**Federal State Budgetary Educational Institution of Higher Education «Prof. V.F. Voino-Yasenetsky Krasnoyarsk State Medical University» of the Ministry of Healthcare of the Russian Federation**

Department of traumatology, orthopedics and neurosurgery with a PE-course

Head of the department, Doctor of Medical Science P.G. Shnyakin

**ALBUM OF ALGORITHMS AND PRACTICAL SKILLS**

**IN NEUROSURGERY,**

**TRAUMATOLOGY AND ORTHOPEDICS**

**Student name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Group \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |
| --- | --- | --- |
| **Discipline** | **Teacher** | **Grade** |
| **4th year Neurosurgery** |  |  |
| **5th year Traumatology** |  |  |
| **6th year Traumatology and Orthopedics** |  |  |

Krasnoyarsk, 2023

**COURSEWORK**

**IS A FAIRLY COMPLETE**

**PRACTICAL GUIDE FOR**

**THE ENTIRE PERIOD**

**OF YOUR ACTIVITY**

***EACH DOCTOR OF A NON-SURGICAL SPECIALTY MUST BE ABLE TO PROVIDE CARE TO INJURED INDIVIDUALS IN THE SCOPE OF FIRST DOCTOR AID, TEACH PERSONS OF NON-MEDICAL SPECIALTIES THE SCOPE OF FIRST MEDICAL AID AND TO PARAMEDICAL PERSONNEL THE PRE-HOSPITAL AID***

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| 6 | Osteochondrosis of the spine |  |  |
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| 9 | Complicated fractures and complications of fractures. Surgical treatment |  |  |
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| 3 | Infectious complications of gunshot wounds. Purulent and putrefactive infection. |  |  |
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| 5 | Amputations. Prosthetics of the upper and lower limbs. Orthopedic shoes |  |  |
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Class 1 **Topic:** **TRAUMATIC BRAIN INJURY (PART I)**

1. Classification of traumatic brain injury
2. Sketch the types of traumatic hematomas (subcutaneous, subgaleal, epidural, subdural, intracerebral)
3. Schematically sketch the classic symptoms of traumatic hematoma (homolateral anisocoria, heterolateral hemiparesis, bradycardia).
4. Draw the “glasses sign” (also called “raccoon eyes” and “panda eyes”) and Battle's sign for fractures of the base of the skull.
5. Draw and describe the “double spot sign”
6. Draw typical points where search burr holes are placed in case of suspected traumatic hematoma

Class 2 **Topic:** **TRAUMATIC BRAIN INJURY (PART II)**

1. List and schematically draw the clinical signs of open traumatic brain injury
2. List and sketch the types of traumatic skull fractures
3. Schematically draw up the tactics of managing patients with each type of fracture
4. Draw decompression and resection craniotomy
5. List the types of traumatic liquorrhea and draw up a scheme for managing patients with each type of it
6. List and sketch the types of the brain herniation

Class 3 **Topic:** **INJURIES OF THE SPINAL CORD AND VERTEBRAE AND CONCOMITANT INJURY**

1. Draw a three-column model of Denis of the spine
2. Classification of injuries of the spinal cord and vertebrae
3. Draw variants of damage to the columns of the spine according to Denis, leading to instability.
4. Sketch and write down the clinical presentation of the acute period of the injuries of the spinal cord and vertebrae with a complete anatomical interruption of the spinal cord а) at the level of С3; b) at the level of С6; c) at the level of Th5; d) at the level of epiconus; e) at the level of the medullary cone
5. Present in the form of a diagram the features of severe traumatic brain injury with the shock
6. Schematically present the pathogenesis and types of fat embolism.

Class 4 **Topic:** **BRAIN TUMORS**

1. Schematically draw CNS cells and indicate what types of tumors develop from them.
2. In the form of a table, present the modern classification of tumors according to Grade I-IV.
3. Describe the possibilities, features and differences of MSCT, MRI and PET in the diagnosis of brain tumors (in the form of a table). Specify contraindications for MRI.
4. Classification of pituitary adenomas. Draw the cause of the development of bitemporal hemianopia.
5. Write the most common cancer locations accompanied by metastasis to the CNS.
6. In the form of a table, present the principles and types of radiotherapy and radiosurgery of brain tumors.

