**Ministry of Health of Ukraine**
**Higher State Educational Establishment of Ukraine**
**"Ukrainian Medical Stomatological Academy"**

**S. M. Bilash, O. M. Pronina, M. M. Koptev**

# CLINICAL ANATOMY AND OPERATIVE SURGERY OF REGIONS AND ORGANS OF NECK AND HEAD

**Manual for training of specialists**
**for II (Masters Degree) 22 "Health Care"**
**in speciality 221"Dentistry"**

**Poltava – 2017**

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**Authors:** S.M. Bilash, O.M. Pronina, M.M. Koptev

**Clinical anatomy and operative surgery of regions and organs of neck and head. Manual for training of specialists for II (Masters Degree) 22 "Health Care" in speciality 221"Dentistry".– Poltava: Publishing office “Kopir servis”, 2017. – 158 p.**

The manual on clinical anatomy and operative surgery for international students of dental departments corresponds to the syllabus and curriculum of the subject. The main issues for practical training and also recommendations on the methodology of the subject are represented sequentially. The manual includes theoretical material, assignments for self-control, situational tasks and the list of recommended literature for self-training.

It provides development of learning effectiveness of the students and is directed on mastering the subject "Clinical anatomy and operative surgery", gaining practical experience and skills which is important in future medical practice.

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CONTENT

| | |
|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module No 1** | Clinical anatomy and operative surgery of regions and organs of head and neck |
| **Content module 1** | Introduction to clinical anatomy and operative surgery |
| **Topic 1** | Specification and tasks of clinical anatomy and operative surgery. History of the subject development. Topografoanatomical research methods. Classification of surgical operations. Surgical instruments and suture equipment |
| **Year** | II |
| **Department** | Foreign students training (dental) |

**1. The relevance of the topic**

Every surgical intervention, regardless of the complexity and region, is performed by surgical instruments and requires high-quality suture material. Profound knowledge of surgical instruments and rules of their use is important in professional activities of specialists in different fields of surgery that should be combined with knowledge of rules and surgical techniques.

**2. Specific objectives**

1. Classify general surgical instruments.
2. Explain the technique of general surgical instruments application.
3. Classify surgical suture materials.
4. Explain the use of basic types of suture material.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson**

| Term | Definition |
|---|---|
| Operative surgery | The science dealing with surgical operations, methods of surgical interventions, which provides mechanical effect on organs and tissues with diagnostic, medical or reconstructive purpose. |
| Clinical anatomy | Science dealing with anatomical issues which are relevant to various fields of practical medicine. |
| Topographic anatomy | The science dealing with structure, shape and relative location of organs and tissues in various parts of the human |

| | |
|---|---|
| | body. |
| Anatomy of ages | The science that studies the age-related aspects of anatomical features in individual human development – ontogenesis. |
| Comparative anatomy | The science that studies similarities and differences in the body structure of animals and humans, the body structure itself at different stages of evolution, that clarifies the historical development of human organism – phylogenesis. |
| General surgical instruments | Surgical instruments used for all types of surgery. |
| Special surgical instruments | Surgical instruments used only for certain surgical interventions on the organs. |

**3.2. Theoretic questions**

1. What is the order of instrument placement on the table of scrub nurse?
2. What types of scalpels do you know? Positions for holding a scalpel.
3. What is a scalpel position while performing the skin incision?
4. How should the scissors be held in the hand while dissecting tissue?
5. What is the difference between Kocher's and Billroth's hemostatic forcepts?
6. What is the difference between Hegar's, Troianov, and Mathieu needle holders?
7. Is it correct position of the forcepts in the hand, when its end is directed to the palm?
8. What types of surgical needles do you know?
9. What are the requirements for suture material?
10. What is the classification for suture materials? What are their comparative characteristics?

**3.3. Practical skills acquired in class**

1. Arrange the instruments on the table of scrub nurse.
2. Perform the soft tissue cutting with a scalpel.
3. Apply hemostatic forcepts on the blood vessels.

**4. The content of the topic**

At the beginning of the lesson the teacher should acquaint students with the department, its educational facilities, equipment, the main tasks of the department in teaching and research work.

**Description of surgical instruments**

Starting with surgical instruments, the teacher explains that there are general and special instruments and surgical suturing devices. Then proceeds to description of each instrument, pays attention to its application in surgical practice and region of its using.

General surgical instruments can be distributed into the following groups: for tissue separation (cutting instruments), for bleeding arrest (hemostatic instruments), auxiliary (fixing) instruments and instruments for tissue connecting.

Instruments for tissue separation include scalpels (bellied, sharp-pointed, straight).

When dissecting tissue surgeons often use scissors: straight or curved along the plane or edge. There are scissors for special purpose: ocular, vascular and others.

Hemostatic instruments include clamps, which can have straight or curved working surface. Kocher's clamps are widespread in surgical practice (with teeth on working surface), Mikulich's (with teeth and diagonal notches on working surface) and Billroth's (without teeth). For small vessels bleeding arrest hemostatic clips "mosquitoes" are used. Halstead clamps provide simultaneous capture of both vascular wall and adjacent tissue.

Auxiliary (fixing) instruments are used to examine occurring wound, identify bleeding vessels, pathologically changed tissues and organs by thorough widening of the wound edges. It is performed by capturing the wound edges with fixing tools: tweezers, hooks, specula etc.

Hooks can be: sharp-pointed, blunt, laminar, one-, two-, three- and four toothed. If surgeon manipulates in the depth of the wound near large vessels and nerves, it is advisable to use blunt or laminar hooks.

Tweezers are often used as fixing instruments. Anatomical forceps (without teeth) is preferable in case of soft tissue capture (blood vessels, nerves, walls of the intestines and others), and surgical ones are used while capturing the edges of dissected skin, aponeurosis, tendons.

The group of auxillary (fixing) instruments include probes, namely, grooved, bulbous-end, Kocher probe. Grooved probes are used in cutting aponeurosis, fascia, the bulbous-end – to examine the depth and direction of the wound channel or fistule, detection of foreign bodies and other. Kocher probe is used in surgical interventions on the thyroid gland.

Deshan's ligature needles also belong to auxiliary group of instruments. They are used to bring the ligature under the vessels and ducts. There are right and left-handed Deshan's needles, they can be sharp-pointed and blunt-ended.

Instruments for tissue connection: needle holders (Hegar's, Troianov, Mathieu), curved surgical needles (taper and cutting), straight, pointed and blunt (for liver surgery), clamps, tweezers and Michel clips remover.

Cutting (triangular) surgical needles are used when suturing the skin, aponeurosis, fascia and taper (round) one – while suturing the walls of hollow and parenchymatous organs.

Atraumatic needles are used for angiorrhaphy, suturing of the heart and lung wounds.

The teacher indicates the order of instruments placement on the table of scrub nurse, rules for passing them to the surgeon and how the surgeon should hand back the instruments to the nurse.

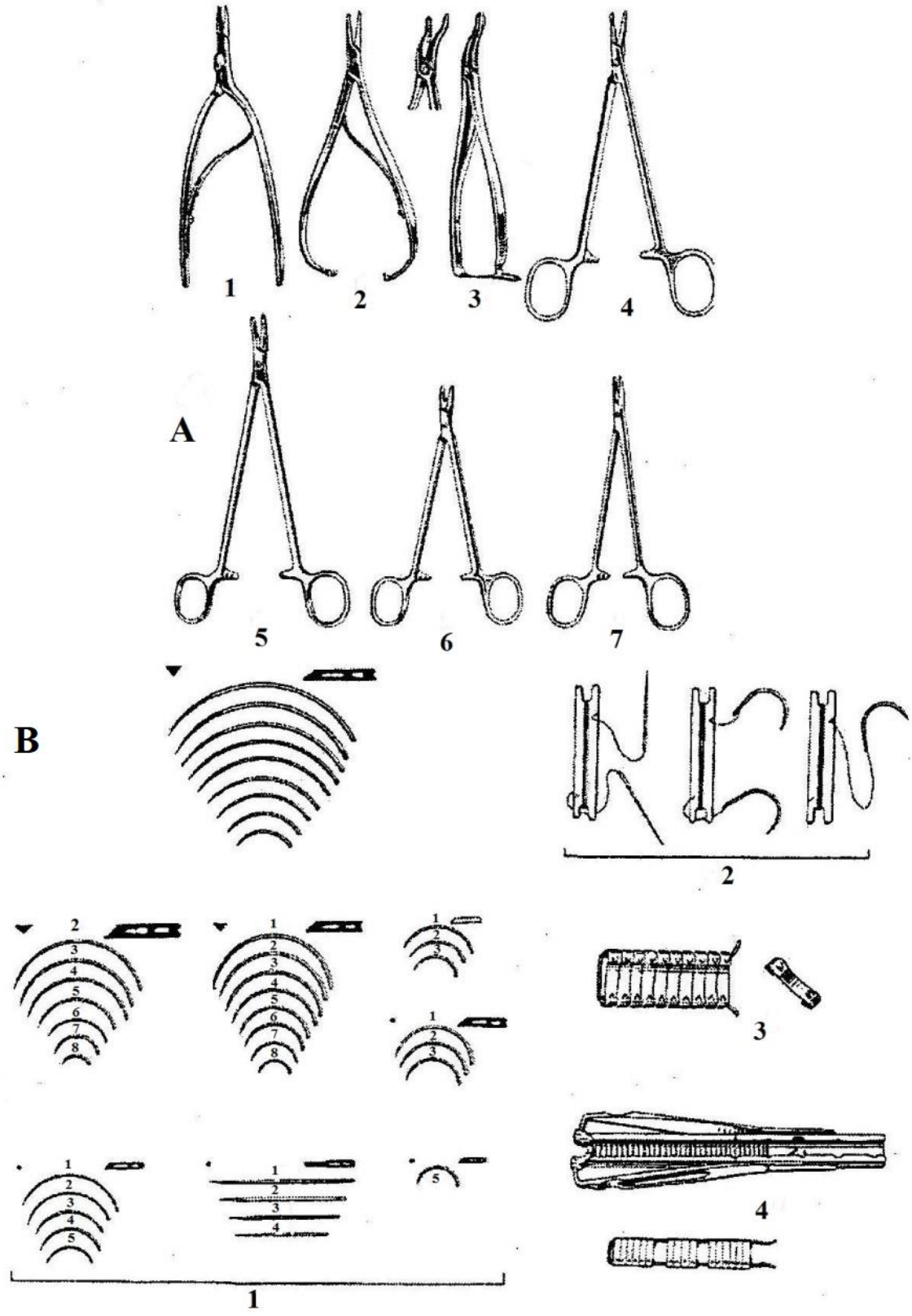


Fig.1. Instruments for tissue connection:
A − needle holders: 1 − for angiorrhaphy; 2 − with bent handles and ratchets; 3 – Troianov's; 4 − with straight ring handles and ratchets; 5 − curved with straight ring handles and ratchets; 6,7 − straight and curved with straight ring handles and ratchets;
B − surgical needles: 1 − surgical needles straight and curved (cutting and taper); 2 − atraumatic surgical needle; 3 − the metal clips (Michel); 4 − forceps for metal clips applying.

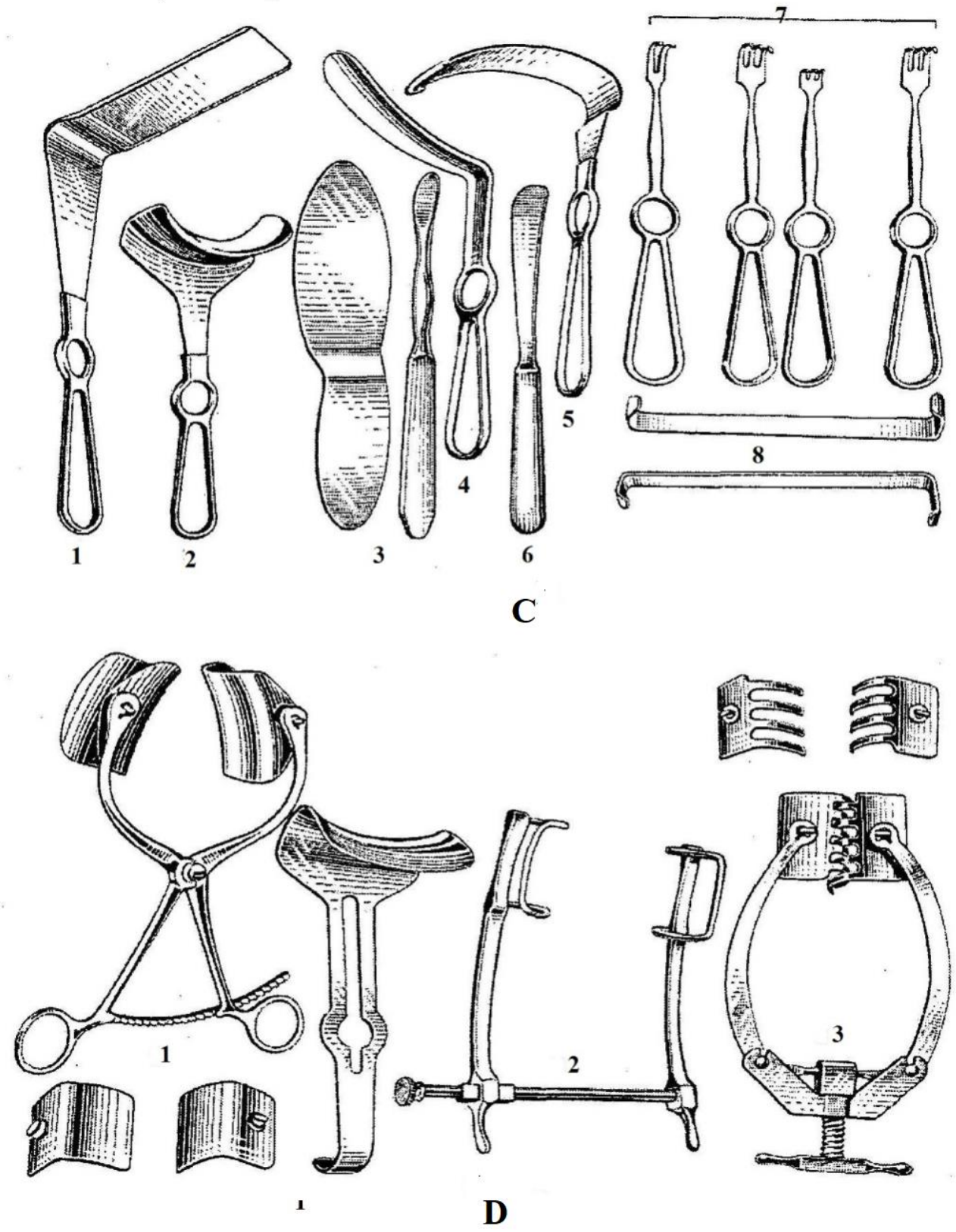


Fig.2. Auxiliary tools:
C – retractors: 1 – liver speculum; 2 – abdominal wall speculum; 3 – kidney abduction speculum; 4 – soft tissue elevator; 5 – speculum for heart; 6 – Buial'skii spatula; 7 – surgical toothed hooks; 8 – laminar hooks; D – retractors: 1 – double with ratchet; 2 – without ratchet; 3 – screw retractor used for ribs.

The teacher shows students different positions of scalpel fixing (dinner knife position, pen holding position, fiddlestick position, amputating knife position) depending on the purpose of the incision (Fig.3−8).

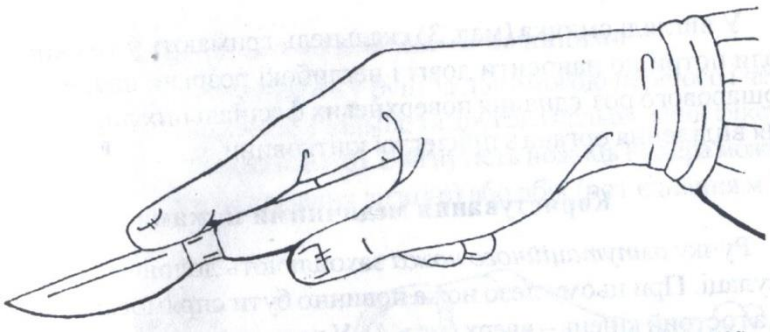

Fig.3. The dinner knife position of the scalpel

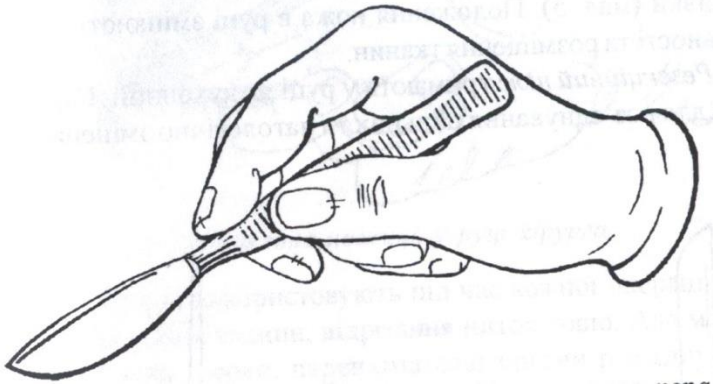

Fig.4. The pen holding position

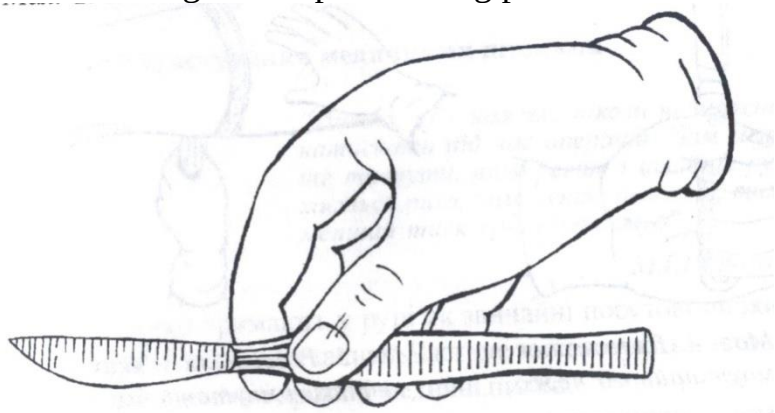

Fig.5. The fiddlestick position

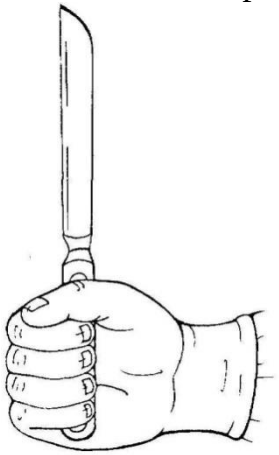

Fig.6. Position like amputation knife

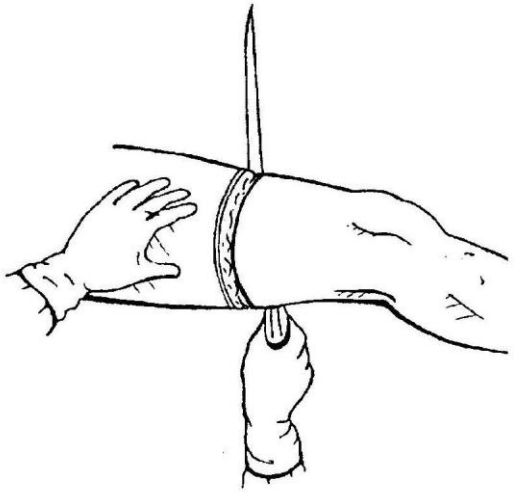

Fig.7. Dissection of the leg soft tissues using amputation knife

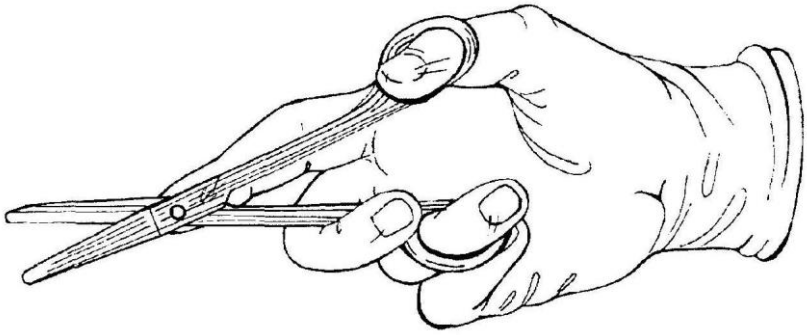

Fig.8. The scissors position in the surgeon's hand

The teacher should draw attention to certain types of special surgical instruments: retractors, tongue forcepts, tracheostomic cannulas, intestinal clamps, trocars, liver speculum, and the like.

The first practical lesson in each academic group includes presentation of "General surgical instruments", "Special surgical instruments", suturing surgical devices and instruments for blood vessels suturing (Fig.1,2).

**1. Materials for self-control**

**A. Tasks for self-control:**

*Test No. 1.* The scrub nurse gave the surgeon bellied scalpel instead of required sharp-pointed one. What is the main difference between them ?

a. length of handle;
b. thickness of handle;
c. length of working part;
d. sharpness of blade;
e. angle of the point.

*Test No. 2.* The surgeon used Billroth clamp, curved along the edge during surgery. What is it used for?

a. separation of tissues;

b. bleeding arrest;
c. separation of wound edges;
d. providing surgery technique;
e. connection of tissue.

*Test No. 3.* The surgeon used scissors while separating tissues. Scissors were fixed in the hand in such a way, that the thumb of the surgeon was in one of two rings. What finger of the surgeon should be in the second ring of the instrument to provide optimal fixation in the hand?

a. $1^{st}$;
b. $2^{nd}$;
c. $3^{rd}$;
d. $4^{th}$;
e. $5^{th}$.

*Test No. 4.* On the table for general surgical instruments of scrub nurse the following instruments were placed: scalpels, scissors, haemostatic clamps, hooks, tweezers, packer, towel clips, grooved probe, Luer cannula, Hegar needle holders, needles, suture material and gauze wipes. What should not be on the table?

a. hooks;
b. packer;
c. towel clips;
d. grooved probe;
e. Luer cannula.

*Test No. 5.* While performing surgical access the surgeon dissect aponeurosis. What hooks should be used for separation of aponeurosis edges?

a. sharp single-toothed;
b. blunt single-toothed;
c. sharp multi-toothed;
d. blunt multi-toothed;
e. Farabeuf hook.

**B. Tasks for self-control:**

*Task No. 1.* For removal of foreign body from the gastrocnemius muscle the scrub nurse placed cutting, auxiliary and connecting tissues instruments. Is it possible to start the foreign body removal surgery with these instruments?

*Task No. 2.* The surgeon used pointed scissors for skin dissection during surgery. What was his mistake?

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| | |
|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module No. 1** | Clinical anatomy and operative surgery of regions and organs of the head and neck |
| **Content module No.1** | Introduction to clinical anatomy and operative surgery |
| **Topic 2** | Primary surgical technique. Separation of tissues, the concept of rational incisions. Temporary and final bleeding arrest. Technique of tying knots. Connection of tissues, types of sutures.Venesection, venepunction. Local anesthesia |
| **Year** | II |
| **Department** | Foreign students training (dental) |

**1. The relevance of the topic**

Every surgical intervention, regardless of the complexity and region, is performed by surgical instruments and requires high-quality suture material. Profound knowledge of surgical instruments and rules of their use is important in professional activities of specialists in different fields of surgery that should be combined with knowledge of rules and surgical techniques.

**2. Specific objectives:**

1. Explain how to prepare the surgical field for surgery.
2. Explain how to carry out layer by layer infiltration anesthesia.
3. Explain how to carry out layer by layer separation of tissues.
4. Explain how to carry out layer by layer connection of tissues.
5. Explain the technique of bleeding arrest using hemostatic clips and ligatures on the vessels.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson**

| TERM | DEFINITION |
|---|---|
| Primary surgical wound management | Surgery involving wound cleaning (from dirty (infected) into clean to provide conditions for healing by primary tension |

| | |
|---|---|
| Venepunction | Puncturing of a vein to take a sample of venous blood or inject drugs |
| Venesection | Vein incision |

**1.2. Theoretic questions:**

1. What are the surgical hand scrub techniques ?
2. How is surgical field prepared for surgery?
3. What are the methods of local anesthesia?
4. What is Vishnevsky anesthesia?
5. What types of scalpels do you know? Positions of scalpel holding.
6. What is the scalpel position for skin incision?
7. How should scissors be held in the hand when dissecting tissue?
8. What is the difference between Kocher hemostatic clamp and Billroth clamp?
9. What is the difference between Hegar's needle holders, Troyanov and Mathieu needle holders?
10. Is position of tweezers in the hand correct, if its end is directed to the palm of the hand?
11. What types of surgical needles do you know?
12. What are the requirements for suture material?
13. How can suture materials be classified? Name their comparative characteristics: biological, synthetic, absorbable and non-absorbable?
14. What main types of surgical knots are used in practice?
15. What is the basic principle of tissue disconnection?
16. How should the skin, fascia, muscles be disconnected?
17. What is the principle of tissue connection?
18. What are the types of skin sutures?
19. What instruments are needed for injections and infusions?

**3.3. Practical activities performed in class:**

1. Surgical scrubbing of the surgeon's hands.
2. Preparation of operating field and surgical draping, namely, placing of sterile coverings on it.
3. Layer by layer tissue disconnection.
4. Bleeding arrest in the surgical wound.
5. Layer by layer connection of tissues.
6. Tying of main types of surgical knots.

**4. Content of the topic**

**Types of sutures and technique of surgical knot tying.** Main types of sutures: knotless, continuous, mattress, etc. The technique of knot tying: double surgical, simple (for women), marine. The technique of knot tying using a needle holder.

**Preparation of operating field**

Surgery begins with preparation of operating field. Hair should be removed by special cream − depilator. The skin of the surgical field should be disinfected twice by 70% of

alcohol, and then by 2% solution of iodine. It should be noted, that iodine causes skin irritation and may be an allergen, so, currently, it is rarely used. More often the alcohol solutions of iodophores (iodonate, betadine, betazidone, iodopirone) are in use. Alcohol solution of gibitanum, roccalum and peracetic acid are also available. The skin of the surgical field is isolated by sterile sheets or self-adhesive sterile drapes, through which surgical incisions are performed.

Generally, during the operation, the surgical field is disinfected 4 times (according to Grossikh-Filonchikov), namely:

- before conducting local anesthesia, or placing sterile coverings (for general anesthesia);
- before layer by layer tissue dissection (performing of operative access);
- before skin suturing (after all stages of surgery);
- before applying an aseptic dressing on the surface of the surgical wound.

**Technique for conduction of layer by layer local infiltration anesthesia**

The teacher explains, that there are two types of anesthesia: general and local, and then assigns the scrub nurse, surgeon and assistant from the number of students. The scrub nurse places syringe, injection needles, and other instruments required for local anesthesia on the table for instruments. The surgeon and assistant at this time occupy appropriate places and start disinfection of operating field, perform surgical draping.

The teacher emphasizes priority of domestic authors in development of local anesthesia methods, points out the principles of anesthesia according to Vishnevsky creeping infiltration method.

**Layer by layer tissue disconnection**

The teacher draws attention to sparing conduction of incisions, taking into account direction of skin folds, muscle fibers, topography of neurovascular bundles. Incision is usually performed with bellied scalpel, fixing the skin at the moment of incision by the fingers of the left hand. After skin incision, the edges of the wound are dilated with sharp hooks and arrest bleeding from damaged blood vessels. Then subcutaneous tissue, superficial and proper fascia are incised. Large vessels and nerve trunks can be located under the proper fascia, so they are incised along the grooved probe. Vessels and nerves that are in the direction of incision, if possible, are drawn aside. Fascia propria can also be incised with blunt scissors, bringing in the lower branch of the scissors below the fascia. Disconnection of muscles, if possible, is performed according to blunt pattern in direction of the muscle fibers, if necessary, the muscles are incised. Periosteum is incised with scalpel, then the edges of the periosteum are exfoliated with straight or curved raspatory. Periosteum should be preserved as much as possible, as in future it will provide regenerative function. Currently, laser devices "Scalpel-1", "Scalpel-2", "Romashka" are used in surgery.

**Suturing**

The first series of continuous sutures (simple, locking, mattress) students perform on fascia propria. Assistant shows how to tie the knot properly while suturing. Students put loop stitches on the skin. The distance from the edge of incision is 0.3−0.5 cm. The wound edges are carefully put together. The distance from one knot to another is about 1 cm (Fig.

9,10,11).

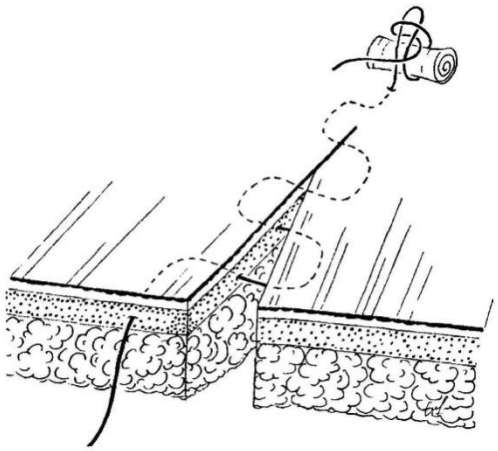

Fig.9. Intracutaneous continuous suture

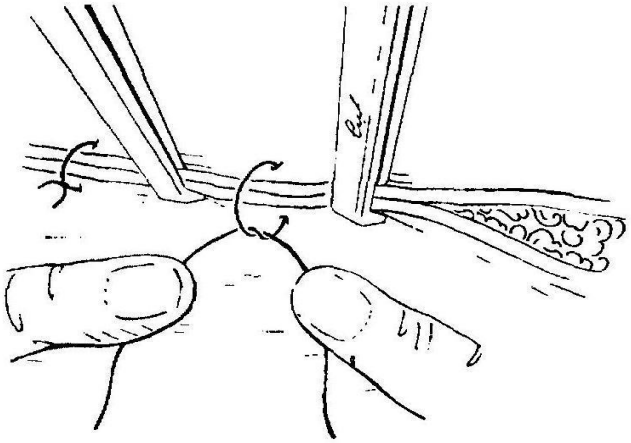

Fig.10. Tying the surgical knot on apposed wound edges

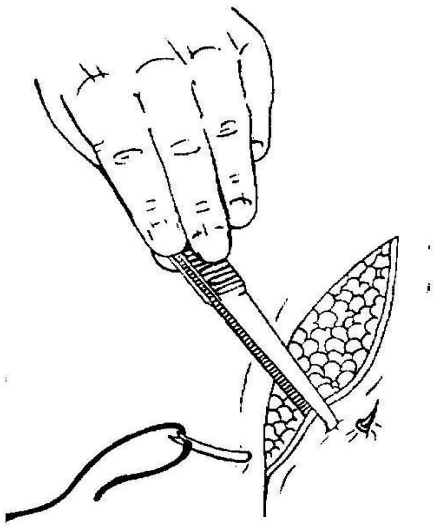

Fig.11. Stringing dense skin on the needle with tweezers

**5. Materials for self-control**
**A. Tasks for self-control:**

Test No. 1. The surgeon has performed operation. Which should the sequence of its stages be?

a) access, procedure, exit;
b) access, exit, procedure;
c) procedure, access, exit;
d) procedure, exit, access;
e) exit, procedure, access

Test No. 2. Surgeon is performing surgical access. What does this stage of surgical intervention include?

a) access to the organ or formation where the intervention is performed;
b) examination of adjacent organs or formations in surgical field;
c) preparation of organs or formations for intervention;
d) action pertaining the organ or formation where the intervention is performed;
e) connection the tissues

Test No.3. Surgeon is performing operative procedure. What does this stage of surgical intervention include?

a) access to the organ or formation where the intervention is performed;
b) examination of adjacent organs or formations in the operational field;
c) preparation of organs or formations for intervention;
d) action pertaining the organ or formation where the intervention is performed;
e) connection the tissues

Test No.4. Surgeon is performing the operative exit procedure. What does this stage of surgical intervention include?

a) access to the organ or formation where the intervention is performed;
b) examination of adjacent organs or formations in the operational field;
c) preparation of organs or formations for intervention;
d) action pertaining the organ or formation where the intervention is performed;
e) connection the tissues

Test No. 5. The scrub nurse placed general surgical instruments on the sterile table. What instruments should be on this table?

a) for tissue separation;
b) for tissue disconnection and bleeding arrest;
c) for tissue disconnection, bleeding arrest and auxiliary;
d) for tissue disconnection, bleeding arrest, auxiliary and for tissue connection;
e) for tissue disconnection, bleeding arrest, auxiliary and special

**B. Tasks for self-control:**

Task No.1. While making incision of the skin and subcutaneous tissue, uneven, jagged edges of the wound were formed. What rule did the surgeon ignore while incising the skin?

Task No. 2. When removing a foreign body, the surgeon disinfected the surgical field with 96 ° alcohol and performed its sterile draping. Is the preparation of surgical field carried out

correctly?

Task No.3. The final bleeding arrest of the wound was performed with Kocher's clamp, which assistant applied on bleeding vessel; surgeon lifted the ligature to the clamp without removing the clamp, tied the vessel with two knots. When assistant removed the clamp, bleeding started again. What was the mistake?

Task No.4. Three hours after the wound stitching, severe bleeding occured. How can this be explained?

Task No.5. While suturing the wound, the surgeon used silk ligature and very tightened knot. Did he connect the edges of damaged muscle correctly?

Task No. 6. While connecting the edges of wound, surgeon made the cavity in subcutaneous tissue. The skin was sutured with knot stitches. Was the tissue connection performed properly?

Task No. 7. When applying the interrupted sutures on the skin of the wound, that is 12 cm in length, an area of excess skin was formed at the angle of the wound. What mistake has the surgeon done?

Task No. 8. In 48 hours after suturing the skin, marginal necrosis occured. What caused it?

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| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module No. 1** | Clinical anatomy and operative surgery of regions and organs of the head and neck |

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|---|---|
| **Content module No.1** | Introduction to clinical anatomy and operative surgery |
| **Topic 3** | Elements of primary surgical technique in the chest region. Clinical and anatomical information about the chest wall and chest cavity. Operative access to chest cavity. Puncture of pleural cavity. Puncture of pericardial cavity. Pneumothorax, surgical care for various types of pneumothorax. Suture of the heart |
| **Year** | II |
| **Department** | Foreign students training (dental) |

**1. Relevance of the topic**

Injuries of the chest, common diseases of the mammary gland, resection of damaged ribs, as well as healthy ones for operative access to thoracic organs, require knowledge of topographic anatomy of the chest, study of various surgical accesses and techniques.

**2. Specific objectives:**

1. Explain surgical accesses and techniques for carrying out of surgical interventions on chest wall and mammary gland.
2. Explain how to perform pleura puncture.
3. Explain how to carry out the primary surgical debridement of penetrating wounds of the chest wall. Explain how to perform surgical access to the heart.
4. Explain how to perform heart access and heart wounds suturing.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson**

| Term | Definition |
|---|---|
| 1. Pleural puncture | 1. Puncture of pleura for diagnostic or therapeutic purposes. |
| 2. Pneumothorax | 2. Accumulation of air in the pleural cavity and increased pressure in it. |

**1.2. Theoretic questions:**

1. Puncture of pleura.
2. Pneumothorax.
3. Methods for closing open pneumothorax.
4. Pericardium puncture.
5. Suturing of heart wounds.

**3.3. Practical activities performed in class:**

1. Carry out a puncture on cadaver.

2. Carry out the closure of pneumothorax.
3. Carry out suturing of the heart wound.

**4. Content of the topic**

The skin on the anterior surface of the chest is thinner, more movable than on posterior one; in the sternum area it is not so movable.

Subcutaneous tissue is well marked. Superficial fascia of the breast, which forms mammary gland capsule, follows subcutaneous tissue.

The proper fascia of the chest in the anterior part forms fascial compartments for the large thoracic and serratus anterior muscles. Its deep plate forms a fascial compartment for m. pectoralis minor.

The deep layer of the thorax includes: sternum, 12-pairs of ribs with their cartilages, 12 thoracic vertebrae, intercostal muscles, blood vessels and nerves.

Intercostal spaces form a complex of formations represented by intercostal muscles, blood vessels, lymphatic vessels and lymph nodes.

While prosecting intercostal spaces from the outside, it can be determined that external intercostal muscles, mm. intercostales extemi, are directed from up to down and back to front. After their dissection, a thin layer of cellular tissue becomes visible, where the intercostal neurovascular bundle is located. It consists of intercostal vein, that is located higher, intercostal artery that lies beneath the vein, and intercostal nerve, which is located at the lowest position.

Pleura consists of two leaves (parietal and visceral), between which the slit-like pleural cavity is located.

Parietal pleura has three surfaces: costal, diaphragmatic and mediastinal. Portion of parietal pleura, located above the clavicle, is called the pleural dome. It stretches 2−3 cm above the clavicle, and reaches a line, that passes along the level of VII cervical or I thoracic vertebra behind.

It is important to determine the presence of pleural sinuses (sinuses, where accumulation of pleural effusion, blood or pus occurs in case of pleura or lung diseases). Costodiaphragmatic recess is one of the largest sinus (recessus costodiaphragmaticus), formed at the point of costal pleura transition into diaphragmatic one. The deepest point of this sinus is at the level of middle axillary line in the space between VII−X ribs, its length is 6−8 cm.

Each lung consists of apex, surface (costal, diaphragmatic, mediastinal), lung hilus, lobes: three − on the right, two − on the left; segments: 10 segments are in the right lung, 9 segments are in the left one.

Each lung includes major bronchi (branching of trachea at the level of V−VI thoracic vertebrae), which are further divided into bronchi of II and III order.

