MEDICAL UNIVERSITY- PLOVDIV
FACULTY OF MEDICINE
DEPARTMENT OF NEUROSURGERY

# CURRICULUM

# NEUROSURGERY

**/Included in the cycle of Specialized Surgeries/**

**Approved by the Department Council with Protocol №3/09.06.2025 and Faculty Council with Protocol № 6 /18.06.2025**

# NEUROSURGERY

## CURRICULUM

| Discipline | Final exam/ semester | Auditorium classes (hours) | | | | ECTS non-auditorium classes | ECTS total | Academic hours in years and semesters | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total | Lectures | Practices | ECTS | | | IV year VIII sem | V year IX sem |
| Neurosurgery /part of *Specialized surgeries/ | VIII/IX | 24 | 8 | 16 | 3.0 * | 1.7* | 4.7* | L T 2 4 weekly | L T 2 4 weekly |
| Neurosurgery /part of Neurology/ | VIII | 8 | 4 | 4 | | | | IV year VIII sem. L T 2 2 weekly | |

*** ECTS Credits are for Specialized surgeries**

**Name of discipline:**

"Neurosurgery"

**Type of discipline according to EDA:**

Compulsory

**Degree of education:**

Master /M/

**Teaching methods:**

Lectures, seminars, tutorials, additional activities (self-preparation, preparation of presentations, etc.)

**Years of education:** IV

and V year (course)

**Duration of teaching:**

Four weeks

**Horarium for Neurosurgery as part of Specialized Surgeries:**

8 hours lectures, 16 hours tutorials

**Horarium for Neurosurgery as part of Neurology:**

4 hours lectures, 4 hours tutorials **Teaching**

**facilities:**

Multimedia presentations, discussions, demonstrations of patient-based cases, solving practical tasks, links to contemporary electronic databases, elaboration of behavioral algorithms and abstracts on certain topics, real-time observation of neurosurgical procedures through the monitor of the operating microscope Leica M525

**Methods for stimulation of creative activity of students:**

They include encouraging of the active participation and self-preparation of students in developing of clinical abstracts, clinical discussions, preparation of multimedia presentations on specific clinical cases, solution of clinical casuses and interpretations of clinical data, development of diagnostic and therapeutic algorhythms, practical problem-solving of specific clinical cases.

**Assessment forms:**

Ongoing evaluation during the semester, solving clinical cases, preparation of essay

**Grading:**

The final grade is formed based on at least two ongoing grades from the tutorials during the semester and the final semestrial exam

**Aspects of grading:**

Participation in discussions, test solving, preparation of an clinical
abstract

**Semestrial exam:**

Yes / Part of the Specialized Surgeries – written – combined test/.

**State exam:**

No

**Leading lecturer:**

Habilitated lecturer from the Department of Neurosurgery

**Department:**

Neurosurgery

## ANNOTATION

Neurosurgery is a specialized medical discipline, combining knowledge of the human nervous system, neurology, surgery, radiology, traumatology, oncology and others. Neurosurgery deals with the surgical treatment of diseases and anomalies of the central and peripheral nervous system, which represent social and personal issue. Neurosurgery is a discipline that has made a tremendous progress for the last 20-30 years.

## DISCIPLINE OBJECTIVES

Medical students have to get familiar with the nature and the need of specialized neurosurgical care as well as with the resources and knowledge necessary for its implementation.

## DISCIPLINE TASKS

Medical students have to learn the clinical presentation, diagnosis and contemporary treatment methods of the basic neurosurgical diseases –injuries, tumors, vascular diseases, inflammatory and parasitic diseases of the central nervous system, spondylogenic myelopathies and radiculopathies, hydrocephalus, etc. The main emphasis is put on the emergency conditions in neurosurgery and the actions needed for their management.

## EXPECTED RESULTS

1. Students have to be able to give life-saving help for patients with central nervous system trauma.
2. Students have to be able to identify life-threatening neurosurgical diseases, and to be able to perform timely and adequate actions for their prevention.
3. Students have to be able to recognize the basic neurosurgical diseases in outpatient setting.
4. Students have to be able to prescribe the necessary studies and to direct patients for treatment in specialized neurosurgical unit.
5. Students have to obtain the necessary competence to avoid complications before the admission of patients to specialized neurosurgical unit.

