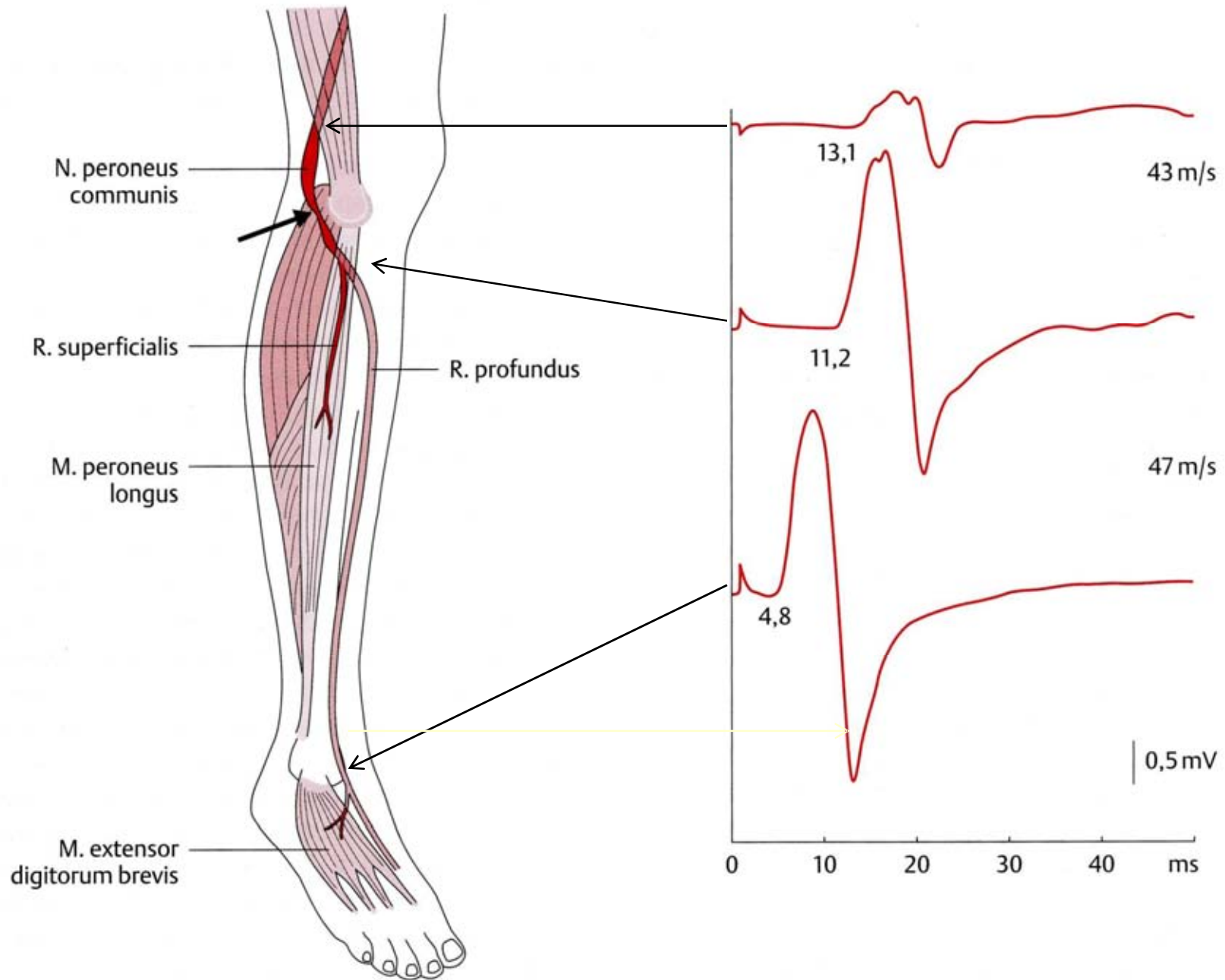
Superficial peroneal nerve sensory conduction study

