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# Purulent-Destructive Lung Diseases, Pathogenesis & Modern Principles of Treatment

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## ABSTRACT

The review article provides basic information on the diagnosis and treatment of acute purulent destructive lung diseases. The problem is considered relevant in connection with the wide spread of this disease among the population of the planet, since according to statistical summaries, lung diseases are statistically in fourth place. An analysis of modern methods of treatment of purulent destructive lung diseases is presented, which is based on the classical approach - in the maximum early period, drain and empty the abscess in the lung. This method of treatment has been worked out and is widely used in clinical practice. However, this method of treatment does not satisfy the results, which to date remain not comforting. All this indicates the need to continue research in this direction and the search for new approaches in the treatment of patients with purulent destructive lung diseases.

**Keywords:** Acute purulent destructive lung diseases, diagnosis, treatment, complications, pathogenetic approach to treatment

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Thanks to the organization and improvement of diagnostic methods, new methods of treatment, and surgical techniques, significant progress has been made in the treatment of acute purulent-destructive lung diseases. However, this problem remains relevant at the present time.

In recent years, there has been an increase in the number of patients with severe and complicated forms of the course of acute purulent-destructive lung diseases [6]. According to studies by different authors [7], the percentage of development of pulmonary-pleural complications in lung abscesses ranges from 30% to 70%, and the incidence of gangrenous forms from 28% to 74% [8]. Despite different approaches to the treatment of Acute purulent-destructive lung diseases, the results of complex treatment can hardly be recognized as satisfactory. Still remains a high lethality, constituting in general various forms of purulent-necrotic processes from 12.7% to 77.8%.

As a detailed analysis of the work shows, most cases of complete recovery refer to uncomplicated purulent abscesses of small diameter. At the same time, with giant and gangrenous abscesses, the percentage of transition to a chronic form range from 32% to 56% [83].

To date, it has already become known that from a pathogenetic point of view, in all cases, the development of acute purulent destruction of the lungs is determined by the combination and interaction of three main factors:

- 1) acute infectious inflammatory process in the pulmonary parenchyma.
- 2) violation of bronchial patency.
- 3) impaired blood flow leading to necrosis of the lung tissue.

Recently, many authors assigned a decisive role in the development of acute purulent-destructive lung diseases to the non-spore-forming anaerobic flora [90].

Almost 100 years ago, S.N. Spasokukotsky [11] also revealed anaerobic flora in 43.3% of patients with lung abscesses but did not attach much importance to it. In the 50s of the last centuries, M.S. Grigoriev also wrote [15], believing that "... the role of fusospirillosis symbiosis is insignificant, in most cases it is a secondary infection, only aggravating the process."

Most authors are of the opinion about the polymorphism of microflora in purulent destruction of the lungs, giving primary importance to one or more types of microorganisms [22]. Thus, many researchers pay great attention in the genesis of acute purulent-destructive lung diseases to gram-negative bacteria [43]. Improvement of the methods of modern clinical bacteriology, which included anaerobic technology in the arsenal of studies,

made it possible to establish the leading role of non-clostridial anaerobes in the development of destructive processes in the lungs [71]. At the same time, many clinicians still consider pathogenic staphylococcus to be the main etiological factor [63].

Currently, it has been established that lung tissue serves as a good nutrient substrate for strains of staphylococcus that produce lecithinase, alkaline phosphatase, and hemolysins. At the same time, the growth of staphylococci occurs mainly due to lipoproteins, non-esterified fatty acids, and carbohydrates, i.e., the main components and main parts of the pulmonary surfactant.

As shown by the research of D.A. Egorkina [34], staphylococci that produce strictly defined toxins and enzymes have practically no differences in cytotoxic action.