6. Students have to be able to make a prognosis and to be informed for the contemporary methods of treatment of neurosurgical diseases.
7. Students have to be able to follow-up neurosurgical patients in the postoperative period and to avoid possible complications.

## LECTURES PROGRAMME Neurosurgery Cycle (part of Neurology)

### LECTURE № 1 /2 hours/ NEUROONCOLOGY

**1. Intracranial tumors:**

- Classification of intracranial tumors.
- Focal (local) syndrome according to tumor location.
- Syndrome of increased intracranial pressure.
- Brain dislocation syndromes (types of brain herniations) - diagnosis and treatment.
- Syndromes of tumors with specific location:
  - ✓ Pituitary gland adenoma
  - ✓ Craniopharyngioma
  - ✓ Optic nerve glioma
  - ✓ Intraventricular tumors
  - ✓ Cerebello-pontine angle tumors
- Neuroradiological diagnosis of intracranial tumors.
- Clinical presentation of intracranial tumors in children.
- Treatment of intracranial tumors. Contemporary treatment methods - options and advantages.
- Prognosis for different types of intracranial neoplasms.

**Aim of teaching:** Students have to be able to recognize different types of intracranial tumors, their pathophysiology, clinical presentation according to their location in the brain, the contemporary imaging diagnosis and treatment. Students should be aware of the urgent indications for surgical treatment of intracranial tumors as well as with the prognosis of the different types of tumors.

**2. Tumors of the spine and spinal cord:**

- Syndromes of spinal cord compression – in relation to the region of the spinal cord, the site of the spinal cord compression

  2.2. Classification of spinal cord tumors – according to location and histology.
- Possibilities for early outpatient diagnosis.
- Neuroimaging - features.
- Contemporary treatment methods.
- Stable and unstable spinal segment.
- Disease prognosis and outcome.

**Aim of teaching:** Students should be able to differentiate different types of spinal tumors according to the region of spinal cord compression. They should be able to diagnose the location of the tumors, to give first aid and to be familiar with the diagnostic and treatment options.

**3. Peripheral nerve tumors:**

- Types of peripheral nerve tumors.
- Clinical presentation according to the damaged nerve.
- Diagnosis and treatment (conservative and surgical)

**Aim of teaching:** Students should be able to diagnose peripheral nerves tumors in a timely manner, so they can direct the patient for specialized treatment.

**LECTURE № 2 /2 hours/**

**HEAD INJURIES**

1. Closed head injuries:

1.1. Cerebral concussion:

- Clinical presentation, diagnosis and treatment

**Aim of teaching:** Students have to get acquainted the pathophysiological mechanisms of the head trauma, causing the specific clinical presentation. They should be aware of the risks if the diagnosis of intracranial hematoma is delayed. Students should be familiar with the medico- legal aspects and consequences of omitted intracranial hematomas.

1.2. Cerebral contusion

- Grades
- Patophysiological mechanisms
- Clinical presentation, diagnosis and treatment

**Aim of teaching:** Students have to be familiar with the Glasgow Coma Scale for assessment of consciousness and the severity of brain contusions. They should be able to give first aid, recognize primary and secondary brain damage, and apply the necessary adequate therapeutic measures.

1.3. Intracranial hematomas and subdural hydroma

- Types of intracranial hematomas
- Patophysiological mechanisms
- Location
- Specific imaging studies for differentiating the type of intracranial hematoma
- Subdural hydroma- mechanism of development and diagnosis

- Treatment of traumatic intracrarnial hematomas and subdural hydroma

**Aim of teaching:** Students should be able to differentiate the types of traumatic intracranial hematomas and their clinical presentation. They should know the stages of development of different types of hematomas and for their surgical treatment.

2. Skull fractures:

- Fractures of the cranial vault – linear and comminuted fractures (impression and depression fractures). Imaging diagnosis, possible complications, treatment.
- Fractures of the cranial base- possible complications (nasoliquorrhea and otoliquorrhea) and treatment.
- Diagnosis.

3. Opened and penetrating head injuries:

- Types.
- Clinical presentation.
- Diagnosis.
- Treatment.
- Possible complications.

**Aim of teaching:** Students should know the different types of skull fractures, possible complications and their treatment. They should be able to recognize opened and penetrating head injuries and the necessary therapeutic measures.

