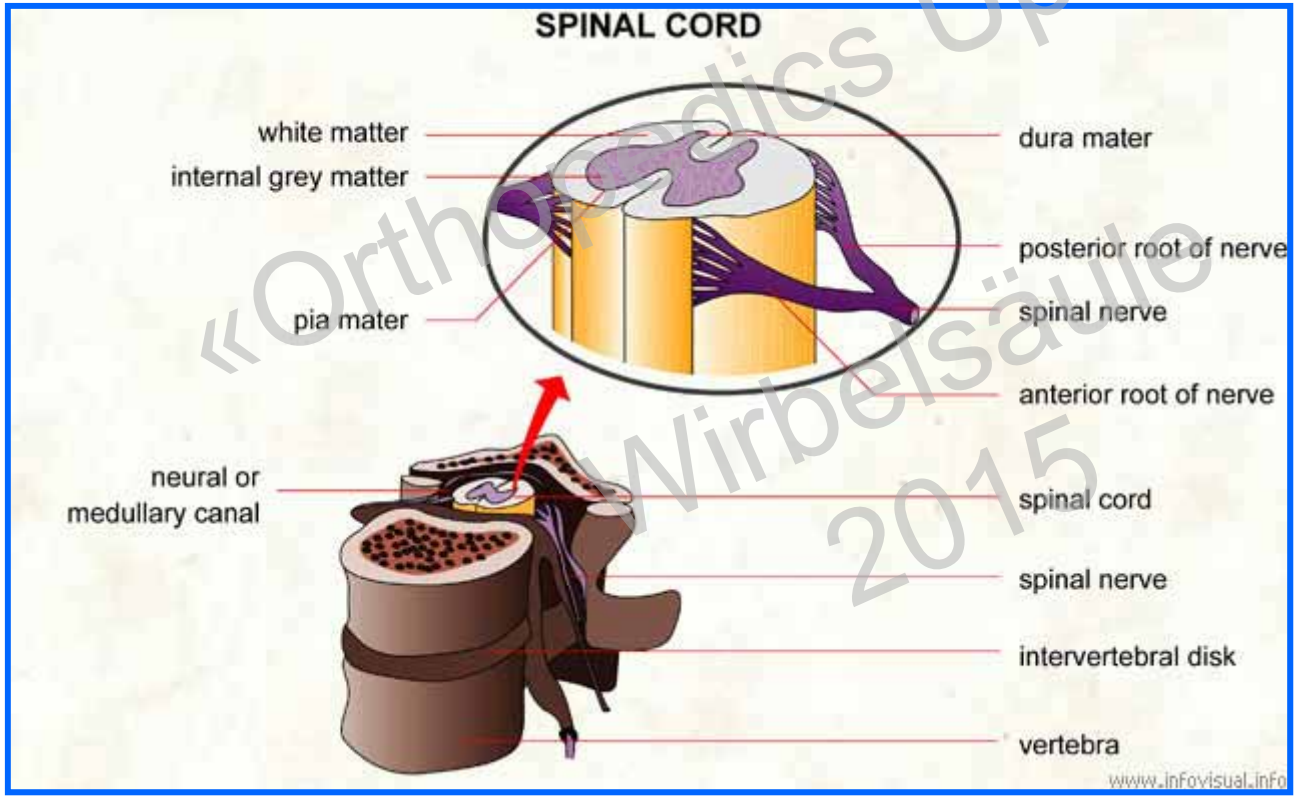
Der spinale neurologische Notfall

Spinal cord emergency



Prof. Dr. A. Curt, FRCPC

Universität Zürich[UZH]

Universitätsklinik Balgrist
Zentrum für Paraplegie

Spinal cord emergencies

- traumatic
- non - traumatic
  - primary (myelitis, syringomyelia, intramedullary tumors..)
  - secondary (spinal metastases, intraspinal hemorrhage and abscess, spinal canal stenosis..)
- congenital
  - (meningo-myelocele, diastematomyelia, tethered cord..)

Spinal cord disorders:
„the neurological examination is key!“

Patient Name _____

Examiner Name _____ Date/Time of Exam_____

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

ASIA American Spinal Injury Association

ISCOS

MOTOR

KEY MUSCLES (scoring on reverse side)

	R	L	
C5	☐	☐	Elbow flexors
C6	☐	☐	Wrist extensors
C7	☐	☐	Elbow extensors
C8	☐	☐	Finger flexors (distal phalanx of middle finger)
T1	☐	☐	Finger abductors (little finger)

UPPER LIMB TOTAL (MAXIMUM) ☐ + ☐ = ☐ (25) (25) (50)

Comments:

	R	L	
L2	☐	☐	Hip flexors
L3	☐	☐	Knee extensors
L4	☐	☐	Ankle dorsiflexors
L5	☐	☐	Long toe extensors
S1	☐	☐	Ankle plantar flexors

Voluntary anal contraction (Yes/No) ☐

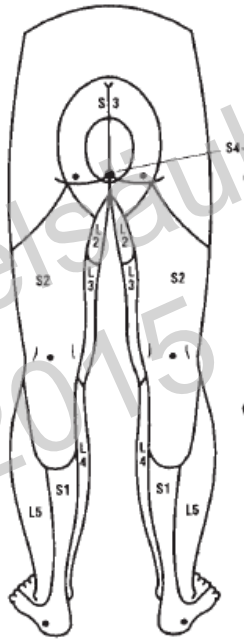
LOWER LIMB TOTAL (MAXIMUM) ☐ + ☐ = ☐ (25) (25) (50)

SENSORY

KEY SENSORY POINTS

	LIGHT TOUCH R	LIGHT TOUCH L	PIN PRICK R	PIN PRICK L
C2				
C3				
C4				
C5				
C6				
C7				
C8				
T1				
T2				
T3				
T4				
T5				
T6				
T7				
T8				
T9				
T10				
T11				
T12				
L1				
L2				
L3				
L4				
L5				
S1				
S2				
S3				
S4-5				

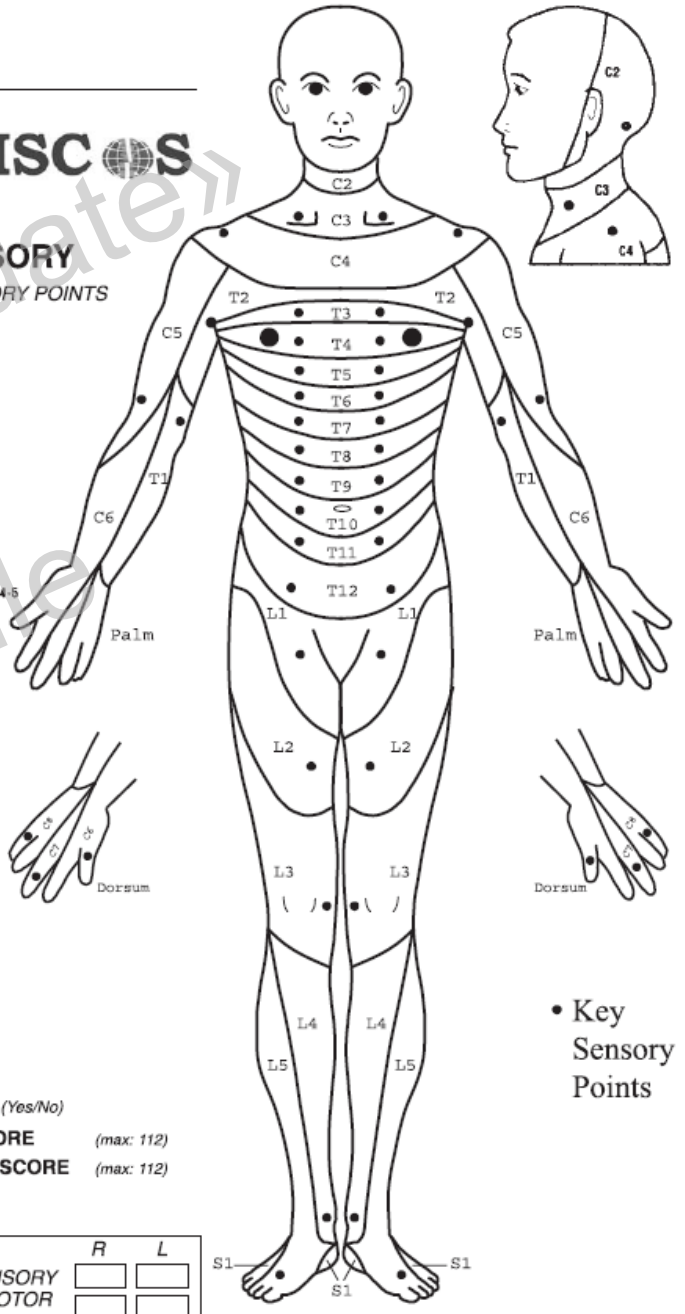
0 = absent
1 = impaired
2 = normal
NT = not testable



☐ Any anal sensation (Yes/No)

TOTALS (MAXIMUM) (56) (56) ☐ + ☐ = ☐ PIN PRICK SCORE (max: 112)

(56) (56) ☐ = ☐ LIGHT TOUCH SCORE (max: 112)



• Key Sensory Points

NEUROLOGICAL LEVEL		R	L	COMPLETE OR INCOMPLETE?		ZONE OF PARTIAL PRESERVATION		R	L
The most caudal segment with normal function	SENSORY	☐	☐	Incomplete = Any sensory or motor function in S4-S5	☐	Caudal extent of partially innervated segments	SENSORY	☐	☐
	MOTOR	☐	☐	ASIA IMPAIRMENT SCALE	☐		MOTOR	☐	☐

REV 03/06

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- congenital
  - (meningo-myelocele, diastematomyelia, tethered cord..)