The order of bronchi and vessels location in the root of the right lung is the following: bronchus, arteries, veins − BAV (from up to down); in the root of the left lung − arteries, bronchi, veins (ABV).

Blood supply of the lung is provided by two systems: 1) bronchial arteries and veins, 2) pulmonary arteries and veins.

Heart is a muscular organ that is located in the middle mediastinum. Its base is directed upwards and somewhat backwards, and its apex is forward, down and left. The heart is

located in the pericardial cavity (cavitas pericardialis).

## Access to the organs of the chest cavity

Currently, domestic and foreign thoracic surgery has achieved success, which provides wider use of surgical interventions, both on the chest wall and organs of the thoracic cavity.

Thoracotomy means incision of the thoracic wall to provide further operations on thoracic organs, pus evacuation from the pleural cavity, etc. The incisions are carried out through ribs or intercostal spaces. Thoracic surgery most commonly uses anterior- or posterior lateral access.

Median (transsternal) thoracotomy is widely used for free access to thoracic organs, but sometimes sternum is dissected transversely.

## Puncture of pleura

*Indications, anesthesia, position of the patient during surgery*

Students carry out puncture of pleura in the eighth and ninth intercostal spaces, between the scapular and middle axillary lines, along the upper margin of the rib (Fig. 12).

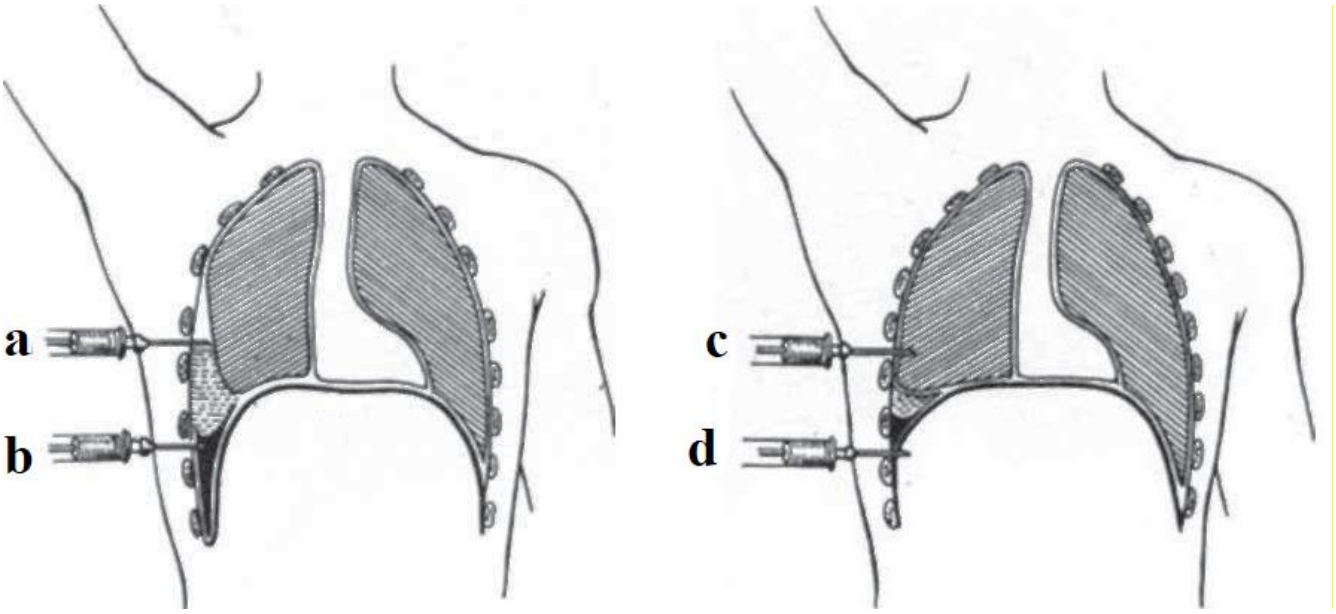


Fig.12. Puncture of the pleural cavity and possible complications
a − needle passed into the pleura cavity above effusion;
b − needle passed into commissure between the pleura leaves of costodiaphragmatic sinus;
c − needle passed above effusion into the lung tissue;
d − needle passed through the lower part of costodiaphragmatic sinus into abdominal cavity.

## Pneumothorax

Pneumorotax occurs in the presence of penetrating wounds of the chest wall. According to their nature they can be:

1. open, in the presence of constant connection between the pleural cavity and external environment;
2. closed, when the air enters into pleural cavity single-shot, with subsequent closure of the pleural defect with a patch of soft tissues;
3. valvular, when the air enters through the site of damage into the pleural cavity, but does not flow in the opposite direction.

The first medical aid in case of open pneumothorax includes applying of occlusive (tight) bandage on the wound. Firstly, sterile gauze pad is applied on the wound of the chest wall, and further, an oilcloth padding or piece of cellophane film is tightly fixed to the chest.

## Pericardium puncture

Students determine the indications for pericardium puncture. They include the presence of exudate, pus, transudate, blood in the cavity of pericardial sac, introduction of drugs for diagnostic purposes.

Larrey method is one of the most commonly used, when a prick is made to the left within the angle formed by the base of xiphoid process of the sternum and cartilage of VII rib. Firstly, anterior wall of the abdomen is pierced with a needle at a depth of 1.5 cm, then the direction of injection needle is changed and puncture of the tissues is performed from the bottom upwards and parallel to the posterior wall of the sternum. The anterior lower sinus of pericardium is located at the depth of 2−3 cm. Fluid is taken very slowly, so as not to disrupt the work of the heart. When pericardial puncture is completed, the disinfection of injection site with alcohol solution of iodine is performed with further adhesive plaster application.

## Suturing of heart wound

Access to the heart when suturing its wounds can be different, but sternotomy is more often used. In this operation, tissues are first incised up to the pericardium, which is cut somewhat anteriorly from the diaphragmatic nerve.

Temporarily bleeding of the heart wound is closed with the index finger of the left hand, and wound is sutured with the atraumatic needle using knot or P-shaped sutures.

### 1. Materials for self-control

### A. Tasks for self-control:

Test No. 1. Primary surgical debridement of penetrating chest wound is carrying out. Particular carefully the surgeon puts sutures, which should provide hermetic state for:

a) pleura;
b) endothoracic fascia;
c) intercostal muscles;
d) superficial muscles;
e) skin and subcutaneous tissue

Test No. 2. Surgeon performs pleural puncture for exudative pleuritis. During procedure the intercostal nerve was damaged. Where is it necessary to perform a puncture of the thorax to prevent this complication?

a) along the upper edge of the rib located below;
b) along the lower edge of the rib located above;
c) in the middle between the lower margins of ribs;
d) in the middle between the upper margins of ribs;
e) in the upper part of intercostal space

Test No. 3. Patient with pneumonia complained of heaviness and moderate pain in the right subcostal area, shortness of breath, weakness two weeks after disease. Chest X-ray examination determined accumulation of fluid in the pleural cavity over the dome of the

diaphragm. What pleural sinus does fluid accumulate more often?

a) costal diaphragmatic;
b) costal mediastinal;
c) diaphragmatic mediastinal;
d) vertebral mediastinal;
e) costal vertebral

Test No. 4. Patient K. was transported to the surgical department from the scene of traffic accident with a closed chest trauma and right side fracture of rib. The patient was diagnosed right-sided pneumothorax, he was urgently indicated drainage of pleural cavity. Choose the place of pleural puncture:

a) in $2^{nd}$ intercostal space along the medioclavicular line;
b) in $6^{th}$ intercostal space along the posterior axillary line;
c) in $7^{th}$ intercostal space along the scapular line;
d) in the projection of pleural sinus;
e) in the place of greatest dullness, which is determined by percussion

**B. Tasks for self-control:**

Task No. 1. When puncturing the left subclavian vein, the transparent opalescent fluid was taken with the syringe when plunger moved backwards. What error was made while performing the puncture?

Task No. 2. Performing puncture of the pleural cavity in $7^{th}$ intercostal space along the anterior axillary line near the lower margin of the rib, the blood was observed in the syringe of patient with suspected pleural empyema and established hemothorax diagnosis. What is the surgeon's mistake?

Task No. 3. During puncture of pleural cavity by thick needle with a wide lumen without syringe, the patient with pleural empyema experienced accelerated breathing and loss of consciousness. What explains this complication?

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| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module No. 1** | Clinical anatomy and operative surgery of regions and organs of the head and neck |
| **Content module No.1** | Introduction to clinical anatomy and operative surgery |

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|---|---|
| **Topic 4** | Elements of primary surgical technique in the abdominal region and abdominal wall region. Clinical and anatomical information about the abdominal wall and abdominal cavity. Surgical accesses to thoracic organs. The notion of hernia. Operations on liver and gallbladder. |
| **Year** | II |
| **Department** | Foreign students training (dental) |

**1. Relevance of the topic:** abdominal injuries, accompanied by damages of the small intestine, atresia, bowel necrosis as a complication of intestinal obstruction require emergency surgery. Therefore, mastering the technique of intestinal sutures, skills in suturing the intestine wound, carrying out its resection and applying enteroanastomosis are of great importance, as they are necessary interventions, which often used in surgical practice.

**2. Specific objectives**

1. Analyze layer by layer topography of anterolateral wall of the abdomen, age and sex related characteristics of blood supply, innervation, lymph flow.
2. Explain how the weak areas of anterolateral wall are formed (white line, umbilical ring).
3. Analyze rational access to the organs of the abdominal cavity.
4. Explain how to perform the most common operations on the liver and extrahepatic biliary tracts.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson**

| Term | Definition |
|---|---|
| Hernia | 1. Displacement and protrusion of the abdominal organs under the skin through the weak areas of muscular aponeurotic layer of the anterolateral abdomen wall. |
| Laparatomy | 2. Surgical incision of anterolateral abdomen wall. |
| Cholecystectomy | 3. Surgical removal of gallbladder. |
| Liver resection | 4. Surgical removal of liver part. |

**3.2. Theoretic questions:**

1. Give a comparative description of the longitudinal, transverse and oblique incisions of abdominal wall.
2. Give the definition of "hernia".
3. What types of hernia do you know?
4. How is the liver wound sutured?
5. How is liver resection performed?
6. How are retrograde and antegrade cholecystectomy performed?

**3.3. Practical activities performed in class:**

1. Performing surgical access to the liver, extrahepatic biliary tracts, pancreas, spleen.
2. Suturing of the liver wound.
3. Bandaging of the cystic artery and gallbladder neck, allocation of the gall bladder from its bed.

**4. Content of the topic**

The skin of the anterolateral abdomen wall is elastic, it can significantly dilate under physiological conditions (pregnancy) and pathological processes in the abdominal cavity (ascites, tumors, accumulation of blood and pus). Subcutaneous fatty tissue of the anterolateral abdomen wall is well developed. Superficial neurovascular formations pass between the leaves of the superficial (subcutaneous) fascia. The proper fascia of the abdomen is a thin fibrous layer, intertwined in the inguinal ligament. The external oblique abdominal muscle (m.obliquus externus abdominis) occupies a superficial position among the muscles of the anterolateral abdomen wall. It arises from VII−VIII ribs and lumbar fascia. Its fibers are directed forward and downward and are attached to external lip of iliac wing. The last part of this muscle passes into aponeurosis, which forms the axillary ligament and linea alba of the abdomen. It should be noted, that aponeurosis of m. obliquus externus adominis is divided in the medial part of the inguinal ligament and forms external opening of the inguinal canal. The internal oblique abdominal muscle (m. oliquus internus abdominis) has a fan-like direction of the muscle fibers, stretching from below upwards and medialwards. The aponeurosis of this muscle, when approaching the rectus abdominis muscle (m. rectus abdominis), divides into two parts, that along with aponeurosis of the external oblique abdomen muscle form the sheath of this muscle. The lower part of m. obliquus internus abdominis adjoins to ligament, with which it is not fused. The lower fibers of the internal oblique muscle form m. cremaster. The deepest position is occupied by the transverse abdominal muscle (m. transversus abdominis), which is one of the thinnest muscles in the anterolateral abdomen wall. Its fibers have transverse direction and pass into the aponeurosis, which forms the posterior wall of rectus abdominis muscle sheath and its linea alba. The transition line of muscle fibers of m. transversus abdominis is called a semilunar one. The lower fibers of this muscle also run parallel to the inguinal ligament and participate in formation of m. cremaster.

Rectus abdominis muscle (m. rectus abdominis) is located on the anterior abdomen wall. Its fibers arise from the anterior surface of the cartilaginous part of V, VI and VII ribs and xiphoid process of the sternum, have a vertical direction and are attached below to the pubic bone by the tendons between symphysis and pubic tuberculum (tuberculum pubicum). Rectus abdominal muscle is enveloped by sheath, which at different levels of the anterolateral abdomen wall has its own features. So, above umbilicus in front, it is formed by aponeurosis of external oblique muscle and superficial layer of the inner oblique muscle of the abdomen, behind – by deep leaf of the inner oblique and transverse abdominal muscles, below umbilicus 4−5 cm in front – by aponeuroses of the external and internal oblique abdominal muscles, posterior − only by transverse fascia, that is a part of the intra-abdominal fascia. Between the inner margins of the rectus abdominis muscles, the linea alba of the abdomen is located. Above and within umbilicus, it is represented by a wide aponeurotic plate, and below umbilicus this line gradually narrows to a few millimeters and is a dense

cord, which attaches to the pubic symphysis. These topographic features of abdominal linea alba are very significant. Thus, incisions along the linea alba of abdomen above umbilicus can be performed without opening of rectus abdominis muscles sheath, but below umbilicus it is necessary to make sheath incision.

When examining the linea alba of the abdomen, students find out, that it is fixed to the xiphoid process of the sternum at the top, and to the pubic symphysis − below.

Peritoneum is a serous membrane lining the inner surface of the abdominal wall and covers the organs located in the abdominal cavity. Parietal and visceral sheets of peritoneum can be distinguished. The first is much thicker and denser, than the second one.

**Cavity of the abdomen** (cavitas abdominalis) is bounded by the anterolateral wall of the abdomen anterior and laterally; posterior − by the lumbar region; above – by the diaphragm; below it passes into the small pelvis cavity. Cavity of the abdomen includes the peritoneum cavity and retroperitoneal space.

**Peritoneum cavity** is bounded by the serous membrane − peritoneum. It contains all the organs enveloped by peritoneum. Peritoneum consists of two sheets: parietal and visceral. The first one is lining the abdomen wall from the inside, the second covers abdominal organs, they form a single unit, as they pass from each other. About 30 ml of serous fluid always present between the sheets of peritoneum.

**Organs of the abdominal cavity** relative to the peritoneum can be located intraperitoneally, mesoperitoneally and retroperitoneally.

Most of these organs are enveloped by the peritoneum from all sides (stomach, jejunum, caecum, transverse colon, sigmoid colon, spleen), that is, lie intraperitoneally. If the organs are covered with peritoneum on three sides (liver, gallbladder, ascending and descending parts of the colon, part of the duodenum and rectum), then they belong to mesoperitoneally located organs.

Retroperitoneally placed organs located behind the peritoneum (part of the duodenum, pancreas, kidneys, ureters, abdominal aorta and inferior vena cava).

The transverse colon with its mesentery divides the abdominal cavity into two parts: the upper and lower. Outwardly, this line corresponds to a horizontal line drawn through the ends of X ribs (linea bicostarum).

The upper part includes three bursae: hepatic, pregastric and omental. **Hepatic bursa** (bursa hepatica) is located between the right lobe of the liver, diaphragm and anterior wall of the abdomen. **Pregastric bursa** (bursa praegastrica) is located in front of the stomach and is boundered to the right by the left lobe of the liver, and to the left – by the spleen. **Omental bursa** (bursa omentalis) − is a slit-like space, that is bounded by stomach with its ligaments anteriorly, to the left – by spleen with its ligaments, from below − by the left part of the transverse colon with its mesentery and posteriorly − by peritoneum of posterior abdominal wall which covers the pancreas, left kidney with the adrenal gland (glandula suprarenalis), aorta and inferior vena cava. Omental bursa adjoins to the caudate lobe of the liver from above. It is connected with the general abdominal cavity through omental foramen (foramen epiploicum Winslowi), which has a width of 3−4 cm and may be absent in the presence of adhesions.

**Omental foramen** anteriorly is bounded by hepatic-duodenal ligament, posteriorly – by the lower hollow vein with peritoneum, which envelops it, from above – by the lobus caudatus of the liver, and from below – by the initial part of the duodenum.

The lower part of the abdomen includes two lateral canals and right and left mesenteric sinuses.

**The right lateral canal** (canalis lateralis dexter) is medially bounded by the ascending part of the colon, and laterally by the lateral wall of the abdomen, **the left** one (canalis lateralis sinister) is bounded by the descending part of the colon on the right, and by the lateral wall of the abdomen − on the left.

These canals are connected with the upper part of the abdominal cavity at the top, but the left canal is shorter, because it is bounded by the phrenicocolic ligament (lig. phrenicocolicum); in the lower part the canals are connected with the small pelvis cavity.

Inflammatory processes can spread both into the upper part of the abdominal cavity and to the small pelvis cavity along the lateral canals.

**The right mesenteric sinus** (sinus mesentericus dexter) is bounded above by the mesentery of the transverse colon, on the right − by the ascending colon, on the left and below − by the mesentery of the small intestine, and anteriorly − by the greater omentum. The left mesenteric sinus (sinus mesentericus sinister) is also bounded above by the mesentery of the transverse colon, on the right – by the mesentery of the small intestine, on the left − by the descending colon, and anteriorly – by the greater omentum. The right mesenteric sinus connects with the left fissura, which is between the initial part of the small intestine and the mesentery of the transverse colon. The left sinus, unlike the right one, opens into the cavity of the pelvis below, which can provoke penetration of pus and blood to this area.

Recesses in the peritoneal cavity usually arise at the places of the peritoneal transition from the walls of the peritoneal cavity to the organs or from one organ to another.

**The duodenojejunal recess** arises at the point of the transition of duodenum into the jejunum. Hernias occurring in this recess are called Treitz ones and are usually diagnosed as intestinal obstruction. There are also the superior and inerior ileocecal recesses. They are formed at the points of transition from ileum to cecum. Retrocecal recess can be seen by raising the initial part of the caecum. Intersigmoid recess is bounded by the mesentery of sigmoid colon and parietal peritoneum.

**Stomach** is located in the epigastric region, mainly in the left hypochondrium.

The following parts of the stomach can be distinguished:

1. The cardia (adjacent to the entrance of the stomach esophagus along the small curvature up to 5 cm in length).
2. The fundus (on the left of the cardia and above the level of the cardial incisure).
3. The body − between the cardia and fundus superior, and the antrum inferior.
4. Antral part (between the body and pylorus).
5. The pylorus (it includes sphincter).

There are greater and lesser curvatures of the stomach. The wall of the stomach consists of serous, subserous, muscular, submucosal and mucous membranes. The muscular membrane has three layers: longitudinal, circular, oblique. The mucous membrane has longitudinal folds, which along the lesser curvature form a path with little submucosal layer.

Stomach ligaments are hepatogastric, gastrophrenic, gastrosplenic, gastroduodenocolic and gastropancreatic.

The blood supply is provided by the branches of abdominal aorta along the lesser stomach curvature − left, right gastric, general hepatic branch, short branches, that extend from the splenic artery. The left gastro-omental artery extends from the splenic artery, and inosculates along the greater curvature of the stomach with the right gastro-omental artery, which extends from the gastroduodenal artery. Venous outflow passes through the system of the portal vein.

**Liver.** Hepatic tissue (lobules) is located around connective tissue spaces, where the bile ducts, branching of the portal vein, hepatic artery and nerves pass. One pole of the liver cells is facing the vessels, another − the bile ducts. Structure of the biliary tract includes: intrahepatic bile ducts, intrahepatic ducts (segmental), right and left hepatic, general hepatic, common bile duct that flows into the descending part of the duodenum, forming major duodenal papilla.

Gallbladder is located in the longitudinal groove of the lower surface of the liver, 2/3 of it is covered with the peritoneum, 1/3 − with the liver. The length of the bladder is 6−8 cm, diameter 3−4 cm. The bottom, body, neck with Hartmann's pouch and cystic duct can be distingished. The volume of the gallbladder is 40 − 70 ml. The wall of the gallbladder consists of three layers: mucous, fibromuscular, subserous and serous. The branches of the bladder vein and arteries are located in the wall of the gallbladder and pass in front and behind the bladder, as well as lymphatic vessels and nerves.

**Surgical accesses to the organs of the abdominal cavity**

In abdominal surgery, operations on the anterolateral wall of the abdomen and organs of the abdominal cavity require substantiation of surgical access.

The teacher draws students' attention, that performing any incisions, the surgeon should minimize injuries of the neurovascular formations and muscles of the surgical area. Muscle fibers should not be dissected, if possible, they are incised along the muscle bundles. This prevents atrophy of muscle elements in the postoperative period.

In case of surgery on the anterolateral abdomen wall, the length of the incision should be sufficient and does not restrict the surgeon's actions during surgery.

Incision on the anterolateral wall of the abdomen can be:

*longitudinal* (midline incision − laparotomia mediana), which is carried out along the linea alba of the abdomen bypassing umbilicus on the left to prevent damage of the round ligament of liver (lig. teres hepatis). Laparotomy can be upper, middle and lower. The midline incision is used quite often. It provides wide access to the organs of the abdominal cavity, while minimally damaging muscles, neurovascular formations and, if necessary, it is easy to expand both up and down;

*paramedian*, which is carried out along the medial margin of the rectus abdominis muscle. First, the external sheath layer of m. rectus abdominis is incised, and the muscle is exposed by hooks. After this, the inner sheet of the sheath of this muscle along with the parietal peritoneum is incised. After surgery a fairly firm scar is formed, but the length of such incision is limited, which significantly complicates the operation;

*transrectal*, which differs from the previous one, because after incision of the external sheet of rectus abdominis muscle sheath, it is necessary to dissect it along the muscle bundles, that can lead to injuries of nerves leading to m. rectus abdominis and hernias in the postoperative period;

*pararectal*, which is carried out along the external margin of the rectus abdominis muscle of the abdomen. After dissection of the external sheet of m. rectus abdominis sheath, the external margin of this muscle is pulled medially with blunt, and then the inner margin of the muscle sheath is incised along with the peritoneum. This incision was widely used in appendectomy (Lenander access). One of its disadvantages is the damage of intercostal nerves (T. Zolotariova), that can lead to muscle atrophy;

*oblique* incisions in the epigastric abdomen are carried along the margin of the rib arcs, and in the hypogastric − parallel to the inguinal fold or at a certain angle to it. Such incisions are used for access to the liver, gall bladder, spleen, vermiform appendage as well as in herniotomy, etc.;

*transverse* incisions are performed on rectus abdominis muscles. In this case, nerve trunks are not damaged, sufficient access to the organs of the abdominal cavity is provided. But these incisions are rarely used in surgical practice, because certain difficulties in suturing can

occur as well as their separation;

*combined* (thoracoabdominal) incisions provide wide access to the organs of the abdominal cavity. They are performed in gastrectomy, splenectomy, liver resection and other operations;

*angular* incisions are used when it is necessary to continue previous incision in another direction at an angle (access to the liver, spleen, etc.).

## The notion on hernia

Hernia means bulge or protrusion of organs covered with the peritoneum from the abdominal cavity at weak points in the anterolateral abdomen wall.

Hernia consists of the hernial orifice, the hernial sac and part of the organs. Hernial orifice is an opening in the abdomen wall. More often they can be localized in the inguinal and femoral canals, within the umbilical ring, linea alba of the abdomen. Depending on the hernial orifice location, they can be: inguinal, femoral, related to linea alba of the abdomen, umbilical. The hernial sac is formed due to protrusion of parietal peritoneum along with anterior peritoneal tissue and transverse fascia of the abdomen to the hernial orifice. In the hernial sac cavity, there may be loops of the intestine and other mobile formations of the abdominal cavity.

## Operations on the liver and gallbladder

In case of open and closed liver injuries, gunshot wounds, the upper median laparotomy is performed. This incision can be supplemented by transverse incisions to the right and to the left. Surgical debridement of the liver injury is carried out. For this purpose the edges of the wound with damaged tissue should be removed. Bleeding in the wound is arrested by vasoligation, suturing, biological tamponade. Bile leakage is eliminated by ligation, suturing of intrahepatic bile ducts. In significant ruptures of the liver lobe it is resected, in marginal wounds ─ wedge resection is perormed. It should be noted, that surgical treatment of liver injuries includes firstly bleeding arrest and removal of the damaged tissue almost until complete liver resection.

The surgeon connects wound edges after removal the damaged area and sutures with simple knot stitches. The stitches are performed with round curved needle, the prick in the parenchyma is made 2−3 cm from the wound edge. To prevent complications, capping is performed using a cap or segment of the falciform ligament of the liver, separated from the diaphragm. The surgeon also applies a special Kuznetsov-Pensky suture using blunt needle and double thread. The stitches of the thread are looped one after the other, compressing the vessels of the damaged area of the liver. Applying of P-shaped sutures (Fig. 13) and X-shaped suturing of vessels are possible.

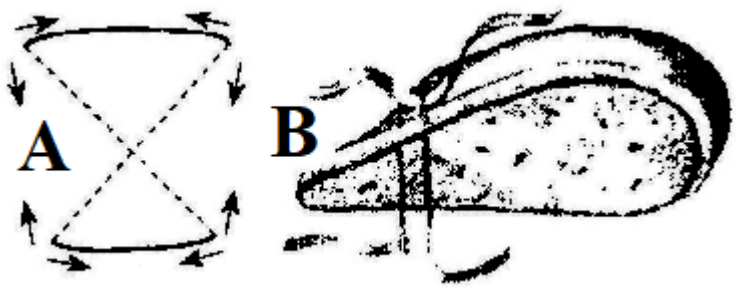

Fig.13. The most common sutures on the liver:
A −X-shaped suture; B− suture with applying synthetic materials

The surgical team conducts margin resection of the liver. Apply P-shaped sutures or Kuznetsov-Pensky sutures. Retreating 0.5 cm ectad applied sutures, the damaged area of the liver is cut off with the scalpel. Large vessels and bile ducts are sutured and ligated. Several drainage tubes are introduced to the wound (Fig. 14, 15).

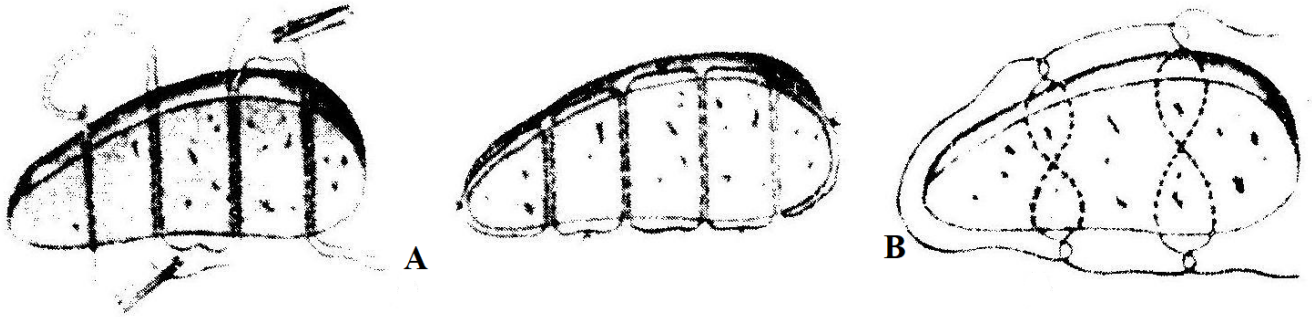


Fig.14. Hemostatic sutures on the liver:
A− Kuznetsov-Pensky suture; B – Labbock suture

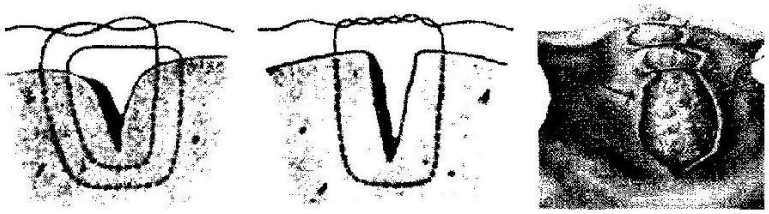

Fig.15. Types of sutures on the liver. The technique of applying a simple interrupted suture on the liver

**Retrograde cholecystectomy** (removal of the gallbladder from neck to fundus). Two fenestrated forcepts are placed on the gallbladder, one − at the fundus, another − at the neck. The neck of the bladder is strained and incision along the right side of the hepatoduodenal ligament is performed, exposing the cystic duct. The duct is cut between the forcepts and a double ligature is applied to its stump. Pulling the bladder by the neck, the bladder artery is exposed and after careful detection is cut between the forcepts; the stump is ligatered. Further, the gallbladder is isolated from the hepatic bed. For this purpose, a serous membrane is cut with the scalpel along the right and left margins of the gallbladder, connecting incisions at the fundus of the bladder. Scissors and drape are used for pulling out bladder from its bed. The bed of the bladder is peritonized with running suture. The wound of the anterior abdominal wall is sutured tightly.

Antegrade cholecystectomy is possible, that is removal of the bladder from fundus to neck. It is carried out in case of technical difficulties in exposing the bladder neck and the cystic artery (cicatricial and infiltrative changes, adhesive process, various variants of the bladder neck position, the bladder duct and cystic artery position).

The operation is performed by opening the common bile duct, which is carried out in case of obstructive jaundice, calculi in hepatic and bile ducts, a great number of small calculi in the gallbladder, and pathological changes in the major duodenal papilla. The length of the incision of the common bile duct wall is 1 cm. The incision is performed longitudinally

between two holders, on the anterior wall of the duct, closer to its external margin, at a distance of 0.5 cm from the duodenum margin. The probe is introduced through the major duodenal papilla. If the probe does not pass into the duodenum, it should be opened, the papilla is examined and, if necessary, sphincterotomy should be performed.

**5. Materials for self-control**

**A. Tasks for self-control:**

*Test No. 1.* The surgeon removed the gallbladder using low-traumatic operative access without damaging intercostal neurovascular bundles. What kind of laparotomy did he use?

a. according to Shalimov;
b. upper medial;
c. middle medial;
d. oblique subcostal;
e. angular

*Test No. 2.* The surgeon applied Kuznetsov-Pensky suture on the liver. What needle should be used for this purpose?

a. blunt needle and double thread;
b. blunt needle with a single thread;
c. taper needle with single thread;
d. single-thread cutting needle;
e. cutting needle with double thread

*Test No. 3.* The surgeon performs retrograde cholecystectomy. What bile duct should be ligated?

a. right hepatic;
b. left hepatic;
c. common hepatic;
d. common bile;
e. cystic

*Test No. 4.* During the surgical intervention in case of hepatic duct calculi the surgeon must identify a common hepatic duct. Between the sheets of what ligament is it located?

a. hepatoduodenal;
b. hepatogastric;
c. hepatorenal;
d. round liament of liver;
e. venous ligament

*Test No. 5.* During cholecystectomy (removal of the gallbladder), performed from the fundus, concrements (gallstones) can move along a wide cystic duct to other parts of the bile passages. What area should be examined?

a. Ductus choledochus;
b. Ductus hepaticus communis;
c. Ductus hepaticus dexter;

d. Ductus hepaticus sinister;
e. Ductulus billifer

**B. Tasks for self-control:**

*Task No.1*. While examining the abdominal cavity organs, the surgeon has determined that traumatic rupture of the right share of liver lobe is the source of internal bleeding. What are the further measures of the surgeon in this case?

*Task No. 2*. While examining the abdominal cavity of the patient after blunt abdominal trauma, the surgeon has determined a massive bleeding from the liver. How can bleeding be arrested in this case?

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|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module No. 1** | Clinical anatomy and operative surgery of regions and organs of the head and neck |
| **Content module No.1** | Introduction to clinical anatomy and operative surgery |
| **Topic 5** | Elements of primary surgical technique in the abdominal region. Intestinal sutures. Intestinal anastomoses. Operations on the intestines, stomach. Appendectomy |
| **Year** | II |
| **Department** | Foreign students training (dental) |

**1. Relevance of the topic:** abdominal injuries, accompanied by damages of the small intestine, atresia, bowel necrosis as a complication of intestinal obstruction require emergency surgery. Therefore, mastering the technique of intestinal sutures, skills in suturing the intestine wound, carrying out its resection and applying enteroanastomosis are of great importance, as they are necessary interventions which often used in the practice of surgeons.

**2. Specific objectives**

1. Explain the use of special surgical instruments for abdominal surgery.
2. Analyze the technique of intestinal sutures applying.
3. Explain how to apply enteroanastomosis.
4. Explain how to perform suturing of intestinal wounds and intestinal resection.
5. Explain the general principles of appendectomy.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson**

| Term | Definition |
|---|---|
| 1. Intestinal sutures | 1. Stitches used for suturing hollow organs of the gastrointestinal tract. |
| 2. Enteroanastomosis | 2. Intestinal anastomosis. |
| 3. Intestinal resection | 3. Removal of the part of intestine. |
| 4. Appendectomy | 4. Removal of vermiform process. |

**1.2. Theoretic questions:**

1. What types of intestinal sutures do you know?
2. Advantages and disadvantages of various types of intestinal sutures.
3. What are the indications for resection of the small intestine? Stages of the operation

depending on the size of the resected area.

4. Types of interintestinal anastomoses, technique of their applying and anatomical and physiological substantiation for the choice of operation method. Complications that can occur.
5. Technique for accessing the vermiform process according to Volkovich-Diakonov.
6. Technique for appendectomy.

**3.3. Practical activities performed in class:**

1. Application of intestinal sutures.
2. Application of anastomoses "end to end" and "side by side".
3. Performing appendectomy.

**4. Content of the topic**

The small intestine is up to 5 m long and consists of duodenum (27 − 30 cm), jejunum (2 m), ileum (3 m).

Jejunum that starts from Treitz ligament and the ileum to the transition into colon, are covered with the peritoneum on all sides, except for a narrow strip where the mesenterium sheets are attached. The presence of mesenterium causes considerable mobility of the small intestine. The length of the mesenterium along the length of the intestine is not the same; the mobility of the intestine depends on it. The least mobile guts are located at the beginning of the jejunum next to Treitz ligament, at the final part of the ileum, in the ileocecal angle.

Cecum is covered with the peritoneum from all sides; the transverse colon and the sigmoid colon have long mesenteries which makes them considerably mobile. Least moving parts of the colon are ascending and descending, that are covered with the peritoneum only anteriorly. However, in 16.7% of cases in men and in 11.7% in women the ascending part of the colon is covered by the peritoneum on all sides.

The blood supply of the small intestines is performed by the system of the superior mesenteric artery, which extends from the abdominal aorta at the level of the 1$^{st}$ lumbar vertebra. When passing from the lower margin of the pancreas, the artery lies down along the anterior surface of the lower horizontal part of duodenum, that can lead to tightening of this section and causes obstruction.

The superior mesenteric artery has numerous branches (up to 20 and more), among which the main are: small intestinal, middle, right colonic and ileocecal.

The following branches arise from the inferior mesenteric artery:

1. left colon artery, which supplies the left transverse colon, the splenic angle and descending colon;
2. artery of the sigmoid colon;
3. superior rectal artery.

The veins of the small intestine flow into the superior mesenteric, the main tributary of the portal vein. The veins of the large intestines accompany arteries in the form of unpaired trunks and belong to the portal vein system. Nerves of the small intestine are the branches of the superior mesenteric plexuses, colonic − the branches of the superior and inferior mesenteric plexuses.

Colon consists of cecum, ascending colon, transverse colon, descending colon and sigmoid. The large intestine is 4−5 times shorter, than the small one. The wall of the large intestine consists of three layers: inner membrane − the mucous layer, middle − the muscle

layer with fibers of longitudinal direction grouping into three bands, external – the serous layer (peritoneum). Large intestines have characteristic signs: epiploic appendages, protrusions and muscle bands.

The blood supply of the right half of the large intestine is provided by the vessels extending from the superior mesenteric artery (a.ilecolica, a.colica dextra, a.colica media). The left half of the large intestine is supplied with blood by the inferior mesenteric artery. Blood outflows along the mesenteric veins into the upper and lower mesenteric veins.

## Intestinal sutures

The term "intestinal sutures" combines all the sutures used in surgical practice when stitching the hollow organ of the gastrointestinal tract (esophagus, stomach, small and large intestines).

Principal requirements for intestinal sutures technique:

- compliance with strict asepsis and antiseptics, thorough haemostasis, minimal traumatization of tissues, especially mucous and submucosal layers;
- safe hermic condition, which is provided by wide contact of serous surfaces and other layers of the esophagus, stomach, intestine walls;
- use of resorbable material (catgut, biofil) when placing buried sutures on the edges of the wound as well as non-resorbable − when placing sutures on the serous-muscular layer;
- intestinal sutures should be placed by using a round (taper) surgical needle.

Histologically, four layers of the digestive tract wall can be distinguished: mucosal, submucosal, muscular and serous.

From the surgical point of view, there are two coverings in the wall of the digestive tract: the inner (mucosal-submucosal layer) and the external (muscular-serous layer). In surgical practice, the term "through-and-through sutures" is accepted. It is the suture when surgical needle simultaneously pierces all layers of the intestine. When connecting the walls of the dissected hollow organs of the digestive tract during the operation or in the acute trauma, two layer suture is most often placed: the first row of sutures (internal) passes through all layers of the organ, and the second (external) through the external covering (muscular serous layer).

One of the through-and-through sutures, widely used in surgical practice, is blanket continuous catgut suture. The technique of its application includes several stages, namely, firstly the needle pierces the mucous membrane, then the submucosal layer and serous membrane are pierced on one side, and serous membrane, muscular, submucosal layers and mucous membrane – on other side.

