SYLLABUS

WS03: Ultrasound Of Muscle and Nerve

Monday, November 14, 2011 14:45 - 18:15 Hall K

Marrakesh, Morocco, November 12-17, 2011

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XXth WCN 2011 MARRAKESH World Congress of Neurology

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SMN SOCIETE MAROCAINE DE NEUROLOGIE

WCN Education Program

Monday, 14 November, 2011

14:45-18:15

ULTRASOUND OF MUSCLE AND NERVE

Chairperson: **Konrad Scheglmann,** *Germany*

INTRODUCTION
Konrad Scheglmann, *Germany*

SONOGRAPHIC ANATOMY OF THE PERIPHERAL NERVE

CHARACTERISTIC OF DISEASED NERVE

NERVE COMPRESSION SYNDROMES

NERVE TUMORS

TRAUMATIC NERVE LESION

POLYNEUROPATHY

MUSCLES

SONOGRAPHIC GUIDED BOTULINUM TOXINE THERAPY

Faculty:
Peter Poeschl*, Germany*
Konrad Scheglmann, *Germany*

16:15-16:45 *Coffee Break*

Mononeuropathies

Andrea Vass
Vienna, Austria

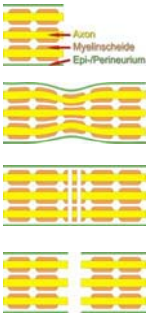
Assessment of Mononeuropathies...

- **Cause of nerve lesion**
- **Severity of nerve lesion**
- **Time elapsed since nerve lesion**

Causes of Mononeuropathies

- **Entrapment syndromes**
- **Compression** by position, bandage, hematoma
- **Stretch injuries** plexus lesions, hip replacement
- **Penetrating wounds** incisision, injection, gun shot
- **Cold injury** trench foot, phrenic nerve in heart surgery
- **Mononeuritis multiplex** diabetes, vasculitis

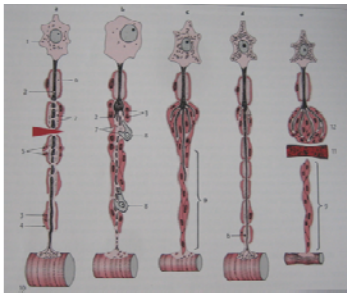
Nerve lesions according to Seddon



Intact nerve		
Neurapraxia	Lokalized conduction block, .	Full recovery within weeks
Axonotmesis	Axonal interruption, connective tissue framework preserved, wallerian degeneration	Axonal regeneration, reinnervation and collateral sprouting
Neurotmesis	Axons and connective tissue interrupted	Reinnervation always incomplete

http://de.wikipedia.org/wiki/Neurapraxie

Wallerian Degeneration & Reinnervation



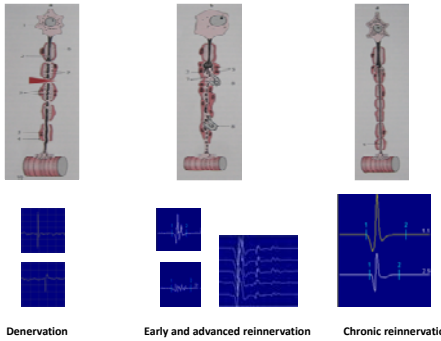
Reinnervation ~1mm/d

motoric 1.36 (0.56-3) mm/d
sensory 2.4 mm/d

Seddon 1943

Mummenthaler, Stöhr, Müller-Vahl 2007

Nerve lesion and EMG



EMG **Denervation** **Early and advanced reinnervation** **Chronic reinnervation**

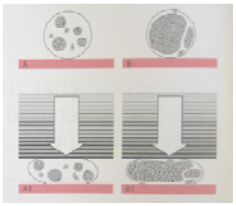
Mummenthaler, Stöhr, Müller-Vahl 2007

Entrapment – Pathophysiology

= chronic compression – mechanical and ischemia

- Narrow anatomic pathways
- Other factors restricting - metabolic, endocrine, traumatic, amyloidosis
- Factors influencing vulnerability of nerves – diabetes mellitus, hereditary pressure palsy, GBS
- Intraneural anatomy