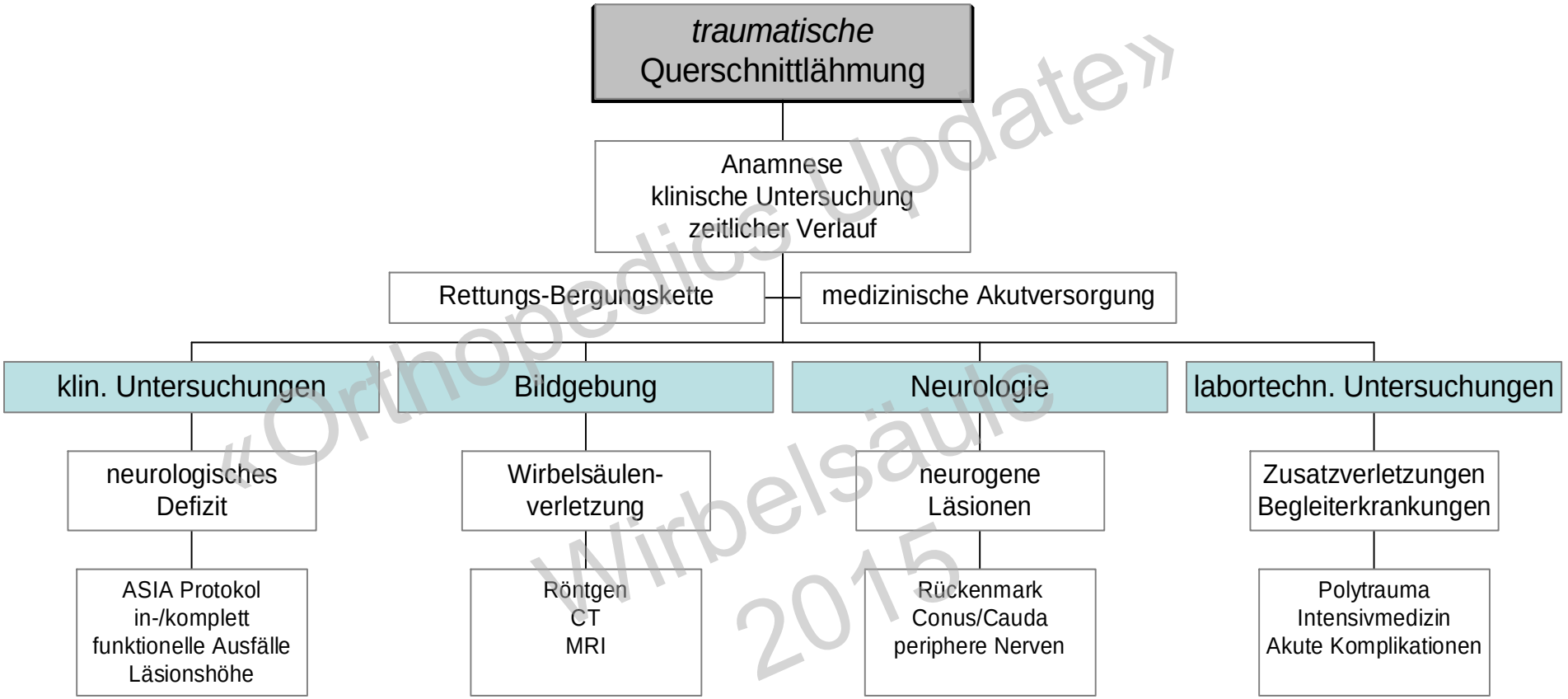
Sport injuries

Traffic accidents

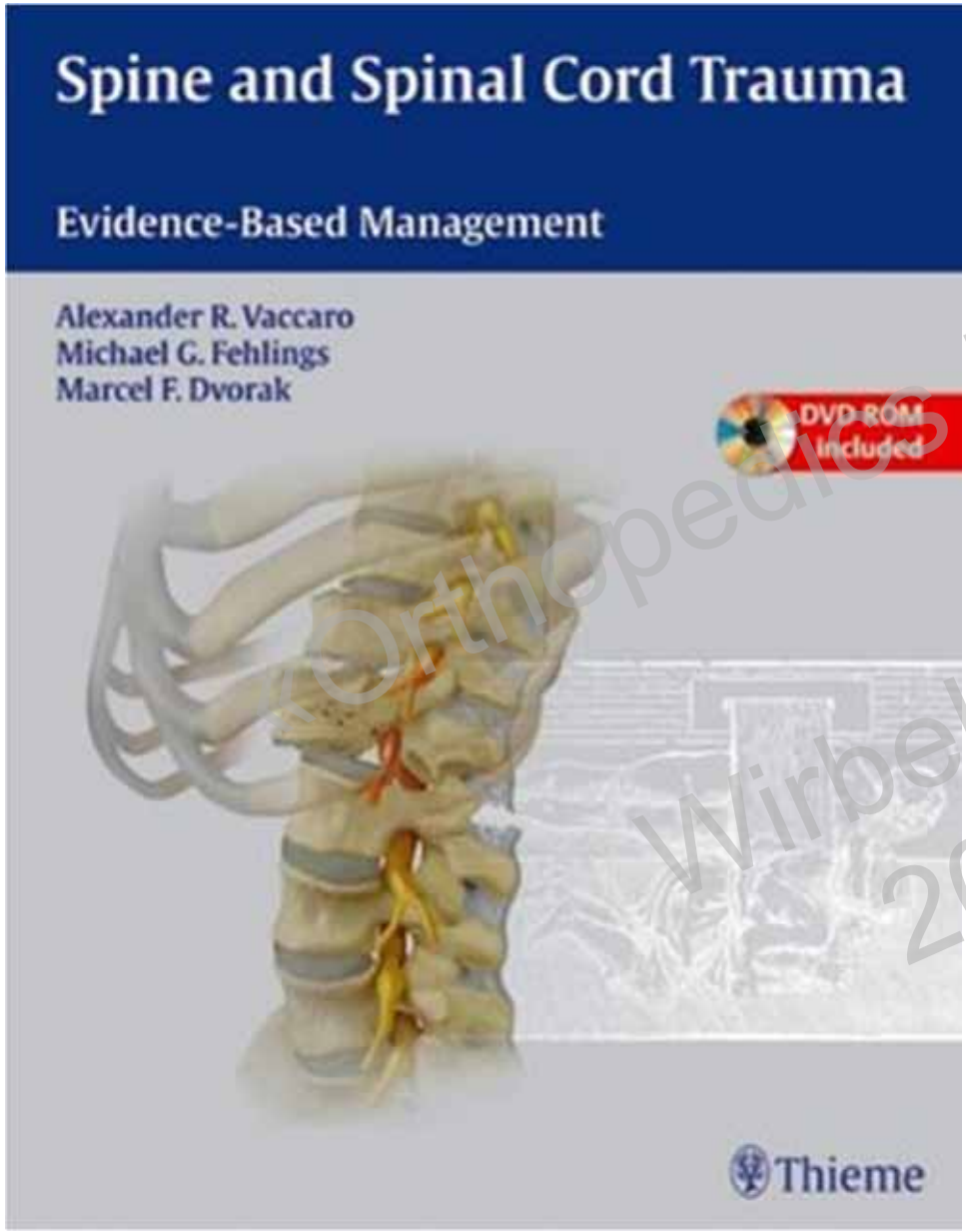





Emergency management



Diagnostische Abklärung einer akuten traumatischen Querschnittslähmung, Leitlinien DGN 2010



- ✓ Time is spine
  (early treatment)
- ✓ Decompression surgery
- ✓ Stabilization
- ✓ Cardiovascular management (ICU guidelines)
- ✓ Controlled mobilization

- ➢ Methylprednisolone
  No evidence!

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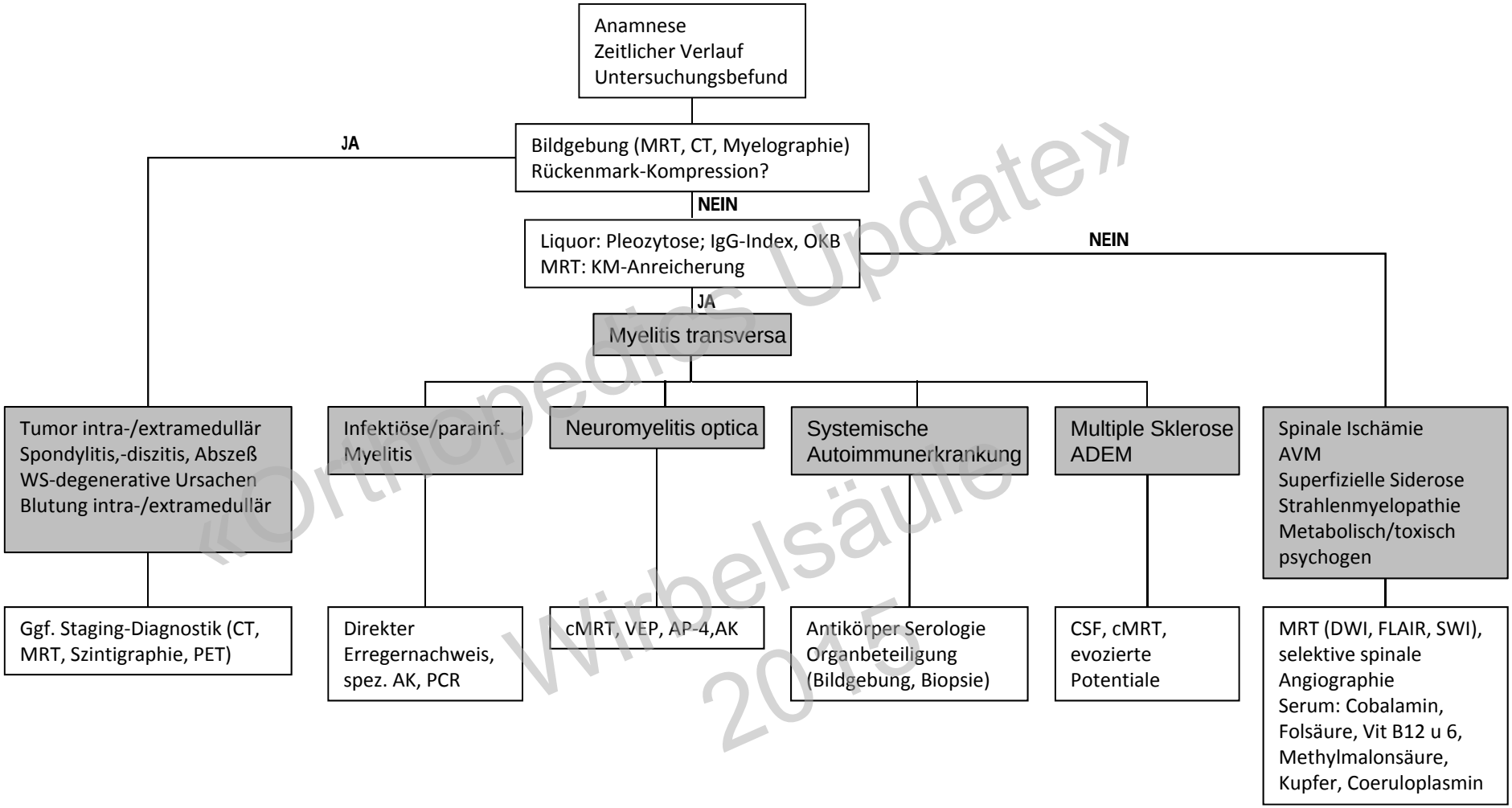
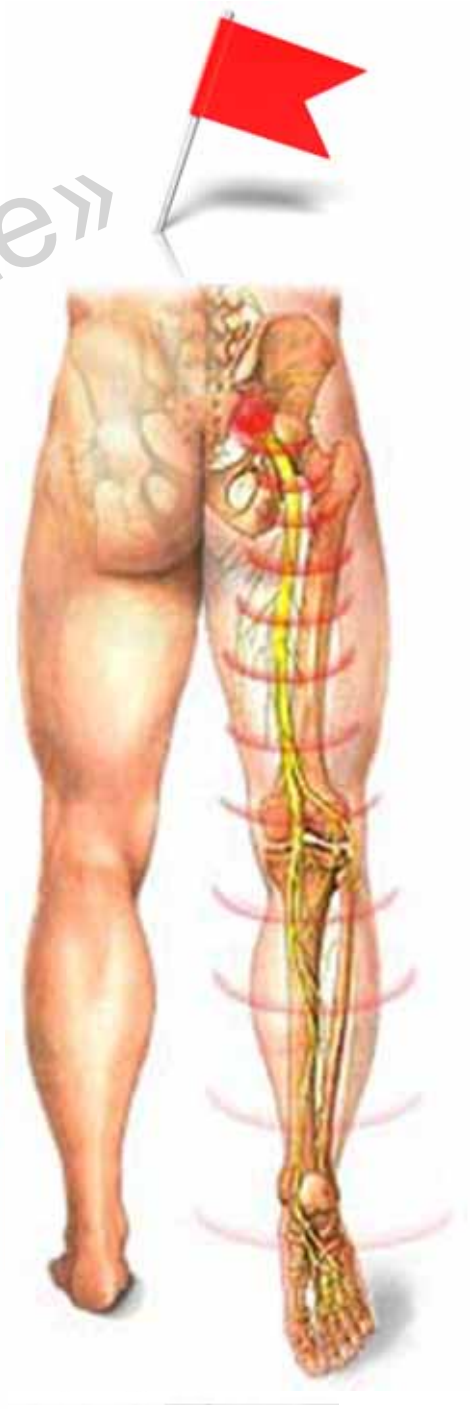


Diagnostische Abklärung nicht-traumatischen Querschnittlähmung
DGN Guidelines 2010

Red flags



Red flags

First Red Flag: Pain

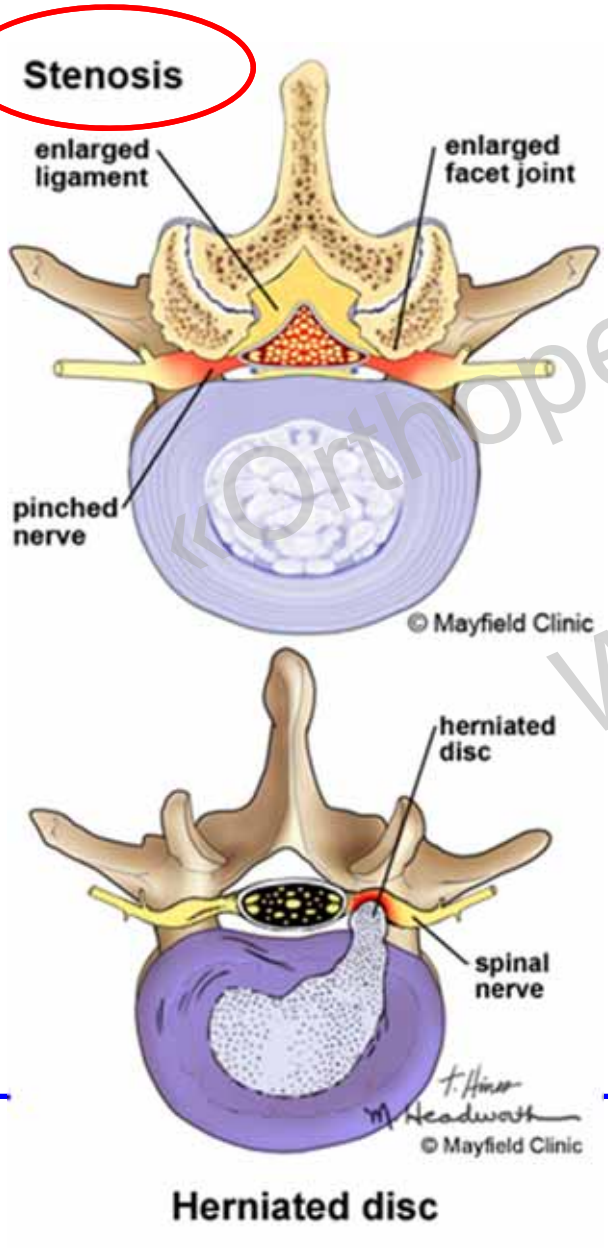
- **Usually first symptom**
  - 80-90% of the time
- **Usually precedes other neurologic symptoms by 7 weeks**
  - Increases in intensity
- **Severe local back pain**
- **Aggravated by lying down**
  - Distension of venous plexus

Distribution of pain:

