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CLINICAL ANATOMY, PHYSIOLOGY AND RESEARCH METHODS OF THE LARYNX. DIAGNOSIS AND TREATMENT OF THE MAIN TYPES OF ITS PATHOLOGY

Study guide

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This study guide is aimed at developing basic knowledge on clinical anatomy, physiology and research methods of larynx, inflammatory and non-inflammatory diseases of the larynx, precancerous diseases and emergencies caused by laryngeal diseases. In accordance with the requirements of evidence-based medicine, the treatment of various nosological diseases of the larynx is briefly described.

For English-speaking students of medical specialties of Institutions of higher education, interns, otolaryngologists and general practitioners (family medicine).

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FOREWORD

Today, diseases of the ENT organs in general, as well as the larynx in particular, are faced not only by otorhinolaryngologists, but also by family doctors, pediatricians, intensivists, oncologists and other doctors of various specialties. Therefore, clinical otorhinolaryngology occupies one of the leading positions in modern medicine.

This tutorial describes the clinical anatomy, physiology, functions and methods of examination of the larynx. The mechanisms of voice formation and voice mutations are highlighted. Topical issues of modern otorhinolaryngology on non-inflammatory and inflammatory diseases, precancerous diseases of the larynx, injuries and foreign bodies of the larynx, trachea and bronchi are considered. Information on the etiology, pathogenesis, clinical picture, diagnostic methods, as well as methods of providing emergency care to patients with laryngeal pathology in accordance with treatment protocols approved by the Ministry of Health of Ukraine are presented in an accessible form.

The training manual is designed for students of medical specialties (222 "Medicine", 221 "Dentistry", 228 "Pediatrics"), interns, otolaryngologists and general practitioners (family doctors).

In addition to the coverage of the main material, the manual contains questions for self-control, test questions and situational tasks from the database "Step-1" in order to consolidate the studied material and self-control of its assimilation. The manual outlines all topics in accordance with the curriculum.

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Associate Professor

1 CLINICAL ANATOMY AND PHYSIOLOGY OF THE LARYNX

1.1 Topographic and anatomical characteristics of the larynx

The larynx is a hollow organ that is the lower part of the upper respiratory tract and contains the vocal apparatus. It is located in the front of the neck under the hyoid bone in front of the spine. The upper part of the larynx is an extension of the pharynx, the lower part is connected to the trachea.

Topographically, in an adult this organ corresponds to the location of IV-VI cervical vertebrae, in children the larynx is located higher and corresponds to III-IV cervical vertebrae, in the elderly the larynx descends to the VII cervical vertebra.All these factors are taken into account when determining the level of tracheostomy. Children undergo a lower tracheostomy because lower tracheal rings are available for dissection. This should be done because the farther the dissection from the cartilage of the larynx, the more successful the decannulation. Adults have an upper tracheostomy.

The larynx borders the mobile organs - the hyoid bone, the tongue, the lower jaw, the trachea, the esophagus, the vascular-nervous bundle of the neck. All these formations are mobile, so the larynx is also mobile. It moves when breathing, swallowing, while talking. During swallowing and exhalation the larynx rises, during inhalation it goes down.

In the case of damage to the larynx by a malignant tumor and the growth of the tumor in the surrounding tissues, it becomes immobile.

There is the lower part of the pharynx behind the larynx - the laryngopharynx (hypopharynx). Starting from the level of

the annular cartilage (VI cervical vertebra), the pharynx passes into the esophagus. Therefore, foreign bodies entering the hypopharynx and the initial esophagus can cause laryngeal stenosis, especially in children.

1.2 Cartilage, joints and ligaments of the larynx

The larynx is built on the principle of the musculoskeletal system. It has a skeleton in the form of cartilage, its connections in the form of ligaments and joints, as well as muscles that move the cartilage, which leads to a change in the size of the glottis and the degree of tension of the vocal folds.

There are three single (cricoid, thyroid and epiglottis) and three paired (arytenoid cartilages, corniculate cartilages and cuneiform cartilages) cartilage (Fig. 1).

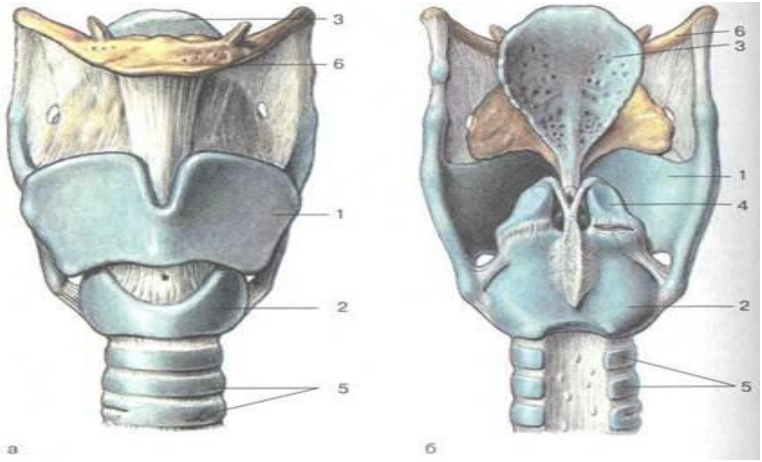

Figure 1 - Cartilage of the larynx: (a) - front view; (b) - back view: 1 - thyroid cartilage, 2 - cricoid cartilage, 3 - epiglottis (epiglottis cartilage), 4 - arytenoid cartilages, 5 - rings of the trachea, 6 - hyoid bone

Cricoidcartilage ***(cartilago cricoidea)*** is the basis of the larynx. It resembles a ring in shape, the extended part of which - the plate ***(lamina)*** - is turned back, and the narrow arc ***(arcus)*** - forward.

Thyroid cartilage ***(cartilago thyroidea)*** consists of two plates connected at an angle, open backward, and placed above the annular cartilage. There is a notch between the plates.The upper and lower horns ***(cornu superius et inferius)*** extend from the back of the plates on each side.The upper cartilage horns are connected to the large horns of the hyoid bone, the lower ones are connected to the lateral surface of the annular cartilage arch. The upper corner of the thyroid cartilage is well visible in men and is called the "Adam's apple" ***(pomum Adami)*** – according to the Bible, Adam choked on an apple stuck in this place.

The epiglottis cartilage ***(cartilago epiglottica)***, or epiglottis, has the form of a petal and is attached to the thyroid cartilage in the area of its notch. Arytenoid cartilages ***(cartilagines arytenoideae)*** resemble a ladle. In the ladle cartilage distinguish the base, which has two processes – the external muscular and internal vocal cords and the apex.

Corniculate cartilages ***(cartilagines corniculatae)*** are located near the top of the arytenoid. Cuneiform cartilages (cartilagines cuneiformes) are located in the thickness of the arytenoid-epiglottis fold. These cartilages are sesamoid. They strengthen the outer plate of the larynx.

The larynx has another one sesamoid cartilage in the thickness of the lateral parts of the thyroid sublingual membrane – granular cartilage ***(cartilage triticea)***.

There are two joints in the larynx, both paired:

1 The cricothyroid joint ***(articulatio cricothyroidea)*** is formed between the lateral surface of the arch of the annular cartilage and the lower horns of the thyroid cartilage. As a result

of movements in this joint, the thyroid cartilage leans forward, which causes tension or relaxation of the vocal folds.

2 The ***articulatio cricoarytenoidea*** is formed between the upper border of the seal of the cricoid cartilage and the lower surface of the arytenoid cartilage. There are some movements in it:

- Rotation around the vertical axis of the arytenoid cartilage - the vocal processes and vocal folds converge or move apart;

- Sliding movements of the arytenoid cartilages on the upper surface of the seal - the cartilages diverge and converge, causing the glottis to expand and contract.

The larynx has many connections. The thyrohyoid membrane ***(membrana thyrohyoidea)*** is located between the hyoid bone and the upper edge of the thyroid cartilage. The larynx is suspended from the hyoid bone by this membrane. The vascular-nervous bundles of the larynx pass through its lateral departments, which are taken into account during anesthesia of the upper laryngeal nerve and its blockade.

The epiglottis is also connected to the hyoid bone by ***(lig. hyoepiglotticum).*** The epiglottis is connected to the thyroid cartilage by the thyroid epiglottis ligament ***(lig. thyroepiglotticum***).

The larynx is connected to the trachea by a cricotracheal ligament ***(lig. cricotracheale)***.When performing a tracheostomy, it should be remembered that this ligament and the first ring of the trachea can not be dissected, otherwise the tracheo cannula will press on the cricoid cartilage, causing its bed-sore and further - scar stenosis..

An elastic membrane adjoins the inner surface of the laryngeal cartilage ***(membrana fibroelastica laryngca).*** It consists of two parts:

1 A quadrangular membrane ***(membrana quadrangularis),*** the upper edge of which is the arytenoid-

epiglottis ligament ***(lig. aryepiglotticum),*** is part of the arytenoid-epiglottis fold, and the lower edge of which is the base of the vestibular fold ***(lig. vestibulare)***, which limits the dorsum of the larynx.

2 The elastic cone ***(conus elasticus),*** the upper free edge of which is the vocal cord ***(Iig. vocnie)***, and the anterior lower fibers of which are the cricothyroid or conical ligament ***(lig. cricothyroideum seu conicum).***

Conic ligament dissection - conicotomy - is a type of throat dissection. It is performed in extreme conditions and then in specialized conditions, but a classic tracheostomy is performed as soon as possible. Leaving the tracheo cannula between the cricoid and thyroid cartilages is not allowed, because there are bedsores of cartilage, chondroperichondritis and cicatricial laryngeal stenosis.

Lig. glossoepiglotticum medianum et laterali connect the epiglottis to the root of the tongue. The recesses between the middle and lateral ligaments are called valecules. Foreign bodies often get there, most often small fish bones.

1.3 External and internal muscles of the larynx

The muscles of the larynx are divided into laryngeal-skeletal (or external) and own (or internal) (Fig.2).

The external muscles of the larynx raise and lower the larynx. They are, to some extent, a laryngeal shield because they are located in front of it.

The external muscles of the larynx can also be divided into two groups. The first group is characterized by the fact that one end of the muscle is attached to the larynx and the other to the skeletal bones.There are three such muscles: sternothyroid muscle (***m. sternothyroideus***), sternohyoid muscle (***m. sternohyoideus***) i thyrohyoid muscle

(***m. thyrohyoideus***). The second group also consists of three muscles that affect the movement of the larynx indirectly, through the effect on the hyoid bone. One end of these muscles attaches to the hyoid bone and the other to the other skeletal bone. These are the following muscles: omohyoidmuscle (***m. omohyoideus***), stylohyoid muscle (***m. stylohyoideus***) and digastrics muscle (***m. digastricus***). The lower laryngeal constrictor also takes some part in the movement of the larynx.

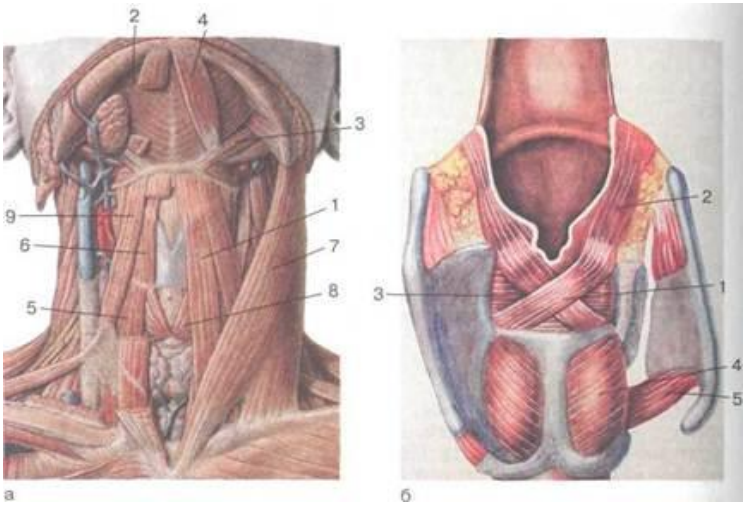

Figure 2 - Muscles of the larynx:
(a) - Extrinsic:
1 - sternohyoid muscle, 2 - mylohyoid muscle, 3 - stylohyoid muscle, 4 - digastric muscle, 5 - sternothyroid muscle, 6 - thyrohyoid muscle, 7 - sternocleidomastoid muscle, 8 - cricothyroid muscle, 9 - omohyoid muscle;
(b) - Intrinsic:
1 - oblique epiglottic muscle, 2 - aryepiglottic muscle, 3 - transverse arytenoid muscle; 4 - posterior cricoarytenoid muscle, 5 - cricothyroid muscle

The internal muscles of the larynx give movement to the cartilage of the larynx, change the width of its cavity, as well as the width of the glottis, limited by the vocal folds. They are characterized by the fact that one end of them is attached to one cartilage of the larynx, and the other - to another cartilage. The most convenient classification of the internal muscles of the larynx was developed by M. Gracheva (1956). The classification is based on their functional features. According to this classification, the internal muscles of the larynx are divided as follows:

1 The main laryngeal dilator – posterior cricoarytenoid muscle***(m. cricoarytenoideus posterior seu m. posticus)*** - is paired, starting from the posterior surface of the plate of cricoid cartilage and attaching to the muscular process of the arytenoid cartilage, pulling the muscular process posteriorally and medially during contraction. This causes the vocal process of the arytenoid cartilage to rotate laterally and the glottis to expand.

2 The main laryngeal cricothyroid muscle ***(m. cricothyroideus seu m. anticus),*** paired. The muscle is attached at one end to the arch of the cricoid cartilage and at the other end to the plate of the thyroid cartilage (straight part) and to its lower horn (oblique part). The muscle tilts the thyroid cartilage forward, thus moving it away from the arytenoid cartilage. This tightens the vocal folds and narrows themd.

3 Auxiliary muscles. They help either the main dilator or the main constrictor. Due to reciprocal innervation, some of them contract, while others relax at the same time. This occurs automatically according to the contraction or relaxation of the posterior posterior cricoarytenoid muscle or cricothyroid muscle. If the main dilator works, the helper muscles also help to widen the glottis, and if the main constrictor works, they help to narrow the glottis.

This group consists of three muscles: lateral cricoarytenoid muscle ***(m. cricoarytenoideus lateralis)***, transverse arytenoid muscle ***(m. arytenoidus transversus)***, oblique arytenoid muscle ***(m. arytenoideus obliquus)***.

The lateral cricoarytenoid muscle is paired. It originates from the lateral surface of the cricoid cartilage, extends upward and backward, and attaches to the muscular process of the arytenoid cartilage. The muscle pulls the arytenoid cartilage forward and downward, while the vocal cords, attached to them, come together and the vocal fold narrows.

The transverse arytenoid muscle is the only unpaired muscle of the larynx stretched between the posterior surfaces of the arytenoid cartilages. When contracted, the muscle pulls the arytenoid cartilages together, narrowing the glottis, especially at the back.

The oblique arytenoids are paired and lie behind the transverse arytenoid muscles. The oblique arytenoids extend from the base of one arytenoid cartilage to the apex of another, with the muscles intersecting at an acute angle. Their contraction helps to narrow the entrance to the larynx and the laryngeal vestibule.

4 Muscles that control the vocal folds. These muscles relax or tense the vocal cords. This group of muscles includes: vocal muscle (***m. vocalis***), thyroarytenoid muscle ***(m. thyroarytenoideus) and*** cricothyroid muscle ***(m. cricothyroideus seuanticus).***

The paired vocal muscle lies in the thickness of the ***plica vocalis***. Plica vocalis are in close contact with the ***lig. vocale*** medially and laterally to the fibers of the ***m. thyro-erythenoideus.*** *The* ***mustle vocalis*** originates from the lower part of the cartilaginous horn and is attached posteriorly to the lateral surface of the ***proc. vocalis***. During contraction, the muscle pulls the ***proc. vocalis*** forward, causing the vocal folds to relax.