Class 5 **Topic:** **CEREBROVASCULAR DISEASES**

1. Present in the form of a diagram the classification of cerebrovascular accidents.
2. Draw the FAST test that helps to determine the symptoms of a stroke.
3. Draw on a horizontal section of the brain (at the level of subcortical structures), the most frequent localizations of hypertensive intracerebral hemorrhages: subcortical, putamenal and thalamic.
4. Sketch the circle of Willis and indicate the most common locations of aneurysms.
5. Sketch the types of aneurysm exclusion: aneurysm clipping and endovascular aneurysm embolization. Describe the advantages of both methods.
6. Sketch the structure of an arteriovenous malformation.

Class 6 **Topic:** **OSTEOCHONDROSIS OF THE SPINE**

1. 1. Write down the definition of "Dorsopathy".
2. Draw the pathogenesis of the formation of protrusion and disc herniation
3. 3. Draw and describe radicular symptoms on the upper limb at C3, С4, С5, С6, С7
4. 4. Draw and describe radicular symptoms on the lower limb at L3, L4,L5,S1.
5. 5. Sketch and describe the cauda equina syndrome.
6. 6. Draw the principle of the surgery "transpedicular fixation of the spine" for osteochondrosis (describe the indications for this intervention).

*Class 1* **Topic: STAGES OF MEDICAL CARE IN THE NATIONAL HEALTH CARE. PRINCIPLES, TACTICS, METHODS, AND MEANS OF TREATMENT**

QUALIFICATION CHARACTERISTICS OF THE EDUCATIONAL DISCIPLINE

(the amount of practical knowledge that 5th and 6th year students of the Faculty of General Medicine should acquire, having finished courses in traumatology and orthopedics)

1. Be able to apply all types of bandages by various means and teach these actions to non-medical specialties

2. Apply splints to bone fractures with standard splints and improvised means and teach these actions to persons of non-medical specialties

3. Temporarily stop bleeding by any available means and teach these actions to non-medical specialties

4. To be able to bring injured individuals out of terminal states and shock, using actions at the medical level (novocaine blockades, blood replacement, etc.)

5. Determine the severity of the condition according to I.S. Kolesnikov and carry out their medical triage, according to the conditions of peacetime

6. Be able to identify orthopedic patients of different etiological groups, organize their treatment, conduct medical examinations

7. Carry out sanitary and educational work among the population on the prevention of injuries and the early detection of orthopedic diseases

**TYPES OF INJURIES**

**I. Production (industrial, agricultural, etc.)**

**II. Non-production,**

injuries caused by:

а) railway transport

b) water transport

c) air transport

d) underground transport

e) road transport

f) other types of land transport (tram, trolleybus, horse-drawn carriage, etc.)

received:

g) during pedestrian traffic (except for those caused by transport)

h) household

i) sports

j) criminal

k) other and not established

**CAUSES OF INJURIES**

**I. Material**: objects, moving parts of machines and mechanisms, tools, machine parts, falling workers, falling objects on workers, processed material, high and low temperatures, electric shock.

**II. Technical**:

faulty condition of equipment - machine tools, machines, devices;

malfunction and non-compliance of the used hand tools;

structural defects of machines;

absence, malfunction of protective devices.

**III. Organizational**:

safety violation,

insufficient instruction or its absence,

lack of leadership and supervision over the production of works,

maintenance by insufficiently qualified workers of complex units and mechanisms,

employing a worker outside his specialty,

lack of overalls, glasses, etc.

**INJURY CASE STUDY METHODOLOGY**

*PLACE OF INJURY - Where did the injury occur?*

*MATERIAL CAUSE OF INJURY - What caused the injury?*

*CIRCUMSTANCES OF THE INJURY - How did the injury occur?*

*CAUSE OF INJURY - Why did the injury occur?*

**ISSUES OF THE FRACTURE TREATMENT THEORY**

**Principles of fracture treatment**

1. Residents of even the most remote places should be provided with the same amount of help as residents of central cities

2. Complete (ideal) realignment of fragments.

3. Reliable fixation of fragments during the entire period of fracture healing.

4. Early functional treatment, corresponding to the methods and means of treatment, not causing the formation of a gap between fragments.

**Fracture treatment strategy**

1. Saving the life of an injured individual due to shock, possible damage to the brain, internal organs, etc.

2. After providing first medical aid, promptly evacuate (send) the injured individuals to the stage of highly specialized care.