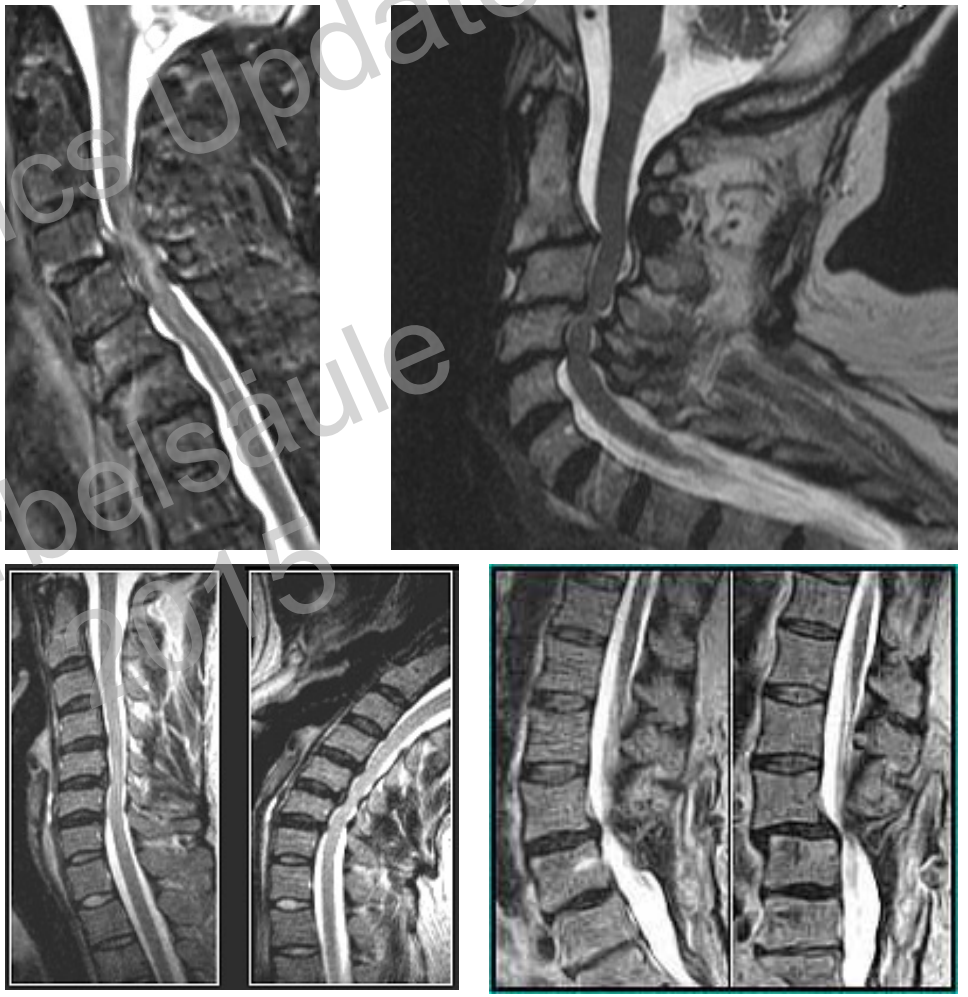
- bilateral pain
- clumsy hands/feet
- altered temp sen.
- girdle/belt like

Bach, F, Larsen, BH, Rohde, K, et al. Metastatic spinal cord compression. Occurrence, symptoms, clinical presentations and prognosis in 398 patients with spinal cord compression. Acta Neurochir (Wien) 1990; 107:37.

Degenerative spinal canal stenosis



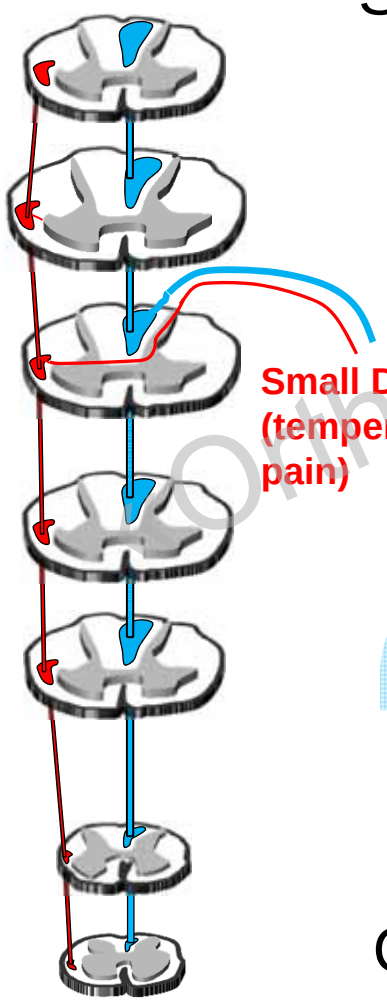
Spinal canal encroachments and instability



Segmental Sensory Assessment

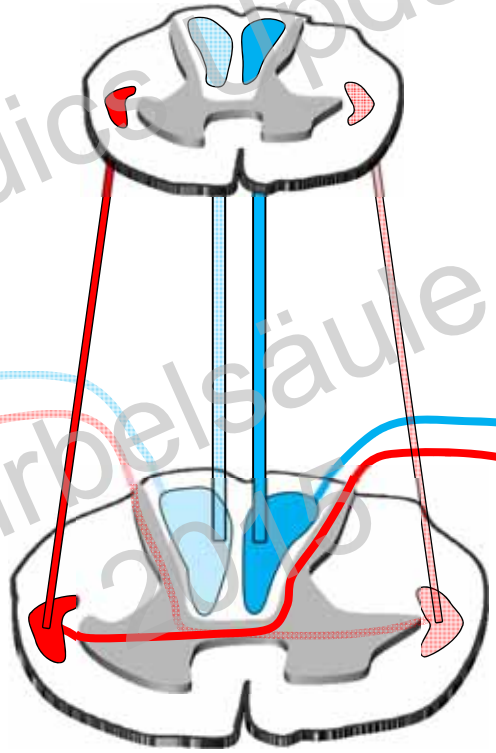
Somato-sensory Evoked Potentials

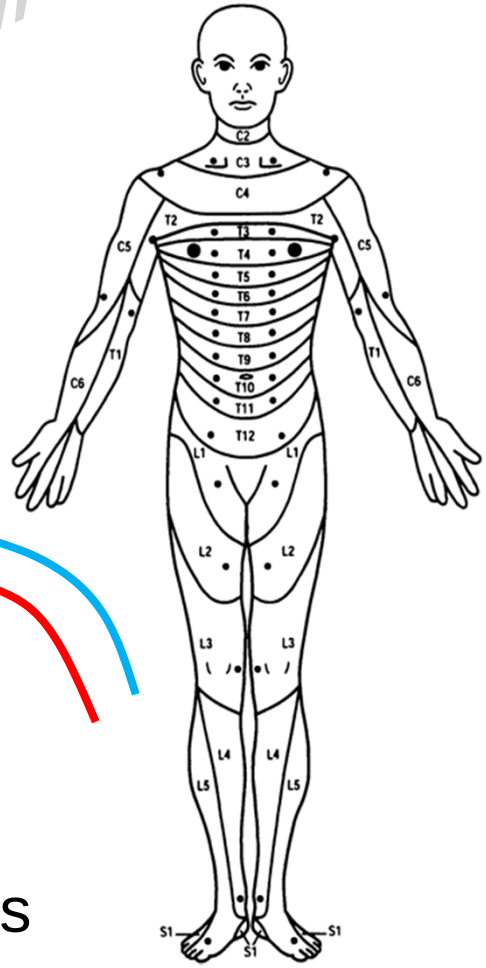
SSEPS



Large Diameter (tactile)

Small Diameter (temperature, pain)