4. Long-term complications of head injuries:

- Posttraumatic cerebrasthenia.
- Posttraumatic encephalopathy.
- Posttraumatic epilepsy.
- „Growing skull fracture".
- Terms for developing of complications.
- Clinical presentation, diagnosis and treatment

**Aim of teaching:** Students should be able to predict the possible development of long-term complications of head trauma, so they can take measures to prevent them. They should know the clinical presentation of the long-term complications, the diagnosis and treatment.

**TUTORIALS PROGRAMME Neurosurgery cycle (part of Neurology)**

**TUTORIAL № 1 /2 hours/ INTRACRANIAL TUMORS**

1. Classification of intracranial tumors according to:

- Histology
- Origin

2. Topographical characteristics of intracranial tumors in relation to:

- Tentorium cerebelli.
- Brain parenchyma.

- Cerebral vasculature
- CSF pathways.
- Eloquent and non-eloquent brain areas

3. Focal neururological symptoms according to the location of intracranial tumors
4. Clinical presentation of increased intracranial pressure
5. Brain herniations - clinical presentation and treatment
6. Neuroradiological diagnosis (CT, MRI and carotid angiography) – indications, procedure description, typical imaging findings.
7. Treatment - types and timing of surgical treatment, necessity of postoperative chemotherapy and radiotherapy.
8. Advantages of contemporary radiosurgery- Gamma and Cyber knife

**TUTORIAL № 2 /2 hours/ HEAD**

**INJURIES**

1. Closed head injuries – definition, epidemiology, types

1.1. Cerebral concussion:

- Pathophysiology
- Clinical presentation
- Treatment

Students should know that a 24-hours observation period is necessary in order to rule out the development of intracranial hematomas.

1.2. Cerebral contusion:

- Biomechanics of brain contusions.
- Pathophysiology of primary brain injury (coup, contre coup and diffuse axonal injuries) and secondary brain injury (cytotoxic and vasogenic brain edema).
- Syndromes of brain dislocation.
- Treatment of secondary brain injury.
- Evaluation of the unconscious state of patients and the severity of head injury according the Glasgow Coma Scale

Students should know that the treatment of brain contusion aims at reducing the impact from secondary brain injury. 1.3. Cerebral compression:

- Types of traumatic intracranial haematomas (epidural, subdural and intracerebral) • Source of bleeding.
- Location.
- Time for clinical presentation of intracranial haematoma.
- Clinical presentation and its characteristics.

- Neuroradiology - characteristics of images of the different types of intracranial hematomas.
- Timing of surgical treatment.

1.3.2. Subdural hydroma:

- Pathophysiology, clinical presentation, diagnosis and treatment.

2. Skull fractures:

2.1. Fractures of the cranial vault – linear and comminuted fractures (depressed fractures).

- Diagnosis and treatment.

2.2. Fractures of the cranial base

- Possible complications (nasoliquorrhea, otoliquorrhea and pneumocephalia)
- Routes of CSF leakage.
- Imaging diagnosis and treatment 3. Opened and penetrating skull and brain injuries:

3.1. Types.

- Characteristics of injury according to the damaging agent.
- Clinical presentation, diagnosis and treatment.
- Late complications.

4. Long-term complications of head injuries:

- Posttraumatic cerebrasthenia- clinical presentation, diagnosis and treatment.
- Posttraumatic encephalopathy- clinical presentation, diagnosis and treatment.
- Posttraumatic epilepsy- clinical presentation, diagnosis and treatment.
- „Growing skull fracture"- clinical presentation, diagnosis and treatment.
- Prophylaxis of posttraumatic complications.
- Clinical presentation, diagnosis and treatment

**LECTURE PROGRAMME Neurosurgery cycle (part of Specialized Surgeries)**

**LECTURE № 1 /2 hours/ SPINAL INJURIES. PERIPHERAL NERVE INJURIES**

1. Spinal injuries:

- Classification.
- Types of spinal injuries according to the damage of the vertebral column.
- Types of spinal cord injuries - specific syndromes.

2. Specific spinal cord injuries:

- Injuries of the occipito-atlanto-axial complex - types, mechanism, clinical presentation, diagnosis and treatment.

- Subaxial cervical injuries- types, mechanism, clinical presentation, diagnosis and treatment.
- Thoracis, thoraco-lumbar and lumbar injuries - types, mechanism, clinical presentation, diagnosis and treatment.
- Stable and unstable fractures - diagnosis and treatment.

**Aim of teaching:** Students should be aware of the first aid and the adequate transportation procedures for patients with spinal injury. They should be able to locate the spinal injury and to be familiar with the options for imaging diagnosis and treatment.