Pathophysiology – Vulnerability



Vulnerability depends on size of fascicles and epineural tissue

Outermost fibers are more vulnerable

Myelinated fibers are more vulneralble

Mummenthaler, Stöhr, Müller-Vahl 2007

Pathophysiology - Entrapment

time

Thinning of nerve at compression site

Swelling of nerve proximal of compression site

Deformation of myelin

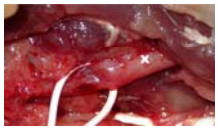
Paranodal demyelinization

Invading of fibroblasts

Fibrosation of epi- and endoneurinum

Thickening of perineurinum

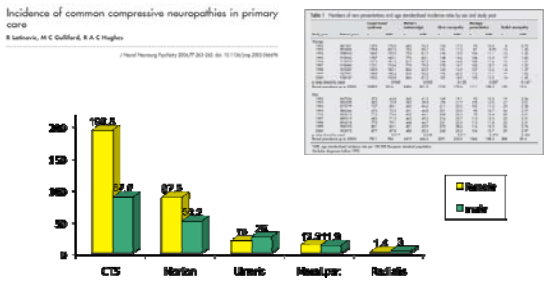
Wallerian degeneration



Pressure in carpal tunnel:

healthy ind.	2.5 mm Hg
CTS	30 mm Hg
Extension – flexion	100 mm Hg

Epidemiology



Age standardized incidence rates / 100.000

Latinovic et al. 2006 JNNP

Carpal Tunnel Syndrome

- **Most common entrapment neuropathy**
- **45% of non traumatic nerve lesions**
- **Prevalence: 0.2 to 5.8**
- **90% of entrapment syndromes**
- **First operation: 1924**
- **Women/ men: 2-3/1**

CTS – Risc Factors

Table 1
Prevalence of risk factors in the studied groups, with the respective odds ratio and its 95% confidence interval presented for each association*

Risk factor in study	Cases (791) (%)	Controls (981) (%)	OR	CI 95%
Female gender	88.1	67.0	3.66	2.84–4.71
BMI > 30	26.8	11.2	2.90	2.25–3.73
Age between 41 and 60 years	62.1	46.2	1.91	1.58–2.31
Diabetes mellitus	4.6	2.5	1.82	1.08–3.06

* OR, odds ratio; CI 95%, 95% confidence interval; BMI, body mass index.

Work-related: forest worker, road making, drilling, household
PCP (up to 23%)

Becker et al. 2002 Clin Neurophysiol
Macfarlane 2001 Lancet
Chamberlain & Corbett 1970 Ann Rheum Dis

CTS - Symptomes and Signs

- **Dysaesthesia in fingers and pain in the hand spreading to shoulder** during night and in fixed position (car driving, phoning)
- **Relief by shaking**
- Worsened by using hands (knitting, hammering)
- Clumsiness

•Stage I - mild

–Intermittent symptoms, no deficits, provocative tests positive Tinel- or Phalen sign (sensitivity 75%, specifity 47%)


•Stage II – moderate

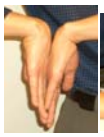
–Permanent symptoms, hypesthesia at fingertips 1- 4, thumb opposition und abduction weak

•Stage III – advanced

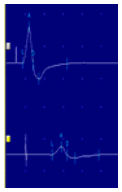
Sensory loss at fingers, atrophy of thenar, anhidrosis

CTS – Diagnosis

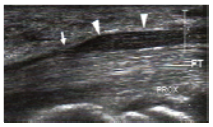
- **Clinically**




- **Electrophysiology**

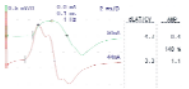
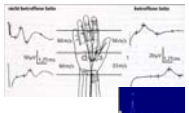
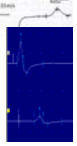


- **Sonography**



CTS – Nerve Conduction Studies

- **Motor and sensory nerve conduction study of median nerve**
- **Comparison DML of M.Lumbricalis I and M.Interosseus II**
- **Inching across wrist to M.Lumbricalis I**
- **Fraktionate sensory neurography (8/16) (temperature !)**
- **Comparison of DML and sensory nerve conduction with ulnar nerve**
- **EMG in atrophy or suspected innervation anomaly**