Unlike these strains of staphylococci, *Pseudomonas aeruginosa*, as proved by K.I. Savitskiy [88], uses the protein fraction of surfactant (proteolytic action), and its cytotoxic activity with the ability to produce hemolysins, lecithinase and phosphatase reaches (in vitro) 42-62%. The cytotoxic effect of streptococci with a set of pathogenicity factors was detected in 48% of cases. *Pseudomonas aeruginosa* destroys the most superficial part of the "cloak" of the lung, causing hemorrhages, extensive atelectasis, destruction of small bronchi [81].

The infectious process that develops in the body covers all vital manifestations of both the microbial pathogen and the sick person. It causes a variety of changes in metabolism, due, on the one hand, to the entry into the blood and tissues of various protein substances and toxins, on the other hand, by a change in enzymatic reactions aimed at neutralizing toxic products of various origins [70].

A kind of pathogenetic vicious circle arises, a detailed definition of which was given by Yu.A. Muromsky back in 1988: "... enzymes and toxins of staphylococcal strains destroy surfactant, then penetrate into alveolar cells (alveocytes type II) and use their lipid granules as a nutrient material, destroy their membrane, cause cell lysis, microcirculation disorders and oedema (atelectasis), which ultimately leads to rapid destruction of respiratory departments. In turn, this leads to a violation of the "capture" of lipids circulating in the blood by the damaged parenchyma and the secretion of alveocytes of type II of the surfactant (surfactant)" [64].

At the same time, in stage I of staphylococcal destruction of the lungs (oedema, atelectasis), the lipid metabolism of the cell is first activated and the release of surfactant increases [61]. This reaction is considered as a complex humoral response of a macroorganism to a

stressful state. In the future, in most patients, especially with reduced nutrition, the synthesis of surfactant is inhibited. In clinical settings, this is confirmed in disorders of lipid metabolism, mainly due to total lipids, especially phospholipids, free fatty acids, beta-lipoproteins, i.e. substances that make up the pulmonary surfactant [60].

It was established that after 2 minutes. after the introduction of labeled palmitic acid, 2% of the administered dose is included in the phospholipids of the lung tissue [55]. Hence the need at the very beginning of the disease to use fatty emulsions (lipofundin, intralipid) to maintain a normal level of total lipids and create conditions for the synthesis and secretion of pulmonary surfactant, as well as to prescribe drugs that inhibit the increased activity of kallikrein - contrical, trasilol, gordox [51]. To stimulate the synthesis of surfactant, E.N. Nesterov et al. [42] Heparin has been recommended as a means of improving microcirculation.

The reasons for the transition of acute abscesses to chronic ones have not been studied enough. According to most clinicians, a significant role is played, first, by inadequate conservative treatment in the acute period of the disease [37]. Among the reasons that cause the transition of an acute abscess to a chronic one, also include:

- 1) insufficient drainage and outflow of pus from the abscess cavity.
- 2) the presence of necrotic sequestrum in the cavity.
- 3) the formation of dense pleural fusions.
- 4) large size of the destruction cavity;
- 5) violation of the patency of the draining bronchus due to overgrowth with granulation tissue [33].

R.S. Tishenina and V.G. Khazardzhyan [29] noted that in 14 patients with staphylococcal destruction of the lungs, who 1.5-2 years ago were treated in the thoracic department of the Moscow regional research clinic, there was not only normalization of lipid metabolism, but also an increase in the concentration of cholesterol, beta-lipoproteins, triglycerides and especially phospholipids with a clear tendency to normalize the concentration of synthesis. According to the results obtained, these patients continued to consume an increased amount of refractory fats after discharge from the department, all of them are healthy and able-bodied.

Objective criteria for the transition of an acute purulent-destructive process in the lungs to a chronic one have not yet been developed. The generally accepted calendar period of 4-6 weeks is often not correct, and does not reflect the essence of morphological changes in each case.

In the literature, there is no consensus on the tactics of treating acute purulent-destructive lung diseases. It is

indicated that in the process of treatment it is necessary to focus not on anyone, although quite effective method of treatment, but on the system of therapeutic measures in order to affect as many links as possible in the pathogenetic mechanism of the development of this disease [21].

