



Pain

Neurologická klinika a Centrum klinických neurověd
1. lékařská fakulta
Univerzita Karlova

a

Všeobecná fakultní nemocnice v Praze

Definition WHO

An unpleasant sensory and emotional experience associated with actual or potential tissue damage.

The same stimulus can lead to different perceptions of pain in different people and in the same individual.

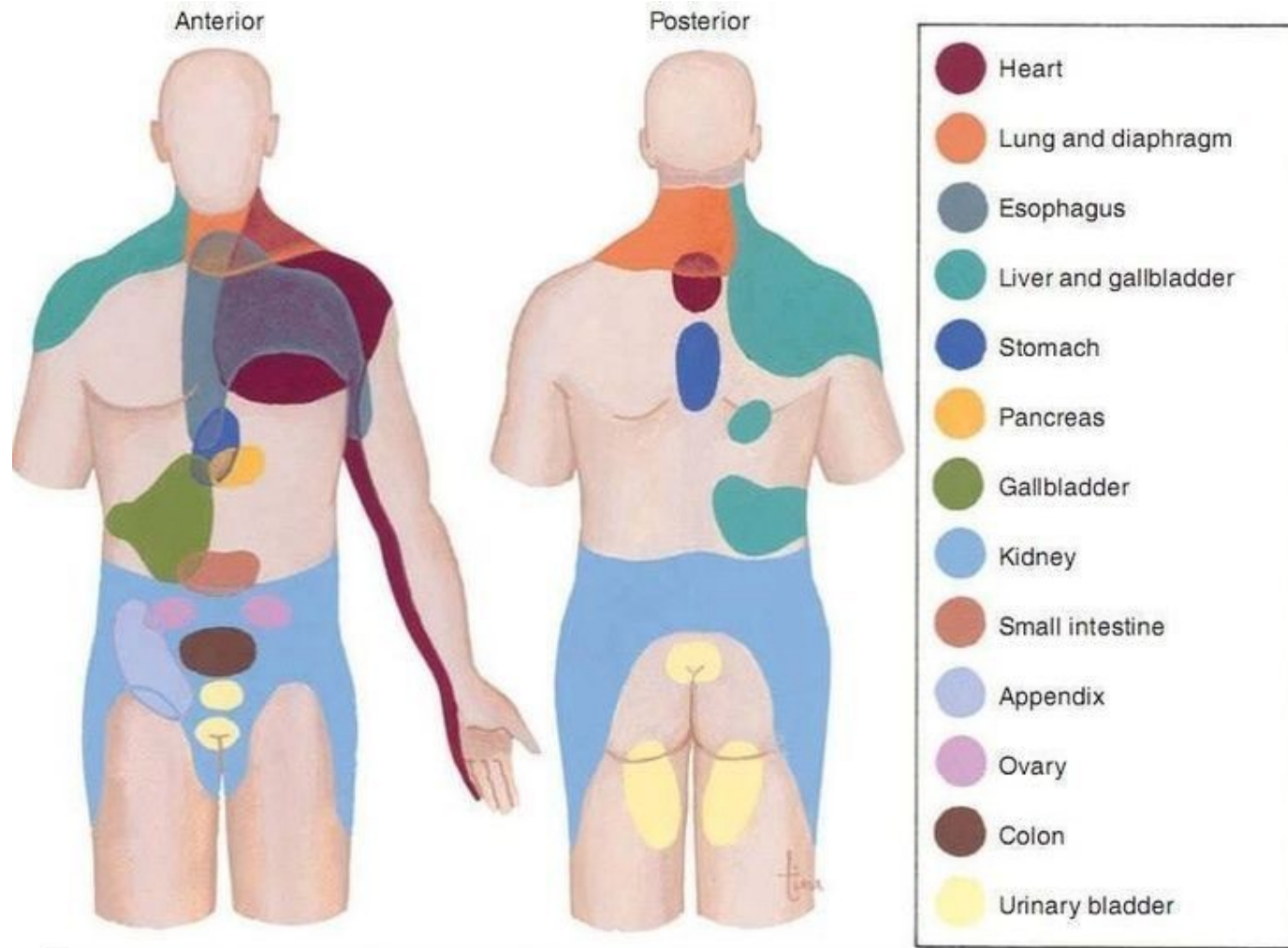


Classification of pain

- somatic nociceptive pain
- visceral nociceptive pain
- central neuropathic pain
- peripheral neuropathic pain
- dysautonomic pain
- psychological pain
- functional pain syndrome
- mixed pain
- pain of undetermined origin



Head zones (Sir Henry Head)



Referred pain. The sites for referred pain from various organs are shown.



Pain history taking

- The first onset of pain
- Character, nature of pain or different types of pain
- Localisation / distribution
- Intensity
- Duration
- Factors provoking or alleviating pain
- Somatic symptoms
- Cognitive and behavioral changes
- Current therapy and its effect



	Acute pain	Chronic pain
Character	Symptom	Syndrome
Meaning	Protective	Destructive
Mechanism	Simple	Complex
Autonomic r.	Sympathetic r. +++	Sympathetic +
Psychological r.	Anxiety	Depression
Behavior	Defensive, reactive	Learned, painful
Therapy	Analgetics	Analgetics, coanalgetis
Analgetic effect	Significant	Often small
Treatment strategy	„step down“	„step up“
Duration	<3 months	>3 months



Non-Opioid Analgesics

Drug Name	Adult Dose	Pediatric Dose	Toxic Dose	Maximum Dose
Acetaminophen (Paracetamol)	325-650mg PO q 4-6 hours or 1000mg q 6-8 hours	>1 month: 10-15mg/kg PO q 4-6 hours >12 years: 325-650mg PO q 4-6 hours	-Loss of appetite - Nausea, vomiting, stomach pain -Sweating -Confusion -Weakness	1gm/dose or 4gm/day for adults
Aspirin (ASA)	650-975mg PO q 4h	10-15 mg/kg PO	- Reye's syndrome in children who then get flu or chickenpox. - Tinnitus - Toxic dose 150mg/kg	60mg/kg/day
Ibuprofen (Motrin)	600mg PO q6-8h	10 mg/kg PO q 6-8h	-GI irritation -Platelet dysfunction -Renal dysfunction -Bronchospasm	40mg/kg/day
Tramadol (Ultram)	50-100mg PO	Not approved	- May precipitate serotonin syndrome in SSRI patients	
Ketorolac (Toradol)	60mg IM/dose 30mg IV/dose	0.5 mg/kg IV q 6 h Max 120 mg/day	-Same as for Ibuprofen -Plus decrease dose by one-half in elderly	



A Guide To Opioid Equivalency For Common Opioids

OPIOID PRODUCTS	ORAL ROUTE	IV/SC/IM ROUTES
Morphine	30 mg	10 mg
Codeine	130 mg	75 mg
Hydromorphone	7.5 mg	1.5 mg
Methadone	5 – 15 mg	2.5 – 10 mg
Meperidine	300 mg	75 mg
Levorphanol	4 mg	2 mg
Oxymorphone	10 mg	1 mg
Pentazocine	50 mg	30 mg
Hydrocodone	20 mg	N/A
Oxycodone	20 mg	N/A
Buprenorphine	N/A	0.3 – 0.4 mg
Butorphanol	N/A	2 mg
Fentanyl	N/A	0.1 mg
Nalbuphine	N/A	10 mg
* <u>mme</u> = based on morphine milligram equivalency	mg = milligrams	N/A = not applicable

Coanalgetics

Antidepressants

Amitriptyline

Initial d. (mg)

12,5

Therapeutic d. (mg)

50-150

Dosulepine

12.5-25.0

25-125

Venlafaxine

35-75

75-300

Duloxetine

30-60

60-120

Anticonvulsants

Gabapentine

100-300

900-3600

Pregabalin

50-75

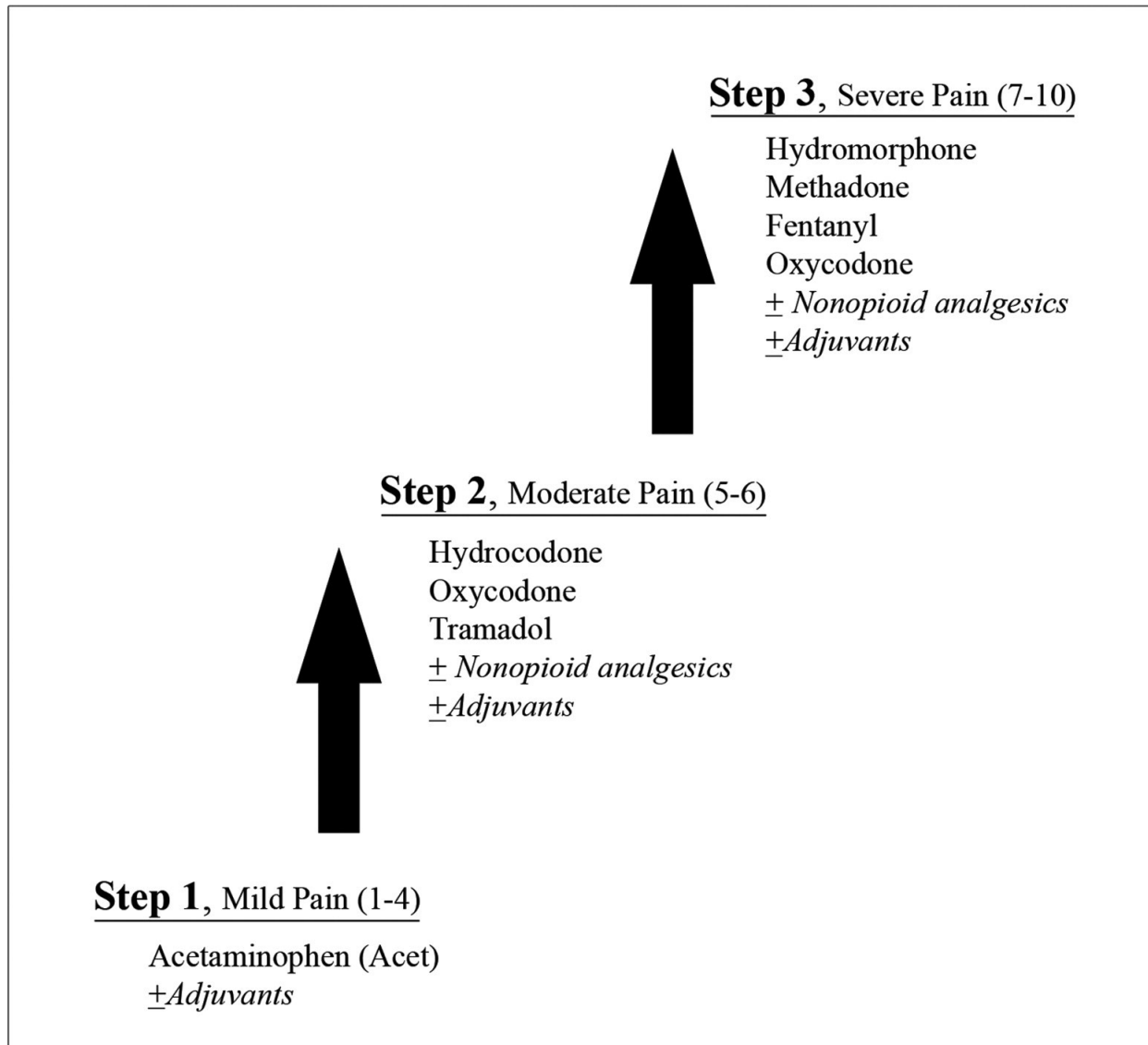
150-600

Carbamazepine

100-200

600-1600





We follow not only the patient's stated intensity of pain, but also the quality of his life! Watch out for age!

Strategy for a dissatisfied patient?