CTS – Diagnosis

Sono
1 Is the median nerve entrapped at the wrist?
2 Are other nerves involved (another trunk, root, or plexus) which may explain the complaints, or which are free of symptoms?
3 Where are the nerve lesions located?
4 What is the mechanism of the nerve lesions (axonal or demyelinating)?
5 Is the median nerve lesion at the wrist a single nerve lesion, or is it associated with a polyneuropathy, or is it part of a polyneuropathy and is the first symptom (such as in chronic idiopathic dysimmune polyneuropathy, Lewis and Sumner's syndrome, hereditary pressure palsy, amyloidosis, etc.)?
Sono ?
6 What is the severity of the nerve lesion?
7 Is the nerve lesion acute or chronic?
Sono ?
8 Can the evaluation be precise enough to objectively evaluate the effect of treatment?

Seror 2007 Eur J Radiol

CTS - Therapy

- Conservative
  - Manual rest
  - Nightly splinting
  - Injection of methylpredisolone
  - Oral prednisolone 20 mg oral over 2 weeks
  - Ultrasonic therapy ??




- Operative
  - With ongoing pain
  - With functional impairment

CTS – Untreated

267 Patients
10-15 Months follow-up

Table 5 Untreated carpal tunnel syndrome (CTS) sample: Percentage of CTS hands improved, worsened, or stationary at follow-up in the different neurophysiologic classes

CTS severity measurement	Neurophysiologic evolution	SYMPT evolution	FUNCT evolution
Negative (n = 12)			
Improvement	0	22	18
Stationary	17	67	73
Worsening	83	11	9
Minimal (n = 25)			
Improvement	31	39	25
Stationary	38	31	56
Worsening	31	30	19
Mild (n = 66)			
Improvement	32	34	17
Stationary	53	40	62
Worsening	35	24	21
Moderate (n = 126)			
Improvement	29	31	20
Stationary	63	46	66
Worsening	8	24	14
Severe (n = 43)			
Improvement	46	49	38
Stationary	50	41	44
Worsening	4	11	18
Extreme (n = 2)			
Improvement	0	0	50
Stationary	100	100	50
Worsening	0	0	0

SYMPT = symptoms, patient-oriented assessed; FUNCT = hand functional status, patient-oriented assessed.

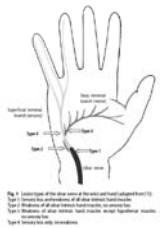
Padua et al. 2001 Neurology

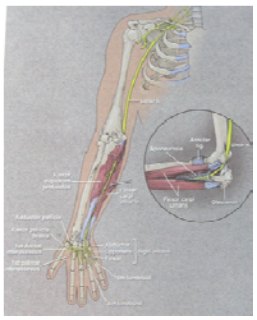
CTS - postoperative Phase

- **Immediate ergotherapy**
- **Complications:**
  - **Laceration of the sensory ramus palmaris (painful neuromas)**
  - **Transection of the motoric ramus thenaris (denervation und atrophy of thenar)**
  - **Incomplete transection of the retinaculum flexorum**
  - **Scar rezidives**
- **Always comparison of NCS with preoperative data**
- **Even in successful decompression NCS may stay reduced**

Ulnar Nerve

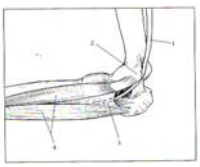
- **Lesions at the elbow (87%)**
- **Lesions in the wrist and hand (12%)**
- **Others (1%)**





Mednell, Kissel, Cornblath 2001

Ulnar Nerve Lesion at the Elbow



Sono better than MRI

- **Causes:**
  - Acute Lesion
    - Intraoperative
    - Bedrest
    - Trauma
  - Chronic Lesion
    - Cubital tunnel , aponeurosis of Flexor carpi ulnaris
    - Ulnaris - Luxation
    - Struther´s Arcade
    - Scars after trauma
    - Bony deformities
    - Alcohol

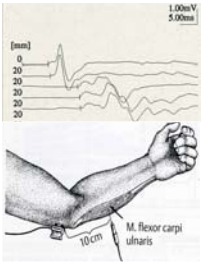
Ulnar Nerve Lesion at the Elbow - UNE



- Symptoms
  - Numbness and tingling at 5th digit , clumsiness at wrighting, turning keys; pain at medial palm
- Signs
  - Atrophy of small handmuscles, " Claw hand"
  - Sensory deficit 4th , 5th digit and ulnar hand palmar und dorsal
  - Finger spreading, finger flipping,finger crossing, pinch grip are weak, Fromment's sign