The paired thyroarytenoid muscle has a square shape, starts from the inner surface of the cartilage plates and attaches to the muscular process of the arytenoid muscle. During the contraction of the muscles of one or another side of the laryngeal cavity above the vocal folds ***(regio supraglottica)*** narrows, the vocal cord is pulled forward, and the vocal folds relax.

The cricothyroid muscle tenses the vocal folds. In professional singers, hypertrophy of this muscle can even simulate an enlarged thyroid gland.

5 The muscles that control the epiglottis. This group includes the following muscles: aryepiglottic muscle ***(m. aryepiglotticus***), oblique aryepiglottic muscle ***(m. aryepiglotticus obliqus)*** and thyroeppiglottic muscle ***(m. thyroepiglotticus).***

The aryepiglottic muscle, paired, is an extension of the oblique aryepiglottic muscle, which begins at the apex of the arytenoid cartilage and attaches to the edge of the epiglottis. The aryepiglottic muscle and the oblique aryepiglottic muscle contract, narrowing the entrance to the larynx and the vestibule of the larynx.

The thyroeppiglottic muscle, paired, located on the side of ***lig. thyroepiglotticus,*** originates from the inner surface of the plate of thyroid cartilage It is attached to the edge of the epiglottis and partly passes into the ***plica aryepiglotticci***. During its contraction, the muscle pulls the epiglottis and opens the entrance to the larynx, acting as an expander of the entrance and the larynx.

1.4 Clinical anatomy of the laryngeal cavity

The shape ofthethe laryngeal cavity ***(cavum laryngis)*** resembles hourglass: it is narrowedin the middle, widened at the top and bottom.

The entrance to the larynx is limited in front by the epiglottis, behind - the tops of the arytenoid cartilage together with the fold of the mucous membrane between them, on the sides - the folds of the mucous membrane stretched between the epiglottis and the arytenoid cartilage – ***plica aryepiglottica***. On the sides of the laryngeal folds there are pear-shaped depressions, or pockets ***(recessus piriformes)***, which are part of the pharynx. Pear-shaped pockets pass behind the larynx into the esophagus. There is a depression between the tongue and the lingual surface of the epiglottis called a vallecula. Pear-shaped pockets and valleculae often contain foreign bodies, most commonly fish or, less commonly, meat bones.Stasis of saliva in pear-shaped pockets indicates a violation of esophageal patency, particularly in the case of foreign bodies of the esophagus.

The mucous membrane of the larynx is lined with multilayered ciliated epithelium, except for the vocal folds, the lingual surface of the epiglottis and the arytenoid area, where the epithelium is multilayered flat. Laryngeal cancer mostly occurs in these departments.

The mucous membrane of the larynx in the area of the epiglottis and vocal folds is tightly connected with the surrounding tissues. In other places (arytenoid cartilage, pear-shaped sinuses, liningspace) there is a layer of loose fiber under the mucous membrane, due to which edema may occur here.

There are three floors of the larynx: upper, middle and lower. The upper floor, or vestibule of the larynx ***(vestibulum laryngis)***, extends from the entrance to the larynx to the vestibular folds ***(plica vestibularis)***. In the thickness of the vestibular folds, there is inactive in terms of functionality muscle - Simanovsky-Rüdinger ***(m. ventricularis)*** - which closes the vestibular folds. This muscle is involved in the

formation of the wrong voice when there is a violation of the mobility of the vocal folds.

The middle floor of the larynx corresponds to the vocal folds, between which the glottis***(rima glottidis)*** is formed.

The lower floor is the liningspace, or subvocal cavity ***(cavum infraglotticum)***, downwards it expands in the form of a cone and passes into the tracheal cavity. This floor of the larynx has its own structural features: under the mucous membrane is a loose connective tissue. Swelling is often observed here. This is especially true for young children. Swelling and infiltration of the mucous membrane and submucosal layer of the liningspace are some of the main components of airway obstruction in the case of acute laryngotracheitis in children.

The cavity between the ***plica vestibularis and the plica vocalis*** is called the ventricle of the larynx ***(ventriculum laryngis)***. These are rudimentary formations of "voice and throat sacs" of monkeys, in which they continue under the skin and are resonators. Simangs and gibbons, which have particularly large throat sacs, make exceptionally loud noisesBoth can be unmistakably attributed to the loudest creatures on earth. In pathology, air cysts of the larynx emerging from the laryngeal ventricles are observed, if a valvular mechanism is formed at the same time.

In the larynx, there is lymphadenoid tissue, which is submucosally in clusters located in the laryngeal ventricles, pear-shaped sinuses and valecules. The largest of these clusters is located in the laryngeal ventricles, the so-called laryngeal tonsil. Inflammation of the lymphadenoid tissue of the larynx is called laryngeal angina.

1.5 Blood supply and lymphatic system of the larynx

The blood supply to the larynx comes from ***aa. thyroidea superiores*** (branch of the external carotid artery) ***et inferiores*** (branch of the thyrocervical trunk). The superior and middle laryngeal arteries depart from the superior thyroid artery***(aa. laryngeae sup. et med).*** The inferior laryngeal artery departs from the inferior thyroid artery***(a. laryngea inferior).***

Venous outflow is carried out through a plexus and veins of the same name in an internal jugular vein.

The lymphatic system of the larynx consists of two divisions, separated from each other by vocal folds. The upper is more developed, draining from it is carried out into the cervical lymph nodes along the internal jugular vein, from the lower - into the nodes in front of the cricothyroidligament or on the isthmus of the thyroid gland, along the internal jugular vein and into the pretracheal nodes.The upper and lower departments anastomose with each other through numerous vessels of the vocal folds.

Due to the fact that the upper part of the lymphatic system of the larynx is better developed, in the case of cancer of the upper floor, laryngeal metastases occur earlier and more often. During extirpation of the larynx, the isthmus of the thyroid glandis resected, because there are often metastases to the lymph nodes located on it.

1.6 Innervation of the larynx

The larynx receives sympathetic innervation from the ***truncus sympathicus.*** Sympathetic nerves of the larynx depart from the upper cervical sympathetic and stellate ***(ganglion stellatum)*** nodes.

Parasympathetic innervation of the larynx is carried out due to the vagus nerve. ***N. laryngeus superior*** departs from the

ganglion nodosum. It is a mixed nerve consisting of two branches:

- Internal ***(ramus internus),*** which penetrates the larynx through the sublingual membrane and carries out sensitive innervation of the mucous membrane of the laryngeal cavity to the glottis;

- Eternal ***(ramus externus)*** - a motor part of the upper laryngeal nerve, innervating only one internal muscle of the larynx - the main constrictor ***(m. cricothyorideus seu anticus)*** and the lower pharyngeal constrictor.

All other muscles of the larynx are innervated by the recurent laryngeal nerve ***(n. laryngeus recurrens),*** a branch of which is***n. laryngeus inferior. N. laryngeus ini.*** also contains sensitive fibers coming to it from***n. laryngeus sup.*** through the Galen loop, they carry out sensitive innervation of the mucous membrane below the vocal folds.

Motor innervation of the larynx may be disrupted due to compression of ***n. laryngeus recurrens*** in the thoracic cavity by tumor of the mediastinum or apex of the lung, aortic aneurysm, enlarged lymph nodes of the mediastinum. At the same time, the laryngoscopic picture is characteristic: half of the larynx is limited in mobility or immobile. The glottis takes the shape of a right triangle.

Sensitive nerve fibers are distributed unevenly in the larynx. According to researches of M. Grachova (1956), there are three reflexogenic zones in the larynx:

- The first zone - the laryngeal surface of the epiglottis and the edge of the aryepigloittic folds;

- The second zone – the anterior surface of the arytenoid cartilage and the space between the vocal cords, the mucous membrane of the vocal folds;

- The third zone – the lower floor of the larynx.

The first and second reflexogenic zones provide respiratory function. The third zone provides the act of phonation.

1.7 Functions of the larynx. Voice mutation. Singing voice

1 The larynx performs the following functions:
2 Respiratory.
3 Protective.
4 Phonatory (voice).

Respiratory function. The amount of air entering the lower respiratory tract is regulated by the expansion and contraction of the glottis by the neuromuscular apparatus of the larynx. ***M. cricoarytenoideus posterior***, which expands the glottis, shrinks during inspiration.

The respiratory center is located in the medulla oblongata and is connected to the vagus nerve, which innervates the larynx. Passing through the larynx, air plays the role of a stimulus to the receptor apparatus of this organ in the occurrence of reflex changes in rhythm and depth of respiratory movements.Irritation of the receptors of the larynx and trachea causes impulses in the respiratory muscles, first of all the intercostal and diaphragm, which also affects the condition of the glottis. The larynx, regulating the function of external respiration, affects the filling of the alveoli with air, the diffusion of gases in them, the blood supply to the heart cavities.

Protective function. When swallowing, the epiglottis and other elements of the dorsum cover the entrance to the larynx and thus isolate the airways from the esophagus. During each swallowing movement, the position of the larynx changes: it moves upwards and from back to front. As a result, the entrance to the larynx is higher than the food lump, which passes through its lateral surfaces and through the pear-shaped sinuses enters the esophagus, not the respiratory tract.The tongue simultaneously presses on the epiglottis, the glottis deviates, so it closes the entrance to the larynx, and the

vestibular and vocal folds close. Separate phylogenetic function is one of the earliest functions of the larynx. Another protective mechanism also developed from it: a spasm of the entrance to the larynx and glottis occurs in the case of entry of foreign bodies and harmful impurities with inhaled air. An important protective mechanism of the larynx is a reflex cough (forced exhalation), which facilitates the evacuation of solid, liquid and gaseous particles. Expectoration also contributes to this. The ciliated epithelium, lymphadenoid tissue of the larynx, and bactericidal properties of mucus perform a barrier function.

Phonator (voice) function. The larynx resembles a reed wind instrument, while the vocal folds can change length and shape.

Sound production occurs on exhalation during the closing of the vocal folds. Not the air oscillates the vocal cords, but the vocal cords, which rhythmically contract, give the air current an oscillating character. Vocal fluctuations are the cause of voice formation.

The whole respiratory system, from the lungs to the nose, takes a complex part in sound formation. The lungs, bronchi, and trachea play the role of bellows, and the pharynx, nasal cavity, and mouth play the role of resonators.

The vocal cords oscillate due to the influence of ***m. vocalis***, which contract under the action of rhythmic impulses coming from the centers of the brain with a sound frequency.

However, the "connective" sound is not at all like the sounds of a living voice. The voice acquires the natural human timbre only thanks to system of resonators, that is, it consists of the basic tone and overtones. The role of resonators is played by air cavities, the most important of which are the pharynx, nasal and oral cavities.

The main sound is formed in the larynx, while the speaking is formed in the superficial tube and is possible due to

the articulatory movements of the lips, soft palate, tongue, lower jaw, and larynx.

The voice is characterized by strength, pitch, and timbre. The strength of the voice is determined by the power of exhaled air, the degree of tension of the vocal folds, the amplitude of their oscillations. The pitch of the voice is determined by the number of oscillations of the vocal folds per second, which also depends on the length, elasticity and thickness of the latter. Timbre determines warmth, softness and melody of the voice. The timbre is formed due to the overtones or harmonics formed in the resonators. In vocals there are constant and variable resonators. The cavities of the pharynx, mouth and nose, which are the so-called superficial tube, belong to the constants. Changing resonators are emotions that change the voice during a lecture or singing. The timbre of the voice has age-specific features.

Singing voice. Children's singing voices are divided into treble and viola. Treble - high children's voice, viola - low (above the tenor).

Up to 3 years, the length of the larynx is the samein boys and girls. Its clearance is funnel-shapedin children, and in adults - cylindrical.It is notedmanifest growth of the larynx at the age of 5-7 years and during puberty: in girls - at 13-14 years, in boys – at 14-16 years. This is the period of the most intense growth of the larynx. It increases by 2/3 in boys, and in girls - by half. At this time there is the physiological redness of the larynx, "causeless" hoarseness. Ultimately, this physiological process causes a change in voice, the so-called mutation of the voice.As a result of the mutation, the timbre, strength and pitch of the voice change. Treble can be tenor, and viola - baritone or bass. During the mutation in boys the voice is reduced by an octave, in girls - by two tones. An example of how a mutation changes the voice is the Italian singer Robertino Loretti.

Male singing voices are divided into tenor (high voice) - the length of the vocal cords is 15-17 mm, the number of

oscillations – 122-580 Hz; baritone (medium pitch voice) - the length of the vocal cords is 18-21 mm, 96-426 oscillations per 1 second; bass (low voice) - the length of the vocal cords is 23-25 mm, 81-325 oscillations per 1 second.

Tenor is divided into lyrical, dramatic (piano requires effort, but sounds strong at the top and bottom) and light. Baritone and bass are divided into low and high.

Female singing voices are divided into soprano (dramatic, lyrical and coloratura) – high voice, length of vocal folds is 10–12 mm, 258–1,304 oscillations per 1 second; mezzo-soprano - medium pitch voice, length of vocal folds is 12–14 mm, 217–1,034 oscillations per 1 second; contralto – low voice, length of vocal folds – 13–15 mm, 145–690 oscillations per 1 second.

The range of the spoken voice is 1 octave, the singing – 2 octaves. Rare singing voices can be in a larger range – up to 4 octaves.

1.8 Methods of examination of the larynx

The main method of examination of the larynx is mirror (indirect or reverse) laryngoscopy (Fig. 3). The method was developed in 1854 by the Spanish singer and one of the greatest teachers of singing Manuel Garcia. However, a year later, the technique of mirror laryngoscopy was adopted by doctors. In Russia, this technique was first used by a prominent pediatrician and pediatric otorhinolaryngologist K. Rauchfus.

This technique is performed using a laryngeal mirror, which is a round mirror attached at an angle of 125^0 to a straight metal rod.

To prevent the mirror from fogging up during the inspection, the mirror surface is slightly heated with alcohol.

The back surface of the mirror should be unheated so as not to burn the pharynx. This is controlled by applying the back of the mirror to the back of the hand. The laryngeal mirror is taken with the right hand, and the fingers of the left hand hold the tip of the tongue through a napkin.At the same time, the doctor's thumb lies on top, the third finger - on the bottom of the tip of the tongue, and the index finger – slightly pushes the upper lip of the patient. The mirror is inserted into the mouth and pressed against the soft palate. Do not touch the mirror to the root of the tongue and the back wall of the pharynx, it can cause a vomiting reflex.

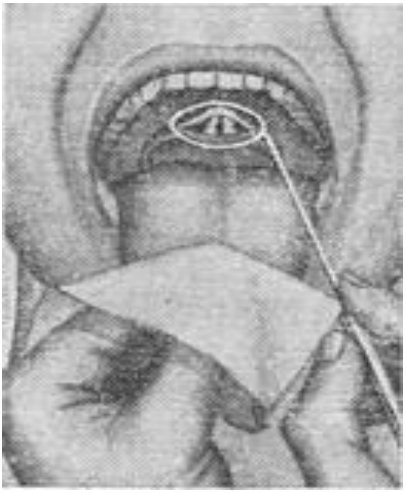

Figure 3 –
Indirect laryngoscopy

During the mirror laryngoscopy, three points are observed: free breathing, phonation of the sound “[ı]” or “[e]”, deep breathing.