Tightening (glover's) suture differs from through-and-through one. While placing glover's suture, the needle first pierces the mucous membrane, and then serous one. After each stitch the ligature is tightened and the organ wall is retracted, which results in connection of the wall surfaces.When the second row of sutures is placed on the organs of the gastrointestinal tract, they are considered aseptic (clean), because the mucous membrane is not pierced, and only the serous-muscular layer is sutured. Aseptic sutures by their technique can be both interrupted and continuous.

Albert suture is often used to perorm the inner infected suture. According to this technique, all layers of the organ wall are pierced by the needle. These sutures are "dirty". Infection can get from a lumen of intestines, stomach into abdominal cavity along the ligature. When suturing a wound of the stomach or intestine wall, it is necessary to place one

more row of serous-muscular sutures (Lambert suture) after Albert suture. Schmieden suture is placed on the posterior wall of anastomosis of the blanket continuous catgut suture, and tightening glover's suture − on the anterior one. Over this suture, the serous-muscular row of sutures with the interval which should be no more than 3−5 mm is placed.

In the stump formation and immersion as well as when inserting the tube into the lumen of the intestine, a purse-string or Z-shaped sutures are used. The purse-string suture is placed in a circle. It is used in immersing the stump of appendix, duodenum, jejunum or ileum as well as stitching of small stab wounds of the stomach or intestine. After suturing the edges of the ligature are tightened and tied. The stump is deepened and peritonized.

*Z-shaped suture* is additional, it is placed over the purse-string suture for safe hermetic condition. Four pricks are used at four angles of the imaginary quadrum to the depth of the serous-muscular layer that finally forms a stitch in the form of the letter "Z".

## Intestinal resection

Students are distributed into surgical teams. Each team performs resection and anastomosis "side to side", "end-to-end" or "end-to-side" on the cadaver or on separate segments of the small intestine with the mesenterium.Thus, it is necessary to pay attention to compliance with strict asepsis, therefore, the operation is performed on the abdominal cavity organ, carefully insulated with drapes from it. The use of appropriate instruments (intestinal forceps, anatomical tweezers, round needles, etc.) is very important. Vessel ligation during immobilization of the intestine is carried out closer to it. In case of malignant tumors it is performed farther, but distal to the first-order arcades to prevent necrosis of the intestine. Management of the ends of intestinal segments, between which anastomosis "side to side" or "end-to-end" will be placed is very important. When "side to side" anastomosis is performed the stump is formed in two ways: by ligation and immersing it in purse (for peritonization) or by suturing the lumen of the intestine with a two layer suture. The isoperistaltic placement of the stumps in "side to side" anastomosis, as well as features of its application (with elastic intestinal forceps or ligature holders) are important.

In case of "end-to-end" anastomosis, the stump is not formed, but the clamp along which the resection is performed is placed obliquely to increase the diameters of the segments that should be sutured. While forming this anastomosis, continuous suture should not be used, as it can cause its narrowing. Other stages of both anastomoses applying are similar.

Anastomosis "side to side" should begin with applying of a silky interrupted serous-muscular or serous-serous Lambert suture closer to the mesenterium. The incision of the intestine that is 7−8 cm long on the surfaces facing each other is larger, than the diameter of the intestine, and is performed 0.5 cm from the first row of the sutures. The second row of catgut sutures is applied through all layers according to Jolly or Pirogov on the posterior part of anastomoses, and according to Schmieden to the anterior one. After anastomosis application, it is necessary to check its patency.

The end-to-end type of anastomosis is placed similarly: on the inner part – Jolli suture, on the anterior part – Schmieden suture. The operation is completed by applying a circular seroserous suture.

## Principles of stomach surgery

**Gastrostomy** is carried out to form temporary or permanent anastomosis in case of esophagus obstruction to provide patient's nutrition. It is used in case of thoracic esophagus

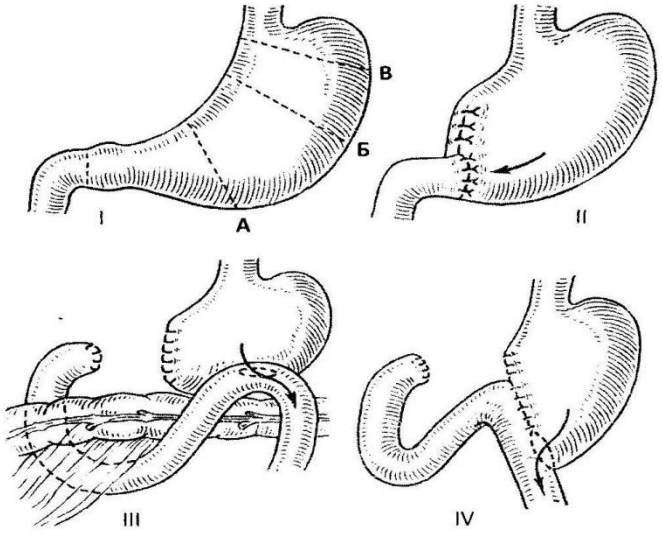
injuries, presence of gastro esophageal fistula, disorders of the esophageal patency in case of its atresia, scarry strictures after chemical burns, malignant tumors of the esophagus.

**Gastrostomy by Witzel's method**

Group of students that includes surgeon, assistant and scrub nurse conduct a layered dissection of the abdominal wall and exteriorization of the anterior stomach wall through the surgical wound using upper midline laparotomy. Along the longitudinal axis of the stomach in the middle between the greater and lesser curvatures of the stomach, closer to the cardia, a rubber tube that is 0.8 cm in diameter is placed so, that its end is directed towards the entrance of the stomach. Two folds which cover the tube are formed by the anterior wall of the stomach. These folds are sutured together with 6−8 interrupted serous-muscular sutures. Within the last suture the opening in the wall of the stomach is carried out, around which a semipurse-string suture is placed. The end of the tube is inserted into this opening, and the tube is sutured with catgut sutures along the wall of the stomach. The site of the opening is peritonized with two−three sutures, which were placed after the introduction of the rubber tube into the cavity of the stomach. After that, the anterior wall of the stomach is sutured to the parietal peritoneum. The wound of the abdominal cavity is stitched layer by layer. Nutrition of the patient in the postoperative period is carried out through a tube that was withdrawn from the abdominal cavity to the anterior wall of the abdomen through contraincision.

**Gastrostomy by Toprover method**

Surgical access does not differ from the previous operation. Through the opening performed in the anterior wall of the abdomen, the anterior wall of the stomach is pulled in the form of a cone. Two silk ligatures are placed on the top of this cone at the distance 2 cm from each other and one purse-string suture is placed 1.5−2 cm below them, in 1.5 cm − the second, and after 1.5 cm − the third. All stitches are not tightened, but are fixed temporarily with clamps. At the top of the cone, between the holders, the wall of the stomach is incisured, where a rubber tube, that is 0.8−1.0 cm in diameter is inserted. The purse-string sutures are sequentially placed, starting from the first, tightened and tied. This surgical technique provides formation of an artificial canal in the gastric wall. Along the level of the lower purse-string suture, the stomach wall is stitched to the parietal peritoneum, along the level of the second one − to the rectus abdominis muscle and its sheath. On the last segment the sheath incision is sutured with silk interrupted stitches. Along the level of the first purse-string suture, the wall of the stomach is sutured to the skin so, that protruding mucous membrane of the stomach is attached to the skin and can be sutured to it for constant lip-shaped fistula formation.




**Gastrectomy**

Principles of stomach resection according to Billroth-I and Billroth-II in modification of Hofmeister-Finsterer and possible resection volumes for various types of organ pathology (Fig. 16).

**Fig.16. Resection of the stomach:**

I− borders of resection:

A− one-third;

B − two thirds;

B− subtotal;
II− scheme of resection according to Billroth I;
III − scheme of resection according to Billroth II;
IV − scheme of resection according to Billroth II in modification of Hofmeister-Finsterer.

When resecting the stomach according to Bilrot-I method the end-to-end anastomosis is performed with duodenum mobilization by Kocher method.

In case of stomach resection according to Bilrot-II method in the modification of Hofmeister-Finsterer, attention is focused on suturing of the duodenum stump. This stage of operation is very important, because the development of duodenal fistulas and peritonitis is possible, which is dangerous for the patient.

**Appendectomy**

Incision of the abdominal wall is performed according to Volkovich-Diakonov. Layered incision of tissues, sparing separation of the fibers of the internal oblique and transverse abdominal muscles are carried out. When the peritoneum is incised, it is necessary to raise it so, as not to injure nearby organs. The ileocecal angle is identified and characteristic features of the large intestine are determined. The base of appendix is always on the free band of the colon, along the posterior-medial margin of the intestine, 2−2.5 cm from the ileocecal angle. Appendix is usually directed downward and medially. The surgeon mobilizes the process, cutting off its mesentery and ligating the vessels of the mesentery, often suturing it. Cutting out the process between the ligature and the clamp, the stump of the appendage is cauterized with alcohol solution of iodine, tied with catgut thread and place in the purse-string suture. Other methods of appendix stump processing are possible − without ligation with placement in the purse-string suture. The wound of the abdomen anterolateral wall is sutured tightly layer by layer.

**1. Materials for self-control**

**A. Tasks for self-control:**

*Test No. 1.* For applying the intestinal suture, surgeon used Hegar needle holder. What surgeon's fingers should be in the rings of this instrument to provide optimal fixation in the hand?

a. first and second;
b. first and third;
c. first and fourth;
d. first and fifth;
e. second and fourth

*Test No. 2.* The surgeon used jejunum to form anastomosis. How is this gut usually covered by the peritoneum?

a. intraperitoneally;
b. mesoperitoneally;
c. extraperitoneally;
d. retroperitoneally;
e. first intra-, then − extraperipherally

*Test No. 3.* The surgeon placed a single-layer interrupted serous-muscular suture catching the submucosal layer with the taper needle on the external margin of the anastomosis. Knots were tied in the lumen of the hollow organ. The distance between the stitches is 1 cm. What requirement for intestinal sutures will be broken?

a. asepticity;
b. hemostaticity;
c. hermeticity;
d. organ patency;
e. relative automaticity

*Test No. 4.* The surgeon used a single layer interrupted seroserous suture to form anastomosis. How is this suture called?

a. Pirogov suture;
b. Schmieden suture;
c. Lambert suture;
d. Reverdin suture;
e. Czerny suture

*Test No. 5.* When resecting the small intestine, surgeon formed intestinal anastomosis "side to side" with two layer suture. What wall of anastomosis should be formed first?

a. anterior;
b. posterior;
c. superior;
d. inerior;
e. it does not matter

**B. Tasks for self-control:**

*Task 1.* While suturing longitudinal wound of the small intestine, surgeon placed one row of seroserous sutures longitudinally, drying the peritoneal cavity, closed the wound of the abdominal wall layer by layer. Are there any mistakes in the surgeon's actions?

*Task No.2.* When resecting the small intestine and placing end-to-end interstitial anastomosis, surgeon incised the loop of the intestine transversely. What is the surgeon's mistake, what complications can be expected after anastomosis?

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9. Chassin J.L. Operative Strategy in General Surgery / J.L.Chassin. – New York etc., Springer. – 1994. – 368 p.


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|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module No. 1** | Clinical anatomy and operative surgery of regions and organs of the head and neck |
| **Content module No.1** | Introduction to clinical anatomy and operative surgery |

| | |
|---|---|
| **Topic 6** | Elements of primary surgical technique in the lumbar, spinal and pelvic areas. Clinical and anatomical information about the lumbar, vertebral and pelvic areas. Operative access to kidneys. Resection of the kidney. Paranephric blockade. Lumbar puncture. Catheterization and puncture of the bladder. |
| **Year** | II |
| **Department** | Foreign students training (dental) |

**1. The relevance of the topic**

Every surgical intervention, regardless of the complexity and region, is performed by surgical instruments and requires high-quality suture material. Profound knowledge of surgical instruments and rules of their use is important in professional activities of specialists in different fields of surgery that should be combined with knowledge of rules and surgical techniques.

**2. Specific objectives**

1. Explain how to carry out the operative access to the kidneys (incision according to S.P. Fedorov and Bergman-Israel).
2. Explain how to perform nephrotomy, kidney resection and nephrectomy.
3. Explain the technique of a bladder puncture.
4. Explain the technique of high resection of bladder (epicystotomy).
5. Explain the structure and location of the spine.
6. Explain the structure and location of the spinal marrow.
7. Explain the technique of lumbar puncture.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson**

| Term | Definition |
|---|---|
| kidney resection | Surgical removal of kidney part |
| cystotomy | Operation of bladder incision |

**1.2. Theoretic questions:**

1. Operative access to the kidney.
2. Technique for performing nephrectomy.
3. Technique for performing nephrotomy, resection of the kidney.
4. Technique of urinary bladder puncture.
5. Technique of a high section of the bladder.
6. Indications and technique of lumbar puncture, possible complications.

**3.3. Practical activities performed in class:**

1. Incision according to S.P. Fedorov and Bergman-Israel.

2. Conducting operations: nephrectomy, kidney resection.
3. Conduct a puncture of the bladder.
4. Conduct a high incision of the bladder.
5. Perform a lumbar puncture.

## 4. Content of the topic

### Topographic anatomy of the lumbar region

Skin is thick and not mobile. Subcutaneous tissue, in addition to its inferior lateral parts, is poorly developed. The presence of lumbogluteal mass (massa adiposa lumbogluteatis) in the inferior lateral parts of the area is the characteristic feature of subcutaneous tissue topography. The superficial fascia has its own peculiarities: it is well enough developed, the branch arises from it, which delimits the massa adiposa lumbogluteatis from the subcutaneous tissue. Behind the superficial fascia the proper fascia of the area is located, which is called thoracolumbar fascia (fascia thoracolumbalis). It forms the fascial sheaths for muscles located in this area: mm. latissimus dorsi, obliquus extemus abdominis et obliquus intemus abdominis, serratus posterior inferior, erector spinae, transversus abdominis. The muscles of the lumbar region lie in the form of three layers. The first includes external oblique abdominal muscle and the widest muscle of the back; the second − m. erector spinae, lying medially, and m. serratus posterior inferior − laterally and upwards, from below − internal oblique abdominal muscle; the third layer of the lumbar region is represented by one muscle − m. transversus abdominis.

The retroperitoneal space is located between the parietal layer of the peritoneum and the posterior wall of the abdominal cavity, which is covered by the endoabdominal fascia (fascia endoabdominalis).

The retroperitoneal space superiorly reaches the posterior part of the diaphragm, which skeletotopically is the level of XI thoracic vertebra. This level corresponds to the location of the adrenal glands. In the lateral regions the retroperitoneal space is conventionally separated from the anterolateral wall of the abdomen by a vertical line corresponding to the middle axillary line. Inferiorly it passes directly into the cavity of the small pelvis.

The kidney has 3 capsules. The fibrous capsule directly adjoins the parenchyma of the organ, a fat capsule is placed behind it, and externally − the outer capsule of the kidney formed by the retroperitoneal fascia. The kidneys are located on the sides of the spine at the level of XII thoracic vertebra, I and II lumbar (sometimes and III), and XII rib divides the left kidney into two approximately equal halves, while the right is divided into two unequal parts −1/3 lies above XII rib and 2/3 inferiorly.

The projection of kidney hilum to the lumbar region (posterior renal point) is defined in the angle between the external margin of the musculus erector spinae and XII rib.The kidney hilum is projected on the anterior abdominal wall in the angle between the external margin of the rectus abdominis and costal arch next to anterior end of its costal cartilage. Pressing these points in case of renal pelvis lesion usually causes severe pain.

### Operative access to the kidneys

The operative accesses to the kidneys are carried out along the line corresponding to the bisector of the angle formed by XII rib and external margin of m. erector spinae. In surgical practice, a number of accesses to the kidneys and other organs of the genitourinary system

are used. So, Bergman recommended to start the incision from the top of the angle formed by XII rib and external margin of m. erector spinae, and continue to the middle axillary line (linea axillaris media). M.I. Pirogov considered it advisable to continue this incision forward 3−4 cm above the iliac bone, and then direct it parallel to the inguinal ligament.

S.P. Fedorov recommended to begin incision from the top of the angle formed by XII rib and external margin of m. erector spinae and continue down along XII rib, gradually moving to the anterior surface of abdomen at the umbilicus level and leading it to the lateral margin of m. rectus abdominis. The described incisions enable surgeon to make access to the kidneys retroperitoneally.

## Kidney resection

This operation is carried out in case of gunshot wounds to the kidneys, tuberculosis of kidney, echinococcosis. Resection of the kidney refers to the organ-preserving operations. After performing Fedorov or Bergman incision, the access to kidney is carried out. It is isolated from the surrounding mass and exposed from the wound.

The vascular pedicle is constricted by elastic clamp. The damaged area of the kidney is determined and removed. Severely bleeding vessels on the wound surface are ligated, the edges of the wound are connected and sutured. To ensure sufficient hemostasis, the muscle layer is introduced into the kidney wound. Connected surfaces of the kidney are sutured so, that the suture passes through the capsule and its parenchyma. If the pole of kidney is removed during operation, its cut is covered with fascia or omentum leaf, suturing this section with P-shaped sutures. This method provides complete hemostasis.

## Topographic anatomy of the pelvis

The notion "pelvis" in topographic anatomy means a small pelvis, that is, all those anatomic formations lying below the boundary line (linea terminalis). The skeleton of the pelvis consists of two pelvic bones, sacrum and coccyx. The pelvic ring is formed due to the little mobility of the sacroiliac joints and pubic symphysis.

From the inner surface of the pelvic bones, the pelvic walls are lined with muscles. So, m. obturatorius internus arises from the obturator foramen and passes through a small sciatic foramen and is attached to the trochanteric fossa (fossa trochanterica) of the femur. Pear-shaped muscle (m. piriformis) arises from the anterior surface of the sacrum, passes through the obturator foramen, and downwards, is attached to the major trochanter (trochanter major) of femur.

There are two foramens next to pear-shaped muscle: foramen suprapiriformis and foramen infrapiriformis.

The pelvic floor consists of the muscle lifting up the anus (m. levator ani). It is composed of two muscles: m. pubococcygeus et m. ileococcygeus; it is attached along the line that passes along the inner surface of the pubic and ileac bones, as well as from the arcuate tendon of the pelvic fascia (arcus tendineus). Muscle fibers m. levator ani reach the anus and pass into external sphincter of the rectum. Some of them along with lig. anococcygeus reaches the coccyx. The anterior part of the pelvic ring is formed by a triangular ligament − the urogenital diaphragm, which is represented by m. transversus perineus profundus and fascia, that envelops it. In men urethra passes through the urogenital diaphragm, and in women − also and vagina.

The pelvis fascias are divided into fascias of pelvis and fascias of the perineum.

The proper pelvic fascias are located above the diaphragm, and the perineal fascias are below it.

Fascia endopelvinae (endopelvic fascia) covers the organs of the small pelvis and forms a series of ligaments that are covered by muscle fibers: lig. anococcygeum, lig. puboprostatum lateralis etmedialis, lig. pubovesicale.

In men the peritoneum forms a rectovesical cavity (excavatio rectovesicalis) behind the bladder. It descends to the seminal vesicles, and on the sides is bounded by plicas of the peritoneum (plicae rectovesicales), directed from the lateral surfaces of the bladder to the rectum. In women a vesicouterine cavity, which does not reach the uterine cervix is located between the urinary bladder and the uterus.

Unlike men, in women the rectouterine excavation between the uterus and rectum (excavatio rectouterina) is located, which is in contact with the wall of the posterior vaginal vault. These features are very significant when puncturing and performing incisions through the vagina in case of making access to the excavatio rectouterina.

The bladder (vesica urinaria) is located behind the pubic symphysis in the cavity of the small pelvis. However, the filled bladder protrudes above this symphysis.

The bladder inside is lined with a mucous membrane with folds that straighten out when the bladder is filled. There are no such folds within the bladder floor, because of submucosa absence. This area is triangular in shape and has internal ostium of the urethra. At the base of this triangle, the fold of the mucous membrane connects the ostia of both ureters. The part of the bladder behind the triangle occupies the lowest position and is the area of calculi localization in case of urolithiasis. In the wall of the bladder around the urethra the muscle layer (sphincter vesiculi) is located, which is an involuntary sphincter, and voluntary sphincter is located in the area where the urethra passes through m. transversus perinei profundus.

Blood supply of the bladder is carried out by the upper and lower arterial bladder (aa. vesicalis superior et inferior), which branch off from the internal iliac artery (a. iliaca interna).

## Catheterization of the bladder

Students study the main indications for conducting the catheterization of the bladder: releasing it from urine, irrigation and drug injecting.

In women, catheterization of the bladder is carried out as follows: labia majora are parted and catheter is inserted into the urethral orifice which is above the vaginal opening. It moves deeper along the channel of the urethra without resistance to the entrance to the bladder.

In men, catheterization of the bladder is much more difficult than in women.

Three important rules for metal catheter introduction should be observed:

1. the doctor stands to the left of the patient that is lying on the table. The glans penis is grasped with the thumb and forefinger of the left hand, the foreskin of the penis is retracted, so that urethra orifice opens. The catheter within the pavilion is grasped with the right hand, inserted parallel to the left inguinal fold and is introduced into the urethra. After this, the catheter moving is stopped, and the penis is started to move until the catheter reaches the lower margin of the pubic articulation;
2. catheter is moved to the position along the median line of the body and, while holding the glans penis, continue to push it onto the instrument until it reaches the membranous part of the urethra (pars membranocea). After this, the end of catheter is directed into the angle

between the pubic bones;

3. the pavilion part of catheter is transferred to another position, doing an arc 180 ° in the sagittal plane; the instrument is located between the hips of the patient. Urine begins to flow out of the catheter. This is achieved by passing catheter through the narrowing in the membranous part of urethra and penetrating it into the bladder. When pulling catheter, described above steps are carried out in the reverse order. In order not to damage the wall of the urethra, the metal catheter is removed from the urethral lumen very slowly and cautiously.

## Puncture of the bladder

In those cases when the catheterization of the bladder is impossible, puncture of the bladder is performed.

For this purpose, by 2 cm above the pubic symphisis along the median line of the abdomen a long injection needle directed perpendicular to the skin is introduced to the anterior wall of the abdomen inwards by 6−8 cm until the sensation of falling into the cavity occurs, that confirms the penetration of the needle end into the bladder cavity. If the students additionally inject a solution into the bladder, then it freely flows through the end of the needle and is aspirated by syringe.

After emptying the bladder, the needle is removed, and the site of the introduction is iodinated with alcohol solution of iodine.

## Incision or high section of the bladder

The main indications for incision of the bladder are foreign bodies in it, access to the prostate gland, etc.

Before the operation, the bladder is catheterized, its cavity is rinsed with rivanol solution (1: 3000), followed by 150−200 ml of 3% solution of boric acid. In this case, the transitional fold of peritoneum is shifted upwards, which makes it possible to access the bladder by retroperitoneal route.

Along the midline of the abdomen above the pubic symphisis incision in length of 6−8 cm is performed. The skin with subcutaneous layer is incised up to the linea alba of the abdomen. Along the grooved probe this line is incised, and the rectus abdominal muscles are stretched by hooks. Transverse fascia of the abdomen is incised. Prostatic mass with the same fascia and peritoneum fold is pulled upward, which exposes the anterior wall of the bladder. Pink color and longitudinal direction of vessels located on it are its signs. Through the muscle layer of the bladder, the silk ligature is carried on the round needle, which during the operation serve as holders. While using them, the assistant pulls the anterior wall of the bladder, and the surgeon makes longitudinal incision of 5−6 cm of the bladder wall.

The resulting wound of the bladder wall is stretched by hooks, and foreign bodies and polyps are removed. After this, the wound of the bladder is sutured layer by layer. It is significant, that when the first layer of sutures is applied, the mucosa of the bladder is not stitched, but only its muscle layer. The second row of sutures is put on the serous-muscular layer. The previously upwards shifted fold of the peritoneum is pushed onto the suture area. The operation is completed by introducing drainage into prostate mass and layer-by-layer suturing the wound of the anterior abdomen wall.

## Topographic anatomy of the spinal column

Anatomically, there are five departments in the spinal column: cervical, thoracic, lumbar, sacral and coccygeal.

When a horizontal line is drawn through the most pointed points of the iliac crest (Jacobi line), it corresponds to the interval between the spinous processes of IV and V lumbar vertebrae, or the projection of IV lumbar vertebra.

The vertebral canal (canalis vertebralis) is formed by the posterior surface of the vertebral bodies, intervertebral discs, posterior longitudinal ligament and arcs of the vertebrae along with the yellow ligaments located between them.

The vertebral canal at different levels has a different cross-sectional area and shape: in the cervical spine it is a triangular in shape, and in the thoracic spine it is round. Gradually, the shape of the canal in the lumbar and sacral sections again becomes triangular.

The average cross-sectional area of the spinal canal is 2.5 $cm^2$, and in the lumbar region it is the largest and reaches 3.5 $cm^2$. This channel is narrower in the cervical region and the narrowest in the thoracic one.

The vertebral canal, approaching the level of the sacral vertebrae, passes into the sacral canal (canalis sacralis), which also has a triangular shape, but is gradually flattened and narrows down in the anteroposterior direction.

On each of the vertebrae arches, there are upper and lower vertebral incisurae, which, when applying the vertebrae one on one, form intervertebral foramena through which the spinal nerves and vessels arise. There are 31 pairs of such foramena. Due to them, paired bone fibrous canals are formed in the cervical spine where the vertebral arteries and veins lie.

The spinal cord lies in the vertebral canal and is surrounded, like the brain, by a solid (dura mater spinalis), arachnoidea mater spinalis, and soft (pia mater spinalis) membranes.

The spinal cord is represented by contracted in the sagittal plane band that extends from the level of the first cervical vertebra arch to the upper margin of the II lumbar vertebra. The average length of the spinal cord is 43−45 cm, and the weight − up to 3 0 g.

The lower border of the spinal cord in adults can be shifted one vertebra up or down. There are age specific features of the spinal cord topography. So, in children under 1 year of age, the lower border of it may be at the level of the third lumbar vertebra. This feature is due to the fact, that at this age there is a discrepancy between the growth of the spinal cord and lengthening of the spinal column. Consequently, when performing spinal puncture in adults, the puncture is carried out above or below IV lumbar vertebrae, and in young children − below the spinous process of IV lumbar vertebra.

## Lumbar puncture

*Indications.* Lumbar puncture is performed with both diagnostic and therapeutic purposes.

With the diagnostic purpose, it is carried out to determine the pressure of the cerebrospinal fluid, evaluate the permeability of subarachnoid space, for the purpose of cytological, bacteriological and chemical examination of cerebrospinal fluid; with a therapeutic purpose – in case of severe increases of intracranial pressure, in fractures of the skull base, as well as for the administration of medicinal substances into the subarachnoid space of the spinal cord. In addition, lumbar puncture is performed for the purpose of spinal anesthesia.

*Position of the patient.* The patient is on the table in lying position with lower limbs bent in the knee joints. The head of the patient should be as close as possible to the knee joints. This position provides sufficient contouring of the spinous processes of the lumbar vertebrae

and an increase in the distance between their tips.

If the puncture is carried out sitting position, then he is placed across the table. The back of the patient is bent as much as possible in the lumbar and thoracic areas, a chair is placed under the feet.

*Anesthesia.* At the site of the puncture, layer-by-layer infiltration anesthesia is carried out with 0.5% solution of novocaine.

*Puncture technique.* Primarily students apply on the cadaver Jacobi line, which connects the crests of both ileal bones using diamond green. It passes through the spinous process of IV lumbar vertebra.

When preparing for puncture, one should remember that in adults the spinal cord ends at level of II lumbar vertebra, so they are punctured between III and IV or IV and V lumbar vertebrae.

At an early age, the spinal cord reaches the level of III lumbar vertebra, so puncture in young children is carried out between IV and V lumbar vertebrae.

After disinfecting skin the needle is inserted along the middle of the distance between the spinous processes of the lumbar vertebrae. It is directed perpendicularly or slightly obliquely upward in relation to the inclination of the spinous processes of the vertebrae.

The needle is gradually introduced to the skin, subcutaneous tissue, ligaments over and between the spinous processes, yellow ligament, and then into the hard and arachnoid membranes of the spinal cord. The needle is moved on average by 4−7 cm in adults and 2 cm in children.for this purpose, the special needles 10−12 cm long with the diameter up to 1.5 mm are used.

The feeling of elastic resistance when pricking the yellow ligament and the hard membrane of the spinal cord is orientation of the needle movement depth. After puncturing of the hard membrane, the end of the needle enters the subarachnoid space; its forward movement thus proceeds without difficulties and resistance.

The movement of the needle is stopped, mandrin is taken out and spinal fluid discharges from the lumen of the needle.

In those cases when the tip of the needle hits the bone obstacle and its further movement is impossible, it should be taken in reverse direction and do it again, changing the direction a few millimeters forward or backward. If spinal fluid from the lumen of the needle discharges with the blood admixture, then the cause of its occurrence should be detected: vascular damage or the presence of blood in submembraneous space. For this purpose, spinal fluid is gradually gathered in 2−3 glass tubes. If the amount of blood in each of the next tubes gradually decreases, this indicates the blood vessels damage. If the amount of blood admixture does not decrease, then repeated puncture by one vertebra above or below the previous one is performed. The increase in the blood admixture in the cerebrospinal fluid is a sign of submembraneous bleeding.

In case of lumbar puncture for diagnostic purposes, the cerebrospinal fluid (10−12 $cm^3$) is gathered in a sterile tube for in-depth examination. If detection of the cerebrospinal fluid pressure is required, then a special needle is added to the special manometers. When performing puncture with a therapeutic purpose (administration of drugs or anaesthetics), the amount of spinal fluid, that is previously removed, should be the same as the amount of corresponding solution, that is introduced into the subarachnoid space.

After the puncture, the needle is removed, the site of introduction is disinfected with alcohol and adhesive bandage is applied. The patient should be taken to the ward in lying

position with a mandatory bed regimen for three days.

*Complications.* After lumbar puncture, such complications can occur:

1) paralysis of the respiratory center in case of low position of the head during the puncture for the purpose of anesthesia;

2) herniation of the cerebellar tonsils into the large occipital foramen, followed by compression of the medulla oblongata, that occurs in case of pathological process in the posterior cranial fossa.

To prevent these complications, the low position of the patient's head should be avoided, and the cerebrospinal fluid must be taken slowly. If the patient's condition worsens, the puncture should be stopped.

**1. Materials for self-control**

**A. Tasks for self-control:**

*Test No.1.* During examination the renal ptosis was detercted in boy. What is the normal vertebal level of the kidney?

a. 11 thoracic and 3 lumbar;
b. 9−10 thoracic;
c. 4−5 lumbar;
d. 12 thoracic and 1 lumbar;
e. 2−5 lumbar

*Test No.2.* After considerable weight loss, the man experiences dull pain in the lumbar region. On examination the diagnosis "wandering kidney" has been made. What part of the kidney fixation apparatus was most likely affected?

a. Capsula adiposa;
b. Capsula fibrosa;
c. M. iliopsoas;
d. Lig. hepatorenalis;
e. There is no correct answer

*Test No.3.* When examining the patient, there was a suspicion of the presence of purulent effusion in the rectal-uterine cavity. Through what anatomical formation is it better to perform the puncture of this cavity?

a. posterior part of the vaginal vault;
b. anterior part of the vaginal vault;
c. ampoule of the rectum;
d. diaphragm of the pelvis;
e. anterior wall of the vagina

*Test No. 4.* A patient with suspected internal bleeding (ectopic pregnancy) was hospitalized to gynecological department. Through what formation is the puncture performed in case of the urgent bleeding diagnosis?

a. posterior vaginal vault;
b. anterior vaginal vault;
c. cervix uteri;

d. external orifice of uterus;
e. anterior wall of the vagina

**B. Tasks for self-control:**

*Task No. 1.* The patient was hit by a car. The skin is pale and cold. Blood pressure is 70/50 mm Hg. Above the pubis and in the groin area there is a considerable swelling of the tissues. There is no urination. When urinary catheterization, the urine is colored with blood. What is the diagnosis? How can it be clarified?

*Task No.2.* After retroperitoneal rupture of the bladder, the patient had a bilateral urinary swelling into the paravesical layer, which spreads to the perineum. What surgical access will you choose for treatment?

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| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module 1** | Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| **Content module No.1** | Introduction to clinical anatomy and operative surgery. |
| **Topic 7** | A primary surgical technique in the regions of extremities. Clinical and anatomical information. Accesses and bandaging of vessels. |
| **Year** | II |
| **Faculty** | Foreign students training (dental) |

**1. The relevance of the topic**

Every surgical intervention, regardless of the complexity and region, is performed by surgical instruments and requires high-quality suture material. Profound knowledge of surgical instruments and rules of their use is important in professional activities of specialists in different fields of surgery, which should be combined with knowledge of rules and surgical techniques.

**2. Specific objectives**

1. Demonstrate how to apply a tourniquet or an elastic bandage on the limb.
2. Demonstrate how to bare large arteries of the extremities.
3. Demonstrate how to impose a vascular suture.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

**3.2. Theoretic questions:**

1. Topography and projection lines of the vascular-nerve bundles of the extremities.
2. Basic moments of operations with bandaging of vessels.
3. Technique of manual and mechanical vascular suture.

**3.3. Practical skills acquired in class**

1. Put on a tourniquet or elastic bandage on the limb.
2. Demonstrate how to bare large arteries of the extremities.
3. Apply vascular suture.

**4. The content of the topic:**

Early studies briefly stop at the clinical and anatomical data on human limbs, noted that the diversity and complexity of operations on the organs of the musculoskeletal system led to the emergence of a separate science - operative orthopedics and traumatology.

The main subject of this science is surgical intervention on the bones and joints. There are the following basic types of operations on the bones: permanent skeletal extraction; osteoclasia (an operation in which the bone fracture is performed to correct its deformation);

| Term | Definition |
|---|---|
| Vascular suture | Suture that is used in clinics at sewing of the damaged vessels, at aneurysm, innate vices of blood vessels, transplantation of organs and others. |
| Carrel suture | Variety of vascular suture |

osteotomy or bone section; osteosynthesis (open operative connection of bone fragments); bone transplant; bone resection for removal of sites affected by the pathological process; trepanation, amputation.

During the discussion of operations on vessels, mark that modern microsurgery of vessels

and nerves is sent not only to proceeding in anatomic safety of the damaged organs but also on the return of their physiological functions. Every surgeon must be able skilled to sew together the walls of the damaged vessels and nerves.

Vascular seam is used in clinics not only in case of damage to the vessels, but also in aneurysms, congenital malformations of blood vessels, organ transplants. Recently, more than 60 types of vessel compounds have been proposed, which can be divided into manual, mechanical and seamless (cannulae). Mandatory requirements for connection of vessels are the tightness of the vascular seam and the absence of pronounced narrowing in the region of anastomosis. An important condition for vascular connections is the sufficient mobilization of them, careful bloodless of the operating field, contact of the internal surfaces of the vessels that sew, along the suture, minimal contact of the suture material with blood.

Students demonstrate the technique of overlaying of circular suture by Carrel. For this above and below the place of the future vascular suture is imposed by vascular clamps. The damaged region of the vessel is removed. The ends of the vessel are connected by three P-shaped seams. When stretching these joints, the edges of the vessels turn out. As a result, the sew of the vessel becomes triangular, and intima of vessels is compared. Previously, cut off the adventitia by 0.5 cm at each end of the sewing vessel. Enlargement of the vessel is washed with physiological solution. A continuous seam sews the edges of the vessels on each face of the triangle. Before attaching the last seam, the clamper of the distal end of the vessel is released so that the blood squeeze out air; after applying all the stitches it is removed. Bleeding is stopped with tampons or additional sutures, after which remove the central clamp.

It is noted that for the simplification of the technique of the vascular seam, prevention of possible narrowing of the lumen of the vessel and shortening the time of surgery were proposed vasoconstriction devices, first created in the former USSR in 1946-1950. Recently, models of vasoconstrictor devices with vacuum devices have been developed for the extension of blood vessels, which is performed without turning the artery by 180˚, but only by pulling its edge at 90˚ in the form of a corolla.

Discuss the indications for artery banding, and the technique of execution. It is noted that the vessel in the wound captured by a hemostatic clamp and tied. Arteries, which are located in connective intermucosal tissue, intercutaneous partitions or in a compact cicatricial tissue, capture by the Koher's klammer, the tissue around the vessel is stitching and tying the ligature.

**Bandaging of the axillary artery**

At the first, students determine the projection line for approaching a. axillaris. It passes between the front and middle third of the axillary cavity, which corresponds to the leading edge of the hair growth line. Leaving 1 -2 cm outside of the projection line over the m. coracobrachialis sequentially cut the skin for 8 -10 cm, subcutaneous tissue and surface fascia, and by the grooved probe - its own fascia. With the help of hooks draw m. coracobrachialis outside and through the probe dissect the medial wall of the muscle's fascia. In the formed wound find and bind a. axillaris. After banding the arteries, colateral circulation is performed by the transverse artery of the neck (a. transversal colli) and the suprascapular artery (a. suprascapularis), which is the branches of the subclavian artery, as well as the axillary arterial branches, the thoracodorsal artery (a. thoracodorsalis), and circumflex scapular artery (a. circumflexia scapulae).

