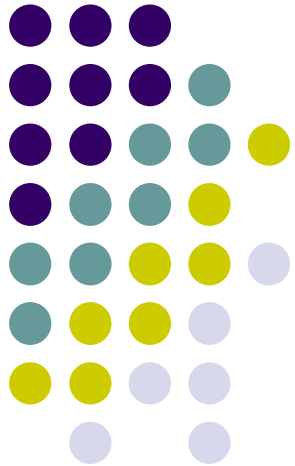
BEDSIDE NEUROLOGICAL EVALUATION

Eva Vlčková

Clinic of Neurology, Masaryk University and University Hospital Brno - Bohunice



MEDICAL HISTORY – PRESENT ILLNESS

= getting information ***from the patient*** or – in some cases – ***from other observer*** (important in seizures, dementia, aphasia…)

STANDARD PRACTICE IS TO RECORD:

- **PATIENT´S CHIEF COMPLAINT** („what brings you to see me?“) these data *focus attention on particular questions* to be addressed *in taking the history* and focused *neurological examination*

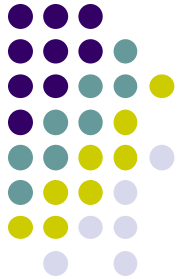
- **HISTORY OF PRESENT ILLNESS *including a history of development of particular symptoms:***
  - *mode of onset*
  - *duration* a *and progression* are critical in investigating the etiology! – sudden onset x paroxysmal episodes x exacerbations and remissoins x slow progression)

- **CHARACTERISTICS OF THE SYMPTOMS** (intensity – VAS, Likert scale, localisation, what relieves/makes the symptom worse)

MEDICAL HISTORY – OTHER DATA

- *history of* ***MEDICAL ILLNESSES AND PREVIOUS SURGICAL PROCEDURES****:*
- neurological system is affected by *many non-neurological diseases* (DM)
- adversely *neurological diseases may involve the function of many systems* (Parkinson disease, diabetic neuropathy)
- And/or may be a *part of multiorgan involvement*
  - sarciodosis,
  - vasculitis,
  - mitochondrial diseases
  - storage diseases
- current (and sometimes) ***MEDICATIONS AND ALLERGIES***
  - previous – chemotherapy, izoniazid, neuroleptic agents
  - current – hypolipidemics, corticoid hormones, neuroleptics, opioids, hypnotics….

MEDICAL HISTORY – OTHER DATA



- ***timing of developmental milestones*** (sitting, walk, first words)
  - in infants
  - In young children
  - in adults whose illness started during childhood also the
- ***personal and social history***
  - occupation
  - marital status
  - excessive stress at home, in school or in the workplace
- did the patient ever ***use of alcohol, tobacco*** or any other prescription or illegal ***drugs*** (dependence)
- ***family history*** (cave! misinterpreting the symptoms and sings! – consequence of aging, family secret…)

EVALUATION OF THE PATIENT

- ***History of*** the symptoms and the ***clinical examination*** of the patient are the **KEY TO ACHIEVING AN ACCURATE DIAGNOSIS**
- in all branches of medicine and particularly in neurology

- ***DIAGNOSTIC PROCESS CONSIST OF A SERIES OF FOLLOWING STEPS:***
- *MEDICAL HISTORY* usually ***starting with chief complaint*** of the patient, following the general medical history and including the review of any symptoms and signs involving the neurological or non-neuroloical body systems

- *NEUROLOGICAL EXAMINATION* and general medical examination

- ***based on the findings: differential diagnosis*** with generation of a ***list of possible causes*** of patient´s symptoms and signs

GENERAL ASPECTION OF THE PATIENT

- assessed while recording the history
- you can see e.g.:
  - **CHANGES OF FACIAL EXPRESION** or mimics:
    - lack of facial expression (hypomimia) may suggest parkinsonism or depression
    - a worried or astonished facial expression may suggest progressive supranuclear palsy
    - unilateral ptosis may suggest myasthenia gravis or a brainstem lesion
  - the **PATTERN OF SPEECH** may suggest dysarthria, aphasia, or spasmodic dysphonia
  - the **PRESENCE OF ABNORMAL INVOLUNTARY MOVEMENTS** may indicate an underlying movement disorder.

REVIEW OF ANY SYMPTOMS AND SIGNS IN ALL BODY SYSTEMS

Ask the patient **(and/or the relatives)** about all ***elements of nervous system function that did not surface in taking the history***:

- cognition, personality and mood change
- seizures or other impairments of consciousness
- speach and language function
- involuntary movements or vocalisation
- orthostatic faintness
- headaches
- special senses
- swallowing
- limb coordination
- slowness of movement
- hallucinations
- strength and sensation
- pain
- gait and balance
- sphincter, bowel and sexual function

→ a positive response may help clarify the diagnosis

+ review of all of the organ systems (GIT, liver, kidney, heart…)

NEUROLOGICAL EXAMINATION

- **STARTS ALREADY DURING THE INTERVIEW**:
  - mental status
  - changes of facial expresion or mimics
    - Hypomimia
    - Ptosis
  - Rattern of speech (dysarthria, aphasia),
  - Presence of abnormal involuntary movements
  - …..

- **FULL NEUROLOGICAL EXAMINATION TESTS** in detail ***every central nervous system region, peripheral nerve, muscle, sensory modality and reflex***
- → too lengthy to perform in practice.

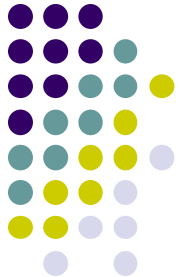
NEUROLOGICAL EXAMINATION

- in practice: **FOCUSED NEUROLOGICAL EXAMINATION**
  - to examine in detail the neurological functions that are relevant to the history
- + then **SCREENING NEUROLOGICAL EXAMINATION**
  - to check remaining parts of the nervous system

- ***both the presence***
- ***and the absence***

  of abnormalities may be of diagnostic importance
  - (e.g. separation of hemiparesis arising from spinal cord and right cerebral cortex lesion….)

SCREENING NEUROLOGICAL EXAMINATION



= QUICK EVALUATION OF:

- mental status

https://el.lf1.cuni.cz/neuronorma/

- cranial nerves
- motor system
  - Strength
  - muscle tone and tendon reflexes
  - presence of involuntary movements and postures
- coordination
- gait and balance
- Sensation

MORE COMPLEX FUNCTIONS ARE TESTED FIRST (no need to test the simplex ones may happened)!

EXAMINATION OF THE LIMBS/TRUNK

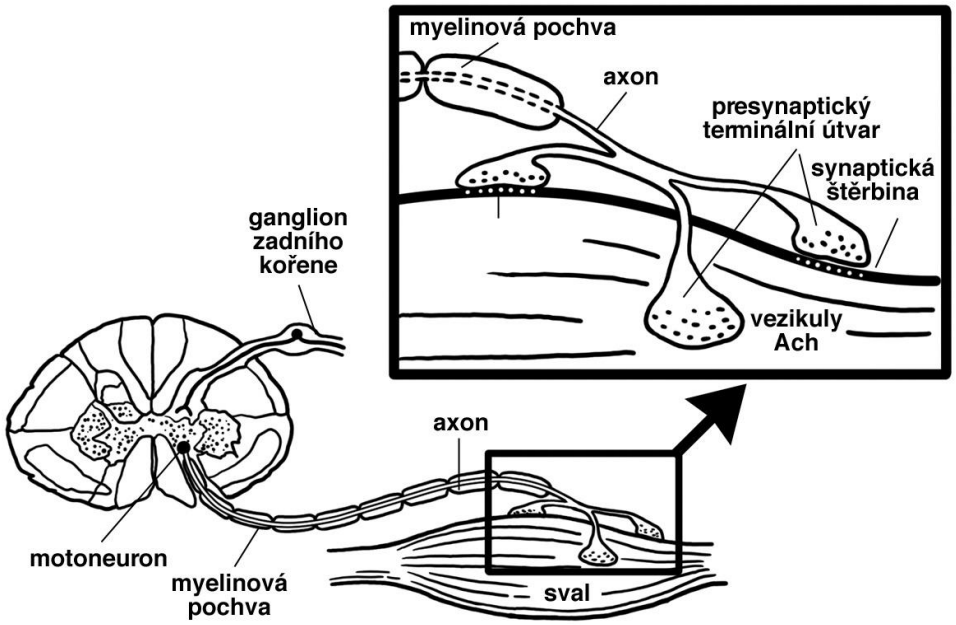
Separate testing of each limb:

- Presence **OF INVOLUNTARY MOVEMENTS, ABNORMAL LIMB POSITION** (pain release, flexion, extension)
- **MUSCLE MASS** (atrophy x (pseudo- hypertrophy) and look for fasciculations
- **MUSCLE TONE** in response to passive flexion and extension
- **ACTIVE MOVEMENTS** in particular segments or joints (pasive motility?)
  - Paretic signs
  - Power of main muscle groups
- **TENDON REFLEXES**
- Plantar responses or other **ABNORMAL REFLEXES**
- **COORDINATION**
  - Finger-to-nose and heel-to-shin test x rapid alternating movements

MOTOR UNIT (MU)

= is made up of a motor neuron + the skeletal muscle fibers innervated by tha motor neuron's axonal terminals (3-200)

- All muscle fibres in a motor unit are the same fibre type.
- In a muscle, particular MUs are intertwined with the others

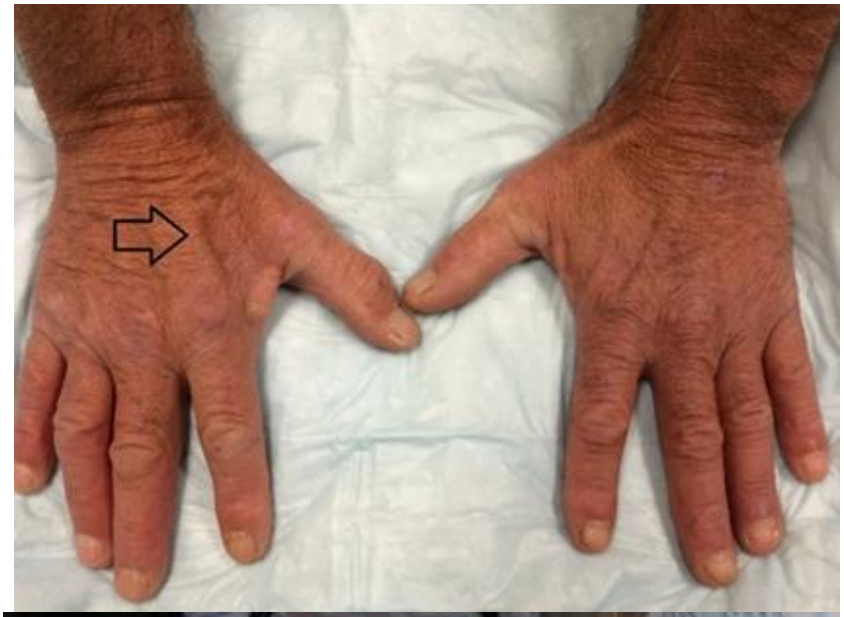


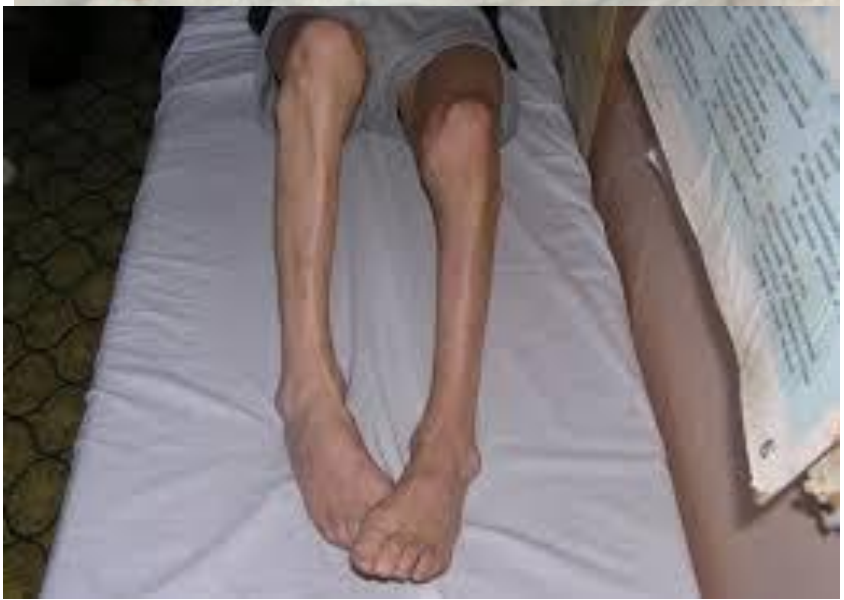
Contraction of single motor unit = a **fasciculation**

- a small, local, involuntary muscle contraction and immediate relaxation which may be visible under the skin. In deeper areas, they can be detected by EMG.