- Diary - momentum, pain, circumstances, leisure activities
- Positive motivation, realistic goals.
- Test the effect of analgesics and co-analgesics
- Therapeutic experiment with an antidepressant
- What is the pain that is resistant to treatment?
- Multidisciplinary approach





Headache

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Primary headache

- Tension headache (80 %)
- Migraine (20 %)
- Cluster headache
- Trigeminal neuralgia (0,1 %)



Secondary headache

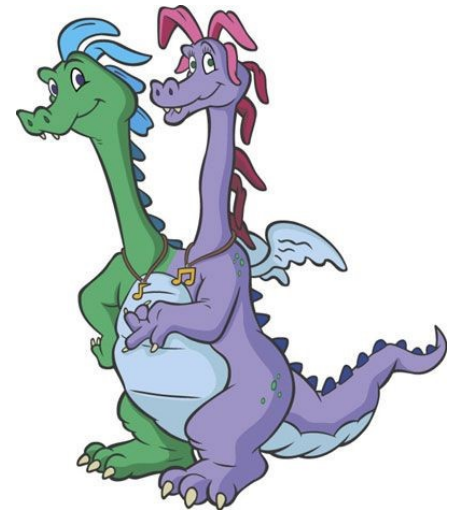
- neuroinfection
- vascular disease(1 %) – venous sinus thrombosis
- subarachnoid hemorrhage, dissection of large vessels
- intracranial expansion (0,1 %), systemic hypertension
- infection (63 %) – systemic infection, sinusitis, meningitis
- cervicocranial syndrome (27 %)
- head injuries (4 %), acute angle closure crisis in glaucoma



Do not overlook the serious cause

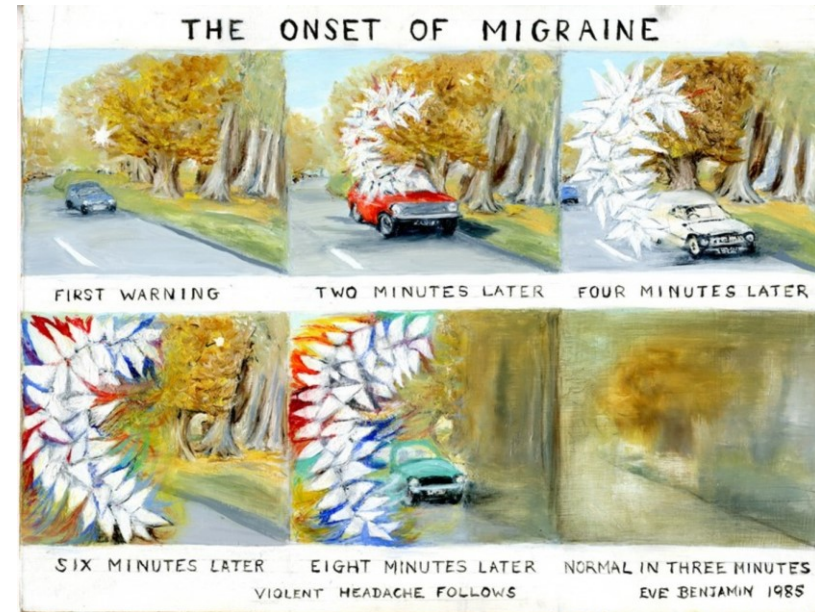
Have you ever had
a CT?

- **Every patient with a headache should have an imaging examination at least once in their lifetime**
- **Practical question for the patient: is it your usual headache or is it different? - if different, CT of the brain**



Migraine attack stages

- **Prodrome** – in 60% (mood, food etc)
- **Aura = focal symptom**
 - Less than 60 minutes
 - Visual, sensitive, motor, phatic
- **Headache** (next slide)
- **Postdrome**



Migraine without aura– 80%

- Duration of 4–72 h
- Two of more of the following headache characteristics:
 - **unilateral location**
 - **pulsating quality**
 - moderate to severe intensity
 - aggravation by physical activity
- One or more associated symptoms occurring during the attack:
 - **nausea/vomiting**
 - **Photophobia/phonophobia**
- Attacks must not be attributable to another disorder



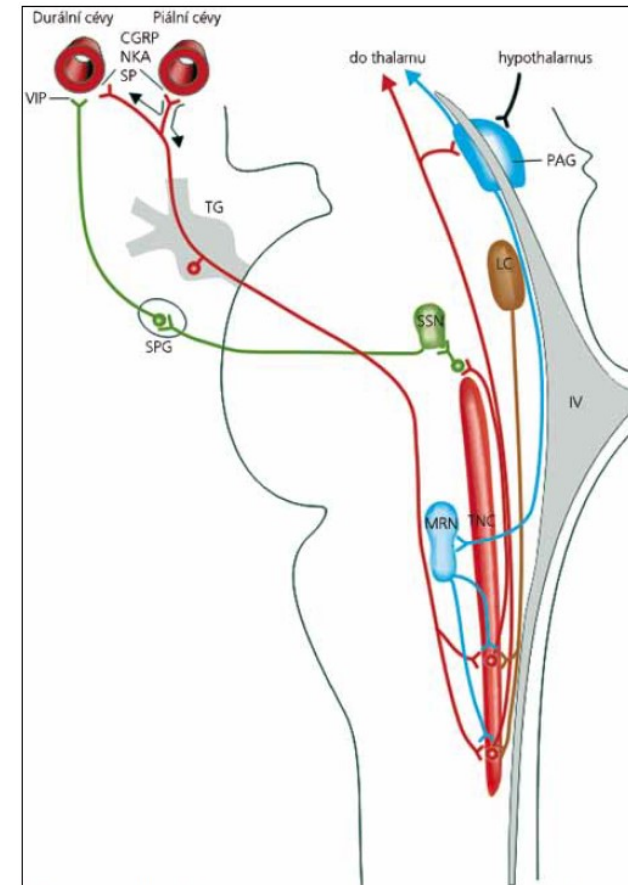
Other variants of migraine

- **Migraine with aura**
- Familial hemiplegic migraine (rare, AD inher)
- Migraine with brainstem aura (basilar migraine)
- Retinal migraine
- **Chronic migraine (headache >15 days/30)**
- Menstrual migraine and other hormonal migraines
- **Status migraenosus** - more than 72 hours (with/without treatment)



Pathophysiology of migraine

- Depolarisation of nociceptive fibers of the **trigeminovascular complex**
- vasoactive neurotransmitters - **calcitonin gene-related peptid (CGRP)**, substance P, neurokinin A
- **Vasodilatation of meningeal vessels**
- sterile perivascular neurogenic inflammation
- Inflammatory mediators – **serotonine (5-HT₂ rec)**, **histamine**, **prostaglandins**, leukotrienes from activated and granulated dural mast cells



Acute treatment

- **nonspecific** (analgetics) - **NSA**
- **specific**

triptans – agonists of 5-HT_{1B} a 5-HT_{1D} rec.

- **Sumatriptan 50 – 100 mg tbl** (**Rosemig nasal spray 20 mg**,
Imigran s.c. inj. 6 mg)
- **Eletriptan (Relpax) 40 – 80 mg**
- **Naratriptan (Naramig) 2,5 mg**
- **Zolmitriptan (Zomig) 2,5 – 5 mg**
- **Frovatriptan (Fromen) 2,5 mg**



Prophylactic treatment

- **Chronic**

- Betablocators
- Amitriptyline
- Topiramate
- Valproate
- Cinarizine
- Venlafaxine

Indication

- ≥ 4 severe seizures per month
- **Attacs lasting > 48 hours**
- Failure/impossibility of acute treatment

- **Monoclonal antibodies against CGRP**

- **Intermittent**- Naproxen 5 days 2x1 for menstrual migraine
- **Episodic** - before an activity causing a migraine attack
- **Diaries and psychohygiene!!!**



Tension headaches

- Two of the following characteristics must be present:
 - Pressing or tightening (nonpulsatile quality)
 - Bilateral, frontal-occipital location
 - Mild/moderate intensity
 - Not aggravated by physical activity
- The pain is not accompanied by nausea or vomiting
- Mild photophobia or phonophobia may occur
- Other causes of headache are excluded



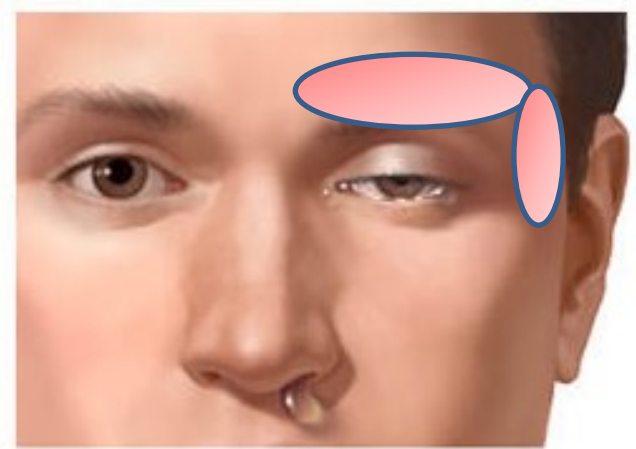
Medication overuse headaches

- Prevalence 2% -
- chronic migraine on triptans and tension pain on analgesics
- 15 or more days a month drug
- Overuse of acute medication for at least 3 months
- Risk drugs - analgetics, opioids, triptans, ergotamine
- Other risk factors – behavioral and personality disorders, stress, abuse



Cluster headache

- Intensive, unilateral orbital, supraorbital and/or temporal pain lasting 15 - 180 minutes – cruel, graduating pain
- Vegetative symptoms
 - Conjunctival congestion
 - Lacrimation
 - Rinorea
 - Sweating forehead or face
 - Miosis
 - Ptosis
 - Eyelid edema
 - Congestion of the nasal mucosa
- Attack frequency: 1 to 8 times a day in a cluster of weeks 1-2 times a year

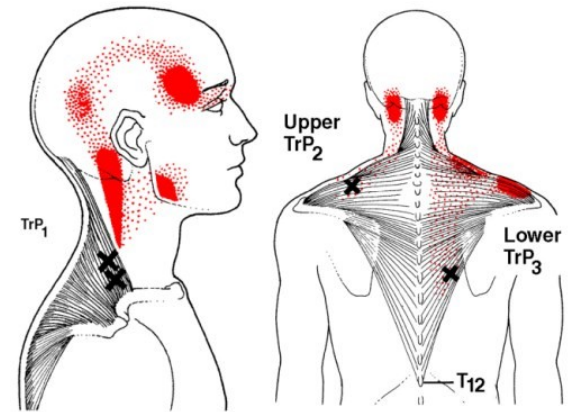


Watery eye, drooping eyelid, runny nose



Cervicocranial syndrome

Pain localized in the neck and occipital with possible radiation to frontal, orbital, parietal area, to the vertex and into the ears.



- The pain is often preceded by movements in the cervical spine or a certain position or accentuated by the pain
- At least one of the following criteria applies :
 - limited passive range of motion of the cervical spine
 - changes in the tone, shape and overall consistency of the PV muscles
 - abnormal sensitivity of the neck muscles

→ Examine cervical spine in all headaches types – cervicocranial sy may contribute to tension headache

Warning signs of headache I.

- **focal neurological symptoms** (stroke, tumor, metastase...)
- **quantitative or qualitative change of consciousness** (vascular, tumor, meta – intracranial hypertension)
- **cognitive deficit** (infection, meta, intracranial hypertension)
- first headache over the age of 40
- **sudden, intense pain** (SAH)
- sudden pain during **physical activity** or change of position (SAH)
- gradually developing **atypical pain unresponsive to conventional treatment**
- **increasing frequency and intensity of pain**

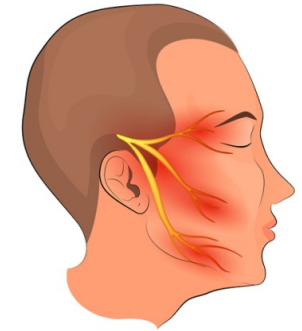


Warning signs of headache II.