**Bandaging of the brachial artery**

Students determine on the corpse that the projection line for access to the brachial artery corresponds to the medial spine of the two-head muscle of the shoulder. In this case, the hand should be pulled to the side. During the incision, you should retreat from the projection line externally by 1.5 cm and cut the skin in a longitudinal section within 5-6 cm. The teacher put attention of the students to the fact that in such section there is a preservation of damage of medial nerve and a hit in the postoperative scar, which will result in the occurrence of postoperative pain. Then cut subcutaneous tissue, superficial fascia, and on a grooved probe - own fascia of a shoulder. Hooks pull out the two-headed shoulder muscle. Dissecting the back wall of this muscle, the median nerve is pull back with hooks, medially, and the shoulder artery is led out and bandaged.

**Bandaging of radial artery**

At first, students determine the projection line for access to the radial artery. It is drawn from the medial edge of the tendon of the two-headed muscle of shoulder (m. biceps brachii), which corresponds to the middle of the elbow fossa, to the pulse point, or to a point located on 0.5 cm more medially than the styloid process of the radius. If bandaging of radial artery is conducted in overhead one-third of the forearm, then the hand of the cadaver is in a supination position. The cut of the skin is carried out along the projection line. And along the medial edge of m. coracobrachialis fascia of forearm is dissected. The medial edge of the m.brachioradialis is pulled aside, while the back wall of the vagina of this muscle is exposed, which represents the anterior wall of the vascular-nerve bunch. The radial artery which lying on the front surface of the square pronator is separated from the fascial compartment; at the same time, the superficial branch of the radial nerve (ramus superficialis n. radialis), which lying lateral than artery, blunt hooks are pulled apart. First, on the radial artery, impose two ligatures, and then tied it.

If the radial artery is bandage in the lower third of the forearm, then, along the projection line, from the level of the processus styloideus of the radial bone, the skin is dissected upwards for 6-8 cm.

The radial artery is located between the shoulder muscle (m. brachioradialis) from the lateral side and m. flexor carpi radialis from the medial, that is, it lies in the radialis gutter.

If skin veins and nerves are detected along the course of the cut, then they are directed side by side, the probe dissects its own fascia of the forearm and under it detects a radius artery that covers a small layer of fiber. It is isolated from the surrounding tissues and bandaged.

**Bandage of the elbow artery**

To bandage the elbow artery, it is first necessary to determine its projection line. It straith from the medial process of the humerus to the outer edge of the pea-like bone. If the elbow artery is banaged in the upper third of the forearm, then initially through the projection line, the skin is cut through 8-10 cm, then its own fascia of the forearm and find m. flexor carpi ulnaris. This muscle is pulled out by blunt hooks, and m. flexor digitorum superficialis - inward. Between them there is an elbow vascular-nerve bundle. The elbow artery lies on the deep bending of the fingers, and on 1-2 cm inward from it - the elbow nerve. The artery is isolated from the surrounding tissues and bandaged.

If the elbow artery is bandaged in the lower third of the forearm, then the cut of the skin in the length of 5-8 cm is 1 cm outside from the projection line from the bottom up. The skin wound is stretched with blunt hooks, and its own fascia of the forearm is dissected through a tufted probe. In the wound, the edge of the tendon is the elbow flexion of the brush, after which the hooks are immersed in the gap between the elbow bending brush (medial) and the

surface bending fingers in (laterally). Under the deep leaf of the fascia, the elbow artery secreted, which lies at the deep flexing of the fingers. In this case, the students determine that this artery with the same veins is located in the wound laterally, and closer to the elbow bone lies the ulnar nerve (n. ulnaris). The elbow artery is isolated from the surrounding tissues and imposes two ligatures on it.

**Bandaging of femoral artery**

At first, the students on determine the projection line for the femoral artery banding the corpse, which, follow to Ken, it is carried out from the middle of the distance between the anterior superior iliac spine (spina iliaca anterior superior) and the symphysis, and below - from tuberculum adductorium femoris. Attention is drawn to the fact that along the Ken line, the femoral artery can be bandaged both in the upper, middle, and lower third of the thigh. It is noted that B.V. Petrovsky for the access to the femoral artery under the Poupart's ligament, especially in the presence of common femoral artery aneurysms, recommends the T-shaped incision. The vertical part of this section corresponds to the projection a. femoralis down to 10-12 cm, and horizontal (5-6 cm in length) corresponds to the direction of the Poupart's ligament. If the baring of the femoral artery is carried out under the Poupart's ligament, then the bandage a. femoralis spend below the level of the deep thigh artery (a. profunda femoris). Cut the skin, subcutaneous tissue and surface fascia, the edges of the wound spread through blunt hooks.

Wide fascia (fascia lata) is separated by gauze balls from fiber, on a grooved probe dissects the surface plate of a wide fascia downwards and its edges are pulled by blunt hooks at the sides. From the fiber of the vascular bed, the femur vessels are excreted. Attention is drawn to the fact that the femoral artery is placed in the wound laterally and the vein of the same name – medially.

Vessels are separated from surrounding tissues by anatomical tweezers or gauze balls fixed with a packer.

Bandage a.femoralis below the discharge of the deep artery of the hip causes the preservation of the main collateral circulatory pathways.

If the femoral artery is damaged above the place of departure a. profunda femoris, it is better to impose a vascular seam: bandage a. femoralis in such situations may be complicated by the development of the lower limb gangrene in the postoperative period.

When bandaging of the femoral artery in the actuating canal, the incision is carried out along the medial surface of the lower third of the thigh within 8-10 cm. Students independently dissect the skin with subcutaneous tissue and superficial fascia. And thus, the large subcutaneous vein (v. saphena magna), which occurs in the course of the cut, is diverted to one side. The broad fascia of the thigh (fascia lata) is exposed, through which the oblique directed fibers of the sartorius muscle (m. sartorius) are projected.

The superficial plate of a wide fascia of the thigh is dissected and exposed m. sartorius, which pulls the hooks out. At the same time, the tendons of the adductor magnus are exposed (m. adductor magnus). The edges of the formed wound are stretched with hooks and near the lateral edge of the cut bare m. vastus medialis, which is connected to adductor magnus with a dense lamella (lamina vastoadductoria). Remembering that this plate forms the front wall of the adductor canal, the students independently looking for her anterior hole, through which the subcutaneous nerve (n. saphenus) and the lower knee artery (a. genus descendens) are released. Through this hole enter the grooved probe. On this probe dissect with scalpel lamina vastoadductoria over the entire length. The edges of the cut plate are hooked in the

sides and go to the femoral artery.

It should be remembered that the subcutaneous nerve (n. saphenus) is located at the front of the femoral artery, and behind it lies the same vein. In the adductor channel a. femoralis should be tied as low as possible. a. genus descendes, which plays an important role in providing collateral circulation and the formation of the rete articulations genus.

**Bandage of popliteal artery**

Students put the corpse on the operating table with the abdomen down, the lower extremity slightly bend in the knee joint. Departing from the middle of the popliteal fossa, so as not to damage v. saphena parva, cut through the vertical incision of the skin for a length of 10-12 cm is performed. The popliteal fascia (fascia poplitea) is cut out, which is cut through a grooved probe, and the vascular-nerve bundle is carefully isolated from the surrounding fiber. It turns out that the most superficial, directly under the fascia of the popliteal fossa (fascia poplitea), lies the tibial nerve (n. Tibialis). It carefully pulled out; much deeper and more medially lies a large popliteal vein (v. tibialis); deeper and more medially, near the articulative bag, is a popliteal artery (a poplitea). With the help of a hook v. poplitea stand out and drag back and forth. During the separation of the popliteal artery, care must be taken not to damage the branches that branch out from it.

**5. Materials for self-control**

**A. Tasks for self-control:**

*Test No.1.* The patient is 50 years old. The operation of removing the pathologic process of knee joint was performed. What is the name of such surgical intervention?

a) Joint resection
b) arthroplasty
c) Arthrodes
d) Arthrolysis
e) There is no right answer

*Test No.2.* The patient is 60 years old. The amputation of the femur was carried out. What are the absolute indications for this operation?
a) Gangrene limbs
b) Chronic osteomyelitis
c) Neutrophic ulcers that cannot be treated
d) Chronic bone tuberculosis
e) Congenital deformities which not undergoing surgical treatment or prosthetics

*Test No.3.* What are the relative indices for amputation of the limb:
a) Chronic osteomyelitis with signs of severe amyloidosis of the internal organs
b) Traumatic separation of the limbs
c) Gangrene limbs
d) Malignant tumors
e) Large open lesions of the limb with fragmentation of the bones, rupture of the major vessels and nerves, the crushing of the muscles

**B. Tasks for self-control:**

*Task No.1.* Wound in the region of the vascular-nerve bundle of the shoulder. The wound is infected. A severe bleeding from a large vessel began. What operation should be performed?

*Task No.2.* Acute thrombosis of the major artery of the limb. What surgical intervention is needed in this case?

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|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module 1** | Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| **Content module No. 2** | Clinical anatomy and operative surgery of regions and organs of the head |
| **Topic 8** | Clinical anatomy and operative surgery of the cranial-cerebral sections of the head. Layers of frontal-tympano-occipital, temporal and mastoid process. Blood supply and innervations of soft tissues of the skull's arches. Trepanation of the Chipault triangle. Antrotomy. |
| **Year** | II |
| **Faculty** | Foreign students training (dental) |

**1. The relevance of the topic:** the trauma of soft tissue of the head, penetrating and impermeable wounds of the arch of the skull, hematomas of different localization, intracranial tumors in surgical practice are encountered quite often. The surgeon requires knowledge of the anatomical and physiological features of the soft tissues and bones of the brain department of the head during operations on the brain of the head. In addition, they will help doctors understand the peculiarities of the course of pathological processes and use

optimal surgical techniques in the treatment.

**2. Specific objectives.**

1. Explain the topography of the vessels and nerves of the cranial arch, the regions of their placement for carrying out conduction anesthesia, the scraping of the scuffs when performing surgical interventions.
2. Analyze the features of the layered structure of the tissues of the vault.
3. Analyze the ways of distribution of phlegmon, purulent edema, hematoma on the vault of the skull.
4. Explain the connections of the subcutaneous veins of the cranio-cerebral department with the sinuses of the solid cerebellum.
5. Explain how to perform primary surgical treatment of the wounds of the cervical-cerebral sections of the head.
6. Explain the technique of discontinuing bleeding from blood vessels of the subcutaneous tissue, skull bones, brain occipital and venous sine.
7. Explain the boundaries of the trepanation of the Chipault triangle.
8. Explain technical techniques of anthrotomy.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| 1. Anthrotomy | Trepanation of the mastoid process |
| 2. Trepanation of the Chipault triangle | The region of the mastoid process, within which perform anthrotomy |

**3.2. Theoretic questions:**

1. The borders of the head, divided into the cerebral and facial divisions.
2. The borders of the vault of the skull.
3. The borders of the frontal-parietal-occipital region.
4. Layers of the frontal-parietal-occipital region.
5. Vessels and nerves of the frontal-parietal-occipital region.
6. The borders of temporal region.
7. Layers of the temporal region.
8. Cellular spaces of the temporal region.
9. Vessels and nerves of the temporal region.
10. Boundaries and layers of the mastoid region.
11. The borders of the trepanation of the Chipault triangle.
12. Technique of anthrotomy. Major mistakes of operations and complications.

**3.3. Practical skills acquired in class:**

1. Preparation of sites according to the theme of the class: frontoparietooccipital, temporal,

region of the mastoid process.
2. Perform anthrotomy.

**4. The content of the topic:**

**Frontal-parietal-occipital region**

At the beginning of the classes students after short verbal analysis and parsing layered structure frontal-parietal-occipital regions start self-preparation of this region. On the frontal, parietal or occipital parts of the head draw an imaginary patch. At the same time, it is important to emphasize that the patch that is bent should be directed down the bottom. This provides sufficient blood supply to the patch and its attachment.

Students disconnect the skin and subcutaneous tissue together with aponeurosis. Attention on the connection of the skin with aponeurosis due to connective tissue injuries from the skin to aponeurosis. The connection of the walls of subcutaneous blood vessels with connective tissue and the possibility of prolonged bleeding from the vessels is determined. The teacher gives a description of scalped wounds on the fornix of the skull. After dissecting the aponeurosis flap, students enter to the Koher's probe between aponeurosis and periosteum. At the same time, they are sure of the foaminess of fascia subaponeurotica. Then cut off the periosteum of the skull.

Due to the presence of subperiosteal layer of loose fiber, the periosteum is easily removed from the bone.

Students view the structure of the bone on a sagittal branch of the skull. It is important to emphasize the importance of the thickness of the inner lamina in the occurrence of damage to the skull bones in the region of the brain section of the skull. In the process of preparation of the frontal-tympano-occipital region, attention should be paid to the radial direction of the vascular-nerve bundles.

Thus, summing up the discussion of the layered structure of the tissues of the arch of the skull, it should be noted that a layer of fiber accompanies each layer: the skin - subcutaneous tissue, epicranial aponeurosis (tendon helmet) - fascia subaponeurotica; periosteum - subcutaneous tissue. The first three layers are vertically tied together with the connective tissue partitions. The bones of the vault consist of external and internal plates, between which located a diploid substance (diploe).

Arteries carry out blood supply of the frontal-parietal-occipital region: a. supraorbitalis, a. suprathrochlearis, superficial temporal artery, and its branches (frontal and parietal), a. temporalis superficialis and its branches (r. frontalis et r. parietalis), a. auricularis posterior and a. occipitalis. Innervation: n. supraorbitalis, n. suprathrochlearis, n. auriculotemporalis, n. auricularis major, n. occipitalis major and n. occipitalis minor.

**Temporal region**

In the temporal region, a tongue-like flap is made up of 2.5 cm in width and 4 cm in length. At first, students disconnect the skin from the deeper tissues. Pay attention to the absence of pronounced supercranial aponeurosis in this region. It is thin and determined in the form of the surface fascia of the temporal region. After detaching the skin with subcutaneous tissue and surface fascia, students isolate the temporal fascia, separate it from the upper and middle layers and make sure that there is a closed cellular space above the articulate artery between them. After that, they dissect the deep plate of the temporal fascia, conduct the Koher's probe, penetrating the temporal arch, and make sure in connection between the fascia subaponeurotica and fat pad of the cheek. After detaching the subfascial fiber, the students

cut out a tongue-like flap of the temporal muscle and strip it down. At the back of the temporomandibular muscle, students dissect the branches of the deep temporal artery and the same name nerve of. Students bare a deep layer of the friable fiber of the temporal region between the muscle and the periosteum. After that we must cutting periosteum.

At the bone preparation, students study the structure of the temporal bone scales. Pay attention to the presence of a furrow for the middle meningeal artery, the possibility of damage to this artery due to injuries of the temporal bone.

Blood supply of the site: the superficial temporal artery and its branches, as well as deep temporal branches of the maxillary artery.

Innervation: auriculotemporal nerve and facial nerves, deep temporal branches of the mandibular nerve.

**Mastoid region**

At the bone preparation, students examine the boundaries of the site corresponding to the mastoid process. After that, students move to the layered preparation of the mastoid region. Pay attention that the skin is thin, has a strong connection with deeply placed aponeurosis.

In the process of preparation, it should be noted that the periosteum has a strong bond with the bone. On the spine of the mastoid process, they study the structure, possible pneumatic or sclerotic forms of variability of its cells. It is noted the presence of the largest cell - a cave.

At the bone preparation, students are considering the boundaries of the Chipault triangle, within should be performed the trepanation of the mastoid process - anthrotomia.

**Primary surgical treatment of craniocerebral wounds**

It is noted that the evidence for primary surgical treatment of craniocerebral wounds is craniocerebral trauma. It is noted that the purpose of this operation is to transform the infected wound into a non-infected. The signs of permeable and impenetrable craniocerebral wounds are indicated. Thus, with damage to the solid cerebellum, wounds are considered permeable, and while maintaining its integrity - impenetrable. The main stages of primary surgical treatment of craniocerebral wounds are as follows:

• removal of foreign bodies, bone debris, treatment with antiseptics, anesthesia;
• layered removal of non-viable edges of the wound within the boundary tissues;
• thorough hemostasis;
• revision of the bottom of the wound.

Only the fragments of bones that are not fixed to the periosteum, along with the extraneous bodies, should be removed.

During layer treatment of craniocerebral wounds, special attention is paid to the state of the dura mater. If it is not damaged, it is pulsating, it has no signs of subdural hematoma, then it does not dissect. At the end of the operation, seams are imposed on aponeurosis, the skin is not sewn or fixed with liquid sutures.

With penetrating wound, by arcuate incision clears the dura mater, from the cerebrospinal fluid removed the fragments of bones, foreign bodies, blood clots.

The crushed brain tissue (detritus) and small bone fragments in it are washed out of the wound by a stream of the physiological solution with the help of a rubber pear. After a thorough hemostasis dura mater is sewn together. If this can not be done (significant defects of the dura mater), it is not sewn, aponeurosis is applied to the liquid seams, the skin, as a rule, is sewn with liquid seams, in the corners wounds leave rubber drain for 1-2 days.

**5. Materials for self-control**

**A. Tasks for self-control:**

*Test № 1.* The victim has cut wound in the anterior part of the frontoparietooccipital region. What is on the front edge of this part?
a) linea nuchae superior
b) bridge and superciliary arch
c) linea temporalis superior
d) linea temporalis inferior
e) the seam between the parietal and frontal bones

*Test № 2*. The patient has the abscess of 2 x 2 cm in the frontal-parietal-occipital area. In what layer is the inflammatory process in this case localized?
a) intradermal
b) in subcutaneous tissue
c) interaponeurotic tissue
d) subaponeurotic tissue
e) subperiosteal tissue

*Test № 3.* The doctor determined the pulse of the patient on the superficial temporal artery. Where is the pulsation point of this artery?
a) For 1 transverse finger in front of the ear tragus
b) For 1 transverse finger behind the ear
c) 2 cm behind the mastoid process
d) the anterior edge of the masseter muscle
e) over the ears

*Test № 4.* A patient has a purulent mastoiditis. The surgeon cuts the abscess. What section will the most anatomically be justified and least traumatic in this case?
a) transverse
b) longitudinal
c) radial to the vertex
d) radial to ear tragus
e) arcuate

*Test № 5.* A patient has the abscess in the left temporal region. The surgeon cuts the abscess. What section will the most anatomically be justified and least traumatic in this case?
a) transverse
b) longitudinal
c) radial to the vertex
d) radial to ear tragus
e) arcuate

**B. Tasks for self-control:**
*Task №1.* The patient M. sent to the hospital ambulance with complaints of a headache, swelling at the site of the skull. The patient slipped and fell two hours ago. In the review -

the presence of fluctuating swelling, limited in the front edge of the orbit, the upper nuchal line is behind; the upper temporal line is on the sides.
Make the diagnosis. In what cell layer is hematoma localized?

*Task №2.* During anthropometry, the surgeon went beyond the posterior borders of the trepanation Chipault triangle. There was a serious bleeding. What is the source of this bleeding?

*Task №3*. During the anthrotomy, the patient had a paralysis of muscles from the side of the operation (left-sided anthrotomy). What is the reason of this complication?

*Task №4*. After the injury to the skull, palpable fluctuation tumor in the borders to the left temporal bone. Where is hematoma located?

*Task №5.* During anthrotomy, the surgeon went beyond the borders of the trepanation Chipault triangle. What formations can be damaged in this case?

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|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module 1** | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| **Content module No.2** | Clinical anatomy and operative surgery of regions and organs of the head |
| **Topic 9** | Clinical anatomy and operative surgery of the cranial cavity. Topography of external and internal bases of the skull. Meninges, spaces, and sinuses of dura mater encephali. The scheme of craniocerebral topography (Kronlein-Brusova, Egorova). Trepanation of the skull (decompression, cranioplasty). Surgical treatment of |
| **Year** | II |
| **Faculty** | Foreign students training (dental) |

**1. The relevance of the topic:** injuries of the brain part of the head, which are often found in surgical practice, may be associated with open bone fractures (permeable and non-permeable wounds), hematomas, posttraum arterial circle of the braiatic edema of the cerebral brain, tumors, and cysts. Operative interventions in the brain department of the head require a surgeon to have deep knowledge of the layer topography of the brain, the sulcuses and gyruses, which are shown in the Kronlein-Bruce's scheme.

**2. Specific objectives.**

1. Explain the topography of the external and internal bases of the skull, cranial holes and their contents.
2. Explain the topography of the cerebral meninges and venous sinuses of the brain.
3. Draw a scheme of the cranio-cerebral topography of Kronlein-Brusova, Egorova.

4. Analyze various methods of trepanation (craniotomy, craniectomy) of the skull.
5. Explain the technique of execution of cranioplasty in the parietotemporalis region.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| 1. Primary surgical treatment of the brain's wounds | The surgical operation, which involves the transformation of the wound of the brain department of the head from the dirty (infected) into a clean and creation of proper conditions for healing by its primary tension. |
| 2. Trepanation of the skull | A surgical intervention in which a hole is drilled or scraped into the human skull, exposing the dura mater to treat health problems related to intracranial diseases or release pressured blood buildup from an injury |

**3.2. Theoretic questions:**

1. Blood supply of the brain.
2. Cranial-cerebral topography-scheme Kronlein -Bruceva.
3. Special surgical tool for operations on the brain department of the head.
4. Types of anesthesia in operations on the brain of the head.
5. Methods of stopping bleeding from the bones of the arch of the skull.
6. Technique for stopping bleeding from the vessels of the brain.
7. Primary surgical treatment of penetrating wounds of the skull.
8. Cranioplasty trepanation of the skull in the parieto-temporal region by Olivekron.
9. Decompressive trepanation of the skull by Cushing.

**3.3. Practical skills acquired in class:**

1. Construction of the Kronlein-Bruce's scheme on the head of the embalmed corpse.
2. Realization of primary surgical treatment of skull wounds stops the bleeding.
3. Realization of bone-plastic trepanation of a skull by Olivekron.
4. Realization of a decompression infratemporal trepanation of the skull by Cushing.

**4. The content of the topic:**

## Topographic and anatomical features of the outer and inner skull base

During analyzing of the topography of the internal and external skull, students pay attention to the bones formation of cranial fossae. Thus, the anterior cranial fossa on the inner surface of the skull is separated from the middle posterior margin of small wings of sphenoidal bone. In its formation two orbital parts of the frontal bone with a cribriform plate (lamina cribrosa) of the ethmoid bone is involved; the body and wings of sphenoid bone complement the fossa. Attention is drawn to the fact that the anterior cranial fossa is located above the cavity of the nose and orbits. The frontal lobes of the brain are lying on it, and underneath them on the sides of the crista galli on the cribriform plate of ethmoid bone located olfactory bulbs (bulbus olfactorius). From the cavity of the nose through the holes in the cribriform plate is approaching about 30 nerve trunks. Through these holes in the mucous membrane of the nasal cavity pass the anterior and posterior ethmoid arteries (aa. ethmoidales anterior et posterior), and ethmoid nerves (nn. ethmoidales ).

At the base of the small wing of the os sphenoidale, there are pair eye holes, through which, through the cavity of the skull, the optic nerves (n. opticus) and the ophthalmic artery (a. ophtalmica), without the same name vein, passes through the cavity of the skull.

**The middle cranial fossa** (fossa cranii media) consists of three bones – the sphenoid bone and the two temporal bones. Anteriorly and laterally it is bounded by the lesser wings of the sphenoid bone. These are two triangular projections of bone that arise from the central sphenoid body. Anteriorly and medially it is bounded by the limbus of the sphenoid bone. The limbus is a bony ridge that forms the anterior border of the chiasmatic sulcus (a groove running between the right and left optic canals). Posteriorly and laterally it is bounded by the superior border of the petrous part of the temporal bone. Posteriorly and medially it is bounded by the dorsum sellae of the sphenoid bone. This is a large superior projection of bone that arises from the sphenoidal body. The floor is formed by the body and greater wing of the sphenoid, and the squamous and petrous parts of the temporal bone. The middle cranial fossa consists of a central portion, which contains the pituitary gland, and two lateral portions, which accommodate the temporal lobes of the brain.

The central part of the middle cranial fossa is formed by the body of the sphenoid bone. It contains the sella turcica which is a saddle-shaped bony prominence. It acts to hold and support the pituitary gland, and consists of three parts:

**1)** the tuberculum sellae (horn of the saddle) is a vertical elevation of bone. It forms the anterior wall of the sella turcica, and the posterior aspect of the chiasmatic sulcus (a groove running between the right and left optic canals);

**2)** the hypophysial fossa or pituitary fossa (seat of the saddle) sits in the middle of the sella turcica. It is a depression in the body of the sphenoid, which holds the pituitary gland;

**3)** the dorsum sellae (back of the saddle) forms the posterior wall of the sella turcica. It is a large square of bone, pointing upwards and forwards. It separates the middle cranial fossa from the posterior cranial fossa.

The sella turcica is surrounded by the anterior and posterior clinoid processes. The anterior clinoid processes arise from the sphenoidal lesser wings, while the posterior clinoid processes are the superolateral projections of the dorsum sellae. They serve as attachment points for the tentorium cerebelli, a membranous sheet that divides the brain.

The depressed lateral parts of the middle cranial fossa are formed by the greater wings of the sphenoid bone, and the squamous and petrous parts of the temporal bones. They support the temporal lobes of the brain. It is the site of many foramina – small holes by which vessels

and nerves enter and leave the cranial cavity.

**Features and contents of the middle cranial fossa:**

**Sphenoid bone:** the sphenoid bone resembles a bat having a centrally placed body with greater and lesser wings extending to both sides. The body contains the sphenoid air sinuses that are lined with mucous membrane and communicate with the nasal cavity. Like all other air sinuses of the skull, they serve as voice resonators.

**Optic canal (canalis opticus):** it is located anteriorly and transmits the optic nerve (n. opticus) and the ophthalmic artery (a. ophtalmica).

**Superior orbital fissure:**

It is a slit-like opening between the lesser and the greater wings of the sphenoid bone. It transmits many important structures including the lacrimal (n. lacrimalis), frontal (n. frontalis), trochlear (n. trochlearis), oculomotor (n. oculomotorius), nasociliary (n. nasociliaris) and abducent nerves (n. abducens) as well as the superior ophthalmic artery (a. ophthalmica superior).

**Foramen rotundum and foramen ovale:**

Foramen rotundum is situated behind the medial end of the superior orbital fissure, perforating the greater wing of the sphenoid. It transmits the maxillary nerve (n. maxillaris). Foramen ovale is situated posterolateral to foramen rotundum, also perforating the greater wing of sphenoid. It transmits both the large sensory root and the small motor root of the mandibular nerve (n. mandibularis).

**Foramen spinosum:** it also perforates the greater wing of sphenoid, lying posterolateral to the foramen ovale. It transmits the middle meningeal artery (a. meningea media) into the cranial cavity.

**Foramen lacerum:** it is large an irregularly shaped and lies between the apex of the petrous part of the temporal bone and the sphenoid bone. In life, the opening of this foramen is filled with cartilage and fibrous tissue and only small blood vessels pass through it.

**Carotid canal (canalis caroticus):** it opens into the side of the foramen lacerum above the closed inferior opening. The internal carotid artery (a. caroticus internus) enters the foramen lacerum through this canal.

**Impression for trigeminal ganglion (ganglion trigeminale):**

Lateral to the foramen lacerum, on the apex of the petrous part of the temporal bone, there is an impression for the trigeminal ganglion.

**Grooves on petrous bone:** on the anterior surface of the petrous bone (petrous part of temporal bone), there are two grooves for nerves. The larger medial groove is for the greater petrosal nerve (n. petrosus major) (a branch of facial nerve) and the smaller lateral groove for the lesser petrosal nerve (n. petrosus minor), (a branch of tympanic plexus).

**Arcuate eminence:** it is a rounded eminence found on the anterior surface of the petrous bone and is caused by the underlying superior semicircular canal.

**Tegmen tympani:** it is a thin plate of bone that is actually a forward extension of the petrous part of temporal bone. From behind forwards, it forms the roof of the mastoid antrum, the tympanic cavity and the auditory tube. Tegmen tympani is clinically important because it is the only barrier that separates the infection in the tympanic cavity from the temporal lobe of the cerebral hemisphere.

**Median part of middle cranial fossa:** as described above, the median part is formed by the body of sphenoid bone. It has following important structures:

**Sulcus chiasmatis:** it lies in front and is related to the optic chiasma. It leads laterally to the

optic canal on each side.
**Tuberculum sellae:** it is an elevation that lies posterior to sulcus chiasmatis.
**Sella turcica:** it is a deep depression behind the elevation (tuberculum sellae). It lodges the pituitary gland.
**Dorsum sellae:** it is a square plate of bone that bounds the sella turcica posteriorly.
**Posterior clinoid processes:** these are two tubercles on the superior angles of the dorsum sellae. They give attachment to the fixed margin of the tentorium cerebelli.
**Cavernous sinus:** it is directly related to the side of the body of sphenoid bone. The oculomotor, trochlear and ophthalmic and maxillary divisions of trigeminal nerve (n. trigeminalis) pass along its lateral wall. The internal carotid artery (a. caroticus internus) and the abducens nerve (n. abducens) pass through it.
**The posterior cranial fossa** (fossa cranii posterior) is comprised of three bones: the occipital bone and the two temporal bones.
**It is bounded as follows:**
Anteriorly and medially it is bounded by the dorsum sellae of the sphenoid bone. This is a large superior projection of bone that arises from the body of the sphenoid.
Anteriorly and laterally it is bounded by the superior border of the petrous part of the temporal bone.
Posteriorly it is bounded by the internal surface of the squamous part of the occipital bone.
The floor consists of the mastoid part of the temporal bone and the squamous, condylar and basilar parts of the occipital bone.
The posterior cranial fossa houses the brainstem and cerebellum.
The brainstem is comprised of the medulla oblogata, pons and midbrain and continues down through the foramen magnum to become the spinal cord. The cerebellum has an important role in coordination and fine motor control.
Alongside the gross anatomical structures of the brainstem and cerebellum, the posterior cranial fossa also accommodates associated arteries and nerves. Some key structures will be discussed with regards to their foramina below.
**Foramina.** There are several bony landmarks and foramina present in the posterior cranial fossa (a foramen is simply a hole that allows the passage of a structure – usually a blood vessel or nerve).
**Temporal Bone.** The internal acoustic meatus is an oval opening in the posterior aspect of the petrous part of the temporal bone. It transmits the facial nerve ( n. facialis VII), vestibulocochlear nerve (n. vestibulocochlearis VIII) and labyrinthine artery (internal auditory artery).
**Occipital Bone**
A large opening, the foramen magnum, lies centrally in the floor of the posterior cranial fossa. It is the largest foramen in the skull. It transmits the medulla of the brain, meninges, vertebral arteries, spinal accessory nerve (n. ascendens), dural veins and anterior and posterior spinal arteries. Anteriorly an incline, known as the clivus, connects the foramen magnum with the dorsum sellae.
The jugular foramina are situated either side of the foramen magnum. Each transmits the glossopharyngeal nerve (n. glossopharyngeus), vagus nerve (n. vagus), spinal accessory nerve (descending) (n. descendens), internal jugular vein (v. jugularis internus), inferior petrosal sinus (sinus petrosus inferior), sigmoid sinus and meningeal branches of the ascending pharyngeal and occipital arteries (aa. occipitalis).

Immediately superior to the anterolateral margin of the foramen magnum is the hypoglossal canal. It transmits the hypoglossal nerve through the occipital bone.
Posterolaterally to the foramen magnum lies the cerebellar fossae. These are bilateral depressions that house the cerebellum. They are divided medially by a ridge of bone, the internal occipital crest.

**Topographic and anatomical features of the external skull base**

The students determine the boundary of its external basis on the skull. It passes along a line wich connects protuberantia occipitalis externa with a sphenoidal rostrum (rostrum sphenoidalis) what lies between the wings of the vomer: on the superior nuchal line, through the basis of the mastoid process, the posterior and lower edges of the external acustic meatus, continues along the zygomatic process of the temporal bone, its crista infratemporalis, and on margo supraorbitalis of the frontal bone.

If you draw a line through the foramen magnum, which connects the top of the mastoid processes, as a result the outer skull base is divided into two parts: the front and the back.
Within the back part, there are occipital protuberance (condylus occipitalis) which is connected with atlas, and a large hole through which the medulla oblongata passes.

The front section of the external skull base combines the upper wall of the pharynx, the upper wall of the eye-socket and nasal cavity.
The pharyngeal aponeurosis (fascia pharyngealis), the atlanto-occipital membrane (membrana atlantooccipitalis), and the muscles membrane, starting from the mastoid process, are attached to the external skull.

**Meninges of the brain**

During analysis, the meninges of the brain on the preparation of the head, pay attention to the fact that the outermost is dura mater encephali. It is noted that with the bones of the vault of the skull, it is connected loosely, and with the inner base of the skull - tight. With the help of a cut of a dura mater, it can be verified that it consists of two leaves that are loosely connected to each other and between which pass the main vascular-nervous formations of the skull.

The teacher accentuates that the founder of native surgery M. N. Burdenko introduced into the neurosurgical practice the plastic defects of the solid brain membrane at the expense of a flap on a stem that is cut out from an outer sheet of a solid brain membrane.

Between the leaves of the the dura materwithin the arch of the skull there pass the front, middle and rear meningeal arteries. The students determine that the anterior meningeal artery (a. meningea anterior) deviates from the anterior ethmoidal artery (a. ethmoidalis anterior), which is the branch of the optic artery on the bone preparation of the skull and in the tables,. The anterior ethmoidal artery penetrates into the anterior cranial hole through the same name holes and branching to own branches within the scales of the frontal bone.

The middle meningeal artery (a. meningea media) is one of the largest of the middle meningeal branches. It departs from the maxillary artery (a. maxillaris) and penetrates into the cavity of the skull through a foramen spinosum. Initially, this artery is in the same name sulcus as a short general barrel and rises above the zygomatic arch, where it is divided into the anterior and posterior branches.

The posterior meningeal artery departs from the ascending pharyngeal artery (a. pharyngea ascendens) and into the cavity of the skull penetrates through the jugular hole, where within the scale of the temporal bone divided into branches that have blood supply to the posterior surface of the tent of the cerebellum with a falx cerebelli.

Meningeal arteries are forming the pair with the same name veins, from which the front and rear enter to the upper sagittal sinus, and the middle ones - in the sphenoid venous plexus.

The lymph from the dura mater flows into different groups of lymph nodes. So, from the frontal and parietal regions it comes to the superficial parotid nodes, and from the temporal and occipital - to the parotid lymph nodes.

The innervations of the dura mater realised by I, II, and III branches of the trigeminal nerve, branches of the periarterial nervous system, as well as elements of other cranial nerves.

Under the dura mater lies an **arachnoid mater** (tunica arachnoidea) that evenly covers the gyrus of the brain and does not penetrate into its grooves. From the arachnoid mater form the formaions in the form of villi. They pin a dura mater and bound with sinuses of a dura mater by Pacchioni's granulations.

The **pia mater** or vascular membrane of the brain (pia mater cranialis) covers the substance of the brain and penetrates into all sulci and ventricles, forming a plexus (plexus chorioideus) there. There is a network of blood vessels that provide a blood supply to the brain substance.

If on the not old corpse in the process of preparation to exfoliate off pia mater, then it is easily separated from the brain, because between it and the brain lies loose tissue.

Since between the **dura mater** and the inner surface of the bones of the vault of the skull there is a loose connection, then in the trauma here can accumulate blood, which leads to the emergence of epidural hematomas.

If the hematoma or matters are localized between dura and arachnoid mater, then there are subdural processes. When pathological processes developed between the arachnoid and the pia mater, they are called subarachnoid.

The three branches leave from the dura mater: the falx cerebri, the falx cerebelli, and the cerebellar tentorium (tentorium cerebelli).

Students carefully study these branches of the dura mater. They determine that the falx cerebri lies in the sagittal plane from the cribriform plate of ethmoidal bone to the internal protuberance of the occipital bone and penetrates between the hemispheres of the brain to the corpus callosum. It’s uncovered that the falx cerebelli is a continuation of the falx cerebri. It separates the cerebellum's hemisphere and extends to the large opening of the occipital bone. At the same time, the preparation clearly shows that the cerebellum tent is located almost in the horizontal plane and separates the occipital particles of the cerebral hemispheres from the cerebellum.

The teacher pays attention of the students to the fact that the falx process and the tent of the cerebellum are formed by a double dura mater. Because of this, between the dura mater leaves form venous sinuses. Their feature is the presence of intima in the lumen of sinuses and the absence of valves. There are no muscle fibers in the walls of these sinuses, so they are inelastic. When you are dissecting the wall of the sinus, it's gaping, and there is a massive bleeding. Since the blood flows through the sinuses of a dura mater to the system of the internal jugular vein, in the wounds may occur an air embolism.

**The venous sinuses of the cerebral dura mater.** The students determine the main sinuses on the tables and the anatomical preparations with the processes of dura mater and the inner base of the skull.

The upper sagittal sinus (sinus sagittalis superior) begins with blind hole (foramen caecum), gradually expanding and ending within the inner protuberance of the occipital bone. The lower sagittal sinus (sinus sagittalis inferior) passes along the lower edge of the dura mater

falx process. It goes front to back, connect with a large vein of the brain (v. cerebri magna) and forms a direct venous sinus.

The direct sinus is connected to the upper sagittal sinus in the upper part of the cerebellum tent, near the inner protuberance of the occipital bone.

Students determine that the occipital sinus (sinus occipitalis) begins with a large opening of the occipital bone and goes to the internal protuberance of the occipital bone. It should be noted that in the occipital protuberance regio sinus occipitalis, along with the upper sagittal sinus and the straight sinus, form drainage sinus (confluens sinuum). With damage to the drainage sinus there is life-thretening bleeding.