- Small rapid flickering or vermicular twitching
- https://www.youtube.com/watch?v=xuwdvBXcr30

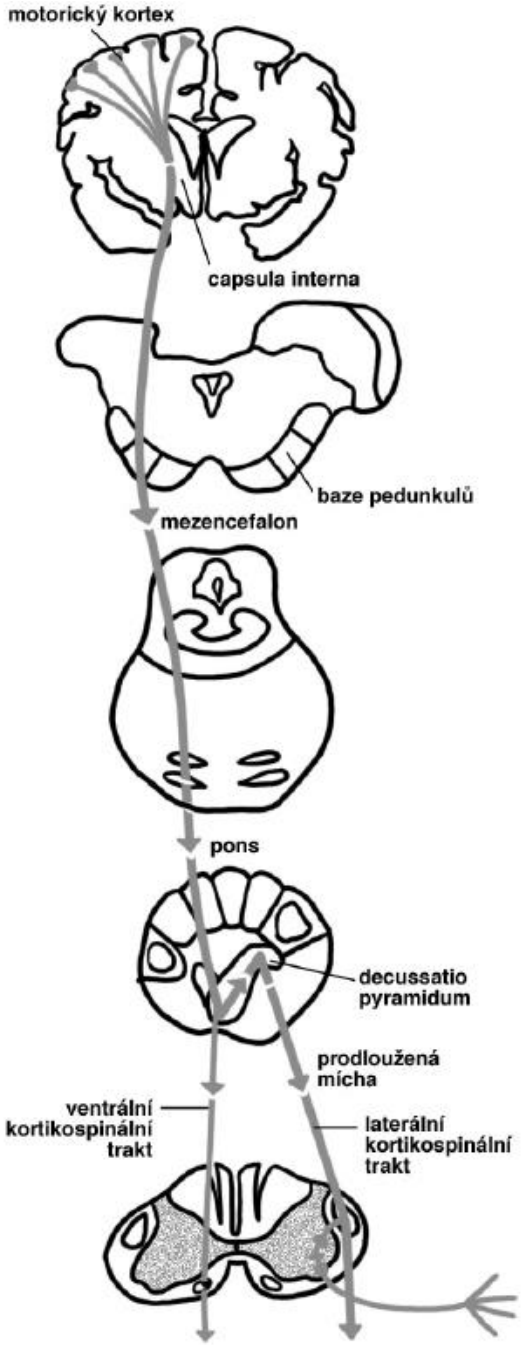
MUSCLE ATROPHY

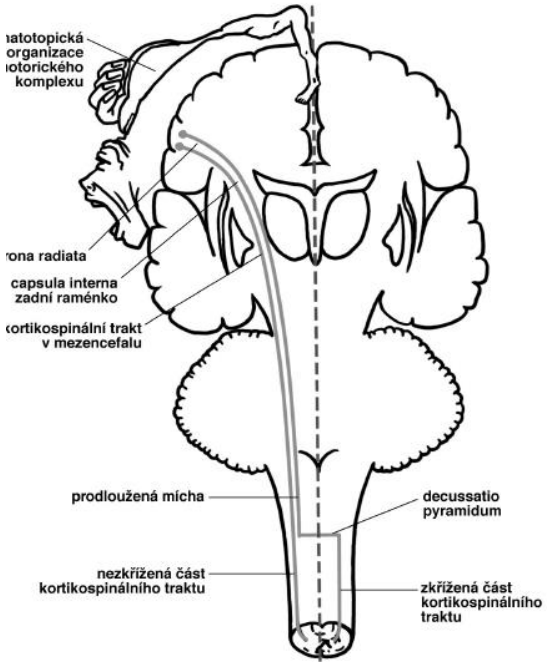




MOTOR PATHWAYS

- 1. *(central) motoneuron*: **GYRUS PRECENTRALIS**
- ➔ **PYRAMIDAL TRACT**
  - Branches towards cranial nerves nuclei
- **CROSS OVER IN THE MEDULLA LEVEL**
  - resulting in muscles being controlled by the opposite side of the brain
- 2. (*peripheral) motoneuron:* **ANTERIOR HORN OF THE SPINAL CORD**
- ➔ PERIPHERAL NERVE ➔ MUSCLE

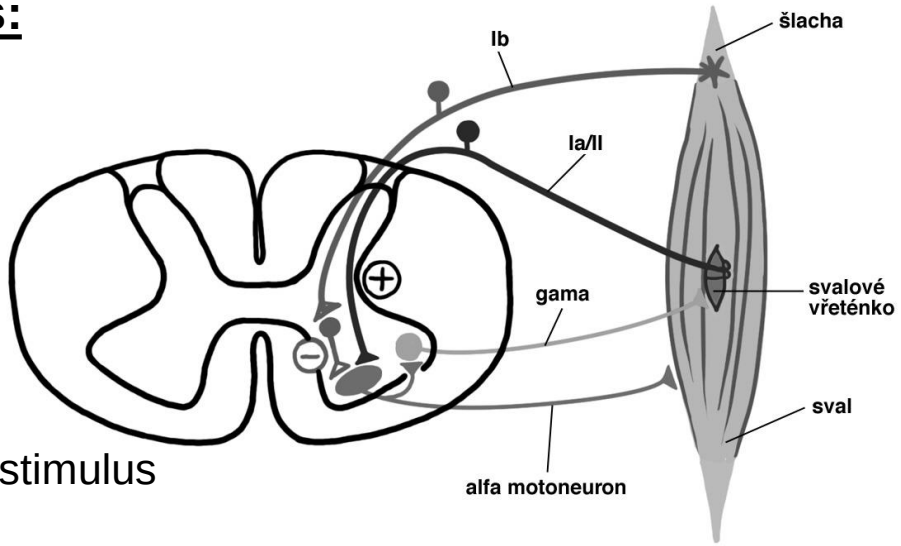




MOTOR SYSTEM

- Consists of 2 **basic types of movements:**

- *VOLUNTARY MOVEMENTS*
  - EASY (locomotion, rythmic movements)
  - COMPLICATED



- *REFLEX RESPONSES*
  - Fast, stereotypic, involuntary, evoked by a stimulus
  - A part of many voluntary movements
    - E.g. Maintain muscle tone
    - Relax antagonists during agonist contraction

- **ABNORMAL MOTOR FUCTION RESULT TO MUSCLE WEAKNESS = PARESIS** = loss of voluntary movements (reflex movements may be perserved)
  - COMPLETE LOSS OF VOLUNTARY MOVEMENTS = *PLEGIA*
  - INCOMPLETE = *PARESIS.*

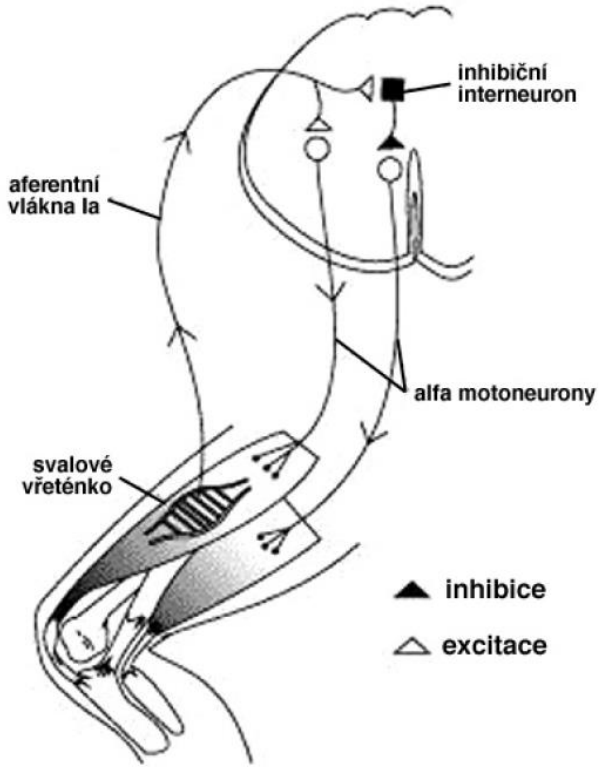
DEEP TENDON REFLEXES

- Intact **REFLEX ARC**

- BASIC PRINCPLE :
- Blow upon the tendon with a hammer
- → short muscle stretching
- → leads to muscle contraction

- Quantification:

GRADE	Reflex
0 (--)	Absent
1 (-)	Decreased (hypoactive)
2 (N)	Normal
3 (+)	Increased (hyperactive) without clonus
4 (++)	Hyperactive with **clonus**



DEEP TENDON REFLEXES

- = proprioceptive reflexes

General interpretation:

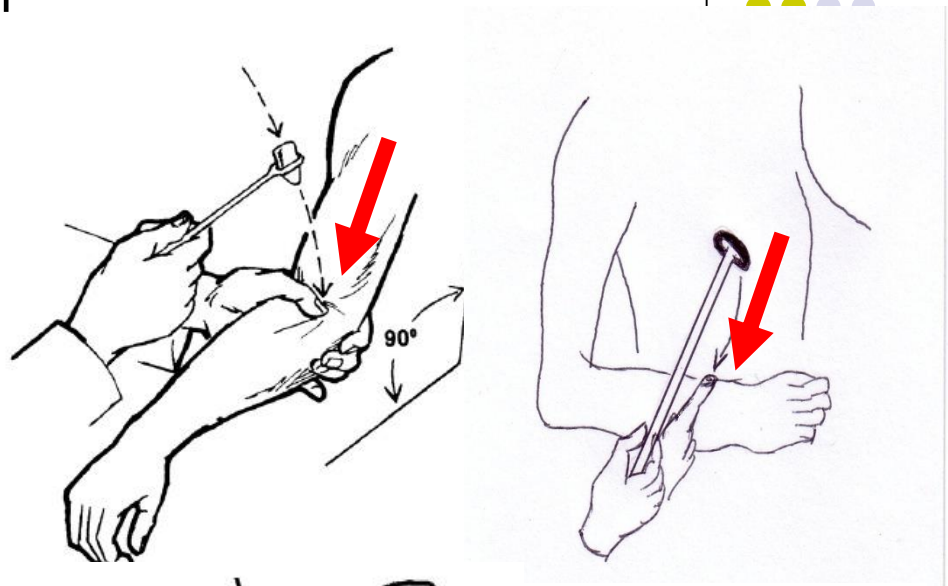
- Decreased DTR = **periheral paresis (flaccid)**
- Increase DTR **= central paresis (spastic)**

- Note interindividual differences (intraindividually ± stable)

- Following the sudden development of central paresis (stroke…) = the central paresis is flaccid (decreased DTR).