3. Peripheral nerves injuries:

- Types of peripheral nerve injuries according to the mechanism.
- Stages of nerve damage.
- Diagnosis.
- Terms and types of surgical treatment.

**Aim of teaching:** Students should know the clinical presentation of the damaged peripheral nerve and be aware of the timing of surgery for the different peripheral nerve injuries according to the mechanism and severity of the trauma.

**LECTURE № 2 /2 hours/**

**SPNDYLOGENIC MYELOPATHY AND RADICULOPATHY. NEURALGIA. HYDROCEPHALUS.**

I. Spondylogenic myelopathy and radiculopathy

1.1. Types of disc disease according to:

- Affected spinal segment.
- Type of disc herniation.
- Severity of disc herniation.

1.2. Pathophysiological mechanisms of disc degeneration.

1.3. Clinical presentation of the different types of disc disease.

1.4. Contemporary neuroimaging diagnosis.

1.5. Types of treatment. Indications for surgical treatment - urgent and elective, differential diagnosis

2. Types of spinal stenosis
according to:

- Time for occurrence.
- Affected spinal segment.

2.2. Clinical presentation of spinal stenosis:

- Lumbar spinal stenosis.

- Cervical spinal stenosis.
- Thoracic spinal stenosis.

2.3. Differential diagnosis between herniated disc and spinal stenosis.

2.4. Neuroimaging diagnosis.

2.5. Treatment options depending on the type of spinal stenosis.

**Aim of teaching:** Students should be able to differentiate the clinical presentation of spinal stenosis and herniated disc, the type of the surgical treatment needed and the timing for its implementation.

3. Degenerative spondylolisthesis: •

Pathophysiology

- Location.
- Clinical presentation, diagnosis and treatment.

**Aim of teaching:** Students should know the clinical presentation of the disease and the treatment options.

II. Neuralgias and hydrocephalus:

1. Trigeminal neuralgia:

- Etiology.
- Types of trigeminal neuralgia according to the causative agent.
- Clinical presentation and diagnosis.
- Contemporary treatment options.

2. Glossopharyngeal neuralgia:

- Etiology.
- Clinical presentation, diagnosis and treatment

**Aim of teaching:** Students have to differentiate neuralgias from other similar pain syndromes. They should be able to direct the patients for treatment in a timely manner.

2. Hydrocephalus:

- Congenital hydrocephalus.
- Obstructive hydrocephalus.
- Normal pressure hydrocephalus.
- Difference in the clinical presentation of hydrocephalus a/ in infants, b/ in children, c/ in adults.
- Clinical presentation of normal pressure hydrocephalus.
- Diagnosis.
- Treatment - methods, indications for elective and urgent surgical treatment.

**Aim of teaching:** Students should know the different types of hydrocephalus and their etiology. They should be able to accurately diagnose the disease and the patients for surgical treatment before occurrence of irreversible complications.

**LECTURE № 3 /2 hours/ VASCULAR DISEASES OF THE CENTRAL NERVOUS SYSTEM**

1. Spontaneous intracerebral hematomas (non-traumatic, hypertensive):
    - Incidence.
    - Epidemiology.
    - Pathophysiology of brain tissue damage - syndromes.
    - Clinical presentation according to the location.
    - Diagnosis and treatment.
    - Prognosis.
2. Intracranial aneurysms:
    - Types of aneurysms.
    - Location.
    - Clinical presentation according to the location of the aneurysm and the subarachnoid hemorrhage distribution.
    - Contemporary neuroimaging diagnosis.
    - Indications and contraindications for surgical treatment.
    - Timing of surgery.
    - Alternative treatment methods – endovascular coilling.
3. Cerebral arterio-venous malformations /AVMs/:
    - Types.
    - Epidemiology.
    - Clinical presentation of non-ruptured and ruptured AVM.
    - Diagnosis.
    - Treatment- conservative, surgical, endovascular, radiosurgery.

**Aim of teaching:** Students should be able to differentiate spontaneous intracerebral hematoma and subarachnoid hemorrhage, hypertensive and non-hypertensive intracerebral hematoma. They should be able to direct the patient in a timely manner to specialized neurosurgical unit for diagnosis and treatment. Students should know the indications and contraindications for surgical treatment. They should know the difference in the clinical presentation between AVM and intracerebral aneurysm and the different types of treatment of these diseases.