The students determine on the tables and the bone preparation that in transverse groove (sinus transversus) of occipital bone occurs the transverse sinus, in which the venous blood flows out into the sigmoid sinus, which leads to the jugular opening. Cavernous sinus (sinus cavernosus) is a system of venous sinuses that surround the Turkish saddle with the pituitary gland.

**Blood supply of the brain (Circle of Willis)**

The students study the main sources of his blood supply at the anatomical preparation of the brain, skull and tables,. Thus, through the carotid canalis (canalis caroticus) of the pyramid of the temporal bone, the internal carotid artery enters the cavity of the skull. First, it enters the cavernous sinus, where it gives a number of small branches and is divided into the anterior (a. cerebri anterior) and secondary (a. cerebri media) cerebral arteries. The second source of blood supply to the brain is the vertebral arteries. They penetrate into the cavity of the skull through a large opening of the occipital bone and merge into the common trunk, forming the main artery (a. basilaris), from which the number of branches at first goes to the cerebellum and medulla oblongata. Within the back of the Turkish saddle, the main arteries branch out to its final branches - the posterior cerebral arteries.

Brain arteries around the Turkish saddle are connected between each other. So, the right and left anterior cerebral arteries (a.a. cerebri anterior) have a connecting branch (r. communicans anterior). They go to the longitudinal gap between the hemispheres of the brain.

Between the posterior cerebral artery and the internal carotid artery, there are also connecting branches (r. communicans posterior) on both sides. They essentially provide blood supply to the brain. The teacher pays attention of students on the individual variability of the connecting branches development (r. communicans anterior), and their absence in some cases.

The teacher emphasizes that the feature of brain veins is that they do not repeat the course of arteries. From the cerebral hemispheres of the brain, venous blood flows through the veins of the large hemispheres to the venous sinuses, mainly in the upper sagittal sinus. From the lower sinus (sinus sagittalis inferior) and the ventricles of the brain, the blood flows out into the large vein of the brain (v. cerebri magna).

**Trepanation of the skull**

The cranioplasty consists in the opening of the cranial cavity by the temporary removal of a flap of soft tissues and a bone marrow on a periosteum stalk with a return to their place at the end of the operation. Unlike osteoplastic trepanation, the decompression operation consists in the final resection of the cranial bone.

During the decompression trepanation, hard shell of the brain is not sewn in contrast to the osteoplastic.

Students define the shape of a possible flap on a corpse's cranium. At the same time, it is necessary to pay attention to the fact that the basis of the bone's flap should be wide and directed to the main vessels. In the process of analysis the operation should mention the one-flaped Wagner - Wolfe's method and the two-flaped method of the Olivecron. The teacher emphasizes that in our time such operation is usually performed in a two-flaped method. At first, cut out the flap, which includes the skin, supercranial aponeurosis, muscle.
Put the flap back to the base and close by the warm saline - soaked napkin.
After that, the surgeon cuts off the bone fracture. At the same time, he retreats from the edge of the skin wound on 1 cm and cleaves the periosteum. Periosteum is exfoliated by bone raspatory. Put on the bone 5 cuts. At the base of the future skeletal bone flap, the distance between the cuts must be at least 4 cm. By brace, the assistants drill a mill holes. The teacher points to a rather cautious technique for creating mills, especially when extending the inner plate, to prevent damage of the dura mater and medullary substance. After the formation of 5 mill openings, they alternately inject a wire saw on Polenov's conductor and cut the bone between the openings. From the base of the skeletal bone flap, the bone is not completely sawing, so as not to damage the periosteum with blood vessels. After connecting the milling holes in the gap between the skeletal bone flap and the skull, introduce an elevator and broke the flap. The skeletal bone flap is turned out; the medullary membrane is cut through a cross-section. After that, the surgeon performs appropriate surgical procedures on the brain: removal of the tumor, cysts, aneurysms of the vessel, etc. At the end of the operation, a dura mater is sewn, if there are no contraindications, nodules, the bone flap is placed in its place and fixed in three rows of seams: the first series of sutures is applied to the periosteum, the second - to the muscle, the third to aponeurosis. At the end of the operation, silk seams are applied to the skin.

The indication for decompression cranial trepanation is a steady increase in intracranial pressure by significant tumors, hydrops and other brain diseases, in cases of impossible removal of pathological conglomerate, with increased edema and swelling of the brain. The purpose of the operation is to remove the part of the skull's vault, the dissection of the dura mater to reduce the compression. Decompressive trepanation is performed directly above the injury region (if the diagnosis is unmistakable) or in the right temporal region (according to Cushing's), if the localization of the pathologic process is unknown. The surgeon makes an arcuate cut in accordance with the attachment of the temporal muscle; the base is directed to the zygomatic arch. Bandage the vessels (superficial temporal artery and its branches). The flap is rejected to the base. Dissecting the temporal fascia and the temporal muscle is performed along the fibers. Skeletonization of the temporal bone is 6x8 cm. In the center of the bone, bared from the periosteum, drill a hole by a milling cutter. This hole is expanded with diagonal pliers to a size of 6x8 cm. The dura mater is dissected by a cross-sectioned cut. Soft tissues, except for the dura mater, sewed tightly. Emphasize that before the autopsy of the dura mater for reducing its tension usually make a spinal puncture. This reduces the possibility of a collapse and brain prolapse, bleeding and other complications.

**5. Materials for self-control**
**A. Tasks for self-control:**

*Test №1.* The patient has reduced skin sensitivity as a result of the craniocerebral trauma. What area of the cerebral cortex can be affected?

a) gyrus centralis posterior
b) regio occipitalis
c) regio tympany
d) regio frontalis
e) gyrus centralis anterior

*Test №2.* The patient has trauma of the skull. What sinus can be affected?
a) sinus sagittalis superior
b) sinus petrosus superior
c) sinus petrosus inferior
d) sinus sagittalis inferior
e) sinus cavernosus

*Test №3.* A woman has violation of tactile sensitivity. What part of the brain is damaged?
a) gyrus centralis posterior
b) medulla oblongata
c) cerebellum
d) gyrus centralis anterior
e) regio temporalis

*Test №4.* The victim has trauma of soft tissues and parietal bones of the sagittal suture, which is accompanied by severe bleeding. Which of the formations could be damaged?
a) Sinus sagittal superior
b) Sinus petrosus superior
c) Sinus rectus
d) Sinus sagittalis inferior
e) There is no right answer

*Test №5.* The victim has subdural hematoma which is detected in the temporal region. Which artery is damaged?
a) a. meningea media
b) a. cerebri media
c) a. communicans posterior
d) a. meningea anterior
e) there is no right answer

**B. Tasks for self-control:**
*Task №.1.* A patient with a chopped wound of the parietal site has severe bleeding. Despite treating wounds with a 3% solution of hydrogen peroxide and imposing compressed bandage the blood does not stop. What is the reason for such a severe bleeding, how do you stop it?

*Task №2.* During the primary surgical treatment of an impenetrable wound of the frontal region, the surgeon decided to cut soft tissues at a distance of 1 cm from the edge of the wound within normal tissues. Is it correct?

*Task №3.* At the wound of the cerebral part of the head with bones damage of the skull, there

was a severe bleeding from the diploid veins. How is it technically right to stop it?

*Task №4.* After the penetrating wound of the cerebral part of the head, many cerebral detritus, small fragments of the bones were detected. How should wound channel from extraneous parts release?

*Task №5.* During sewing penetrating wound of skull, the surgeon carefully sewed tight the skin. Is his action correct?

*Task №6.* During the bone-plastic trepanation of the skull, the surgeon combines all the trepanation openings by a wire saw. What is the surgeon's mistake?

*Task №7*. The surgeon connected the holes during conducting bone-plastic trepanation of the skull. By closing the bone flap collapses and freely lies on the dura mater. What is the surgeon's mistake?

*Task №8.* A sudden brain prolapse arises after the cut of dura mater during decompressive trepanation of the skull by Cushing. What should surgeon do to prevent this complication?

*Task №9.* After the bone-plastic trepanation of the skull, the surgeon separated the bone flap from the periosteum. What is the surgeon's mistake?

*Task №10.* During the trepanation of the posterior cranial fossa, Cushing's crossbow cut was made by the surgeon. Did the surgeon match the place of trepanation?

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| | |
|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module 1** | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| **Content module No.2** | Clinical anatomy and operative surgery of regions and organs of the head |
| **Topic 10** | Clinical anatomy of the lateral facial part. Parathyroid salivary gland. Deep (submaxillary) area of the face. Blood supply, features of the venous system of the face, lymphatic drainage. |
| **Year** | II |
| **Faculty** | Foreign students training (dental) |

**1. The relevance of the topic:**

1. Surgical treatment of purulent and epidemic mumps, inflammatory processes of the sinuses, phlegmon of the face regions, fractures and injuries of the bone and base of the face require from the surgeon deep knowledge of the anatomical and physiological features of the facial part of the head. This section is important for students of dental faculties because maxillofacial surgeons precisely perform the treatment of these pathological processes.

2. Surgical treatment of phlegmon of retropharyngeal space (spatium retropharyngeum) and parapharyngeal space (spatium parapharyngeum), cellular spaces of a deep part of the face requires knowledge of the anatomical and physiological features of these sites.

**2. Specific objectives.**

1. Explain the fascia, cellular spaces of the lateral face region and the ways of spreading purulent - inflammatory processes.
2. Explain the fascia, cellular spaces of the deep face region and the ways of spreading from them purulent-inflammatory processes.
3. Interpret the topographic anatomical features of the parotid gland and its ducts.
4. Analyze the topographical relationship within the studied regions.
3. Make layered tissues preparation of the lateral face region.
4. Make layered tissues preparation of the deep face region.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| 1. Deep region of the face | The area of the facial part of the head, which is located behind the branch of the mandible and temporal muscle, in the area of attachment of this muscle to the coronary branch of the mandible. |
| 2. Spatium temporopterygoideum | Space between the outer surface of the lateral pterygoid muscle and the inner surface of the temporal muscle. |
| 3. Spatium interpterygoideum | Space between lateral and medial pterygoid muscles. |
| 4. Spatium pterygomaxillarum | Space between the medial pterygoid muscle and the inner surface of the mandibular branch |

**3.2. Theoretic questions:**

1. The boundaries of the facial region of the head.
2. The division into sections.
3. Buccal region. Borders, layers, blood supply, innervation, lymphatic drainage.
4. Parotid region. Borders, layers, blood supply, innervation, lymphatic drainage.
5. The topography of the parotid gland.
6. The topography of the duct of the parotid gland.
7. The topography of facial muscles.
8. The boundaries of the deep facial region.
9. Cellular spaces of the face, their connections, and ways of dissemination of infection.
10. Pterygopalatine fossa, boundaries, content.
11. Typical incisions at phlegmon of the deep region of the face, parapharyngeal space and retropharyngeal space.

**3.3. Practical skills acquired in class:**

1. Layer-by-layer dissection of the masseteric and buccal regions and their formations.
2. Layer-by-layer dissection of the parotid area and its formations.
3. Layer-by-layer dissection of the deep face and its formations.
4. Perform typical incisions on the face with deep phlegmons of the face, retropharyngeal and parapharyngeal space.

**4. The content of the topic:**

**General information about the facial part of the head**

Students draw on the skull a line that separates cerebral department from the facial one. It

passes from the bridge of the nose on the upper edge of the optic fossa, on the zygomatic bone, the zygomatic arch, through the external acoustic opening and on the anterior edge of the mastoid process.

Below the neck, the facial part is separated by a line that runs from the chin to the lower edge of the mandible body, its angle to the anterior edge of the mastoid process base.

Students determine that there are front and two lateral divisions on the face. In the anterior department there are the following regions: orbita, nasal part, infraorbital fossa, oral region and mental region. In the lateral part there are the parotid masticatory region with the retromandibular fossas, buccal region, and deep part of the face.

It is advisable to consider a number of characteristic for all facial regions of the head for a more complete description of the topography of these regions at the practical lesson.

The face skin is thin, contains a lot of sweat and sebaceous glands. The instructor pays attention of students to the fact that an atheroma is formed at the occlusion of the excretory duct of the sebaceous gland and boils are formed with inflammation of the hair follicles.

The skin of the face has many sources of blood supply, so that face wounds are resistant to infection and healed rapidly, if they are not very contaminated.

On the overwhelming part of the face there is a lot of subcutaneous tissue which can be a cause of the spread purulent infection and hematoma on the face.

It is necessary to pay attention of students to the role of mimic muscles: these muscles provide the function of the oral cavity and orbital fissures, help to restore a certain emotional state of a person (grief, illness, joy, care, etc.).

It is emphasized that mimic muscles, unlike chewing, usually do not have two fixing points. One group of mimic muscles starts on the bone and plaits only into moving tissures. The second group is fixed only to moving tissues. These include the orbicularis oculi muscle (musculus orbicularis oculi) and orbicularis oris muscle (musculus orbicularis oris).

Attention is drawn to the fact that on the face, unlike the skull, there is a thin superficial face fascia under the subcutaneous tissue. It forms fascial compartments for mimic muscles and vascular-nerve bundles in the subcutaneous fat layer.

**Buccal region (regio buccalis)**

At the corpses, preparations, slides, tables, the students first practically define the boundaries of the site: at the top is the lower edge of the orbit, at the bottom is the lower edge of the body of the mandible, the front is the nasolabial and nasobuccal folds, behind is the front edge of the chewing muscles. As the students have already theoretically studied the layered topography of this region, they must confirm this at the lesson; make a layer preparation under the supervision of the teacher.

Pay attention that the skin of this region is thin, easily shifted, contains a lot of sebaceous and sweat glands. Subcutaneous tissue, unlike adjacent areas of the face, is sufficiently developed. It is adjacent to the buccal fat pad (corpus adiposum buccae). The buccal fat pad is located below the zygomatic bone, between the chewing and buccal muscles and covered by skin and subcutaneous tissue. There are three branches: temporal, orbital and pterygopalatine in the buccal fat pad. During profound purulent processes within the corpus adiposum buccae, its fascia capsule can be fused, which reduces purulent to diffusion into adjacent areas (under the zygomatic arch, fossa temporalis and infratemporal fossa, on the orbit through the inferior orbital fissure).

During preparation, students are convinced that facial mimic muscles lie in several layers in the subcutaneous tissue.

The next layer is the fascia buccopharyngea that covers the buccal muscle. If you have prepared the tissues to the buccal muscle, you will see that the duct of the parotid gland penetrates this muscle and opens at the side of mouth vestibule at the level of 1-2 molars or between them. The cheek muscle is covered by the mucous membrane of the mouth vestibule inside. The mucous membrane has a salivary papilla, in which opens the duct of the parotid gland.

The facial artery passes in the thickness of the subcutaneous tissue near the anterior margin m. masseter. This artery deflects in the medial direction and initially releases the branches to the lower and upper lip (a. labialis superior et a. labialis inferior), and then goes to the inner corner of the orbit, where it continues into the angular artery (a. angularis). The teacher draws the attention of students to the fact that the angular artery through the dorsal nasal artery (a. dorsalis nasi) anastomosis with the ophthalmic artery (a. ophthalmica), a branch of the internal carotid artery. As well as, attention should be paid to the anastomosis of the facial artery includes such arteries as: the buccalis (from the maxilla), the transverse facial artery (a. transversa faciei) (from the superficial temporal artery) and the infraorbitalis (from the maxillary artery). The facial artery is accompanied by the same name vein, which is located behind the artery and is directed straight, and the facial artery has a twisting direction. The facial vein (v. facialis) anastomoses with deep venous network of the face and optic veins. At thrombosis it is possible for retrograde blood flow and penetration of infection into the cavernous sinus.

Infraorbital vascular-nerve bundle (a., v. et n. infraorbitalis) goes out loose tissues under of the superior orbital margin through the foramen infraorbitalis, which is located 5-8 mm below the edge of the orbit. The infraorbital nerve forms a small «goose's foot» (pes anserinus minor). Within the buccal area through the mental foramen, which is located on the anterior surface of the mandible body, goes out a vascular-nerve bundle (a., v. et n. mentalis). The vascular-nerve bundle (cheek artery, the same name vein and the cheek nerve) and 2-3 small cheek lymph nodes are situated on the outer surface of the cheek muscle under the fat pad. Sensitive innervation of the buccal area provides the branches of the trigeminal nerve: infraorbital, cheeks, mental; motor innervation provides branches of the facial nerve. Due to these branches, all mimic muscles are innervated, to which nerve branches approach from the depth of their surface. This should be taken into account for surgical interventions.

**Parotid region (regio parotideomasseterica)**

At first, students determine the boundaries of the site on the corpse: at the top is zygomatic arch, below is the lower edge of the body of the mandible, the front is the anterior edge of the masseter muscle, behind is the posterior edge of the mandible branch. Attention is drawn to the fact that the posterior edge of the parotid area is adjacent to the mandible fossa. After that, the instructor appoints a surgeon, assistant and operating nurse who begins the preparation of this region. First of all, there are two horizontal cuts: one on the zygomatic arch, the other cuts are performed on the lower edge of the mandible body, and then both cuts are connected in the middle by longitudinal incision. During dissect of the skin, subcutaneous tissue is separated with the surface fascia and the fascia parotideomasseteric, which encircles the parotid gland. Attention of students emphasize on the fact that from the capsule of the gland leaves a lot of septums, which penetrate the parenchyma of the gland, distinguishing between its parts. Gradually destroying the parenchyma of the gland, students distinguish the formations which pass through it: external carotid artery with its limit branch (a. temporalis superficialis), retromandibular vein (v. retromandibularis), auriculotemporal

nerve (n. auriculotemporalis) and facial (n. facialis) nerves. At the same time the relationships of the vascular-nerve bundle of the parotid gland are studied. Thus, the external carotid artery goes to glandula parotis from the posteriointernal surface of the gland, on the border between the lower and middle third of the branches of the mandible. In most cases, according to the observations of T V. Zolotareva and G. M. Toporova (1968), this artery lies in the thickness of the gland. During preparation, students find that posterior auricular artery constantly go off in the parenchyma of the parotid gland from the external carotid artery, superficial temporal and transverse artery of the face. Variable branches include mandibular, deep temporal and zygomatico-orbital artery. The instructor points out that many branches of the arteries of the parotid gland leave numerous anastomosis to the facial, buccal, posterior superior alveolar artery, occipital and other arteries.

The external carotid artery is accompanied by retromandibular vein (v. retromandibularis) in parenchyma glandula parotis. This is important to take into account during operation on the parotid gland because bleeding from this vein is no less dangerous than from the damaged external carotid artery.

The teacher emphasizes that different venous outflow from various localizations of parts of the gland is not the same. Thus, venous blood flows out into the transverse vein of the face from the upper parts of the gland and goes to the retromandibular vein from it; goes in the veins of the masseter muscle from the middle parts and lower parts; flows from the anterior parts to the anterior auricular vein; flows from parotid to the posterior auricular vein.

The nerve fibers go to the parotid gland (r. r. parotidei) and leave the third branch of the trigeminal nerve in the auriculotemporal nerve; secretory fibers go from the auricular node in the r. r parotidei. In addition, the parotid gland receives sympathetic fibers from the plexus surrounding the maxillary and superficial temporal arteries. Considering that lymph vessels are additional pathways for the spread of infection, it is advisable to consider the links of the lymphatic vessels of the parotid gland with adjacent groups of lymph nodes. From the gland lymph flows into the nodi lymphatici preauriculares, which lie in the front of the auricle and external acoustic meatus on the outer surface of the gland. T.V.Zolotareva and G.M.Toporov (1968) indicate that one part of these nodes are located outside of the fascia (fascia parotidea), and the second is under it, in the parenchyma of the gland.

**Topography of the parotid gland**

Since the parotid gland (glandula parotis) lies within the regio parotideomasseterica, then at the practical lesson should be studied in more detail its topography.

The parotid gland has a triangular shape in its transverse section and its deep part is located in a retromandibular fossa. This fossa is limited by the branch of the mandibular in the front, it is limited by external acoustic meatus at the top and temporomandibular joint, there are mastoid process and sternocleidomastoid muscle behind, and fossa is limited from the bottom by a fascia septum that delimits the parotid gland from the submandibular gland.

Students find that the anterior margin of the gland extends to the outer surface of the masseter muscle during preparation.

It is emphasized that the fascia is thickened on the outer surface of the gland and is defined as aponeurosis. However, fascia grows thinner in places where the gland is adjacent to the pharynx (pharyngeal process), and it is too thin within the cartilaginous part of the acoustic meatus, where are located the santoriev fissures. Because of them, the infection can spread to the middle ear, which can be complicated with parotitis by purulent inflammation of the middle ear (otitis media). In addition to the fascia, the parotid gland is covered with a thin

capsule, which penetrates together with the fascia to the parenchyma of the gland and divides it into particles. It is emphasized that such a relationship between the capsule and the parenchyma of the glands limits the spread of purulent process in the gland. The gland itself may have different sizes, additional particles. Sometimes it only fits the edge of m. masseter, and in some cases it reaches the anterior part of this muscle. Attention is paid to the topography of the parotid duct. It is formed in parenchyma with interlobular ducts. Proceeding from the parenchyma gland, the duct lies on the outer surface of the masseter muscle. At the front edge of this muscle, ductus parotideus penetrates the buccal muscle and opens onto the mucous membrane of the oral vestibule. Determine variability in the topography of the glandula parotis. For example, S. M. Kasatkin, S. V. Bilay and al. distinguish such forms: straight, ascending, cranked, descending, S-shaped, double duct. L. O. Tsakadze (1952) recommends the projection of the duct of the parotid gland to determine with using two lines: the upper line passes between the lower edge of the external acoustic meatus and ala of the nose, and the lower one passes between the lower edge of the earlobe and the angle of the mouth. At high position, this duct is adjacent to the upper, and at low one is adjacent to the bottom line (L. O. Tsakadze).

**Topography of the maxillary artery and its branches**

The study of the topography of the maxillary artery is important in practice because its branches are related to the blood supply to both deep and superficial facial parts.

Attention is drawn to the fact that a deep study of the surgical anatomy of the maxillary artery was made by S.I. Danilchenko (1996).

The students determine that a. maxillaris is one of the largest branches of the external carotid artery, leaves it at the level of the neck of the mandible articular process on wet preparations and tables. It is emphasized that the maxillary artery has a deep deposition, so approach to it is difficult and practically impossible, which it makes impossible to bandage artery during bleeding. That is why, with damage to the maxillary artery, the surgeon is usually forced to bandage the internal carotid artery.

There are three groups of branches in the topography of the maxillary artery.

The first group includes the branches that extend from the main artery stem at the level of the neck of the articular process:

1) Deep auricular artery (auricularis profunda);
2) Tympanic artery (a. tympanica);
3) Middle meningeal artery (a. meningea media),
4) Inferior alveolar artery (a. alveolaris inferior).

The second pterygoid group of branches includes:

1) Two deep temporal arteries - the anterior and posterior;
2) Artery of the masseteric muscle (a. masseterica);
3) Two arteries of the pterygoid muscles (r. r. pterygoidei);
4) Cheek artery (a. buccalis);
5) Posterior superior alveolar artery (a. alveolaris superior posterior).

The third (spatium interpterygoideum) group includes:

1) Infraorbital artery (a. infraorbitalis);
2) Descending palatine artery (a. palatina descendens);
3) Sphenopalatine artery (a. sphenopalatina).

The teacher once again emphasizes that numerous anastomosis of the maxillary artery with a facial artery have a practical significance.

Veins of the face and their ligaments

The students study the veins of the face and the variability of their topography on tables, atlases, slides.

From the coverage of the face (skin, subcutaneous tissue, facial mimic muscles) and partly from the organs, the venous blood flows out into the facial vein (v. facialis), which accompanies the same artery.

The sources of the formation of the facial vein are the following: angular vein (v. angularis), supratrochlear vein (v. supratrochlearis), supraorbital vein (v. supraorbitalis), palpebral vein (v. v. palpebrales), external nasal vein (v. v. nasales externae), labial veins (v.v. labiales), external palatine vein (v. palatina externa), vena profunda faciei (v. faciei profunda), mental vein (v. mentalis), and others. The teacher emphasizes that there is anastomosis, according to L. G. Shchitova, in the area of the root of the nose between the two facial veins. In addition, the facial vein at the medial angle of the orbit anastomoses from superior ophthalmic vein, and within the lower eyelid anastomoses from the lower eyelid vein. Anastomosis between the leakages of the facial veins is in the area of the forehead, dorsum and apex of nose, lips and chin. The teacher notes that from the deep part of the face (masseter muscles and organs), venous blood through the temporal (v. v. temporales), maxillary (v. v. maxillares) veins, transversal facial vein (v. transversa faciei), and sphenopalatine plexus flows into the retromandibular vein. Plexus venosus pterygoideus is a very important from a practical viewpoint. It is located in the spatium temporopterygoideum and at the expense of venous anastomosis binds facial vein and retromandibular vein. It is important to focus on sphenopalatine venous anastomosis with pharyngeal venous plexus, through the middle meningeal vein connect with the veins of the cranial cavity; through the ophthalmic veins connect with cavernous sinus. We emphasize that odontogenic inflammatory processes of the jaws and periarticular soft tissues throught veins, and their numerous anastomoses, can spread to the cavity of the orbit, cavernous sinus of the dura mater, which causes inflammatory processes of the meninges. It is important to remember that the facial and retromandibular veins behind the angle of the lower jaw are combined into a common trunk, which goes straight and down and on the neck covers the place of division of the common carotid artery to the outer and inner. Such features of the topography complicate the ligation of the external carotid artery.

**The common venous trunk falls into the internal jugular vein.**

M.A. Sresely (1957) in his studies found that the veins of the face are divided into superficial and deep. The superficial veins lie in the form of two layers: the first layer is located above the superficial fascia of the face in the subcutaneous tissue, the second is under it, and the deep veins of the face are represented mainly by the pterygoideus plexus. Summing up, it should be emphasized that the structure of the veins of the face is very variable. The veins, like the arteries, have numerous anastomosis, due to which the superficial veins of the face are connected with the deep, the veins of the right half of the face are connected with the veins of the left half. The veins of the face are connected through the orbit, as already noted, by anastomosis with intracranial veins and sinuses of the dura mater, mainly through the cavernous sinus (sinus cavernosus). That is why the thrombophlebitis of the facial veins is very dangerous because the process can spread to the cranial cavity and complicate the development of purulent inflammation of the sinuses and meninges (sinus thrombosis, meningitis).

Temporomandibular joint

(articulatio temporomandibularis)

Students study the structure of the joint on the bone preparation of the skull with the lower jaw, a wet preparation of the temporomandibular joint with its ligaments, tables, slides. It is formed by connection of the head of the articular process of the mandible (caput mandiblae) with the mandibular fossa (fossa mandibularis). The top of the joint is covered with cartilage.

It should be noted that only the anterior-superficial part of the articular head is involved in the formation of the temporomandibular joint because only it connects to the articular fossa.

The articular fossa reminds ellipsoid hollow. In the front, it is limited to the posterior surface of the articular hump of the temporal bone; behind there is the wall of the external acoustic meatus; at the top is bottom of fossa cranii media; inside is pterygoid process; from the outside is crus posterior processus zygomaticus

The articular fossa is lined with connective tissue cartilage. Thin bone plate is separated in the posterior part of the external acoustic meatus. That is why the inflammatory processes can spread from the external acoustic meatus to the joint.

The articular tubercle (tuberculum articulare) is individually variable. According to N. Mich. its height is more or less constant. It varies (depending on age) within the range of 0.5-1.5 cm. The shape of the tubercle is variable.

In the cavity of the joint between the articular head of the mandible and the articular fossa of the temporal bone lies an articular disk (discus articularis). On the periphery, it is accreted with an articulate bag and divides the joint cavity into two divisions: the upper front, located between the articular fossa and the articular tubercle of the temporal bone, and the lower back, which is located between the connecting surface of the articular head and the lower underside of the disk. It should be remembered that the upper front and lower back segments of the cavity of the joint are not interconnected.

The joint capsule (capsula articularis) is a weekly tight bag that attaches to the edge of the articular cartilage. The front of the bag is thinner than the back. The joint capsule is more thickened in the outer parts, because the fibers entwined to the lateral joint ligament here. (lig. laterale seu temporomandibulare). This ligament has the form of a triangle whose apex is directed to the neck of the articular mandible process, and the base to the zygomatic process of the temporal bone.

There are also other ligaments that are not connected to the joint capsule; there are sphenomandibular ligament (lig. sphenomandibulare), which extends from the angular axis of the sphenoidal bone to the lingula of mandible (lingula mandibulare); stylomandibular ligament (lig. stylomandibulare), which extends from the styloid process to the angle of the mandibular.

Knowledge of the topography of these ligaments is necessary for dental surgeons during surgical interventions on the temporomandibular joint. When the joint is removed, all ligaments should be stretched, a joint capsule is usually dissected in the anterior inward surface.

The temporomandibular joint is block-shaped; both joints function simultaneously and therefore constitute combined joints.

This joint can perform such movements: lifting and lowering of the mandible with simultaneous closing or opening of the mouth; mandible displacement forward and backward; side movements to the right and to the left.

The teacher pays attention of students to age-specific features of the temporomandibular joint.

Thus, the articular head is covered with a thin layer of hyaline cartilage and perichondrium with developed cambial and fibrous layers in childhood and adolescents. The articular fossa and articular tubercle are lined only with periosteum with also quite pronounced cambial and fibrous layers.

The articular disk consists of dense collagenous connective tissue. The fibrous cartilage forms on the articular surfaces in older people, instead of cambial and fibrous layers; the disk in its center is represented by cartilaginous tissue. That is why in childhood and young age, during the inflammation process in the joint between the joint surfaces formed bone intergrowth, and in adults this intergrowth is more often formed by a connective tissue (G.I. Semenchenko).

**Typical cuts in purulent processes parotid gland (parotitis)**

The incisions should be made in the radial direction, taking into account the projections of the main branches of the facial nerve on the lateral side of the face when purulent-inflammatory processes,.

The teacher notes that it is necessary to use blunt instruments to prevent wounding of the vascular nerve formations at the site of the incision after the opening of the skin with a subcutaneous tissue to lay deeper into the adjacent tissues.

In order do not to damage the main branch of the facial nerve, radial incisions must begin with a point located at a distance of 1.5 cm from the earlobe.

With phlegmons of the parotid area, it is necessary to retreat outward from the angle of the mandible and make a cut around the angle of the mandible. At the same time, it is necessary to dissect the skin with a subcutaneous tissue, and the fascia between the sternocleidomastoid muscles and to dissect the posterior margin of the branch of the mandible. To prevent the damage of the parenchyma of the parotid gland and the vascular nervous structures located in the vascular nervous formation, in the deep wounds penetrate bluntly, stratifying the tissues.

## 5. Materials for self-control

### A. Tasks for self-control:

*Test № 1.* The patient was slaughtered in the parotid region; damaged parotid salivary gland and nerve passing through its stratum and accompanying superficial temporal artery. Which nerve has been damaged?

a) n. auriculotemporalis
d) n. opticus
c) n. hypoglossus
d) n. glossopharyngeus
e) n. lingualis

*Test № 2.* During the treatment of the cut wound in the lateral area of the face there was a bleeding from the parotid gland, damage the artery, which is a continuation of the external carotid artery. Which vessel has been damaged?

a) a. alveolaris inferior
b) a. occipitalis
c) a. auricularis posterior
d) a. auricularis anterior
e) a. temporalis superficialis

*Test № 3.* The victim has a cut wound at the front of the masseter muscle. What muscle has been damaged in this case?
a) musculus pterygoideus lateralis
b) musculus pterygoideus medialis
c) musculus temporalis
d) musculus buccinator
e) musculus occipitofrontalis

*Test № 4.* The victim has a cut wound in the regio parotideomasseterica and regio buccalis on the left. How should a doctor describe the localization of the wound with external reference points to determine the boundary between these sites?
a) On the line that connects the alae nasi and the angle of the mouth
b) On the nasolabial and nasobuccal folds
c) At the lower edge of the orbit
d) At the anterior edge of the masseter muscle.
e) At the lower edge of the body of the mandible

*Test № 5.* The surgeon performs the primary surgical treatment of the wound in the buccal region. As a result of injuries, the cheek muscle is damaged. Which fascia that covers the outer surface of the muscle is also damaged in this case?
a) fascia occipitalis
b) fascia temporalis
c) fascia parapharyngea
d) fascia buccopharyngea
e) fascia pterygoidea

Test № 6. In a patient with phlegmon of the parotid salivary gland, the inflammatory process has spread through the pharyngeal process of the gland. What cellular space has the pathological process spread?
a) spatium parapharyngeal anterior
b) spatium parapharyngeum posterior
c) spatium parapharyngeum
d) spatium temporopterygoideum
e) spatium interpterygoideum

Test № 7. The inflammatory process is localized in the spatium interpterygoideum of the deep part of the face in patient. Where can the pathological process spread in this case through the foramen ovale?
a) In the cavity of the skull
b) In the orbit
c) In the cavity of the nose
d) In the cavity of the mouth
e) On the neck

*Test № 8.* The patient had furuncle with abscess in the left regio parotideomasseterica. The

surgeon damaged the branches of the facial nerve during the dissection of the furuncle; in the result the movement of innervations of the mimic muscles is damaged. What section had been made by the surgeon?
a) arch like cut behind the boil
b) longitudinal
c) transverse
d) radial from the base of the earlobe
e) radial from the corner of the eye

*Test № 9.* The dentist temporarily stopped the bleeding from the buccal region by pressing the facial artery to the lower mandible.
In what area of the mandible is the pulsating point of the artery pressed by a doctor?
a) In the middle
b) Between the front and middle thirds
c) Between the middle and the rear tertiary
d) In the middle of the front third
e) In the middle of the back third

**B. Tasks for self-control:**

*Task №1.* To remove the pus from the fat pad of the cheek, the surgeon made a cut on the anterior edge of the masseter muscle. Is this incision correct and with what kind of formations the surgeon will encounter during its carring out?

*Task №2.* Can the phlegmon of the parotid gland spread to the spatium peripharyngeum? If so, how it can spread?

*Task №3.* In a patient with furuncle of the upper lip diagnosis: thrombosis of the cavernous sinus. Identify possible ways to spread the infection to the cavernous sinus. What anatomical factors contribute to the spread of infection?

*Task №4*. For the drainage of purulent parotitis the surgeon made five cuts from the earlobe radially in the direction of the temporal region, zygomatic arch, nasal ala, the angle of the mouth, to the angle of the mandible and its edges. Is that correct?

*Task №5.* The patient with purulent parotitis had the symptoms of lowering the angle of the mouth, smoothing of the nasolabial and nasobuccal folds. What could these symptoms cause?

*Task №6.* What complications are possible during phlebitis of a plexus venosus pterygoideus when is the treatment started late? How do you explain them from the topographic anatomical point of view?

*Task №7.* After the opening of the abscess of the buccal region in the patient was appeared the smoothness of the nasobuccal fold. How do you explain such complication and how could it be avoided?

*Task №8.* The phlegmon appeared in the infratemporal fossa in the patient because of a facial injury. What cellular spaces can be involved in the inflammatory process?

*Task №9.*The bunches of pus were found in the anterior part of the peripharyngeal space. Is it possible to spread the pus to the posterior part of the peripharyngeal space and in retropharyngeal space?

*Task №10.* The surgeon made the incision parallel to the anterior edge of the masseter muscle with deep phlegmon of the face. Is the surgeon's tactic correct?

*Task № 11.* The swelling of the back wall of the throat was detected while the examination in the child. Swallowing is difficult, the temperature is high. Before that, the patient had tonsillitis with a severe course.
What is your diagnosis? What does the treatment include?

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|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module 1** | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| **Content module No.2** | Clinical anatomy and operative surgery of regions and organs of the head |

| | |
|---|---|
| **Topic 11** | Innervation of the face. Clinical anatomy of the facial and trigeminal nerves and their branches. |
| **Year** | II |
| **Faculty** | Foreign students training (dental) |

**1. The relevance of the topic:**

1. Knowledge of the surgical anatomy of the trigeminal and facial nerves is extremely important for the practical work of dentists. All pathological processes, injuries, operative interventions in the maxillofacial region cause both damage to these nerves and their involvement in the pathological process.

2. The dentist constantly faces with the need for local conduction of anesthesia in the maxillofacial region in daily work. Their performance is impossible without deep knowledge of the topography of branches of the trigeminal nerve.

3. The correct carrying out of surgical incisions on the face is impossible without knowledge of the topography of the facial nerve. The surgical incisions should be performed with the obligatory consideration of the surgical anatomy of branches of the facial nerve, the damage of which leads to serious complications and injuries.

4. All of the above confirms the need for deep knowledge of the surgical anatomy of the facial and trigeminal nerves by future dental practitioners.

**2. Specific objectives.**

1. Explain the features of surgical anatomy of the facial nerve and its branches.
2. Explain the features of the surgical anatomy of the trigeminal nerve and its branches.
3. Explain the innervation of the teeth of the maxilla and mandible.
4. Determine the projections of the main branches of the facial nerve on the face skin.
5. Determine the zone of innervation of the trigeminal nerve branches in the maxillofacial region.
6. Determine the projection points of the output of the trigeminal nerve branches from the bone openings on the face.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learned by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| 1. Trigeminal nerve | 1. Mixed nerve is the fifth pair of cranial nerves, contains motion, sensory and secretory nerve fibers |

| | |
|---|---|
| 2. Facial nerve | 2. The mixed nerve is the seventh pair of cranial nerves, contains motor fibers from its efferent brain nucleus and sensory and vegetative, which belong to |

**3.2. Theoretic questions:**

1. Features of the topography of the facial nerve.
2. Features of the topography of the trigeminal nerve.

**3.3. Practical skills acquired in class:**

1. Preparation of the trigeminal nerve.
2. Preparation of the facial nerve.

**4. The content of the topic:**

**Topography of the facial nerve**

At the beginning of the lesson, the teacher pays attention of the students to the fact that in the past time the facial nerve was considered as a motor, which provides innervation of facial mimic muscles.