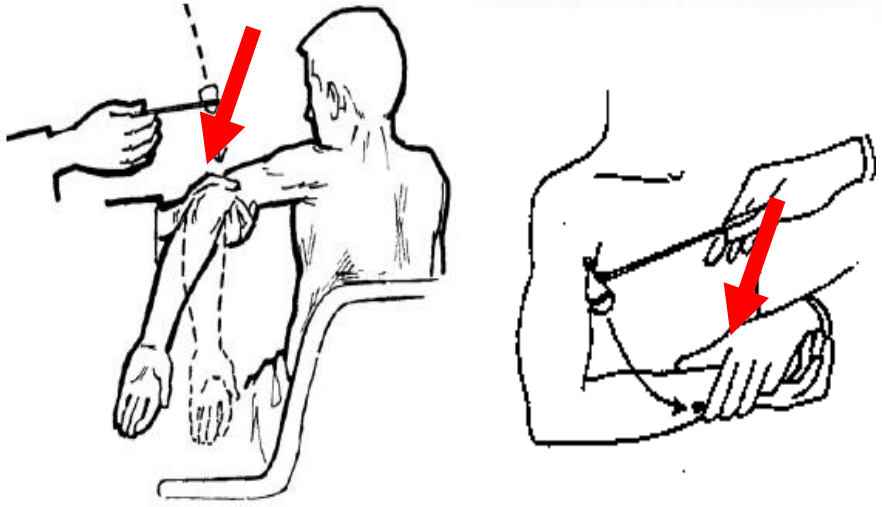
DEEP TENDON REFLEXES - UE

Biceps reflex (**C5**-6): reflex contraction of the biceps muscle and jerk of the forearm.



Styloradial (pronatinon) (**C6**) (periosteal): tapping the processus styloideus radii (elbow in flexed in 90 degrees and semiproned forearm) leads to the slight forearm pronation

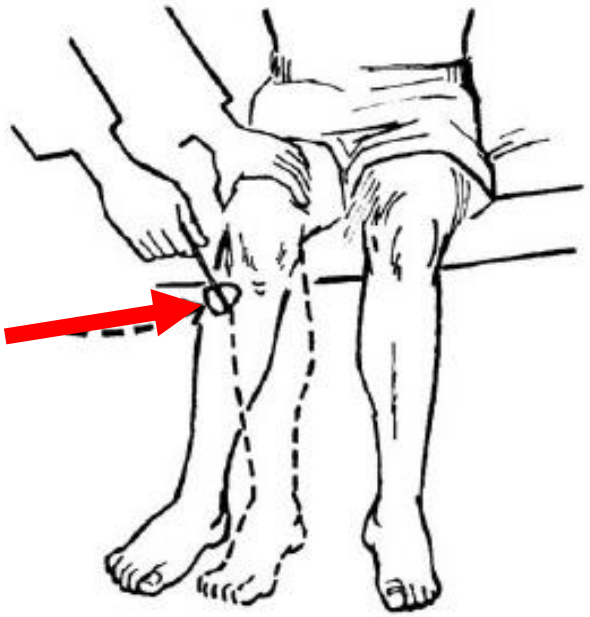
Triceps reflex (C6-8,mainly **C7**): tapping the triceps tendon while the forearm is hanging loose at a right angle to the arm causes the forearm extension.



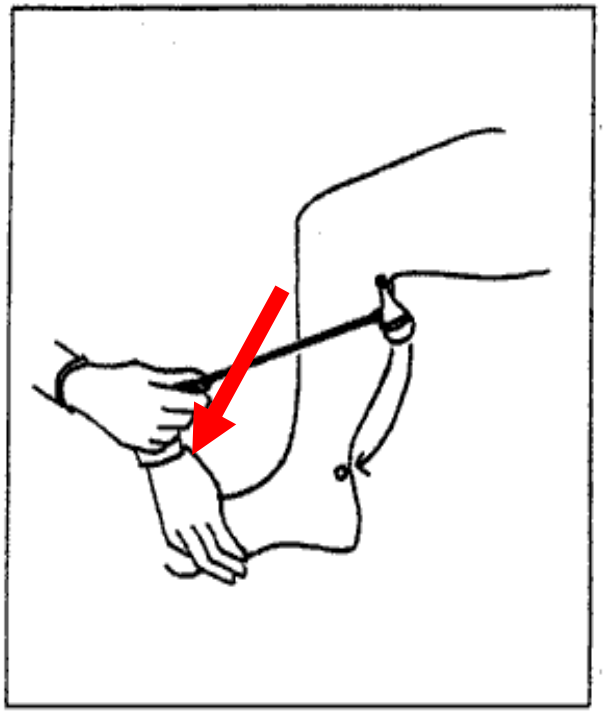
Reflex of finger flectors (**C8**): tapping the ligamentum carpi transversum leads to slight flection of the fingers

DEEP TENDON REFLEXES - LE

Patellar reflex L2-**L4 (**knee-jerk) = striking the patellar tendon with a hammer just below the patella causes the quadriceps femoris contraction and shank extension



Ankle jerk reflex **S1**/S2 (Achilles reflex) occurs when the Achilles tendon is tapped while the foot is dorsi-flexed leading to the jerking of the foot towards its plantar surface



MUSCLE TONE

- **DECREASED** (flaccidity) in lower motor neuron/ peripheral nerve disseases
- **INCREASED** in central nervous system disease: *spasticity or rigidity*

- In **SPASTICITY**, the increased tone is caused by an exaggeration of the stretch reflex and accordingly is dependent on stretch rate:
  - if the muscle is slowly stretched, tone may be normal
  - if the muscle is stretched more rapidly, increasing amounts of resistance occur
  - ⇒ rate-sensitive, preferential involvement of extensors
  - „clasp knife“ or pocket knife fenomenon

- **RIGIDITY**: increased muscle tone, not depending on the rate of movement.
  - found equally in both extensors and flexors.
  - caused by extrapyramidal disease (or side effect of antidopaminergic drugs)

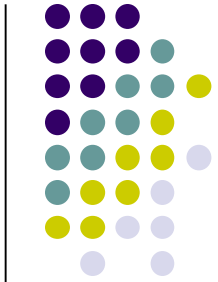
PARETIC SIGNS

- Not much used in English literature
- Signs of paresis: **FUNCTIONAL TESTS OF MUSCLE ENDURANCE**, reflect global impairment of muscle strength in particular extremity, not only the dysfunction of pyramidal tracks

- UE: Mingazzini – holding the extended arms raising forward,
  eyes closed (15 seconds or more) (decrease?)
  Duffour (pronator drift) – supination in the same position (pronation?)

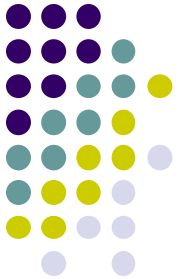
- LE: Mingazzini – in lying position, lower extremities flexed in hipps and knees (90 degrees angle)

ACTIVE MOVEMENT TESTING



- Active movement in each big joint:
  - Shoulders - abduction
  - Elbow – flection, extension
  - Wrist – flection, extension
  - Make a pinch
  - Hip – flection
  - Knee – extension, flection
  - Ankle – dorsal and plantar extension
  - Movements of the big toe

WEAKNESS (MUSCLE STRENGTH)



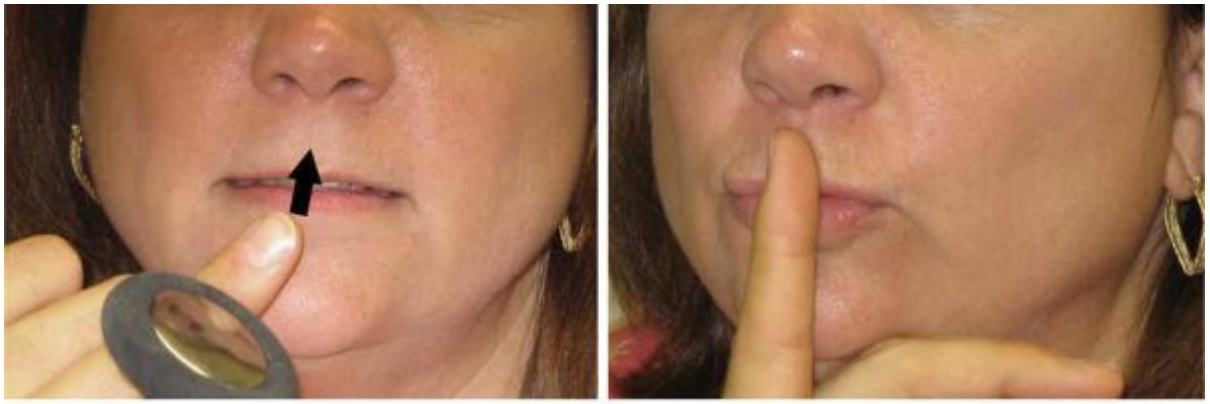
5-POINT MEDICAL RESEARCH COUNCIL (MRC) GRADING SCALE

- Grade 5 represents normal strength.
- Grade 4 = ability to move the limb only against gravity and resistance, but not full strength: represents "weakness" somewhere between 3 and 5.