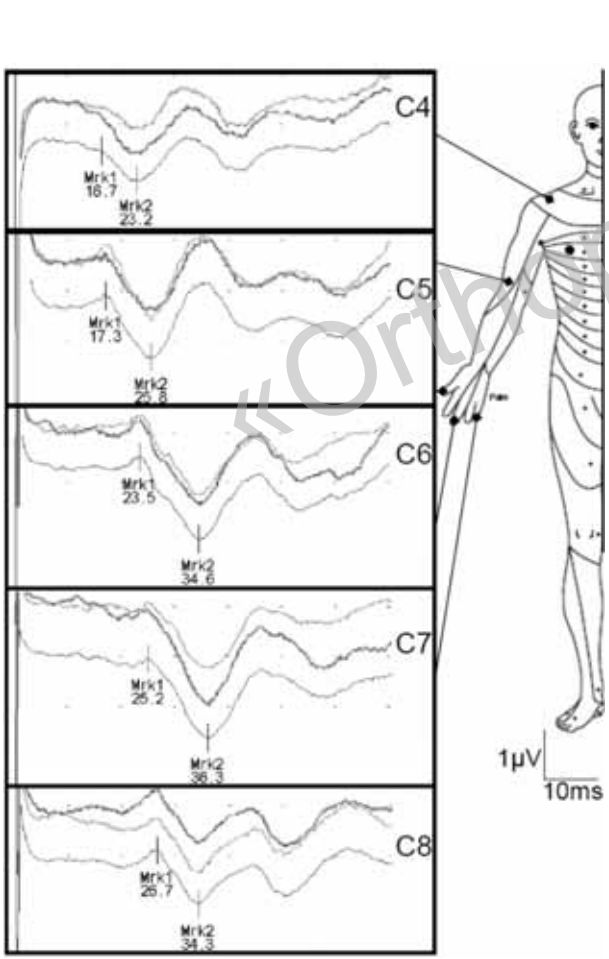
Contact Heat Evoked Potentials

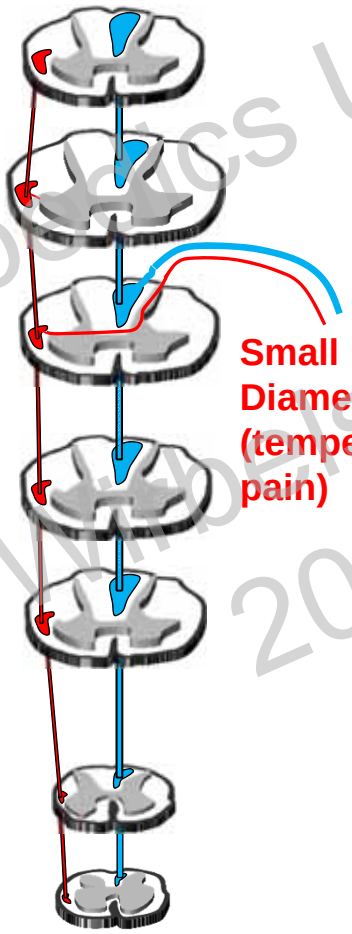
CHEPS

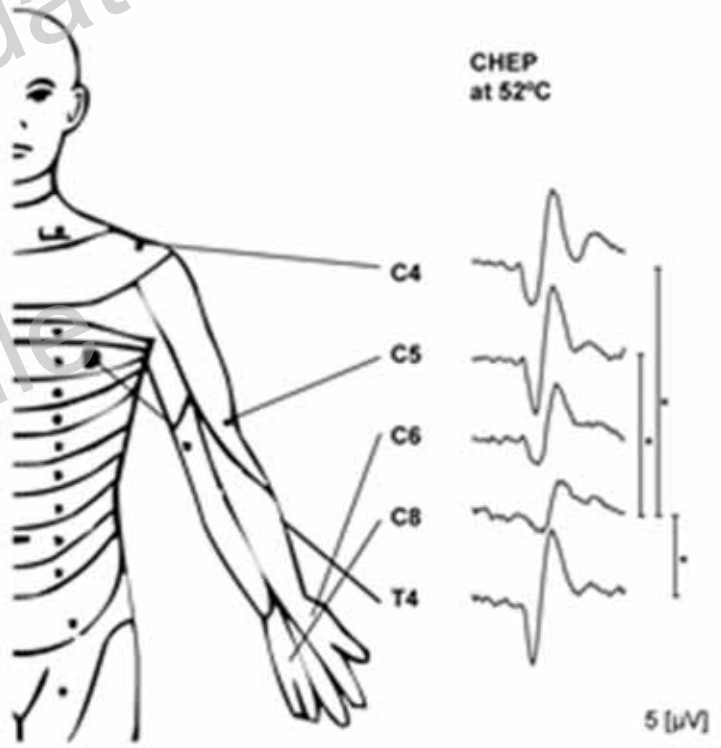
Segmental Sensory Assessment

Somato-sensory Evoked Potentials

SSEPS



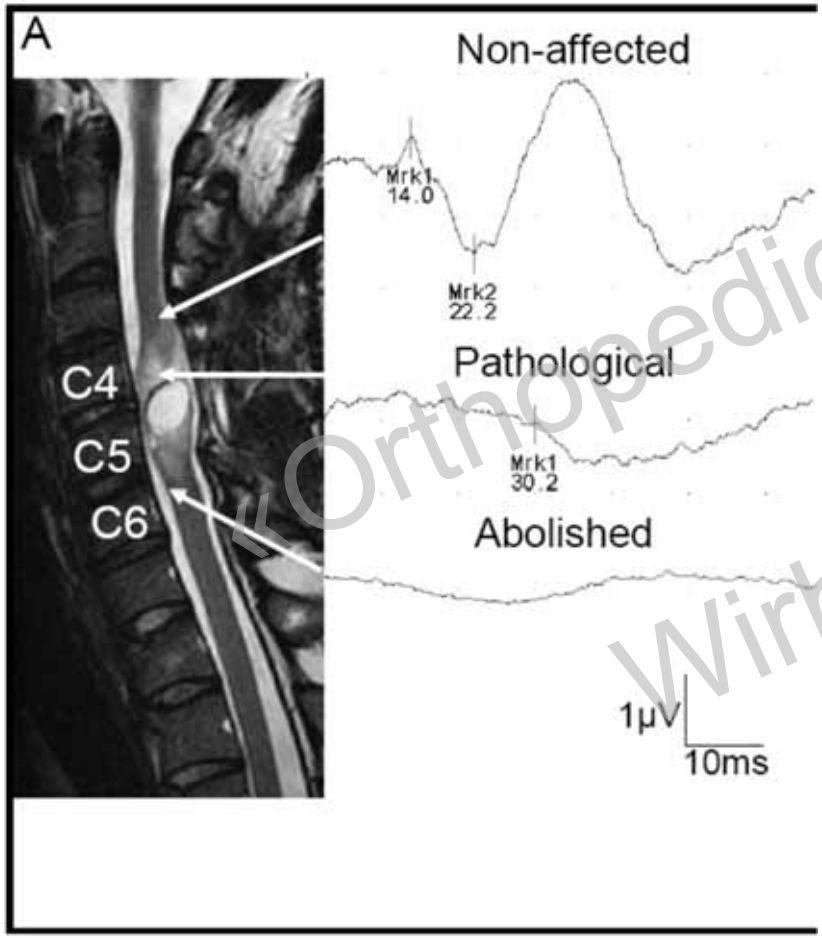


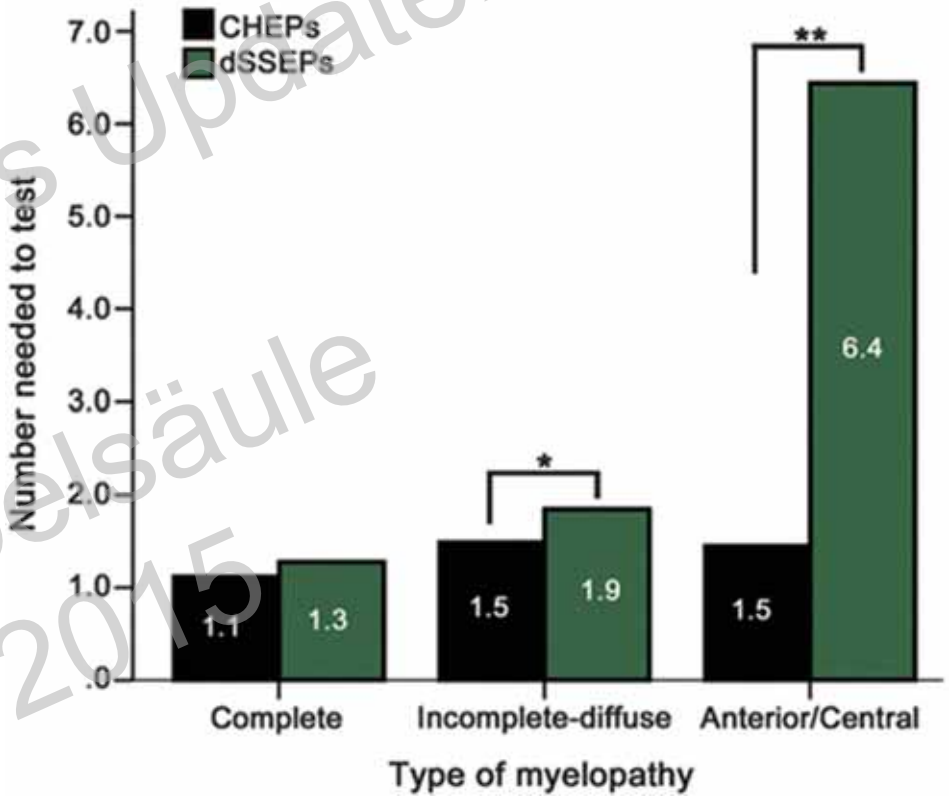


Contact Heat Evoked Potentials

CHEPS

Segmental Sensory Assessment

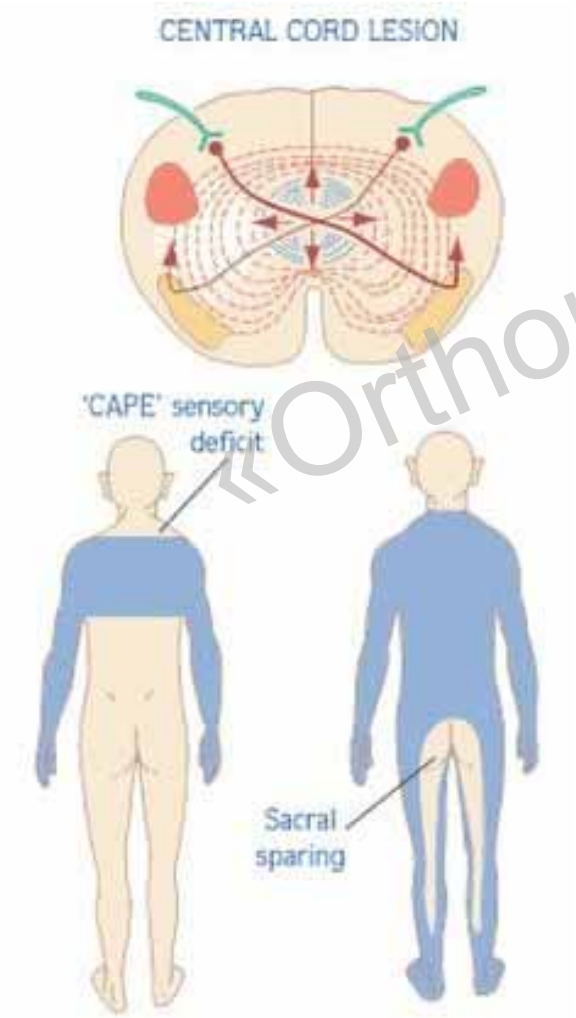


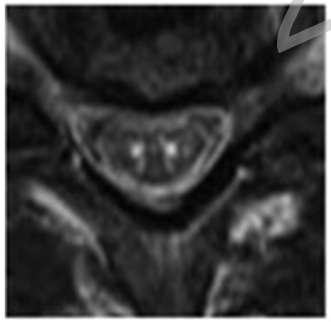


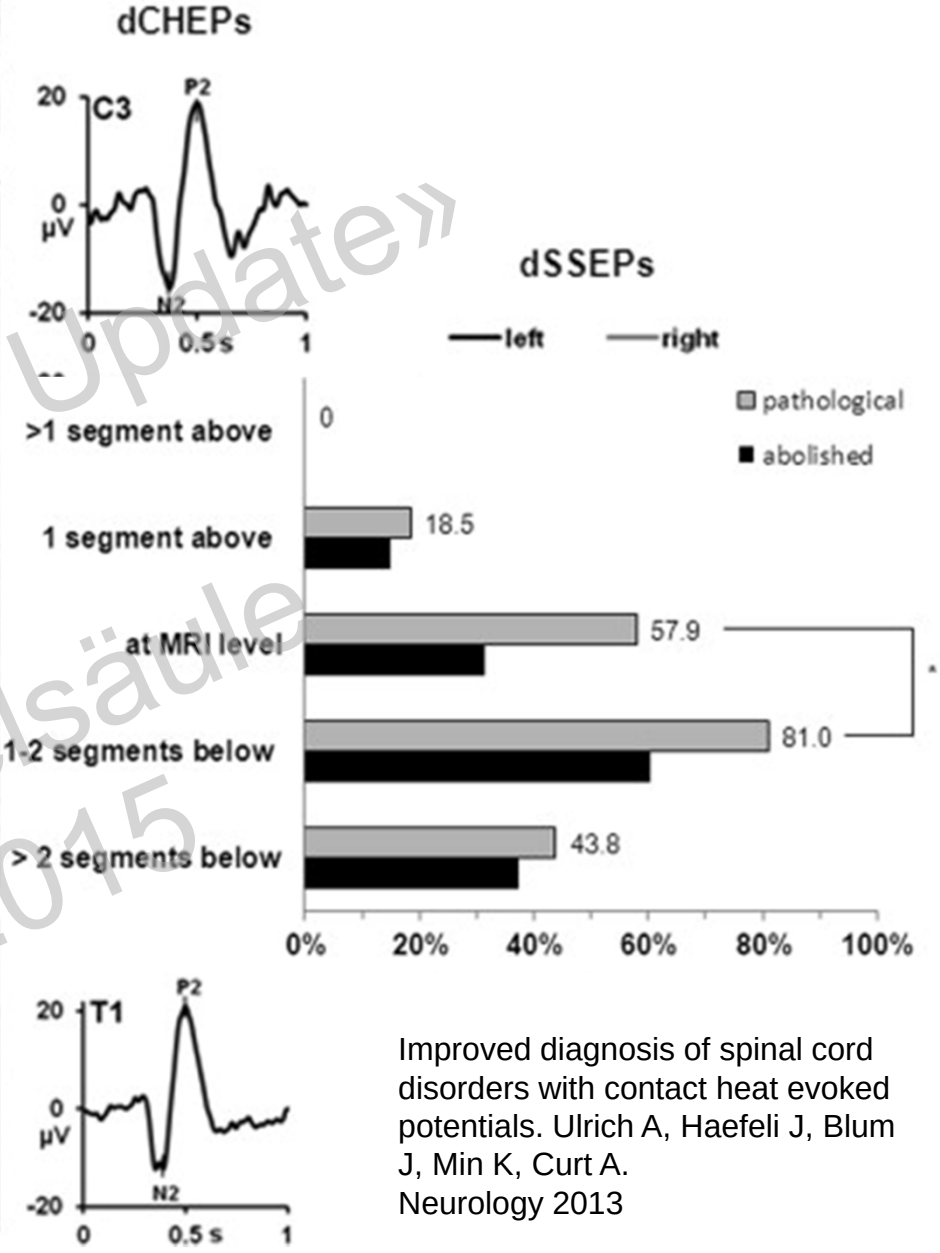
Kramer J, et al.. D-SSEP and EPT for the assessment of posterior cord function in SCI. J Neurotrauma 2008

Improved diagnosis of spinal cord disorders with contact heat evoked potentials. Ulrich A, Haefeli J, Blum J, Min K, Curt A. Neurology 2013

Snake – eye myelopathy







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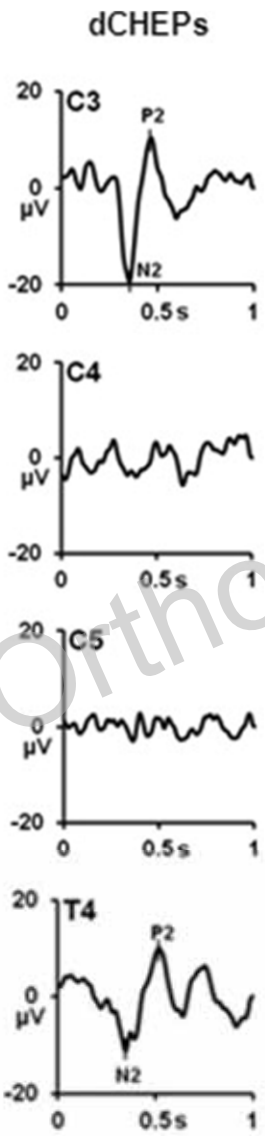
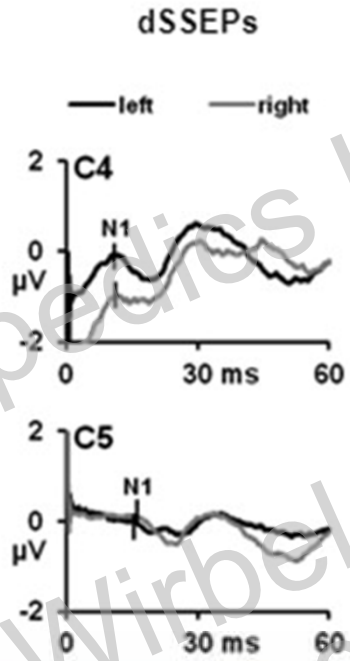
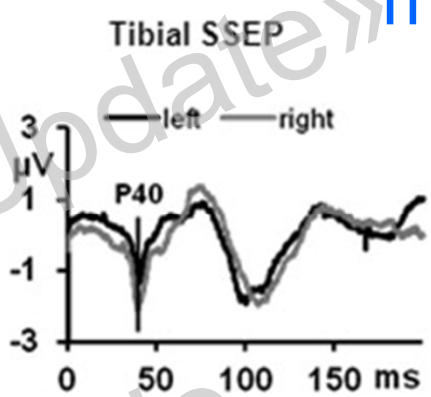
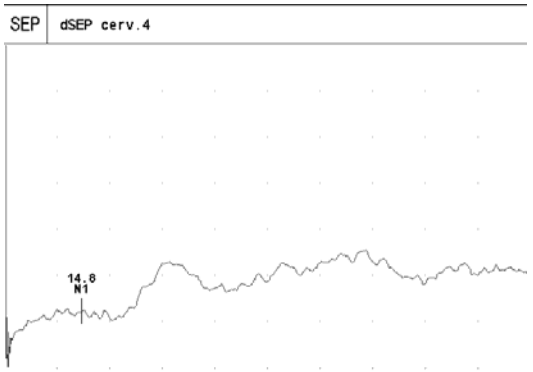
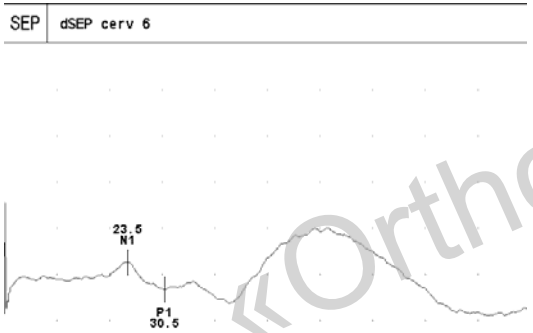


