

MINISTRY OF HEALTH OF UKRAINE
O.O. BOHOMOLETS NATIONAL MEDICAL UNIVERSITY

**Limb compartment syndrome. Classification, pathogenesis, clinic,
diagnostics and principles to assist**

WORK BOOK

For independent work of students of 5th course
Study discipline "Traumatology and Orthopedics"
direction "Medicine"
specialty "Curative care"

Department of Traumatology and Orthopedics

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Introduction

One of the effective means of organizing an independent work of students on topics of disciplines assigned for independent study is the work of a student with his/her workbook. Work with the workbook should begin with the acquaintance with the key issues on the topic. The next step includes the acquaintance with the list of sources from which the student can find the answers to the posed questions. For more deep study of the problem students can visit professional websites.

Having become acquainted with the theory, the student needs to assess his/her degree of mastering the material. In this regard, he/she resolves the proposed tasks; answers test questions on the topic. Students should pay particular attention in preparing for classes to the required minimum of practical skills to be mastered. In the relevant sections of textbooks, manuals, he must glean the information that he needs for mastering further practical skills.

Arrangement of independent work with the use of workbook is conducted as follows: tutor provides the workbook to a student in digital format (to be downloaded from website of the Department), or in printed version; later the students do the tasks at their extra-curricular time, whereupon the tutor checks and assesses them **at the initial stage of practical classes.**

Criteria for assessing the tasks in the workbook

Each task requires a separate approach when assessing the quality of its implementation under particular criteria. And yet, with a 5-point evaluation ranking for each type of tasks, one should observe the general didactic criteria, namely:

“5” is graded when the student:

1. Executed the work w/o errors and deficiencies.
2. maximum one deficiency.

“4” is graded when the student executed the work in full but made:

1. maximum one gross error and one deficiency.
2. maximum two deficiencies.

“4” is graded when the student executed at least one half of a work correctly or made:

1. maximum two gross errors or one gross and one mild errors and one deficiency.
2. maximum two mild errors or one mild error and three deficiencies.
3. In the lack of errors but when four or five deficiencies are available.

“2” is graded when the student made:

1. number of errors (deficiencies) exceeding the limit when grade “3” could be applied.
2. In case less than half of work is completed.
3. Failed to start the work.

Subject. "Compartment syndrome of the limbs. Classification, pathogenesis, clinical manifestations, diagnosis and principles of medical care"

Target (learning objectives):

1. Topicality of limbs compartment syndrome in inpatient and outpatient practice, especially in gunshot wounds of the extremities.
2. Define the factors of the limb compartment syndrome.
4. Analyze the results of clinical, ultrasound, CT, MRI examination of patients with limb compartment syndrome.
5. Justify the principles of prevention of limb compartment syndrome.
6. Justify the objectives and principles of conservative and surgical treatment, depending on the nature of the compartment syndrome of limbs.

The student should know:

1. Anatomical and physiological features of the compartments of the upper limb (location, content of the fascia).
2. Anatomical and physiological features of the compartments of the lower limb (location, content of the fascia).
3. Features of gunshot wounds, as a major factor in the development of limb compartment syndrome
4. Etiopathogenesis of limb compartment syndrome
5. Clinical signs and basic diagnostic tests used to determine the limb compartment syndrome
6. Indications for conservative and surgical treatment.
7. Indications for prophylactic fasciotomy
8. Indications for curative fasciotomy
9. Etiopathogenesis and principles of treatment of Volkmann's ischemic contracture
10. Options for the rehabilitation of patients with compartment syndrome

The student should be able to:

Conduct a survey of trauma patients

Analyze the typical clinical picture of limb compartment syndrome in a patient. Analyze data X-ray examination, ultrasound, CT, MRI,

Electroneuromyography, intra-compartmental pressure and measurement pressure; to diagnose the compartment syndrome

Develop a treatment plan, to predict its timing and results

Apply the bandage, elastic bandage, the splint on the affected segment.

Justify the choice of the most efficient approach, comprehensive treatment.

Define the principles of rehabilitation.

The main theses of the topic.

Compartment syndrome - a condition in which increased pressure in the closed compartments case leads to ischemia and necrosis of muscle, ischemic contracture development. Pathogenesis: increased intra-compartmental pressure reduces microcirculation within the closed compartment, causing the tissue injured limb not receive nutrients and oxygen and do not give full of waste products (CO₂, free radicals, ammonia, etc. .), that results in the formation of a vicious circle of the pathological process that results in the progressive necrosis of tissue.