**LECTURE № 4 /2 hours/ INFLAMMATORY AND PARASITIC DISEASES OF THE CENTRAL NERVOUS SYSYTEM**

1. Inflammatory diseases of the central nervous system:

1.1. Posttraumatic meningitis:

- Pathophysiology.
- Etiology.
- Clinical presentation.
- Diagnostics and treatment.

1.2. Subdural empyema and epidural abscess.

- Etiology, path of transmission.
- Clinical presentation.
- Diagnostics and treatment.

1.3. Cerebral abscess.

- Etiology, path of transmission.
- Clinical presentation.
- Diagnostics and treatment. • Indications and contraindications for operative treatment.

1.4. Inflammatory diseases of the brain and spine.

- Etiology.
- Paths of contamination. • Clinical presentation, diagnostics and ways of treatment.

**Aim of teaching:** Students should be aware of the risks for possible infection after opened and penetrating head injury. They should be familiar with the options for prophylaxis, etiology, epidemiology, pathology and the treatment of brain abscesses. Indications and contraindications should be outlined. They should be able to diagnose or rule out the presence of spinal infection.

2. Parasitic diseases of CNS

2.1. Brain echinococcosis

- Etiology.
- Pathology.
- Clinical presentation and course.
- Laboratory tests. • Diagnostics and treatment.

2.2. Spinal echinococcosis

- Etiology
- Disease course
- Clinical presentation
- Laboratory tests and diagnostics
- Treatment

2.3. Brain cysticercosis:

- Etiology
- Pathology
- Clinical presentation
- Types
- Laboratory tests
- Diagnostics and treatment

2.4. Brain toxoplasmosis:

- Etiology
- Path of transmission
- Types and pathology
- Clinical presentation
- Laboratory tests
- Diagnostics and treatment

**Aim of teaching:** Pathology and the localization of the parasitic diseases should be known and the students should be familiar with etiology, clinical presentation, types, diagnostics and treatment of the diseases.

## TUTORIAL PROGRAMME

### Neurosurgery (part of Specialized Surgeries)

### TUTORIAL № 1 /2 hours/ INTRACRANIAL

### TUMORS

1. Classification of intracranial tumors:

- Histological

- In relation to tentorium cerebelli
- In relation to brain parenchyma
- In relation to functionally eloquent and non- eloquent brain areas
- In relation to major intracranial vessels
- In relation to the ventricular system.

2. Syndromes caused by intracranial tumors – increased intracranial pressure and focal neurological deficit.

3. Dislocation phenomena – types of brain herniation, clinical and diagnostic characteristics.

4. Initial symptoms of brain neoplasms in relation to their localization in eloquent or non-eloquent areas.

5. Type of symptoms – excitatory (epileptic seizures), focal neurological symptoms and symptoms of increased intracranial pressure – their characteristics in cases with intracranial neoplasms.

6. Clinical syndromes in tumors with specific localization:

   - Pituitary adenomas
   - Craniopharyngiomas
   - Optic nerve glioma
   - Intraventricular tumors
   - Cerebellopontine angle tumors

7. Modern imaging methods (computed tomography, magnetic resonance tomography and angiography) – when and how they should be performed and interpreted.

8. Principles of surgical treatment –potions for different kinds of tumors, necessity of subsequent radiotherapy and chemotherapy. Advantages and indications of the most contemporary treatment (gamma knife and cyber knife).

9. Postoperative course – what to do, what to follow and how to react.

10. Characteristics of pediatric brain tumors. • Types – specific onset and disease course.

11. Brain metastases:

    - Specificity of brain metastases.
    - Localization.
    - Indications and contraindications for surgical intervention.
    - Options for surgical treatment

**TUTORIAL № 2 /2 hours/**

**SPINE AND SPINAL CORD TUMORS**

1. Classification
2. Types of clinical syndromes in relation to:
    - The level of damage of the spinal cord
    - Tumor location according to the axial section of the spine
3. Differences in the onset and clinical presentation of spinal cord tumors
4. Diagnostic methods – clinical, laboratory and imaging 5. Treatment of spinal cord tumors and their prognosis
6. Metastatic tumors of the spine and spinal cord:
    - Paths of metastasizing
    - Clinical course before and after spinal cord decompression
    - Types of treatment:
        - ✓ In cases without neurological symptoms
        - ✓ In cases with neurological symptoms
7. Tumors of the peripheral nerves
    - Incidence
    - Types
    - Localization
    - Recklinghausen's disease
    - Clinical presentation, diagnostics and treatment

**TUTORIAL № 3 /2 hours/**

**HEAD INJURIES**

1. Closed head injuries
    - Definition
    - Epidemiology
    - Types
2. Cerebral concussion
    - Pathophysiology
    - Clinical presentation and treatment

**Aim of teaching:** Students must be aware that patients need to be strictly observed in the first 24 hours due to possible formation of intracranial hematoma with fatal consequences.