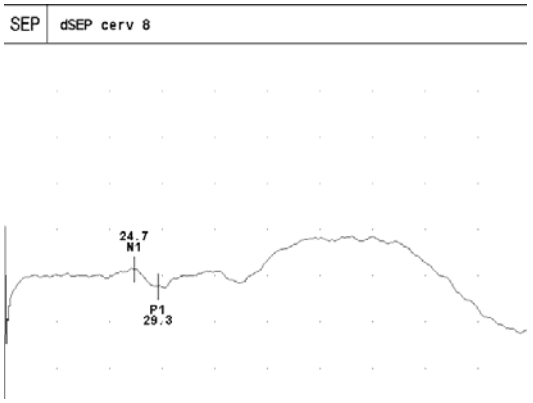


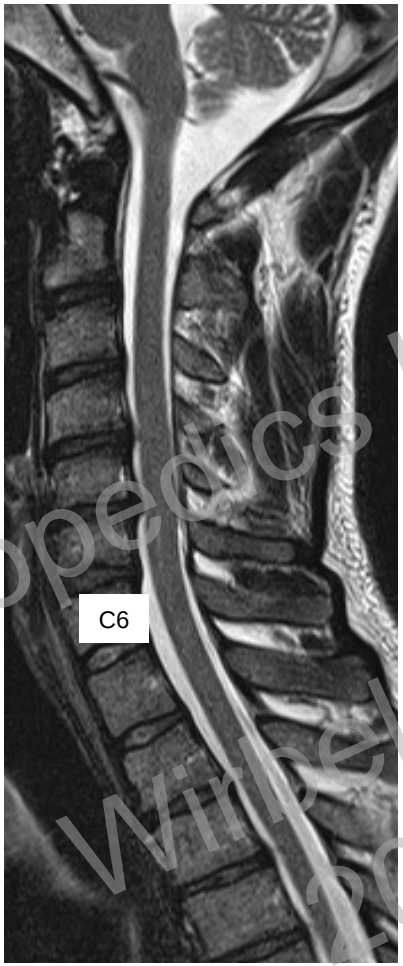


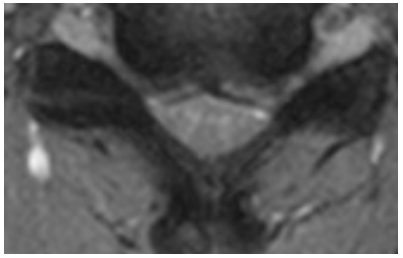
High sensitivity of contact-heat evoked potentials in "snake-eye" appearance myelopathy. Ulrich A, Min K, Curt A. Clin Neurophysiol 2015