  Covers such a large range, that should be expanded into mild, moderate, or severe: 4+, 4, and 4–
- Grade 3 = ability to move the limb only against gravity (not against resistance)
- Grade 2 = active movement only with gravity eliminated
- Grade 1 = is just a flicker or trace of contraction (visible contraction without visible joint movement).
- Grade 0 = no contraction

ABNORMAL REFLEXES

- Primitive Reflexes or Atavistic Reflexes
- present at birth or with very early stages of the nervous system development and disappear in most people in early infancy (in some patients may not dissapear and persistence of single reflex does not represent a reliable sign of abnormity)
- The *snout reflex* can be assessed by gently tapping over the patient's upper lip. If this reflex is present, a puckering of the lips will be seen. The snout reflex is present in 30% to 50% of healthy adults over age 60

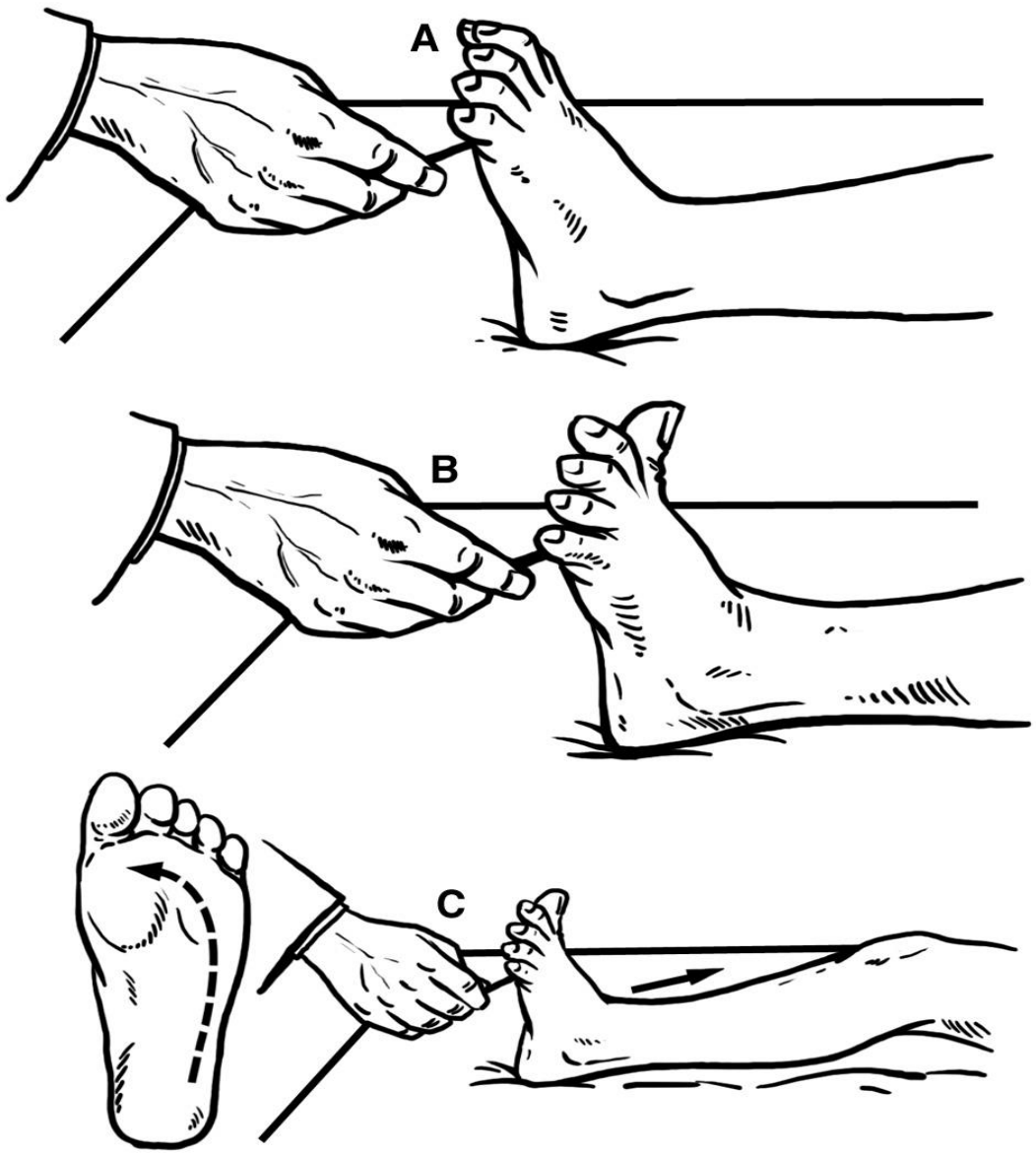


A B

ATAVISTIC REFLEXES

- A *suck reflex* may also be elicited and is considered a more worrisome reflex. When present, the suck reflex is elicited by stimulation of the lips; this is followed by sucking movements of the lips, tongue, and jaw.
- The *palmomental reflex* is an ipsilateral contraction of the mentalis and orbicularis oris after stimulation of the thenar region of the hand. This reflex is present in 20% to 25% of healthy adults in their thirties and forties.
- The *grasp reflex* (physiological in infants, sign of deliberation of frontal lobes) – patient grasps the examinator fingers inserted into his/her hands (palms). When being ased, patient does not know why he/she performed the grasp maneuver. Alternatively: is elicited by stroking the palm of the patient's hand. The reflex is present if the patient's fingers flex or the hand closes.

ABNORMAL REFLEXES (EXTENSION)



- Elicited by scratching the skin (not painful!) of the bottom of the foot along its lateral aspect from the heel forward
- A = plantar reflex (normal response = flection of the foot and toes)
- B = Babinski sign (extensor plantar response)
- C= Triple flexion response (a spinal reflex characterized by hip and knee flexion accompanied by ankle dorsiflexion)

ABNORMAL REFLEXES - LE

- Other abnormal reflexes with *EXTENSOR RESPONSE*:
  - **Roch** - scratching the skin of lateral aspect of the foot from the heel forward to the half of the distance hell-fingers
  - **Chaddock** - scratching the skin below the external ankle
  - **Oppenheim** – stimulation of the skin of anterior aspect of the shank (crura) by the examinator thumb and second finger
  - **Gordon** – distal calf massage

- Abnormal reflexes with *FLEXOR RESPONSE*:
  - **Rossolimo**: tapping the balls of the fingers (from plantar aspect) by hammer produces their flection

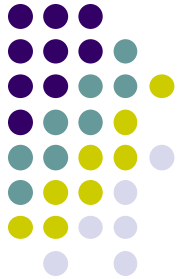
ABNORMAL REFLEXES - UE

- **JUSTER PHENOMENON (CUTANEOUS OR SUPERFICIAL REFLEX,** counterpart of an extensor plantar reflex, a positive proof of pyramidal tract dysfunction): Elicited by scratching the skin of the palm along its lateral aspect (antithenar side) in the distal direction and then along the metacarpo-phalagneal joints to the thumb.
  - Normal reaction = no reaction
  - Slow tonic slight adductuion of the thumb with slight opposition represents abnormity = sign of pyramidal dysfunction

ABNORMAL REFLEXES - UE

- **TRÖMNER´S SIGN -** with the fingers of the patient partially flexed, the tapping of the **volar** aspect of the tip of the middle or index finger
- https://www.youtube.com/watch?v=59Tw9hbbAZE
- **A HOFFMANN REFLEX** — evoked by flicking a **dorsal** aspect of the relaxed finger tip with the fingers held in semiflexion
- https://www.youtube.com/watch?v=saUkeRHkeCw
  - Positive response in both of them = flexion of all four fingers and thumb;
  - simply implies increased muscle tone
  - not a direct counterpart of an extensor plantar reflex, which is positive proof of pyramidal tract dysfunction

FLACCID VS. SPASTIC PARESIS (CENTRAL VS. PERIPHERAL)



- The term "flaccid" indicates the absence of spasticity or other signs of disordered central nervous system motor tracts such as hyperreflexia, clonus, or extensor plantar responses

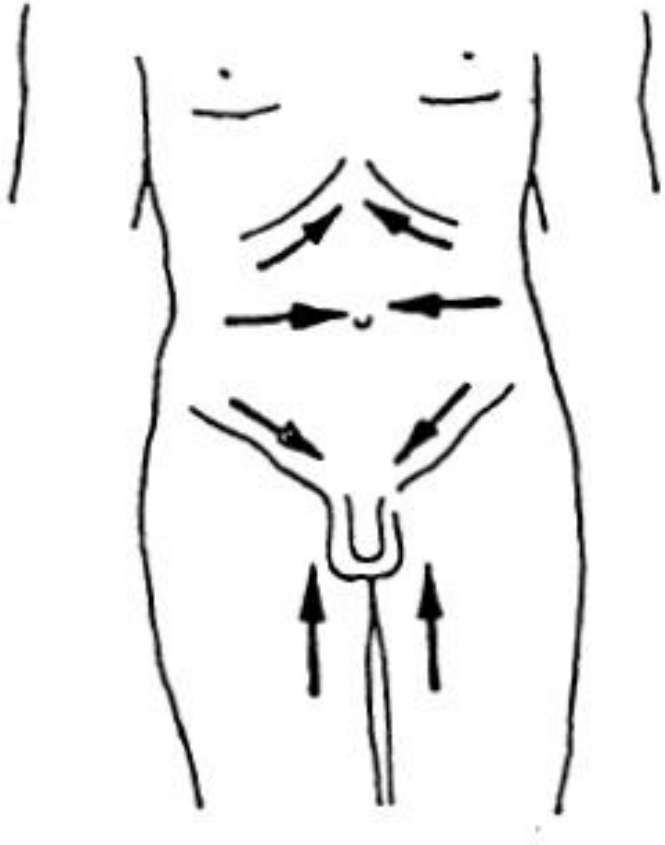
- **Spastic paresis = central** (upper motor neuron dysfunction)
- **Flaccid paresis = peripheral** (lower motor neuron dysfunction)

  - Following the sudden development of central paresis (stroke…), the central paresis is flaccid for few days (weeks?)

CUTANEOUS REFLEXES (TRUNK)

abdominal reflexes (superficial) :

epigastric (T6-9)
mesogastric (T9-11)
hypogastric (T11-L1)



EXTEROCEPTIVE REFLEXES

= decreased both in central and peripheral nerve lesions

CEREBELLUM

- **located in the posterior cranial fossa**
- **It is separated from the overlying cerebrum by a layer of dura mater (called tentorium cerebelli)**
- two hemispheres + a narrow midline zone (the vermis)
- Superficial cortex (grey matter)
- white matter in the depth

- **FUNCTION**
- Important role in the motor control
- contributes to coordination, precision,
- and accurate timing of precise movements
- Responsible for muscle synergy
- **Modifies the muscle tone**
- Upright body position, balance maintenance

COORDINATION (CEREBELLUM): TERMS

- ***ATAXIA*** denotes a syndrome of imbalance and incoordination involving gait, limbs, and speech
- lack of voluntary coordination of muscle movements
- usually results from a disorder of the cerebellum or its connections

- ***DYSMETRIA*** refers to a lack of coordination of movement typified by the undershoot or overshoot of intended position with the hand, arm, leg, or eye. It is a type of ataxia.
- ***HYPERMETRIA and HYPOMETRIA*** refer, respectively, to overshooting and undershooting the intended position

- ***DYSDIADOCHOKINESIA, DYSDIADOCHOKINESIS, (***from Greek *dys* "bad", *diadocho* "receive", *kinesia* "movement) – a term for an impaired ability to perform rapid, alternating movements (i.e. diadochokinesia). Complete inability is called adiadochokinesia

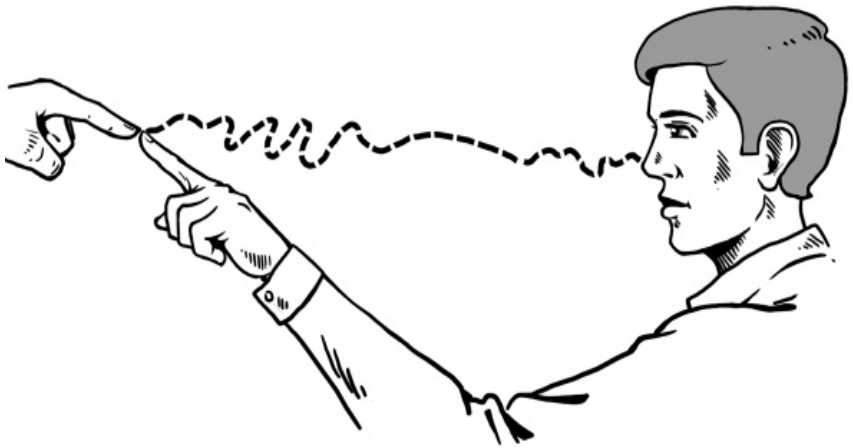
TESTS FOR CEREBELLAR FUNCTION

- ***RAPID ALTERNATING AND REPETITIVE MOVEMENTS*** (supination – pronation – symmetry?) *(ADIADOCHOKINESIA?)*
- ***FINGER TO NOSE / HEEL TO SHIN TESTS*** (NEXT SLIDE)
- ***STEWART-HOLMES TEST:*** The subjects are asked to perform a strong isometric biceps contraction (UE flexed in elbows) against resistance, performed by examiner. Sudden release of the resistance, the healthy patient is able to stop his hand immediately, the patient with cerebellar dysfunction may not be able to stop his hand fast enought (prevent hitting the face!)
- ***WALKING, AND RUNNING***
- note involuntary movements (e.g., tremor, dystonia, chorea, athetosis, tics, myoclonus) and conditions under which they are enhanced or suppressed.
- Note abnormal gait (e.g. waddling, wide based, tiptoed).