3. Cerebral contusion
    - Biomechanics

- Types and pathophysiology of primary brain damage (coup, contre coup and diffusional axonal injury), as well as secondary brain damage (cytotoxic and vasogenic swelling/edema).
- Dislocation syndromes
- Glasgow Coma Scale for assessment of the level of depressed consciousness and severity of the sustained head injury. • Treatment of secondary brain damage

**Aim of teaching:** Students have to know that the treatment of cerebral contusion should be aimed at controlling and minimizing secondary brain damage.

4. Cerebral compression

4.1. Traumatic intracranial hematomas

- Pathology
- Localization
- Acuteness of development
- Clinical presentation and its characteristics
- Neuroimaging studies – imaging specifications of different types of hematomas • Timing of treatment

4.2. Subdural hydroma

- Pathophysiology
- Clinical presentation, diagnostics and treatment 5. Skull fractures:
- Fractures of the cranial vault - linear and comminuted (depressed)
- Diagnostics and treatment

6. Skull base fractures:
   - Possible complications (liquorhhea and pnemocephalus) – according to fracture localization
   - Imaging and treatment

7. Opened and penetrating head injuries:

- Types
- Characteristics (according to the damaging agent)
- Clinical presentation, diagnostics and treatment
- Late complications

**TUTORIAL № 4 /2 hours/**

**SPINE AND SPINAL CORD INJURIES. PERIPHERAL NERVE INJURIES**

1. Spine injuries
    - Classification
    - Types injuries to the vertebras and ligaments
2. Spinal cord injuries
    - Types – syndromes
    - Pathophysiology
    - Clinical presentation in relation to level of injury
3. Specific spinal injuries
    - Occipito-atlanto-axial injuries – types, biomechanics, clinical presentation, diagnostics and treatment
    - Subaxial cervical injuries - types, biomechanics, clinical presentation, diagnostics and treatment
    - Thoracolumbar injuries - types, biomechanics, clinical presentation, diagnostics and treatment
    - Stable and unstable fractures – diagnostics and treatment
    - types, biomechanics, clinical presentation, diagnostics and treatment

**Aim of teaching:** Students have to pay attention to the following factors – first aid at the site of incident, immobilization of the patient and his/her proper transportation.

4. Peripheral nerves injuries:

    4.1. Injury to brachial plexus
    - Types
    - Clinical presentation
    - Diagnostic tests
    - Therapeutic options

    4.2. Injury to peripheral nerves:
    - Clinical presentation (according to the affected nerve)
    - Diagnostics
    - Treatment - timing • Types of operative interventions

**Aim of teaching:** Students have to know that the primary revision of the wound is extremely important– it could prevent additional nerve damage.

**TUTORIAL № 5 /2 hours/**

**VASCULAR DISEASES OF THE BRAIN**

1. Spontaneous intracerebral hematomas (hypertensive):
    - Incidence
    - Epidemiology
    - Pathophysiology of brain damage – syndromes
    - Clinical presentation of stroke, depending on the localization of hemorrhage
    - Diagnostics
    - Indications and timing of operative treatment and prognosis
2. Cerebral aneurysms:
    - Types of aneurysms
    - Localization
    - Clinical presentation depending on aneurysm localization and severity of hemorrhage
    - Contemporary neuroimaging studies (CT and MRI angiography, conventional DSA angiography).
    - Recurrent bleedings
    - Indications and contraindications for operative treatment
    - Timing of surgery
    - Alternative methods of treatment – endovascular coilling
3. Arteriovenous malformations /AVMs/:
    - Epidemiology
    - Types and incidence
    - Clinical presentation of ruptured and non-ruptured AVM
    - Diagnostics • Treatment options– conservative, operative, endovascular and radiosurgery.

Students should be aware of the different symptoms between AVM and cerebral aneurysms.