The main clinical symptom of compartment syndrome (CS) is a busy limb edema, which is accompanied by intense pain and sensory disturbances in the distal segments, muscle weakness and a sharp increase in pain when trying to extension of fingers and toes. Objective evaluation criterion of compartment syndrome is a measurement of intra-compartmental pressure. Normally intra-compartmental pressure is 3-7 mmHg. When compartment syndrome level intra-compartmental pressure 30-40 mmHg below the diastolic blood pressure in normotensive patient (BP 120/80) is 40-50 mmHg. In the case of compartment syndrome development in most cases, the main blood flow will be saved, but especially fast and aggressively compartment syndrome occurs in cases of combined damage of the great arteries and gunshot fractures. In cases of light compartment syndrome treatment is limited to the control of tissue pressure and conservative measures: cut all compressing dressings, limb position at the «heart» level, the appointment of painkillers, diuretics, etc. If conservative measures do not reduce intra-compartmental pressure, it is advisable to perform a closed fasciotomy ischemia damaged compartments. In more severe cases, where the average (moderate) degree of the compartment syndrome, when the pressure of the fabric is in the range of diastolic pressure, is closed fasciotomy performed whose purpose is to decompression bone fascial sheath. In severe cases of compartment syndrome, characterized by the presence of blisters (flictena) on the skin, the absence of a pulse at the distal segments may experience redness of the skin. In cases, when diagnosed severe compartment syndrome doctor should immediately take a decision on the implementation of the expanded dermatofasciotomia with revision of neurovascular trunks.

In order to prevent the development of compartment syndrome, preventive fasciotomy is provided. Indications for preventive fasciotomy have different options of gunshot wounds of limbs:

1. Localization of gunshot fracture near the elbow and knee joints (especially important in the localization in the upper third of the leg).
2. Gunshot fracture at any site with damage to the main blood flow.
3. Firearms polytrauma - at primary surgical treatment fractures at any site.
4. Gunshot fractures of any location in cases of prolonged tourniquet (over 2 hours).
5. Gunshot fractures at any site in conjunction with the circular burns.

Medical (curative) fasciotomy performed during the development of the clinic compartment- syndrome. Indications for curative fasciotomy

1. Tight edema of the limb segment.
2. Tight edema of the limb segment hyposthesia or anesthesia of fingers (wrist, foot).
3. Tight edema, accompanied by intense pain, which increases with fingers extension.

4. Tight edema after recovery of major vessels.

5. Edema of limb segment, wherein intra-compartment pressure for 30-40 mmHg lower than diastolic pressure.

Therapeutic (curative) fasciotomy should be combined with extrafocal fixation or stability control of apparatus that is previously imposed. Therapeutic (curative) fasciotomy in the case of breach of the main blood vessels to be combined with the restoration. The highest efficiency of decompression fasciotomy - in the first 6-8 hours of the development of compartment syndrome

Ischemic contracture of the limbs - a severe disease that causes disability and permanent loss of physical activity, and in severe cases, there is a problem of social adaptation of the patient. Pathological installing of wrist in result of Volkmann's ischemic contracture (upper limb damage) impairs the quality of life due to the inability to perform basic grippers and self. Ischemic contracture occurs as a result of suffering a compartment syndrome.

Literature.

Summary:

1. Buryanov A.A., S.S. Strafun Guidelines "Gunshot wounds of limbs" 46.
[Http://www.kaftravm.com.ua/](http://www.kaftravm.com.ua/)
2. Strafun S.S., Leskov V.G., Skobenko A.E., Lopaychuk V.A., Timoshenko S.V. «Local hypertensive ischemic syndrome (compartment syndrome) as a complication of fractures of limbs» // Materials of the Plenum of the Association of Orthopedists and Traumatologists of Ukraine, Kiev - Vinnitsa, 2004. - S. 77-78
3. Strafun S.S., A.T. Brusco, Liskina I.V., S. Timoshenko, V.A. Lopaychuk «The relationship of intraosseous blood and intra-compartment pressure // Vestn. orthopaedist., trauma. and prosthetic. - 2005. - № 2. - S. 12-15.