- change in the nature of the headache
- a new type of headache
- still in the same location
- occurrence after injury
- the presence of cancer or infection
- aggravated by an increase in intracranial pressure
- headache associated with seizures
(epileptic seizures)



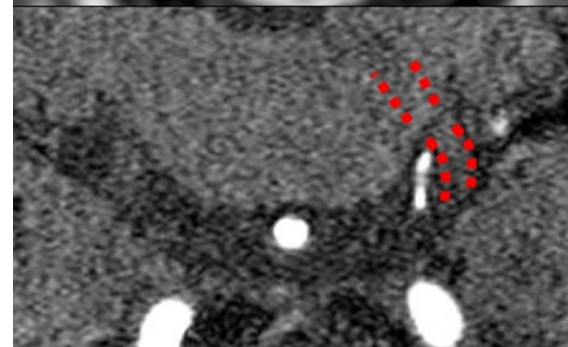
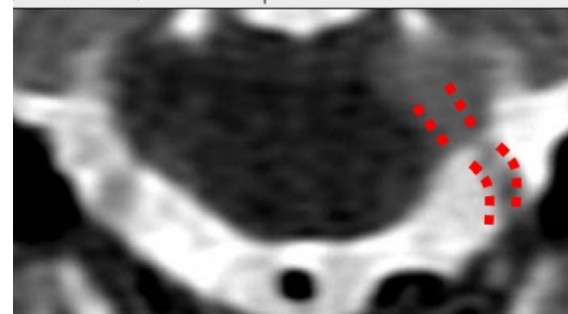
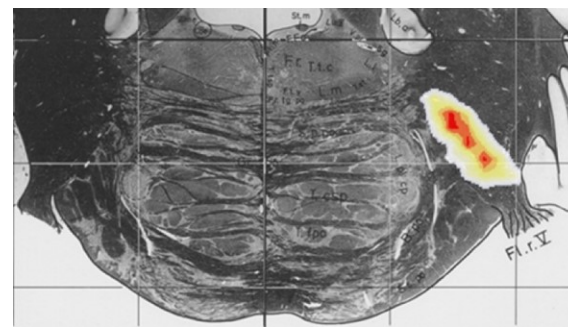
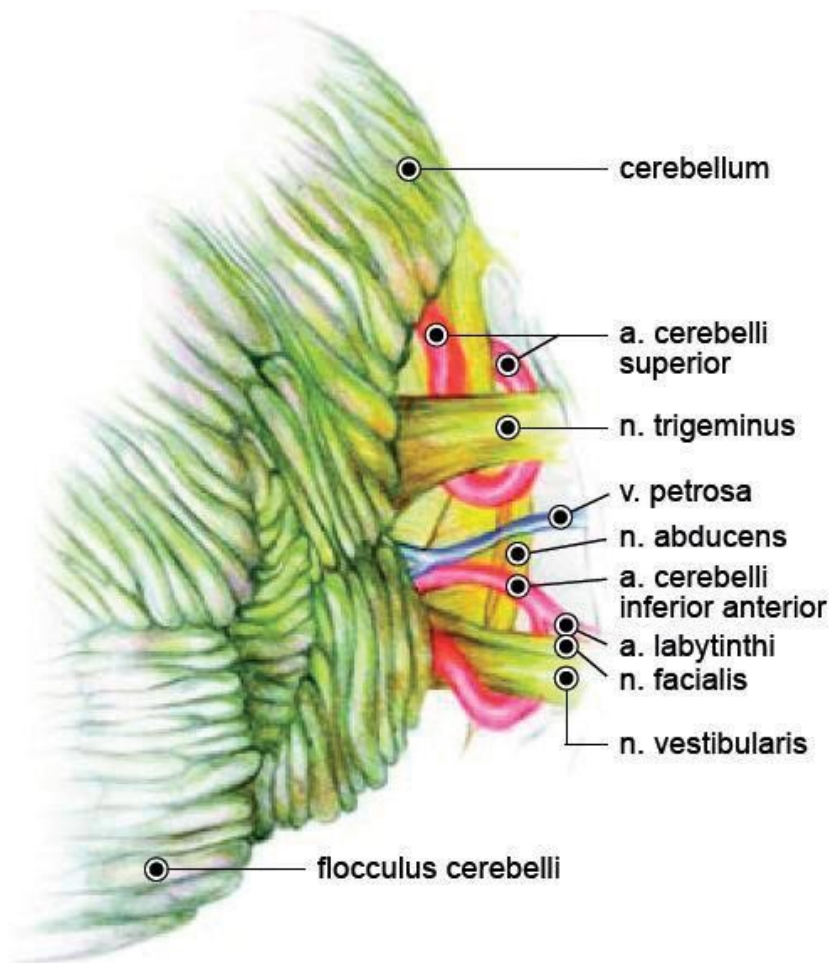
Primary neuralgia of the trigeminal nerve



- Paroxysmal attacks of facial pain lasting a few seconds and less than two minutes
- Vegetative symptoms are common
- Pain has at least four of the following characteristics :
 - localization most often in the 1st or 2nd branch n .V
 - sudden, intense, sharp, superficial, stabbing, burning pain
 - high intensity pain
 - pain can be **caused by trigger or trigger zones** - some activities like brushing teeth, chewing
 - between paroxysms, the patient is asymptomatic 😊
- Normal neurological findings
- Attacks in individual patients are **repeated stereotypically**
- Other causes of facial pain are excluded

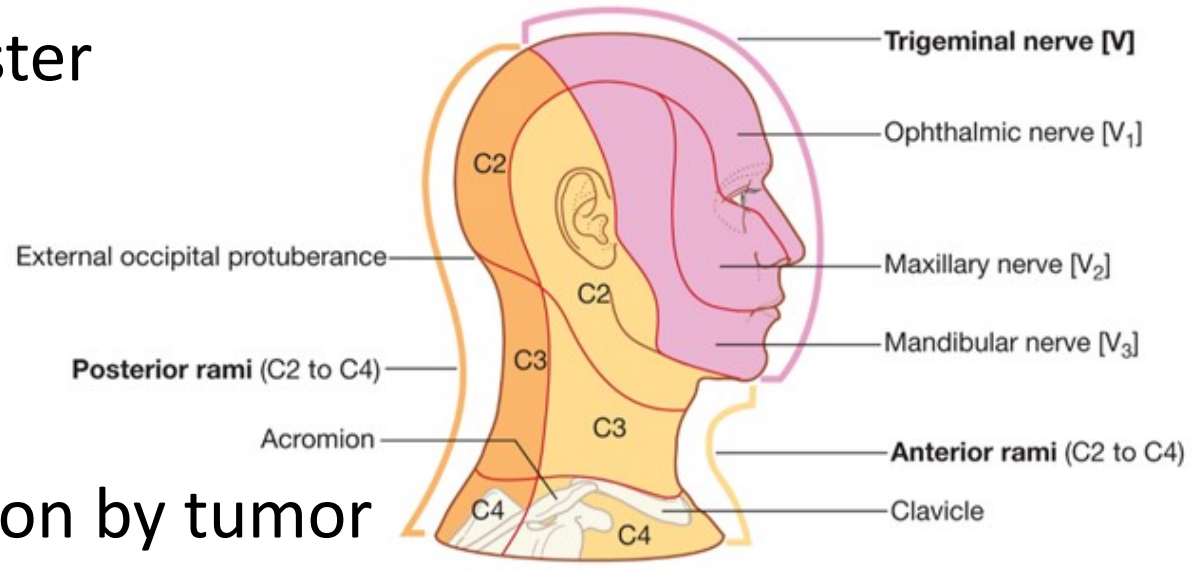
Neurovascular conflict

anomaly of basilar artery or cerebellar arteries



Painful trigeminal neuropathies

- Acute herpes zoster
- Postherpetic
- Posttraumatic
- Nerve compression by tumor
- Demyelination in multiple sclerosis
- Other diseases - dental, etc.





Vertebrogenic pain syndromes

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Vertebrogenic pain syndromes

Back pain, spinal cord and root impairment resulting from degenerative changes of the spine

- Most common disease (together with common cold 😊)
- 60-90 % of people experiences back pain in lifetime
- Even children! experience back pain (75 %)

Forces on the neck increase the more we tilt our heads, causing spine curvature

0 degrees
10-12 lbs

15 degrees
27 lbs

30 degrees
40 lbs

45 degrees
49 lbs

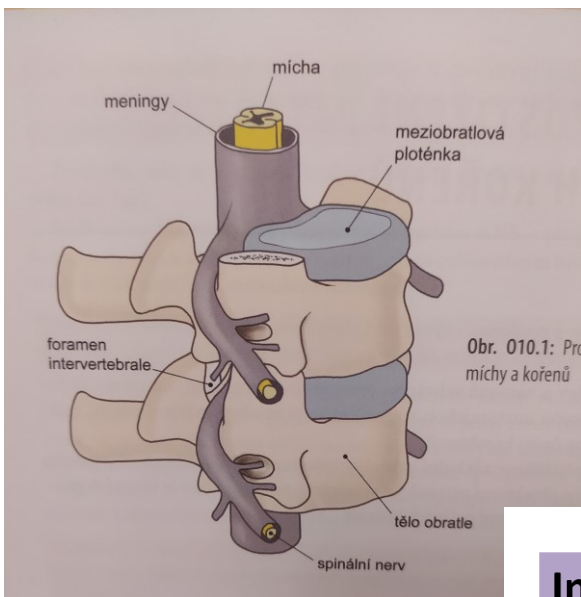
60 degrees
60 lbs



Origin of pain:

- myofascial structures
- bone-joint structures**
- compression of nerve structures