At the first moment, pay attention to the condition of the epiglottis, aryepiglottic, parietal and vocal folds, pear-shaped sinuses, assess the condition of the root of the tongue, lingual tonsils, valleculaes. The vocal fold in this case has the shape of a triangle.

At the second moment, it is necessary to determine the closure of the vocal folds. Changing the phonation and inspiration allows you to establish the symmetry of the mobility of the laryngeal halves.

At the third moment – a deep breath – examine the lining space and the upper clearance of the trachea.

In most individuals, mirror laryngoscopy is performed relatively easily. If due to the high pharyngeal reflex it is difficult to perfom a laryngoscopy, then resort to the following techniques: examine the patient on an empty stomach (after a meal the pharyngeal reflex is higher) and, finally, if necessary, do superficial anesthesia of the pharynx. Examination of the larynx can only be considered qualitative if the anterior commissure of the larynx (anterior corner of the glottis) is clearly visible. For a thorough examination of the larynx, it is necessary to use local superficial anesthesia and removal of the epiglottis forward with a laryngeal probe or a specially designed elevator.

If indirect laryngoscopy cannot satisfy the doctor, then do direct laryngoscopy. Direct laryngoscopy was started in 1895 by Kirstein, who offered a special spatula for it.

The essence of the method of direct laryngoscopy is to straighten the angle between the mouth and pharynx with the blade of the laryngoscope, which allows you to examine the larynx and trachea. All laryngoscopes used in otorhinolaryngology can be divided into two groups:

1 Laryngoscopes, held by the hand of a doctor who does direct laryngoscopy;

2 Laryngoscopes inserted into the larynx, held independently, leaving the hands of the doctor who performs the manipulation free; this type of laryngoscopy is called “hanging” or “supporting”.

The technique of direct laryngoscopy is shown in Fig. 4.

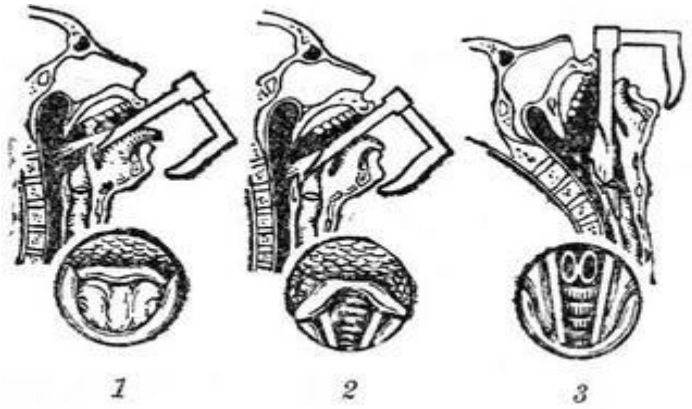

Figure 4 - Direct laryngoscopy: 1–3 - consecutive stages with appropriate endoscopic pictures

The patient lies on his back. His head is slightly thrown back, his neck is elongated. The doctor sits on his headboard. The blade of the laryngoscope is turned on along the midline of the tongue until the appearance of the epiglottis, then it is inserted behind the epiglottis and pulled up.

Microlaryngoscopy is an examination of the larynx using a surgical microscope with a focal length of 300-400 mm, which can be done in the case of both mirror and direct laryngoscopy. The laryngeal microsurgery was developed on the basis of microlaryngoscopy. Kleinsasser (1976) created a set of laryngosurgical microinstruments.

The success of microlaryngoscopy and microsurgery largely depends on analgesia. At the beginning of its development, microlaryngoscopy was performed under local anesthesia. Today, local anesthesia is used only in the case of indirect microlaryngoscopy. Previously, the patient is premedicated using sedatives and antihistamines. Then anesthesia of the pharyngeal mucosa and larynx with 1-2 % solution of dicaine is performed. Indirect microlaryngoscopy is

performed in a “sitting” position - both the patient and the doctor. This method of research should be implemented in outpatient practice, which would contribute to the earlier detection of laryngeal cancer.

Direct microlaryngoscopy allows the surgeon to work with both hands, using a direct instrument. The patient lies supine with the neck extended. After the patient is anesthetized, direct laryngoscopy is performed. The laryngoscope is attached to the patient's chest with a special device. The microscope must be aimed at the larynx.

There are light microlaryngoscopy and fluorescence microlaryngoscopy. Light microlaryngoscopy is an examination in light of different spectral composition (green, yellow, red and blue). Low-contrast details become more contrasted in a certain light. It concerns hyperkeratosis, leukoplakia, small blood vessels and hemorrhages. Such contrast is based on the fact that different parts of the larynx absorb and reflect certain rays of the spectral composition of light in different ways.

Fluorescence microlaryngoscopy is an examination of the larynx after the introduction of one of the fluorochromes, in particular sodium fluorescein. A blue light filter is used to monitor the luminescence of the fluorescein. During this method of examination, the size, shape of vessels, their atypia are defined more intensively and accurately; fluorescein is absorbed differently by the tissues of the larynx.

An important place in the study of the larynx is *laryngostroboscopy*. The method is based on examination of the larynx in intermittent light, which allows you to see individual oscillations of the vocal folds.

During stroboscopy, attention is paid to the type of oscillations of the vocal folds - longitudinal, transverse, wavy and mixed; amplitude of oscillations; the speed of oscillations - it is large and small. The described stroboscopic pictures are

characteristic for various pathological conditions of a larynx (dysphonia, benign, precancerous and infiltrative processes).

A technique using a surgical microscope in combination with an electron stroboscope has been developed - *microlaryngostroboscopy*. A pulsed stroboscope lamp is used instead of a conventional lamp. In the mode of continuous, constant glow of a stroboscope lamp, the microscope can be used as usual operation.

The achievement of medical technology is the development of *fibrolaryngoscopy*. Thanks to the mobility of the flexible end of the fibroscope at 270°, all parts of the larynx are accessible for inspection. The manipulation is performed under local superficial anesthesia. Fibrolaryngoscopy allows for a targeted biopsy and perform high-quality endophotography of the larynx.

A special place among the methods of examination of the larynx is *X-ray diagnosis*. In the clinic of otorhinolaryngology lateral and anterior-posterior projections are used in conventional radiography, tomography in anterior-posterior and lateral projections.

Lateral projection images of the larynx have become the most common during radiography. In this projection the main details of the larynx and peritoneal soft tissues can be seen: epiglottis, aryepiglottic folds, arytenoid cartilages, air-filled laryngeal ventricles, laryngopharynx and root of the tongue are clearly defined.

Tomography is a mandatory part of the radiographic examination of patients with suspected laryngeal tumor or chronic laryngeal and tracheal stenosis. Tomography allows to obtain frontal images of the larynx, on which the condition of the epiglottis, aryepiglottis, vestibular and vocal folds, laryngeal ventricles, lining space, as well as the cervical trachea can be determined.

Computed tomography, which is widely used in the study of various organs and systems, is still underutilized in the diagnosis of diseases of the larynx. The advantage of computed tomography over other means of imaging the larynx is the ability to get a clear idea of the ratio of structures in cross-section, to better determine the depth of cartilage damage, to identify blood vessels and muscles.

2 NON-INFLAMMATORY DISEASES OF THE LARYNX

2.1 Swelling of the larynx

Swelling of the larynx is not an independent disease, but only one of the manifestations of many pathological processes. Swelling of the larynx can be inflammatory and non-inflammatory in nature.

Inflammatory edema of the larynx occurs in the following pathological conditions: laryngeal sore throat, phlegmonous laryngitis, epiglottis abscess, purulent processes in the pharynx, periopharyngeal and retropharyngeal spaces (paratonsillitis, paratonsillar, pharyngeal and lateropharyngeal abscesses), purulent processes of the cervical spine, root of the tongue and soft tissues of the bottom of the mouth.

One of the most common causes of laryngeal edema are injuries: gunshot, blunt, prickly, cutting, thermal, chemical, foreign bodies. Edema occurs in the case of burns of the larynx with hot food, acids and alkalis, frostbite of the larynx. Traumatic laryngeal edema may develop in response to surgery on the larynx and neck in general (for example, in the case of strumectomy), due to prolonged upper tracheobronchoscopy, prolonged and traumatic intubation of the larynx, after radiation treatment of diseases of the neck.

Non-inflammatory edema of the larynx (Fig. 5) occurs under the condition of idiosyncrasy to certain foods (strawberries, eggs, crayfish, etc.), drugs and cosmetics, ie is a manifestation of allergies. This group of causes includes Quincke's angioneurotic edema, in which laryngeal edema is combined with swelling of the face and neck.

Swelling of the larynx can develop with diseases of the cardiovascular system, accompanied by circulatory failure II, III

degrees, kidney disease, cirrhosis of the liver, cachexia. It can occur with some infectious diseases - influenza, measles, scarlet fever, typhus.

Figure 5 – Swelling of the larynx

Swelling of the larynx usually develops in areas where there is a lot of loose tissue in the submucosal layer, i.e. on the lingual surface of the epiglottis, in the aryepiglottic folds, on the posterior wall of the larynx, in the lower floor of the larynx (lining space).

The pronounced swelling of the larynx, which has developed rapidly, especially the swelling of the lower floor of the larynx, is followed by significant respiratory distress.

Treatment for laryngeal edema is aimed at treating the underlying condition that caused the edema and always includes dehydration, hyposensitization, and sedation.

Treatment should always be done in a hospital, as a tracheostomy may be necessary if there is increased difficulty breathing through the larynx.

In case of inflammatory edema of the larynx, it is necessary to dissect the abscess of the larynx or adjacent organs.

The patient is prescribed the following drug treatment: 20 ml of 40 % glucose solutionintravenously, 10 ml of 10 % calcium chloride solution (or 10 ml of 10 % sodium chloride), 5 ml of 5 % sodium ascorbate solution, 5 ml of 40 % urotropin solution, 30-90 mg of prednisolone. Due to the fact that laryngeal edema is often accompanied by spasm of the internal muscles of the larynx, it is recommended to administer intravenously 5-10 ml of 2.4 % solution of euphyllin.Euphyllin is also useful because it has a diuretic effect. Diphenhydramine (1 % - 2 ml) or another antihistamine is administered intramuscularly. 1 ml of 0.1% atropine solution is injected under the skin. Diuretics are indicated (for example, Lasix 1 ml intravenously or intramuscularly).Intranasal blockades are used - a solution of novocaine 0.5-1 % 2-3 ml is injected into the thickness of the lower nasal sinuses. Distractions have a good effect: hot foot baths, mustard on the chest and calf muscles. Distractions should be performed in the absence of cardiovascular failure and severe hyperthermia. In this case, prescribe symptomatic drugs: cardiac and antipyretic.

Inflammatory edema requires the appointment of a powerful anti-inflammatory treatment - antibiotics and sulfonamides. Treatment of allergic edema should begin with the elimination of the allergen. In case of burns of the larynx, anti-shock measures should be taken – 1-2 ml of 2 % promedol solution or 1 % omnopon solution is injected subcutaneously.

2.2 Laryngeal stenosis

Laryngeal stenosis - narrowing of the larynx, which leads to difficulty in breathing (Fig. 6). Laryngeal stenosis, as well as laryngeal edema, is not an independent nosological unit. This condition can be a symptom of a variety of diseases.

Figure 6 -Laryngeal stenosis

Laryngeal stenosis can be acute or chronic. Acute laryngeal stenosis is a difficulty in breathing through the larynx that occurs quickly (within a few seconds, minutes, hours or days). Chronic stenosis develops over weeks, months or years. Taking into account the time factor during which the laryngeal stenosis develops, it is possible to note lightning, acute, subacute and chronic stenosis.

Acute stenosis is caused by various factors:

– Edema – non-inflammatory (allergic) and inflammatory;

– Trauma - gunshot wounds;

– Thermal and chemical burns;

– Surgical interventions (paralysis of the lower laryngeal nerves during strumectomy);

– Prolonged upper tracheobronchoscopy;

– Prolonged and traumatic intubation during endotracheal anesthesia;

– Reflex spasm of the glottis in the case of impact of toxins (eg chlorine);

– Foreign bodies;

– Laryngotracheitis in the case of acute respiratory viral infections (the most common cause in early childhood);

– Laryngeal diphtheria;

– Asthma can occur acutely and in the case of chronic stenosis that accompanies malignant neoplasms of the larynx in adults or laryngeal papillomatosis in children.

The most common causes of **chronic laryngeal stenosis** are as follows:

– Benign and malignant tumors of the larynx;

– Infectious granulomas - gum syphilis, tuberculosis, scleroma;

– Scarring as a result of chondro-perichondritis of the larynx, burns, traumatic injuries, gunshot wounds;

– Extraglottic processes that lead to paralysis of both inferior laryngeal nerves;

– Congenital and acquired laryngeal membranes and cysts.

The cause of laryngeal stenosis can usually be determined during the history and examination of the larynx.

Regardless of what caused the laryngeal stenosis, the clinical picture is the same, at first inspiratory dyspnea develops. There are four stages of the clinical course of laryngeal stenosis: the stage of compensated respiration, the stage of incomplete respiratory compensation, the stage of respiratory decompensation, the terminal stage.

The duration of the stages varies depending on the course of the stenosis. For example, in chronic stenosis, the stages are most clearly visible, whereas in lightning stenosis (aspiration of a large foreign body), only stages III, and IV are visible.

I The stage of compensated breathing is characterized by deepening and more infrequent breathing,

reduction of pauses between inhalation and exhalation, decrease in pulse rate, inspiratory dyspnea which occurs only during exercise.

II The stage of incomplete compensation of respiration is determined by the fact that the breath requires effort, breathing becomes loud, audible at a distance, the skin is pale, the patient behaves restlessly, fussing, the act of breathing involves the accessory muscles of the chest, there is involvement of supraclavicular, subclavianmuscles, jugular fossae, intercostal spaces and epigastrium during inspiration.

III The stage of respiratory decompensation – the patient's condition is extremely severe, breathing is frequent, shallow, pale bluish skin, first – acrocyanosis, then – widespread cyanosis, the patient occupies a forced semi-sitting position with his head thrown back, the larynx makes the maximum excursions downwards during an inhalation and upwards during an exhalation, there is a sweating, pulse becomes frequent, its filling is weak.

IV Terminal stage – the patient develops severe fatigue, indifference, shallow, intermittent breathing (Cheyne-Stokes type), pale gray skin, frequent pulse, filamentous, dilated pupils, then loss of consciousness, involuntary urination, defecation and death.

The choice of treatment is determined first by the stage of stenosis and then by the cause that led to it. Emergency treatment can be conservative or surgical. In the first two stages of laryngeal stenosis, treatment is directed at the pathological process that caused the shortness of breath. Treatment of laryngeal edema includes dehydration, hyposensitization, sedation.