Unfortunately, in the available classifications, assessments of the course, the proposed methods of treating acute purulent-destructive processes in the lungs, the state of non-respiratory activity of the lungs is practically not considered.

An opinion is expressed about the advisability of early lung resections in patients with acute pulmonary suppuration in the period from 3 to 6 weeks from the onset of the disease [19]. At the same time, several authors believe that the expansion of indications for surgical treatment often brings more harm than benefit to such patients. Moreover, this is explained by the fact that lung resections produced before stabilizing the suppurative process and eliminating acute inflammatory phenomena in the bronchial tree and pulmonary parenchyma, are high-risk interventions, accompanied by a high percentage of complications and high mortality [15].

Currently, most clinicians are inclined to believe that indications for emergency operations in the acute stage occur only with the progression of the purulent-destructive process against the background of low effectiveness of the therapy, as well as the occurrence of profuse pulmonary hemorrhage [4].

Nevertheless, the optimal method of treating patients with acute lung abscesses at the present stage is mainly conservative. This tactic was approved at the VII National Congress on Respiratory Diseases.

The success of conservative therapy for patients with acute purulent-destructive lung diseases largely depends on the use of antibacterial drugs. Antibacterial therapy should be rational and based on a number of principles. The choice of the drug should be carried out taking into account the sensitivity of the microflora sown from the contents of the purulent cavity. This takes into account the species resistance of microbes to certain antibiotics, their spectrum of action, as well as in each case. - antibiogram data [13].

Given that in acute purulent-destructive lung diseases, the identified "microbial landscape" is characterized by pronounced polyvalence and polymorphism, it is recommended to prescribe combinations of antibiotics [7]. Until now, there is no consensus on the continuation of antibacterial treatment of acute purulent-destructive lung diseases.

Failures of antibiotic therapy in most cases are associated with difficulties in achieving an adequate concentration of antibacterial drugs in the pathological focus [63]. To achieve the latter goal, various ways of their administration are used: intravenous, intraarterial, endolymphatic, into the abscess cavity. There are several works reporting successful use in patients with acute purulent-destructive lung diseases long-term regional infusion therapy with the use of drugs that improve microcirculation [11].

It is believed that the effectiveness of intraarterial injections is associated not only with the achievement of a large level of concentration of the substance in the blood, but also with a high rate of its penetration through the walls of the capillaries, since in this case the route of administration, a much smaller amount of it is blocked by plasma proteins. This position is confirmed by the data of other authors [25], who studied the distribution of antibiotics in the body and their concentration in the blood and tissues with various routes of administration. As a result of these studies, it was proved that intraarterial administration creates the highest concentration of drugs in the lesion compared to other methods, and this, in turn, leads to neutralization of toxins faster, significantly reduces their absorption, stimulates phagocytosis, limits tissue necrosis.

The positive effect of prolonged infusion of drugs into the pulmonary artery system, according to N.F. Krotov [42], began to affect the 2-3rd day, and with infusion into the vena cava - on the 3-4th day and was expressed in a noticeable improvement in appetite, a decrease in body temperature.

In recent years, some clinics in our republic have also begun to use the infusion of antibiotics through the central arterial bed (aorta or bronchial artery) for the treatment of purulent-destructive lung diseases [11].

It is believed that catheterization of the bronchial arteries is a valuable auxiliary method of treating suppurative lung diseases, accompanied by severe purulent intoxication. At the same time, indications for it are limited only to a severe, complicated course of an acute purulent-destructive process in the lungs with the ineffectiveness of conventional means of treatment. There is no information in the literature on the possibility of intraarterial correction of disorders of non-respiratory lung function in bronchopulmonary diseases.

Analysis of modern methods of treatment of acute purulent-destructive lung diseases showed that most are aimed at combating infection and intoxication [24]. This is absolutely necessary, but not always successful antibiotic therapy will provide the patient with recovery, if not purposefully affect other links of pathogenesis.