Tight space



**Intervertebrální
skloubení**

**Vertebrokostální
skloubení**

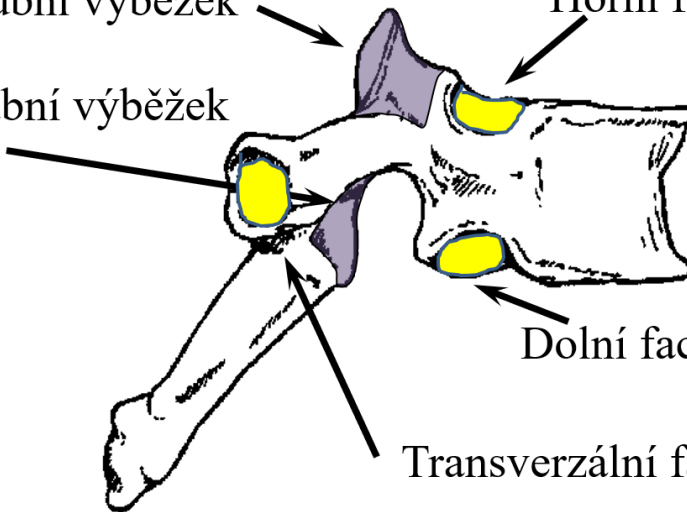
Horní kloubní výběžek

Horní faceta

Dolní kloubní výběžek

Dolní faceta

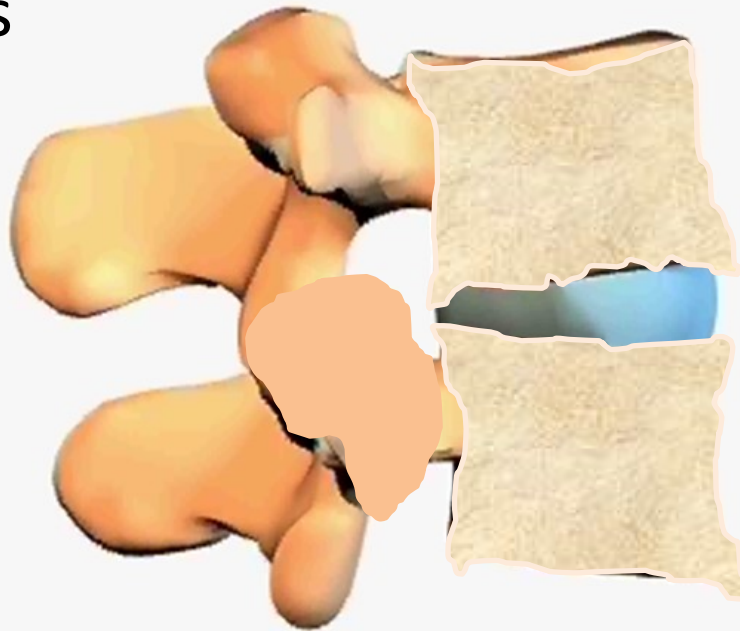
Transverzální faceta



Terminology

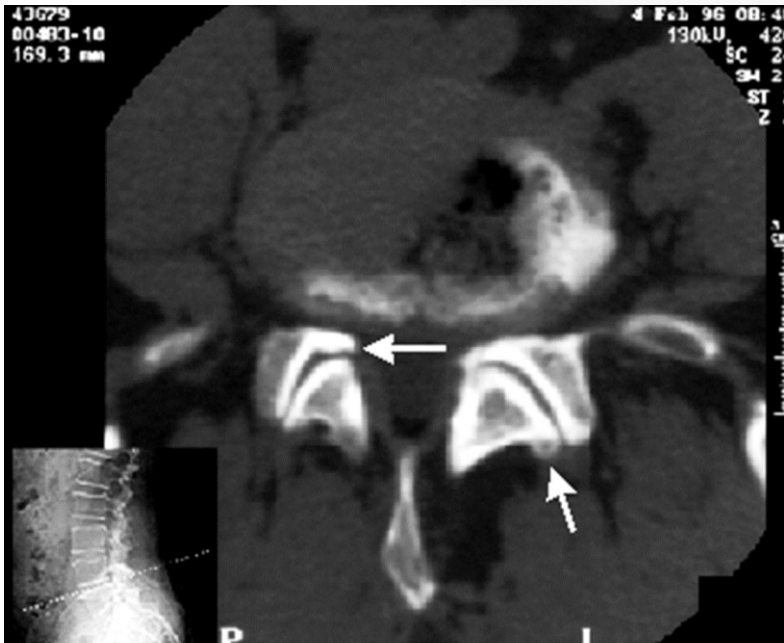
Spondylarthrosis

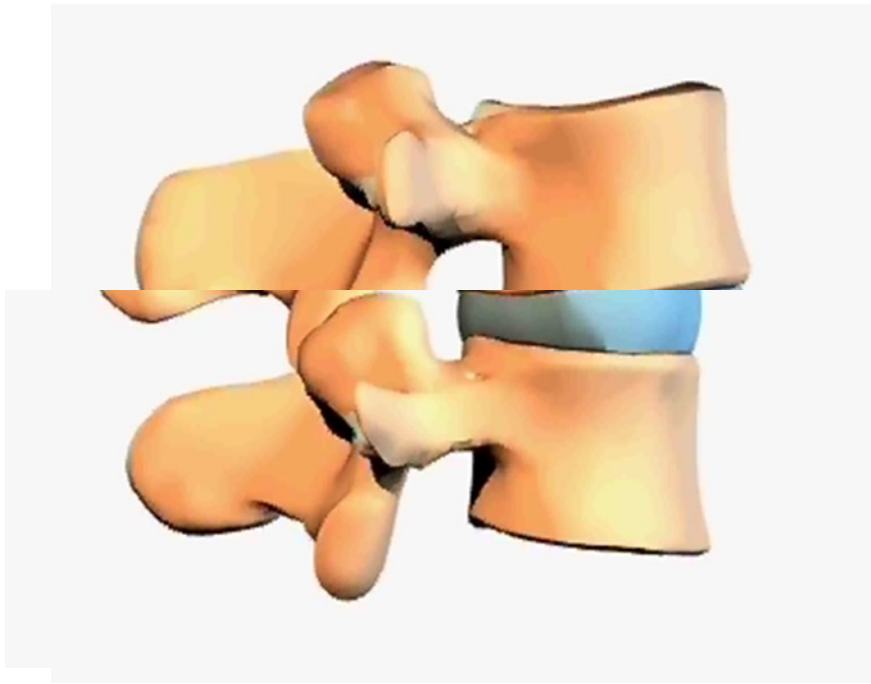
Joint disease of the vertebral column including osteophyte formation, intervertebral joint degeneration and narrowing



Spondylosis

Degeneration of the vertebral body including formation of osteophytes, degeneration of the vertebral bone marrow and its sclerotization)



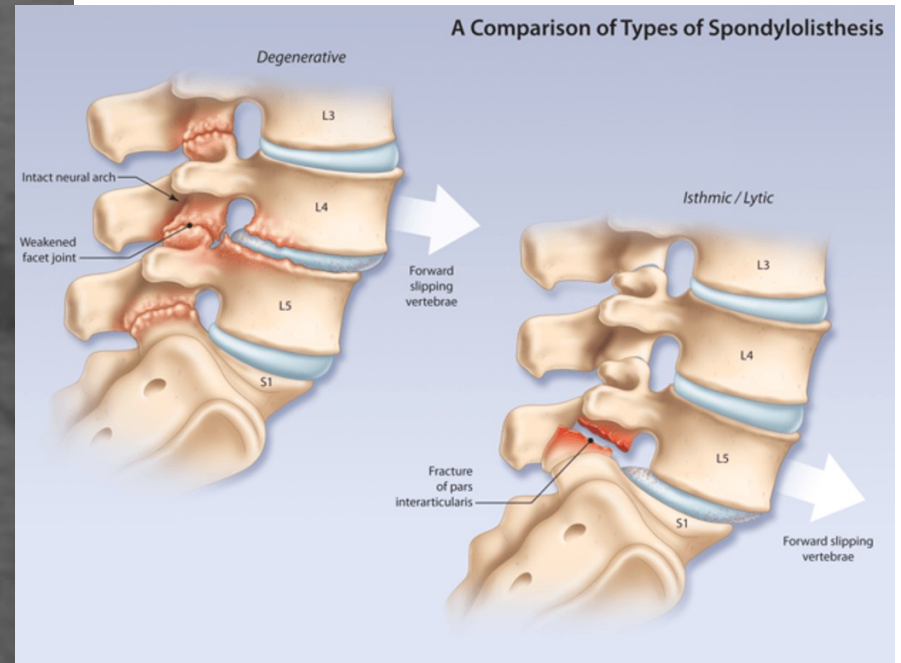


Spondylolisthesis is the displacement of one spinal vertebra compared to another

Congenital

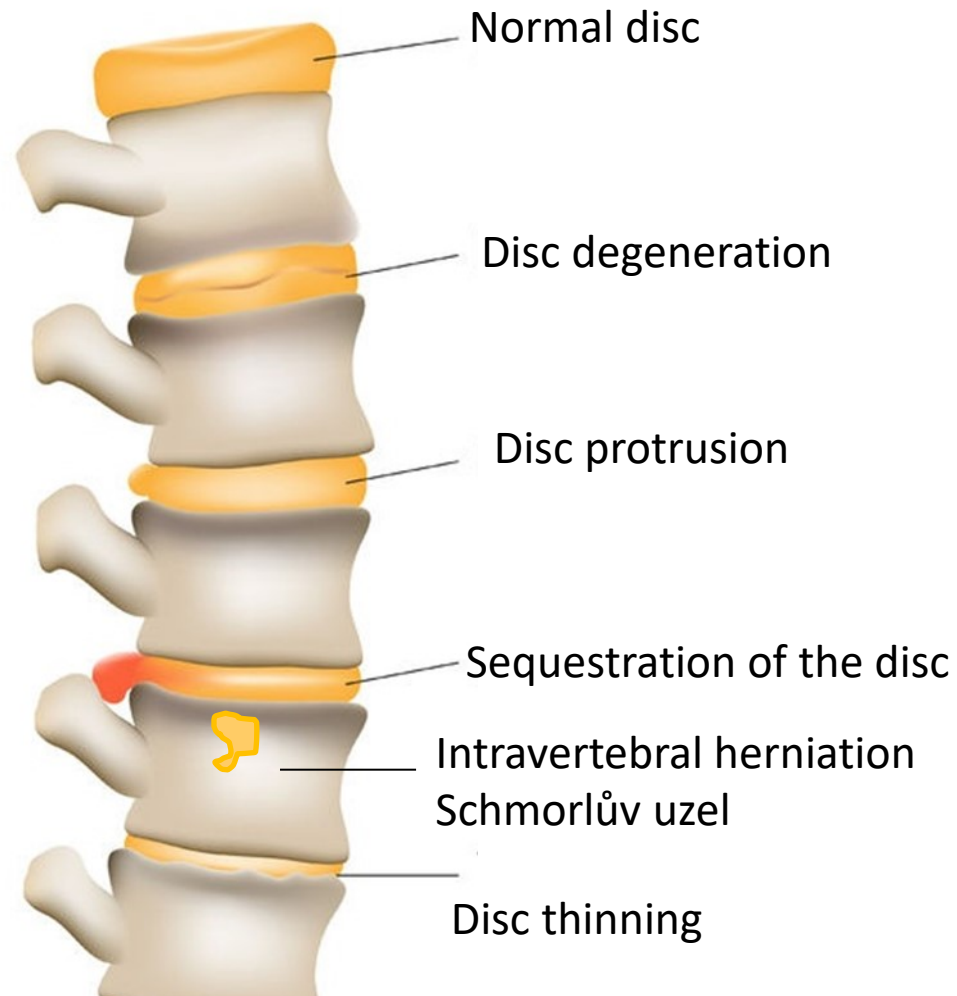
Degenerative

Trauma



Spondylolysis is a stress fracture through the pars interarticularis (isthmus) of the lumbar vertebrae.

Chondrosis

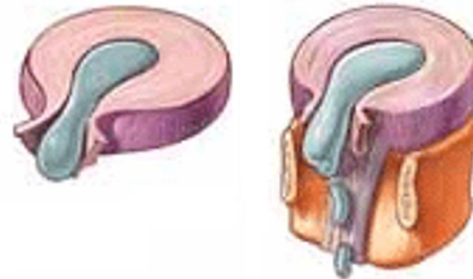
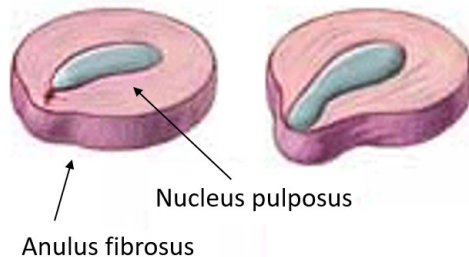


Počínající degenerace

Prolaps disku

Extruze disku

Sekvestr



Terminologie - shrnutí

- **Spondylosis:** vertebral body
- **Spondylartróza:** intervertebral joints
- **Spondylolysis:** Isthmus fracture
- **Spondylolisthesis:** (slipping)displacement of vertebral body .
- **Chondrosis:** disc changes

- **Spinal stenosis:** narrowing of spinal canal (congenital or degenerative)

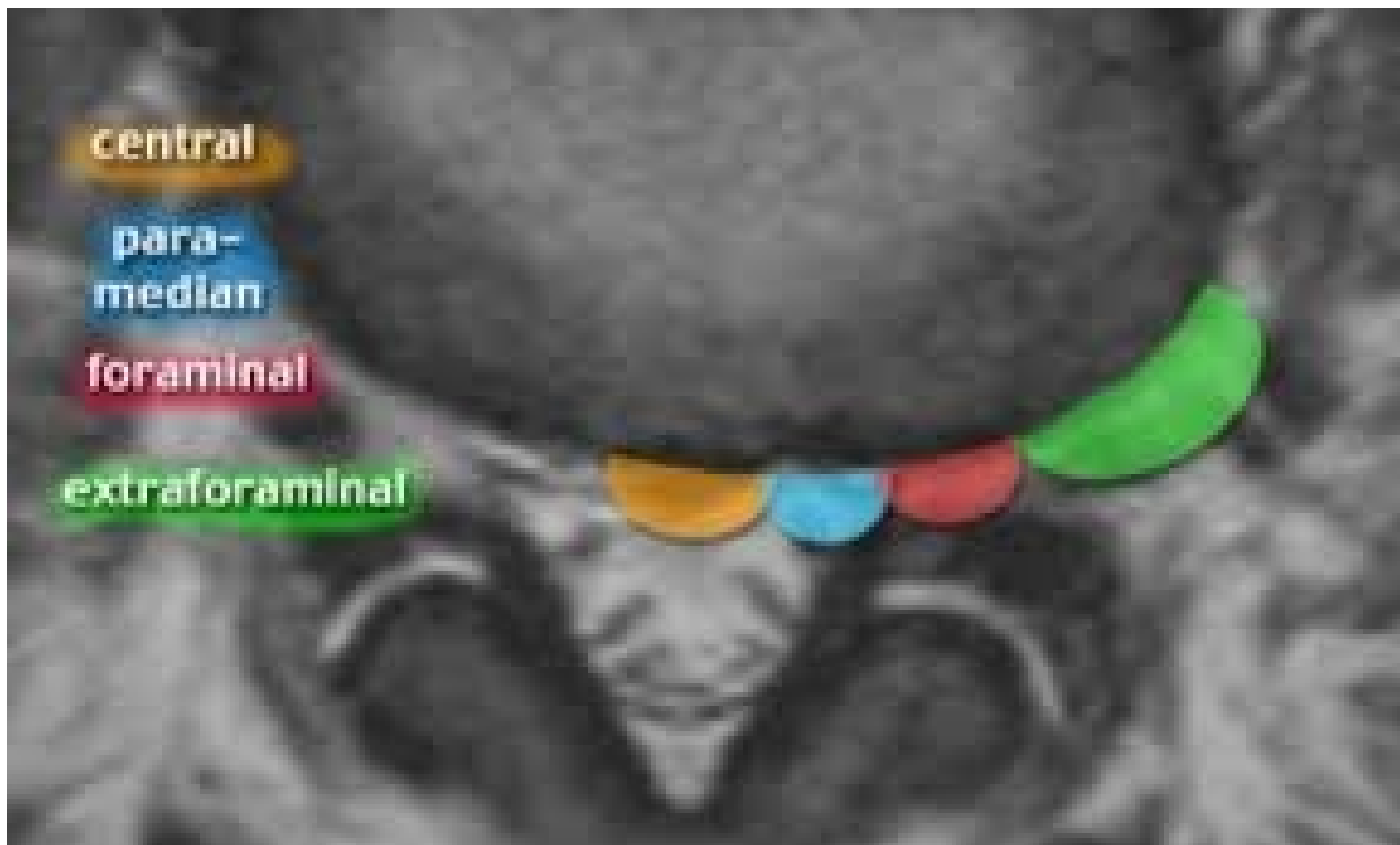


central

para-
median

foraminal

extraforaminal



Terminology of clinical syndromes

Clinical syndromes to differentiate

- **Segmental syndrome** – localized pain, no radiation
 - Cervikalgia, thorakalgia, lumbalgia
- **Radicular syndrome** – spinal root impairment
 - Dif dg.: Pseudoradicular syndrome – pain projecting into radicular distribution not resulting from root impairment
pozn. - autodermography + intensity!
- **Compressive myelopathy** – spinal cord compression
- **Cauda syndrome**
- **Neurogenic claudication**
- Differential dg: radikulitis, discitis, red flags CAVE



