11. scissoring
12. wide base of support

4.3 Neurological examination

Neurologické vyšetření

General considerations

1. Explain each examination technique to the patient prior to assessment.
2. Always consider left to right symmetry.
3. Consider central vs. peripheral deficits.

4.3.1 Mental status/Cognition

Psychický stav/kognice

1. Level of consciousness (LOC)	úroveň vědomí
2. Orientation (to person, time, place, situation)	orientace (osobou, časem, místem, situací)
3. Level of cognitive functioning	kognitivní funkce
4. Ability to follow commands	schopnost plnit povely
5. Language ability and comprehension	jazykové schopnosti a porozumění
6. Neglect, perceptual impairments	opomíjení, poruchy percepce
7. Safety awareness	povědomí o bezpečnosti

The common scale for measuring level of consciousness is Glasgow Coma Scale.

4.3.2 Motor assessment

Vyšetření motoriky

- **Involuntary movements**
- **Mimovolní pohyby**

Tremor, oscillation, chorea, dystonia, hemiballismus, fasciculation.

- **Muscle bulk**
- **Svalová hmota**

Muscle symmetry (left to right, proximal versus distal)
Atrophy or hypertrophy (pay particular attention to the hands, shoulders, and thighs)

- **Muscle tone**
- **Svalový tonus**

For assessment in the upper extremities, the patient may be lying or sitting. In the lower extremities, tone is best assessed with the patient lying down. Ask the patient to relax. Flex and extend the patient's fingers, wrist, and elbow. Flex and extend patient's ankle and knee.

There is normally a small, continuous resistance to passive movement. Observe for decreased (flaccid) or increased (rigid/spastic) tone. Use special tests for further evaluation of muscle tone (Modified Ashworth Scale etc.)

Spasticity („clasp knife") is velocity dependent and should be assessed by a quick flexion/extension of the knee or the elbow or quick supination/pronation of the arm.

Rigidity („cogwheel") is continuous and not velocity dependent so the testing movement should be performed slowly. There is a resistance to passive movement that may make the limb feel like a „lead pipe." When **rigidity** and tremor are present at the same time, the examiner may be able to feel „cogwheeling." Rigidity may be enhanced by having the patient activate the opposite limb („Activated" rigidity).

- **Myotome testing**
- **Testování myotomů**

Myotome is a group of muscles supplied by a single nerve root. To test muscle strength in myotomes have the patient perform: upper cervical flexion (C1 and C2 root), cervical lateral flexion (C3), shoulder girdle elevation (C4), shoulder abduction (C5), elbow flexion (C6), elbow extension (C7), thumb extension and finger flexion (C8), finger abduction and adduction (T1), hip flexion (L2), knee extension (L3), dorsiflexion (L4), great toe extension (L5), eversion, contract buttock, knee flexion (S1), knee flexion and toe standing (S2).

4.3.3 Reflexes

Reflexy

- **Deep tendon reflexes (DTR, also called jerks or muscle stretch reflexes)**
- Šlachookosticové reflexy

include the biceps (C5, C6), triceps (C6, C7), brachioradialis (C5,C6), patellar (knee jerk, L2, L3, L4), and the Achilles tendon (S1, S2) reflex. An instrument called a reflex hammer is used to assess DTR. Although deep tendon reflexes aren't routinely assessed, they should be tested in any patient with a spinal cord injury or with the signs of nerve root irritation. Reflexes can be reinforced by having the patient perform isometric contraction of other muscles (clenched teeth).

Tendon Reflex Grading Scale:

0 Absent
1+ Hypoactive
2+ Normal
3+ Hyperactive without clonus
4+ Hyperactive with clonus

- **Pathologic reflexes**
- Patologické reflexy

Clonus
If the reflexes seem hyperactive, test for ankle clonus: more then three rhythmic contractions of the plantar flexors in response to sudden passive dorsiflexion. Clonus indicates upper motor neurone lesion.

Plantar response (Babinski)
The plantar reflex is a superficial reflex that should be tested in comatose patients and in those with suspected injury to the L4–5 or S1–2 areas of the spinal cord.

Stroke the lateral aspect of the sole of each foot with the handle of a reflex hammer or key. Note movement of the toes, normally plantar flexion. Extension of the big toe with fanning of the other toes is abnormal. This is referred to as a positive Babinski. It indicates upper motor neurone lesion except in children younger than 2 years.

- **Superficial reflexes**
- **Kožní reflexy**

Abdominal – above umbilicus (T8, T9, T10) and below umbilicus (T10, T11, T12). Use a blunt object such as a key or tongue blade. Stroke the abdomen lightly on each side in an inward and downward direction above (T8, T9, T10) and below the umbilicus (T10, T11, T12). Note the contraction of the abdominal muscles and deviation of the umbilicus towards the stimulus.