Table 1 –Stages of airway stenosis

Stage	Compensation	The main features	p O_2 (norm 80–90 mmHg)	p CO_2 (norm 28–30 mmHg)	Auxiliary breathing
1	2	3	4	5	6
I	Compensated	Barking cough, light stridor, deepening and slowing of breathing, reduction of pauses between inhalation and exhalation, decrease in pulse rate, inspiratory dyspnea - only during exercise	80 mmHg	28–30 mmHg	100 %
II	Subcompensated	Expressed stridor, breathing becomes loud, audible at a distance, the skin is pale, the patient behaves restlessly, fussing, the act of breathing involves the accessory muscles of the chest, there is involvement of supraclavicular, subclavianmuscles, jugular fossae, intercostal spaces and epigastrium during inspiration	70 mmHg	50–55 mmHg	350 %

Continuation of Table 1

1	2	3	4	5	6
III	Decompensated	the patient's condition is extremely severe, breathing is frequent, shallow, pale bluish skin, first - acrocyanosis, then - widespread cyanosis, the patient occupies a forced semi-sitting position with his head thrown back,the larynx makes the maximum excursions downwards during an inhalation and upwards during an exhalation, there is a sweating, pulse becomes frequent, its filling is weak	70 мм mmHg	50–55 mmHg	700 %
IV	Asphyxia (terminal stage)	Consciousness is darkened or absent. Symptom of shortness of breath. There is a strong fatigue, indifference, shallow, intermittent breathing (Cheyne-Stokes type), pale gray skin, frequent pulse, filamentous, dilated pupils, then there is loss of consciousness, involuntary urination, defecation and death	–	80 мм mmHg	–

Distractions are widely used in the absence of hyperthermia, cardiovascular insufficiency, they include hot foot baths, mustard on the chest and calf muscles. Inhalations of humidified oxygen, and also with alkaline, hyposensitizing and antispasmodics are effective. In the case of an inflammatory process, antibacterial drugs are administered. It is necessary to

make an autopsy of the abscess in the larynx or adjacent organs. In the case of laryngeal diphtheria, the introduction of diphtheria serum is in the foreground.

In the case of stage II and IV stenosis, surgical treatment is always used, usually a tracheostomy. In an emergency, when there is no time to do a tracheostomy, conicotomy or cricoconicotomyare performed. In the case of acute laryngotracheitis in children, the restoration of the laryngeal opening begins with prolonged intubation with thermoplastic tubes.

2.3 Persistent stenosis of the larynx and trachea

Persistent stenosis of the larynx and trachea is a complete stable narrowing or fusion of their lumen with dysfunctions: respiratory, vocal, sometimes in combination with the separation and protective. Such stenoses are usually caused by scarring, median or paramedial placement of the vocal folds due to their paralysis, and therefore, the narrowness of the glottis, deformation and defect of the cartilage of the larynx and trachea, or the presence of several or all of the above changes simultaneously. Patients are usually forced to breathe through a tracheostomy tube. The causes of persistent stenosis of the larynx and trachea are mostly injuries: domestic, industrial, surgical, radiation, etc..

Depending on the pathological changes that disrupted the anatomical architecture of the larynx and trachea, persistent stenoses are divided into 5 main groups:

1 Persistent stenosis with defects of the cartilage of the larynx and trachea:

1) stenoses caused by a defect of the cartilage of the posterior wall of the larynx with a decrease in the transverse size of its opening;

2) stenoses caused by a defect in the cartilaginous skeleton of the lateral walls of the larynx and trachea with a decrease in the anterior-posterior size of their opening;

3) stenoses caused by a defect of the anterior parts of the thyroid cartilage with the presence of narrowing at the level of the vestibular part and vocal folds;

4) stenoses caused by a defect of the cricoid cartilage with the presence of narrowing at the level of the liningcavity;

5) stenosis caused by a defect of the cervical trachea and a scar over the tracheostomy.

2 Defects of the larynx and trachea without scarring (after resection for tumors).

3 Stenosis with deformation of the cartilage of the larynx.

4 Stenoses without deformation and defects of laryngeal cartilage:

1) paralytic (middle) laryngeal stenosis;

2) local or widespread scar narrowing or fusion of the larynx and trachea.

5 Combined-complicated stenoses. Such stenoses occur due to a combination of all the above factors in combination with the presence of laryngeal-pharyngeal or tracheoesophageal fistulas, with complete or partial scar overgrowth of the hole or with the presence of impaired laryngeal separation function.

Treatment of patients with disabling disease can only be operative and is one of the most difficult tasks in plastic, reconstructive surgery.

Methods of surgical treatment of patients with persistent stenosis of the larynx and trachea are divided as follows:

1 Endolaryngeal (endolaryngotracheal). The stenotic area is removed by dissection of thelaryngeal opening and the formation of a laryngostomy or laryngotracheostomy: endolaryngeal chordectomy, endolaryngeal plane or volumetric laryngeal plasticity.

Plane laryngeal plastics involves cutting the scar tissue and replacing the defect of the mucous membrane with a graft (mucous membrane, fascia, skin, etc.).

Volumetric laryngeal plastic surgery means the replacement of defects in the cartilaginous skeleton of the larynx and trachea with a support graft (cartilage, bone, polymeric materials, etc.).

Patients are usually treated in ***five stages***.

The first stage is a laryngostomy, during which the larynx and, if necessary, the trachea are split. A deep and wide laryngeal or laryngeal-tracheal stoma is formed.At the same time, they remove tissues that deform and narrow the opening of the larynx.

The second stage is modeling of the formed opening of a trachea and a larynx by means of gauze tampons or special splints (T-shaped tubes). The average duration of the second stage is 3 months.

The third stage is checking the stability of the created elements of the larynx (and trachea), assessment of respiratory function. The average duration of the third stage is 1 month.

The fourth stage is the suturing of the stoma: one-step or two receptions (initially only the upper part).

The fifth stage is rehabilitation: breathing and orthopedic gymnastics (2–2.5 weeks).

2 Endoscopic methods, which are performed using direct microlaryngoscopy. The reference laryngoscopes, operating microscope, instruments for laryngeal microsurgery are used to do this. Such operations include: endoscopic

chordectomy, endoscopic excision of the scar membrane of the larynx, etc.

3 Extralaryngeal methods. For example, extralaryngeal laterofixation of the vocal fold. The method is used in the treatment of paralytic (middle) stenosis of the larynx, carried out by exposing, stitching and fixing the elastic cone and vestibular fold to the plate of the thyroid cartilage, which allows you to expand the opening of the glottis and restore breathing.

4 Methods of laryngeal-tracheal or intertracheal anastomoses, which provide for preliminary circular (circular) resection of the stenotic airway with subsequent imposition of laryngeal-tracheal or intertracheal anastomoses due to the mobilization of the thoracic trachea.

5 Methods of functional neuroplasty of the vocal apparatus of the larynx.

Restoration of the function of the neuromuscular apparatus of the larynx is achieved through the formation of interneural, neurovascular anastomoses or transplantation of the neuromuscular element in the denervated muscles of the larynx. These methods are currently at the stage of experimental development and clinical testing.

3 INFLAMMATORY DISEASES OF THE LARYNX

Inflammatory diseases of the larynx are divided into acute and chronic.

3.1 Acute laryngitis (laryngitis acuta)

Among acute inflammatory diseases of the larynx, acute laryngitis is the most common. This term refers to catarrhal inflammation of the mucous membrane, submucosal layer and internal muscles of the larynx.

Acute laryngitis is relatively rare as an independent disease. It is usually a manifestation of acute respiratory viral infection (ARI) (influenza, adenovirus infection, parainfluenza, etc.), in which the inflammatory process is also involved in the mucous membrane of the nose and pharynx, and sometimes the lower respiratory tract.. In that case, if the inflammatory phenomena are most pronounced in the larynx, we can assume isolated acute laryngitis. Thus, the first place among the causes of acute laryngitis is occupied by respiratory viruses.

Bacterial flora (primarily coccal) can also cause acute inflammation of the laryngeal mucosa. At the same time, it can cause the disease alone or together with respiratory viruses.

The clinic of acute laryngitis is characterized by a sudden onset in general satisfactory condition or in case of minor illness. Body temperature remains normal or rises to low numbers. There are feelings of dryness, burning, scratching, tickling, foreign body in the larynx, and occasionally - pain when swallowing.Occasionally there is a frequent painful convulsive cough. The voice first gets tired quickly, then becomes hoarse, sometimes there is aphonia. Dry cough is replaced by wet with significant secretion of first mucous and then mucopurulent sputum.

The laryngoscopic picture in the case of acute laryngitis is characterized by the following signs: the mucous membrane is hyperemic, swollen, the vocal folds are pink or even bright red, thickened, there is a viscous secretion in the larynx in the form of mucopurulent strands (Fig. 7). Incomplete closure of the vocal folds can often be detected during phonation.

Figure 7 – Acute laryngitis

Diagnosis of acute laryngitis is not difficult, it is carried out during laryngoscopy.

Treatment of acute laryngitis. If acute laryngitis occurs during an acute infectious disease, home rest is prescribed and a certificate of temporary inability to work is issued. In all other cases, the patient is treated in the clinic without being discharged from work. Exceptions are persons of vocal professions (teachers, artists, announcers), who receive a certificate of inability to work in case of acute laryngitis, which occurs even at normal body temperature and intact general condition.

Patients are forbidden to eat spicy and hot food, alcohol and smoking. Codeine and dionin are prescribed to eliminate

cough and unpleasant sensations in the larynx. Thinning of mucus and elimination of dryness is achieved by using alkaline mineral waters in the heated form or half with hot milk. With excessive amount of thick secretion expectorants are prescribed - acetylcysteine, broncholitin, carbocysteine.

Topical application of heat in the form of steam inhalation, warm compresses, HPV and microwave therapy in the larynx gives a good anti-inflammatory effect.

Inhalations can be not only steam, but also with the addition of drugs (hydrocortisone, borjomi, etc.): oily, alkaline. It is effective to use aerosols with solutions of antibiotics and sulfonamides, as well as proteolytic enzymes: trypsin or chymotrypsin, in the presence of viscous sputum. The pharmaceutical industry releases ready mixtures for pulverization and inhalation - kameton, ingakamf, ingalipt, kamfomen.

Infusion of drugs into the larynx (instillation), performed with a laryngeal syringe, is widely used. For instillation, 1 % oil solution of menthol, antibiotics, hydrocortisone, vasoconstrictors (add a few drops of 0.1 % solution of adrenaline to the solution), 3 % solution of protargol or kolargol are used.

In the treatment of acute laryngitis, distractions and diaphoretics are used: hot foot baths, mustard on the calf muscles, larynx and chest.

If the disease becomes protracted, and local treatment is ineffective, anti-inflammatory drugs of general action are prescribed: antibiotics, sulfaniamides, antihistamines, calcium supplements, ascorbic acid.

With proper treatment the process in the larynx in the case of acute catarrhal laryngitis is completely eliminated within 5–10 days.

3.2 Laryngeal sore throat (angina laryngis)

The term “laryngeal angina” refers to acute nonspecific inflammation of the lymphadenoid tissue of the larynx, located in the parietal ventricles,aryepiglottic folds, interarytenoidspace, pear-shaped sinuses, with the development of edema and mucosal infiltration. The name comes from the Latin word “ango” - to stifle.

The disease is caused mainly by pathogenic strains of cocci (staphylococci, streptococci, diplococci, pneumococci).

Severe laryngeal sore throat is characterized by a significant violation of the general condition of the patient, body temperature rises to 38–39 ^{o}C, there are severe sore throats when swallowing, hoarseness, often difficulty breathing.Palpation of the larynx can be painful. Regional lymph nodes of the neck enlarge, become painful.

During laryngoscopy, hyperemia and infiltration of the mucous membrane of the epiglottis, aryepiglottic, parietal and vocal folds, pear-shaped sinuses are noted. Occasionally there is a pronounced swelling that causes difficulty breathing. Therefore, patients with laryngeal sore throat must be treated in hospital, as a tracheostomy may be required at any time.

In the treatment of patients with laryngeal sore throat, the appointment of antibacterial (protected penicillins, cephalosporins of 2, 3 generations, fluoroquinolones, macrolides) and dehydration drugs is important. The use of drugs orally, especially in the form of tablets, is limited due to painful swallowing.To reduce edema, 40 % glucose solution, 10 % calcium chloride solution, 60–90 mg prednisolone, diuretics (Lasix) are prescribed intravenously. Antihistamines are given intramuscularly. You can use distraction procedures (hot foot baths). Some experts recommend making incisions at the site of edema, which reduces the symptoms of asthma. A good effect can be achieved with the use of cervical novocaine blockade. In

some cases, when decompensated laryngeal stenosis develops, a tracheostomy is used.

With a favorable course, the disease ends with recovery within 6-8 days. Sometimes the process turns into diffuse purulent inflammation of the submucosal layer, muscles, intermuscular tissue, the phlegmonous laryngitisdevelops.

3.3 Acute phlegmonous laryngitis (laryngitis phlegmonosa acuta)

Phlegmonous laryngitis is an acute inflammatory disease of the larynx, when the purulent process spreads not only in the submucosal layer, but also in the muscles and ligaments of the larynx, and sometimes the cartilages are involved in this process.

The cause of the disease can be laryngeal sore throat, external injuries of the larynx and damage to its mucous membrane (foreign body, chemical and thermal burns, etc.). The cooling factor is important in the development of the disease.As a secondary disease, the process can develop in the case of paratonsillitis, abscess of the root of the tongue, typhus, diphtheria of the larynx, blood diseases, sepsis. In rare cases, phlegmonous laryngitis can complicate the course of cancer, tuberculosis, syphilis of the larynx.

There is no specific pathogen. They can be streptococci, pneumococci, staphylococci.

The inflammatory process in the larynx is accompanied by infiltration and accumulation of purulent exudate in places with a well-developed submucosal layer, gradually gaining a diffuse character. In cases where the process is prone to limitation, abscesses form. With a low virulence of infection and good mobilization of the body's defenses,it may occur a resorption of the infiltrate or purulent fusion of tissues and the

opening of the abscess through the mucous membrane. In case of considerable virulence of flora and the weakened organism purulent process can extend on ocher and on interstitial cracks of a neck to reach a mediastinum. The severity of the disease depends on the extent and severity of the inflammatory process.

The disease begins acutely and progresses rapidly. Patients complain of general weakness, malaise, sore throat, aggravated by swallowing, fever. Severe pain is noted in the case of localization of the abscess on the epiglottis, aryepiglottic folds. If the inflammatory process is localized in the glottis, there are hoarseness, difficulty breathing, rough, barking cough, often develops acute laryngeal stenosis, which requires urgent tracheostomy.

The most common manifestations of the disease are the development of edema, infiltration, abscessing of the mucous membrane of the epiglottis, aryepiglottic folds, areas of arytenoid cartilage or one half of the larynx with perichondritis. The mucous membrane of the site of inflammation is bright red with islands of dead epithelium and clots of mucus-purulent discharge. In the case of abscess, a limited area of infiltration is found, on top of which pus is observed. Isolated abscesses are more often formed on the lingual surface of the epiglottis andaryepiglottic folds.

In the case of phlegmonous laryngitis, limited mobility of the laryngeal cartilage, vocal foldsmay develop, which together with edema of the mucous membrane can lead to the development of stenosis, asphyxia and sudden death. The process can spread beyond the larynx. Deep neck abscesses, jugular vein thrombosis, mediastinitis, sepsis may also develop. In the case of pus aspiration, bronchopneumonia or lung abscess may occur.

Phlegmonous laryngitis should be differentiated from laryngeal sore throat, laryngeal edema, perichondritis. Swelling

of the laryngeal mucosa is easily distinguished by color, jelly-like nature, the absence of signs of inflammation. Chondroperichondritis has a similar course, because the affected and often sequestered cartilage can be in a closed purulent cavity for a long time.

One of the manifestations of phlegmonous laryngitis may be acute inflammation of the epiglottis with the development of edema and abscess. Many researchers in recent years tend to single out acute epiglottitis as a separate disease. However, in our opinion, this is not necessary. The disease is distinguished only by the site of localization and is almost indistinguishable from other localizations of the lesion.

Acute epiglottitis occurs frequently and is severe. Abscess of the epiglottis in the case of phlegmonous laryngitis is quite common and is about 35 %.

Acute respiratory disease may be a prerequisite for the development of epiglottitis. At the same time, the cooling factor of the whole organism or the larynx is of great importance. Streptococcus and staphylococcus are sown mostly during the study.