Additional

1. Strafun S.S., Leskov V.G., Diagnosis and treatment of the local hypertensive ischemic syndrome of the lower limbs 36 // Science. works et al. KIPE them. PL Shupyk. - 2000. - S. 80-84.
2. Mubarak S.I., Hargens A.R., Compartment syndromes and Volkmann's contracture. - Philadelphia: W.B. Saunders, 1981. - 232 p.
3. Seiler J.G., Casey P.J., Binford S.H. Compartment syndrome of the Upper Extremity // J. South Orthop. Assoc. - 2000. - Vol. 9, № 4. - P. 233-347.

Tasks for independent work topics

Must be answered in writing

Option 1

Tests.

1. Compartment syndrome of the upper limb manifests clinically:

- A. Pain at the place where the muscles are attached to the outer shoulder epicondyle
- B. Pain at the place where the triceps muscle of the arm attached to the top of the ulnar process

- C. Pain at the place where the muscles are attached to the inner shoulder epicondyle
- D. Pain at the place where the biceps are attached to the radius
- E. pain on extension of fingers

2. Indications for therapeutic fasciotomy:

- A. De Quervain's disease
- B. Tenosynovitis is a second rear channel tenosynovitis long and short radial wrist extensor muscles.
- C. Tenosynovitis of the third rear channel - tenosynovitis of the extensor of the thumb.
- D. Tenosynovitis of the fourth channel back - extensor tenosynovitis general III-IV finger and second finger extensor.
- E. Gunshot fractures of the forearm bones.
- F. Tenosynovitis sixth back channel - ulnar extensor tenosynovitis brush.

3. The most informative method of diagnosis of compartment syndrome of the limbs:

- A. MRI
- B. ultrasound
- C. electromiography
- D. invasive measurement intra-compartment pressure
- E. CT scan

4. The most effective method of treating of compartment syndrome of the lower limb

- A. paraffin-ozokerite applications
- B. physiotherapy: laser, ultrasound, magnetic therapy,
- C. NSAIDs
- D. local injection of corticosteroids (diprospan, flosteron, depomedrol)
- E. Extracorporeal shock wave therapy
- F. fasciotomy

5. Volkmann's contracture is

- A. inflammation of the tendons surrounding tissues. It may be accompanied by degeneration of the tissue and restriction of movements in the wrist joints
- B. inflammation and tendon damage. The surrounding tissue while in the process is not involved, but there is a limitation of movement in the joints of the foot
- C. abnormal setting of the upper limb due to soft tissue ischemia
- D. degenerative Achilles tendon rupture

Option 2

Tests.

1. Lower extremity compartment syndrome is clinically manifested:

- A. Edema and pain in the place where the muscles are attached to the external epicondyle thigh
- B. Violation of sensitivity and pain in the place where the three-headed calf muscle attached to the hill of the calcaneus
- C. Pain at the place where the muscles are attached to the inner thigh epicondyle
- D. Pain at the place where the biceps femoris are attached to the fibula
- E. Pain in extension of toes, swelling of the lower leg and a violation of skin sensitivity

2. The pathogenesis of compartment syndrome of the lower limb associated with:
 - A. The primary development of ischemic contracture, followed by the gradual emergence of necrosis of the thigh muscles
 - B. secondary reduction of intra-compartment pressure
 - C. immobilization of the knee
 - D. Increasing the intra-compartment pressure with the subsequent development of ischemia and necrosis of muscle, and the formation of ischemic contracture of the foot
 - E. Montedje's gunshot trauma

3. The most effective method of conservative treatment medium compartment syndrome
 - A. paraffin-ozokerite applications
 - B. physiotherapy: laser, ultrasound, magnetic therapy,
 - C. NSAIDs, diuretics, position of extremity at the level of the heart, bandages displacement
 - D. local injection of corticosteroids (diprospan, flosteron, depoomedrol)
 - E. Extracorporeal shock wave therapy
 - F. fasciotomy

4. Pidfastialny pressure is measured in:
 - A. mm wt.
 - B. mmol / l
 - C. degrees
 - D. mmHg
 - E. lm Hg

5. The most effective method of conservative treatment of lung compartment syndrome
 - A. paraffin-ozokerite applications
 - B. physiotherapy: laser, ultrasound, magnetic therapy,
 - C. NSAIDs, diuretics, position of extremity at the level of the heart, bandages displacement
 - D. local injection of corticosteroids (diprospan, flosteron, depoomedrol)
 - E. Extracorporeal shock wave therapy
 - F. fasciotomy