The foregoing allows us to attribute the problem of rational treatment of acute purulent-destructive lung diseases to the number of the most relevant in pulmonology and requiring further development.

The publication in the DVJ journal of the results of a meta-analysis by G. Schierhout and I. Roberts [65] on the evaluation of the effectiveness of albumin in critically ill patients had a wide response among doctors of various specialties. In patients with acute purulent-destructive lung diseases, an inverse correlation of plasma albumin concentration with the risk of death was found. A systematic review of several studies showed that a decrease in concentration plasma albumin for every 2.5 g/L is accompanied by a 24–56% increased risk of death [52].

Violation of the structural and functional organization of membranes in acute inflammation of the lung tissue, activation of lipid peroxidation provides the basis for the correction of membrane disorders in the acute period of the disease. Now, it is believed that the most appropriate is the impact on one of the links of this process - antioxidant protection [64].

Another important link in the complex treatment of patients with acute purulent-destructive lung diseases is to ensure effective drainage of the abscess in the lungs or pleural cavity with a complicated course, which allows not only locally administering antibacterial drugs, but also evacuating purulent contents, thus reducing the resorption of toxins and decay products [74].

The most used for local treatment is transthoracic access - drainage of an abscess or pleural cavity and puncture, as well as transbronchial - endobronchial administration of drugs, inhalations, microtracheostomy, conducting drugs into the draining bronchus transnasally, sanitation fibrobronchoscopy [25].

Transthoracic effects on the focus have a lesser effect on inflammatory changes in the bronchial mucosa, and therefore many authors recommend combining these two methods of local administration of antibacterial drugs with purulent endobronchitis [32].

Even though at the moment most clinicians consider drainage and local sanitation of the cavities of destruction and pleural cavity in the presence of complications mandatory in the treatment of acute purulent-destructive lung diseases, indications for the use of one or another method, the timing of its implementation remains controversial.

The frequency of development and severity of breast phlegmon after transthoracic drainage largely depend on the nature and magnitude of lung destruction: the more pronounced the necrotic component in it, the more likely the occurrence and extensive spread of the purulent

process into the soft tissues of the breast [66]. This phenomenon is due, on the one hand, to the necrotic tissue damage characteristic of anaerobes and the rapid spread of the process, and on the other hand, to the insolubility of tubular drains. with gangrenous destruction of the lungs. The latter are quickly clogged with necrotic detritus and the outflow of pus occurs along the tube into the interfascial spaces of the chest wall. Thus, closed drainage of cavities with unremoved pulmonary sequestrators and massive purulent-fibrin deposits is dangerous and tactically incorrect.

In addition, the spread of infection to soft tissues can contribute to several technical errors made during the installation of drains, when the hole in the intercostals is larger than the outer diameter of the drainage tube, when the drainage is introduced too deeply or, conversely, superficially, or it migrates with poor fixation.

Equally important is information on the prevalence of pulmonary destruction in cases of gangrenous lesions. Timely open drainage or radical treatment also save patients from developing breast phlegmon, which in most cases is a lethal complication for this group of patients [50].

It should be noted that in recent years, most clinicians use thoracoabscsostomy when draining gangrenous abscesses. There are reports on the effectiveness of this technique [49].

The promising possibilities of laser radiation in the complex treatment of patients with surgical lung diseases deserve attention [31].

The basis of the pathogenetic treatment of lung abscesses is the sanitation of the abscess [8]. A special role belongs to transthoracic drainage of the cavity. In the literature, there are only isolated reports of the use of flow-aspiration washing of the abscess cavity in the lung, which is associated with the difficulties of carrying out fluid lavage in a functioning bronchial fistula [77]. Therefore, further research is needed on the use of this method for debridement in purulent lung surgery.

It is noted that although after radical operations, complications in the postoperative period develop almost always, and the mortality rate is 27-63%, nevertheless, their use in the complex treatment of gangrenous lung abscesses is more effective than conservative with the use of "small surgery" techniques.