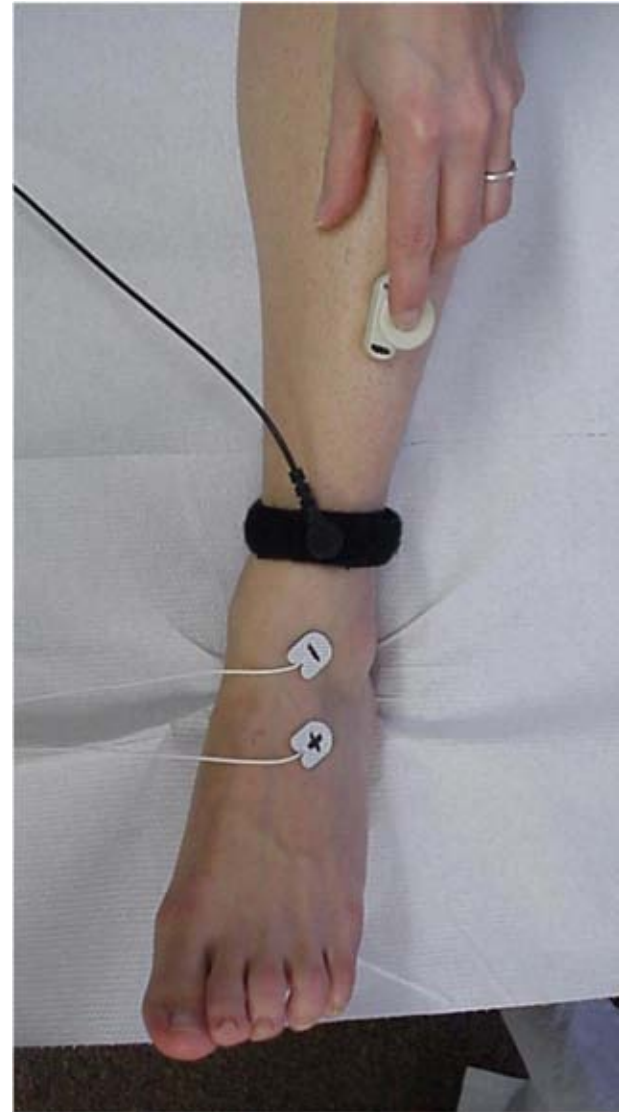
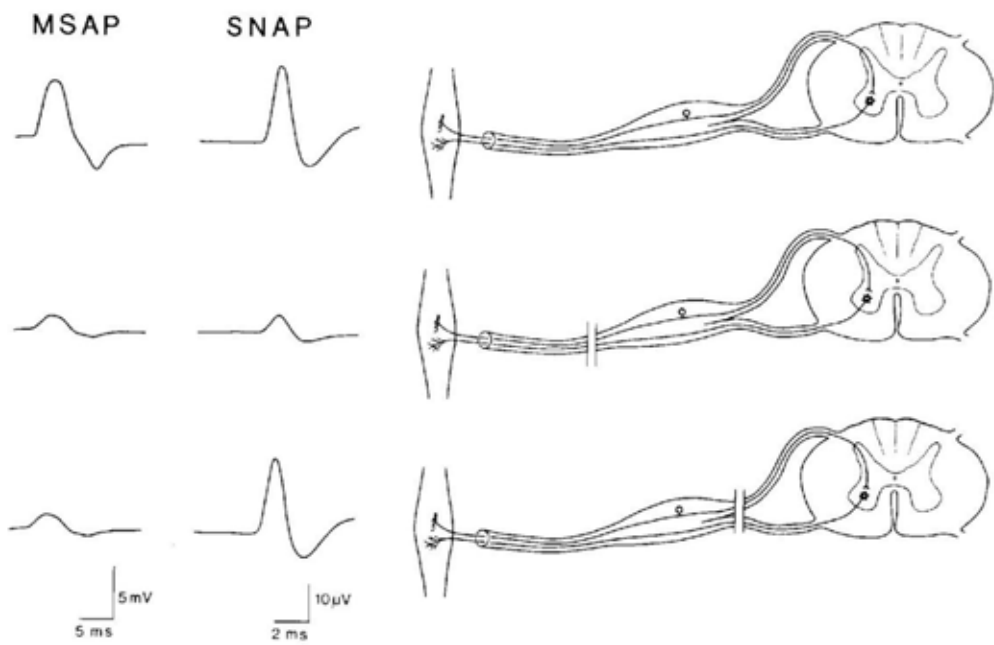