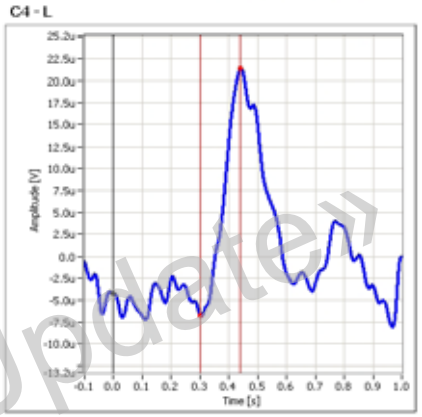


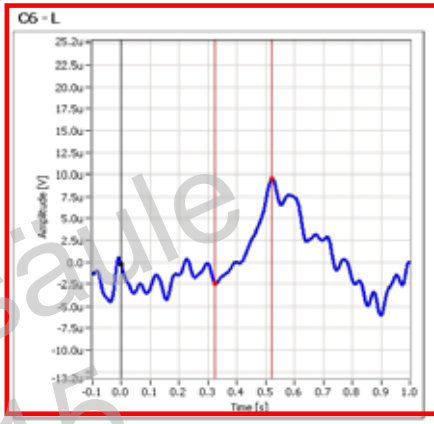


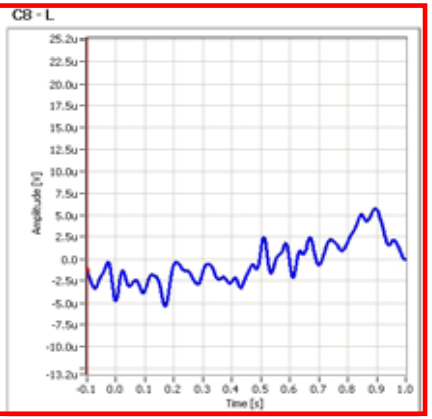


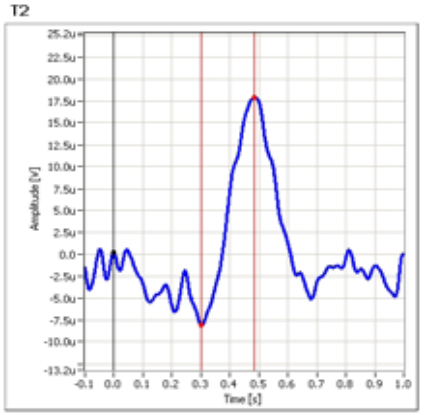




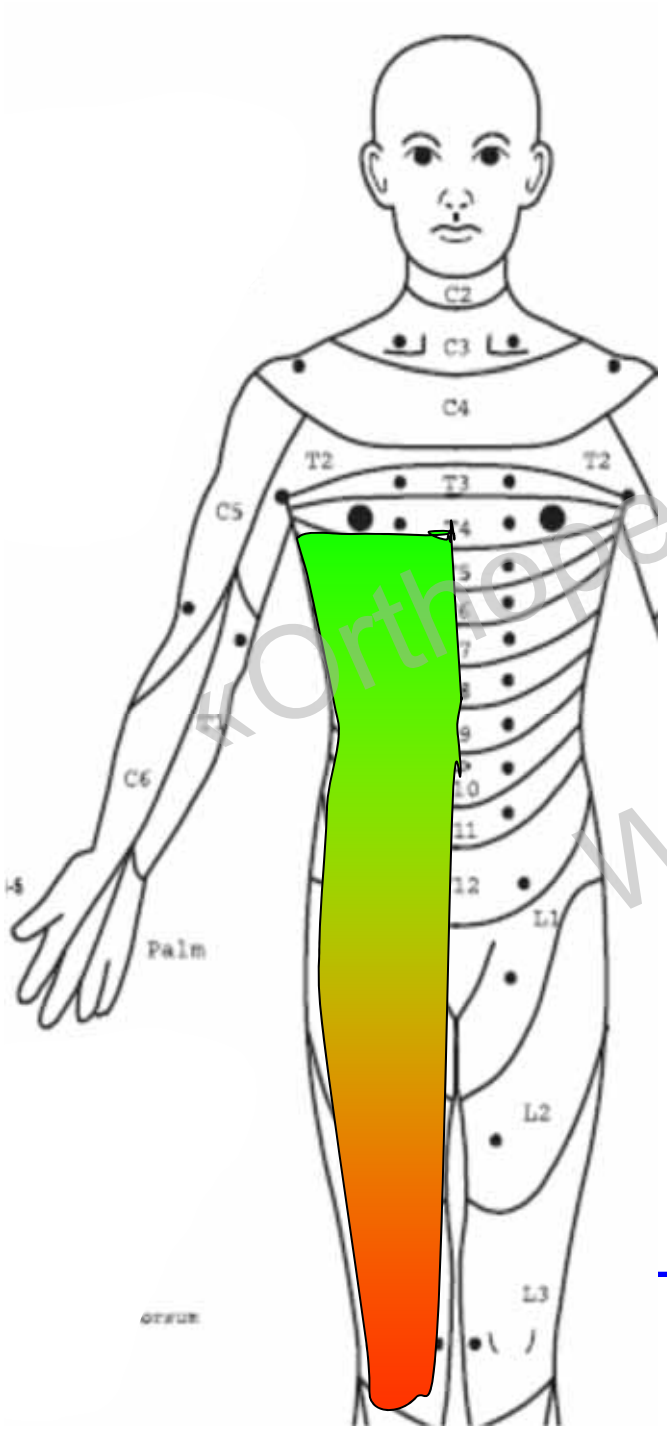


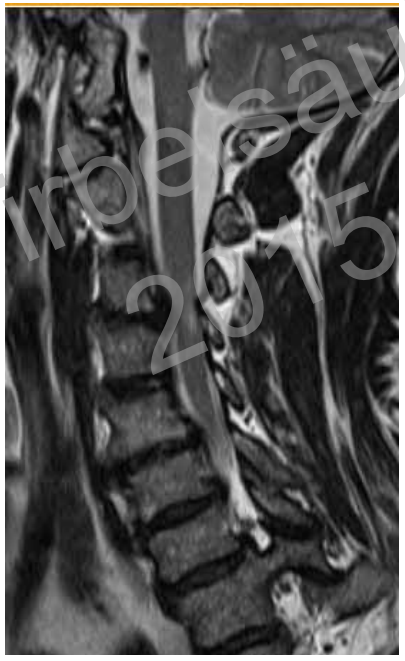




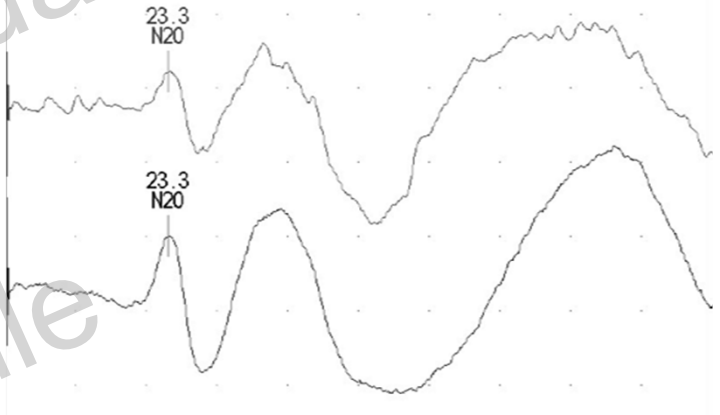


police officer, ♂ 51 yrs
thermal hypaesthesia

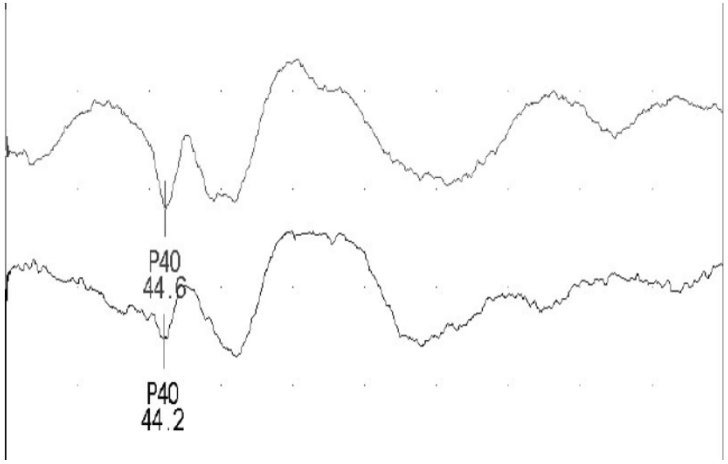


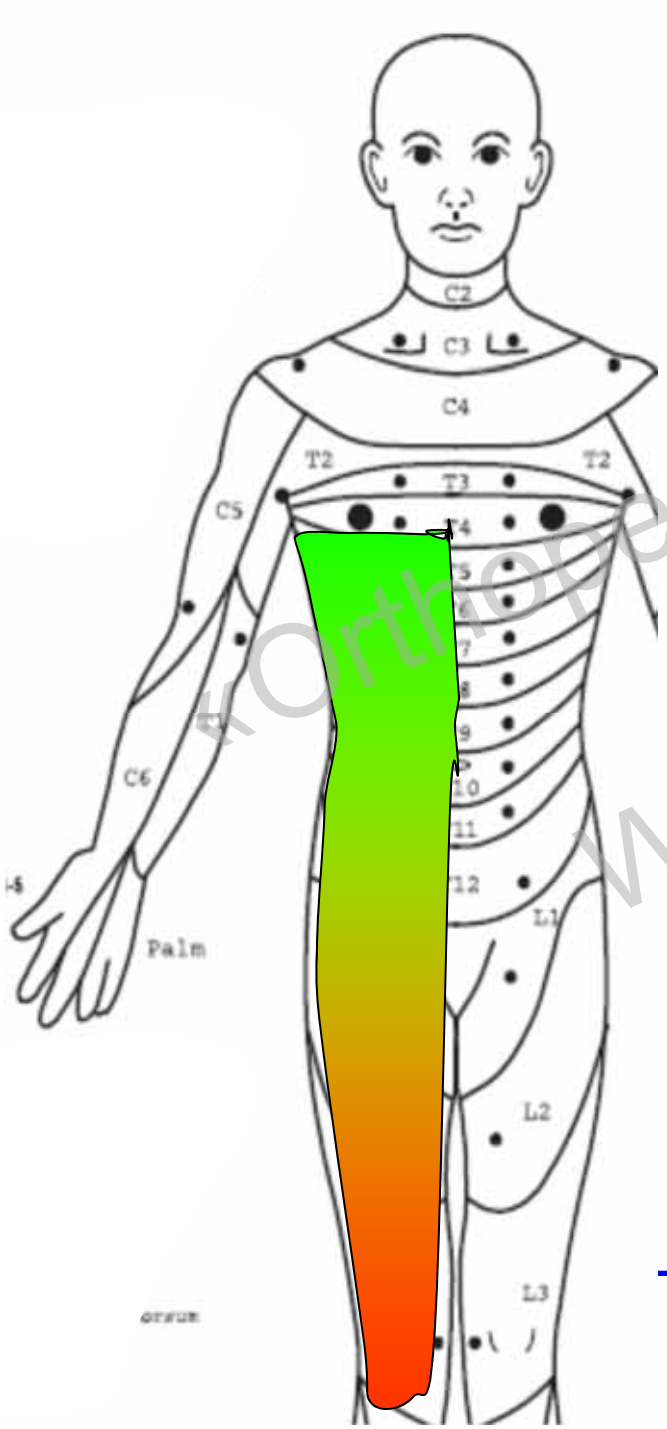


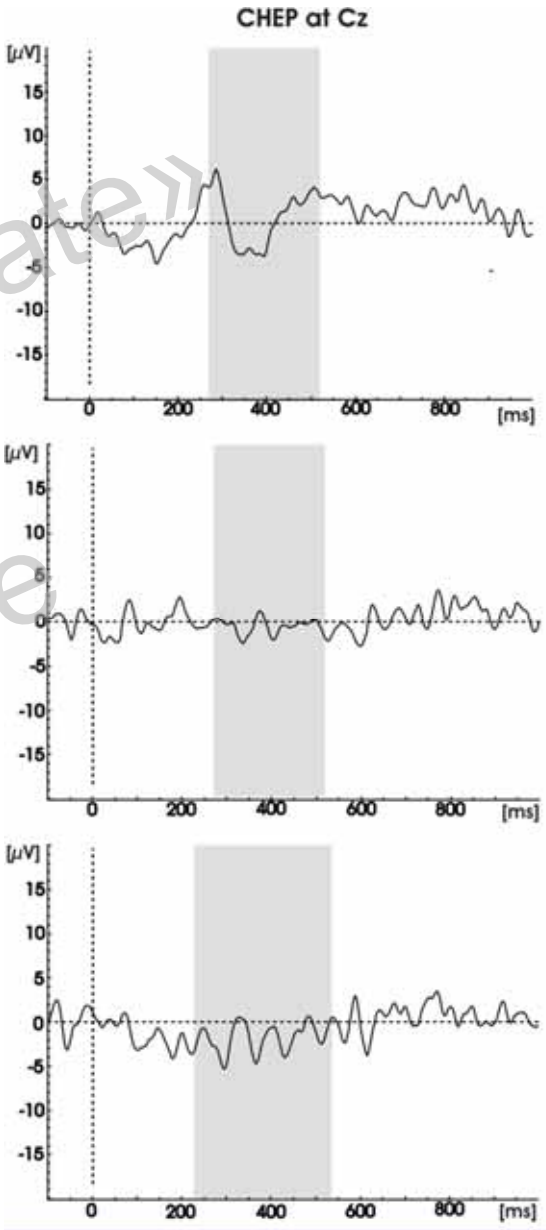
Ulnar SSEP



Tibial SSEP







Universitätsklinik Balgrist
Zentrum für Paraplegie

Red flags

Second Red Flag: Motor

- **Weakness: 60-85%**
  - Tends to be symmetrical
  - Severity greatest with thoracic mets
- **At or above conus medularis**
  - Extensors of the upper extremities
- **Above the thoracic spine**
  - Weakness from corticospinal dysfunction
  - Affects flexors in the lower extremities
- **Patients may be hyper reflexic below the lesion and have extensor plantars**

Greenberg, HS, Kim, JH, Posner, JB. Epidural spinal cord compression from metastatic tumor: Results with a new treatment protocol. Ann Neurol 1980; 8:361.

Walking signs:

- unsteadiness
- fatigue
- weakness

(limb or bilateral)

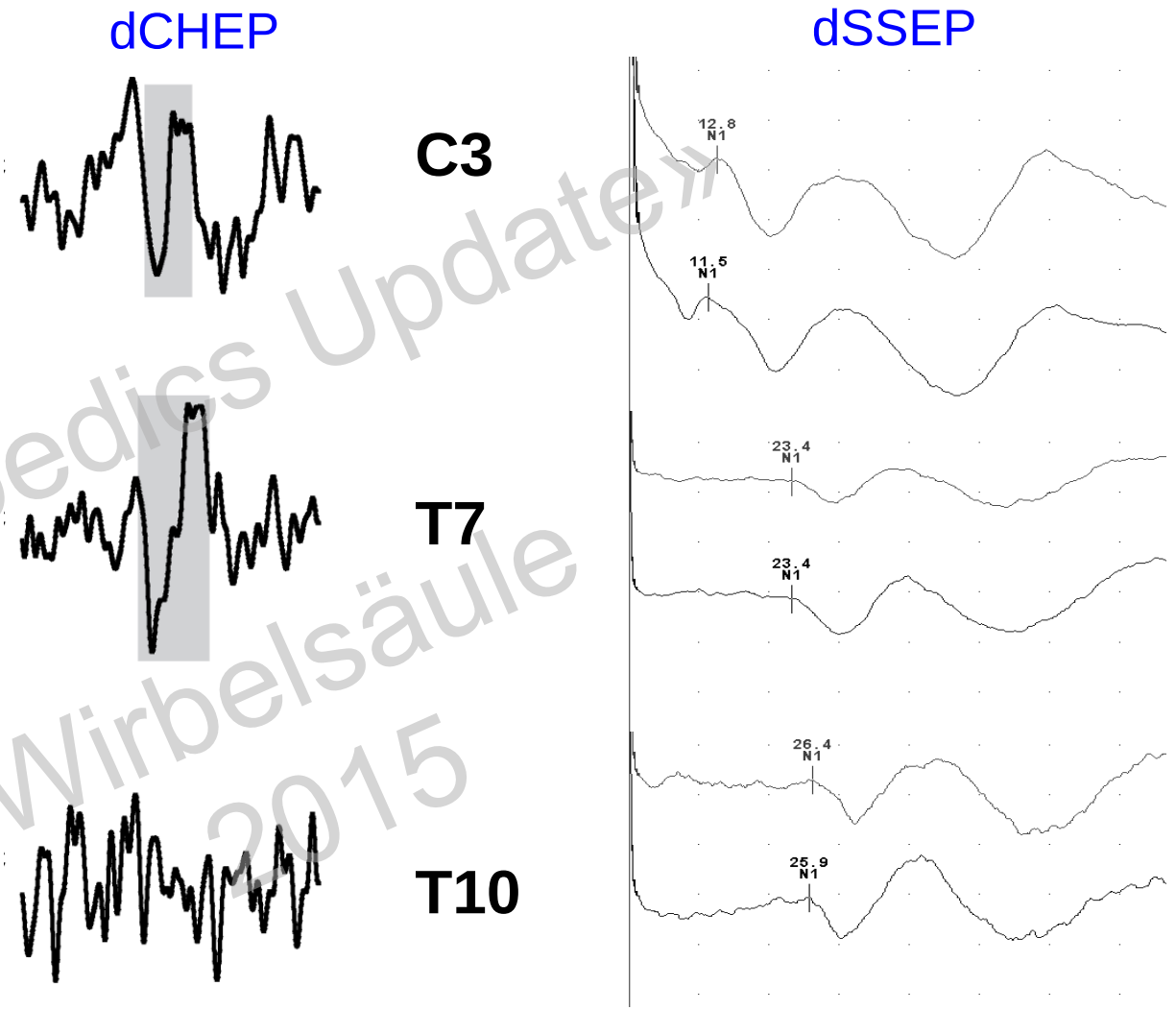
Calcified disc herniation T7/8

Lower back pain
Dysesthesia left leg
Lower limb reflexes increased
Female 36 years

Calcified disc herniation T10/11

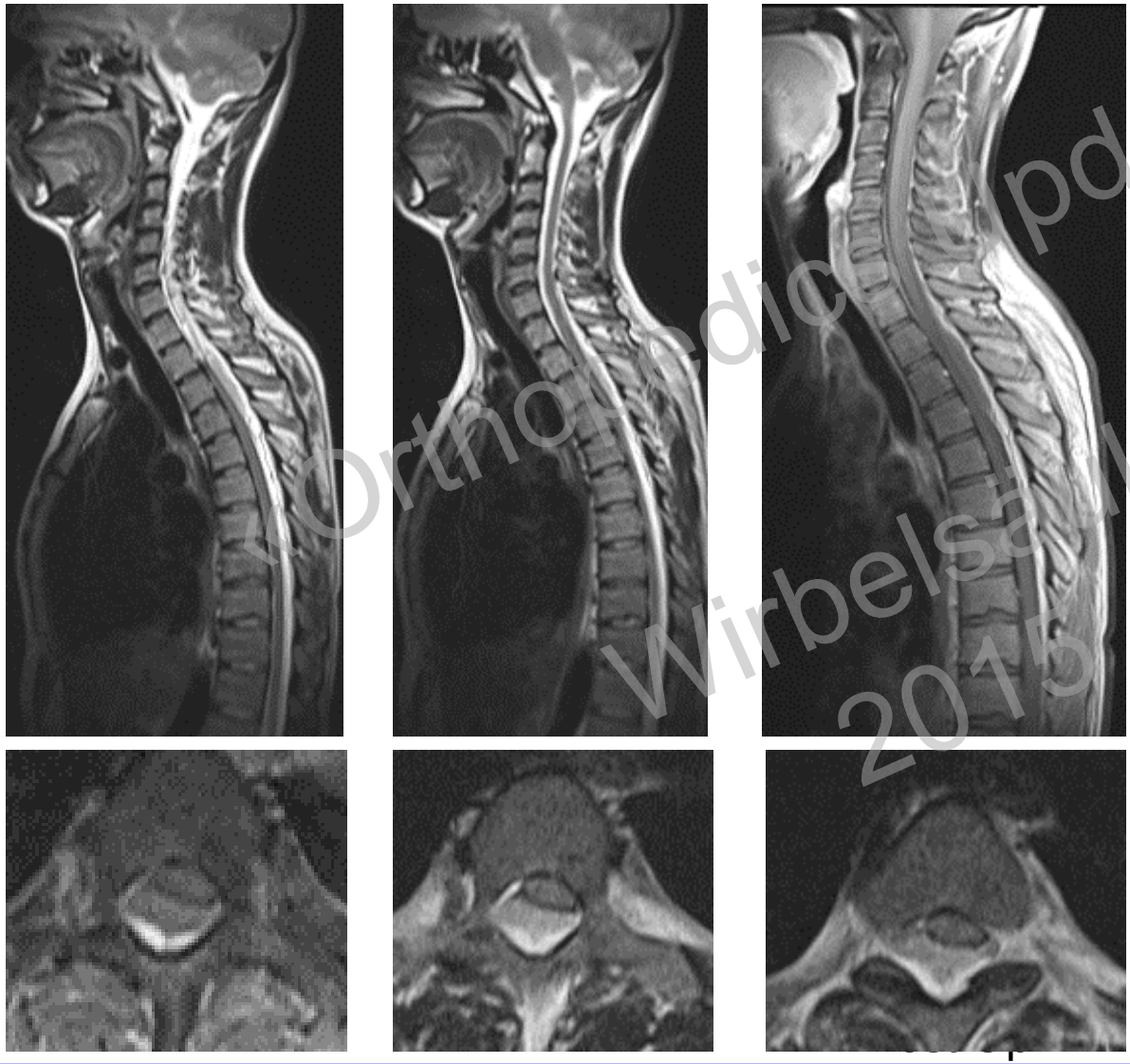
Back pain, left leg pain
Bladder - bowel normal
Unlimited walking
Male 53 years

Spinalis Anterior Syndrome



Patient with complete paralysis due to spinalis anterior syndrome with loss of thermal and pain sensation below T7 but preserved light touch where accordingly dSSEP remained normal but dCHEP were abolished below the level of lesion.