Segmental syndrome = functional impairment

- Simple pain, no radiation
 - **Cervicalgia, thoracalgia, lumbago**
 - Acute or chronic
 - Diffuse, dull pain, position related, worse with static loading of muscles
 - **NORMAL neuro exam!!**
 - **NO red flags!!**
- **Resulting from overload and poor posture/sprain**
- No structural reason
- Resolves in days/weeks and often comes back
- **EDUCATE and send to PHYSICAL THERAPY**
- **NO need to send to a neurologist**



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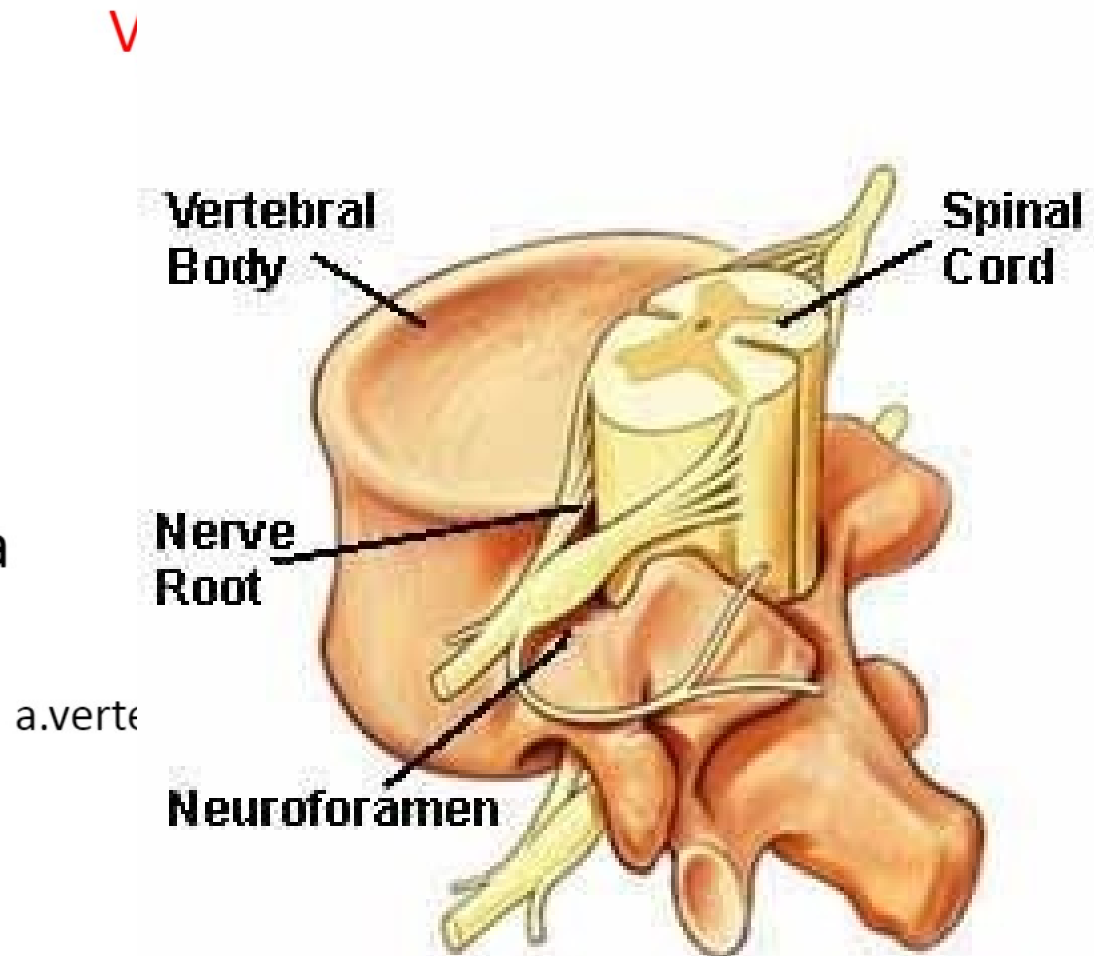
Cervical spine

Etiology of spinal root and spinal cord compression

1. Osteofyt
2. Výhřez
3. Etáž:
 - C5/6 (20%)
 - C6/7 (70%)
4. Cervikální stenóza



Cervikální
spondylogenní
myelopatie



Cervical spine

Etiology of spinal root and spinal cord compression

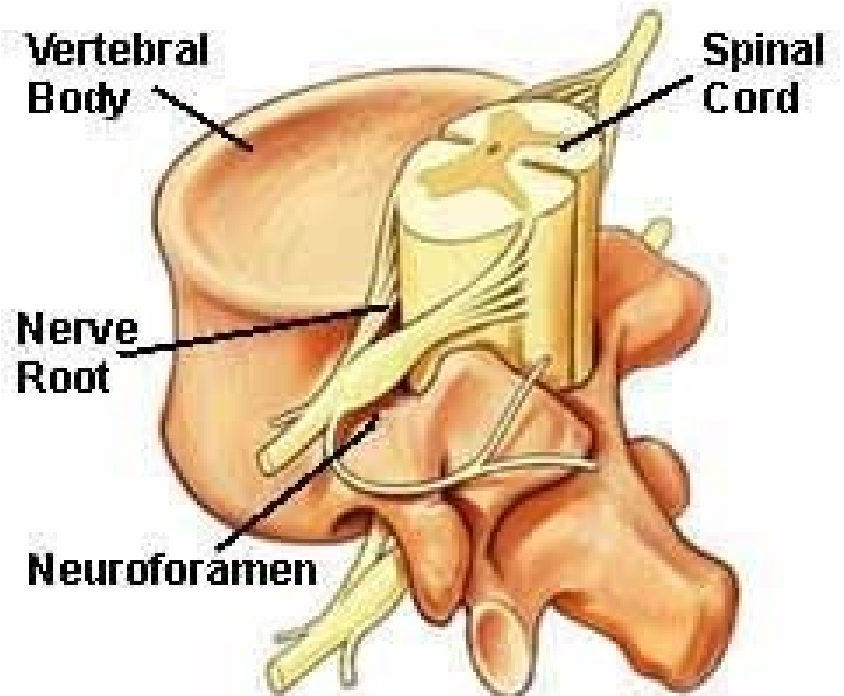
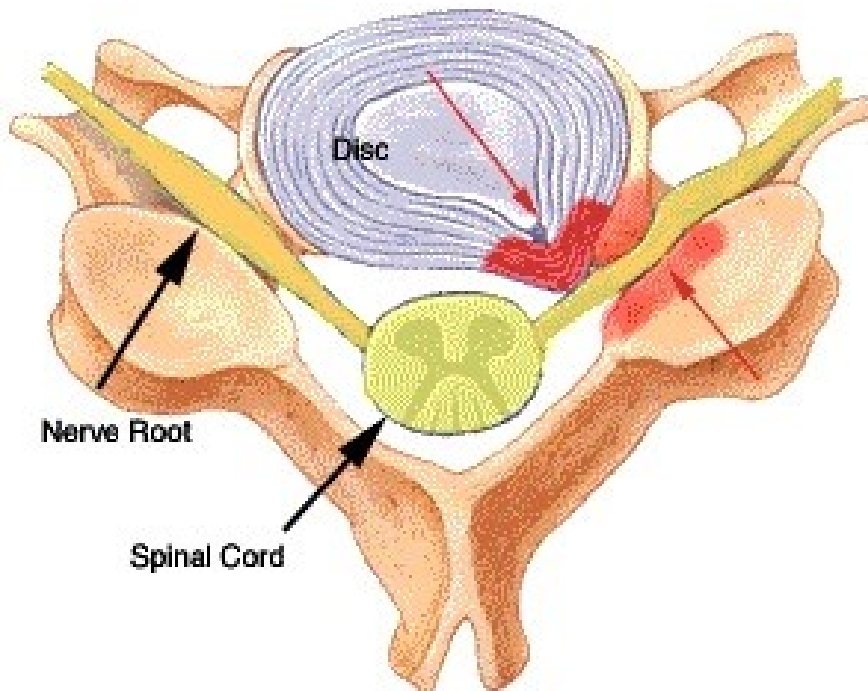
Osteophytes

Disc prolapse

Radicular sy levels:

C5/6 20%

C6/7 70%



Radicular syndromes

Iritation

Paresthesias

Dysesthesia

Hyperesthesia

Pain



Function loss

Hypotrophy, hypotonia

Hypesthesia

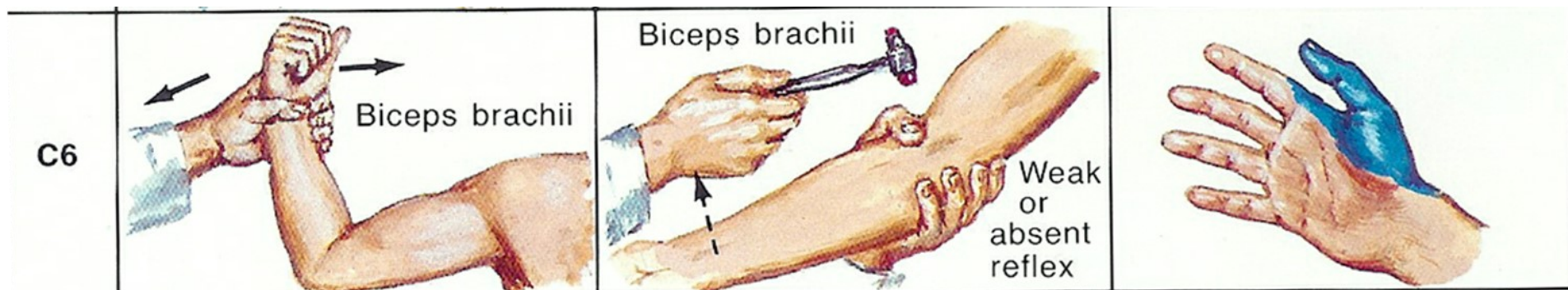
Paresis

Decreased reflexes

Common cervical radicular sy

Radicular sy C6 (20%):

- **Pain and sensory deficit:** Thumb and ½ index finger, radial half of forearm
- **Motor deficit:** biceps brachii, brachioradialis
- **Reflexes:** bicipitový a styloradiální reflex