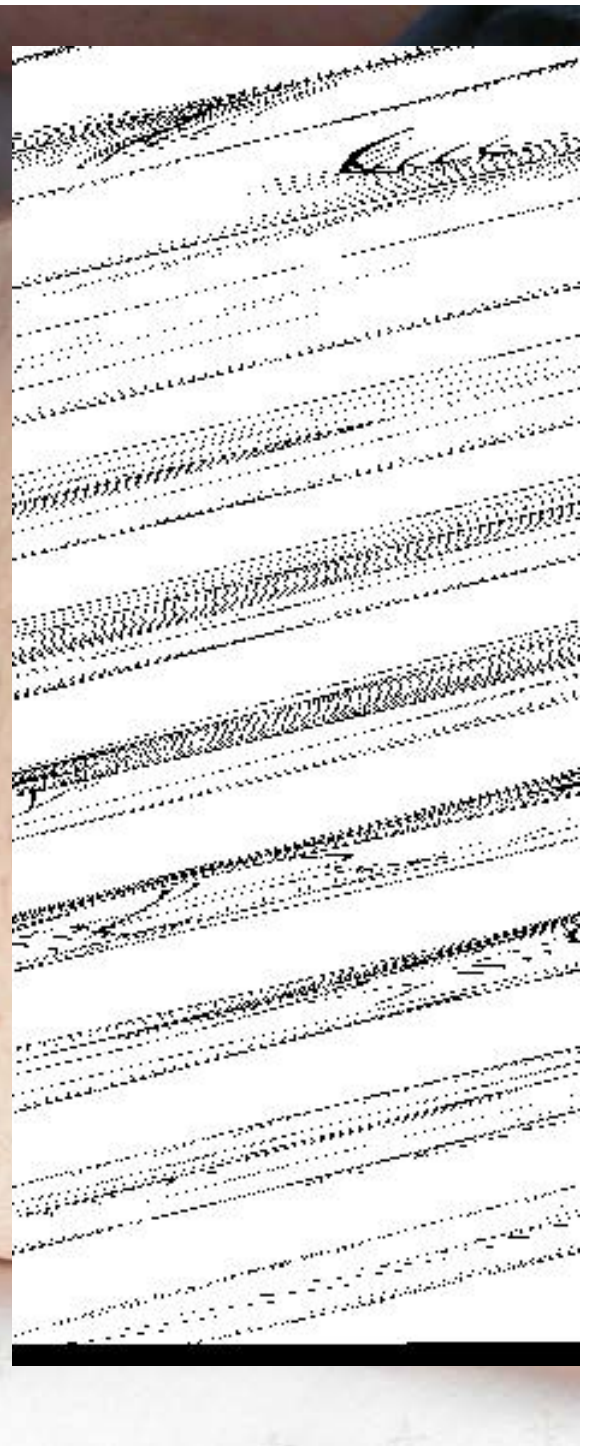
Pitfalls

- Peroneal and tibial nerve are close together in the poplitea
 - observe the toe/foot movement during stimulation
- Sensory neurography is not helpful in case of conduction block at the fibular head
- To exclude proximal peroneal damages the short head of the femoral biceps muscle has to be investigated
- Pure sensory damages exist rarely









Differential diagnosis of drop foot

	Pathological EMG	DD
Deep peroneal	Tib ant, EHL	
common peroneal	+ peroneal muscles	+ superficial peroneal (sural SNAP normal)
proximal peroneal (sciatic nerve, lateral trunk)	+ short head of the biceps femoris	+ superficial peroneal suralis normal or path.
lumbosacral plexopathy	+ tibial posterior + gluteal muscles	+ superficial peroneal + sural (paraspinals normal)
radiculopathy L5	+ paraspinal muscles	(all sensory normal)

Therapy

- Avoid local compression (leg crossing)
- In case of lack of improvement surgery is recommended even if imaging procedures do not show mass lesions
- recovery seems to be doubtful (further studies required)



Local compression at the foot

- Mostly external compression due to shoe
- Pure sensory loss at the dorsal part of the foot
- Sensory NCS may be pathological

- Avoid further compression



- THANK YOU
- Hope to see you again 2014
in Berlin, Germany
at the IFCN congress, March 20.-23.
- ? Questions ?