The disease develops acutely and progresses rapidly. Against the background of a violation of the general condition, weakness, fever, there is an acute sore throat, painful swallowing. After a short time there is inspiratory shortness of breath, loud breathing, the voice becomes hoarse.

Inflammatory edema, infiltration and abscess formation are more often observed on the lingual surface of the epiglottis (Fig. 8). The latter is intensely hyperemic, infiltrated, often visible through the mucous membrane of the abscess. Edema and hyperemia extend to the aryepiglottic, vestibular folds, arytenoid cartilages. At the same time, the function of the neuromuscular apparatus of the larynx may be impaired with the development of stenosis, which requires urgent tracheostomy.

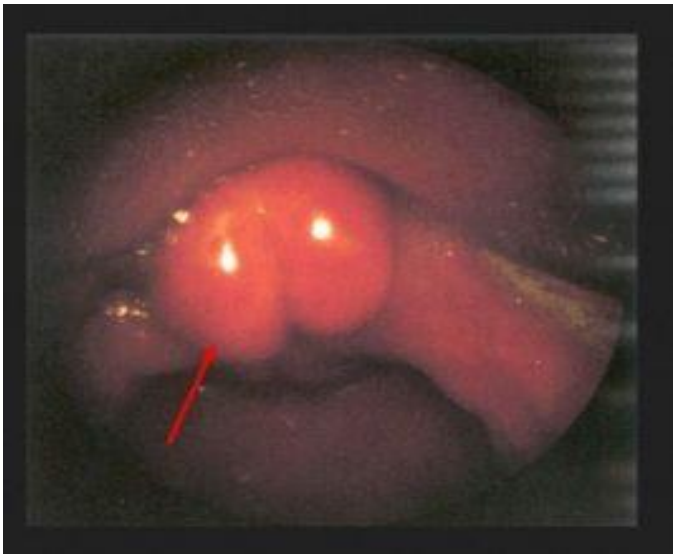

Figure 8 – Acute epiglottitis

Treatment of acute phlegmonous laryngitis involves the use of large doses of broad-spectrum antibiotics, sulfonamides, anti-edema drugs. To do this, use antihistamines, corticosteroids and diuretics (eg, diazoline, hydrocortisone, prednisolone). Sometimes a good anti-inflammatory effect is achieved with the use of cervical novocaine blockade, parallaryngeal injection of penicillin, general warming of the body, mustard foot baths, mustard on the larynx and chest. Often significantly recovers the healing process in the case of electrophoresis on the larynx with 10 % solution of calcium chloride, 1 % solution of diphenhydramine, streptomycin and alkaline oil inhalations, as well as in the case of infusion into the larynx 2-3 % solution of kolargol,rosehip, sea buckthorn, peach, apricot oil.

If an abscess is found, it must be opened with a laryngeal knife, followed by irrigation with antiseptics, washing the pus, lubricating the wound with solutions of kolargol or Lugol. In the case of acute stenosis, an urgent

tracheostomy is indicated, and if the abscesses spread to the neck or in the mediastinum, the neck abscesses are opened or a colar mediastinotomy is performed.

The prognosis is always favorable in the case of an uncomplicated inflammatory process. In case of complications, the prognosis depends significantly on the degree of complication that has developed.

3.4 Chondroperichondritis of the larynx (chondroperichondritis laryngis)

The inflammatory process in the larynx can spread to the cartilage, then chondroperichondritis of the larynx develops. Chondroperichondritis can be primary (occurs hematogenously in the case of infectious diseases) and secondary (first the laryngeal mucosais affected, and then the cartilage). There are limited and diffuse chondroperichondritis, acute and chronic. Both leaves of the perichondrium are more often affected, so the division of chondroperichondritis into external and internal is, to some extent, suppositive.

Often the cause of the disease are injuries, gunshot wounds, blunt injuries, foreign bodies, intubation, highly performed tracheostomy with damage to the annular cartilage and subsequent pressure on the tracheo cannula, which leads to cartilage bedsores. Chondroperichondritis can develop as a result of radiation therapy of a malignant tumor of the larynx.

Perichondritis is mostly purulent. Pus flakes off ocher, disrupts the nutrition of cartilage. Cartilage, which is deprived of nutrition, is resorbed or necrotized with the formation of sequesters secreted through fistulas. The leaves of the cartilage may form a sequestral capsule around the dead cartilage.

Another form of the disease is sclerosing. The infiltrate does not suppurate, and granulations develop with further scarring.

The disease is characterized by pain in the larynx, painful swallowing, fever, hoarseness, difficulty breathing. Smoothness of contours of a larynx, some increase in volume of a neck, thickening of cartilages and sharp pain during a palpation are defined, sometimes they define fluctuation, cervical lymphadenitis. The laryngoscopic picture is characterized by edema and infiltration of a mucous membrane. There is impaired mobility of one or both halves of the larynx. Laryngeal stenosis develops in the case of lesions of the annular cartilage. Purulent chondroperichondritis can be complicated by aspiration pneumonia, sepsis. In the case of chronic chondroperichondritis, the symptoms are less pronounced. Late complications of chondroperic chondritis include persistent scarring of the larynx.

X-ray examination of the larynx helps in the diagnosis of the disease. It detects thickening of the shadow of soft tissues, a change in the pattern of normal cartilage ossification. Chronic chondroperichondritis is characterized by so-called disorderly calcification.

In the treatment of chondroperichondritis of the larynx, the main place is occupied by broad-spectrum antibiotics, sulfonamides, as well as anti-edema drugs.

Timely treatment prevents the development of suppuration. During the development of decompensated laryngeal stenosis, a tracheostomy is performed. In case of abscesses, they must be opened. If this is not enough, you should make a laryngeal fissure with suturing of the mucous membrane to the skin, which removes pus and cartilage sequesters.

Self-disclosure of an abscess can lead to pus aspiration and the development of severe pulmonary complications. Irrational treatment leads to gross deformation of the larynx and its persistent stenosis.

3.5 Acute laryngotracheitis in children

Acute laryngotracheitis in children (Fig. 9) occurs during acute respiratory viral infections (AVRI) and is one of their syndromes. The problem of acute laryngotracheitis is one of the main ones not only in pediatric otorhinolaryngology, but also in pediatrics in general. There is a high frequency and severe course of the disease, almost 99% of observations of acute laryngeal stenosis in young children are laryngotracheitis during AVRI.

Different terms are used to denote this pathology. The most popular are three of them:

1) lining laryngitis;
2) acute laryngotracheitis;
3) obturating stenotic laryngotracheo-bronchitis.

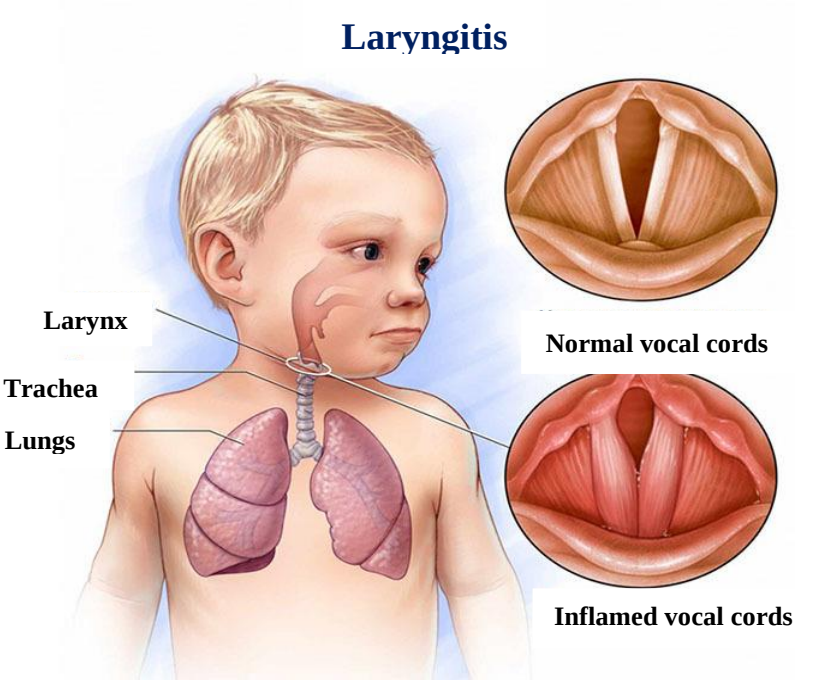

Figure 9 - Acute laryngitis in children

The term “lining laryngitis” today means non-inflammatory allergic laryngeal edema in children. The term “acute laryngotracheitis” refers to the ARVI syndrome, the symptom of which in children is difficulty breathing through the larynx.The term "obstructive stenotic laryngotracheo-bronchitis" refers to a complication of acute laryngotracheitis that occurs as a result of injury to the mucous membranes of the larynx, trachea and bronchi during airway toilet in children who are on prolonged intubation and after tracheostomy.

Today there is a dual nature of acute laryngotracheitis: 1) as a clinical manifestation of the viral infection; 2) as a complication of ARVI, caused by secondary bacterial microflora. The primary etiological factor is always respiratory viruse, and the bacterial flora often joins, at the same time modifies the course, determines the output.

Respiratory viruses as the cause of acute laryngotracheitis are divided by specific weight as follows: influenza viruses – 56.8 %; parainfluenza viruses – 20.1 %; adenoviruses – 16 %, mixed viral infection – 6.4 %.

The pathogenesis of acute laryngotracheitis is inextricably linked to the pathogenesis of ARVI in general. Acute laryngotracheitis syndrome is characterized by three main symptoms:

- Change of voice;
- Gross barking cough;
- Stenotic breathing.

Stenosis of the lumen of the larynx and trachea is due to the following components: edema and infiltration of the mucous membrane; spasm of the muscles of the larynx and trachea; hypersecretion of the glands of the mucous membrane of the trachea and bronchi, accumulation of thick mucopurulent exudate.

At the beginning of the development of the syndrome of acute laryngotracheitis there is inflammation of the mucous

membrane of the larynx and trachea, the most bright manifestation of which in the larynx is edema of the lining space, and in the trachea – it is hypersecretion of glands. Narrowing of the lining space leads to a violation of the drainage function of the respiratory tract, accumulation of tracheobronchial contents. This, in turn, intensifies the cough, which leads to spasm of the muscles of the larynx. As a result, hypoxia increases. At this stage, the inflammatory process in the larynx and trachea is catarrhal or catarrhal-purulent in nature. If conservative therapy is ineffective, it is necessary to perform a toilet of the tracheobronchial tree, prolonged intubation, tracheostomy. The consequence of these interventions are injuries of the mucous membrane and the possible development of obstructive stenotic laryngotracheobronchitis.

The accepted clinical classification of acute laryngotracheitis in children was developed in 1979 by Professor Yu. Mitin, and it is still used.

Clinical classification of acute laryngotracheitis in children:

1 Types of acute respiratory viral infection:

1) influenza, parainfluenza, adenoviral infection;

2) ARVI – is noted in the impossibility of clinical interpretation and in the absence of express diagnosis.

2 Form and clinical variant:

Primary form - recurrent form:

Option 1 - sudden onset in the absence of other symptoms of ARVI;

Option 2 - a sudden onset on the background ofARVI;

Option 3 - a gradual increase in symptoms on the background of ARVI.

3 Course:

1) uninterrupted;

2) wavy.

4 Stage of laryngeal stenosis:

1) compensated;
2) incomplete compensation;
3) decompensated;
4) terminal.

Given this classification, the diagnosis should be formulated as follows: “ARVI. Primary acute laryngotracheitis, 1st option, uninterrupted course. Laryngeal stenosis in the stage of incomplete compensation. "Influenza. Recurrent acute laryngotracheitis, 2nd option, uninterrupted course. Compensated laryngeal stenosis».

Acute laryngotracheitis develops in young children - mostly from 6 months to 3 years. Up to 4 months, this disease is almost not observed, aged 4 months to 6 months, isolated cases are observed, the highest incidence occurs in the 2nd half of the child's life. Boys are almost three times more likely to get sick than girls.This indicates the importance of the reactivity of children of this age, as well as the fact that the narrowness of the glottis in children is not crucial in the development of laryngeal stenosis.

Of great importance in the development of acute laryngotracheitis is the premorbid condition: exudative-catarrhal and thymolymphatic diathesis, prematurity, burdened obstetric history, artificial feeding; transferred in the neonatal period sepsis, pneumonia, ARVI; vaccination immediately preceding ARVI.

Laryngoscopy helps to make a final diagnosis and make a differential diagnosis. The following laryngoscopic picture is typical: hyperemia and infiltration of the laryngeal mucosa, the lumen of the larynx is narrowed due to edema-infiltrative "rollers" of bright red color, ther is a thick purulent contentin the trachea.

The differential diagnosis is determined by the main symptom of acute laryngotracheitis - stenotic respiration. It is differentiated with diseases such as:

1) diphtheria of the larynx;

2) pharyngeal abscess;

3) foreign body of the larynx;

4) bronchial asthma, pneumonia with an asthmatic component;

5) laryngeal stenosis during measles, scarlet fever, chickenpox;

6) uremic laryngeal stenosis;

7) laryngeal papillomatosis.

The problem of treating patients with acute laryngotracheitis should be divided into five parts:

1) organization of assistance;

2) treatment of patients with acute laryngotracheitis, accompanied by laryngeal stenosis at the stage of compensation and incomplete compensation;

3) intensive care of patients with acute laryngotracheitis, accompanied by laryngeal stenosis at the stage of transition from incomplete compensation to decompensation (treatment by inhalation under a tent);

4) intensive care of patients with acute laryngotracheitis, accompanied by laryngeal stenosis at the stage of decompensation (prolonged intubation and tracheostomy);

5) rehabilitation of children who have undergone prolonged intubation and tracheostomy.

The best option for the organizational form of assistance to such patients is a specialized department based on a multidisciplinary hospital. The conditions for combining the efforts of otorhinolaryngologists, pediatricians and resuscitators, without which it is impossible to fully serve this group of children are created here.

Etiotropic treatment of acute laryngotracheitis involves the use of interferon and anti-influenza γ-globulin. Prescribing antibiotics during hospitalization of a child with acute laryngotracheitis, according to the first clinical variant, is impractical. The second clinical variant requires the appointment of broad-spectrum antibiotics for prophylactic purposes in the appropriate dosage.The third clinical variant and the wavy course require powerful antibacterial therapy. In the case of anuninterrupted course, antibacterial drugs should be prescribed according to the clinical variant.

When providing care to patients with acute laryngotracheitis, accompanied by laryngeal stenosis at the stage of incomplete compensation, the following measures are taken. Intravenously: Sol. glucosae 20 % 10-20 ml; Sol. Calcii chloridi 10 % at the rate of 1 ml for 1 year of life; Sol. asciorbinici 5 % at the rate of 1 ml for 1 year of life; Sol. Euphyllini 2.4 % at the rate of 0.2 ml per 1 kg of body weight; Sol. Prednisoloni 23 mg per 1 kg of body weight. Sol. Dimedroli 1 % - 1.0 ml (or other antihistamine) is administered intramuscularly. Delaying procedures (hot foot baths, mustard on the chest) and inhalations are effective. Antihistamines, antispasmodics and proteolytic enzymes are added to the composition of mixtures for inhalation.

Children under 3 years of age receive trypsin and chymotrypsin intramuscularly at 2.5 mg once a day, chymotrypsin is used locally - inhalation, instillation.