UNE – Conduction Studies

- Motor nerve conduction across the elbow ,135° flexed position, 10 cm between stimulation points
- „Inching" across the elbow
- Latency to flexor carpi ulnaris with complete atrophy of hand muscles
  - DML more than 4,2 ms pathologic
- Sensory conduction study - amplitude of SNAP
- Sensory neurography of ramus dorsalis
- EMG of interosseus dors.I, abductor dig.V and flexor carpi ulnaris



UNE – Differential Diagnosis

- Lesion of lower plexus or medial trunk of brachial plexus
- C8 lesion, Th1 lesion
- **Loge de Guyon Syndrome**
- Ramus profundus lesion
- Syrinx
- ALS


Ulnar Nerve – Risc factors

GENDER, BODY MASS AND AGE AS RISK FACTORS FOR ULNAR MONONEUROPATHY AT THE ELBOW

JAMES K. RICHARDSON, MD, DONALD F. GREEN, MD, SARAH C. JAMIESON, MD, and F. CLIFFORD VALENTIN, MD

Male OR 6.9
Male - age
Female - BMI

	Bike type			
	Mountain (18 hands)		Road (32 hands)	
	N	%	*N*	%
Subjective sensory changes [a]	7	38.9	4	12.5

Richardson et al. 2001 Muscle Nerve
Patterson et al. 2003 Am J Sports Med

UNE - Therapie

Table 3 *Outcome at follow-up in 46 conservatively and 28 surgically treated arms with UNE*

Outcome	Conservative, n (%)	Surgical, n (%)	Total, n (%)
Remission	5 (11)	7 (25)	12 (16)
Improvement	11 (24)	10 (36)	21 (28)
Stable	18 (39)	7 (25)	25 (34)
Progression	12 (26)	4 (14)	16 (22)
p Value for trend	0.03		
Total	46 (100)	28 (100)	74 (100)

UNE = ulnar neuropathy at the elbow.

Sono – thicker nerve – worse outcome
EDX – CB and reduced NCS – better outcome

Beekman et al. 2004 Neurology

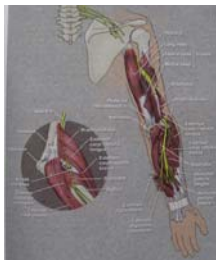
Loge de Guyon – Therapy?

- Conservative
  - Avoid pressure
  - Splinting
  - Steroids p.o.
- Surgical
  - Decompression ± Epineurotomy

Radial Nerve – Wrist Drop

Spiral groove „ Saturday night palsy“

Radial Nerve – Supinator Muscle – Arcade of Frohse

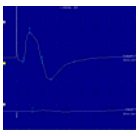


Posterior Interosseous Neuropathy

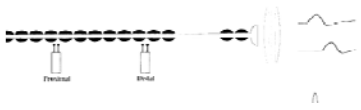
- No sensory loss
- Finger drop
- DD: MMN, MND, C7 radiculopathy
- DD: tendon avulsion
- Trauma (Monteggia fraktur)
- Tumor (Lipoma)
- Entrapment
  - Arcade of Frohse
  - Overload (violonist, tennis, sculptor)

Mednell, Kissel, Cornblath 2001

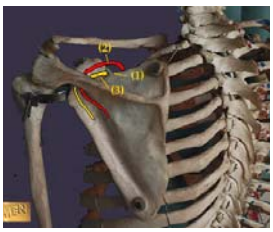
Radial Nerve - Supinator



Better: EMG!