With the development of morphological science, it is confirmed that this nerve is a complex of difficult conductors of different nature; it has motor fibers, sensitive, taste and vasomotor.

The facial nerve fibers, together with the intermediate nerve (n. intermedius), emerge on the basis of the brain at the posterior edge of the pons, between the pons and medulla oblongata. These two nerves, together with the vestibulocochlear nerve (n. vestibulocochlearis), VIII pairs of cranial nerves through the internal auditory meatus (porus acusticus internus) of the pyramid of the temporal bone, enter the canal of the facial nerve.

Students find this place on the skull, and then they study the intracranial part of the facial nerve on the drawings in the atlases.

Pay attention to the fact that the channel in the pyramid of the temporal bone forms two flexions in the form of a knee. The nerve is thickened by the geniculate ganglion (ganglion geniculi) in the place of the first flexion in the channel, which only intermediate nerve fibers (n. intermedius) are inserted into it. From the pyramid of the temporal bone, the facial nerve extends through the stylomastoid foramen. Students are convinced of this, considering the external basis of the skull between the styloid process and stylomastoid process of the temporal bone.

Students also pay attention to a number of branches that extend from the intracanal part of the facial nerve, such as:

1) greater (superficial) petrosal nerve (n. petrosus major), which consists of the trigeminal nerve fibers of the trigeminal nerve. It goes through the hiatus canalis facialis that emerges from the pyramid of the temporal bone and lies in the sulcus (sulcus n. petrosi majoris), and then merges with the deep petrosal nerve (n. petrosus profundus), which separates from the sympathetic plexus of the internal carotid artery, forming the vidian nerve. This nerve passes into the pterygopalatine fossa through the pterygopalatine canal and merges with the pterygopalatine ganglion;

2) the connecting branch to the tympanic plexus (r. communicans cum plexo tympanico) may be separated from the geniculate ganglion, sometimes from n. petrosus major. It extends

to the lesser petrosal nerve which branching from the glossopharyngeal nerve (n. glossopharyngeus);
3) n. stapedius innervates the same muscle;
4) the chorda tympani is a continuation of the fibers of the intermedial nerve. In the tympanic cavity the chorda tympani lies between the incus and the stapes, then goes through the petrotympanic fissure (fissura pterygotympanica) goes into the infratemporalis region and joins the lingual nerve. Several twigs pass from the chorda tympani to the ganglion oticum.
As already noted, this nerve passes through the foramen stylomastoideum from the facial canal.

The extrachannel part of the facial nerve has distinctive features.
According I. A Ponomarev, T. V. Zolotareva, G. M. Toporov, etc., 10 mm below the external acoustic meatus from the facial nerve the posterior auricular nerve (n. auricularis posterior) goes backwards and upwards and gives the occipital branch (r. occipitalis) to the occipital muscle, the branch to the digastric muscle (r. digastricus), and the connective branch with glossopharyngeal nerve (r. communicans cum n. glossopharyngeus). After that, the main trunk of n. facialis penetrates the thickness of the parotid gland, where it breaks down into the main branches, forming a large «goose's foot» (pes anserinus major).

The average length of the main trunk of the extracranial part of the facial nerve in adults is 15 mm, which should be taken into account during conducting cuts on the face.

Branches of the facial nerve are divided in a fan-like manner in five directions: 1) temporal branches (r.r. temporales); 2) zygomatic (r.r. zygomatici); 3) buccal (r.r. buccales); 4)marginal branch of the mandible (r. marginalis mandibulae); 5) neck branch (r. colli).
D. N. Lubotsky points out that, in order to prevent damage to the base trunk and branches of the facial nerve, the incisions should be performed radially, on one transverse toe below the external acoustic meatus, taking into account the direction of the main five facial nerve branches.

As noted A.V. Shilov, Ye.S. Malevich, Yu.A. Palishevsky, and others, the marginal branch of the facial nerve requires special attention. It passes directly along the edge of the mandible. In case of its damage, innervations of the facial muscles of the mouth corner are violated, which in the postoperative period can lead to serious cosmetic defects.

That is why, with cuts within the submandibular region, the tissues cut along the line that connects the middle of the chin with a point 2 cm below the angle of the mandible (Yu. A. Palishevsky).

On the face n. facialis forms nerve connections with other nerves in adults and children: trigeminal (mainly), glossopharyngeal and branches of the cervical plexus.

**Topography of the trigeminal nerve**

The trigeminal nerve (n. trigeminus) has wide areas of innervations on the head; therefore, deep knowledge of its topography is required for the practical work of future dental practitioners.
In the class, students must master both the intracranial and extracranial departments.
They thoroughly study the topographic anatomical features of structure n. trigeminus on anatomical preparations, skulls, tables, slides.
First, it should be noted that this nerve appears on the ventral surface of the pons with two roots: thick (external) is sensitive (portio major) and thinner (internal) is motor (portio minor). These roots are directed to the anterior surface of the pyramid of the temporal bone and penetrate into the gap between the leaves of the solid cerebellum. In this place, the

trigeminal impression (impressio trigeminalis) creates the same name trigeminal ganglion (ganglion trigeminalis). The motor root does not involve in the formation of this ganglion, but only approaches to the lower of its surface.
There are three basal branches: the first - ophthalmic nerve (n. ophthalmicus); the second - maxillary nerve (n. maxillaris), and the third - mandibular nerve (n. mandibularis) from the anterior surface of the trigeminal ganglion.
The motor root goes round of the trigeminal ganglion from the inside and, coming out of the cranial cavity, connects with the third branch of the trigeminal nerve.

The first branch of the trigeminal nerve (n. ophthalmicus) is sensitive. It innervates the skin of the upper eyelid, forehead, vertex and dorsum of the nose. In addition, it leaves sensitive fibers to the eyeball and lacrimal gland, and partly to the nasal cavity (cavitas nasi).

If you track the course of the ophthalmic nerve (n. ophthalmicus), you can be sure that having separated from the trigeminal ganglion in its anterior subunit, this nerve penetrates the outer wall of the cavernous sinus and lies in it between trochlear nerve and oculomotor nerve. In those cases when the pathological process is localized within the cavernous sinus, then, as S. S. Mikhailov notes, there are sensitive disorders of the innervation of the trigeminal nerve's first branch.

From the cavity of the skull, n. ophthalmicus passes through the fissura orbitalis superior and within of the same fissure branches to nerves: frontal nerve (n. frontalis), lacrimal nerve (n. lacrimalis) and nasociliary nerve (n. nasociliaris).

It is known that the authors describe branches that go from n. ophthalmicus in different ways. However, most of them indicate that the frontal nerve gives the supratrochlear branch (r. supratrochlearis), which has nerve ties with the infratrochlear branch (r. infratrochlearis). The supraorbital nerve (n. supraorbitalis) is divided into the medial branch (r. medialis) and lateral branch (n. lateralis).

The medial branch goes to the forehead and the supraorbital margin of the frontal bone; the lateral branch also extends to the frontal surface through the supraorbital notch or foramen (incisura seu foramen infraorbitalis) and innervates the forehead.
The lacrimal nerve passes through the outer wall of the orbit, and takes a connecting branch from the zygomatic nerve (r. communicans cum n. zygomaticum), goes to the lacrimal gland. The small branches that are divided from the lacrimal nerve (n. lacrimalis) innervate the skin of the lateral angle of the eye and upper eyelids.
Nasociliary nerve (n. nasociliaris) accompanies the optic artery and gives a number of branches:
a) a supratrochlear branch that innervates the skin of the medial angle of the eye and the root of the nose, as well as the lacrimal sac and lacrimal caruncle;
b) anterior ethmoidal nerve (n. ethmoidalis anterior), which via the ethmoidal foramen enters to the anterior cranial fossa then through a cribriform plate, enters the nasal cavity and innervates the mucous membrane of the frontal sinus, the mucous membrane of the anterior part of nasal septum and skin of the nose tip;
c) posterior ethmoidal nerve(n. ethmoidalis posterior), which through the posterior ethmoidal foramen enters the posterior cells of the ethmoid labyrinth and innervates their mucous membrane and the mucous membrane of the sphenoid sinus;
d) long ciliary nerves (nn. ciliares longi), 2-4 branches of which fit to the orbit, are connected to the ciliary ganglion (ganglion ciliaris) and innervate the uvea and sclera of the eye.

According to N. A. Pentioshina, the first branch of the trigeminal nerve, in the orbicular

cavity forms nerve bonds with oculomotor, block and zygomatic nerves.

The second branch of the trigeminal nerve (n. maxillaris) begins with the middle part of the convexity of the trigeminal (gasser) ganglion. The length of the intracranial part of the nerve is 15-18 mm. N. maxillaris in the cavity of the skull approaches to the foramen ovale; where from it to the dura mater separates ramus meningeus medius, which accompanies the branches of the middle meningeal artery.

This branch (r. meningeus medius) first is described by F. Arnold as a recurrent branch of the maxillary nerve. Some authors consider it the branch of the optic nerve.

The intracranial part of n. maxillaris on the top borders to the cavernous sinus, and medially border the sphenoidal sinus.

From the cavity of the skull, the maxillary nerve emerges through a foramen ovale, whose diameter varies within 3-6 mm, but on the right, it is smaller. This is how individual authors explain the frequency of right-sided neuralgia of the maxillary nerve.

In the extracranial division of the maxillary nerve is divided into two parts: pterygopalatine and optic.

Length of n. maxillaris in the pterygopalatine division is 2 cm (B. Simon), and according to M. T. Herasymtsya it is 13-22 mm.

There are branches in the pterygopalatine division, which separated from the maxillary nerve:

1) zygomatic nerve (n. zygomaticus), which starts from the main trunk near foramen ovale and enters the cavity of the orbit through the fissura orbitalis superior, which is distributed to the zygomaticotemporal (r. zygomaticotemporalis) and the zygomaticofacial (r. zygomaticofacialis) branches. Those branches that branch out the zygomatic nerve form wide ligaments with the facial nerve (O. S. Semenova);

2) pterygopalatine nerves (nn. pterygopalatini) (from 1 to 7 branches) go from the inferior surface n. maxillaris at a distance of 1-2.5 mm from the foramen ovale.

According to M. T. Gerasimets, one part of the fibers of the pterygopalatine nerve can be woven directly into the pterygopalatine ganglion (ganglion pterygopalatinum), and the second of the fibers pass through it, merging further with palatine nerves.

There are following nerves from the lower surface of the maxillary nerve trunk in the middle part of the pterygopalatine department:

1) the posterior superior alveolar nerve branches (rr. alveolares superiores posteriores), which range from 4 to 7. They are connected with each other and with the middle superior alveolars branches, forming the superior dental plexus (plexus dentalis superior);

2) the middle superior alveolar branch (r. alveolaris superior medius), more often one, but may be two (M.T. Herasymets);

3) the infraorbital nerve (n. infraorbitalis), whose length is 24-30 mm, is separated from the maxillary nerve and enters the orbita through the outer edge of fissura orbitalis inferior. N. infraorbitalis on the lower wall of the orbit, together with the same name artery, lies in the sulcus that passes into the canal (sulcus et canalis infraorbitalis).

Due to the dense periosteum, the infraorbital vascular-nerve bundle is separated from the retrobulbar fiber. In 15% of cases (M.T. Herasymets), the infraorbital sulcus is absent, and then the infraorbital nerve lies in the entire length of the bone channel. Both the canal and the infraorbital foramen can be double, which, of course, complicates anesthesia.

After the passage through the foramen infraorbitalis, the infraorbital nerve forms a small «goose's foot» (pes anserinus minor), which terminal branches innervate the soft tissues of

the buccal region, the outer surface of the nose and upper lip.
The anterior superior alveolar nerve branches (rr. alveolares superiores anteriores) are removed from the same name nerve in the infraorbital canal.

The anterior, middle and posterior upper alveolar nerves form the superior dental plexus (plexus dentalis superior).
In the pterygopalatine fossa lies the same name ganglion called ganglion pterygopalatinum, which is closely linked both morphologically and functionally with the maxillary nerve.

The literature highlights different opinions about the pterygopalatine ganglion. Some authors believe that it is part of the sympathetic nervous system (K.H. Romer, O. G. Plisan, Ya. M. Krynitsky, etc.), others refer it as the sympathetic and parasympathetic innervation (Rauber-Kopsch, S.S. Averbukh and etc.). Some authors (N.P. Fetisov, S. N. Murat and A. M. Mescheryakov) consider it the ganglion where parasympathetic nerve fibers are interrupted.

From the pterygopalatine ganglion, branches leave to the mucous membrane of the nasal cavity, nasopharynx and cells of the ethmoid labyrinth.
The third branch of the trigeminal nerve (n. mandibularis) is formed by two roots: sensitive from the lower surface of the trigeminal ganglion (ganglion tregiminale), and motor, from the motor part of the trigeminal nerve. N. mandibularis extends to the outer surface of the skull through the foramen ovale. Below this opening from the mandibular nerve released a thin branch (r. meningeus) which penetrates into the cavity of the skull together with the middle meningeal artery through the foramen spinosum and innervates a dura mater. In addition, from the back surface of the mandibular nerve, branch 3-4 stems to the anus (ganglion oticum) off, which lies under oval hole on the medial surface n. mandibular.
Scientists differently group the branches of the mandibular nerve. In our description, we will adhere to the grouping systems: on the branches of the anterior and branches of the posterior groups by V.P. Vorobyov and R. D. Sinelnikov.
The nerves of the anterior group include:
1) the masseter nerve (n. massetericus), which departs from the mandibular nerve independently or with a common trunk with posterior deep temporal nerve. Before entering in the masseter muscle from the inner surface, this nerve gives the branches to the temporomandibular joint;
2) deep temporal nerves (nn. temporales profundi), according to N. A. Pentioshina, more than in 50% cases turns out with one trunk with the masseter nerve. After separating from the masseter nerve, it is divided into the anterior and posterior. Deep temporal nerves approach the same name muscle from its internal surface and branch into it;
3) the lateral pterygoid nerve (n. pterygoideus lateralis) may branch out the mandibular or buccal nerve in the form of 1-5 branches. T. Proshina notes that it can be separated from the masseter or anterior deep temporal nerve;
4) the buccal nerve (n. buccalis) is sensitive and belongs to the anterior group of nerves. It can begin with 1-2 or 3 trunks (N. A. Pentioshina, T. T. Proshina). The level of branching of this nerve can be high, medium or low relative to the foramen ovale. This nerve can branch out fanlike immediately or gradually. The buccal nerve has a connection with the facial nerve and innervates the skin, the mucous tunic of the cheek and the angle of the mouth.
The nerves of the back group include:
1) medial pterygoid nerve (n. pterygoideus medialis), which branches from the mandibular nerve more often by one or (occasionally) by two trunks and innervates the same name

muscle. This nerve connects with the nerves of the otic ganglion and gives the nerves to the tensor veli palatini muscle (n. musculi tensoris veli palatini) and tympanic membrane (n. musculi tensoris tympani);
2) the auriculotemporal nerve (n. auriculotemporalis) in its nature is mixed because it consists of both sensitive and secretory fibers from the otic ganglion.

There are number branches out from the auriculotemporal nerve: a) superficial temporal nerves (nn. temporales superficiales); b) anterior auricular nerves (nn. auriculares anteriores); c) external acoustic meatus nerve (n. meatus acustici externi); d) parotidei rami (rr. parotidei). There are connections between the branches of the auriculotemporal nerve, mandibular and facial nerves;
3) according to T. V. Zolotareva and O. I. Malko-Kalyuzhnaya, inferior alveolar nerve (n. alveolaris inferior) can be formed from the mandibular nerve with one or two trunks.

The instructor points out to students that the fascia interpterygoidea separates n. alveolaris inferior with lateral pterygoid muscle from medial pterygoid muscle, lingual nerve and buccal nerve (I. M. Eisenstein, S. A. Soloreev), which prevents both penetration of pus and anesthetic substances during mandibular anesthesia.

The lesson should draw students' attention to the fact that there are four departments in the topography of the inferior alveolar nerve:
1) extracanal, which can be traced from the place of formation to the entrance to the mandibular canal;
2) intracanal proximal, which extends from the mandibular to the mental foramen;
3) extracanal distal, which corresponds to the topography of the mental nerve after its exit from the same name opening;
4) intracanal distal, corresponding to the topography of the incisive branch.
By its nature, the inferior alveolar nerve is mixed, since from the first its (extracanal) department leaves the mylohyoid nerve (n. mylohyoideus) to the same name muscle and the anterior belly of the digastric muscle. In the same department, there are bonds n. alveolaris inferior with other nerves: auriculotemporal, lingual, nerves of the pterygoid muscles.

The intracanal section of the inferior alveolar nerve corresponds to the length of the channel. İn the channel n. alveolaris inferior is more commonly presented as one trunk. Within the canal, the branches branch out to the teeth, gums, bones, and within the mental foramen, the nerve is branched into two branches, of which the larger (mental) in the form of an independent mental nerve (n. mentalis) goes through the same name foramen. From the mental nerve separated the branches: the mental (rr. mentales), the labial (rr. labiales) and the gingival (rr. gingivales).

However, T. V. Zolotaryova and O. I. Malko-Kalyuzhnaya, investigating the anatomical preparations of the intracranial part of the inferior alveolar nerve, in 1/5 of the cases revealed the inferior dental plexus.

The presence of such anatomical preparations at the department allows the teachers to demonstrate to students the features of the intracanal topography of the n. alveolaris inferior.

The lingual nerve (n. lingualis) with an inferior alveolar nerve begins at one level. By its nature, it belongs to sensitive nerves.

The teacher draws the attention of the students to the fact that the chorda tympani, the facial nerve branch, joins to the posterior part of the nerve within its lower part.

**5. Materials for self-control**

**A. Tasks for self-control:**

**1. Multi-choice test. Indicate which of the listed nerves are the branches of the off-channel part of the facial nerve:**

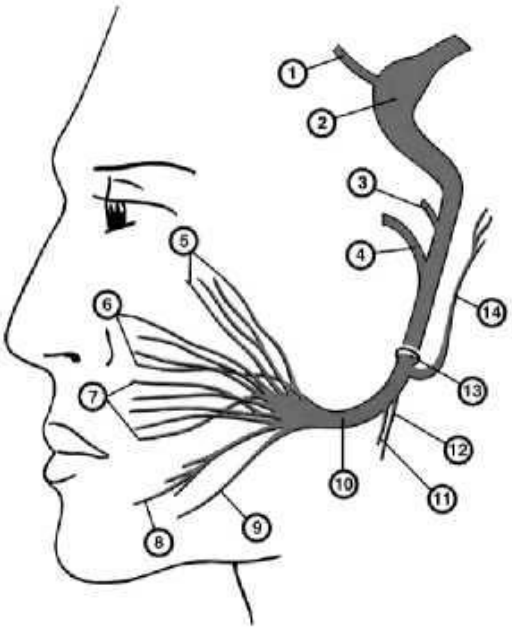
1. Posterior auricular nerve
2. Lacrimal nerve
3. Frontal nerve
4. Temporal branches
5. Infraorbital nerve
6. Zygomatic nerve
7. Nasociliary nerve
8. Posterior superior alveolar nerve
9. Buccal branches
10. Marginal mandibular branch
11. Cervical branches
12. Nerve to stapedius

**2. A test for finding logical pairs.**
**Establish logical connections between the nerves and their branches in pairs:**

| | |
|---|---|
| 1. Ophthalmic nerve | A. Zygomatic nerve |
| 2. Maxillary nerve | B. Chorda tympani |
| 3. Mandibular nerve | C. Lacrimal nerve |
| 4. Intracanal part of the facial nerve | D. Lingual nerve |
| 5. Extracanal part of the facial nerve | E. Sphenopalatine nerve |

**3. The test for determining the correct sequence. Indicate the sequence of branching branches from the facial nerve trunk:**

1. Posterior auricular nerve
2. Cervical branches
3. Greater petrosal nerve
4. Temporal branches
5. Zygomatic nerve
6. Connection branch to the lingual nerve
7. Buccal branches
8. Marginal mandibular branch
9. Nerve to the stapedius




**4. Constructive test.**
**Find which numbers are shown in the image:**

1 - Posterior auricular nerve;
2 - Digastric branch
3 - Stylomastoid foramem
4 - Stylohyoid branch
5 - Parotid plexus
6 - Greater petrosal nerve
7 - Buccal branches
8 - Geniculate ganglion
9 - Cervical branches

10 - Marginal mandibular branch
11 - Chorda tympani
12 - Nerve to the stapedius
13 - Temporal branches
14 - Zygomatic branches

**B. Tasks for self-control:**

*Task №1.* The patient had severe neurological pain due to the injury of the mandible. What do you need to do to calm down the patient?

*Task №2.* After sphenoid anesthesia by the palatine method, the anesthesia of the maxillary nerve did not begin. What is this condition caused?

*Task №3.* The patient has the double vision after sphenoid anesthesia by a sub zygomatico-temporal method. What is the reason of this complication?

*Task №4.* At the end of the cheiloplasty, the unloading seam of Brown was imposed on the patient. Is the operation complete correctly?

*Task №5. T*he surgeon performed the incision parallel with the anterior margin of the masseter muscle with a deep phlegmon of the face. İs it correct?

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| | |
|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module 1** | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| **Content module No.2** | Clinical anatomy and operative surgery of regions and organs of the head |
| **Topic 12** | Local anesthesia on the face - a central and peripheral conduction anesthesia |
| **Year** | II |
| **Faculty** | Foreign students training (dental) |

**1. The relevance of the topic:** knowledge of the surgical anatomy of the trigeminal and facial nerves is very important in the practical work of dentists. All pathological processes, injuries, operative interventions on the maxillo-facial region are caused both by the damage of these nerves and by their involvement in the pathological process. The conduction anesthesia of the branches of the trigeminal nerve is impossible without deep knowledge of the topography of the branches of this nerve. Cuts on the face are also carried out taking into account the topography of the branches of the facial nerve. All this confirms the need for deep knowledge by future dentists of surgical anatomy of the facial and trigeminal nerves.

**2. Specific objectives.**

1. Features of innervations of the maxilla and mandibular.
2. Carry out extra oral methods of conducting dental anesthesia.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| Conduction anesthesia | The method of local anesthesia when the anesthetic solution is injected into the nerve trunks that innervate the site of surgical intervention. |

**3.2. Theoretic questions:**

1. Features of the topography of the facial nerve.
2. Features of the topography of the trigeminal nerve.
3. Intraoral method of infraorbital anesthesia.
4. Incisive anesthesia and its species.
5. The technique of the tuberal conduction anesthesia.
6. The technique of the palatine conduction anesthesia.
7. The technique of the intraoral mandibular anesthesia.
8. The technique of the extraoral conductive mandibular anesthesia.
9. Technique of the chin (mental) conduction anesthesia

**3.3. Practical skills acquired in class:**

Realize the conduction of dental anesthesia by extraoral methods.

**4. The content of the topic:**

Principles of conduction anesthesia of the trigeminal nerve branches.

Students provide insight the main types of conduction anesthesia on the maxilla and mandible looking at the skull, damp preparations of sagittal cutting of the head, tables. At the same time, it is advisable to focus on the application, depending on the indication, intraoral and extraoral methods.

Attention is drawn to the fact that extraoral methods are used in abscesses, phlegmons,

tumors, and trismus when realization other types of intraoral conduction anesthesia are not possible.

To ensure the quality of conduction anesthesia both on the maxilla and mandible should take into account:

- indications for conductive one or another type of conduction anesthesia;
- the position of the patient, his head, his mouth;
- place of injection needle;
- the direction of the needle;
- the depth of movement of the needle into soft tissue;
- amount of anesthetic, needed for anesthesia;
- the name of the blocked nerves;
- start of anesthetic effect after its introduction;
- zone of anesthesia spreading;
- possible complications after conducting one or another type of conduction anesthesia.

At the beginning of the lesson, the instructor appoints an operating nurse who prepares solutions for anesthetics, syringes and all surgical instruments in the table, in accordance with the methodical development of the topic.

Students work out the techniques of the types of conduction anesthesia provided by the curriculum on the corpse (and in those cases where certain conduction anesthesia on the corps can not be made) on the skull.

Conduction or regional anesthesia may be central or peripheral.

The central type of conducting anesthesia includes:

1) Anesthesia around the foramen ovale (pterygopalatine anesthesia);
2) Anesthesia of the trunk of the mandibular nerve near the foramen ovale.

When performing pterygopalatine anesthesia, the maxillary nerve is anesthetized. A solution of novocaine with this anesthesia gets into the pterygopalatine fossa and blocks the maxillary nerve.

During conduction anesthesia near the foramen ovale, the novocaine solution reaches this opening, which causes anesthetized n. mandibularis.

**Anesthesia near the round foramen**

Pterygopalatine anesthesia by S. N. Weisblat has 4 ways of approach: 1) palatal; 2) tuberal; 3) orbital; 4) submalar-pterygoid.

**Palatal way.** The patient opens his mouth widely. The needle is injected at the level of the last molar, departing from the alveolar margin by 0.5-1 cm inside and 1 cm in front of the greater palatine foramen. In this case, the needle directs the oblique front and bottom to back and up, directed by its end in a greater palatine foramen.

If during anesthesia the needle hit the bone, then you should first release from the syringe a few drops of novocaine and by carefully needle pushing finds a foramen. When the needle is immersed in a hole, it is gradually pushed into the pterygopalatine channel at a depth of 2.5-3 cm and released 1.5-2.0 ml of 2% solution of novocaine.

**The tuberal way** of pterygopalatine anesthesia. The patient returns the head to the opposite side, by the thumb and forefinger of the left hand through the tissues of the cheek determine the zygomaticoalveolar crest. The soft tissues are pierced along the projection of the crest edges, shifting to the posterior surface of the crest, and the needle is pushed forward in the front, from top to bottom, and from the outside to inside. The needle should slide along the bone throughout the movement and bend the maxillary tuberosity. A solution of

novocaine is released at the place of the target point of the pterygopalatine fossa.

**Orbital way.** By the index finger of the left arm determine the lower orbital edge. The prick makes a little more medial than the middle of the lower orbital edge. The needle, releasing a small amount of novocaine in the course of its advancement, moves first up to the transition point through the lower orbital edge, and then - on the lower wall of the orbit at 3-3.5 cm deep, all the time slipping along the bone and releases anesthetic solution.

**Subjugal-pterygoid way.** First, determine the middle of the trago-orbital line. This line is led from the tragus of auricle to the external edge of the orbit. The middle of this line corresponds to the projection of the external plate of the wing-shaped appendix. A prick is made in the middle of the indicated line near the lower edge of the zygomatic arch. First, the needle is penetrated in the external plate of the wing-shaped appendix. The depth of penetration of the needle is marked by the end of the middle finger of the right arm. Draw out a needle little more than a half. Return the tag of the needle ahead and again dip the needle into the soft tissues at the first depth. Having reached a pterygopalatine fossa 2% solution of novocaine is injected.

**Anesthesia near the oval foramen**

Anesthetics can be done near the oval hole in two ways: subjugal way and submaxillary - wing-shaped way.

**Subjugal way**

The place of prick is directly above the trago-orbital line at the lower edge of the malar arc. The needle is pushed deep into the external plate of the wing-shaped appendix, tracing the depth of the injection through its course, and retracted back into the subcutaneous tissue. After that lead away the needle for 1 cm back and reach to the target point - the oval foramen, where novocaine is injected.

**Submaxillary - wing-shaped way**

First determine the angle of the mandible and the internal side, retreating to 1, 5 cm, make a prick. At the first measure the distance from the injection site to the lower edge of the zygomatic arch: it is equal between the injection site and the oval foramen.

The needle penetrates along the internal surface of the mandible to its posterior border to a depth of 0.5-0.75 cm while feeling the presence of bone. Then remove it from the bone inside and place it on the rest of the distance (pre-measured) and inject 2% solution of novocaine at the target point (oval foramen).

The needle penetrates along the inner surface of the mandible parallel to its posterior margin to the depth of 0.5-0.75 cm while feeling the presence of bone. Then remove it from the bone inside and move to the rest of the distance (pre-measured) and at the target point (oval foramen), inject a 2% solution of novocaine.

## 5. Materials for self-control

### A. Tasks for self-control:

*Test №1.* The dentist performed anesthesia of the nerve in the infraorbital region. What have nerve branches been anesthetized by the dentist?

a) the second branch of the trigeminal nerve
b) the third branch of the trigeminal nerve
c) the first branch of the trigeminal nerve
d) facial nerve

e) the infraorbital nerve

*Test №2.* The doctor performs an extraoral infraorbital anesthesia. At what point is there a projection site of the nerve output that has been exposed to anesthetic?
a) At the point of intersection of the vertical line, which is carried out through the patient's pupil, with the lower edge of the orbit
b) At the point of intersection of the vertical line, which was carried out through the patient's pupil, with the upper edge of the orbit
c) At the point of intersection of the vertical line, which is carried out through the patient's pupil, with the mandible
d) At the point of intersection of the vertical line, which was carried out through the patient's pupil, with the maxilla
e) At the edge of the lateral and middle third of the lower edge of the orbit

*Test № 3.* The doctor carries out an extraoral mental anesthesia. In what point located a projection site of the nerve output that has been exposed to anesthetic?
a) At the point of intersection of the vertical line, which is carried out through the patient's pupil, with the lower edge of the orbit
b) At the point of intersection of the vertical line, which was carried out through the patient's pupil, with the upper edge of the orbit
c) At the point of intersection of the vertical line, which is carried out through the patient's pupil, with the mandible
d) At the point of intersection of the vertical line, which was carried out through the patient's pupil, with the maxilla
e) At the edge of the lateral and middle third of the lower edge of the orbit

*Test № 4.* The doctor performs central conductive anesthesia for the mandible. What hole should an anesthetic get to?
a) round
b) oval
c) stylomastoid
d) spinosum
e) jugular

*Test № 5.* The doctor performs central conductive anesthesia for the upper jaw. What hole should anesthetic get to?
a) round
b) oval
c) stylomastoid
d) spinosum
e) jugular

**B. Tasks for self-control:**
*Task №1.* After performing mandibular anesthesia, the patient felt the tart on the tongue. What nerve was under the influence of anesthetic?

*Task №2.* After a sphenopalatine anesthesia by the palatal way, the patient did not have anesthesia of the maxillary nerve. What is this condition caused?

*Task №3.* After sphenopalatine anesthesia by the subjugal-pterygoid way, the patient has a double vision. What is the reason for this complication?

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| | |
|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| Module 1 | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of head and neck. |
| Content module No.2 | Clinical anatomy and operative surgery of regions and organs of head |
| **Topic 13** | Clinical anatomy of the anterior part of the face. Orbital region. Nose region (external nose and nasal cavity). Paranasal sinuses. The concept of surgical intervention on the paranasal sinuses. Principles of rhinoplasty. Primary surgical treatment of facial wounds. Filatov flap. |
| Year | II |
| Faculty | Foreign students training (dental) |

**1. The relevance of the topic:** quite often injuries and purulent processes of the face involve in the pathological process the orbit region, as well as the other adjacent regions. Purulent diseases of the orbit, the external nose and paranasal sinuses usually require surgical interventions, which are impossible without profound knowledge of the topographic anatomical features of the operated area. Mastering the techniques of trepanation of the paranasal sinuses promotes timely and effective treatment of pathological processes in these areas and prevents the development of severe intracranial complications.

**2. Specific objectives.**

1. Explain the ways of spreading of purulent infection from the orbit, the external nose and paranasal sinuses.
2. Interpret the topographic relationships of anatomical creations within the studied areas.
3. Carry out operative access to the frontal and maxillary sinuses.
4. Perform withdrawal of rubber drainage from the frontal sinus.
5. Form the anastomosis of the maxillary sinus with the inferior nasal meatus.
6. Perform typical incision during the purulent processes of the areas according to the subject of the lesson.
7. Explain the technique of formation of Filatov flap.

**3. Tasks for independent work to prepare for the lesson**

| Term | Definition |
|---|---|
| 1. Killian's operation | 1. Radical method of frontal sinus opening |
| 2. Caldwell-Luc operation | 2. Surgical operation on the opening of the maxillary |

**3.1. List of the main terms, parameters, characteristics that should be learnt by the**

**student while preparing for the lesson.**
**3.2. Theoretic questions:**

1. Borders and areas of the anterior part of the face.
2. Borders and layers of the orbit.
3. Borders and layers of the infraorbital region.
4. Borders and layers of the mental region.
5. The topography of branches of the facial nerve.
6. Connections of cellular spaces of the anterior part of the face and ways of penetration of infection into the cavity of the dura mater.
7. Connections of superficial veins of the face with sinuses of the dura mater.
8. The principle of incision when inflammatory processes in these areas are present.
9. The topography of the external nose.
10. The topography of the nasal cavity.
11. Topographic features of the maxillary sinus.
12. Indications for the opening of the maxillary sinus.
13. Connecting openings of the paranasal sinuses with the nasal cavity.
14. Topographic features of the frontal sinus.
15. The technique of autopsy of the frontal sinus.
16. The technique of opening of the maxillary sinus.
17. Complications that arise during the opening of the frontal and maxillary sinus.
18. The principle of incisions during the purulent processes of the orbit and infraorbital region.
19. The technique of formation of Filatov flap.

**3.3. Practical skills acquired in class:**
1. Layer-by-layer preparation of areas of the orbit and nose.
2. Opening of the maxillary sinus by Caldwell-Luc.
3. Opening of the frontal sinus by Killian.
4. Typical incision on the face with phlegmons of the orbit and the infraorbital region.

**4. The content of the topic:**
**The region of the orbit** (regio orbitalis) and its borders. The superior wall of the orbit. The inferior wall of the orbit. The medial wall of the orbit. The lateral wall of the orbit is formed by the frontal process of zygomatic and more posteriorly by the orbital plate of the greater wing of sphenoid bone.
**The outer part (the eyelids region) and the orbit.**
**Orbital cavity.** The bulbar and retrobulbar areas. Tenon's capsule. The muscles that provide the movement of the eye. The content of the orbit in children and special characteristics.
Blood supply, innervation and lymphatic drainage of the orbit. The ophthalmic artery (a. ophthalmica) and its branches: the lacrimal artery (a. lacrimalis), the central retinal artery (a. centralis retinae), the posterior ciliary arteries (a.a. ciliares posteriores breves et longuae), the muscle branches (r.r. musculares), the supraorbital artery (a. supraorbitalis), ethmoidal arteries (a.a. ethmoidalis), medial palpebral arteries (a.a. palpebralis mediales superior et inferior), frontal artery (a. frontalis), dorsal nasal artery (a. dorsalis nasi).
**Venous outflow and ophthalmic veins.**

Nerves of the orbit: optic nerve (n. opticus), the nerve of special sensitivity, ophthalmic nerve (n. ophtalmicus) and a number of motor nerves that innervate the muscles of the eye, oculomotor nerve (n. oculomotorius), trochlear nerve (n. trochlearis ) and abducens nerve (n. abducens). Ciliary ganglion (ganglion ciliare).
**Submental space (regio submentale).** Features of the layer-by-layer structure of this region. Blood supply, innervation and lymphatic drainage.
**Nasal region (regio nasalis)** and its borders.
**External nose (nasus externus),** a form of the nose. Skeleton of the external nose. Features of the layer-by-layer topography of the external nose.
Blood supply, innervations and lymphatic drainage of the external nose.
**Nasal cavity (cavum nasi).** Nasal septum (septum nasi). The upper wall of the nasal cavity. The lower wall of the nasal cavity. The lateral wall of the nasal cavity. Nasal conchae (conchae nasales), nasal meatus.
**Paranasal sinuses.** The frontal sinus (sinus frontalis). The maxillary sinus (sinus maxillaris). Sphenoidal sinus (sinus sphenoidalis). Ethmoid sinus (sinus ethmoidales).
**The opening of the maxillary sinus (highmorotomy)**. Indications for surgery, anesthesia and surgical technique (Caldwell-Luc operation).
**The opening of the frontal sinus (frontotomy).** Indications for surgery, anesthesia and surgical technique (Killian's operation).
Incisions during the purulent processes of the area of the optic region and infraorbital region. The technique of formation of Filatov flap.

**5. Materials for self-control**
**A. Tasks for self-control:**

*Test №1.* The inflammatory process in a patient spread from the spatium temporopterygoideum to the nasal cavity. What is the pathway for the pathological process?
a) through the foramen sphenopalatinum;
b) through the canalis palatinus major;
c) through the canalis palatinus minor;
d) through the fissura orbitalis inferior;
e) through the canalis infraorbitalis

*Test №2.* The inflammatory process in a patient spread from the spatium interpterygoideum spread to the cranial cavity. Through which openings of the skull this space interacts with the cavity of the skull?
a) spinosum and rotundum
b) lacerum and spinosum
c) jugulare and rotundum
d) ovale and spinosum
e) jugulare and ovale

*Test №3*. A patient arrived at the maxillofacial department with a diagnosis of closed fracture of the mandible, complicated by the phlegmon of the bottom of the oral cavity. What incision of the skin around the neck (in the submental triangle) is less traumatic and is usually used to open phlegmon?

a) transverse;
b) longitudinal along the middle line;
c) oblique;
d) arched;
e) angle.

*Test №4*. The patient has an inflammatory process on the face. Where are these processes most dangerous in connection with the possibility of intracranial complications?
a) on the upper lip;
b) on the lower lip;
c) on the cheek;
d) in the parotideomasseteric region;
e) in the mental region.