In the case of transition of laryngeal stenosis from the stage of incomplete compensation to the stage of decompensation, the child is placed under an awning made of polyethylene film or in an oxygen tent, which turns into a main awning. The principle of this method of treatment is to create a limited amount of inhaled air, a microclimate with high humidity, high concentrations of oxygen and a variety of drugs.Before placing a child under an awning, it is necessary to

make a toilet of a tracheobronchial tree during direct laryngoscopy or short-term intubation of a trachea by a thermoplastic tube. All these measures are carried out against the background of correction of the main parameters of homeostasis - infusion therapy, corticosteroid hormones, control of acidosis, elimination of potassium deficiency, administration of neuroleptics and sedatives, proteolytics and cardiac glycosides.

Patients with acute laryngotracheitis, who develop decompensated laryngeal stenosis, make up 3 % of the number of children hospitalized in the ENT department. There are two stages of intensive care for patients with acute laryngotracheitis in the case of decompensated laryngeal stenosis:

1) prolonged intubation;

2) tracheostomy.

It is necessary to begin restoration of the airway with the prolonged intubation, and in case of its inefficiency – to carry out a tracheostomy.

Special thermoplastic tubes are used for prolonged intubation. Intubation is nasotracheal in all cases. In the future, the child is in an oxygen tent. Feeding is carried out through natural ways. In the first days, neuroleptics are administered. It is necessary to change tubes every day that is prevention of formation of bedsores of a mucous membrane of a larynx. The ineffectiveness of prolonged intubation for 7-10 days is regarded as an indication for tracheostomy.

3.6 Laryngeal diphtheria(dyphtheria laryngis)

Synonyms of the term “laryngeal diphtheria” are “diphtheria croup” or “true croup”.

Laryngeal diphtheria mainly affects young children, although the disease can occur in older children as well as in adults.

The larynx is affected by diphtheria, usually in combination with diphtheria of the throat and nose, called descending croup.

Isolated lesion of the larynx with diphtheria (primary croup) is less common.

The causative agent of the disease is diphtheria bacillus, which was discovered by G. Klebs in 1883, and isolated in pure culture by Leffler in 1884.

Infection usually occurs by airborne droplets, in the case of direct contact with a patient with diphtheria, a recovering vector, or a healthy vector, less often - through objects or food (eg, milk).

The clinic of laryngeal diphtheria (Fig. 10) is determined by the development of acute laryngeal stenosis, in the pathogenesis of which the following factors can be identified:

1 Formation of fibrinous films (plaques) in the laryngeal cavity;

2 Swelling of its mucous membrane;

3 Spasm of the internal muscles of the larynx.

The course of diphtheria of the larynx is characterized by the consistent development of symptoms, which allows to identify 3 stages of the disease:

1 Dysphonic, or croupous cough;

2 Stenotic;

3 Asphyxial.

Figure 10 – Laryngeal diphtheria:
(a) laryngoscopic picture; (b) schematic representation

The first stage, corresponding to catarrhal changes, is characterized by the appearance of symptoms of general intoxication, high body temperature. The cough appears and gradually intensifies, becoming barking. The voice changes: hoarseness and even aphonia appear. The cough becomes hoarse and then soundless. Voice disorders are explained by the fact that the vocal folds are covered with fibrinous films. This stage can last from several hours to several days.

Against the background of aphonia and low-grade cough, there is difficulty breathing, which corresponds to the second (stenotic) stage. This stage is caused by a decrease in the lumen of the larynx due to the presence of films and reflex spasm of the internal muscles of the larynx due to irritation of the nerve endings by diphtheria toxin. Inspiratory dyspnea occurs. It is accompanied by the involvement of vulnerable areas of the chest. With increasing laryngeal stenosis, the patient becomes more restless, rushes in all directions. The skin becomes pale, then there is acrocyanosis, rapid pulse. Breathing becomes loud.

The next stage is asphyxial, corresponding to the transition of laryngeal stenosis to the terminal stage. The patient becomes lethargic, drowsy, breathing is very frequent,

the pulse is filamentous with the loss of individual pulse waves. Against this background, death occurs. The younger the child, the more severe the disease.

The diagnosis is made on the basis of a gradual increase in laryngeal stenosis; most often diphtheria of the larynx is combined with diphtheria of the throat; in the case of pharyngoscopy in the pharynx are plaques.Laryngoscopy helps to diagnose: in the lumen of the larynx there are films that are difficult to remove, while the mucous membrane bleeds. The diagnosis is confirmed by bacteriological examination of smears from the nose, pharynx and larynx.

At the time of diagnosis, diphtheria should be differentiated primarily from acute laryngotracheitis in acute respiratory viral infections.

If diphtheria is suspected, the patient should be isolated and hospitalized in an infectious hospital.

Treatment of laryngeal diphtheria involves intramuscular administration of diphtheria antitoxic serum in a dosage appropriate to the severity of the diseaseas soon as possible. Specific treatment should be started if diphtheria is suspected, without waiting for its bacteriological confirmation.The patient is pre-prescribed hyposensitizing drugs due to possible allergic reactions to the introduction of diphtheria serum. In the case of a localized form of laryngeal diphtheria, the dose of serum per course of treatment is 10,000-40,000 AU, in the common form - 60,000-80,000 AU.

In the case of a toxic form of diphtheria, a long bed rest is prescribed. Careful monitoring of the condition of the cardiovascular system is mandatory. To eliminate muscle spasm of the larynx, a 2.4 % solution of euphyllin is prescribed intravenously at a rate of 0.2 ml per 1 kg of child weight, as well as ascorbic acid, a complex of B vitamins. Alkaline inhalations, which promote the discharge of diphtheria films,

improve the patient's condition.Antibacterial drugs, mainly antibiotics, are prescribed to fight the secondary infection.

In the case of transition of laryngeal stenosis from the stage of incomplete compensation to decompensated, tracheal intubation or tracheostomy is performed.

3.7 Chronic laryngitis (laryngitis chronica)

The pathology of the larynx is a social problem due to the fact that this condition deprives people of the ability to work for a long time, leads to a permanent violation of voice production and against the background of its chronic diseases can develop malignant degeneration. Chronic inflammatory processes in the larynx account for up to 8 % of all diseases of the ENT organs.

Chronic laryngitis are mostly caused by untreated acute laryngitis. Often their occurrence is due to pathological changes in the nose, sinuses, pharynx. Among the most common causes of chronic laryngitis should be noted increased voice load, smoking, various occupational hazards, alcohol abuse or irritating food.

Bacterial, food and inhalation allergies can often be observed in patients with chronic laryngitis, which is important in the pathogenesis of the disease.

As a result of long-term action of the listed factors the trophism of fabrics is broken, their reactivity changes, dystrophic process develops. Depending on the depth of this process, chronic laryngitis is divided into catarrhal, hyperplastic and atrophic.

In the case of catarrhal laryngitis, local circulatory disorders and changes in the integumentary epithelium, which in some areas can metaplasize from cylindrical to flat, loosen and exfoliate are in the foreground. Round cell infiltration is noted in the subepithelial layer.

The morphological nature of hyperplastic laryngitis is characterized by the growth of connective tissue in its own layer of mucous membrane due to the appearance of exudate, which leads to thickening of soft tissues. Chronic hyperplastic laryngitis can be diffuse and limited.Among the limited hyperplastic laryngitis there are limited hyperplasia in the area of the vocal and parietal folds, laryngeal ventricles, interarytenoid space.

In the case of atrophic laryngitis, deeper changes can be observed, which are expressed in the hyalinization of connective tissue, mainly in the walls of veins and capillaries. In glands pathological processes up to fatty degeneration and disintegration are also observed. Often the excretory ducts of the mucous glands are compressed by hyperplasic connective tissue.

Since chronic laryngitis is an inflammatory disease, the microflora of the larynx is of some interest. The most common pathogenic microflora sown from the larynx is Staphylococcus aureus both in its pure form and in association with streptococcus. Mushroom growth is sometimes detected.

The clinical picture of chronic laryngitis depends on the localization of the pathological process in the larynx. One of the main symptoms characteristic of all forms of chronic laryngitis is hoarseness. Its expressiveness is various (from insignificant dysphonia to aphonia).

In the case of catarrhal laryngitis increased voice fatigue, hoarseness, giggling, increased sputum production are noted.And in case of aggravation of process these phenomena amplify.

The objective picture is characterized by a change in the color of the mucous membrane in the case of catarrhal laryngitis, in hyperplastic - it is thickened, and in atrophic –it is thinned, becomes dry, covered with crusts. The usual symptom of inflammation is hyperemia of the mucous membrane.

During the exacerbation of chronic laryngitis is unequally expressed. The color change is most noticeable on the vocal folds: they become pink. Usually the ligaments are thickened, at the same time their free edge is slightly rounded.

In the case of diffusion form, the mucous membrane of almost the entire larynx is hypertrophied, the least - the epiglottis, the most - the parietal and vocal folds. In limited forms, certain departments are involved in the process. There are 4 main types of limited forms of hyperplastic laryngitis:

1 Nodules of vocal folds (Fig. 11), formed on the border of the anterior and middle third of the vocal folds in symmetrical areas, in the form of semicircular protrusions as poppy or millet grain.

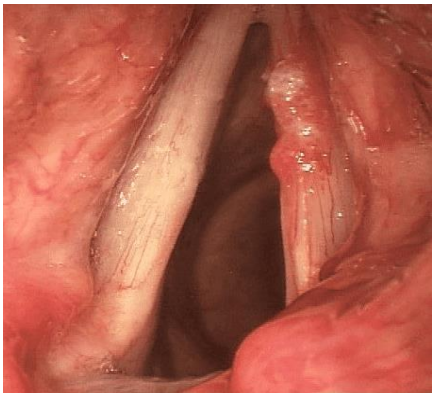

Figure 11 - Chronic hyperplastic laryngitis
("Nodules" of the larynx)

Usually these formations occur during prolonged overstrain of the vocal apparatus, especially in singers, so they are also called singing nodes. Nodules of vocal folds in young children are sometimes called "scream nodules".

2 Pachydermia of the larynx (Fig. 12). This is a hyperplasia of the mucous membrane with keratinization of the integumentary epithelium in the form of hilly or comb growths of

grayish-white or pinkish-white color, which occur in the interarytenoid space and in the posterior third of the vocal folds.

Figure 12 - Chronic hyperplastic laryngitis (laryngeal pachydermia)

3 Thickening of the squamous epithelium in the area of the vocal processes of the arytenoid cartilages may take the form of a mushroom-shaped elevation with a central recess on one fold and the "hammer and anvil" on the opposite. However, epithelial thickenings mostly occur on the posterior wall of the larynx in the interarytenoid space. The location of these formations is symmetrical, or strictly median, which distinguishes them from laryngeal tuberculosis.

4 Reinke-Hayeka laryngitis (Fig. 13). This is a swollen-polypoid form of limited hyperplastic laryngitis. It is manifested by swelling in the anterior parts of the vocal folds in the form of a sail. It is proved that the occurrence of Reinke-Hayek edema is influenced by two main factors - smoking and increased voice load. The combination of these two factors is important for making this diagnosis.

Figure 13 – Chronic hyperplastic laryngitis
(Reinke - Hayeka laryngitis)

5 Hyperplasia of the mucos membrane of laryngeal ventricle as a result of which it falls out - prolapse (it does not fit in this space) (Fig. 14).

Figure 14 – Chronic hyperplastic laryngitis
(hyperplasia of the mucosmembrane of laryngeal ventricle)

It looks like this: a red or bluish-red roller is formed between the parietal and vocal folds, which partially or completely covers the vocal fold.

In the case of chronic atrophic laryngitis (Fig. 15) patients are concerned about dryness, itching, foreign body sensation, cough with sputum, which is poorly excreted. The change of voice during the day is characteristic. In the case of severe atrophic process in the larynx there is a persistent violation of the voice up to aphonia and respiratory disorders due to accumulation of crusts.In this case, during laryngoscopy, atrophy of the entire laryngeal mucosa is determined. It is dry, rough, devoid of luster along its entire length. The crusts are placed both on the vocal folds and on the parietal and interarytenoid area.

Figure 15 – Chronic atrophic laryngitis

One of the frequent causes of the occurrence and development of chronic atrophic laryngitis is a violation of carbohydrate metabolism, kidney disease.

In the treatment of chronic laryngitis, it is necessary to eliminate all the harmful factors that contribute to the development of this disease, especially overvoltage of the vocal apparatus. Remediation of foci of infection in the upper respiratory tract is necessary. If nasal breathing is difficult, it should be normalized.

In the case of chronic catarrhal and diffuse hypertrophic laryngitis, astringents and cauterizing substances are used to reduce tissue volume, reduce glandular secretion (instillation in the larynx of 1-2 % oil solution of menthol, 2-3 % solution of collargol or protargol). Inhalation therapy is widely used. For instillation into the larynx and inhalation, an oil solution of vitamin A, weak alkaline solutions are used. Lubricate the laryngeal mucosa with 1-2 % solution of silver nitrate, 2-3 % solution of tannin in glycerin.

Limited forms of chronic hypertrophic laryngitis are treated surgically. This applies mainly to Hayek's laryngitis and nodules of the vocal folds. Microsurgical endolaryngeal intervention is performed to remove hyperplasia of the mucous membrane.

The treatment of patients with pachydermia is a difficult task. Treatment of this disease should be aimed at removing inflammatory phenomena in the larynx and elimination of the mechanical obstacle to the closing of the vocal folds (expectorants, inhalation therapy with chymopsin, trypsin or chymotrypsin). These drugs dilute thick, viscous mucus and at the same time stimulate the motor function of the ciliated epithelium, have anti-edema and anti-inflammatory effects. In the case of a combination of proteolytic enzymes with antibiotics, corticosteroids and vitamins, the therapeutic effect occurs faster.

Electrophysiotherapeutic procedures for patients with hypertrophic laryngitis **should not be prescribed**, so as not to provoke the development of cancer.

In the case of atrophic forms, infusions of eucalyptus preparations are used in the larynx, in addition to spraying with weak saline solution. It is advisable to use proteolytic enzymes for inhalation therapy or infusion into the larynx (10 mg of the drug per inhalation, in which 5 ml of salineis dissolved), it is possible to use lysozyme 100 mg per

procedure. Alkaline potassium inhalations have a good effect.

Darsonvalization is prescribed, the laryngeal mucosa is irradiated with a helium-neon laser. With atrophic laryngitis, general treatment is also prescribed: biogenic stimulants - aloe, fibs, vitreous, autohemotherapy, novocaine injection - intramuscular or intravenous 0.5, 1.2 % 5 ml No. 25; nicotinic and ascorbic acids, B vitamins, glucose. Spa treatment is shown.

In the prevention of chronic laryngitis, the timely treatment of chronic diseases of the nose and sinuses, chronic tonsillitis is of great importance.

Prevention and treatment of occupational laryngitis is first of all connected with elimination of harmful production factors. In this case, the use of sanitary and hygienic measures is of great importance. As individual protective measures it is possible to use respirators, special masks. Much attention is paid to preventive inhalation procedures directly at the workplace.

The basis of prevention of chronic diseases of the larynx is medical examination of the population. When employing people in places where there is harmful production, it is necessary to remember that nasal breathing difficulties, frequent catarrh of the upper respiratory tract, sore throat, acute laryngitis are considered contraindications.

4 PRECANCEROUSDISEASES OF THE LARYNX

The problem of early detection and treatment of precancerous diseases plays an important role in the prevention of malignant neoplasms. Among chronic diseases of the larynx, papillomatosis, chronic hyperplastic laryngitis and dyskeratosis of the laryngeal mucosa occupy a dominant place.These diseases are important in the genesis of laryngeal cancer, ie they are a group of precancerous conditions.

The morphological features of precancer include proliferative phenomena in the epithelium, accelerated mitosis, reactive phenomena of the vascular system.