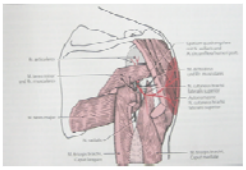
Suprascapular Nerve



Rare (volleyball, baseball, canoe, musicians)
Paresis, pain in the shoulder

Holzgraefe et al. 1988 Nervenarzt
Cummins 1999 Am J Sport Med
Knossalla et al. 2006 Arch Neurol

Axillar Nerve – Quadrilateral Space



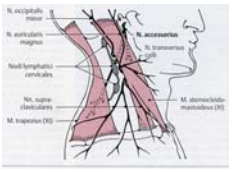
- Pain
- Paresis of abduction and external rotation
- Occlusion of circumflex artery
- Sport
- Physiotherapy
- Surgery

Cahill & Palmer 1983 J Hand Surg

Lesion of left accessory nerve

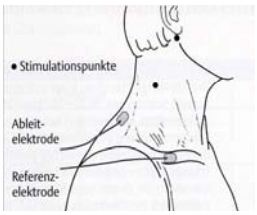
- Shoulder pain
- Dropping shoulder
- Scapular winging
- Weakness at forward elevation
- Diagnosis often delayed

Accessory Nerve



Causes: lymph node biopsy, neck dissection, lipoma, trauma, radiotherapy

Accessory Nerve - Elektrophysiology



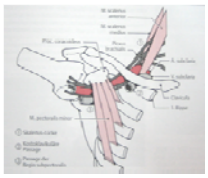
- Stimulation of accessory nerve at lateral triangle in comparison to other side
- EMG trapezius muscle
- EMG deltoide muscle and anterior serratus muscle for differential diagnosis

Accessory Nerve

Long Thoracic Nerve

Thoracic Outlet Syndrome

Anterior skalene syndrome



Incidence??

UK 1:1.000.000 / year
70% women

Mummenthaler, Stöhr, Müller-Vahl 2007
Sanders & Pearce 1989 J Vasc Surg

Thoracic Outlet Syndrome

Provocative tests are unreliable

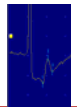
X-Ray: cervical rib in 0.27%

Sonography: low specificity

MRI : currently more appropriate method

Elektrophysiology:

A sensitive method in diagnosing slight lesions of lower brachial plexus:
Cutaneous medial antebrachial nerve
(Amplitude reduction > 50%)



Wilbourne 1999 Muscle Nerve
Roos 1999 Muscle Nerve
Stapleton 2007

Seror 2004 Clin Neurophysiol

TOS – Therapy ?

Value	Total (n = 100)
Symptoms: no change or worse than expected, %	63.5
Having worst symptom "a lot," %	61.2
"Limited a lot" in vigorous activities, %	72.5
Days symptoms interfered with usual activities in last 4 weeks, n	12.7
Quality of life: no better or worse than expected, %	92.7
In retrospect, would have the surgery done again, %	73.7

"non-specific" TOS
~8% path EDX
~ 42% path Doppler

	Unadjusted	
Time loss, costs	TOS surgery	No surgery
Mean medical costs, $	25,614	14,063
Percent on time loss at 1 year	56.8	21.1
Percent on time loss at 2 years	40.5	12.6

* Adjusted for age, cervical spine diagnosis, number of years from injury to diagnosis, previous injury, and previous surgery. All p values were <0.01.

BTX at scalene muscle improvement in 2/3

Conservative improvement in 70%

Franklin et al. 2000 Neurology

Lindgren 1997 Arch Phys Med Rehabil
Jordan et al. 2000 Ann Vasc Surg
Mummenthaler, Stöhr, Müller-Vahl 2007

Miscellaneous mononeuropathies

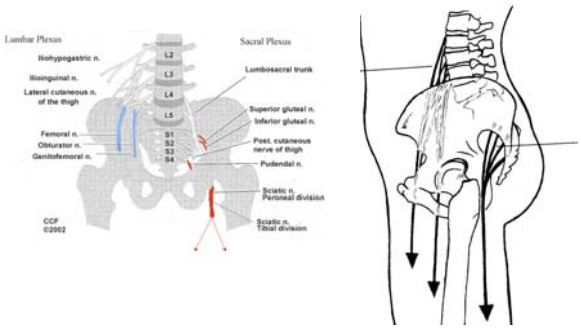





Entrapment Neuropathies of the Legs are rare

- Different anatomical site of the nerves
- Different utilization and exposure
- Statistically more radicular syndromes as differential diagnosis
- Axons are longer than in arms
  - More prone to metabolic disturbances
  - Regeneration time is longer