**B. Tasks for self-control:**
*Task №1*. The patient with furuncle of the upper lip is diagnosed with thrombosis of the cavernous venous sinus. Describe the ways of the infection spreading to this sinus and the anatomical factors contributing to the spread of infection.

*Task №2.* The patient with purulent parotitis had symptoms of downturned mouth, smoothing of the nasolabial and nasobuccal folds. What caused these symptoms?

*Task №3.* In the patient, the carbuncle of the upper lip is accompanied by a high temperature. The condition of convergent strabismus is detected. Make a diagnosis. What is the reason of this symptom?

*Task №4.* The patient has a phlegmon of the bottom of the oral cavity. What is the surgeon's tactic?

*Task №5.* The surgeon needs to have an incision in a cuspid region. How should it be done?

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| | |
|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |

| Term | Definition |
|---|---|
| Module 1 | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of head and neck. |
| Content module No.2 | Clinical anatomy and operative surgery of regions and organs of head |
| **Topic 14** | Clinical anatomy of the oral vestibule and oral cavity. Topography of teeth. Tongue. The bottom of the oral cavity. Operation of tooth extraction. Operations with congenital cleft lip (cheiloplasty) and cleft palate (uranoplasty). Resection of the upper and lower jaws. Operation during ankylosis of the temporomandibular |
| Year | II |
| Faculty | Foreign students training (dental) |

**1. The relevance of the topic:** injuries, inflammatory processes of the maxillofacial region, tumors and other pathologies often require surgical treatment based on profound knowledge of the topography of the area, its arterial blood supply, innervation, venous and lymphatic drainage. The topography of the oral vestibule must also be known both for making a definite diagnosis and for administering the patient. Congenital defects of the palate, lips, external nose, jaws that are observed quite often, as well as pathological processes in these areas require appropriate surgical interventions. Operations on the facial part of the head are based on profound knowledge of the topographic anatomical features of one or another section of the facial part of the head. Possible postoperative complications on the facial part of the head are also always associated with the peculiarities of the layer-by-layer structure of the corresponding area and its connections with adjacent formations.

**2. Specific objectives.**

1. Analyze variants of individual variability in teeth innervation and its influence on the technique of the teeth anesthesia.
2. Interpret topographic anatomical correlations of the formations of the mouth, lips, vestibule and oral cavity, tongue, soft and hard palate.
3. Explain the principles of rhinoplasty by Khytrov.
4. Explain the principles of operations during congenital defects of the palate.
5. Explain the principles of the cheiloplasty.
6. Suggest the principles of resection of the upper and lower jaws.
7. Exercise the oblique osteotomy of the ramus of the mandible by Rauer.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| | |
|---|---|
| 1. Cheiloplasty<br><br>2. Uranoplasty | 1. Surgery, which is performed to eliminate the congenital cleft lip.<br>2. Surgery, which is performed to eliminate the congenital cleft palate. |

**3.2. Theoretic questions:**

1. Topographic anatomy of the mouth region.
2. Topographic anatomy of the oral cavity, blood supply and innervation.
3. Sources of blood supply and teeth innervation.
4. Topographic anatomy of the hard palate.
5. Topographic anatomy of the soft palate.
6. Topographic anatomy of the tongue.
7. Connections of cellular spaces of the bottom of the oral cavity with adjacent areas and the ways of spreading of purulent infection.
8. Indications and the technique of uranoplasty.
9. The technique of surgical intervention for congenital cleft palate (uranoplasty).
10. Principles of rhinoplasty by Khytrov.
11. Stages of oblique osteotomy of the ramus of the mandible by Rauer.
12. The technique of resection of the upper jaw.
13. Basic stages of resection of the half of the mandible.

**3.3. Practical skills acquired in class:**

1. Performing the incisions for phlegmons of the bottom of the oral cavity.
2. Mastering the principles of uranoplasty.
3. Mastering the technique of cheiloplasty.
4. Mastering the principles of rhinoplasty by Khytrov.
5. Mastering the technique of resection of the upper jaw.
6. Mastering resection technique of the half of the mandible.
7. Performing oblique osteotomy of the ramus of the mandible by Rauer.

**4. The content of the topic:**

**Oral region (regio oris). Borders of the mouth.**

**Lips of the mouth (labia oris).** Layer-by-layer structure. Orbicularis oris muscle. The main muscles that move away from the orbicularis oris muscle and are fixed to the bones are: the levator labii superioris (m. levator labii superioris), the levator labii superioris and the wings of the nose (m. Levator labii superioris alaequae nasi), the levator anguli oris (m. levator anguli oris), the zygomaticus minor muscle (m. zygomaticus minor), the zygomaticus major muscle (m. zygomaticus major), the buccinator muscle (m. buccinator), depressor labii inferioris muscle (m. depressor labii inferioris), depressor anguli oris muscle (m. depressor anguli oris), subcutaneous muscle of the neck (m. platysma).

**Blood supply and innervations of lips. Lymphatic outflow.**

**The front of the mouth (vestibulum oris).** Borders. The mucous membrane of the inner surface of the lips and alveolar process. Transitional folds or vaults. Frenulum labii superior

et inferior.
**The cavity of the mouth (cavum oris).** Borders of the cavity of the mouth. Hard and soft palate. Blood supply, innervation, lymphatic drainage. Innate and acquired defects of the palate.
**Teeth (dentes).** The structure and age features of the teeth of the upper and lower jaws. Tooth structure: tooth crown (corona dentis), tooth neck (collum dentis), root of the tooth (radix dentis), apex (apex dentis). Blood supply, innervations, lymph outflow.
**Tongue (linguae).** Features of the structure. Intrinsic and skeletal muscles of the tongue. Papillae: filiform (papillae filiformes); conical (papillae conicae); fungiform (papillae fungiformes); vallate (papillae vallatae); lentil (papille lentiformes); leafy (papillae foliatae). Blood supply, innervation and lymphatic drainage of the tongue.
**The bottom of the oral cavity.** Cellular spaces. Blood supply, innervation, lymphatic drainage. Ways of spreading of purulent processes within the bottom of the oral cavity.
**Operations during the cleft palate (uranoplasty).** Indications, anesthesia, surgical technique.
**Operations during the cleft of the upper lip (cheiloplasty).** Indications, anesthesia, surgical technique.
**Rhinoplasty.** Indications, anesthesia, surgical technique.
**The oblique osteotomy of the ramus of the mandible by Rauer.** Indications, anesthesia, surgical technique.
**Resection of the upper jaw.** Indications, anesthesia, surgical technique.
**Resection of the half of the mandible.** Indications, anesthesia, surgical technique.

**5. Materials for self-control**
**A. Tasks for self-control:**
*Test №1.* In a patient after the operation on a submental triangle the movement of the tongue has been disturbed. During what nerve damage is this clinical picture observed?
a) chorda tympani;
b) n. glossopharingeus;
c) n. mandibular;
d) n. abducens;
e) n. hypoglossus.

*Test №2.* The patient lost taste sensitivity of the tongue. During what nerve damage can special sensitivity of the posterior one third of the tongue be lost?
a) chorda tympani;
b) n. glossopharingeus;
c) n. lingualis;
d) n. stapedius;
e) n. hypoglossus.

*Test №3.* During the appointment at the otolaryngologist, the patient complained of pain during swallowing. At the examination of the pharynx, the doctor found a swelling palatine arches and enlarged tonsils. What tonsils form a ring of lymphoid tissues of the pharynx (Waldeyer's ring)?
a) tubal, palatine, lingual and pharyngeal;

b) laryngeal, pharyngeal and palatine;
c) palatine, tubal and laryngeal;
d) lingual, laryngeal, palatine;
e) pharyngeal, laryngeal, lingual.

*Test №4.* Decline of the general condition is observed in a patient with a furuncle of the upper lip. Intracranial complications due to the spread of infected venous blood from the surface veins of the face are suspected. With what sinus of a dura mater do these veins anastomose?
a) transverse;
b) sigmoid;
c) cavernous;
d) upper sagittal;
e) upper petrosal.

*Test №5.* During operative intervention in a patient suffering from sialadenitis, cystic enlarged interstitial ducts and small cavities with thick secretion in the parietal parenchyma of the parotid gland were found. Where is the duct of this gland opened?
a) in front of the oral cavity, between 1 and 2 upper molars;
b) in front of the oral cavity, between 1 and 2 lower molars;
c) in front of the oral cavity, between the upper incisors;
d) at the bottom of the mouth;
e) in the sublingual fold.

**B. Tasks for self-control:**
*Task №1.* A mother addressed the pediatric dentist with complaints that her child has speech defect and putting of the tongue out of the oral cavity. What are the reasons for these disorders? How can they be treated?

*Task №2.* The patient came to neurologist with complaints of a partial lack of taste sensations. According to anamnesis the patient suffered from neuritis of the facial nerve. Which branches of VII pairs of cranial nerves are associated with a disorder of taste sensations?

*Task №3.* The patient came to the dentist with complaints of swelling, redness and hilly elevation within the gum of III^I teeth of the upper jaw on the left. According to anamnesis, it is noted that before this patient suffered a left-sided maxillary sinusitis. What is your diagnosis and treatment method?

*Task №4.* The patient complains of swelling and pain within the parotid gland and the mandibular body on the left. During the examination the dentist found deep carious lesions. What is the reason of increase and painfulness in the parotid and submandibular lymph nodes?

*Task №5.* A patient after car accident has arrived at the maxillofacial department. During the examination torn wound of the upper and lower lips and severe bleeding have been detected.

How to temporarily stop bleeding before an operation?

*Task № 6.* At the end of the cheiloplasty, tension suture by Brown was used. Is the surgeon's tactic correct?

*Task №7.* During the uranoplasty the surgeon deliberately cut the vascular-nerve bundles coming out from large and small palatine openings and simultaneously eliminated the defect of a palate. Was the surgeon's tactic correct?

*Task №8.* After completion of resection of the upper jaw, the surgeon sewed the edges of the wound, and a severe bleeding from the oral cavity subsequently developed in the patient. What is the tactical mistake of a surgeon?

*Task № 9.* During the resection of the upper jaw, the surgeon applied a horizontal incision along the Infraorbital margin. A swelling of the lower eyelid developed in the patient after the operation. How to explain such a complication?

*Task №10.* During resection of the half of the mandible during the preparatory period, the surgeon did not remove any tooth from the side of tumor localization, which complicated the technique of mandibular body sawing. What is the tactical mistake of a surgeon?

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| **Academic discipline** | Clinical anatomy and operative surgery |
| Module 1 | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of head and neck. |
| Content module No.2 | Clinical anatomy and operative surgery of regions and organs of head |
| **Topic 15** | Clinical anatomy of fascia and cellular spaces of the face. Incisions during the purulent processes on the face. |
| Year | II |
| Faculty | Foreign students training (dental) |

**1. The relevance of the topic:** cuts on the face are carried out by taking into account the topography of fascias and cellular spaces of the face, branches of the facial nerve. All this confirms the need for profound knowledge by the future dentists of surgical anatomy of fascias and cellular spaces of the face, facial and trigeminal nerves.

**2. Specific objectives.**

1. Perform incisions on the face taking into account the topography of the facial nerve.
2. Perform a primary surgical treatment of the face wounds.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| Primary surgical treatment of the face wounds | Surgical operation, which involves transforming the wound of the facial part of the head from the dirty (infected) into clean and creating the proper conditions for primary intention healing. |

**3.2. Theoretic questions:**

1. The topography of fascia and interfascial spaces of the facial part of the head.
2. Ways of spreading of purulent processes on the face.
3. The technique of primary surgical treatment of wounds of the facial part of the head.
4. Incisions during the purulent processes of the face.

**3.3. Practical skills acquired in class:**

1. Providing primary surgical treatment of the wounds of the facial part of the head.
2. Performing the incisions on the face depending on the location of the purulent process.

**4. The content of the topic:**

**Incisions during the purulent processes of the face**

In purulent processes of the face (abscesses and phlegmons) for a full outflow of pus it is necessary:

1) to create the necessary conditions for the outflow of pus by opening the purulent cell with its subsequent drainage;

2) to cut the tissue taking into account topographic anatomical features of the facial part of the head;

3) an operative access to the purulent cell to be carried out mostly through the skin or mucous membrane of the vestibule or oral cavity in order to prevent damage to the large vascular nerves (incision of the deep pustules of the area of the face), the purulent cell should be approached in a blunt way.

A purulent cell of the face is more often cut under local infiltration (0.25-0.5% solution of novocaine) or under block (1-2% solution of novocaine) anesthesia. At deep phlegmons of the face inhalation anesthetesia with nitrous oxide or ether with oxygen is used.

The phlegmons of the face may be localized in the infraorbital, zygomatic, cheek, parotid, temporal regions, and under chewing muscle, in the pterygomaxillary space, in the cellular spaces of the bottom of the oral cavity.

Abscesses can be localized within the tongue, hard palate, sublingual slot, sublingual roller, orbit, parapharyngeal and retropharyngeal spaces, mental region.

**Phlegmons of the infraorbital region** are cut from the side of the transitive fold of the upper arch of the vestibule of the mouth to the bone. Soft tissues are dissected in a blunt way, the bottom of the cuspid fossa is approached and the wound is drained.

**The phlegmons of the zygomatic region** are cut by applying an incision of the skin near the lower edge of the zygomatic bone. It should be guided by the place of the largest fluctuation and the topography of branching of the facial nerve in this area.

**Phlegmons of the buccal region** are also dissected with taking into account the direction of the branches of the facial nerve and the topography of the duct of the parotid gland. Skin cuts pass from the tragus of the ears to the outer corner of the orbit, the nose wings and the angle of the mouth. With localization of purulent cell between the mucous membrane and the cheek muscle, the incision should be performed from the vestibule of the oral cavity.

**The phlegmons of the parotid region** are dissected by an edging cut, retreating from the angle of the mandible of 1,5-2 cm. In this case, the skin and fascia between m. sternocleidomastoideus and the posterior margin of the ramus of the mandible are cut. It should be emphasized to the students that the major vascular nerves' damage which pass through the parenchyma of the parotid gland (a. carotis externa, v. retromandibularis, n. facialis) can lead to serious complications. Therefore, the deep layers should be approached with blunt instruments, gradually dissecting the tissues to the location of the purulent cell.

**The phlegmons of the infratemporal and pterygopalatine regions** are cut into the upper vault of the mouth vestibule within the last two molars to the bone. After this, with blunt instruments (raspatory or Kocher's probe) one go beyond the hump of the upper jaw (tuber maxillare) and direct the instrument back inside and up to the infratemporal fossa.

**Phlegmons of the temporal region**, depending on the depth of occurrence of a purulent cell, are:

1) superficial, placed between the skin and temporal aponeurosis;

2) median, localized between aponeurosis and m. temporalis;
3) deep, localized under the temporal muscle;
4) spilled, which spread to all layers.
The skin is cut along the anterior edge of the temporal muscle, then the subcutaneous tissue and temporal aponeurosis are cut. With certain complications for the outflow of the pus with the help of an additional incision a contrapectura is applied.
**Submasseteric abscesses and phlegmones** are localized in the submasseteric space that lies on the back surface of m. masseter. With a cut of 5-7 cm in length, which borders the angle of the mandible, the tissues are dissected up to the bone. In the place of attachment of the masseter muscle to the bone, the muscle fibers are partly cut off, and by exfoliating the muscle the abscess is reached. It is also possible to approach the purulent cell by the exfoliation of muscle fibers until pus appears.
**The phlegmons of the pterygomaxillary space** are localized between the inner surface of the ramus of the mandible and the outer surface of the medial pterygoid muscle. From the oral cavity, somewhat to the side and parallel to the pterygomaxillary fold in the direction of the branches of the mandible, a cut of 2 cm in length is applied. After the incision of the mucous membrane, blunt sponge forceps penetrate deep into the lower jaw and m. pterygoideus up to the localization area of the pus. In cases where there is a contraindication to intraoral access (trismus of chewing muscles), the incision is applied through the skin behind the angle of the lower jaw that is bypassed and brought to the transverse edge of the masseter muscle. Having cut the skin with a subcutaneous tissue, with the help of blunt instrument one goes beyond the ramus of the mandible, exfoliates the m. pterygoideus medialis and penetrates into the pterygomaxillary space, from which the pus flows. The wound is drained.
**Phlegmons of the bottom of the oral cavity.** Knowledge of cellular spaces of the bottom of the oral cavity will help students justify access. It should be noted that from the side of the mouth cavity incisions are used only in the presence of phlegmon in lateral cellular spaces of the oral cavity bottom. They should be done within the front teeth closer to the surface of the mandible, thereby preventing damage to the n. hypoglossus. First, dissect the mucous membrane, and then bluntly dissect deeper layers of the tissue. In cases where a deep localization of pus is found, the incision is carried out through the skin from the lower edge of the body of the mandible to the hyoid bone. First, dissect the skin with hypodermic cellular and fascia, then by blunt hooks the front abdomen m. digastricus is moved apart and the mylohyoid muscle within its seam is dissected. After this, between the geniohyoid muscles and the muscles that are in the tongue, with the help of blunt instruments one penetrates into the purulent cell. For the adequate outflow of the pus, Voyno-Yasenetsky V. F. recommended that this incision should not be performed in the mental region but in the submandibular region, stepping back from the lower edge of the body of the mandible at 0, 5-1 cm. At the same time, the skin with a subcutaneous tissue, superficial fascia and fascia of the neck are dissected.
The bared submandibular gland is moved together with the regional lymph nodes. The mylohyoid muscle is dissected or its muscular bundles are dissected in a blunt way and the purulent cell is reached.
**Phlegmon of the orbital region** is opened by incision of the skin on the lower outer edge of the orbit. One should be very careful with access to abscess. Dissect the layers on the lower outer surface of the orbit with blunt instruments and approach to the purulent cell.

**The phlegmons of the peripharyngeal space** are opened by the cut of the skin with a subcutaneous tissue and the surface fascia with oblique incision within the angle of the mandible. Blunt instruments passing near the m. pterygoideus penetrate deeper into the abscess. If a limited purulent cell is detected, it is cut through intraoral access. At the same time, one penetrates in the depths of the tissues in the same way as with the extraoral access.
**The retropharyngeal abscesses** are localized between the pharynx and prevertebral fascia and are more commonly observed in childhood. Accesses to pharyngeal abscesses are intraoral. The patient is sitting. The assistant is fixing his head in the middle position.
At the back wall of the pharynx, in the place of the largest protrusion, an incision of 1-1.5 cm is made. It is better to turn the scalpel blade to the top. Some surgeons use the scalpel according to the left-hand finger, with the help of which they previously find a place of fluctuation.
After the opening of the abscess, the head of the patient is quickly tilted downwards to avoid the aspiration of the pus. For removal of the pus, it is advisable to use an electric suction pump.

**5. Materials for self-control**
**A. Tasks for self-control:**
*Test №1.* In what place on the face can the pulse of the facial artery be pulpated?
a) on the front edge of m.masseter;
b) near the mental protuberance of the mandible;
c) in the middle of a zygomatic arch;
d) in the middle of the line that connects the nose wing and the angle of the lower jaw;
e) in the middle of the supraorbital line.

*Test №2.* Injury to which nerve can lead to paralysis or paresis of mimic muscles?
a) trigeminal nerve;
b) vagus nerve;
c) frontal nerve;
d) facial nerve;
e) infraorbital nerve.

*Test №3.* In what cellular space is it possible to spread the inflammatory process in a patient with subcutaneous phlegmon of the cheek region?
a) in the peripharyngeal space;
b) in the fiber of the deep part of the face;
c) in the retropharyngeal space;
d) in the subaponeurotic cellular space of the temporal region;
e) in the interaponeurotic cellular space of the temporal region.

*Test №4.* Name the veins through which the thrombotic embolus in a patient with phlegmon of the cheek region can enter from the angular face vein in the cavernous venous sinus?
a) v. emissaria;

b) vv. cerebri media;
c) v. meningea media;
d) vv. ophthalmicae;
e) v. jugularis interna.

**B. Tasks for self-control:**

*Task№ 1.* There was a purulent inflammation in the temporopterygoideal space and as a result the patient had strabismus and stagnation in the vessels of the sclera. This can be the evidence of the damage of which formation? And what is its mechanism?

*Task№ 2.* To drain the purulent process of Bish's fat body, the surgeon made an opening on the anterior edge of the masseter muscle. Is this the right incision? What kind of formations will a physician meet?

*Task№ 3.* Can the phlegmon from the parotid gland spread to the peripharyngeal space? If it is true, then how it can spread?

*Task№ 4.* A patient with a furuncle of the upper lip was diagnosed with thrombosis of the cavernous sinus. What is the pathway for infecting the cavernous sinus and which anatomical factors contribute to the spread of infection?

*Task№ 5.* To drain the purulent process of the parotid salivary gland, the surgeon made 5 openings from the base of the earlobe radially in the direction of the temporal region, to the cheekbone, to the wings of the nose, to the angle of the mouth, to the angle of the mandible and along the edge of it. Were the surgeon's actions correct?

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|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| Module 1 | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of head and neck. |
| Content module No.3 | Clinical anatomy and operative surgery of the neck. |
| **Topic 16** | Clinical anatomy of the neck segments. Borders, triangles of the neck. Medial and lateral triangles of the neck. Uncovering and ligature of external and common carotid arteries. Vagosympathetic blockade according to O. V. Vyshnevskyi, M. N. Burdenko. |
| Year | II |
| Faculty | Foreign students training (dental) |

**1. The relevance of the topic:** congenital cysts and fistulas of the neck, submandibular adenophlegmones, foreign bodies in the larynx, trachea, pharynx, cervical part of the esophagus, burns of throat and esophagus are a fairly common pathology; injuries to large vessels and organs of the neck are also dangerous. Successful treatment of these pathological processes is possible only based on thorough knowledge of the topographic anatomical features of the neck region, where the operation is foreseen**.**

**2. Specific objectives.**

1. Interpret the topographic anatomical relations of neck formations and their importance for operative tasks within individual neck segments.
2. Explain the topographic anatomical features of access to the common and external carotid arteries.
3. Perform layer by layer preparation of neck regions.
4. Explain the technique of cervical vagosympathetic blockade according to O. V. Vyshnevskyi.
5. Interpret the division of the neck into triangles.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| 1. Cervical vagosympathetic blockade according to O. V. Vyshnevskyi | 1. Type of local anesthesia, which is performed to prevent the occurrence of pleuropulmonary shock in breast injuries and complex operations on the organs of the thoracic cavity. |
| 2. Cervical vagosympathetic blockade according to M. N. Burdenko | 2. The cervical vagosympathetic blockade, which belongs to the bloody interventions because the skin of the subcutaneous tissue |

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| | and deeper layers of tissue are dissected along the anterior margin of the sternocleidomastoid muscle. |

**3.2. Theoretic questions:**

1. Borders and regions of the neck.
2. Triangles of the neck.
3. Submandibular triangle.
4. Pirogov triangle.
5. Carotid triangle.
6. The topography of the vascular-nerve bundle of the neck.
7. Signs of external and internal carotid arteries.
8. Branches of the external carotid artery that go within the carotid triangle.

**3.3. Practical skills acquired in class:**

1. Performing incisions during the purulent neck processes.
2. Distinguishing the external and internal carotid arteries.
3. Performing vagosympathetic blockade according to O. V. Vyshnevskyi.

**4. The content of the topic:**

**Neck borders. Neck regions.**

**Triangles: internal and lateral.**

The main vascular-nerve tract of the neck (a. carotis communis, v. jugularis interna, n. vagus).

**Submandibular triangle (trigonum submandibularis, trigonum submentalis), carotid triangle (trigonum caroticum) and omotracheal triangle (trigonum omotracheale).**

**Omoclavicular triangle and omotrapezoid triangle. Hinged triangle (trigonum submentale).** Borders and layer-by-layer structure.

**Submental triangle (trigonum submandibulare).**

Borders, layer-by-layer structure. The topography of the submandibular gland. Pirogov triangle.

**The carotid triangle (trigonum caroticum).** Borders and layer-by-layer structure. Vascular-nerve tract.

**The region of the sternocleidomastoid muscle (regio sternocleidomastoidea).** Borders and layer-by-layer structure.

**Cervical vagosympathetic blockade according to O. V. Vyshnevskyi.** Indications and performing technique. Characteristic signs of a successful blockade. Claude Bernard-Horner's syndrome.

**Cervical vagosympathetic blockade according to M. N. Burdenko.**

**5. Materials for self-control**

**A. Tasks for self-control:**

*Test №1.* During the primary surgical treatment of the wound on the neck, the surgeon determined the damage to the muscle which is attached to the hyoid bone with its transient tendon. Which muscle is damaged?

a) m. omohyoideus;

b) m. mylohyoideus;
c) m. digastricus;
d) m. hypoglossus;
e) m. sternohyoideus.

*Test №2.* During the ligation of the tongue artery in the Pirogov triangle, the surgeon damaged the nerve which resulted in disturbances of the motor innervation of the tongue. Which nerve is damaged?
a) n. lingualis;
b) n. laryngeus recurrens;
c) n. glossopharyngeus;
d) n. hypoglossus;
e) n. vagus.

*Test №3.* The doctor is palpating the left lateral triangle of the neck. Which formation limits this triangle from below?
a) venter inferior musculus omohyoideus;
b) venter posterior musculus digastricus;
c) os hyoideum;
d) incisura jugularis sterni;
e) clavicula.

*Test №4.* The inflammatory process in the patient spreads from the previsceral space downwards. Where did it get?
a) In the spatium parapharyngeum;
b) In the spatium retropharyngeum;
c) In the anterior mediastinum;
d) In the posterior mediastinum;
e) In the tela subserosa.

*Test №5.* The patient has damaged external carotid artery. To which cervical vertebra can you compress this artery in order to temporarily stop the bleeding?
a) 2nd;
b) 3rd;
c) 4th;
d) 5th;
e) 6th.

*Test №6.* The surgeon performs access to the common carotid artery. In what direction is it necessary to remove the sternocleidomastoid muscle?
a) Inside and forward;
b) Out and back;
c) Inside and back;
d) Outward and forward;
e) Up.

*Test №7*. The surgeon mistakenly ligatured the internal carotid artery instead of the external carotid artery in the carotid triangle. What is the difference between the ligatured artery and the external carotid artery?
a) the absence branches;
b) the presence branches;
c) it is placed more medially;
d) it is placed more superficially;
e) it is placed more ahead.

*Test №8.* For the ligation of the tongue artery, the surgeon identified Pirogov triangle in the wound. What kind of formation forms the front wall of this triangle?
a) n. lingualis;
b) n. hypoglossus;
c) n. mandibularis;
d) tendo intermedius musculus digastricus;
e) m. mylohyoideus.

**B. Tasks for self-control:**
*Task №1.* Student, entering the Pirogov triangle during the preparation of the submandibular triangle, found a lingual vein in it but he could not detect the artery of the same name. How can it be found?

*Task №2.* During the resection of the lower jaw, the surgeon, first of all, exposed the bifurcation of the common carotid artery in the carotid triangle. How to make sure that this artery is an external carotid artery?

*Task №3.* At the lesson, the student persuaded the teacher that there are five fascias of the neck. Is this answer correct?

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|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| **Module 1** | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| **Content module No.3** | Clinical anatomy and operative surgery of the neck. |
| **Topic 17** | Topographic anatomy fascias of the neck. Topographic anatomy of cellular spaces of the neck. Cuts during phlegmons and neck abscess. Removal of lymph nodes on the neck (Operations by Vanah and Krayl). |
| **Year** | II |
| **Faculty** | Foreign students training (dental) |

**1. The relevance of the topic:** congenital cysts and fistulas of the neck, submandibular adenophlegmones, foreign bodies in the larynx, trachea, pharynx, cervical part of the esophagus, throat and esophagus burns are a fairly common pathology; also dangerous injuries to large vessels and neck. Successful treatment of these pathological processes is possible only based on thorough knowledge of the topographic anatomical features of the neck region, where the operation is foreseen**.**

**2. Specific objectives.**

1. Interpret topographic anatomical relations of neck formations and their significance for operative tasks within individual neck segments.
2. Explain the anatomical structure, the function of neck fascias, and the fascial spaces of the neck.
3. Analyze the ways of spreading abscesses, phlegmons, hematomas on the neck and their cuts.
4. Perform cuts in the formation of abscesses, phlegmon, hematoma on the neck.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| 1. The first fascia across Shevkunenko. | 1. Part of the general surface subcutaneous fascia of the body |
| 2. The second fascia across Shevkunenko. | 2. The surface layer of own neck fascia. |
| 3. The third fascia across Shevkunenko. | 3. A pretracheal plate of a fascia of a neck, tendon extension of the infrahyoid group of muscles. |
| 4. The fourth fascia across Shevkunenko. | 4. Endocervical fascia, which covering all organs of the neck. |
| 5. The fifth fascia across Shevkunenko. | 5. Prevertebral fascia, which lies ahead of the bodies of the cervical vertebraes and the |

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| | long muscles of the head and neck. |

**3.2. Theoretic questions:**

1. Fascias of the neck.
2. Fascial spaces of the neck.
3. The topography of the vascular-nerve bundle of the neck.
4. Signs of external and internal carotid arteries.
5. Branches of the external carotid artery that goes within the carotid triangle.

**3.3. Practical skills acquired in class:**

1. Implementation of cuts during purulent neck processes.
2. Implementation of cuts during phlegmons of the neck.
3. Isolation of external and internal carotid arteries.
4. Implementation of layer preparation for orientation in layers and fascias of the neck.

**4. The content of the topic.**

**Fascias of the neck**

According to V. M. Shevkunenko, in the modern period, the requirements for surgical practice correspond to the classification of neck fascia, according to which there are five fascias on the neck.

**The first fascia of the neck** (fascia colli superficialis) is represented by a part of the general superficial subcutaneous fascia of the body. İt completely covers the neck and in its anterior-lateral department forms a fascia sheath for subcutaneous muscle (platysma).

**The second fascia of the neck** (also called the surface lamina of its own neck fascia (lamina superficialis colli propria), it is fixed to the lower edge of the body of the mandible at the top, and it is fixed to the anterior surface of the sternum and clavicles below, as well as the first fascia. It covers the entire neck and forms fascia sheathes for the submandibular gland, sternocleidomastoid and trapezius muscles.

The teacher pays attention of the students to the fact that the fascia sheathes m. sternocleidomastoideus and m. trapezius are stronger on the anterior surface of the muscles, than on the posterior, and from them, septums leave in the thickness of the muscles. A characteristic feature of the second fascia is the withdrawal of spurs from it to the transverse vertebrae processes, which serves as a barrier for infiltration between the anterior and posterior parts of the neck (M.I. Pirogov).

**The third fascia of the neck** (called a tracheal plate of its own neck fascia (lamina pretrachealis fasciae colli propriae)) is one of the strongest neck fascia. İt is considered as a tendon extension of the infrahyoid group of muscles: m. sternohyoideus, m. sternothyroideus, m. thyrohyoideus, m. omohyoideus. For these muscles, the third fascia forms fascia sheathes.

At its inception, the third fascia of the neck is joined with the second, and along the midline line, they form a white line of the neck. It should be noted that the third fascia of the neck is separated from the second fascia by 2-4 cm, not reaching to the sternum and clavicles, and it is wreathed in the posterior surface of the sternum and clavicles, and a second fascia is wreathed in their anterior surface, which contributing to the formation of the

interaponeurotical suprasternal space ( spatium interaponeuroticum suprasternale). From this space behind the m. sternocleidomastoideus, go saccus caecus retrosternocleidomastoideus Gruberi, also called lateral recesses (recessus laterales).
From the clinical point of view, it should be remembered that the interaponeurotical suprasternal space and blind Gruber bags are interconnected. That is why the purulent processes that occur in the spatium interaponeuroticum suprasternale can spread on the blind Gruber's bags.
**The fourth fascia of the neck** (fascia endocervicalis) covers all neck organs. It should be remembered that it consists of two leaves (folium): parietal and visceral. The first one surrounds all organs as a whole and forms a fascia sheath for the vascular-nerve bundle (fascile) of the neck, and the second one surround each organ separately.
**The fifth fascia of the neck** (also known as the fascia praevertebralis) lies in front of the cervical vertebrae and the long muscles of the head and neck (m. longus capiti, m. longus colli), forming closed fascia sheaths for them. At the top it is fixed to the outer base of the skull, below it falls to the level of II-III thoracic vertebrae, on the side continues on the scalene muscles and the levator scapulae muscle (m. levator scapulae) and forms fascia sheaths for them.
Between the spurs of the fifth fascia, which cover the scalene muscles and the levator scapulae muscle, located antescalenum and interscalenum spaces. They have trunk of the brachial plexus, subclavian artery, and the same name vein.
Behind the fascia praevertebralis, there is a prevertebral space (spatium praevertebrale) that lies in front of the vertebral bodies.
**Fascial spaces of the neck.**
As it was already mentioned, between the second and third neck fascia, there is an interaponeuroticumsuprasternal space (spatium interaponeuroticum suprasternale). In the front, the second fascia that attaches to the anterior surface of the sternum and the clavicles, and behind it is the third fascia attached to the rear surface of these structures limits it. The interaponeurotic space is 2-4 cm above the sternum notch and is relatively close but through the opening in the back wall of the vagina m. sternocleidomastoideus connects to the blind Gruber bags. Students, preparing a capsule of the submandibular gland, also find that this space is closed and inflammatory processes from it can spread to the cellular spaces of the bottom of the oral cavity only through the duct of this gland. The second fascia of the neck forms a fascia sheath for the sternocleidomastoid muscle. If you enter a color solution under the fascia sheath of this muscle, it will spread only within the cellular space of the sternocleidomastoid muscle. This indicates that this space is also closed.
Between the leaves of the fourth fascia, in the space between the hyoid bone and the suprasternal notch, there is a previsceral space (spatium previscerale). The part, which corresponds to the topography of the neck part of the trachea, has a name of the pretracheal space (spatium pretracheale). From a practical point of view, it should be remembered that here are concentrated lymph nodes, unpaired thyroid plexus (plexus thyreoideus impar), from which begin the inferior thyroid veins. In this space, the lowest thyroid gland (a. thyreoidea ima) occurs in 12% of cases, which should be taken into account in operations on the thyroid gland.
The pretracheal space is separated from the anterior mediastinum by an unstable membrane at the level of the sternal manubrium. This membrane is formed on the posterior surface of the sternum, at the transition site of the parietal leaf of the fourth fascia, in the visceral leaf,

which covers a trachea. However, due to the fiber that surrounds the vessels, the pretracheal space is connected to the cellular tissue of the anterior mediastinum, which can be complicated by the anterior mediastinitis in the localization of purulent processes in it.
Between the visceral leaf of the fourth fascia and the fifth fascia lies a retrovisceral space (spatium retroviscerale). It starts from the outer base of the skull and spreads to the diaphragm. This explains its connection with the mediastinum and the possible occurrence of posterior mediastinitis in purulent processes in the retrovisceral space of the neck.
There is also a separate space of the vascular-nerve bundle of the neck, which, as already noted, is wrapped by the parietal leaf of the fourth fascia. At the same time, from each side of the neck, formed a narrow vascular gap, called the vasa nervorum, which reaches the outer base of the skull at the top, and then passes into the anterior mediastinum.
It is essential, that in the lateral triangle of the neck, besides the trigonum omoclavicular, the fourth fascia is absent, and therefore the fifth follows the second fascia in the trigonum omotrapezoideum. The cellular space of the lateral triangle of the neck in the front is limited to the vagina of the vascular-nerve bundle, and behind it - the edge of the trapezius muscle.

**Typical cuts in phlegmons of the neck.**

The main requirement for neck cuts is to provide free access to organs, other structures (places of localization of the purulent process) and their safety for the vessels, nerves, and organs that lie deeper.
The dimensions and direction of the neck cuts depend on the indications in each case, also taking into account cosmetic requirements.
Depending on the location of the purulent process on the neck, the following cuts can be: transverse, oblique, vertical and combined.
When accessing the abscesses, which are localized within the spatium interaponeuroticum suprasternale, used a cross-section that connects the medial edges of sternocleidomastoid muscle in the suprasternal region.
In phlegmons of the previsceral space, median neck incision is performed, depending on the level of localization of the purulent process.
Access to the purulent cell of the vascular-nerve bundle is carried out along the anterior margin of m. sternocleidomastoideus and at submandibular phlegmons - 1cm below the body of the mandible.

## 5. Materials for self-control

### A. Tasks for self-control:

*Test №1.* The patient has diagnosis of "interaponeuroticum suprasternal phlegmon". What are the limits of the spatium interaponeurotium suprasternale?
a) by second and fourth neck fascias;
b) by first, second and third neck fascias;
c) by second and fifth neck fascias;
d) by first and third neck fascias;
e) by second and third neck fascias.

*Test №2.* It is possible purulent melting of anatomical objects of this cellular space in patient with phlegmon spatium previscelare (pretracheale) of the neck. What is located in this space?
a) a. subclavia;
b) pl. brachialis;

c) arcus venosus jugularis;
d) v. thyroidea ima;
e) v. jugularis interna.

*Test №3.* In a patient with a phlegmon of cellular space spatium interaponeuroticum suprasternale, there is a spread of inflammation in adjacent cellular spaces. In which of the following spaces can the purulent process spread?
a) front mediastinum;
b) saccus caecus retrosternocleidomastoideus Gruberi;
c) posterior mediastinum;
d) the cellular tissue of the axillary cavity;
e) cellular tissue of the scapula.

*Test №4.* In a patient with a phlegmon of cellular space (spatium retroviscerale), there is a spread of inflammation in adjacent cellular spaces. In which of the following spaces can the purulent process spread?
a) front mediastinum;
b) saccus caecus retrosternocleidomastoideus Gruberi;
c) posterior mediastinum;
d) the cellular tissue of the axillary cavity;
e) cellular tissue of the scapula.