3. Widespread use of minimally invasive methods of surgical treatment.

4. Reducing the terms of treatment and rehabilitation through the use of modern methods and means of treatment, prevention and timely elimination of complications.

Compliance with the principles of standardization of examination and treatment of patients and injured individuals.

**Fracture treatment methods**

1. The main method of treatment is surgery.

2. In the treatment of fractures without displacement of fragments, immobilization with cast s or other medical splints, orthoses is sufficient.

3. At the stage of qualified care, if it is impossible to immediately evacuate to the stage of specialized or highly specialized care, treatment with skeletal traction or casts is applied.

4. After examination and appropriate preparation, surgical treatment using high-tech methods using modern metal structures.

5. Mandatory prevention of inflammatory and thromboembolic complications

**Means of fracture treatment**

1. The use of synthetic, cast bandages or orthoses for fractures without displacement of fragments and after successful one-stage reduction (reposition).

2. Treatment with skeletal traction only if there are contraindications to surgery, the patient categorically refuses it, or the impossibility of evacuation to the stage of highly specialized care.

3. Widespread use of minimally invasive surgical methods and advanced high-tech techniques.

**Stage of medical care** –is a place or medical institution where there are forces and means to provide the appropriate amount of assistance to the injured or sick.

|  |
| --- |
| In urgent cases, HYPERDIAGNOSTICS is always preferable. It is better to overestimate the severity of an injury or condition and take the necessary measures than to underestimate it and, without taking appropriate measures, aggravate the condition of the injured individual. |

KEY PRINCIPLES OF STAGED CARE

**In emergency situations**

Provide the full extent of care possible at this stage.

Evacuate the injured individual in the proper position, by the proper mode of transport for the intended purpose (that is, to where he will be treated, bypassing all intermediate steps).

Maintain consistency in treatment.

**In planned situations**

If the doctor has not dealt with the patient, then he must send him to the next stage, where they must understand the nature of the pathology and determine the scope and place of treatment for this patient or provide him with full care at this stage.

STAGES OF MEDICAL CARE IN PRACTICAL HEALTH CARE

|  |  |  |
| --- | --- | --- |
| Stage of medical care | Where and by whom is assistance provided? | Objectives of care for patients with trauma |
| ***First aid***  *(self-help and mutual aid, first medical aid)* | at the scene of the accident by the injured themselves, by those around them or by persons with medical education | 1) eliminate the immediate cause of death associated with respiratory failure, cardiac activity, external bleeding, etc.;  2) prevent possible complications (shock, asphyxia with vomit, etc.);  3) alleviate the suffering of the injured individual by taking available measures;  4) organize transportation according to purpose |
| ***Pre-hospital care*** | at the feldsher-obstetric station by paramedical personnel, nursing staff | the same as listed above, as well as monitoring the correctness of the measures taken |
| ***First doctor care*** | at the local hospital by a general practitioner | 1) conduct a medical triage (assessment of the state according to the scheme of I.S. Kolesnikov, CITO),  2) provide a full scope of first doctor care, determined by the condition and number of injured individuals,  3) resolve evacuation-transport triage issues |
| ***Qualified care*** | in the Central District Hospital by a surgeon | 1) conduct a medical triage (assessment of the state according to the scheme of I.S. Kolesnikov, CITO),  2) provide a full range of qualified care, determined by the condition and number of injured individuals,  3) perform emergency surgery,  4) solve the issues of evacuation-transport triage of injured individuals who need treatment at the next stages |
| ***Specialized care*** | in the Central District Hospital by a traumatologist-orthopedist | 1) after performing medical triage, provide emergency patients with full assistance  2) perform emergency surgery  3) perform planned surgical interventions for planned patients in need of complex surgical interventions  4) refer to highly specialized care |
| ***Highly specialized care*** | in trauma departments of regional hospitals, clinics of universities, research institutes | provide highly specialized care, including performing complex reconstructive surgeries |