**TUTORIAL № 6 /2 hours/**

**INFLAMMATORY AND PARASITIC DISEASES OF CNS**

I. Inflammatory diseases of CNS

1.1 Posttraumatic meningitis

- Pathology
- Most frequent causative agents

- Clinical presentation, diagnostics (laboratory tests) and treatment

**Aim of teaching:** Students should know that skull base fractures with liquorrhea might cause serious infectious complications.

2. Subdural empyema and epidural abscess
   - Pathology
   - Clinical presentation, diagnostics and treatment
3. Cerebral abscess
   - Etiology
   - Path of transmission
   - Clinical presentation
   - Neuroimaging diagnostics
   - Types of treatment – indications and contraindications for operative treatment
4. Inflammatory diseases of the spine and spinal cord
   - Etiology
   - Pathology
   - Clinical presentation, imaging, types of treatment – indications and contraindications

II. Parasitic diseases of CNS

1. Brain echinococcosis
   - Disease course
   - Clinical presentation
   - Laboratory tests and imaging
   - Treatment
2. Echinococcosis of the spine and spinal cord
   - Path of disease
   - Clinical presentation
   - Laboratory tests and imaging
   - Treatment
3. Brain cysticercosis
   - Etiology
   - Pathology
   - Types
   - Clinical presentation
   - Laboratory tests and imaging
   - Treatment
4. Brain toxoplasmosis
   - Etiology
   - Pathology
   - Forms of disease

- Laboratory tests and imaging • Treatment.

**TUTORIAL № 7 /2 hours/**

**DEGENERATIVE SPINE DISEASE (SPONDYLOGENIC MYELOPATHIES AND RADICULOPATHIES)**

1. Disc herniation
   - Types of disc herniations depending on
     - ✓ Different parts of the spine
     - ✓ Location of the herniated nucleus pulposus
     - ✓ Stage of herniation
   - Clinical presentation of disc herniation depending on the affected spinal segment
   - Pathophysiology of disc degeneration
   - Modern imaging methods
   - Types of treatment
   - Indications for operative treatment – emergency and elective

**Aim of teaching:** Students should know the time frame between reversible and irreversible nerve root damage – especially in cases with cauda equina syndrome!

2. Spinal stenosis
   - Types in relation to
     - ✓ Time for clinical manifestation
     - ✓ Localization of narrowed structures • Differential diagnosis with disc herniations
   - Clinical presentation of:
     - ✓ Lumbar spinal stenosis
     - ✓ Cervical spinal stenosis
     - ✓ Thoracic spinal stenosis
   - Imaging methods
   - Treatment options
3. Degenerative spondylolisthesis
   - Pathophysiologic mechanisms of occurrence
   - Localization
   - Clinical presentation, imaging and treatment

**TUTORIAL № 8 /2 hours/**

**NEURALGIA OF CRANIAL NERVES. HYDROCEPHALUS**

1. Trigeminal neuralgia
   - Etiology
   - Types (depending on etiology)
   - Clinical
   - Contemporary therapeutic option (advantages and disadvantages)
2. Glossopharingeal neuralgia
   - Etiology
   - Clinical presentation and treatment
3. Hydrocephalus • Types
   - ✓ Congenital
   - ✓ Obstructive hydrocephalus
   - ✓ Normal pressure hydrocephalus
   - Differences in the clinical presentation
     - ✓ In infants
     - ✓ In childhood
     - ✓ In adults
   - Clinical presentation of normal pressure hydrocephalus /NPH/
   - Diagnostic methods
   - Treatment – methods, indications for emergency and elective surgery

## CONSPECTUS - NEUROSURGERY

### /within the Specialized Surgery Exam/

1. Head injuries – Classification. Biomechanics. Pathology, clinical presentation, diagnostics and treatment of: a/ cerebral concussion b/ cerebral contusion. Glasgow Coma Scale for the assessment of the level of depressed consciousness and severity of the sustained head injury.
2. Intracranial hematomas – epidural, subdural and intracerebral. Localization, sources of bleeding, types, clinical presentation (typical and atypical), imaging studies – typical findings, treatment. Subdural hydroma.
3. Skull fractures and penetrating head injuries: A/Skull fractures – fractures of the cranial vault (linear and comminuted). Skull base fractures and their complications (liquorhhea, pnemocephalus, etc.) – prophylaxis and treatment. Imaging studies. B/ Penetrating injuries to the brain – types, clinical presentation, diagnostics and treatment.
4. Spine injuries. Classification of spine and spinal cord injuries. Pathology of spinal cord injuries. Clinical syndromes of spinal cord trauma depending on the level of injury. Diagnostics and treatment of spine and spinal cord injuries- conservative and operative.