*Test №5.* In a patient with a phlegmon of the cellular space of the lateral triangle, the spread of the inflammatory process in the adjacent cellular spaces is observed. In which of the following spaces can the purulent process spread?
a) posterior department of the parapharyngeal space;
b) saccus caecus retrosternocleidomastoideus Gruberi;
c) posterior mediastinum;
d) the cellular tissue of the axillary cavity;
e) retroparapharyngeal space.

**B. Tasks for self-control:**
*Task №1.* During carrying out of operative access on a middle line of a neck the surgeon made an incision of a "white line of a neck". What connects this anatomical object?

*Task №2.* During the operation on the cervical part of the esophagus, the surgeon made the incision of its wall, which is covered with fascia. What fascia of the neck (according to the classification of Shevkunenko) was dissected?

*Task №3.* The patient has an inflammatory process in the capsule of the submandibular jaw salivary gland. What fascia of the neck (according to the classification of Shevkunenko) forms this capsule?

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| | |
|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |

| | |
|---|---|
| **Module 1** | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| **Content module No.3** | Clinical anatomy and operative surgery of the neck. |
| **Topic 18** | Topographic anatomy of the neck organs (larynx, trachea). Tracheotomy, tracheostomy. Tracheal intubation. |
| **Year** | II |
| **Faculty** | Foreign students training (dental) |

**1. The relevance of the topic:** amount of operative interventions on the larynx, pharynx, and trachea are quite significant, of topographic anatomical features of these organs, their interrelations with adjacent formations.

**2. Specific objectives.**

1. Analyze the topographic anatomical relations of formations within the different layers of certain areas of the neck.
2. Explain the topography of the trachea, larynx.
3. Perform layered preparation of neck areas.
4. Carry out the upper tracheostomy.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| 1. Tracheotomy<br>2. Tracheostomy | 1. The incision of the trachea.<br>2. Surgical operation with tracheostomy overlay. |

**3.2. Theoretic questions:**

1. The topography of the trachea.
2. Techniques of surgical tracheostomy.
3. Mistakes and complications during tracheostomy.

**3.3. Practical skills acquired in class:**

1. Performing the preparation of the neck organs.
2. Performing a tracheostomy.

**4. The content of the topic.**

**Larynx**

The larynx in its shape resembles a tube, which contains vocal cords. It connects the

laryngopharynx with the trachea. Cricoid cartilage is the basis of the larynx skeleton and is located at the level VI of the cervical vertebrae.
Above the front part of the cricoid cartilage there is a thyroid cartilage, is a ligament associated with the thyroid cartilage that connects the thyroid cartilage with the hyoid bone.
Thyroid cartilage is important benchmarks for operations on the larynx, thyroid gland, and trachea with its incision, as well as the anterior surface of the thyroid cartilage.
The larynx in the front is covered by the prelaryngeal muscles, and on the sides adjoining the lateral parts of the thyroid gland. The laryngopharynx lies behind the larynx. The larynx at the expense of the epiglottis reaches the root of the tongue and below passes into the trachea.
The entrance to the larynx is limited by the epiglottis, on the sides - with arytenoid folds, and behind - the arytenoid cartilages with an incision between them.
The laryngeal skeleton consists of five large cartilages: thyroid cartilage (cartilago thyreoidea), cricoid cartilage (cartilago cricoidea), arytenoid cartilages (cartilago aritenoidea), corniculate cartilages (cartilago corniculata), and epiglottis.
The entrance to the larynx is limited by the epiglottis, on the sides - with arytenoid folds, and behind - the arytenoid cartilages with an incision between them.
The laryngeal skeleton consists of five large cartilages: thyroid cartilage (cartilago thyreoidea), cricoid cartilage (cartilago cricoidea), arytenoid cartilages (cartilago aritenoidea), Corniculate cartilages (cartilago corniculata), epiglottis.
On sagittal sawing the larynx is defined in its cavity three surfaces:
1. The vestibule of the larynx is a gap between the epiglottis and the false vocal cords (plica vestibularis), folds of the mucous membrane lying on the lateral sides of the larynx. The cleft between the vestibule is called the front vestibule - rima vestibuli;
2. Intraligamental space is placed between the front vestibule and the vocal folds. On the lateral surfaces of the larynx, there are laryngeal ventricles (ventriculi laryngis) between these ligaments, the bottom of each of them is directed upwards. In these ventricles, there are a large number of mucous glands, which contributes to constant smearing of the mucus of vocal folds. Between the true vocal cords is a rima glottidis - the narrowest place of the larynx;
3. The subligamental space is the space under the vocal folds.
The students find on the tables, slides that the blood supply of the larynx extends from the upper laryngeal artery (a branch of the external carotid artery) and the lower artery of the same name (a. laryngea inferior), a branch from the thyrocervical trunk ( truncus thyrocervicalis). The veins go parallel to the arteries. The innervations of the larynx provide by branches of the vagus and sympathetic nerves.
The lymph outflows from the larynx to the nodi lymphatici cervicales profundi, nodi lymphatici prelaryngei, nodi lymphatici pretracheales and nodi lymphatici paratracheales, which should be remembered for the presence of tumors of the larynx.

**Trachea**

It is noted that the trachea is a direct extension of the larynx. In the cervical region, it consists of 6-8 cartilage rings, but when thrown back the head, their number increases.
On the back surface, the cartilage C-shaped rings are connected by a connective tissue membrane with non-striated muscle, which is of practical importance for the painless displacement of the trachea when filling the esophagus with food.
The initial department of the trachea, which is clearly visible on the anatomical preparations, is covered in front by the isthmus of the thyroid gland, and on the sides - by its lateral parts.

Below the isthmus of the thyroid gland, there is a pretracheal space (spatium pretracheale), which contains venous plexus, lymph nodes, and sometimes an additional thyroid-artery. These features should be taken into account when performing the upper tracheostomy.
Behind the back wall of the trachea is an esophagus, to the upper department adjoin the lateral parts of the thyroid gland, and to the lower - the common carotid artery.
The cervical part of the trachea supplies by branches of the thyroid arteries. The outflow of lymph from the trachea is carried out in the nodi lymphatici paratracheales, and from them - into the nodi lymphatici cervicales profundi.

**Tracheostomy**

The main indications for tracheostomy are as follows: acute asphyxia, trachea obstruction during the inflammatory process, the presence of foreign bodies, laryngeal injuries, craniocerebral traumas, neurosurgery operations, after severe surgical interventions, when respiratory failure occurs, asphyxia in the drowning man, initial pulmonary edema, and also with a preventive aim, when a patient is expected to have a very complicated operation.

**Upper tracheostomy (tracheostomia superior)**

The patient is placed on the back, a cushion is placed under the shoulder blades, and the head is placed in the middle position and thrown back.
The surgeon is on the right side of the patient, the assistant is on the left side.
From the upper edge of the thyroid cartilage on the midline of the neck, cut of 4-6 cm in length is applied. The skin dissected with a subcutaneous tissue and superficial fascia. On the course of the cut detected a v. mediana colli, which should be pushed aside and bound. Neck aponeurosis cut through a trench probe, and m. sternohyoideus and m. sternothyroideus are swiping sideways by hooks. The connection that captures the thyroid gland isthmus, drawn down with blunt hooks, during this exposed the tracheal rings. By two blunt sharp hooks fix a trachea. The teacher draws attention to the fact that the working surface of the scalpel should be controlled. For this blade of the scalpel is pre-wrapped with sterile gauze, leaving a working surface of 1 cm long. This is a condition that is obligatory because with the free penetration of the scalpel blade into the tracheal lumen may be injured of its back wall and esophagus. By dissecting the rings, the surgeon must direct the scalpel blade up from the isthmus of the thyroid gland and its numerous vessels. Depending on the diameter of the cannula, dissect 2-3 rings of the trachea. The tracheal wound expands with a tracheo extender and in its lumen immersed a tracheostomy cannula.
To prevent damage to the cartilage rings with the insertion of the cannula into the lumen of the trachea its shield must first be in the sagittal plane, and when the end of the cannula reaches the lumen of the trachea, it is transferred to the front plane of the cannula and dip down to and until the shield reaches the level of the skin.With the correct introduction of the cannula into the lumen of the trachea, breathing becomes whistling and even. During the operation, stop the bleeding and apply 2-3 sutures on the wound. To the ears of the cannula tied gauze strips, round them around the neck and tied.
Individual surgeons do not cut the tracheal rings, but the membrane between them cut by the method of Voiachek.
Take into account that children have a small cannula diameter, in pediatric surgery this method is not implemented because you can completely cut the trachea.

**The lower tracheostomy (tracheostomia inferior)**

At the lower tracheostomy, the surgeon stands to the left of the patient. A section of 6-8 cm in length is held up on the midline of the neck from the jugular notch.

Just like the previous operation, at first on the cut line dissect tissues, fascia including a second neck fascia. In this case, the venous arch (arcus venosus juguli) is drawn back downwards and continues to protect by dull hooks. The next fascia of the neck is cut through the probe and its edges with the long muscles are separated with hooks. The fibre that lies in front of the trachea is stratified by blunt hooks and leads to the lowest thyroid vessels (a. et v. thyroidea ima) as they cause a severe haemorrhage.

Further conducting of the lower tracheostomy does not technically different from the previous operation.

It should be remembered that in children the lower tracheostomy is more frequent, therefore in the lower corner the wounds on the left the manipulation are dangerous, because there is a v. brachiocephalica sinistra which rises high, with strong dislocation of the neck it can protrude over the sternal notch and be damaged during the lower tracheostomy.

Possible complications for non-compliance with the requirements of tracheostomy techniques:

- injuries of the vascular-nerve bundle of the neck;
- subcutaneous emphysema in the presence of a hole in the trachea greater than the diameter of the cannula;
- necrosis of the rings of the trachea as a result of their bending in the formation in the trachea of the opening less than the diameter of the cannula;
- aspiration pneumonia, which occurs as a result of blood flow into the lumen of the trachea caused by insufficient hemostasis;
- asphyxia caused by the introduction of a tube under exfoliated mucous membrane of the trachea or under a diphtheria pellicle;
- damage of the esophagus wall, which occurs during deep scabbard blade immersion into the lumen of the trachea.

**5. Materials for self-control**

**A. Tasks for self-control:**

*Test №1.* The victim has the combined wound of the trachea and isthmus of the thyroid gland. At the level of which rings of the trachea the isthmus are usually placed?

a) 1-2;
b) 2-3;
c) 3-4;
d) 4-5;
e) 5-6.

*Test №2.* As the urgent aid, cricothyrotomy is performed to patient with mechanical asphyxia. What was done with this?

a) dissection of the trachea;
b) to put a tracheal fistula;
c) dissection of the ligamentum conicum;
d) punction of the ligamentum conicum;
e) Applying a fistula to the larynx.

*Test №3.* The surgeon performs the lower tracheostomy. In what direction should dissection of the trachea from the isthmus of the thyroid gland be performed?

a) up;
b) down;
c) outside;
d) in the middle;
e) to the front.

*Test № 4.* The surgeon made tracheostomy. What did he do with the patient's trachea in this case?
a) dissect;
b) sew;
c) delete;
d) put a fistula;
e) fix.

*Test № 5.* The physician, providing urgent aid with mechanical asphyxia, performed cutting puncture of the ligamentum conicum. At first, the aim of the doctor's palpation of two larynx cartilages is to determine the puncture site. Which of these given below cartilages was puncture?
a) cartilago thyroidea;
b) cartilago cricoidea;
c) cartilago arytenoidea;
d) cartilago cuneiformis;
e) cartilago corniculata.

*Test № 6.* The surgeon dissected the first ring of the trachea and led into it a tracheostomy cannula. On which cartilage of the larynx, cannula will be pushed in this case?
a) cartilago thyroidea;
b) cartilago cricoidea;
c) cartilago arytenoidea;
d) cartilago cuneiformis;
e) cartilago corniculata.

**B. Tasks for self-control:**
*Task № 1.* During surgery on the neck, the surgeon accidentally cut the external jugular vein. To stop the bleeding, he captured the proximal end of the vein with clamp. Is it correct? What is your tactic?

*Task № 2.* By binding the external carotid artery, the surgeon exposed part of this artery from the bifurcation to the point of departure from a. carotis externa of the upper thyroid artery. Has the surgeon correctly identified the place for ligature?

*Task № 3.* The patient turned to the surgeon with complaints of a pulsating swelling on the neck, deterioration of vision. Near the front edge of m. sternocleidomastoideus, slightly above the collarbone, palpated pulsating tumour, above it - systolic noise. The face of the patient from the localization of a tumour is hyperemic, a narrowed pupil, a narrowed orbital fissure, and with a sunken eye. The surgeon has established a diagnosis - aneurysm of the

common carotid artery. To your point of view, what is the connection between the general carotid aneurysm and the Claude-Bernard-Horner syndrome?

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| **Academic discipline** | Clinical anatomy and operative surgery |
|---|---|
| Module 1 | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of the head and neck. |
| Content module No.3 | Clinical anatomy and operative surgery of the neck. |

| | |
|---|---|
| **Topic 19** | Topographic anatomy of the neck organs (esophagus, thyroid gland). Operation on the thyroid gland. The concept of resection of the thyroid gland. Exfoliation the cervical part of the esophagus. Operations at the esophagus atresia. |
| Year | II |
| Faculty | Foreign students training (dental) |

**1. The relevance of the topic:** the amount of surgical treatment of the thyroid gland, of the cervical part of the esophagus is quite significant and it is impossible to perform it without profound knowledge of the topographic anatomical features of these organs and their interrelationships with adjacent formations.

**2. Specific objectives.**

1. Interpret the topographic anatomical relations of formations within the different layers of certain areas of the neck.
2. Explain the topography of the esophagus, thyroid and parotid glands.
1. Perform access to the cervical part of the esophagus.
2. Perform subtotal subfascial resection of the thyroid gland according to A. V. Nikolaiev.

**3. Tasks for independent work to prepare for the lesson**

**3.1. List of the main terms, parameters, characteristics that should be learnt by the student while preparing for the lesson.**

| Term | Definition |
|---|---|
| 1. Resection of the thyroid gland<br>2. Strumectomy | 1. Partial removal of the thyroid gland.<br>2. Resection of the thyroid gland |

**3.2. Theoretic questions:**

1. The topography of the cervical part of the esophagus.
2. The topography of the thyroid gland and the parotid glands.
3. Features of operative access to the cervical part of the esophagus.
4. The technique of subtotal subfascial resection of the thyroid gland according to O. V. Nikolaev.
5. Mistakes and complications during the subtotal subfascial resection of thyroid gland according to A.V. Nikolaiev.
6. Aneurysms of the common carotid artery and the operation technique.
7. Operations with phlebectasia of jugular veins.

**3.3. Practical skills acquired in class:**

1. Expose the internal jugular vein, external and common carotid arteries.
2. Expose the cervical part of the esophagus.
3. Perform resection of the thyroid gland according to A. V. Nikolaiev.

**4. The content of the topic.**

**Thyroid gland (glandula thyreoidea)**

It consists of two lateral particles and an isthmus. Externally, the gland is covered with a visceral leaf of the fourth fascia of the neck (fascia endocervicalis), which is tightly bound to the parenchyma of the gland and repeats all its contours, as well as the parietal leaf of the fourth fascia. Between these leafs of fascia endocervicalis a layer of loose fibre, which contains numerous blood vessels that provide blood supply for the thyroid gland, is concentrated. Due to fascia induration, a number of connections that fix the gland are formed: from the cartilago cricoidea to the isthmus of the thyroid gland there is a middle ligament, and from the lateral parts of the gland up to cartilago thyroidea and cartilago cricoidea there are letarel ligaments. These features should be taken into account during the operations; in particular, for the mobilization of the gland, it is necessary to cross the ligament that fixes the isthmus of the gland.

The thyroid gland is covered by the infrahyoid muscles (m. sternohyoideus, m. sternothyroideus, m. thyrohyoideus and m omohyoideus) in the front and the common carotid arteries and internal jugular veins adjoin the thyroid gland from the back and from its side.

Thyroid gland envelops the larynx and the trachea, and adjoins the esophagus from the left.

Blood supply of the thyroid gland is carried out by the upper (from the external carotid artery) and the lower (from the subclavian artery) thyroid arteries, and in 10% of cases by the unpaired lowest thyroid artery (a. thyroidea ima).

The arteries of the thyroid gland form two collateral paths: intraorgan and extraorgan. It is indicated that intraorgan collateral tract is formed due to the upper and lower thyroid arteries, and the extraorgan is formed due to anastomosis with the arteries of the pharynx, larynx, esophagus, trachea and adjacent muscles.

On the entire surface of the gland, there are numerous venous plexuses. The sympathetic trunk, the upper and recurrent laryngeal nerves provide its innervation.

Lymph from the upper poles of the thyroid gland exits into the lymph nodes of the vascular-nerve bundle of the neck, and from the lower ones – in the pretracheal lymph nodes.

**Parathyroid glands (glandula parathyreoidea)**

Four epithelial bodies resembling a millet mainly represent these glands

Parathyroid glands lie on the posterior surface of the lateral part of the thyroid gland. They are connected with the parietal leaf of the fourth fascia of the neck.

Attention is paid to the fact that the upper pair of pterygoid glands lies at the level of the cartilago cricoidea of the larynx, and the lower one is 1-1.5 cm above the lower edge of the lateral part of the thyroid gland.

Sometimes parathyroid glands may be located in the visceral fascial membrane of the gland or directly in its parenchyma.

These features should be taken into account when performing surgical treatment of the thyroid gland.

**Esophagus**

The esophagus is a direct extension of the pharynx. It has three divisions: cervical, thoracic and abdominal. The total length of the esophagus is on average 25 cm. Its origin is projected to level VI of the cervical vertebra or the posterior edge of the cricoid cartilage.

In the initial department of the esophagus, there is a first physiological narrowing up to 1.5 cm in width. The length of the cervical part (pars cervicalis) is 4-6 cm. At the neck, the

esophagus deviates to the left, since trachea lies in front of it. Taking this into account the access to the esophagus is carried out on the neck from the left side of the anterior margin of the sternocleidomastoid muscle.
The longitudinal grooves, filled with cellulose, pass on both sides between the trachea and the esophagus. There are recurrent laryngeal nerves. The right one (n. laryngealis recurrens dexter) is adjacent to the back wall of the trachea, and the left one is adjacent to the anterior wall of the esophagus.
From a practical point of view, it is important to remember that at the lower pole of the thyroid gland this groove crosses a. thyreoidea inferior. During the operative access to the cervical esophagus from the left, one should remember these topographic anatomical features.
On the back of the esophagus there is a loose fibre, which upwards extends beyond the throat and below it extends to the posterior mediastinum.
It should be remembered that the lateral parts of the thyroid gland adjoin the upper part of the cervical esophagus, and the common carotid arteries adjoin the lower one.
An asymmetrical position of the common carotid arteries in relation to the cervical part of the esophagus is noted. So, the right common carotid artery passes 1-1,5 cm outside the esophagus, and the left one – only 0,3-1,5 cm.
The cervical part of the esophagus is supplied with blood by the branches from the lower thyroid arteries, and the branches of the recurrent laryngeal and sympathetic nerves provide its innervations. The lymph from cervical part of the esophagus goes into the lymph nodes that lie in the tracheo-esophageal grooves, as well as in the deep cervical lymph nodes, which, as it has already been noted, lie along the internal jugular vein.
At the area of the fusion of the internal jugular and subclavian veins, there is a lymph node, which is increased during the cancer of the lower part of the esophagus and the initial part of the stomach.

**Access to the cervical esophagus**

Basic indications for surgical treatment of the cervical part of the esophagus are: injuries of the cervical part of the esophagus, foreign bodies in it, tumours, cicatricial changes, congenital anomalies.
Since the esophagus in the cervical part deviates to the left of the median line of the neck, the operational access is advisable to perform on the anterior margin of m. sternocleidomastoideus to the left. The surgeon stands on the left hand of the patient. The skin is cut along the anterior edge of the m. sternocleidomastoideus from the jugular notch to the level of the upper edge of the thyroid cartilage. First, you should remove the skin with a subcutaneous tissue and the superficial fascia with the subcutaneous muscle of the neck. The front jugular vein (v. jugularis anterior) is ligated and dissected between ligatures. The vagina of m. sternocleidomastoideus is cut at a grooved probe, the muscle is pulled out with hooks and the back wall of the indicated muscle along with the third fascia is dissected along the grooved probe. The omohyoid muscle, which is detected during the operation, is hooked and retracted to the outer corner of the wound, sometimes it is cut for better access. This muscle should first be stitched in two places and cut off between two ligated ligatures. During the operation, the thyroid gland is pulled inside with dull hooks and the vascular-nerve bundle together with m. sternocleidomastoideus is pulled outside. The esophagus is on the spine and goes beyond the trachea. It starts at the level VI of the cervical vertebra, with reddish colour and longitudinally directed muscle fibers.

From the anterior wall of the esophagus, the recurrent laryngeal nerve is carefully displaced. Since the lower thyroid artery crosses surgical field, the two ligatures are applied to it and they cut this vessel between them. In such conditions, the esophagus becomes available for surgical treatment.

If the purpose of the operation is to remove a foreign body from the esophagus, then two ligatures are imposed on its wall; the needle should not pierce its mucous membrane when sewing the wall of the esophagus. The esophagus wall, due to the tension of these ligatures, is removed from the wound and cut off between them. In this case, the operating field around the wound of the wall of the esophagus is carefully placed with sterile napkins to prevent the infection in the wound. The outer body is carefully removed from the esophagus wound. The wall of the esophagus is stitched layer-by-layer. If the esophagus is exposed due to its injury, the wound isn't sutured, the gastric probe is inserted into the lower edge of the wound and the tampon is inserted in the upper part. Tampons with antibiotics are applied to the esophagus and in some cases a drainage tube is applied. The skin is left open or several stitches are put.

**Subtotal resection of thyroid gland according to A. V. Nikolaiev.**

The most commonly used thyroid gland surgery is a subtotal subfascial resection method according to A. V. Nikolaiev.

It consists of the subfascial removal of the gland without ligating of thyroid arteries along the length, and after the operation, there are no more than 3-6 grams of the mass of the gland.

At first, apply a quadrilateral incision that connects the medial edges of the sternocleidomastoid muscle. It is carried out so that the lowest point of it is somewhat higher than the jugular notch.

Dissect the skin with a subcutaneous tissue and superficial fascia. The edges of the wounds are stretched up and down with blunt hooks. Those vessels that lie between the first and second fascia are fixed with the clamps and are dissected. A 0,25-0,5% solution of novocaine (a hydraulic method) is introduced into the thickness of the fascia, which facilitates safe dissection of the second and third neck fascia. In this case, the infrahyoid muscles become exposed in the wound (mm. sternohyoidei, sternothyreoidei and omohyoidei). The thoracic-sublingual muscles that lie medially, are removed layer-by-layer by Kocher's probe, are fixed with clamps and cut.

Under the parietal leaf of the fourth fascia, a solution of novocaine is introduced, resulting in the formation of another novocaine infiltrate. It spreads under the fascia capsule of the thyroid gland and blocks those nerves that fit into it. Due to the presence of the created novocaine depot, the surgeon painlessly removes the wound and every particle of the gland. To extract the particle of the gland, the edges of the sternothyroideal muscle must be pulled to the side, parietal leaf of the fourth fascia must be cut and the parietal leaf of the fourth fascia must be bluntly separated from the visceral leaf (with tools and partially with fingers). After that, it becomes possible to extract the particle of the gland.

During the operation, the surgeon provides the release of both poles of the right particle of the gland from the fascia capsule. At the same time on these poles, there is only an internal (own) capsule. The surgeon imposes clamps on the vessels of the visceral capsule and dissects them. The leaf of the visceral fascia is gradually removed layer-by-layer to those areas where resection of the part of the gland is foreseen. After that, the isthmus of the gut is crossed, and the blood vessels are fixed with clamps.

The next stage of the operation is the removal of the fraction of the gland from the side of the

trachea. Since the part of the gland that will be left after the operation is covered with visceral fascia, it should be provided with a boat-shaped form. Those blood vessels that were previously pressed with clamps are ligated with a catgut. At the same time, several vessels are tied up, reducing the number of ligatures in the wound. The stump of the right lobe of the thyroid gland is covered with the edges of its outer capsule and is stitches.
The resulting wound is thoroughly washed with novocaine, and the muscle and subcutaneous tissue are once again injected with novocaine solution.
The left lobe begins to be removed from its lower pole. The further tactics of the surgeon do not differ from the surgical techniques on the right particle. After the stumps of both thyroid lateral lobes of the thyroid gland are covered with a capsule, the gland is covered with undamaged breast-thyroid muscles, and a 0.25-0.5% solution of novocaine is added again to the muscular layer and subcutaneous tissue. Then the roller is removed from under the blades of the operated, thoracic-hyoid and thoracic-thyroid-like muscles are stitched. The cavity of the surgical wound is washed again with Novocaine solution. Turunda or strips of rubber are applied for one day to the stumps of the thyroid gland on both sides. Initially catgut suture is applied to the subcutaneous tissue and after it – to the skin. Silk is not recommended in this operation.

**5. Materials for self-control**

**A. Tasks for self-control:**

*Test № 1.* The victim has combined injury of trachea and of the isthmus of the thyroid gland. At the level of which rings of the trachea is isthmus usually placed?
a) 1-2;
b) 2-3;
c) 3-4;
d) 4-5;
e) 5-6.

*Test № 2.* The surgeon performs subtotal, subfascial resection of the thyroid gland. However, he isn't cautious while working in a dangerous (back-medial) zone of this organ. What formations located extracapsular can be damaged?
a) recurrent laryngeal nerves;
b) vagus nerves;
c) common carotid artery;
d) internal jugular veins;
e) parotid glands.

*Test № 3.* During the resection of the thyroid gland, the doctor mistakenly removed all the pterygoid glands. What are these glands?
a) Left, middle, right;
b) Upper, middle, lower;
c) Front, middle, back;
d) Front and rear;
e) Upper and lower.

*Test № 4.* What complications can develop with the bilateral trauma of n. laryngeus inferior

(n. laryngeus reccurens) during thyroid gland surgery?
a) asphyxia and death;
b) paresis of vocal cavity (aphonia);
c) disruption of swallowing;
d disruption of cough reflex;
e) hypoparathyreosis.

*Test № 5.* During the strumectomy, the ligation of numerous thyroid gland vessels is performed. In what layer is venous plexus of the gland located?
a) between the visceral leaf of the fourth fascia of the neck and its own capsule;
b) between visceral and parietal leaves of the fourth fascia of the neck;
c) in the previsceral space;
d) in retroviscral space;
e) under its own capsule.

**B. Tasks for self-control:**
*Task № 1.* For the esophagus exposure, the student decided to perform access at the posterior margin of the sternocleidomastoid muscle from the right. Is the student's tactic correct?

*Task № 2.* Performing strumectomy, the surgeon separated the part of the gland from the trachea throughout its length. The patient had hoarseness of voice. What is the surgeon's mistake?

*Task № 3.* The patient with diagnosis of nodular euthyroid goiter was recommended to remove the thyroid gland. What muscle covers the front surface of this gland?

*Task № 4.* A foreign body of the cervical part of the esophagus was found in the patient, which is not removed by esophagoscopy. What are the tactics of the surgeon. How to distinguish the esophagus from other neck organs? How to protect the wound after removing the foreign body from the esophagus?

*Task № 5*. Which amount of thyroid gland parenchyma should be left during subtotal subfascial strumectomy with a diffuse toxic goiter and for what purpose?

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| | |
|---|---|
| **Academic discipline** | Clinical anatomy and operative surgery |
| Module 1 | Introduction to clinical anatomy and operative surgery. Clinical anatomy and operative surgery of regions and organs of head and neck. |
| **Topic 20** | Final module control of theoretical and practical training of students. |
| Year | II |
| Faculty | Foreign students training (dental) |

**1. The relevance of the topic:** on the basis of the acquired knowledge of the surgical anatomy of head and neck sections at the lesson, each student should be tested from the specified topics of the subject.

**2. Specific objectives.**

1. Check each student's theoretical level of surgical anatomy of head and neck.
2. Ascertain the level of mastery of each student's practical skills from the basics of surgical interventions in the head and neck regions.

**4. The content of the topic.**

**Theoretical questions for the final modular control.**

1. Topographic anatomy of the arachnoid mater and pia mater of the brain. Intrathecal spaces.
2. Topographic anatomy of the dura mater, its sinuses and spurs.
3. Topographic anatomy of the external skull base, individual variability according to T. V. Zolotariova. Openings and fissures in the outer skull base, their contents.
4. Topographic anatomy of the anterior cranial fossa. It's content. Fractures of the anterior cranial fossa.
5. Topographic anatomy of the middle cranial fossa. It's content. Fractures of the middle cranial fossa.
6. Topographic anatomy of the posterior cranial fossa. It's content. Fractures of the back cranial fossa.
7. Schemes of the craniocerebral topography of Kronlein-Brusova and Ehorova. The main fissures and convolutions of the brain. Topographic anatomy of a. meningea media.
8. Topographic anatomy of the arterial circle of the brain (circle of Willis).
9. Topographic anatomy of the fronto-parieto-occipitalis region. Borders, layer-by-layer structure, cellular spaces, blood supply, innervation, lymphatic drainage.
10. Topographic anatomy of the temporal region. Borders, layer-by-layer structure. Cellular spaces, their connection with cellular spaces of adjacent areas. Blood supply, innervation, lymphatic drainage.
11. Topographic anatomy of the mastoid process. Layer-by-layer structure, blood supply, innervation, lymphatic drainage. Trepanation of the Chipault triangle.
12. Topographic anatomy of the vessels and nerves of the cranial vault. Distribution zones.
13. Topographic anatomical substantiation of ways of phlegmon spreading, purulent edema and hematoma on the vault of the skull. Incisions on a cranial vault.
14. Primary surgical treatment of cranial (permeable and impenetrable) wounds.
15. The main methods of stemming the blood flow from blood vessels of the subcutaneous tissue, skull bones, sinuses of a dura mater, brain vessels.
16. Bone-plastic and decompressive trepanation of the skull.
17. Anthrotomy. Mistakes and complications.
18. Topographic anatomy of the cheek area. Borders, layer-by-layer structure, blood supply, innervation. Ways of spreading of purulent processes on this area.
19. Topographic anatomy of parotid salivary glands and their excretory ducts. Topographic anatomy of the triangle of Tsakadze, its clinical significance.
20. Topographic anatomy of the deep part of the face. The deep region of the face according to Pirogov: temporopterygoideal space and interpterygoideal spaces. Ways of spreading of purulent processes of the deep region of the face.
21. Topographic anatomy of the nose. External nose, nasal cavity. Paranasal sinuses.
22. Topographic anatomy of the orbit. It's walls, content. Ways of spreading of purulent processes on this area.
23. Topographic anatomy of the mouth cavity. Tongue (blood supply, innervation, lymph flow).
24. Hard and soft palate. Blood supply, innervation, lymphatic drainage.
25. Topographic anatomy of the bottom of the oral cavity. Borders. Muscles of the bottom of the oral cavity. Cellular space of the area. Incisions during the phlegmons of the bottom of

the oral cavity.
26. Topographic anatomy of the teeth on the upper and lower jaws. Sources of blood supply and innervations of teeth of the upper jaw and the lower jaw.
27. Parapharyngeal and retropharyngeal spaces. Topographic anatomy of anatomical formations located in them. Ways of spreading of purulent processes.
28. Topographic anatomy of the trigeminal nerve, its practical value.
29. Topographic anatomy of the facial nerve and its branches.
30. Primary surgical treatment of maxillofacial wounds. Classification of fractures of the upper jaw.
31. Primary surgical treatment of maxillofacial wounds. Principles of imposition and types of cosmetic sutures.
32. Principles of central anaesthesia near the oval hole (intraoral and extraoral pathways).
33. Principles of central anaesthesia near the round hole (palatal, tuberal, orbital, submalar-pterygoid ways).
34. Principles of peripheral anaesthesia for the teeth of the upper jaw.
35. The technique for performing tuberal anaesthesia, possible complications.
36. The technique for performing incisive anaesthesia, possible complications.
37. The technique for performing infraorbital anaesthesia in the intraoral and extraoral ways. Possible complications.
38. Principles of peripheral anaesthesia of the teeth of the mandible.
39. The technique for performing mandibular anaesthesia intraoral and extraoral ways. Possible complications.
40. The technique for performing torusal anaesthesia. Possible complications.
41. The technique for performing mental anaesthesia in intraoral and extraoral ways. Possible complications.
42. The technique of palatine anesthesia. Possible complications.
43. Phlegmons of the face, ways of their distribution. Incisions during the purulent processes on the face.
44. Maxillotomy. Possible complications with maxillotomy.
45. Dissection of the frontal sinus. Possible complications in frontontomy.
46. Principles of resection of the upper and lower jaws.
47. Uranostaphyloplasty. Surgical technique.
48. The technique for congenital cleft lip (cheiloplasty).
49. Skin plastic, types and surgical techniques. Use of it in dentistry.
50. Principles of plastic surgery on the face. Use of arterial transplants on the vascular leg according to V. M. Sokolov. Donor graft areas.
51. Filatov flap (indications, surgical technique).
52. Borders, external borders of the neck. Division into sections and triangles. Neck fascias according to Shevkunenko.
53. Fascial spaces of the neck, their connection with cellular spaces of adjacent regions (head, chest and upper limb).
54. Topographic anatomy of cellular spaces of the neck. Ways of spreading of purulent processes to adjacent areas.
55. Topographic anatomy of the suprahyoid region.
56. Topographic anatomy of the submandibular triangle. Vascular-nerve formations and lymph nodes. Pirogov triangle, its practical significance.

57. Topographic anatomy of the submandibular salivary gland, its duct.
58. Topographic anatomy of the submandibular triangle. The practical significance of it.
59. Topographic anatomy of the sublingual region. Borders, layer-by-layer structure. Blood supply, innervation of the area. Lymph nodes of the hyoid region.
60. Topographic anatomy of the medial triangle of the neck. Its borders, division into triangles. Fascias and cellular spaces of the medial neck triangle.
61. Topographic anatomy of the carotid triangle of the neck. Layer-by-layer structure. The main vascular-nerve bundle of the neck, its topographic anatomy.
62. Topographic anatomy of the common, external and internal carotid arteries. The projection of incisions during the access to the external and common carotid arteries.
63. Topographic anatomy of the omoclavicular triangle and omotrapezoid triangle. Their practical significance.
64. Lateral triangle of the neck. Its borders, division into triangles. Fascias and cellular spaces of the lateral neck of the triangle. Spatium antescalenum, spatium interscalenum and spatium scalenovertebrale, their contents.
65. Topographic anatomy of the sternocleidomastoid region.
66. Topographic anatomy of the thyroid and parathyroid glands.
67. Topographic anatomy of the larynx, trachea, pharynx and esophagus. Lymphoepithelial ring of Pyrohov-Valdeyer.
68. Vagosympathetic blockade according to O. V. Vyshnevskyi.
69. Vagosympathetic blockade according to M. N. Burdenko.
70. Baring and ligation of the common and external carotid arteries in the carotid triangle. Development of collateral blood circulation. Possible complications.
71. Ligation of the tongue artery in the carotid triangle and Pirogov's triangle.
72. Surgical access to the esophagus. Principles of operations on the cervical part of the esophagus.
73. Outer dissection of the esophagus. Indications, performing technique.
74. Tracheostomy. The main types of tracheostomy. Upper tracheostomy. Indications, complications. Cricothyrotomy.
75. Lower tracheostomy. Indications, performing technique.
76. Tracheostomy according to Burke. Indications, performing technique.
77. Subtotal, subfacial strumectomy according to A. V. Nikolaiev. Indications, surgical techniques.
78. Venipuncture and venesection. Indications, performing technique.

**Practical skills for modular control**

1. The technique for performing conductive anesthesia near the round hole (submalar-pterygoid way).
2. The technique for performing conductive anesthesia around the round hole (tuberal path).
3. The technique for performing conductive anesthesia near a round hole (palatal way).
4. The technique for performing conductive anesthesia near the round hole (orbital way).
5. The technique for performing anesthesia near the oval hole (submalar way ).
6. The technique for performing anesthesia near the oval hole (submaxillary - wing-shaped way).
7. The technique for performing peripheral anesthesia of the upper jaw. Tuberal anesthesia.
8. The technique for performing peripheral conductive anesthesia of the upper jaw. Infraorbital anesthesia (extraoral method).

9. The technique for performing peripheral conductive anesthesia of the upper jaw. Infraorbital anesthesia (intraoral method).
10. The technique for performing peripheral conductive anesthesia of the mandible. Mandibular anesthesia (extraoral method).
11. The technique for performing peripheral conductive anesthesia of the mandible. Mandibular anesthesia (intraoral methods – dactyl, apodactyl).
12. The technique for performing palatine anesthesia.
13. The technique for performing torus anesthesia.
14. The technique for performing mental anesthesia.
15. The technique for performing anesthesia according to Bershe-Dubovym.
16. The technique for the ligation of tongue artery.
17. The technique for performing a facial artery ligation.
18. The technique of maxillotomy.
19. The technique of dissection of the frontal sinus.
20. Incisions with phlegmons of the face.
21. Incisions with phlegmons of the neck.
22. Access and baring of the esophagus.
23. The technique of primary surgical treatment of facial wounds.
24. The technique of primary surgical treatment of neck wounds.
25. The technique of venipuncture.
26. The technique of venesection.
27. The technique of upper tracheostomy.
28. The technique of lower tracheostomy.
29. The technique for performing the ligation of the common carotid artery.
30. The technique for performing vagosympathetic blockade according to O. V. Vyshnevskyi.

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