Anatomy: Lumbar and Sacral Plexus



Topical Diagnosis

- **Lumbar plexus**
- Weakness of hip flexors and knee extensors
- **Plus: adductor weakness**
- Sensory deficits **lateral** and medial thigh and medial calf

- **Femoral nerve**
- Weakness of hip flexors and knee extensors
- Sensory deficits medial thigh and medial calf

Topical Diagnosis

- **Sacral plexus**
- Weakness of hamstrings, calf and foot
- **Plus: Weakness of gluteal muscles**

- **Sciatic nerve**
- Weakness of hamstrings, calf and foot

Lumbal and Sacral Plexopathy

- Neoplastic:
  - Lumbal: 31%
  - Sacral: 51%
  - Lumbosacral: 18%

- Direct tumor extensions of colorectal carcinomas, lymphomas,
- Metastasis from prostate, bladder, uterus, cervical carcinomas
- Signs and symptoms: **pain!** Later motor weakness, mild sensory complaints, hot and dry foot

- DD Radiation therapy, leptomenigeal metastasis - less pain

Elektrophysiologic Criterias for Lesions of Lumbar and Sacral Plexus

- Missing or reduced SNAP of saphenous nerve, sural nerve or superficial peroneal nerve
- Denervation of gluteal muscles in EMG
- Lumbosacral paraspinal muscles unaffected

PITFALLS IN THE ELECTRODIAGNOSTIC STUDIES OF SACRAL PLEXOPATHIES

JINNY TAVEE, MD,[1] MARYANN MAYS, MD,[2] and ASA J WILBOURN, MD[2]*

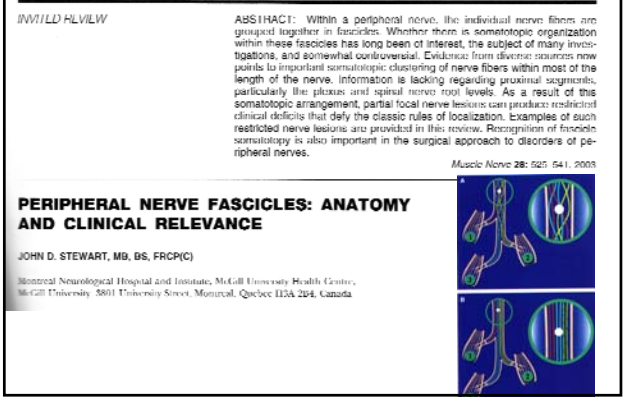
[1] Naval Medical Center Portsmouth, 620 John Paul Jones Circle, Division of Neurology, Portsmouth, Virginia 23708, USA
[2] Cleveland Clinic Foundation, Department of Neurology, Cleveland, Ohio, USA

Table 1. Electrodiagnostic findings of 171 patients with suspected sacral plexopathies

	Denervation		Superficial peroneal SNAP			Sural SNAP					
Lesion localization	Paraspinal muscles (%)	Gluteal muscles (%)	Absent/reduced† ipsilaterally (%)	Absent/reduced† bilaterally (%)	Normal symmetric (%)	Absent/reduced† ipsilaterally (%)	Absent/reduced† bilaterally (%)	Normal/symmetric (%)	Reduced TA CMAP (%)	Reduced AH CMAP (%)	Absent H-Reflex (%)
Definite SP* (n = 60)	17‡	100	63	32	5	48	34	18	71	69	74
Sciatic vs. SP (n = 32)	30	71	84	9.5	6.5	66	19	19	41	50	66
Roots vs. SP (n = 52)	49	68	31	63	6	23	69	8	53	54	83
Roots vs. SP vs. Sciatic (n = 77)	38	16	50	38	12	30	48	20	40	52	69

SNAP, sensory nerve action potential; CMAP, compound muscle action potential; SP, sacral plexopathy; TA, tibialis anterior; AH, abductor hallucis.
†Reduced: LOA4† or SNAP less than 50% contralateral limb value.
‡Brief positive sharp waves or very small amount of fibrillation potentials not considered to represent significant denervation.