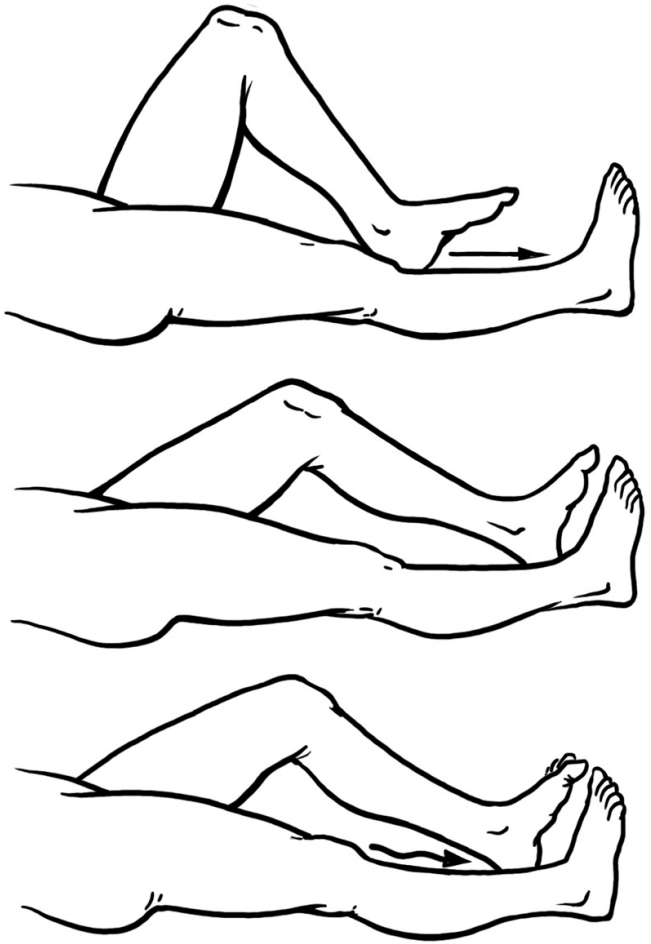
EVALUATION OF ATAXIA AND DYSMETRIA

- **UPPER EXTREMITIES**
- ***FINGER TO NOSE TEST***
  - Eyes opened
- OR ONLY TOUCH OF THE NOSE BY THE INDEX FINGER – eyes opened or closed

- Missing of the goal: ***DYSMETRIA***
- Overshooting: ***HYPERMETRIA***



- **LOWER EXTREMITIES**
- ***HEEL TO SHIN TESTS***



CEREBELLAR SYNDROMES

- The result of the dysfunction of the cerebellum or its pathways
- IPSILATERAL!!!

- **PALLEOCEREBELLAR SYNDROME** (vermis dysfunction)
  - Dyscoordination of the stance and gait (a broad-based gait, „drunken sailor“)
  - The ataxia of whole the body including axial muscles.

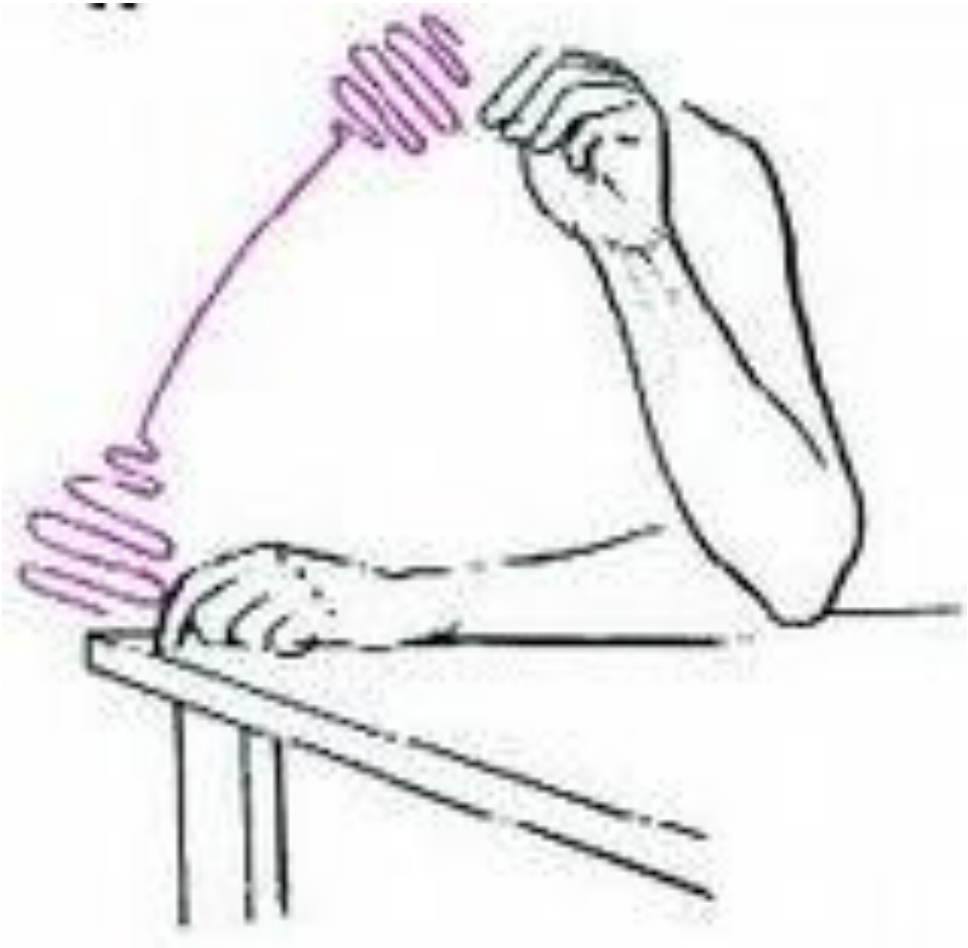
- **NEOCEREBELLAR SYNDROME** (hemispheral dysfunction)
  - The lack of coordination of limb muscles
  - Ataxia
  - dysmetria
  - dysdiadochokinesia
  - hypotonia (decreased muscle tone),
  - intention tremor

CEREBELLAR TREMOR

- involuntary movement caused by alternating contractions of opposing muscle groups),
- ***ACTION*** (only during the movement, minimal or no tremor at rest)

- ***INTENTIONAL*** =
  - the amplitude increases before the goal
  - Patrly increased also at the beginning of the movement

- ***Atactic = GROSS, IRREGULAR***



EXTRAPYRAMIDAL SYSTEM

- ***EXTRAPYRAMIDAL SYSTEM*** is a neural network that is part of the motor system that causes involuntary reflexes and movement, and modulation (tuning) of movement (i.e. coordination).

- The disorders of extrapyr. system usually cause two types of symptoms:
- 1. **PARKINSONISM (PARKINSON´S SYNDROME**) characterized by tremor, hypokinesia, rigidity, and postural instability
- 2. abnormal involuntary movements, i.e. **HYPERKINESIAS OR DYSKINESIAS,** terms used interchangeably
  - are usually evident when a patient is at rest,
  - are frequently increased by action,
  - and disappear during sleep (with some exceptions – e.g. myoclonus can persist in sleep).

HYPERKINESIAS

- ***CHOREA*** delineates brief, irregular contractions and movements (that, although rapid, are not as lightning-like as myoclonic jerks). The jerks affect individual muscles as random events that seem to flow from one muscle to another. They are not repetitive or rhythmic.
- presumably related to disorders of the caudate nucleus (sometimes not)

- ***BALLISM*** is a form of chorea in which the choreic jerks are of large amplitude, producing flinging movements of the affected limbs.
- often related to lesions of the subthalamic nucleus.

- The term ***MYOCLONUS*** refers to ultrabrief, shock like movements that may arise from contractions or inhibitions (negative myoclonus) – various topics

- ***TREMORS*** are rhythmic oscillatory movements. They result from alternating contractions of opposing muscle groups (e.g., parkinsonian tremor at rest) or from simultaneous contractions of agonist and antagonist muscles (e.g., essential tremor).

DYSTONIA

- ***DYSTONIA I***s a syndrome of sustained muscle contraction that frequently causes twisting and repetitive movements or abnormal postures. Dystonia is represented by the following presentations:
- (1) sustained contractions of both agonist and antagonist muscles simultaneously (cocontraction) and persisting in the same muscle groups repeatedly (“patterning”), in contrast to the flowing of choreic movements;
- (2) an increase of these involuntary contractions when voluntary movement in other body parts is attempted (“overflow”);
- (3) rhythmic interruptions (*dystonic tremor*) of these involuntary, sustained contractions when the patient attempts to oppose them;
- (4) inappropriate or opposing contractions during specific voluntary motor actions (*action dystonia*); and
- (5) torsion spasms that may be as rapid as chorea but differ because the movements are continual, patterned, and of a twisting nature in contrast to the random and seemingly flowing movements of chorea.

GAIT AND BALANCE

- SPONTANEOUS GAIT should be observed; stance, base, cadence, arm swing,
- tandem gait (straight line), toe + heel walking, walking backward eventually hopping on one foot should be noted

- Postural stability should be assessed by the PULL TEST (examiner abruptly pulls the patient off balance – usually backwards - while being ready to catch the patient in the event of a fall)

- Examination of the stand stability: ROMBERG TEST: Stand with eyes open and then closed (I= normal stand, II= stand with both feet together, III = + eyes closed, IV = + rotation of the head to the right or V= left)

EVALUATION OF SENSORY DEFICITS

On each limb, trunk, face

- Pinprick and light touch (wisp of cotton) on hands and feet
- Test tubes filled with cold and warm water to test temperature sensation
- Double simultaneous stimuli on hands and feet
- Joint position sense in hallux and index finger
- Vibration sense at ankle and index finger

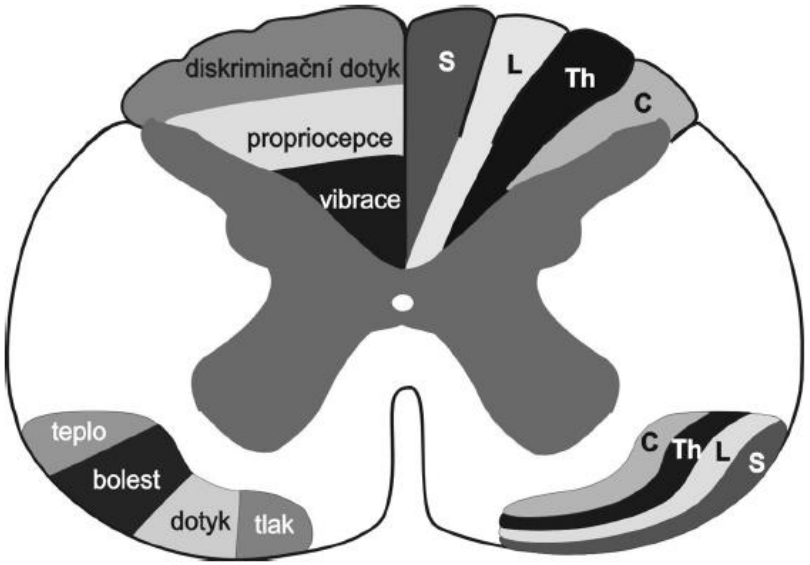
COMPARATIVE PRINCIPLE.