In recent years, the methods of cytological, radioisotope, optical and biochemical studies have become widespread, and it has become possible to use microlaryngoscopy for diagnostic purposes.

Clinical observations show that microlaryngoscopy makes it possible to distinguish benign changes from changes suspected of cancer, to conduct a targeted biopsy, which significantly increases the value of cytohistological studies.

The possibility of malignancy of laryngeal papillomas is confirmed by clinical observations of many laryngologists in adult patients. The course of laryngeal papillomatosis with malignancy in all patients is clinically different from the usual papillomatous process by growth activity. Careful examination helps to suspect the malignancy of the tumor in many cases. While the mucous membrane around the papilloma is not changed, the malignant tumor is constantly accompanied by more or less pronounced infiltration of the surrounding tissues.

The malignant nature of the tumor is evidenced by a violation of laryngeal motility. Papillomas can be seen microlaryngoscopically in the form of growths of the mucous membrane of pink or whitish color, which protrude significantly above the surface and have an uneven papillary

surface. Vessels differ in ampoule-like expansions. However, the chaotic arrangement of blood vessels and their polymorphism, characteristic of cancer, are absent. Vascular pattern of keratinized papillomas is weak or almost not expressed.

Fluorescent microlaryngoscopy is of great importance in the diagnosis and differentiation of malignant processes. The main diagnostic technique for differentiating the nature of laryngeal papillomatosis is still histopathological examination of the material of the targeted biopsy, taking into account their microlaryngoscopic characteristics.

Treatment of patients with malignant papillomas should be comprehensive with a mandatory individual approach in each case. In addition to surgery, radiation and chemotherapy are mandatory.

From the group of chronic laryngitis, much attention is paid to chronic hyperplastic laryngitis. At the same time, a matte thickening of the epithelium is determined, through which the capillaries do not shine.

In the case of chronic hyperplastic laryngitis, areas of papillary hyperplasia detected on the background of smooth hyperplasia, areas of leukoplakia, epithelial erosion and especially atypical forms of blood vessels are always an indicator of malignancy. Surgical treatment in the case of this disease is appropriate. The purpose of the operation is to remove the hyperplasia epithelium under the control of an operating microscope. Removing it is cancer prevention.

Among the group of laryngeal dyskeratoses, pachydermia (contact and interarytenoind), leukoplakia are most often observed. Contact pachydermia is very characteristic, localized in the area of the posterior parts of the vocal folds in the form of thickenings of the epithelium around the vocal cords of the arytenoind cartilage.

Therefore, the above group of chronic diseases of the larynx belongs to the group of precancerous conditions. Therefore, patients with such diseases are subject to dispensary observation, control using modern diagnostic methods, and in case of indications – appropriate surgical treatment.

5 INJURIES OF THE LARYNX AND TRACHEA

Injuries of the larynx and trachea have a relatively small proportion in otorhinolaryngological pathology – about 1 %, in pathology of the larynx and trachea only are up to 10 %. In men, injuries of the larynx and trachea occur 4 times more often than in women. This pathology is severe, requiring emergency care.

Injuries of the larynx and trachea are divided into closed and open, ie without violation or with violation of the skin. Injuries of the larynx can be with or without damage to the integrity of the cartilage.

Typical symptoms of injuries of the larynx and trachea are: disorders of breathing, voice, swallowing; coughing, hemoptysis, emphysema of the subcutaneous tissue and mediastinum. Depending on the severity and nature of the injury, these symptoms may appear immediately after the injury or after some time and may be more or less pronounced. Emphysema indicates a violation of the integrity of the mucous membrane. A blow to the larynx can lead to shock and reflex cessation of breathing, causing loss of consciousness. Hemorrhages in the soft tissues of the larynx are possible. Injury is sometimes accompanied by paresis or paralysis of the laryngeal nerves, which leads to limited mobility or complete immobility of one or both halves of the larynx.

In case of laryngeal injury without cartilage fractures and ruptures of the mucous membrane, there is a moderate swelling of the soft tissues of the neck. At the same time, the pain is moderate. Laryngoscopy allows you to see the swelling, hemorrhage, sometimes hematoma, limited mobility of the vocal folds.

A more severe laryngeal injury is an injury that is accompanied by a cartilage fracture. Fracture of the laryngeal cartilage is usually accompanied by intra-laryngeal bleeding of varying intensity and emphysema of the subcutaneous tissue.

In the case of subcutaneous emphysema, the configuration of the neck changes significantly. Palpation determines local pain and crepitation.

Air can spread to the mediastinum and pleural cavities between the fascial spaces. During laryngoscopy you can see damaged mucous membranes, red blood or blood clots, laryngeal deformity, narrowing of its lumen. Sometimes submucosal emphysema is defined in the form of swelling of a mucous membrane of pale color. X-ray examination determines the expansion of the shadow of the soft tissues of the larynx, deformation and narrowing of the air lumen, the line of the cartilagefracture.

A life-threatening injury is a detachment of the trachea, which usually occurs at the place of transition of a larynx to a trachea or in the area of the bifurcation of the trachea. Tracheal rupture may occur. Such injuries are usually accompanied by severe respiratory disorders. At the same time, emphysema occurs almost immediately, causing an increase in neck volume.

Occasionally there is a detachment of the larynx from the hyoid bone and epiglottis, accompanied by a lowering of the larynx. At the same time, the hyoid bone sinks to the bottom of the mouth and the sublingual space increases. This leads to impaired respiratory and separation function. The latter is manifested in the ingress of food into the respiratory tract.

In the case of a fracture of the hyoid bone, which can be combined with a fracture of the thyroid cartilage, there is pain when opening the mouth and sticking out the tongue, sagging tongue, impaired speech and swallowing. Palpation of the hyoid bone reveals deformation of the latter, crepitation and mobility of fragments.

In the case of the described injuries and if in the future chondroperichondritis of a larynx joins, the patient's condition

worsens. Chondroperichondritis contributes to the formation of persistent stenosis.

Open injuries of the larynx include its wounds. There are cut, stabbed, shrapnel, gunshot and bitten wounds of the larynx. Air enters and leaves through the wound, foamy blood and mucus are released. The patient has a cough, impaired breathing, voice and swallowing. Food can get into the airways and be thrown out through the wound. Getting food into the lower respiratory tract leads to the development of aspiration pneumonia. Emphysema gradually increases, which is larger the smaller the wound opening.

First aid in case of injuries of the larynx and trachea is aimed at restoring respiration (mostly tracheostomy), cessation of bleeding, revision, primary surgery and layered suturing of the wound. The primary suture is applied to the cut wounds. The primary suture does not need to be applied to the stab wound to avoid subcutaneous emphysema. It is advisable to do a tracheostomy as low as possible from the larynx. Sometimes the tracheo cannula is inserted into the wound for several hours if it enters the airways. Then a typical tracheostomyis imposed.

In the case of subcutaneous ruptures of the larynx and trachea, it is necessary to transfer the closed lesion to the open, otherwise emphysema will increase rapidly. In the case of tracheal detachment, the method of choice is the imposition of an end-to-end anastomosis. In case of downward displacement of the larynx, it is sutured to the hyoid bone - laryngopexy.

In case of damage to the pharynx and esophagus, a nasopharyngeal tube is inserted.

First aid in case of thermal burns involves the appointment of painkillers, a gentle diet, intravenous administration of 10-20 % glucose solution, isotonic sodium chloride solution, plasma substitutes.

In the case of chemical burns, it is important to find out what substance caused the burn. Be sure to perform gastric

lavage, pulverization of the pharynx and larynx with neutralizing agents. In case of acid poisoning, the stomach is flushed with 2-3 % solution of burnt magnesium, 4% sodium bicarbonate solution or egg white suspension in water, in case of alkali poisoning - weak acid solutions. It is necessary to carry out detoxification therapy, compensate for the loss of protein by the introduction of hydrolysates, adjust the cardiovascular activity, be sure to prescribe painkillers (drugs) for anti-shock purposes.

Injections of 0.1 % atropine solution are prescribed to reduce salivation. Be sure to prescribe antibiotics to prevent bacterial complications. To prevent edema, antihistamines, calcium chloride or gluconate, vitamin C, and corticosteroid hormones are recommended. For the same purpose intranasal novocaine blockadeis made: in the lower nasal sinuses 0.5–1 % solution of novocaine - 2–3 ml.

Tracheostomy is performed in case of increasing phenomena of laryngeal stenosis.

6 FOREIGN BODIES OF THE LARYNX, TRACHEA AND BRONCHI

Aspiration of foreign bodies into the respiratory tract is observed mainly in childhood. Children account for 80 % to 97 % of all aspiration observations. At the same time, young children predominate. Children under 2 years of age make up 68 %. This problem concerns doctors of various specialties – otorhinolaryngologists, pediatricians, pediatric surgeons, anesthesiologists, resuscitators.

The frequency of the predominant localization of foreign bodies in the respiratory tract is as follows: in the larynx – 13 %, in the trachea – 22 %, in the bronchi – 65 %.

Foreign bodies of the larynx (Fig. 16) are characterized by an acute, violent onset of the disease, severe stenosis, inspiratory dyspnea, cyanosis, paroxysmal cough. During the examination of the patient, pronounced inspiratory dyspnea, the involvement of the pliable areas of the chest attract attention. Percussion and auscultation data are uncommon - perhaps hard breathing and wheezing. X-ray examination reveals a uniform increased transparency of the pulmonary fields.

Figure 16 – Foreign body of the larynx

The diagnosis of a foreign body in the larynx is made in the case of laryngoscopy (in children – in the case of direct laryngoscopy), with the help of which it is removedtoo.

In rare cases of asphyxia, which is rapidly increasing and threatening the life of the child, an emergency tracheostomy is indicated.

Sometimes a significant foreign body entering the esophagus can give severe laryngeal stenosis. In this case, direct laryngoscopy does not detect a foreign body. In such cases it is not necessary to make a direct hypopharyngoscopy with a laryngoscope, which involves examination of the entrance to the esophagus.

Foreign bodies of the trachea, as well as foreign bodies of the larynx, are accompanied by violent manifestations. Characteristic are prolonged, repeated paroxysmal barking painful cough, which often turns into vomiting. Older children sometimes notice dull chest pain.

Aspirated foreign bodies can move in the trachea, but sometimes they are fixed to its wall. Clinical manifestations in this case are varied. The movement of a foreign body can cause respiratory disorders and spasm of the vocal folds due to the impact of a foreign bodyon it. A pathognomonic sign of foreign body movement in the trachea is a symptom of "slapping" during breathing. Foreign bodies in the area of bifurcation of the trachea, changing position, disrupt ventilation in one or the other bronchus, which is reflected in the intermittent clinical picture. Physical data is changing rapidly.

Fixed foreign bodies in the trachea are rare. If moving foreign bodies have a smooth surface (watermelon, sunflower, pea seeds), meat and fish bones, nut shells, etc. are fixed. The condition of patients with foreign bodies fixed in the trachea is very serious.

Breathing is accelerated and difficult, there is a subsidence of the pliable places of the chest, cyanosis. The patient occupies a forced position, which makes it easier for him to breathe. The voice is usually unchanged. In the case of percussion, there is a box sound over the entire surface of the lungs, auscultation is determined by the weakening of respiration on both sides.Increased transparency of the pulmonary fields is detected radiologically. Foreign bodies in the area of tracheal bifurcation are very dangerous. Such a foreign body can completely obstruct the entrance to the main bronchus and cause atelectasis of the entire lung. This leads to a sharp deterioration of the patient's condition, increased shortness of breath and cyanosis.

Legume seeds (peas, beans), that in case of swelling can completely close the opening of the trachea, are extremely dangerous..

The emergency tracheoscopy with subsequent removal of the foreign body is indicated for the patients with foreign bodies of the trachea. In the presence of foreign bodies in the lower segment and bifurcation of the trachea, the tracheostomy will not bring any relief to the patient. The method of choice is immediate endoscopic examination of the trachea (upper tracheoscopy) and removal of a foreign body. In some cases, it is possible to remove a foreign body from the trachea during a direct laryngoscopy.

Foreign bodies of the bronchi mostly occur on the right, which can be explained by the anatomical and physiological features of the bronchial tree (right bronchus is wider than the left, departs at a much smaller angle, is a continuation of the trachea). In the right bronchial tree foreign bodies are found in 67 % of observations, in the left – in 33 %.

Foreign bodies can be X-ray contrast (21 %) and non-X-ray contrast (79 %), among the latter, foreign bodies of plant origin dominate (71 %).

In the clinical course of bronchial foreign bodies, three periodscan be distinguished: the period of acute respiratory disorders, latent period and the period of complications.

The period of acute respiratory disorders corresponds to the moment of aspiration and the passage of a foreign body through the larynx and trachea. The main symptom is a cough that occurs immediately after aspiration and is often accompanied by vomiting.

These phenomena in a child can sometimes be short-lived and not attract the attention of parents. In this regard, the anamnesis does not always have a clear indication of aspiration of a foreign body.

The latent period occurs after the movement of a foreign body into the bronchi, and the farther from the main bronchi the foreign body is located, the less pronounced its clinical symptoms are. This period is characterized by the disappearance of external manifestations of foreign body aspiration: the child's breathing stabilizes, behavior becomes normal, rare cough attacks can be regarded as the result of a cold. At different times after exposure of a foreign body and depending on its size and origin, there is a partial, valvular or complete bronchostenosis.

Complete bronchostenosis leads to atelectasis of the corresponding part of the lung. The most common type of bronchostenosis is valvular, when a foreign body turns into a valve. More air enters the lungs than it leaves. This leads to the development of emphysema of the lung on the side of the foreign body, the displacement of the mediastinum in the healthy direction and the compression of the healthy lung.

During radioscopy in such patients there is a typical shift of the mediastinum on inspiration towards bronchostenosis, ie a foreign body (a positive symptom of Holzknecht-Jacobson). Detection of this symptom provides

especially valuable information in cases of non-X-ray contrast foreign bodies.

As a result of prolonged stay of a foreign body, complications develop: violation of ventilation, disconnection from breathing areas of the lung parenchyma, damage to the bronchial wall, infection. Depending on the nature of the complication that has developed, the clinical manifestations may increase rapidly, acutely or gradually (sometimes over many months and years).

The biggest complication that often occurs is atelectasis of the relevant part of the lung with the subsequent occurrence of severe pneumonia, often destructive. The typical clinical picture of chronic purulent pulmonary process gradually develops.

Late diagnosis of foreign bodies entering the airways leads to the development of irreversible changes in the lungs that require complex surgery. Therefore, doctors should always keep in mind the possibility of aspiration of a foreign body by a child, especially in the case of chronic inflammatory diseases of the lungs with a sluggish and prolonged course, frequent recurrences and resistant to antibacterial drugs.

To prevent errors in the diagnosis of foreign bodies of the bronchi, it is necessary to: first, carefully collect a history of the disease (acute onset of the disease should alert us); secondly, in all cases that are suspicious for the presence of foreign bodies, do an X-ray examination, which includes radioscopy (detection of Holzknecht-Jacobsonss symptom), radiography and tomography; thirdly, remember that inflammatory diseases of the lungs with a sluggish recurrent course, resistant to antibacterial therapy, are an absolute indication for bronchoscopy.

In most cases, bronchial foreign bodies are examined during upper bronchoscopy with a respiratory bronchoscope. The manipulation is performed under anesthesia with the use of

short-acting muscle relaxants. With the introduction of respiratory bronchoscopes, specialists have almost universally abandoned lower tracheobronchoscopy.

7 LARYNGEAL INTUBATION

Today, extended nasotracheal intubation with the help of special plastic tubes has become widespread, which allows in some cases to avoid tracheostomy. This technique is widely used today in the case of acute laryngeal stenosis of various etiologies and, above all, acute laryngotracheitis in children.