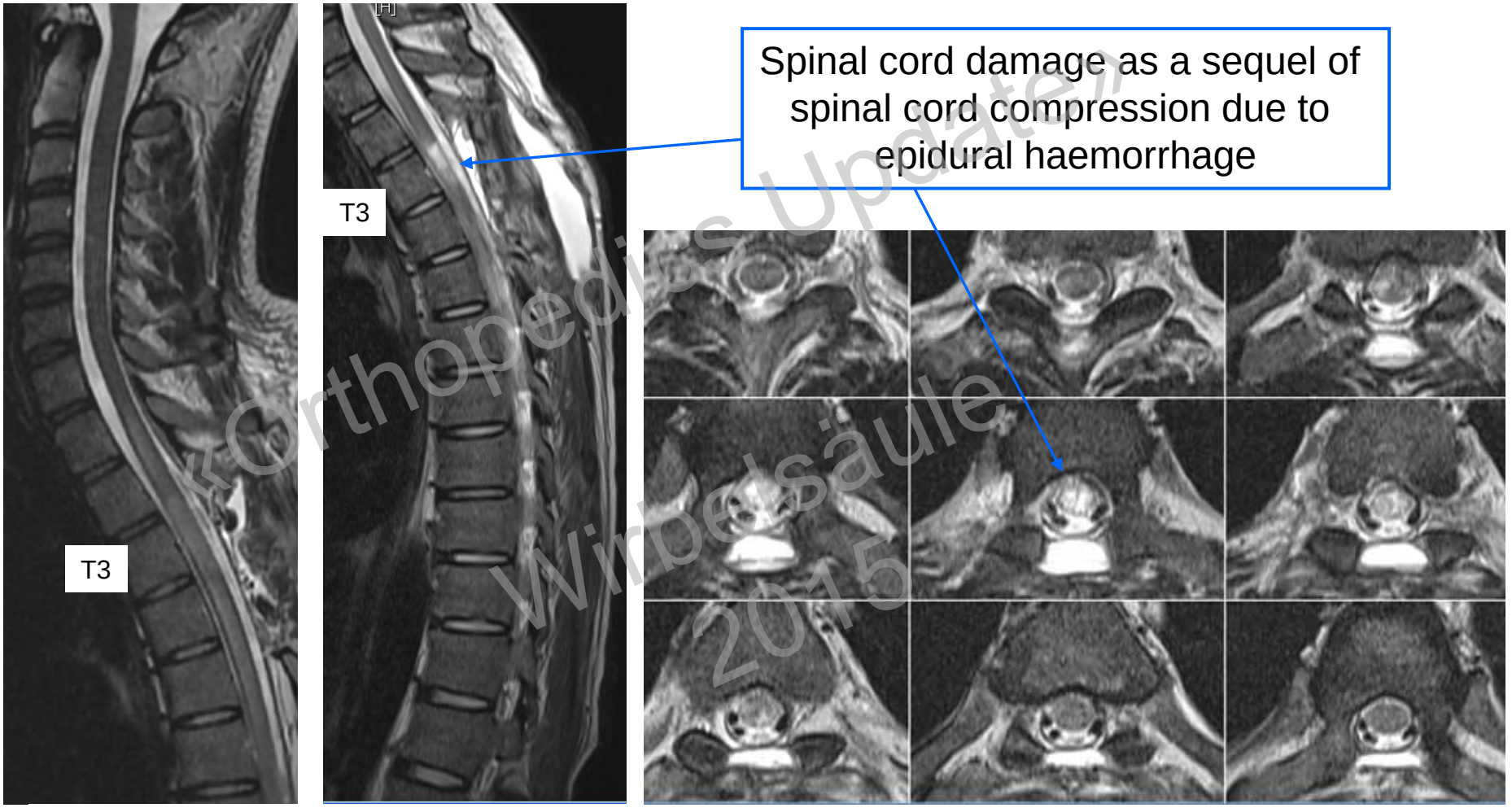
Intraspinal – epidural haemorrhage



Acute,
non traumatic
epidural
haemorrhage

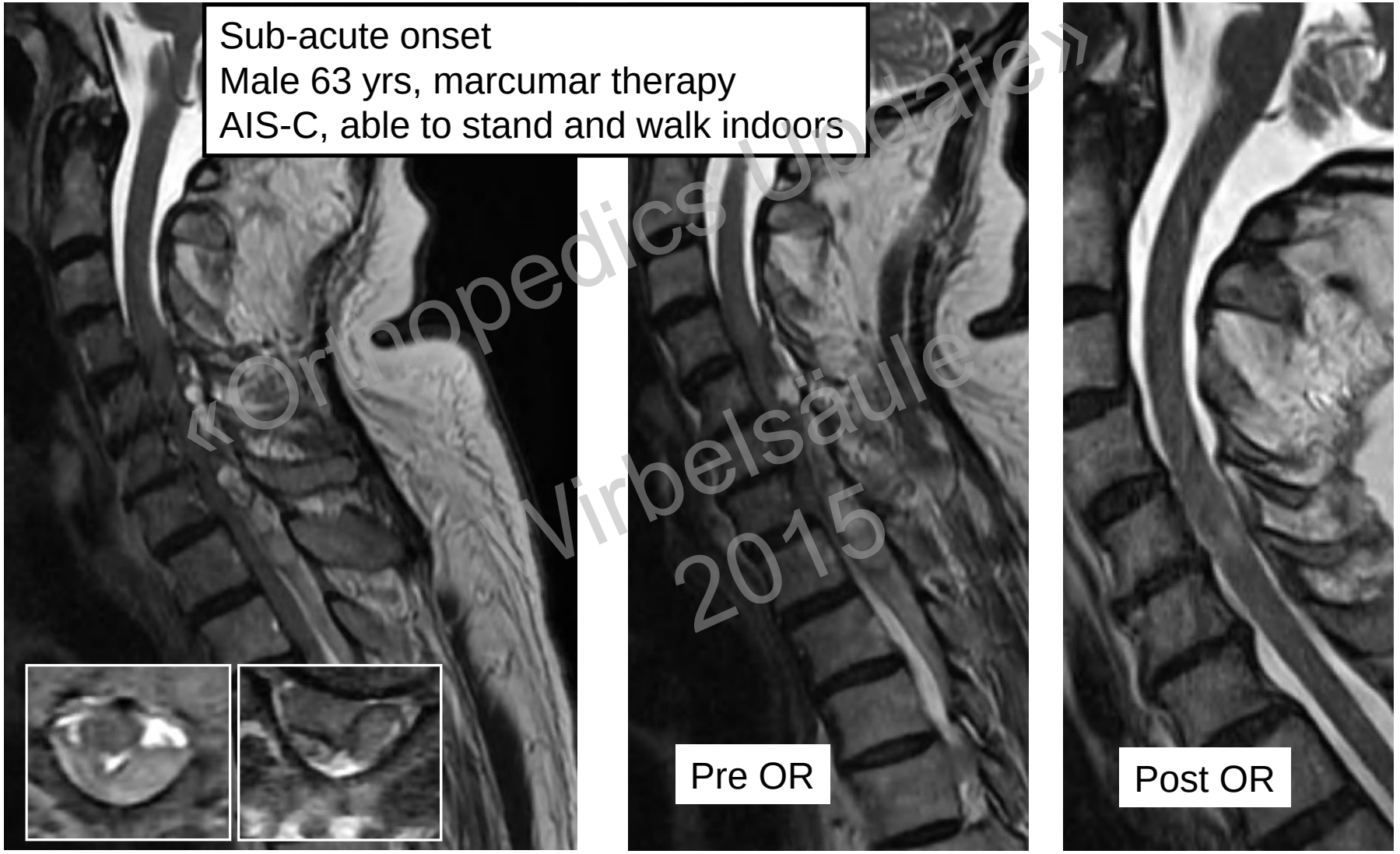
male, 31 years,
physiotherapist,
paraplegia T3 AIS B,
became paralyzed
within 60 min

Intraspinal – epidural haemorrhage



Although patient received decompression surgery within 6 hours after onset of symptoms he suffers from established (chronic) paraplegia (AIS-B)

Intraspinal – epidural haemorrhage

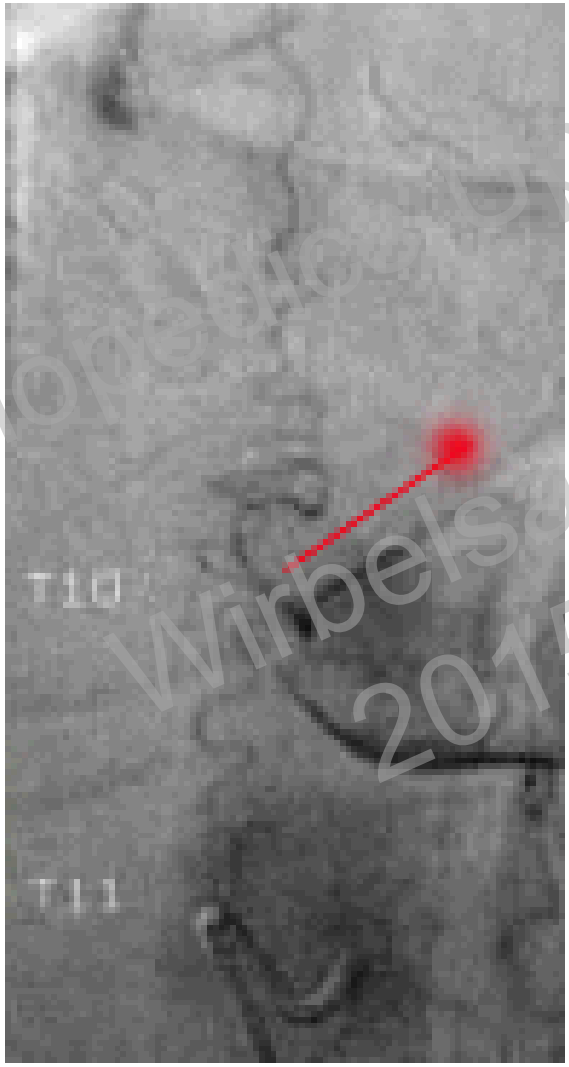


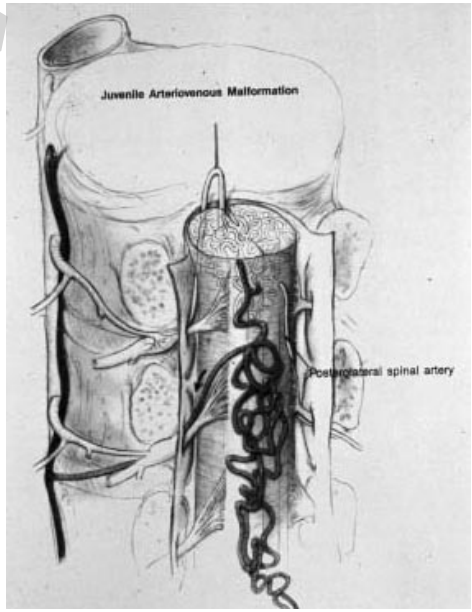
Red flags

Bladder signs:

- frequency
- voiding
- incontinence

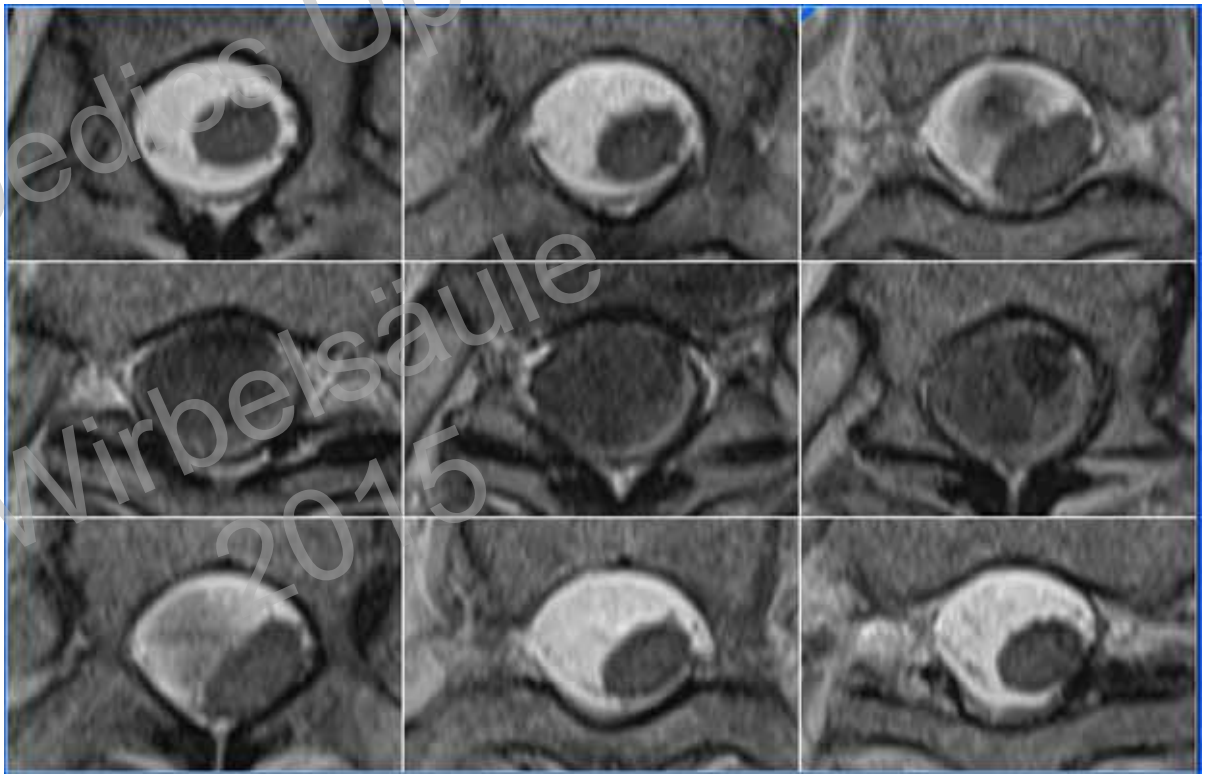
Arterio-venous malformation of spinal cord





Lower limb fatigue and bladder urgency!