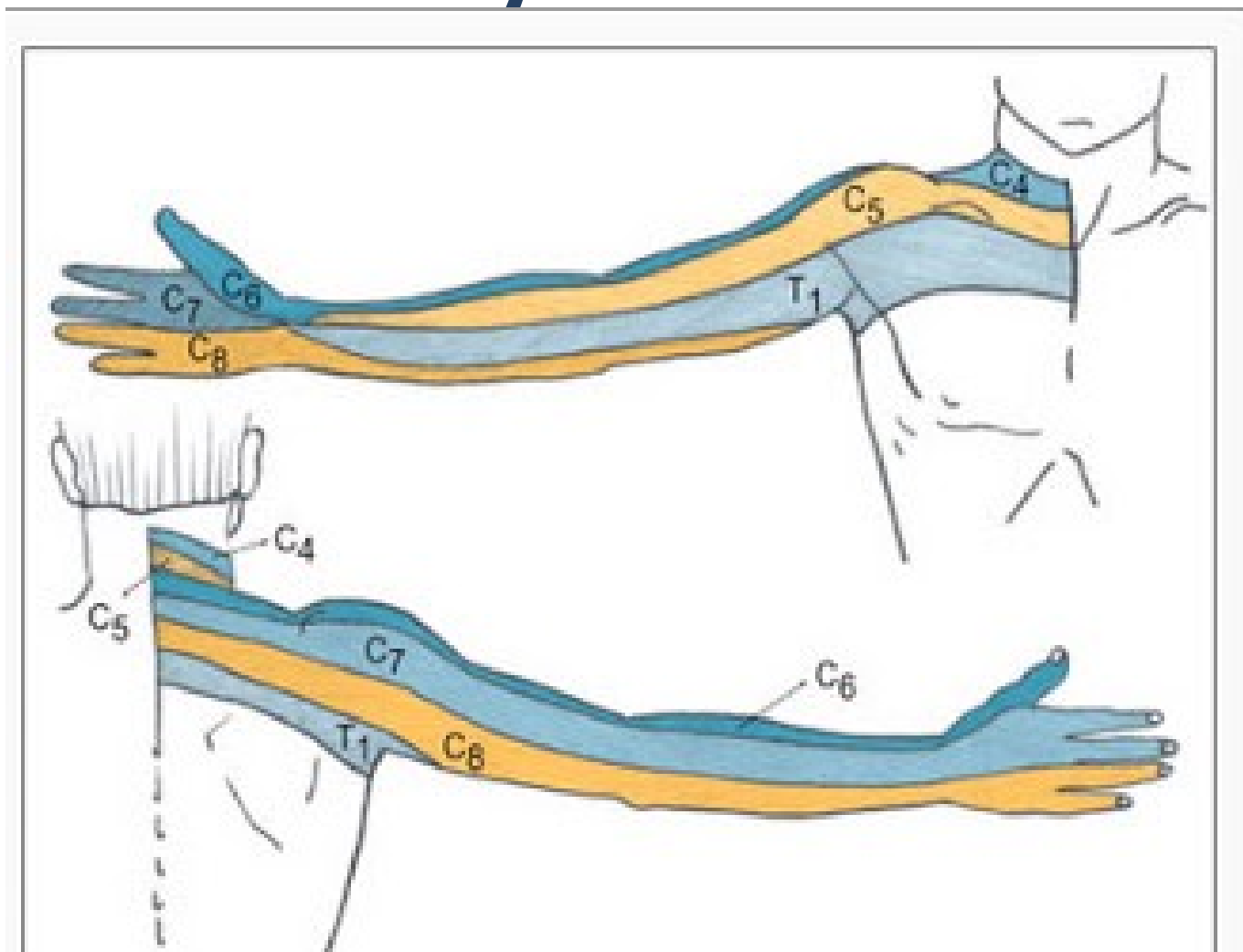
Common cervical radicular sy

Radicular sy C7 (60%):

- **Pain and sensory deficit:** dorzální plocha paže, předloktí a ruky do II.- IV. prstu
- **Motorika:** triceps brachii
- **Reflexy:** tricipitový reflex



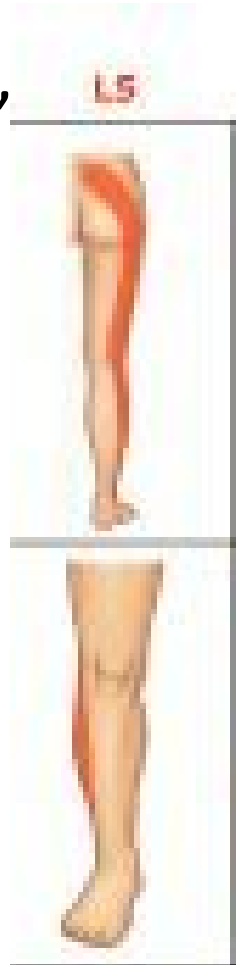
Remember your dermatomes



Lumbar radicular syndromes

L5 radiculopathy:

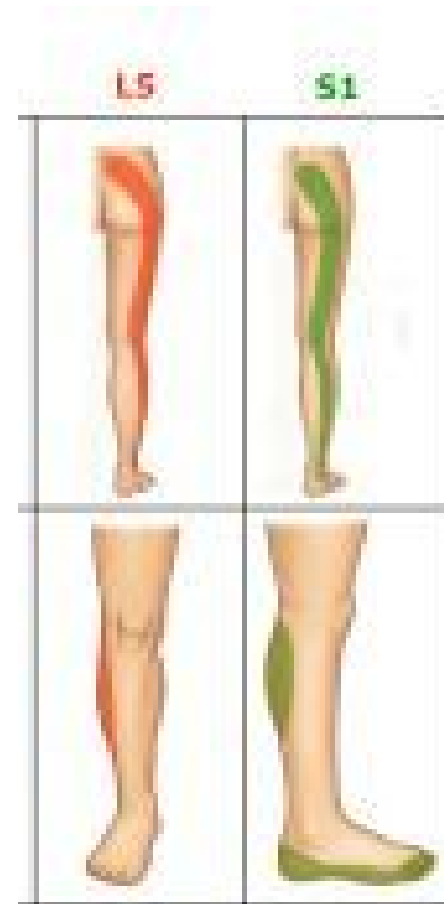
- **Pain and sensory deficit:** Lateral side of the thigh, anterolateral part of the calf, dorsum pedis, **hallux -IV. toe**
- **Motor loss: dorsal flexion of the big toe, foot**
Will not stand on heel !
 - extensor hallucis longus a digitorum longus, partially tibialis anterior
 - gluteus medius, minimus, tensor fasciae latae (hip abduction)
- **Reflexes:** L2-4 normal, also L5-S2 mostly normal



Lumbar radicular syndromes

S1 radiculopathy:

- **Pain and sensory deficit:** dorsal part of thigh, calf and lateral side of the foot
- **Motor loss :** plantar flexion
 - triceps surae, flexory bérce, gluteus max.
- **Reflexes:** hypo- až areflexia rr. L5-S2
- **Will not stand on toes**



Klinické projevy herniace bederního výhřezu

Herniace v úrovni

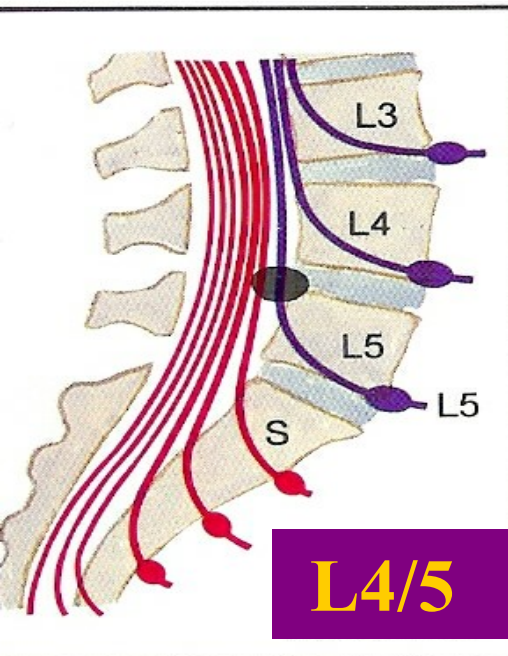
bolest

čítí

motorika

trofika

reflexy



L4/5

Přes SI
kyčel
lat.
stehno
lýtko



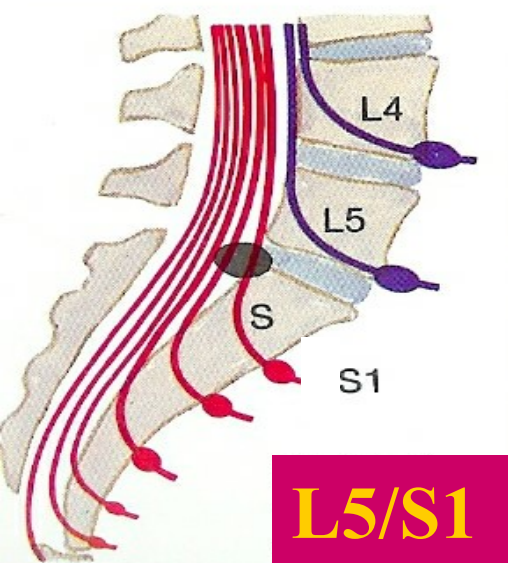
Lat. lýtko
Prsty 1-3



Extenze
nártu,
palce,
vázne
chůze po
patě

Tibialis
anterior

**Normální
rr.L2-S2+
jen**
R. femoro
tibio
posterior
nízký až 0
(FTP 0)



L5/S1

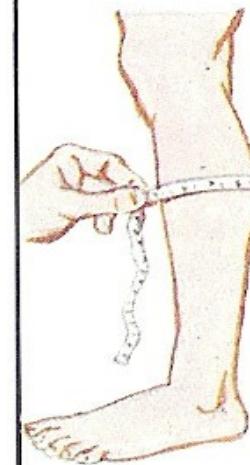
Přes SI
kyčel
poster
lat.
stehno
lýtko
patu



Dorsum lýtko,
laterálně pata
k malíku



Flexe
nártu,
Palce,
vázne
chůze po
spičce



Gastrocne-
mius, soleus



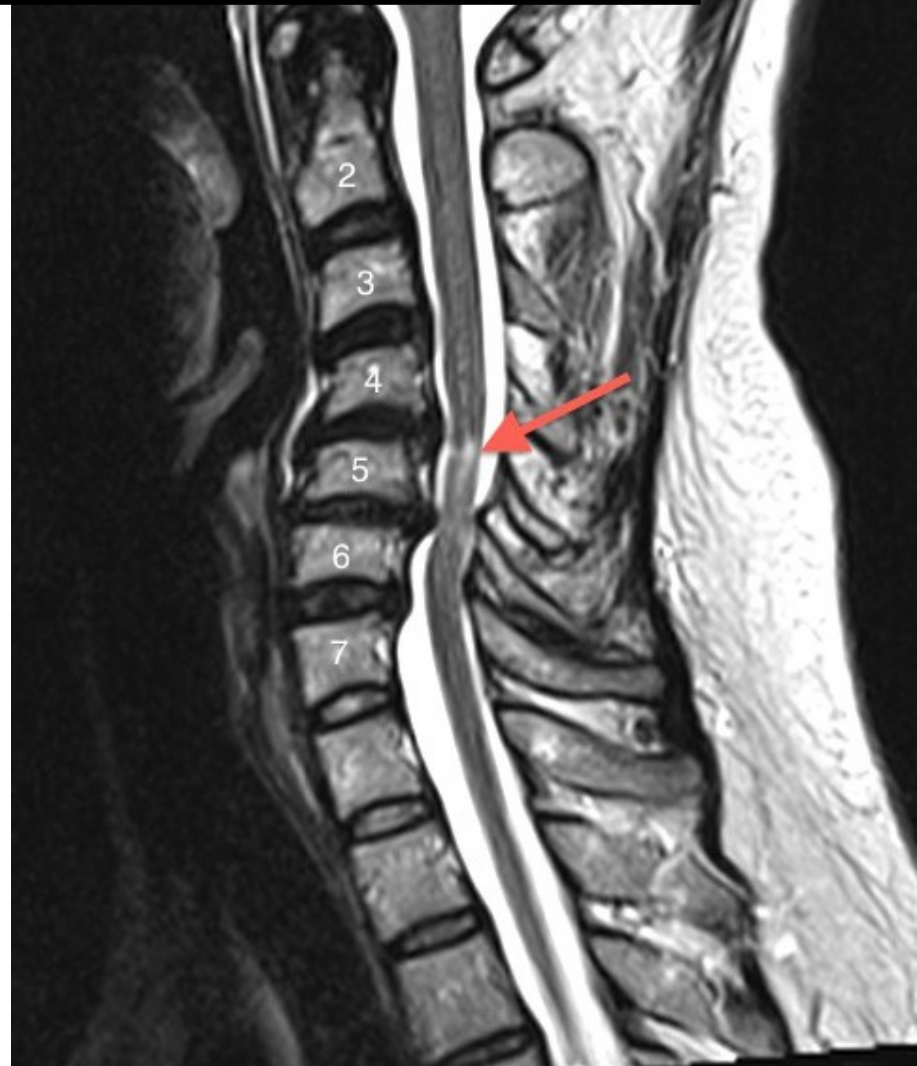
R. šlachy
Achillovy
snížen až 0
L5-S2
snížen až 0

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- **Neurogenic claudication**
- **Diferencial dg: radikulitis, discitis, red flags CAVE**