5. Intracranial tumors. Classification: a/ histological; b/ in relation to tentorium cerebelli; c/ in relation to brain parenchyma; d/in relation to functionally eloquent and non-eloquent brain areas; e/in relation to major intracranial vessels; f/ in relation to the ventricular system. Syndromes of increased intracranial pressure and focal neurological deficit – clinical presentation. Dislocation phenomena – types of brain herniation.
6. Intracranial tumors. Clinical presentation depending on the localization: a/frontal lobe tumors (intra- and extra-cerebral); b/temporal lobe tumors (intra- and extra-cerebral); c/ parietal lobe tumors (intra- and extra-cerebral); d/occipital lobe tumors (intra- and extra- cerebral).
7. Pituitary adenomas. Classification depending on the size, hormonal activity and localization of the tumor. Clinical presentation of intrasellar tumors. Clinical presentation of suprasellar tumors. Diagnostics. Treatment.
8. Subtentorial tumors. Tumors of the cerebellar hemispheres, vermis cerebelli and 4th ventricle. Crebello-pontine tumors – neurinoma of the 8th cranial nerve – clinical presentation during different grades, diagnostics and treatment.
9. Spinal cord tumors. Classification. Clinical syndromes depending on the tumor localization: a/ intramedullary and extramedullary tumors; b/ in relation to the level of the lesion c/ in relation to spinal cord section. Diagnostics and treatment.
10. Vascular diseases of the brain. Spontaneous intracerebral hematomas. Etiology and epidemiology. Clinical presentation depending on the localization. Diagnostics and treatment.
11. Vascular diseases of the brain. Cerebral aneurysms and arteriovenous malformations. Etiology and epidemiology. Localization. Types of aneurysms and AVMs. Clinical presentation of ruptured aneurysm. Clinical presentation of AVM- before and after bleeding. Differential diagnosis between aneurysms and AVMs. Diagnostics and treatment.
12. Inflammatory diseases of the brain. Posttraumatic meningitis. Subdural empyema and epidural abscess. Cerebral abscess. Etiology, path of transmission. Clinical presentation. Diagnostics and treatment.
13. Parasitic diseases of CNS. Echinococcosis – etiology, clinical presentation, diagnostics and treatment. Cysticercosis – etiology, clinical presentation, diagnostics and treatment. Toxoplasmosis – etiology, clinical presentation, diagnostics and treatment.
14. Degenerative spine disease. Disc herniations. Etiology and pathology. Stages. Clinical presenation: a/ depending on the affected spinal segment; b/ depending on the localization of the disc herniation (median, paramedian, lateral, etc.). Cauda equina syndrome – clinical presentation. Imaging studies and treatment.

15. Cervical and lumbar spinal stenosis. Etiology and pathology. Classification: a/ in relation to the time of clinical occurance; b/ localization. Clinical presentation. Imaging studies and treatment.
16. Hydrocephalus. Differential diagnosis between congenital hydrocephalus and hydrocephalic syndrome. Congenital hydrocephalus in infants. Hydrocephalus in childhood. Normal pressure hydrocephalus in adulthood. Clinical presentation, syndromes, imaging studies and treatment.

**Recommended literature for exam preparation:**


1. **Fundamentals of Neurosurgery**. Edited by B. Kitov. LAX BOOK, Plovdiv, 2014. ISBN 978-954-8326-91-9
2. **Atlas of the human Brain** Edited by B. Kitov. Издателство„ Лакс бук", Пловдив, 2015. ISBN 978-619-189 -028-6
3. **Essential Neurosurgery**. Andrew Kaye. 3Edition. Blackwell Publisching Ltd. 2005
4. **Neurosurgery. Principles and Practice**. Anne J. Moore and David W. Newell (Eds). Series Editor : John Lumley. Springer-Verlag, 2005


**Additional literature:**


5. **Yomans & Winn Neurological Surgery,** 8th edition, (Editor R. Winn), Vol. I-IV, Elsevier, 2017
6. **Handbook of Neurosurgery**, 10th Edition, Editor Greenberg MS, Thieme, New York, 2023