**One of the essential elements of care for fractures of the musculoskeletal system is immobilization**

**Types of immobilization**

for transport

therapeutic

**Means of transport immobilization**

headscarves,

bandages,

pneumatic splint

vacuum splint

Cramer splint,

Dietrich splint,

“Lubok”(a splint type),

Vinogradov splint,

and others

Standard hard

Standard soft

Improvised tools

sticks,

boards,

branches,

shrub bunches,

tight rolls of matter

Standard means

Nothing is available

leg to leg

**REQUIREMENTS FOR IMPROVISED IMMOBILIZATION TOOLS**

1.Sufficient length

2. Sufficient strength and rigidity

3. Sufficient smoothness

**PRINCIPLES OF TRANSPORT IMMOBILIZATION FOR LIMB FRACTURES**

1. Provide transport immobilization as early as possible.

2. Clothing and shoes on the injured individual usually do not interfere with transport immobilization, moreover, they serve as a soft pad under the splint. Removal of clothes and shoes is done only when absolutely necessary. It is possible to apply a bandage on a wound, to produce novocaine blockades through an incision in clothing, preferably along a seam.

3. Before transport immobilization, anesthesia should be carried out in order to cause the least suffering to the victim. The method of anesthesia depends on the stage where immobilization is carried out. It must be remembered that the procedure for applying a transport splint is associated with displacement of bone fragments and is accompanied by an additional increase in pain in the area of damage.

4. If there is a wound, it should be closed with an aseptic dressing before splinting.

5. The application of a tourniquet, according to relevant indications, is also performed before immobilization. Do not cover the tourniquet with bandages.

6. In case of open (gunshot) fractures, the ends of bone fragments protruding into the wound cannot be aligned, as this will lead to additional microbial contamination of the wound

7. If there is a threat of perforation of the skin by bone fragments, before applying the splint, a partial reduction is performed by stretching the limb.

8. Before applying the ladder splint should be pre-modeled, adjusted to the shape of the injured limb.

9. In order to avoid the formation of pressure ulcers, the splint should not exert strong pressure on soft tissues, especially in the area of bone protrusions, squeeze large blood vessels and nerve trunks.

10. In case of fractures of long tubular bones, three joints should be immobilized. Immobilization will be reliable if immobilization of all joints, functioning under the influence of the muscles of this segment of the limb, is achieved.

11. The limb should be immobilized in an average physiological position in which the antagonist muscles (eg, flexors and extensors) are equally relaxed. However, the practice of immobilization and transportation conditions force some deviations from the average physiological position. In particular, knee flexion is limited to 170°.

12. Reliable immobilization is achieved by overcoming the physiological and pain contraction of the muscles of the damaged limb segment. Pain contraction is expressed in a decrease in the length of the muscle due to the convergence of its points of attachment during a bone fracture. The contracted muscles hold the bone fragments in a displaced position. Traction, which is highly desirable during transport immobilization, does not aim to completely relax the muscles and reposition fragments; provides only more or less adequate resistance to muscle contraction and partial reduction of fragments.

13. Splints provide more reliable immobilization if they are firmly fixed with bandages throughout their whole length

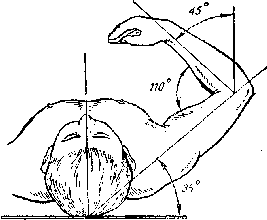
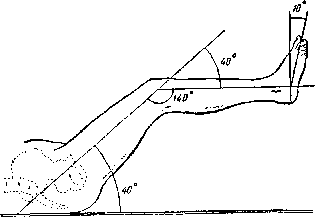
 

Fig. The average physiological position of the upper and lower limbs

Algorithm of transport immobilization in case of the lower leg fracture.

1. Take the Cramer splint and model it according to the contour of the back of the leg, starting from the toes.

2. Model the second Cramer splint according to the contour of the inner surface of the leg, bending the excess splint through the foot to the outer surface of the lower leg.

3. Model the third splint according to the contour of the outer surface of the leg.

4. The assistant, carrying out a gentle traction of the lower leg by the foot with one hand, raises the leg, supporting it in the upper part of the lower leg with the palm of the second hand.

5. Lay the splint on the back of the leg and hold it until the assistant changes hands while applying traction.

6. Place splints on the side surfaces.

7. Fix the splints on the leg with circular rounds of gauze bandage.

Doctors who do not have sufficient work experience, upon first contact with the delivered injured individual, must use the scheme of I.S. Kolesnikov, which allows: 1) quickly orientate in the severity of the condition of the patient and immediately begin treatment and preventive measures. After the start of a set of measures, you should continue to search for the causes of this condition and then solve the issues of intra-point and evacuation-transport triage;

2) competently solve the issues of intra-point and evacuation-transport triage in case of mass arrival of injured individuals.