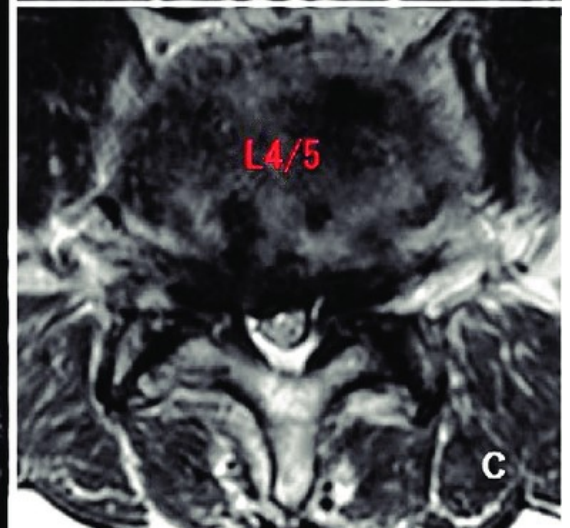
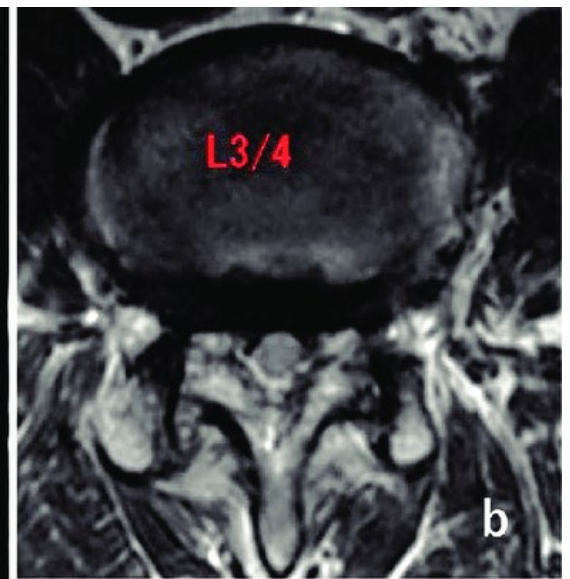
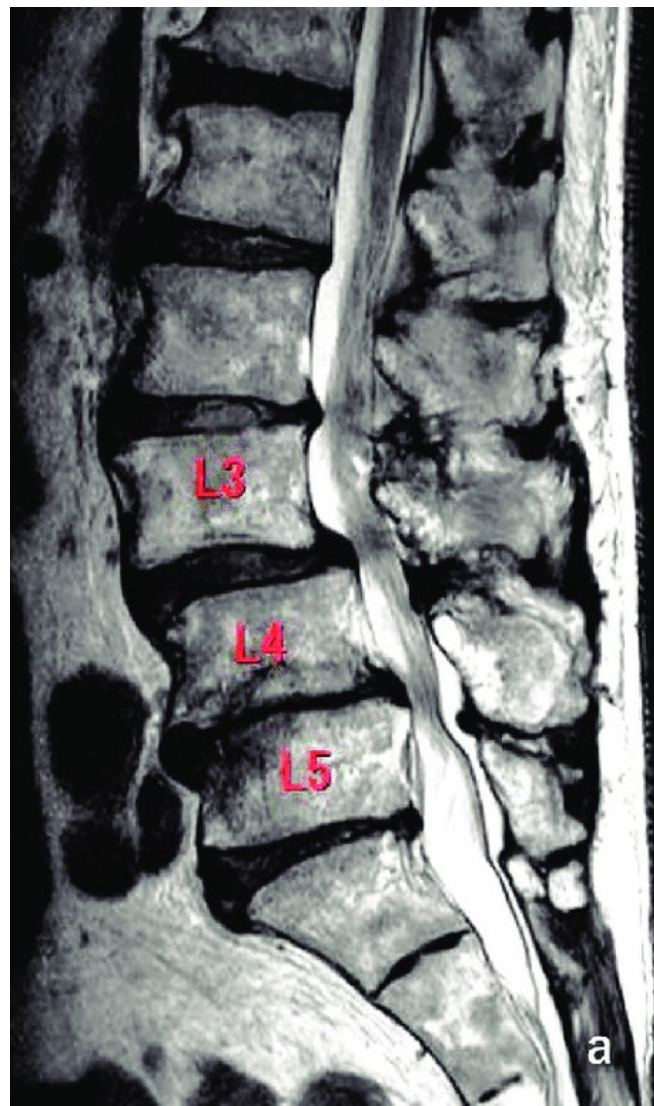
Spinal stenosis and cervical myelopathy



Cervical spondylotic myelopathy

- **Neuro exam:**
- **LE: Central spastic paraparesis (kortikospinal tract)**
- **UE: May have combination of flacid and spastic paresis (+ přední rohy; C5-7)**
 - Fasciculations in UE 30 %; not obvious
 - Sensory deficits variable – depend on compression
 - Sfincters: not common, not severe (25 %)





**Lumbar stenosis:
Narrowing of spinal canal on multiple levels**

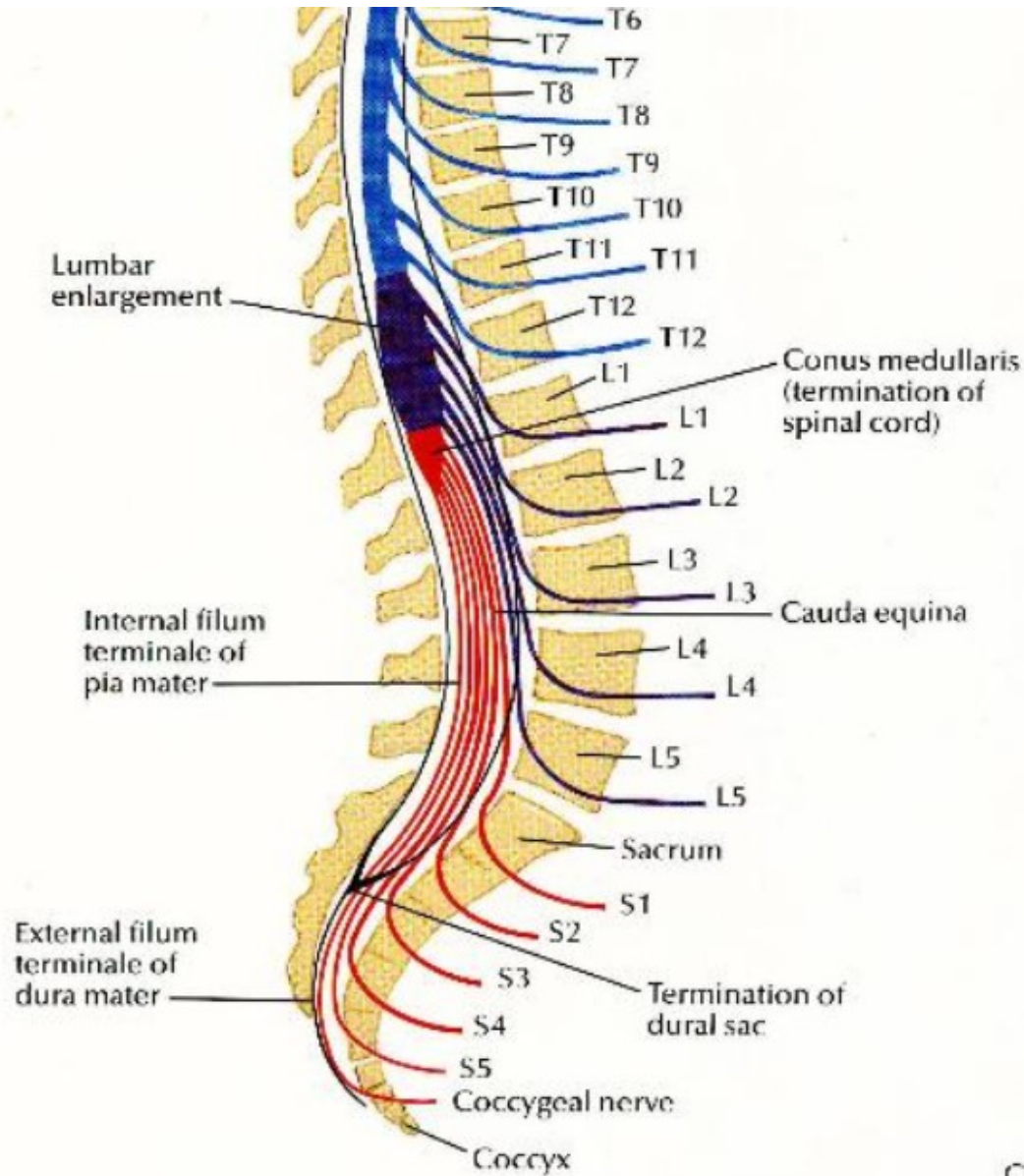
Lumbar stenosis versus vascular claudications

Claudications	Neurogenic	Vascular
Relief	Sitting, bending	Stance, stopping
Uphill walking	negative	painful
Downhill walking	painful	negative
Bicycle riding	negative	painful
Walking distance	variable	Fixed limit

Clinical syndromes to differentiate

- **Segmental syndrome** – localized pain, no radiation
 - Cervikalgia, thorakalgia, lumbalgia
- **Radicular syndrome** – spinal root impairment
 - Dif dg.: Pseudoradicular syndrome – pain projecting into radicular distribution not resulting from root impairment
pozn. - autodermography + intensity!
- **Compressive myelopathy** – spinal cord compression
- **Cauda syndrome**
- **Neurogenic claudication**
- **Diferencial dg: radikulitis, discitis, red flags CAVE**



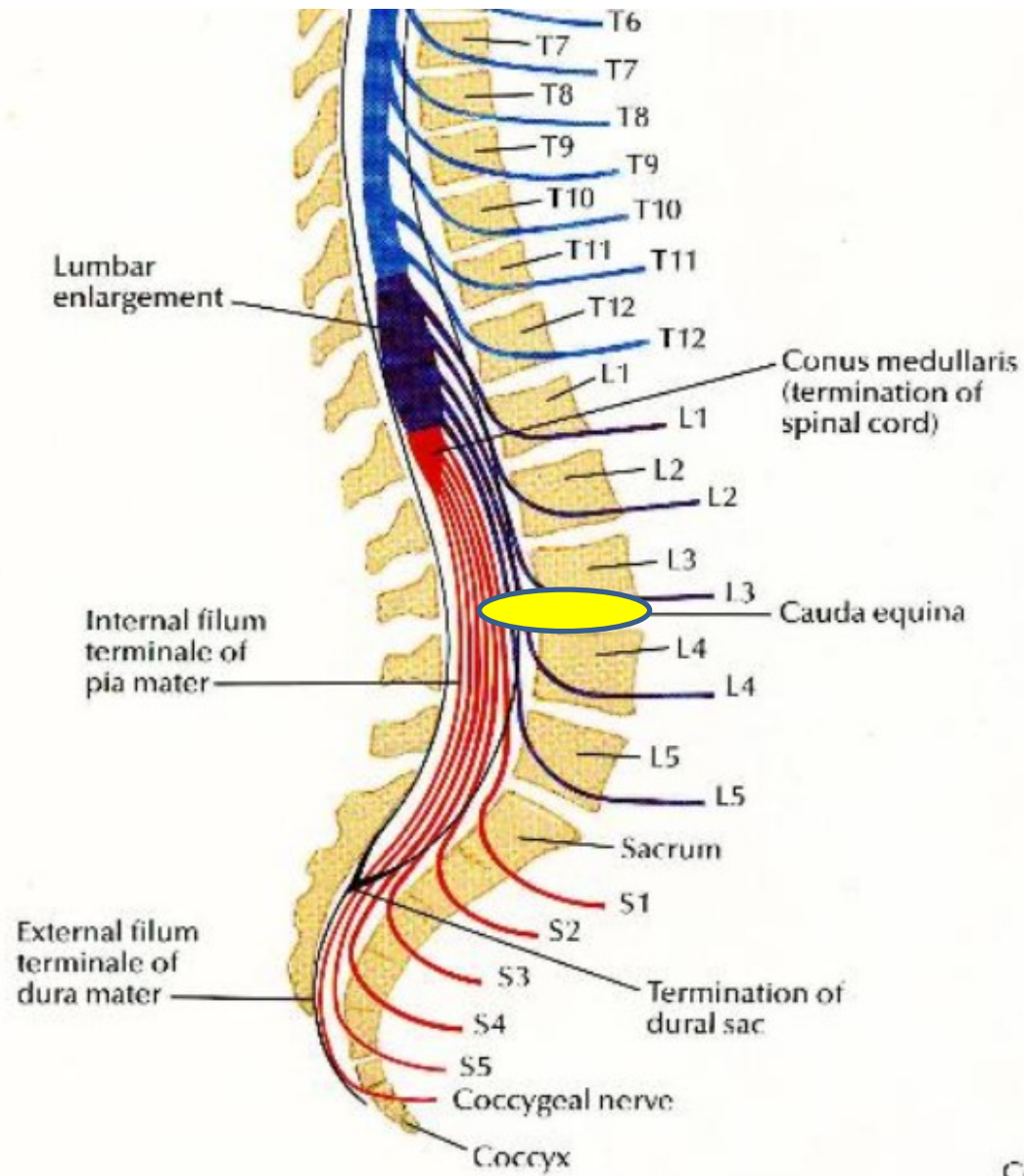


Conus level?