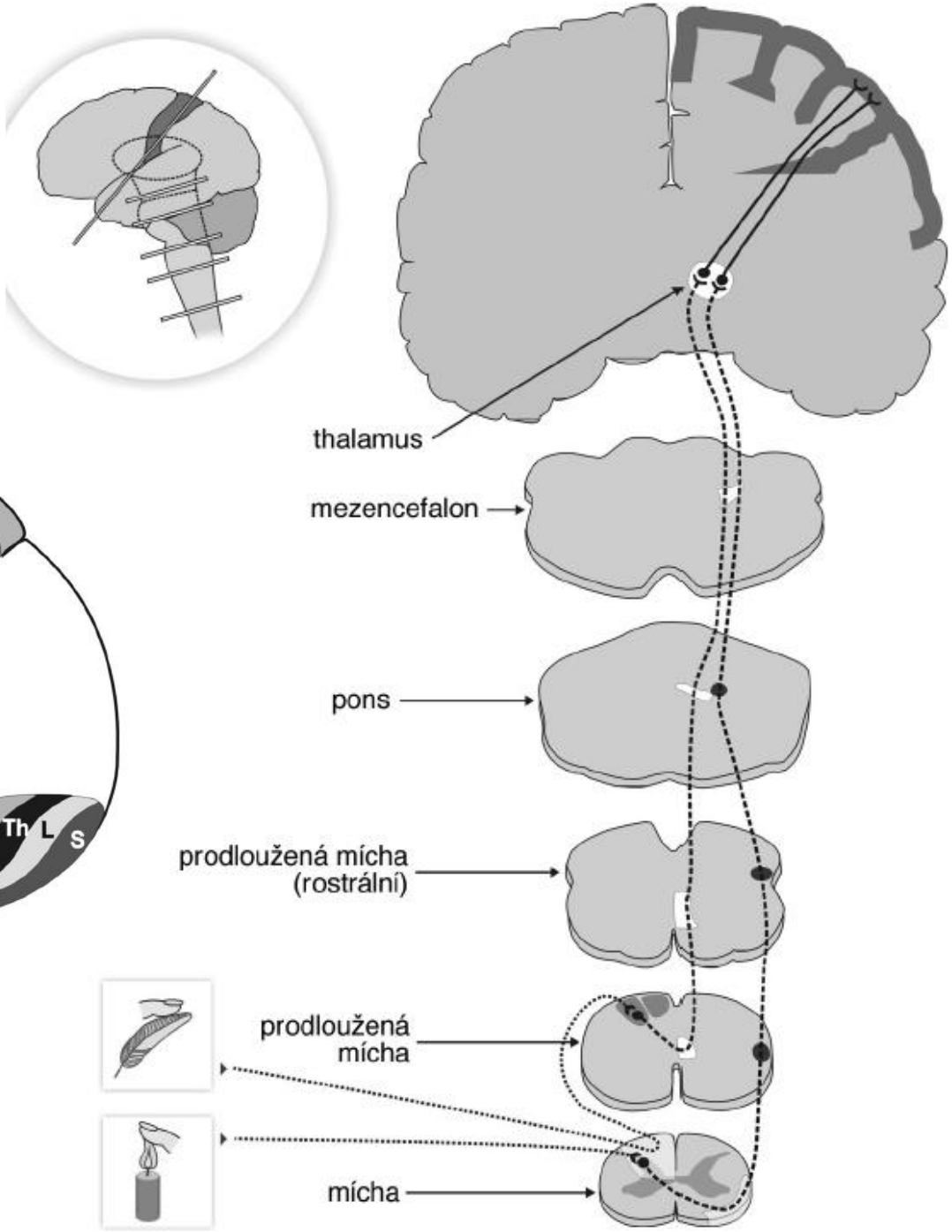
SENSORY LEVELS

Hypoesthesia/ anesthesia….. **for each of the modalities**

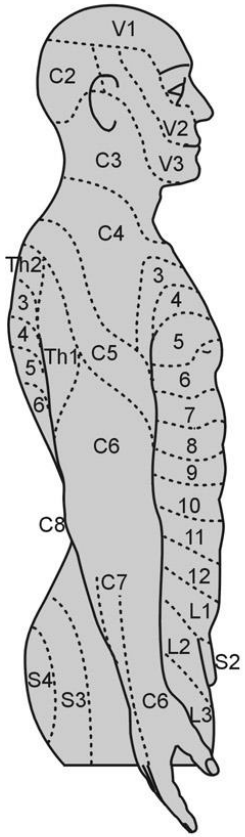
Hyperalgesia/ hypoalgesia/ alodynia **-II-**

SENSORY PATHWAY





DERMATOMES


V1
C2
V2
C3
V3
C4
Th2
3
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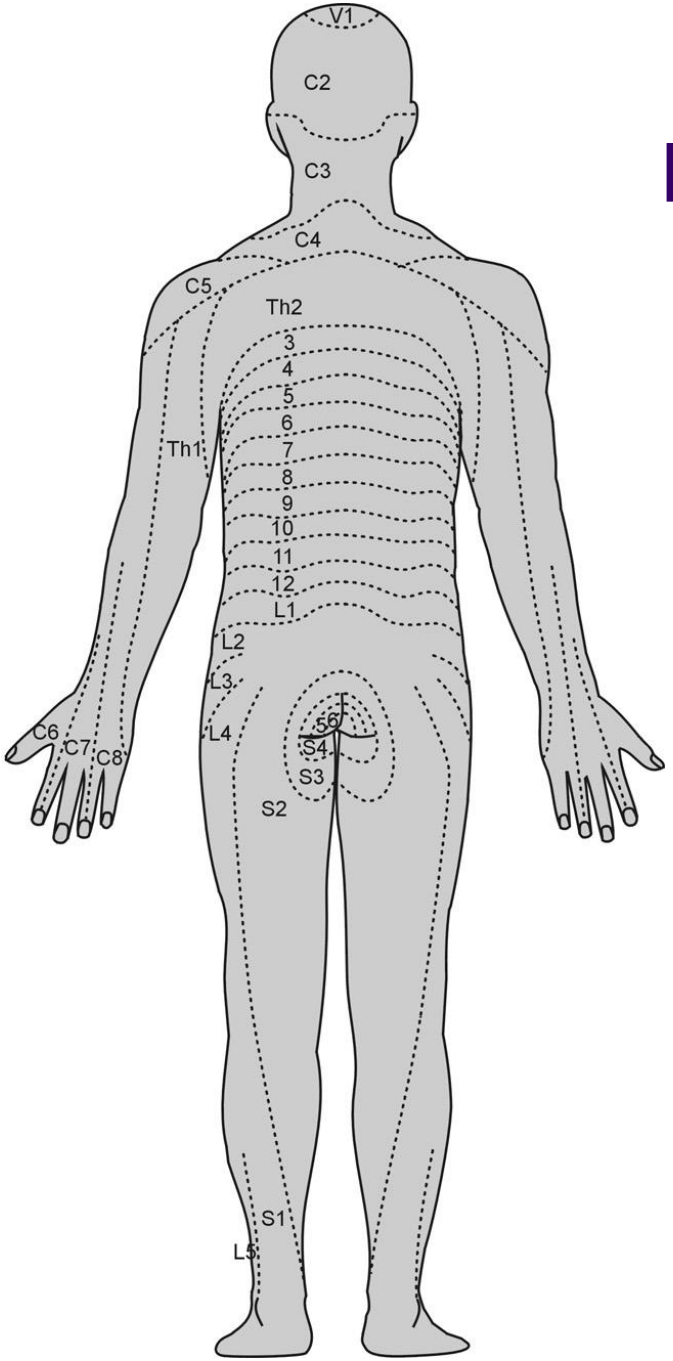
5
6
Th1
C5
C6
C7
C8
L1
L2
L3
S2
S3
S4


V1
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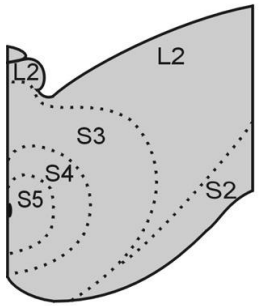
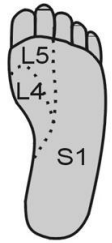
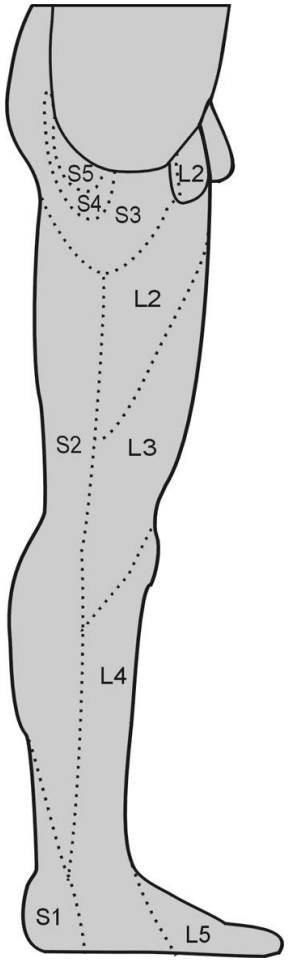
S4
S5
C6
C7
C8