- **Brain stem reflexes**
- **Kmenové reflexy**

Physicians assess brain stem reflexes in stuporous or comatose patients to determine if the brain stem is intact. They include **oculocephalic, or doll's eye**, reflex and the **oculovestibular reflex** (also known as the **ice caloric or cold caloric reflex**).

4.3.4 Coordination

Koordinace

- **Upper extremity**

Rapid alternating hand movements: Ask the patient to strike one hand on the thigh, raise the hand, turn it over, and then strike it back down as fast as possible.
Finger tapping: forefinger on thumb: Ask the patient to tap the distal thumb with the tip of the index finger as fast as possible.
Finger to nose testing: Hold up your finger and ask the patient to touch your index finger and their nose alternately several times. Then have him alternately touch his nose with his right and left index fingers. Finally, have him repeat these tasks with his eyes closed. The movements should be precise and smooth and without tremors.

- **Lower extremity**

Heel-shin: Ask the patient to place one heel on the opposite knee and run it down the shin to the big toe. Repeat with the patient's eyes closed.
Foot tapping: Ask the patient to tap your hand with the ball of each foot as fast as possible. Ask the patient to perform rapid foot taps.

- **Speech**
- **Řeč**

Note any abnormalities such as aphasia, dysarthria, slurred speech, and slow speech.

4.3.5 Balance and gait

Rovnováha a chůze

- **Romberg**

If the patient is able to stand you can assess his balance using the Romberg test. Ask the patient to stand with the feet together arms at the sides, and eyes open; he should be able to stand upright with no swaying. If he can do that, have him close his eyes and stand the same way for 5–10 seconds without support. If the patient falls or breaks his stance after closing his eyes, the Romberg test is positive, indicating proprioceptive or vestibular dysfunction.

- **Berg balance scale (BBS)**

This test is designed to measure balance of the older adult in a clinical setting. The fourteen tasks evaluated in the Berg Balance Scale test include:

1. sitting unsupported
2. change of position: sitting to standing
3. change of position: standing to sitting
4. transfers
5. standing unsupported
6. standing with eyes closed
7. standing with feet together
8. tandem standing (with one foot in front)
9. standing on one leg
10. turning trunk to look behind (feet fixed)
11. picking up object from floor
12. turning 360 degrees
13. stool stepping
14. reaching forward with arm outstretched while standing

These tasks are measured on a 5 point ordinal scale. Maximum score is 56, a higher score reflects better balance; score of 45 required for independent safe ambulation.

Gait assessment is described in the chapter 4.2.9 page 84.

4.3.6 Sensory assessment

Vyšetření čití

Include the evaluation of sensation in your neuro assessment if there's a specific need, as in spinal cord injury (SCI) or stroke. The patient must be able to cooperate with the exam. He'll need to tell you whether he feels the sensation and whether both sides of his body feel it equally. Also compare distal and proximal areas of the extremities. Check dermatomes when needed. The sensory exam is performed with the patient's eyes closed. Remember, guessing will yield correct answers 50% of the time.

- **Vibration**
- **Vibrační čití**

To test vibratory sensation, use a low pitched tuning fork (128 Hz). Place the stem of the fork over the distal interphalangeal joint of the patient's index fingers and big toes. Ask the patient to tell you if they feel the vibration. If vibration sense is impaired proceed proximally: wrists, elbows etc.

- **Light touch**
- **Lehký dotyk**

Use cotton-tipped swabs or your fingers to touch the skin lightly. Ask the patient to respond „yes" whenever a touch is felt. Also test both sides simultaneously. Ask the patient to tell you if there is difference from side to side or other „strange" sensations. Test the following areas:

1. Shoulders (C4)
2. Inner and outer aspects of the forearms (C6 and T1)
3. Thumbs and little fingers (C6 and C8)
4. Front of both thighs (L2)
5. Medial and lateral aspect of both calves (L4 and L5)
6. Little toes (S1)

- **Position sense**
- **Polohocit**

Grasp the patient's big toe and hold it away from the other toes to avoid friction. Show the patient „up" and „down". With the patient's eyes closed ask the patient to identify the direction you move the toe. Test the fingers in a similar fashion. If position sense is impaired move proximally to test the ankle joint or the metacarpophalangeal joints etc.

If vibration, position sense, and light touch are normal in the fingers and toes you may assume the rest of this exam will be normal.

- **Pain**
- **Bolest**

Test superficial pain sensation with a clean, unused safety pin. Be sure not to break the skin. Also, test sensation using a dull object. The patient should be able to distinguish sharp from dull. Test the same areas as with the light touch.

- **Temperature**
- **Teplota**

Often omitted if pain sensation is normal.