L1

Cauda location?

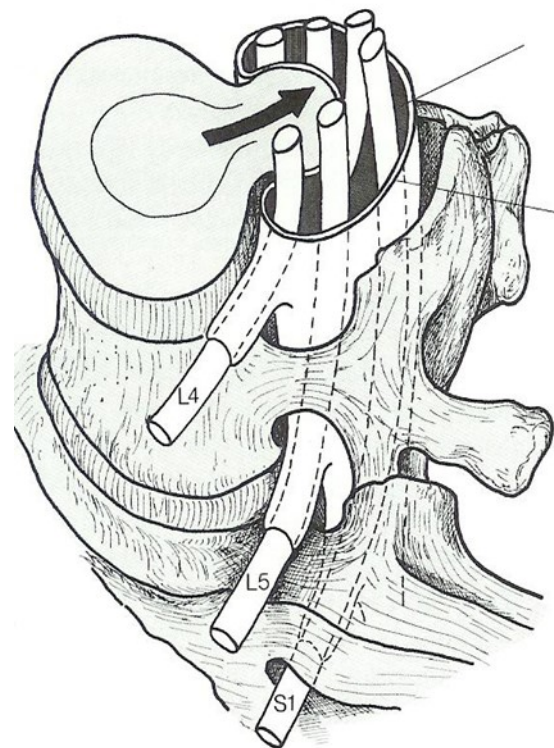
From L2 down



CAVE: surgery < 12-24 h !

- **Cauda equina syndrome**

- Compression: medial (*or paramedial*) by *disc herniation or a sequester*
- **Strong pain, pluriradicular, both legs,** commonly asymmetrical
- **Flacid paresis/plegia**
- **Loss of sfincter control - retention**
- Numbness tends to be more localized to saddle area; asymmetrical
- *Loss of anal reflex and bulbocavernous reflex*



„red flags“

- History of cancer
- Unrelenting pain
- Weight loss - unexplained
- Elevated inflammation markers (sed rate, CRP)
- History of infections, trauma, recent back surgery or invasive procedure (LP, PMG, diskografie aj.)
- Osteoporosis, steroid use
- IV drug use

Choice of imaging

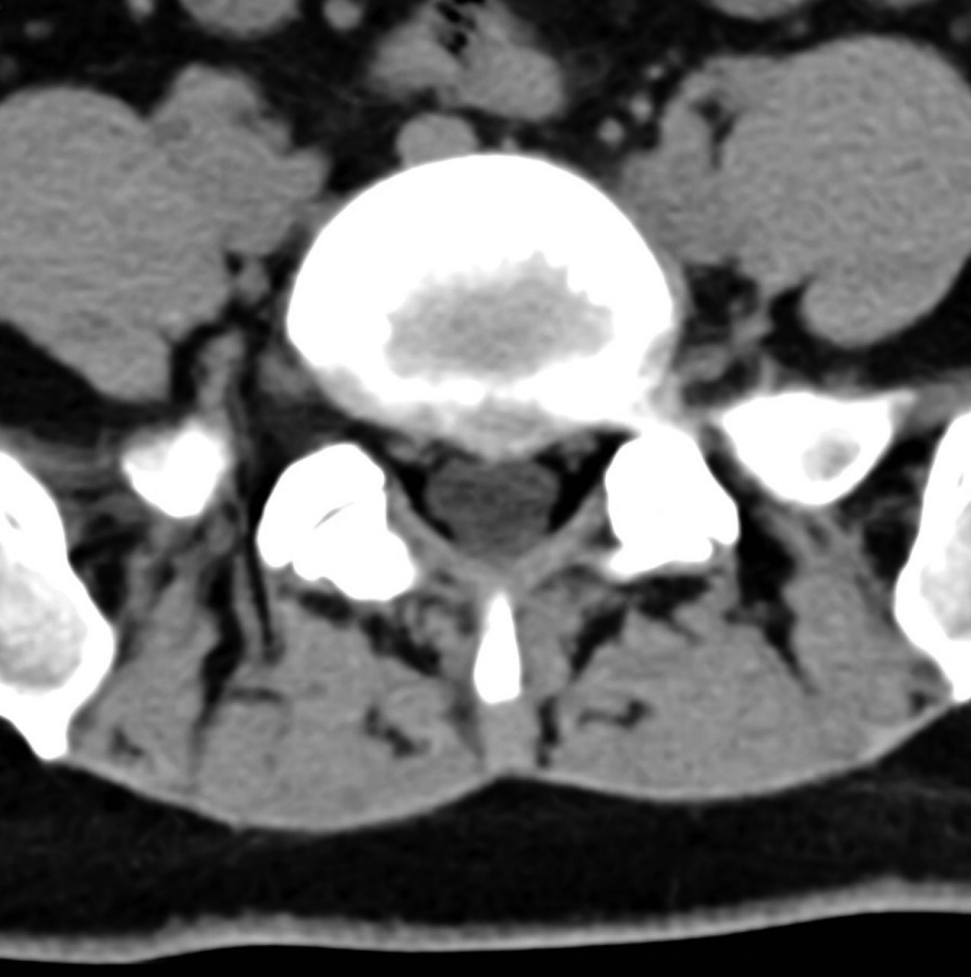


X-ray

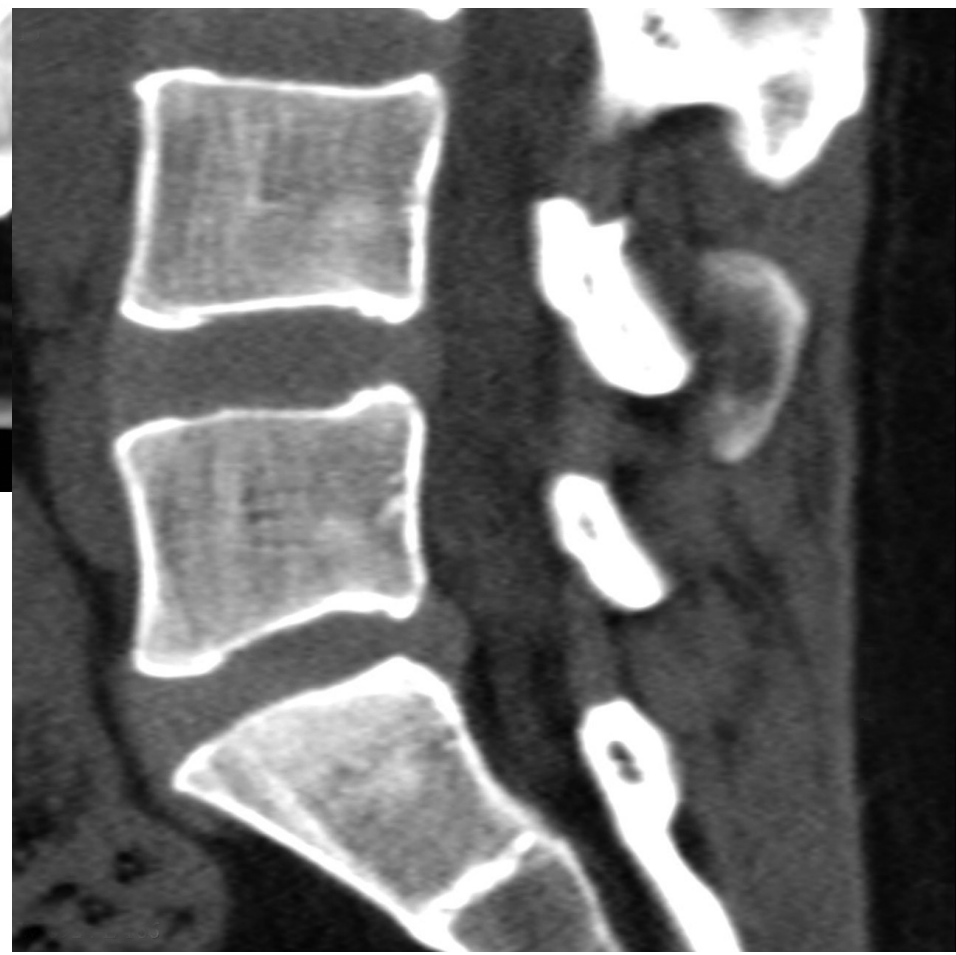


CT – bone window

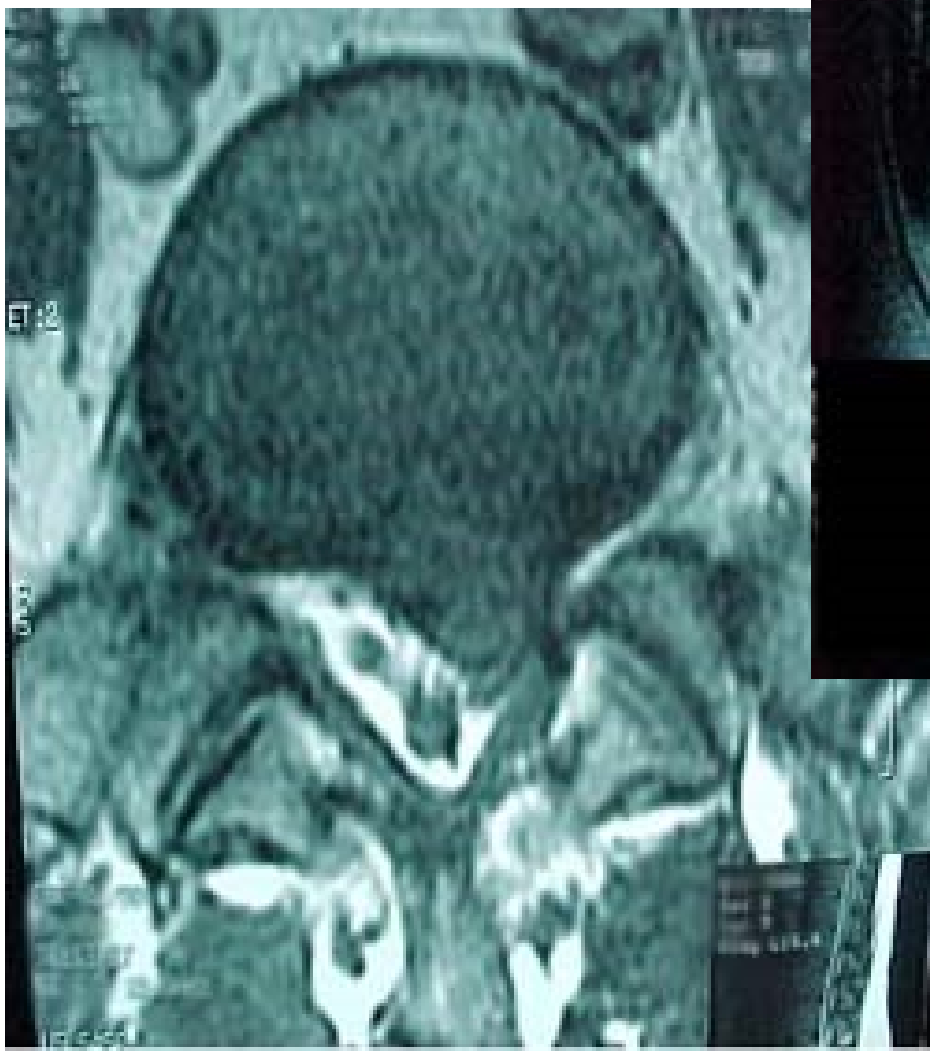




CT



MRI



Treatment: acute stage

REST 1-3 days max

Treat PAIN early and effective with every pain relapse

MYORELAXANS k short term to use co-analgetic effect
– mostly at night!

Neck brace, lumbar brace support – short term, night

Shorten the pain episode, ↓ stress and psychological deprivation, ↓ inactivity and muscle deconditioning, prevent centralization of pain.

Surgical intervention

- Absolute indication in case of:
 - **CAUDA EQUINA SYNDROME**
 - **FAST ONSET OF MOTOR DEFICIT**
- Relative indication:
 - Gradually worsening paresis
 - Failure of physical therapy
 - pain, duration of symptoms, individual factors