**THE SCHEME OF I.S. KOLESNIKOV**

|  |  |  |
| --- | --- | --- |
| Condition characteristics | BP | Actions |
| Normal | normal | psychological influence |
| Stress-compensated | normal, tachycardia | + anesthetize, bandage, immobilize |
| Alarming | lowered, but above critical figures (down to 100-80 mm Hg. Art.) | + novocaine blockade, replenishment of circulating blood volume |
| Threatening | at the level of critical figures  (70-60 mm Hg. Art.) | + O2 inhalation, intravenous blockade, corticosteroids |
| Critical | below the level of critical figures | + bolus transfusion of polyionic and colloidal solutions |
| Catastrophic | not registered | resuscitation |

**The scheme of I.S. Kolesnikov allows to**: 1) quickly navigate the severity of the injured individual’s condition and begin therapeutic and preventive measures, then continue to search for the causes of this condition and competently resolve all issues of intra-point and evacuation triage;

2) competently solve the issues of intra-point and evacuation-transport triage in case of mass arrival of injured individuals.

THREE GROUPS OF SYMPTOMS

Symptoms of all diseases can be divided into three groups

Uncharacteristic or unreliable – found in many diseases

Characteristic or reliable – found in some diseases

Absolute – only occur in one disease

FRACTURE DIAGNOSIS

|  |  |
| --- | --- |
| ***Absolute symptoms of fractures:***  - obvious deformation of the bone that occurs immediately after the injury  - abnormal mobility that occurs immediately after the injury  - crepitus of bone fragments | ***Typical symptoms of fractures:***  - local pain and tenderness  - swelling, smoothness of the contours  - pain on exertion through apparently intact tissues  - functional impairment |

MORPHOLOGICAL CONDITIONS FOR BONE FRACTURE HEALING

The presence of a living, dividing bone cell that forms a regenerate

Preservation or restoration of blood supply to bone tissue

The gap between the fragments should be separated from the surrounding tissues

CLASSIFICATION OF FRACTURES

by the amount of damage

*along the fracture plane*

*by the presence of a wound channel*

by collateral damage

*by mechanism*

**from direct action** (fracture at the site of application of force)

**from indirect action**

(damage occurs at a distance from the place of application of force)

**supporting** (the plane is located across or at a slight angle)

**non-supporting** (such, after comparison of which even a slight load along the axis causes a displacement)

**closed**

**open** (the wound communicates with the area of the fracture)

uncomplicated,

complicated,

combined,

multiple injury

single

multiple

*at the site of fracture of long tubular bones*

*in relation to the joints*

*by displacement of fragments*

*in the direction of the fracture plane*

by the degree of damage

**at an angle**

**in width:**

I degree - less than the thickness of the cortical layer

II degree - on the thickness of the cortical layer

III degree - more than ½ bone

**by lenght:**

1) displacement with shortening

2) distraction

(patella,

olecranon,

calcaneus)

**rotational**

**impacted fracture**

**complete**

**incomplete** (greenstick)

transverse,

transversely serrated,

oblique transverse,

oblique,

spiral,

сomminuted,

multifragmented,

**extracapsular**

**intracapsular** (periarticular, intraarticular)

metaphyseal,

diaphyseal,

epiphyseal

According to the plane and nature of the fracture, there are:

transverse, oblique transverse, transversely serrated - these fractures belong to the supporting group;

oblique, spiral, сomminuted, multifragmented (large and small fragmented, crushed) – these fractures are classified as non-supporting fractures.

SITUATION IN THE AREA OF FRACTURE

(fracture formula)

soft tissues

fragment gap fragment

soft tissues

FIVE GROUPS OF FRACTURES

(DEPENDING ON THE DISPLACEMENT OF FRAGMENTS, TACTICS FOR THE CASES)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Spatial relationship between fracture fragments | | | | | Open fractures |
| without displacement of fragments | angulated | with displacement along the length (shortenrd) | with distraction of fragments along the length | |
| 195 | 122 | 195 | 187 | | 195 |
| What to do? | | | | | |
| apply a cast | perform single-stage reduction (repositioning) by applying pressure at the corner, apply a cast | apply skeletal traction | | make an open reduction (repositioning), osteosynthesis | perform surgical treatment taking into account the Kaplan-Markov table |