L2
L2
S3
S4
S5
S2


L5
L4
S1


S5
L2
S4
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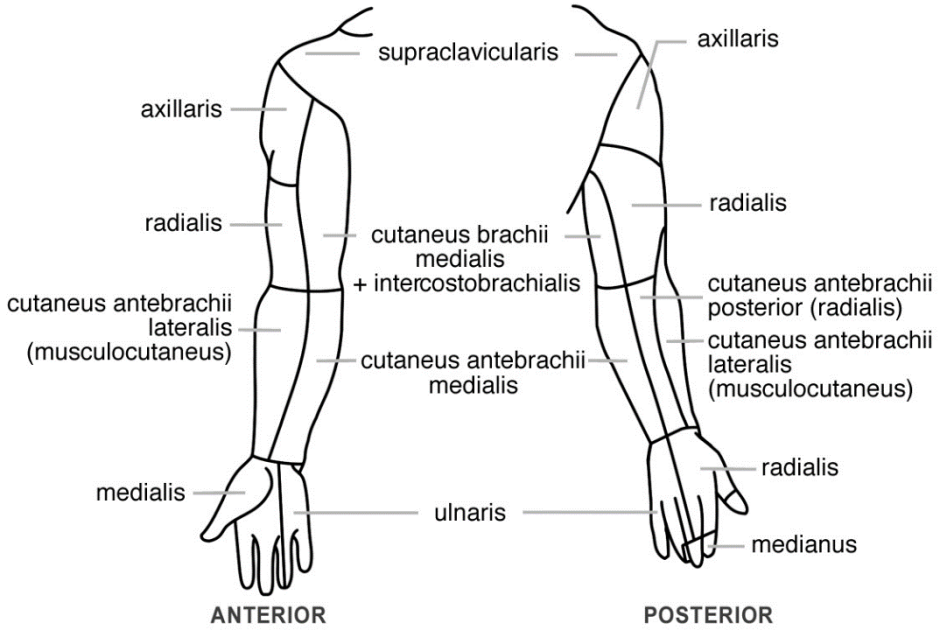
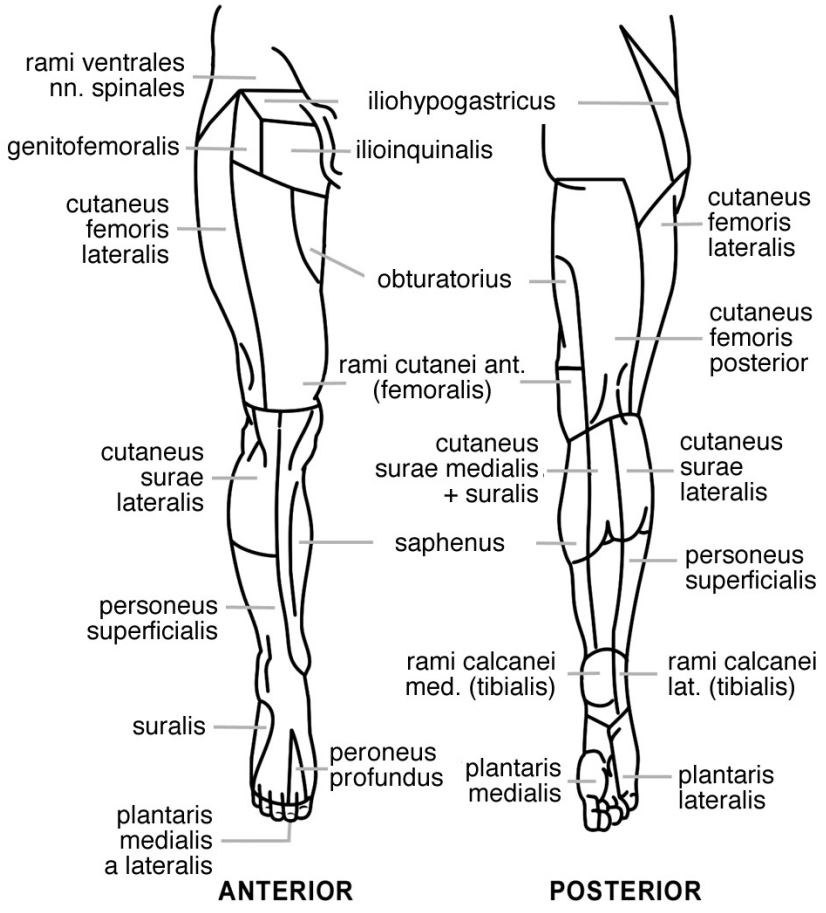
S1
L5

PERIPHERAL NERVOUS SYSTEM – SENSORY NERVES

Areae nervinae





MENINGEAL SYNDROME: CLINICAL EXAMINATION (OBJECTIVE SIGNS)

UPPER

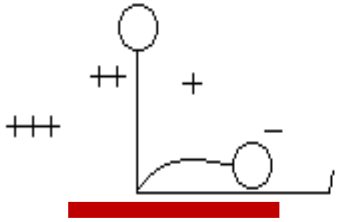
- **NUCHAL RIGIDITY**
- **BRUDZINSKI: forced flexion of the neck elicits a reflex flexion of the hips, with the patient lying supine.**

opozice šíje

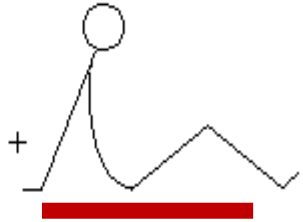
Brudziński

MIDDLE

- **SPINE SIGN** – inability to touch the knees by the head
- **KERNIG I.** –knee flection during passive sitting
- **AMOS SIGN** – when sitting, support by the arm /behind the trunk/ is necessary



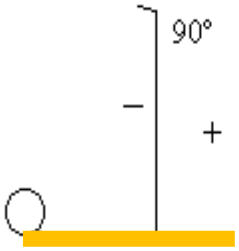
spine sign



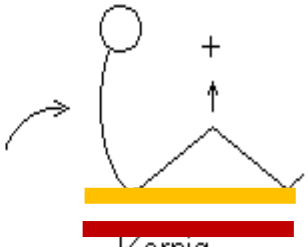
Amoss (trojnožka)

LOWER

- **LASSEGUE**;
- **KERNIG II.** – in lying patient with the hip and knees flexed in 90 degree ankle, the extensior of the knees is not possible.



Lasègue



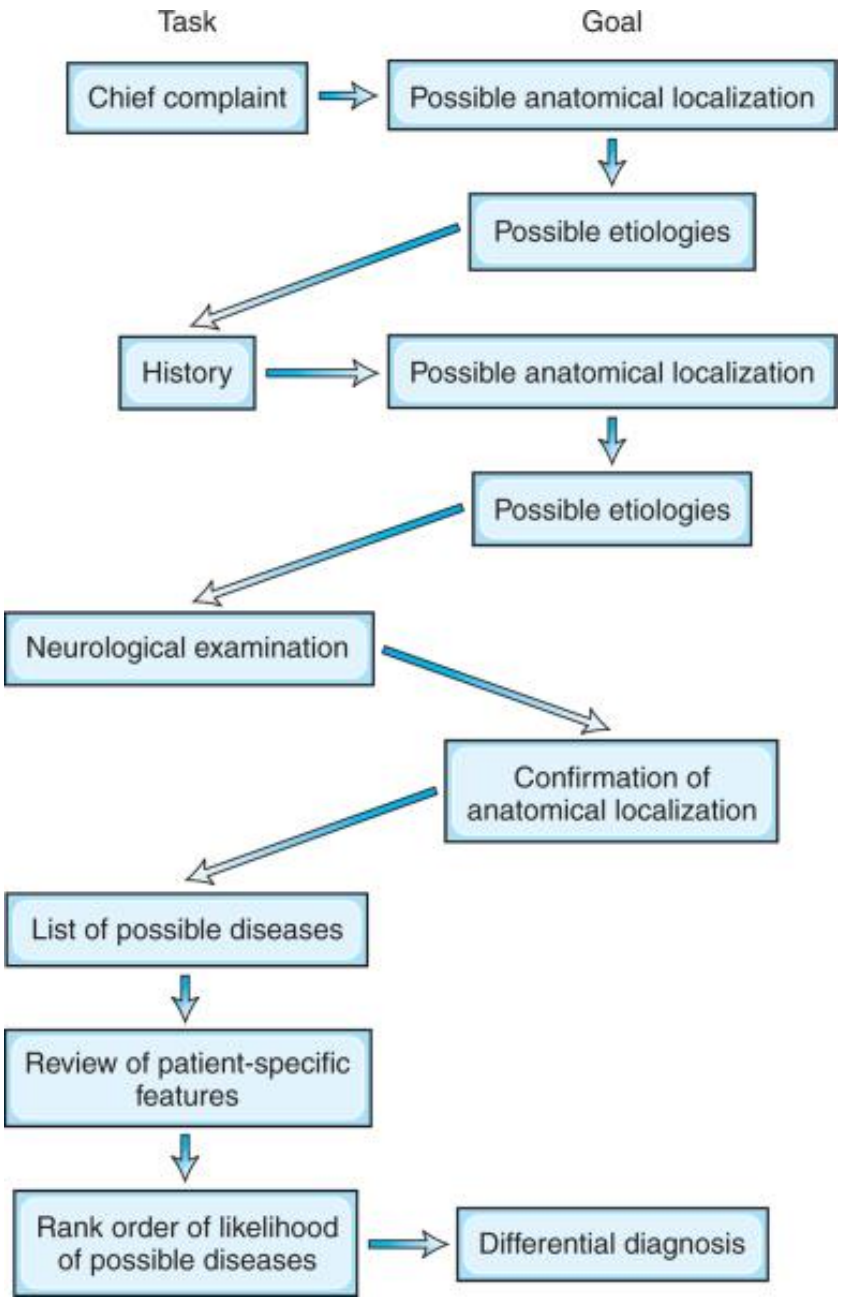
Kernig

OTHER SIGNS ATTRIBUTED TO BRUDZINSKI

The **symphyseal sign**, in which pressure on the pubic symphysis leads to abduction of the leg and reflexive hip and knee flexion.

The **cheek sign**, in which pessure on the cheek below the zygoma leads to rising and flexion in the forearm.

Brudzinski's reflex, in which passive flexion of one knee into the abdomen leads to involuntary flexion in the opposite leg, and stretching of a limb that was flexed leads to contralateral extension.



THE DIAGNOSTIC PATH IN NEUROLOGY

Illustrated as a series of steps in which the neurologist collects data (Task) with the objective of providing information on the anatomical localization and nature of the disease process (Goal).

EXAMINATION OF CONSCIOUSNESS

- assessed while recording the history

TWO TYPES OF ALTERATION OF THE CONSCIOUSNESS (a state of awareness of self and surroundings):

- The first type AFFECTS AROUSAL – described on four levels (not very accurate – more than this it is a continuum of subtly changing status)
  - *ALERT* – perfectly normal state of arousal
  - *LETHARGY* (drowsinness) – between alertness and stupor („sleepy“, fine stimuli enough)
  - *STUPOR* – a state of baseline unresponsiveness that requires repeated application of vigorous stimuli to achieve arousal
  - *COMA* - coma is a state of complete unresponsiveness to arousal, in which the patient lies with the eyes closed

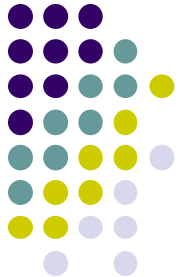
- The second type INVOLVES COGNITIVE AND AFFECTIVE MENTAL FUNCTION, sometimes referred to as the “content” of mental function (dementia, delusions, confusion)

THE GLASGOW COMA SCALE

BEST MOTOR RESPONSE:	
Obeys	6
Localizes	5
Withdraws	4
Abnormal flexion	3
Extensor response	2
Nil	1
VERBAL RESPONSE:	
Oriented	5
Confused conversation	4
Inappropriate words	3
Incomprehensible sounds	2
Nil	1
EYE OPENING	
Spontaneous	4
To speech	3
To pain	2
Nil	1

- Widely used scale to assess the initial severity of traumatic brain injury.
- Separate assessment of three aspects of a patient's behavior: the stimulus required to induce eye opening, the best motor response, and the best verbal response
- Each symptom is scored, sum score is obtained
- Simple and reproducible
- An ideal method of assessment for non-neurologists involved in the care of comatose patients
- Limited use in patients who are intubated or who have suffered facial trauma or have aphasia.