For prolonged intubation, you should use special thermoplastic tubes, which become soft at body temperature and and, being in the opening of the larynx for a long time, do not cause bedsores of its tissues. Intubation in all cases is nasotracheal. The child's nutrition is also carried out through natural paths. It is necessary to change a tube daily, but at least for a short time the child remains without a tube.This allows you to restore the local hemodynamics of the laryngeal tissues, and thus prevent the formation of bedsores, granulations and scars in the area of the laryngeal-tracheal junction. The duration of intubation can be from 2-3 days to 7-10 and even more, which is strictly individual for each patient. Recently, the use of intubation tubes with a double inflatable cuff has become widespread. Alternate inflating of the cuffs avoids the development of bedsores in the larynx and trachea for a long time. Prolonged intubation in the case of acute laryngotracheitis is successful in 60 % of cases. Ineffective prolonged intubation is an indication for tracheostomy.

8. TRACHEOTOMY AND TRACHEOSTOMY

Tracheostomy - an operation aimed at creating a temporary or permanent opening of the tracheal cavity with the environment. The term "tracheotomy" refers to the opening of the rings of the trachea, ie the stage of tracheostomy. Tracheostomy (Fig. 17) leaves an obstacle for the passage of air into the trachea above the tracheostomy.

Figure 17 – Tracheostomy of the larynx

In an extreme situation, a tracheostomy must be performed by every doctor, no matter what his specialty.

Indications for tracheostomy can be divided into 3 groups:

1st group – to eliminate the causes that lead to obstruction of the upper respiratory tract: foreign bodies, paralysis and spasm of the vocal folds, edema, tumors, infectious granulomas, etc .;

2nd group – for sanitation of the lower respiratory tract;

3rd group – for long-term artificial lung ventilation.

There are upper, middle and lower tracheostomies. They are divided depending on the level of opening of the rings of the trachea relative to the isthmus of the thyroid gland: above the isthmus - the upper; below - the lower; middle - rings corresponding to the isthmus of the thyroid gland are dissected.This is done after its intersection. Because children's larynx is located high and their lower tracheal rings are accessible, they should have a lower tracheostomy. In this case, the opening of the trachea is performed further from the larynx, which is the prevention of chondroperichondritis of the larynx and facilitates further decannulation. Adults are usually given an upper tracheostomy. A middle tracheostomy is performed when it is impossible to make an upper or lower one. This situation can occur in the case of thyroid tumor.

During a tracheostomy, the patient lies on his back, a roller is placed under his shoulders, his head is thrown, so this position allows the patient to bring the larynx and trachea as close as possible to the anterior surface of the neck. The operation is performed under local anesthesia or endotracheal anesthesia. Preliminary intubation of the trachea technically greatly facilitates the operation. In extreme conditions, the operation is performed without anesthesia.

The upper horn of the thyroid and the arch of the cricoid cartilage are the distinguishing points during surgery. The section of the skin, subcutaneous tissue and superficial fascia is performed from the lower edge of the thyroid cartilage to the jugular notch along the midline of the neck.The median vein of the neck is pushed or tied and cut, a white line is found, along which the muscles are bluntly pushed apart and the isthmus of the thyroid gland is exposed. In the case of an upper tracheostomy, the lower edge of the thyroid cartilage is found and the fascia, which attaches the capsule of the thyroid gland to the annular cartilage, is incised by cross-section.The isthmus is separated from the thyroid gland in a blunt manner and

pulled down.The rings of the trachea, released above the isthmus, are opened by longitudinal opening. Before opening the trachea, if the operation is performed under local anesthesia, 0,25-0,5 ml of 1-2% solution of dicaine is injected with a syringe through the gap between the rings into the opening of the trachea to reduce the cough reflex.To facilitate the introduction of the tracheo cannula into the opening of the trachea, the edges of the opening are diluted with a Trusso dilator. 1-2 stitches of silk are applied to the skin above and below the stoma. The stoma does not need to be sutured tightly to avoid the formation of subcutaneous emphysema. The tracheocannula is fixed on the patient's neck with gauze tape.

During the lower tracheostomy, the isthmus of the thyroid gland is pulled up. In the case of a middle tracheostomy, after separation of the isthmus from the thyroid gland, it is clamped with two clamps, dissected and stitched on the clamps with a wrap seam on both sides. The trachea is dissected at the level of the isthmus.

Tracheostomy can cause the following complications: bleeding, emphysema of the subcutaneous tissue, pneumothorax, pneumomediastinum, cessation of breathing after opening the tracheal opening, later - arosive bleeding, esophageal injury, the development of purulent tracheobronchitis in the postoperative period.

In emergencies, when there is no time and conditions to perform a tracheostomy, a conicotomy or cricoconicotomy is performed, ie the conical ligament is dissected or, at the same time with it, the arch of the annular cartilageis dissected. The conical ligament is palpated and dissected. This operation can lead to perichondritis of the larynx, so then a typical tracheostomy is performed and the tracheo cannula is moved into the opening of the trachea.

QUESTIONS FOR SELF-CONTROL

1 Muscles of the larynx, their functions.

2 List the functions of the larynx. The mechanism of voice formation.

3 Name the main methods of examination of the larynx.

4 Clinical and diagnostic features of laryngeal edema, treatment tactics.

5 List the causes of laryngeal stenosis. Clinical features and treatment of laryngeal stenosis depending on the stage.

6 Methods of surgical treatment of patients with persistent stenosis of the larynx and trachea.

7 Acute laryngitis. Clinic, diagnosis, treatment.

8 Carry out a differential diagnosis between acute phlegmonous laryngitis and chondroperichondritis of the larynx.

9 Acute laryngotracheitis in children. Etiopathogenesis, classification, clinical picture and emergency care for this pathology.

10 Diphtheria of the larynx. Differential diagnosis, treatment regimen.

11 Clinical picture of chronic laryngitis depending on the localization of the pathological process in the larynx.

12 What pathological conditions are related to precancerous diseases of the larynx?

13 Injuries of the larynx and trachea. Typical symptoms, complications, first aid.

14 Name the clinical features in the presence of foreign bodies of the larynx, trachea and bronchi. Diagnosis, emergency care.

15 Tracheal intubation, tracheotomy and tracheostomy. List the indications for manipulations, the technique of their implementation.

TEST QUESTIONS

1 The woman has an injury to the thyroid and cricoid cartilage of the larynx. As a result, the act of swallowing was violated. Which of the following muscles is affected:

a) palatine-pharyngeal muscle;
b) the middle pharyngeal compressor;
c) the upper pharyngeal compressor;
d) stylopharyngeal muscle;
e) the lower pharyngeal compressor?

2 On examination of the laryngeal cavity, the phoniatrician found nodules on the vocal cords. Between which formations are the voice connections located:

a) arytenoid and thyroid cartilage;
b) arytenoid cartilages;
c) thyroid cartilage andepiglottis;
d) arytenoid cartilagesandepiglottis;
e) vocal and muscular processes of the arytenoid cartilage?

3 The patient went to the ENT doctor with complaints of voice change. The examination revealed a tumor within the posterior department of rima vocalis. Between which of the cartilages of the larynx is this departmentlocated:

a) cartilago thyroidea;
b) cartilago cricoidea;
c) cartilago arytenoidea;
d) cartilago corniculata;
e) cartilago cuneiormis?

4 The patient went to the ENT doctor with complaints of voice disorders. The examination revealed

changes in the submucosal structure of the larynx. What derivatives does it form:

a) lig. cricotracheale;
b) cartilago crycoidea;
c) ventriculus laryngis;
d) rima vocalis;
e) membrana fibroelastica laryngis?

5 The patient went to the ambulance with complaints of pain at the root of the tongue when swallowing. Examination revealed a foreign body between the tongue and the larynx. In what anatomical formation is this body located:

a) pear-shaped pocket;
b) blind hole of the tongue;
c) deepening of the epiglottis;
d) pharyngeal pocket;
e) tonsilar fossa?

6 Bronchial foreign bodies are mostly removed during:

a) indirect laryngoscopy;
b) bronchoscopy;
c) conicotomy;
d) tracheotomy.

7 Symptoms of a foreign body in the larynx are:

a) dyspnea;
b) dysphonia;
c) cough;
d) dysphagia.

8 For foreign bodies of the larynx is characteristic:

a) inspiratory dyspnea;
b) expiratory dyspnea;
c) shortness of breath of a mixed nature;

d) normal breathing.

9 Signs of a foreign body in the larynx are:

a) sore throat when swallowing;
b) the symptom of “salivary lake”;
c) inspiratory dyspnea.
d) cough.

10 The most common localization of laryngeal cancer is:

a) laryngeal dorsum;
b) vocal folds;
c) lining department;
d) epiglottis.

11 Precancerous diseases of the larynx include:

a) papilloma;
b) fibroma;
c) leukoplakia;
d) cyst.

12 Laryngeal papillomatosis is:

a) precancerous disease;
b) is not a precancerous disease;
c) precancerous disease only in childhood;
d) precancerous disease in elderly men.

13 Indicate the signs that differ in the clinical course of laryngeal papillomatosis in children from this disease in adults:

a) in children, papillomas can develop into a malignant tumor;

b) in children, papillomas do not regenerate into a malignant tumor;

c) in children, papillomas after puberty may be reversible;

d) in children, papillomas do not reverse after puberty.

14 The largest cartilage of the larynx is:

a) arytenoid;

b) thyroid;

c) cricoid;

d) epiglottis.

15 The vocal muscle is attached by it posterior end to:

a) horn-shaped cartilage;

b) the vocal process of the arytenoid cartilage;

c) muscular process of arytenoid cartilage;

d) the bases of the arytenoid cartilage.

16 The most common cause of iatrogenic laryngeal stenosis is:

a) prolonged intubation of the larynx;

b) heart surgery;

c) radiation burns of the larynx;

d) inadequate antibacterial therapy.

17 Laryngeal stenosis is divided into stages:

a) two;

b) three;

c) four;

d) five.

18 During the course of laryngeal stenosis there are stages:

a) two;

b) three;

c) four;
d) five.

19 If there are growing symptoms of asthma, a tracheotomy should be performed in case of laryngeal stenosis:

a) in the stage of compensation;
b) in the stage of subcompensation;
c) asphyxia;
d) in the absence of stenosis.

20 Causes of laryngeal stenosis in the late post-injury period are:

a) chondroperichondritis;
b) laryngitis;
c) epiglottitis;
d) phlegmon.

21 Lining laryngotracheitis is mainly observed:

a) in adulthood;
b) at a young age;
c) at the age of 1–3 years;
d) in old age.

22 What shortness of breath is characteristic of lining laryngotracheitis:

a) non-permanent;
b) of a mixed nature;
c) expiratory nature;
d) inspiratory nature.

23. An acute attack of kining laryngotracheitis usually begins:

a) at night;
b) in the morning;

c) during the day;
d) at any time.

24 Laryngotracheitis is characterized by a triad of symptoms:

a) cough, runny nose, fever;
b) barking cough, shortness of breath, hoarseness;
c) sore throat, cough, hoarseness;
d) dysphagia, dysphonia, rhinitis.

25 In the case of unstopped false croup, it is preferable to peform:

a) conicotomy;
b) laryngotomy;
c) tracheostomy;
d) intubation of the larynx.

26 The appearance of false croup in children is due to:

a) frequent allergic reactions;
b) narrowing of all parts of the larynx;
c) narrowing of the lining part of the larynx and looseness of the submucosal layer of this department;
d) the presence of lymph nodes in the lining department of the larynx.

27 The laryngoscopic picture in the case of false croup is:

a) enlargement of the epiglottis;
b) paresis of the true vocal folds;
c) the presence of white films and plaque in the lining department;
d) narrowing of the lining space in the form of red rollers.

28 Acute epiglottitis is:

a) inflammation of the epiglottis;

b) inflammation of the laryngeal tonsil;

c) inflammation of the lingual tonsil;

d) diffuse inflammation of the pharynx.

29 Epiglottitis is characterized by a laryngoscopic picture:

a) abscess at the root of the tongue;

b) abscess on the epiglottis;

c) enlargement, edema and hyperemia of the epiglottis;

d) narrowing of the lining space.

30 Patients with epiloglotitis complain of:

a) hoarseness of voice;

b) rapid voice fatigue;

c) cough, dryness and sore throat;

d) dysphagia of varying severity and sore throat.

31 Epiglottis abscess is dangerous due to:

a) asphyxia;

b) dysphagia;

c) aphonia;

d) dyspepsia.

32 Complaints are characteristic of patients with acute laryngitis:

a) itching, dry throat, cough, hoarse voice;

b) shortness of breath, dysphagia, copious amounts of sputum;

c) difficulty breathing at rest;

d) cough, hemoptysis.

33 The main pathological changes observed in the larynx in the case of acute laryngitis are:

a) hemorrhages in the glottis;
b) plaque on the vocal folds;
c) immobility of one voice fold;
d) redness, swelling, infiltration of the mucous membrane.

34 The most dangerous complications in the case of phlegmonous laryngitis are:
a) paresis of the larynx;
b) asphyxia;
c) laryngeal cancer;
d) pleurisy.

35 Chronic hypertrophic laryngitis is differentiated from the following diseases:
a) benign tumors of the larynx;
b) epiglottitis;
c) laryngeal sore throat;
d) diphtheria.

36 Laryngeal diphtheria has a synonymous:
a) true croup;
b) false croup;
c) scleroma of the larynx;
d) infectious laryngitis.

37 The most typical localization of intubation granuloma:
a) the front commissure;
b) the front parts of the true vocal folds;
c) arytenoid cartilage and posterior parts of true vocal folds;
d) false vocal folds.

38 The vocal fold, in the presence of nodules of singers in the larynx, during phonation has the form of:

a) the triangle;
b) a rectangle;
c) an oval;
d) hourglass.

39 Papillomatosis of the larynx can mostly be observed in:

a) children;
b) middle-aged patients;
c) the elderly;
d) at any age.

40 The main complaint in patients with benign tumors of the larynx is:

a) dyslexia;
b) dysphonia;
c) dysphagia;
d) dysgraphia.

ANSWERS TO TEST QUESTIONS

Question number	Right answer		Question number	Right answer
1	A		**21**	C
2	E		**22**	D
3	C		**23**	A
4	D		**24**	B
5	C		**25**	D
6	B		**26**	C
7	A, B, C		**27**	D
8	A		**28**	A
9	C, D		**29**	C
10	B		**30**	D
11	C		**31**	A
12	A		**32**	A
13	B, C		**33**	D
14	B		**34**	B
15	B		**35**	A
16	A		**36**	A
17	C		**37**	C
18	C		**38**	D
19	B		**39**	A
20	A		**40**	B

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КЛІНІЧНА АНАТОМІЯ, ФІЗІОЛОГІЯ ТА МЕТОДИ ДОСЛІДЖЕННЯ ГОРТАНІ. ДІАГНОСТИКА ТА ЛІКУВАННЯ ОСНОВНИХ ВИДІВ ПАТОЛОГІЇ ГОРТАНІ

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Навчальний посібник спрямований на формування базових знань із клінічної анатомії, фізіології та методів дослідження гортані, запальних і незапальних захворювань гортані, передракових захворювань та невідкладних станів, спричинених захворюваннями гортані. Відповідно до вимог доказової медицини стисло описано лікування різних нозологічних захворювань гортані.

Для англомовних студентів медичних спеціальностей закладів вищої освіти, лікарів-інтернів, лікарів-оториноларингологів та лікарів загальної практики – сімейної медицини.