Meningeoma at thoracic cord level



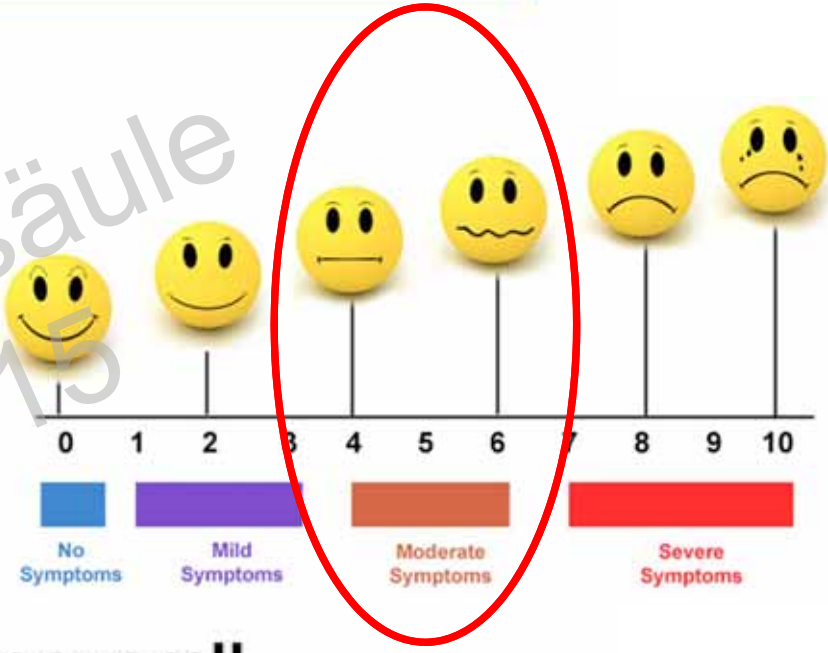
Lower limb pain and bladder urgency!

Spinal metastases

What types of cancer cause it?

Most commonly seen in

- Breast
- Lung
- Prostate
- Lymphoma
- Myeloma



– **3-5% of patients with cancer overall**

constant & increasing

Take home message:
Red flags

Distribution of pain:

- bilateral pain
- clumsy hands/feet
- altered temp sen.
- girdle/belt like

Walking signs:

- unsteadiness
- fatigue
- weakness

(limb or bilateral)

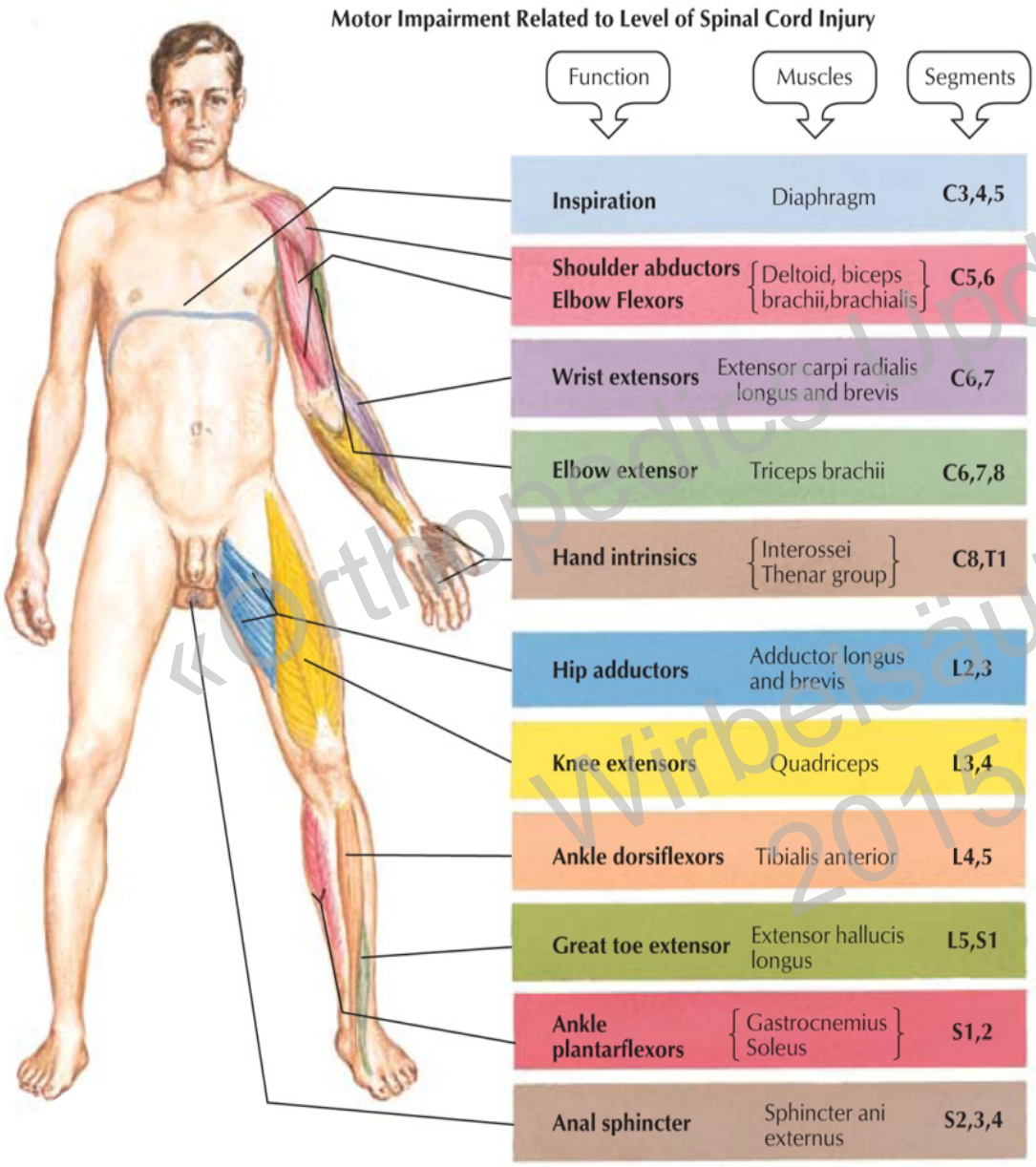
Bladder signs:

- frequency
- voiding
- incontinence

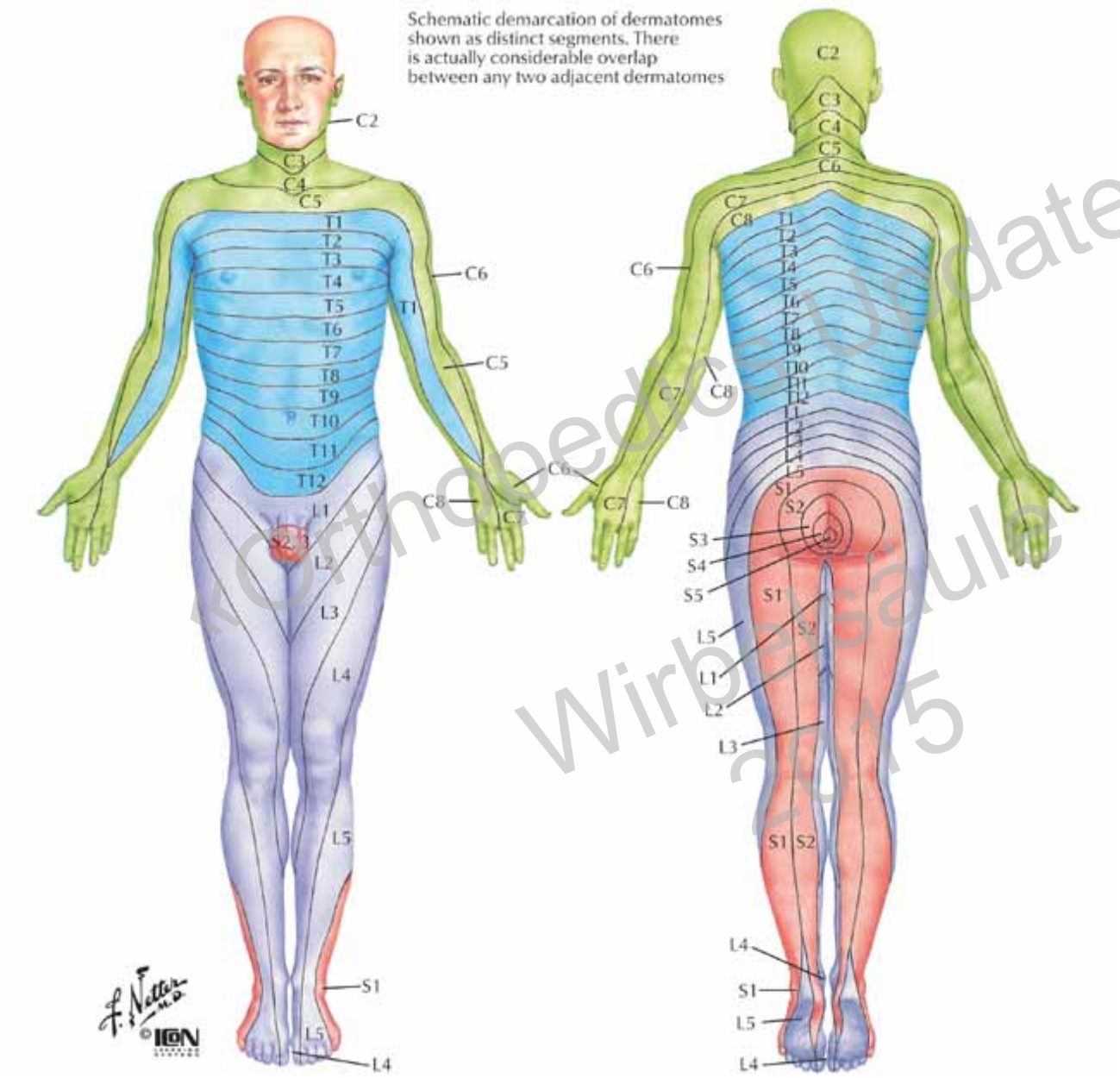
Lecture can be found on:
www.balgrist/Zentrum für Paraplegie

…the spinal cord works not wireless yet, and we have ways to assess it….

Supplement



The examination of motor function is key!!



Cervical segments

C5—Anterolateral shoulder
C6—Thumb
C7—Middle finger
C8—Little finger

Thoracic segments

T1—Medial arm
T3—3rd, 4th interspace
T4—Nipple line, 4th, 5th interspace
T6—Xiphoid process
T10—Navel
T12—Pubis

Lumbar segments

L2—Medial thigh
L3—Medial knee
L4—Medial ankle
Great toe
L5—Dorsum of foot

Sacral segments

S1—Lateral foot
S2—Posteromedial thigh
S3, 4, 5—Perianal area

MUSCLE GRADING

0 total paralysis

1 palpable or visible contraction

2 active movement, full range of motion, gravity eliminated

3 active movement, full range of motion, against gravity

4 active movement, full range of motion, against gravity and provides some resistance

5 active movement, full range of motion, against gravity and provides normal resistance

5* muscle able to exert, in examiner's judgement, sufficient resistance to be considered normal if identifiable inhibiting factors were not present

NT not testable. Patient unable to reliably exert effort or muscle unavailable for testing due to factors such as immobilization, pain on effort or contracture.

ASIA IMPAIRMENT SCALE

☐ **A = Complete**: No motor or sensory function is preserved in the sacral segments S4-S5.

☐ **B = Incomplete:** Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-S5.

☐ **C = Incomplete:** Motor function is preserved below the neurological level, and more than half of key muscles below the neurological level have a muscle grade less than 3.

☐ **D = Incomplete:** Motor function is preserved below the neurological level, and at least half of key muscles below the neurological level have a muscle grade of 3 or more.

☐ **E = Normal:** Motor and sensory function are normal.

CLINICAL SYNDROMES (OPTIONAL)

☐ Central Cord
☐ Brown-Sequard
☐ Anterior Cord
☐ Conus Medullaris
☐ Cauda Equina

STEPS IN CLASSIFICATION

The following order is recommended in determining the classification of individuals with SCI.

1. Determine sensory levels for right and left sides.
2. Determine motor levels for right and left sides.
   Note: In regions where there is no myotome to test, the motor level is presumed to be the same as the sensory level.
3. Determine the single neurological level.
   This is the lowest segment where motor and sensory function is normal on both sides, and is the most cephalad of the sensory and motor levels determined in steps 1 and 2.
4. Determine whether the injury is Complete or Incomplete (sacral sparing).
   If voluntary anal contraction = No *AND all S4-5 sensory scores* = 0 *AND any anal sensation* = No, *then injury is COMPLETE. Otherwise injury is incomplete.*
5. Determine ASIA Impairment Scale (AIS) Grade:

Is injury Complete? — If **YES**, AIS=A Record ZPP (For ZPP record lowest dermatome or myotome on each side with some (non-zero score) preservation)

↓ NO

Is injury motor incomplete? — If **NO**, AIS=B (Yes=voluntary anal contraction OR motor function more than three levels below the motor level on a given side.)

↓ YES

Are at least half of the key muscles below the (single) neurological level graded 3 or better?

NO ↓ AIS=C YES ↓ AIS=D

If sensation and motor function is normal in all segments, AIS=E
Note: AIS E is used in follow up testing when an individual with a documented SCI has recovered normal function. If at initial testing no deficits are found, the individual is neurologically intact; the ASIA Impairment Scale does not apply.

Thank you for your attention!