Other Factors – Fascicle Topography



INVITED REVIEW

ABSTRACT: Within a peripheral nerve, the individual nerve fibers are grouped together in fascicles. Whether there is somatotopic organization within these fascicles has long been of interest, the subject of many investigations, and somewhat controversial. Evidence from diverse sources now points to important somatotopic clustering of nerve fibers within most of the length of the nerve. Information is lacking regarding proximal segments, particularly the plexus and spinal nerve root levels. As a result of this somatotopic arrangement, partial focal nerve lesions can produce restricted clinical deficits that defy the classic rules of localization. Examples of such restricted nerve lesions are provided in this review. Recognition of fascicle somatotopy is also important in the surgical approach to disorders of peripheral nerves.

Muscle Nerve **28:** 525–541, 2003

PERIPHERAL NERVE FASCICLES: ANATOMY AND CLINICAL RELEVANCE

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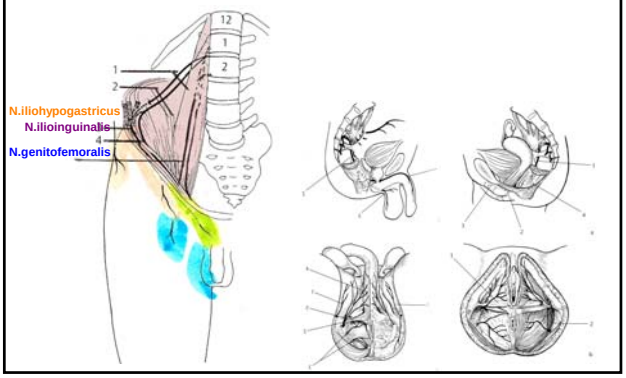
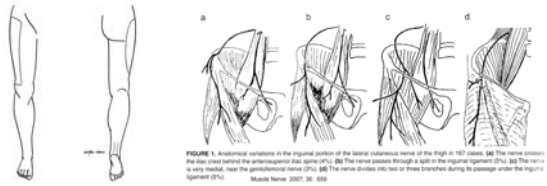
Genital and Pudendal Area

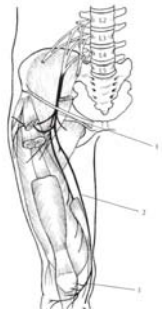


Lateral Cutaneous Femoral Nerve



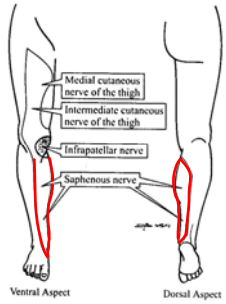
- Causes may be pregnancy, obesity, diabetes mellitus, trauma due to external injury, surgery, belts, mobile phones...
- Electrophysiology not reliable
- Sonography !
- Usually conservative management (nerve block, antiepileptics)
- Sometimes surgical nerve decompression

Femoral Nerve



- Retroperitoneal hematoma or tumor
- Postoperative
  - abdominal surgery, TEP
- Electrophysiology
  - Amplitude and Latency
  - EMG

Saphenous Nerve



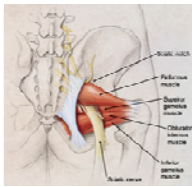
Saphenous nerve lesions:
Bursitis of pes anserinus
Entrapment, medial side of knee
Entrapment by a branch of the femoral artery
Meniscectomy, arthroscopy
Neurolemmoma

Sciatic Nerve

N. Gluteus sup

Foramen infrapiriforme

N. Ischiadicus



Weakness of hamstrings, calf and foot

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Sciatic Nerve

Common causes:
Acute compression (coma, drug overdose, intensive care unit, prolonged sitting, falls, hematoma)
Gluteal contusion or rhabdomyolysis gluteal compartment syndrome
Gunshot or knife wound
Hip replacement, hip fracture or dislocation, or femur fracture
Infarction (vasculitis, iliac artery occlusion, arterial bypass surgery)
Intramuscular gluteal injection

Less common causes:
Tumor: carcinoma, lipoma, lymphoma, neurofibroma, schwannoma, endometriosis
AV malformations, ruptured aneurysm, false aneurysm of the aorta, child birth, infection, vasculitis, myositis ossificans