MENTAL STATUS EXAMINATION



Partially assessed already while **RECORDING THE HISTORY** –insight can be gained into the subject's recent memory, orientation, language function, affect or mood, insight, and judgment.

Must not be omitted even in patients who seem “alert and oriented“ (subtle deficits may be masked by formal social contact)

- **ORIENTATION** (time, place, person, situation)
- **MEMORY**: immediate (recalling of 3 unrelated words X reproducing drawings)
  short-term: hours to weeks
  long-term (remote): decades (names of children x other relatives – verified by relative)
- **FUND OF INFORMATION** (recent presidents or other political figures, athletic stars or television celebrities)
- **SPEECH AND LANGUAGE** (spontaneous speech, naming, repetition, auditory comprehension, reading+ writing)
- **PRAXIS** (use of both imaginary and real objects – „Show me what to do with a saw, hammer, or pencil)
- **CALCULATIONS** (serial-7 subtraction test)
- **VISUAL-CONSTRUCTIONAL ABILITIES** (line bisection, copying a cube or other design, drawing a clock or a house, MMSE - copying of intersecting pentagons)
- **INSIGHT AND JUDGMENT** : tested by assessing the patient's understanding of his own illness
  - interpretation of proverbs, such as “Those who live in glass houses should not throw stones „
  - stating why an apple and an orange are similar
- **ABSTRACT REASONING, SEQUENTIAL PROCESSES**

MMSE - BEDSIDE MENTAL STATUS TESTING

- Folstein's Mini-Mental State Examination (MMSE) - perhaps the most widely used test.

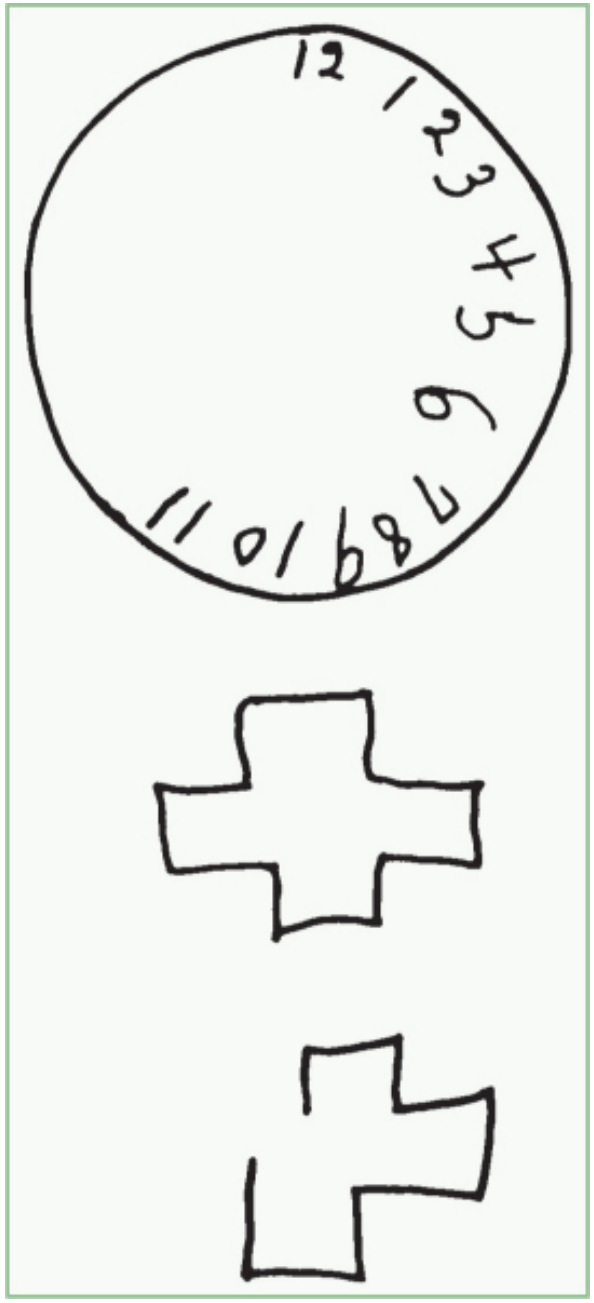
- **CONSISTS OF 30 POINTS**:
  - 5 for orientation to time (year, season, month, date, and day)
  - 5 for orientation to place (state, county, town, hospital, and floor)
  - 5 for attention (either serial 7subtractions from 100 with 1 point for each of the first five or "spell *world* backward")
  - 3 for registration of three items (unrelated words - shovel, scarf, vase)
  - 3 for recall of three items after 5 minutes
  - 2 for naming a pencil and a watch
  - 1 for repeating "no ifs, ands, or buts"
  - 3 for following a three-stage command (take the paper, fold it, lay it down to the floor)
  - 1 for following a printed command ("close your eyes")
  - 1 for writing a sentence
  - 1 for copying a diagram of two intersecting pentagons

MMSE

THE ADVANTAGES: short time of administration and quantitation, useful in documentation for changes of clinical status.

THE DISADVANTAGES:

- the normal range of scores depends on education. (The low-normal cutoff 19 for uneducated people, 23 for graduates of elementary or junior high school, 27 for high school graduates, and 29 for college graduates).
- depends on age
- the test is weighted toward orientation and language, and results can be normal in patients with right hemisphere or frontal lobe damage.
- even an abnormal score does not distinguish a focal lesion from a more diffuse disorder, such as an encephalopathy or dementia.



SPONTANEOUS CLOCK DRAWING AND COPYING OF A CROSS TESTS

Spontaneous clock drawing and copying of a cross by a patient with a right parietal infarction. The patient had only mild hemiparesis but dense left hemianopia and neglect of the left side of the body. The neglect of the left side of space is evident in both drawings

EXAMINATION OF LANGUAGE FUNCTIONS

- Monitored during the clinical interview (minor word-finding difficulty, occasional paraphasic error, turn-taking in conversation and the use of humor and iron)

BEDSIDE LANGUAGE EXAMINATION

6 steps to complex assessment of language function

1. **SPONTANEOUS SPEECH**
   - **a.** Informal interview
   - **b.** Structured task (ask the patient to describe the weather or the reason for coming to the doctor)
   - **c.** Automatic sequences (recitation of lists, such as counting or listing days of the week)

PARAMETERS OF SPONEOUS SPEECH

- Fluency: fluent= effortless and rapid
  nonfluent speech = uttered in single words or short phrases, with frequent pauses and hesitations
- Initiation difficulty
- Articulation, phonation or voice volume
- Rate of speech and a presence of word-finding pauses and circumlocutions
- Prosody or melodic intonation of speech
- Phrase length
- Content
- Errors such as neologisms or paraphasias (= substitutes one word/phonem for another)
  - *Phonemic paraphasia*, also *literal paraphasia* – Mispronunciation – treen/ train.
  - *Verbal paraphasia* - Substitution of words
    - *Semantic paraphasia* - The substituted word is related to the intended word by content. e.g. „I spent the whole day working on the television (computer)."
    - *Morphologic paraphasia* - The substituted word is similar by its form, e.g. „you are lazy (crazy).

BEDSIDE LANGUAGE EXAMINATION - II

2. NAMING (name objects, object parts, pictures, colors, or body parts to confrontation)

3. AUDITORY COMPREHENSION

- ask the patient to follow a series of commands of one, two, and three steps
- CAVE APRAXIA: the inability to carry out a motor command despite normal comprehension and normal ability to carry out the motor act in another context.
- nonsense questions (e.g., “Do you vomit every day?”) - tendency of some aphasics to cover up comprehension difficulty with social chatter.

4. REPETITION

- better repetition of familiar or “high-probability” phrases than unfamiliar ones = “no ifs, ands, or buts”.!

5. READING

- **a.** Reading aloud
- **b.** Reading comprehension

6. WRITING = most sensitive indicator of mild aphasia, record for future

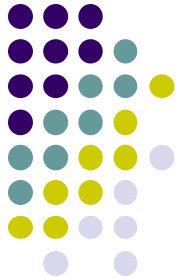
- **a.** Spontaneous sentences
- **b.** Writing to dictation
- **c.** Copying

EXAMINATION OF CRANIAL NERVES – I, II

- I: Gross assessment – ask the patient about the ability to smell and changes of foot flavor
  - More detailled testing: in all persons who experience spontaneous loss of smell, in patients suspected to have Parkinson's disease, and in patients who have suffered head injury
  - familiar odoriferous substance (using a small bottle of coffee, oil of cloves, or oil of peppermint, soap) held beneath each nostril in turn while the other is occluded by a finger.

- II: *Each eye*:Gross visual acuity (optotypes)
  - Visual fields by confrontation (perimeter)
  - Funduscopy

EXAMINATION OF CRANIAL NERVES – III, IV, VI



- III, IV, VI:
  - Horizontal and vertical eye movements (full range of movements/ limitations)
  - Position of the ocular bulbi: parallel, squint (=strabismus – convergent, divergent)
  - Presence of nystagmus or other ocular oscillations
    - Nystagmus: direction, degree, amplitude, frequency
  - Pupil size (norma – midposition, miotic, mydriatic, symmetry – isocoria, anisocoria)
  - Pupil shape (round, irregular)
  - Pupillary response to light – direct (illuminated pupil), indirect (consesual)
  - Ability of convergence and pupilary reaction to it (constriction)

EXAMINATION OF CRANIAL NERVES – V, VII, VIII

- V: Pinprick and touch sensation on face

  corneal reflex

  pressure to points where the 3 divisions emerge from the bone - painful ?

- VII: facial symmetry in rest and action (Close eyes, show teeth: wrinkles, eyebrows, mouth angle drop)

- VIII: Perception of whispered voice in each ear or rubbing of fingers; if hearing is impaired, look in external auditory canals and use tuning fork for lateralization and bone versus air sound conduction

  No vertigo, no tinnitus

EXAMINATION OF CRANIAL NERVES – IX-XII

- IX, X: Palate (uvula) in rest in the midline position,
  - lifts symetrically during phonation,
  - no dysarthria, no dysphonia (hoarse voice)

  Gag reflex (pharyngeal reflex) = a reflex contraction of the back of the throat evoked by light touching the soft palate (e.g. by cotton wool bud)

  Palate reflex: particular (left or right) palatine arch lifts slighly in a response to slight touch of particular arch

- XI: Shrug shoulders, turn (rotate) the head against counteraction

- XII: Protrude tongue (tongue position in rest in the mouth and during protrusion) (mid-position,no atrophy,no fasciculations)

EXAMINATION OF THE NECK

- **cervical column** - movement and its limitation in directions of motion
  - forward flexion – anteflexion
  - extension – retroflexion
  - lateral flexion
  - Rotation

- **carotid arteries** : auscultation for the sake of bruits

MAIN SOURCE OF INFORMATION

Daroff RB, Jankovic J, Mazziotta JC, Pomeroy SL. Bradley's Neurology in Clinical Practice, 7th Revised edition. Philadelphia US: Elsevier 2015

Lewis ED, Mayer SA, Rowland LP. Merritt's Neurology, 13th edition. LWW 2015.

Ambler Z, Bednařík J, Růžička E (eds.). Klinická neurologie (část obecná). Praha: Triton 2015 (most of the pictures)