Use a tuning fork heated or cooled by water or test tubes (specimen tubes) with hot and cold water and ask the patient to identify „hot" or „cold". Test the same areas as with the light touch.

- **Discrimination**
- **Diskriminace**

Two point discrimination

Use a bent paper clip to touch the patient's finger pads alternating randomly between touching the patient with one or both points. Ask the patient to identify „one" or „two." Find and record the minimal distance at which the patient can discriminate.

Graphesthesia

Explain to the patient that you will be drawing a number in the palm of their hand. Show him what is up and down, the distal side is usua-

lly up as this is a typical orientation of the palm. Demonstrate with eyes open. Ask the patient to close their eyes. With the blunt end of a pen or your fingertip, draw a large number in the patient's palm and ask the patient to identify it.

Stereognosis
Explain to the patient that you will be placing a familiar item in their hand which they should then manipulate and identify with their eyes closed. Objects include a coin, a paper clip, a pencil, a key etc.

- **Extinction (double simultaneous stimuli)**
- **Extinkce (dva simultánní stimuly)**

Tactile (sensory) extinction: With eyes open demonstrate to the patient that you will touch them on the left side, the right side or both. Have the patient close their eyes and as you deliver a gentle touch, report whether they feel it on the left side, right side or both sides.

Visual extinction: Wiggle a finger in the left, right or both visual fields and ask the patient to report where they see it.

Auditory extinction: Snap your fingers on the left, right or both sides and have the patient report where they hear the stimulus.

4.3.7 Cranial nerve assessment
Vyšetření hlavových nervů

- **Observation**

Ptosis (III)
Facial Droop or Asymmetry (VII)
Hoarse Voice (X)
Articulation of Words (V, VII, X, XII)
Abnormal Eye Position (III, IV, VI)
Abnormal or Asymmetrical Pupils (II, III)

- **Olfactory nerve (CN I)**

Usually not tested by a PT.

- **Optic nerve (CN II)**

1. **Fundoscopy:** examination of the fundus by ophthalmoscope, done by an ophthalmologist.
2. **Visual acuity:** this assessment is usually done by a physician
3. **Visual field** (extent of vision of a non moving eye)

Visual fields are assessed by confrontation, i.e. the examiner compares the patient's visual field to their own and assumes that theirs is normal.

- **Oculomotor, trochlear and abducens (CNs III, IV,VI)**

1. Observe pupil size.
2. Observe eyes: resting position: aligned or one eye is different, deviation, any abnormal movement (e.g. nystagmus).
3. **Pupillary light reflex**: Dim the lights, ask the patient to look into the distance, shine a bright light (approaching laterally) into one eye. Observe for the direct response (same eye) and consensual response (opposite eye).
4. **Accommodation:** Ask the patient to focus on far object, then on a closer object. Note what happens to pupil. **„perrla"** stands for „pupils equal, round, reactive to light, accommodation". This acronym is used when documenting assessment of pupils.
5. **Eye movements (extraocular movements):** Ask the patient to follow your finger with their eyes without moving their head. Check gaze in the six cardinal directions using a cross or „H" pattern. Check convergence by moving your finger toward the bridge of the patient's nose.

- **Trigeminal (CN V)**

1. **Facial sensation:** Same principles apply as in sensory examination of rest of the body (touch, pain, temperature).
2. **Corneal reflex:** Ask the patient to look up and away. From the other side, touch the cornea lightly with a fine wisp of cotton. Look for the normal blink reaction of **both** eyes. Repeat on the other side.
3. **Motor function** (muscles of mastication): Ask if there is fatigue during chewing meat or other food. Ask the patient to open their mouth and repeat this against resistance. Observe for any deviation of the jaw to one side. With their mouth open, ask the patient

to protrude their jaw to either side against resistance. Test the jaw--jerk reflex.

- **Facial nerve (CN VII)**

Observe for any facial droop or asymmetry

1. **Facial muscles:** Ask the patient to do the following, note any lag, weakness, or asymmetry:
   raise eyebrows and wrinkle forehead
   purse his lips and puff out their cheeks
   close their eyes tightly (and against resistance)
   show their teeth
2. **Sense of taste:** limited to anterior 2/3 of tongue
3. **Salivation and lacrimation**

A lower motor neuron lesion causes weakness of the entire side of the face with equal involvement of upper and lower facial muscles.

An upper motor neuron lesion results in weakness primarily of lower facial muscles. The upper muscles of facial expression (frontalis and orbicularis oculi) are much less affected because the facial nucleus that innervates them receives partial input from the ipsilateral hemisphere.