Piriformis syndrome:
Compression of the sciatic nerve at the pelvic outlet

Rare cause:
screw after hip fracture

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Common Peroneal Nerve

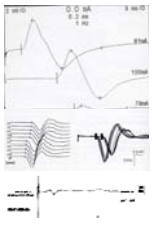
- **Most common entrapment of the legs**
- **Foot drop with weakness in foot and toe dorsiflection and ancle eversion**
- **Sensory deficits first web space, dorsum of foot and lateral aspect of lower leg**

- **Causes:**
- **External compression during sleep, coma, anesthesia, plaster casts, bandages, legs crossing, squatting**
- **Cysts, ganglions, lipoma, callus**
- **Weight loss, in metabolic syndromes**

DD: L5 radiculopathy, sciatic lesions

Peroneal Nerve – Diagnosis

- **Motor NCS across fibular head**
- **Inching**
- **Sensory NCS of superficial peroneal nerve**
- **EMG Tests**
- **Sonography**



Differential Diagnosis of Foot Drop

- Sciatic Lesion
- L5 radiculopathy
- L4 radiculopathy
- Polyneuropathy
- Anterior tibial syndrome
- ALS
- Distal Myopathy

CMT

EMG and Muscle Testing - Foot Drop

	Deep Peroneal Nerve	Common Peroneal Nerve	Sciatic Nerve	Sacral Plexus	L 5
Tibialis anterior	X	X	X	X	X
Peronäus longus		X	X	X	X
Short head of Biceps femoris			X	X	X
Gluteus Medius				X	X
Paraspinal					X

Peroneal Nerve - Therapy

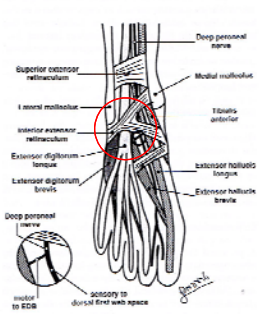
Compression palsies : conservative
- Physiotherapy
- Splinting

- In case of no recovery after 4 month - neurolysis

Traumatic lesions
NTX

- Additionally transfer of posterior tibial muscle

Peroneal Nerve - Anterior Tarsal Tunnel Syndrome



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Tibial Nerve – Posterior Tarsal Tunnel Syndrome

- Severe foot pain, burning, worse on standing and walking. Tinel sign at the medial malleolus, atrophy of the sole muscles
- DD: Morton's neuroma, plantar fasciitis, heel spurs, arthritis, early Charcot's neuroarthropathy, S1 radiculopathy, neuropathy (d.m.) CRPS
- Causes:
  - Trauma: distorsion, anklefracture, hematoma, adhäsions, fibrosis
  - Masses : ganglion, lipoma, varikosis
  - Diabetes mellitus??
- MRI : neuromas
- EDX: difficult, if DNP is severe
- Decompression if compression is identified

Posterior Tarsal Tunnel Syndrome - Elektrophysiology

- Sensitivity low (50-80%)
- Motor NCS : prolonged distal motor latency and reduced muscle action potential
- Sensory NCS of plantar nerves
- EMG of intrinsic foot muscles
- Denervation in coexisting neuropathy or S1 radiculopathy

Tarsal Tunnel Syndrome

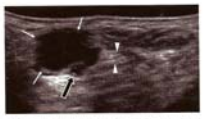
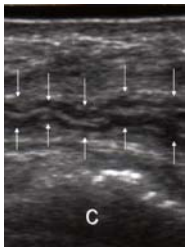
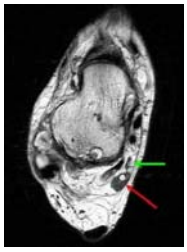


Fig. 4.57. Posterior tibial tunnel syndrome. Transverse 13-MHz scan at the level of the medial malleolus. A cystic mass (*small arrows*) is seen expanding within the medial plantar nerve, displacing the nerve fascicles marginally (*large arrow*). The lateral branch is unaffected (*arrowheads*)



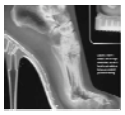


Peer 2008

Morton Neuroma

- Morton 1876
- Lesion of interdigital nerve
- Mostly women (80%)
- Pain when walking
- Often misinterpreted as splainfoot
- Elicited by pressing
- Sensory loss in adjacent toes

- **Therapy**
- Insoles
- Infiltration
- Excision



Thank you !

"Mr. Osborne, may I be excused? My brain is full."