- **Vestibulocochlear nerve (CN VIII)**

Cochlear nerve

1. **Hearing acuity:** tuning fork, ticking watch, rubbing fingers together
   speech discrimination: whisper numbers in each ear
2. **Rinne test (air versus bone conduction):** Place the vibrating tuning fork against the mastoid process. Use the 512 Hertz tuning fork. Ask the patient when they can no longer hear it, then place it in front of the ear.
3. **Lateralization test (Weber test):** Place the vibrating tuning fork to the centre of the forehead and ask the patient where they hear it.

Vestibular nerve

The vestibular component of the auditory nerve is tested by observing for nystagmus when extraocular movements are assessed.

- **Glossopharyngeal-vagus nerve complex (CN IX and X)**

1. **Swallowing:** Ask the patient to take a sip of water and observe them swallow, note any difficulty.
2. **Phonation:** Listen to the patient's speech. Is there a hoarse or nasal quality?
3. **Palatial elevation:** Ask the patient to say „Ah" to observe soft palate rising on both sides.
4. **Gag reflex**: Assess the gag reflex by gently stroking the soft palate on each side.

- **Accessory nerve (CN XI)**

The accessory nerve supplies the trapezius and sternocleidomastoid muscles.

Observe trapezius for atrophy and asymmetry. Ask the patient to shrug shoulders against resistance. Ask the patient to turn their head against resistance. Watch and palpate the sternocleidomastoid muscle on the opposite side. Ask the patient to flex their head against resistance.

- **Hypoglossal nerve (CN XII)**

The hypoglossal nerve is motor to the tongue.

1. Observation: tongue appearance and bulk of tongue (look for atrophy)
   abnormal movement (fasciculation)
2. Ask the patient to show his tongue. Note any deviation. Ask the patient to move the tongue quickly from side to side. Ask the patient to push the tongue into each cheek, apply resistance. Compare the two sides.
3. Listen to the articulation of the patient's words.

4.3.8 Neural tension tests (neural provocation tests, neurodynamic tests)

Napínací testy

These tests are used by clinical practitioners to assess the mobility of neural tissue in the extremities and spinal cord. A positive neurodynamic test will reproduce the patient's symptoms, the test response

can be altered by movement of distant body parts and there are differences from right side to left side. A positive test indicates abnormalities of neural structures (e.g. intervertebral disc herniation causing pressure on a nerve root).

- **Straight leg raise (SLR) test (also called Lasègue's sign)**
- **Lasègueova zkouška**

This is a test for sciatic nerve (or L5/S1 root) irritation. With the patient lying supine, legs fully extended, the examiner lifts the patient's leg keeping the knee straight. The test is considered positive if pain is reproduced or increased in the lower back or leg.

- **Prone knee bend (PKB) test**
- **Obrácená Lasègueova zkouška**

With the patient prone, flex both knees together to 90 degrees, and then bring the heels together toward the buttocks. This test is considered positive if symptoms are reproduced when bending both knees together past 90 degrees. Pain in the anterior thigh indicates shortening of the hip flexors or irritation of the L4 nerve root. To differentiate between the nervous tissue and the muscles, this test can be performed in side lying with the head and trunk flexed. That allows cervical extension to be added as a desensitizing test.

- **Passive neck flexion**

In the supine position the clinician flexes passively the patient's head.

- **Slump test**

In essence, this test comprises the following components, performed in sitting:

1. Thoracic and cervical flexion
2. Knee extension
3. Foot dorsiflexion
4. Release of cervical flexion (to determine symptom response)

The slump test may be quite uncomfortable and provocative, so care must be taken with the test. The slump test helps the therapist to differentiate between local causes of the symptoms (e.g. muscle tightness) and distant causes (e.g. nerve root irritation).

- **Upper limb tension tests (ULTT)**
- **Neurodynamické testy horních končetin**

These tests were devised to evaluate the neural mobility of the upper limb. They are sometimes called the „SLR of the arm". They are used in the diagnosis of nerve (root) and plexus lesions of the upper extremity.

4.3.9 Vocabulary

Tab. 4.4 *Neuro examination vocabulary*

English	Czech	Synonyms
a drooping upper eyelid	pokles horního víčka, ptóza	ptosis
absent	chybějící, nepřítomný	
accommodation	akomodace	
affected	postižený	
alternately	střídavě	
appearance	vzhled	
blink	mrknout, mrknutí	
blunt	tupý	dull
clasp knife	zavírací nůž	
clench one's teeth	zatnout zuby	
cogwheel	ozubené kolo	
consider	vzít v úvahu, zvážit, považovat	
consideration	zřetel, hlavní bod	
cotton-tipped swab	vatová tyčinka	
demonstrate	předvést	
determine	určit	identify
deviation	odchylka, úchylka	
differentiate (between)	rozlišit (mezi)	
distinguish	rozlišovat	tell the difference
equal pupils	izokorické zornice	
extraocular movements	pohyby očních bulbů	
facial droop	pokles tváře	