It should be borne in mind that after active treatment in the acute stage of the disease, long-term painstaking work is necessary to eliminate residual effects after suffering suppuration of the lungs (thin-walled residual cavities, inflammatory perifocal reactions of connective tissue with a transition to pneumosclerosis, chronic bron-

chitis, extensive pleural fusions), thanks to which the ultimate goal can be achieved - the full rehabilitation of the respiratory organ after the illness. [62].

Investigating the long-term results of treatment of acute purulent-destructive lung diseases, a number of authors argue that in a certain percentage of patients discharged with clinical recovery, after a long time, a relapse of the disease occurs [72]. According to V.I. Struchkov [74], half of the cured patients in the long term reveal somewhat pronounced symptoms of lung suppuration. Patients discharged with the outcome of "improvement", "without" changes, "deterioration", make up 2/3 of the total number of patients with acute purulent-destructive lung diseases and need further therapeutic measures in the city and district health care network to achieve a complete cure.

Debatable is the question of the timing of observation of such patients, in the process of treatment of which so far it has not been possible to achieve good long-term results, improving the level of their quality of life.

The presented information on modern achievements in the study of pathogenesis, the development of new methods of surgical treatment of patients with acute purulent-destructive lung diseases using the techniques of "small surgery" showed that many issues related to improving the results remain unresolved.

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**YIRINGLI-DESTRUKTIV O'PKA KASALLIKLARI, PATOGENEZI VA ULARNI DAVOLASHNING ZAMONAVIY TAMOYILLARI**

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**Abstrakt**

Tadqiq maqolasida o'tkir yiringli o'pka kasalliklarini tashxislash va davolash bo'yicha asosiy ma'lumotlar keltirilgan. Muammo ushbu kasallikning sayyora aholisi orasida keng tarqalishi bilan bog'liq holda dolzarb hisoblanadi, chunki statistik xulosalarga ko'ra, o'pka kasalliklari statistik jihatdan to'rtinchi o'rinda turadi. Yiringli destruktiv o'pka kasalliklarini davolashning zamonaviy usullarini tahlil qilish, bu klassik yondashuvga asoslangan - maksimal erta davrda o'pkada xo'ppozni bo'shatish va bo'shatish. Ushbu davolash usuli ishlab chiqilgan va klinik amaliyotda keng qo'llaniladi. Biroq, bu davolash usuli bugungi kunga qadar tasalli bermaydigan natijalarni qoniqtirmaydi. Bularning barchasi ushbu yo'nalishda tadqiqotlarni davom ettirish va yiringli halokatli o'pka kasalliklari bo'lgan bemorlarni davolashda yangi yondashuvlarni izlash kerakligini ko'rsatadi.

**Kalit so'zlar** - O'tkir yiringli o'pka kasalliklari, tashxis, davolash, asoratlar, davolanishga patogenetik yondashuv

**ГНОЙНО-ДЕСТРУКТИВНЫЕ ЗАБОЛЕВАНИЯ ЛЕГКИХ, ПАТОГЕНЕЗ И СОВРЕМЕННЫЕ ПРИНЦИПЫ ИХ ЛЕЧЕНИЯ**

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**Абстракт**

В обзорной статье представлены основные сведения о диагностике и лечении острых гнойных деструктивных заболеваний легких. Проблема считается актуальной в связи с широким распространением данного заболевания среди населения планеты, так как по статистическим сведениям заболевания легких по статистике находятся на четвертом месте. Представлен анализ современным методам лечения гнойных деструктивных заболеваний легких, в основе которого лежит классический подход – в максимальный ранний период провести дренирование и опорожнение гнойника в легком. Данный метод лечения отработан и широко применяется в клинической практике. Однако, этот метод лечения так и не удовлетворяет результаты, которые на сегодняшний день остаются не утешительными. Все это свидетельствует о потребности продолжения исследований в данном направлении и поиску новых подходов в лечении больных с гнойными деструктивными заболеваниями легких.

**Ключевые слова** – Острые гнойные деструктивные заболевания легких, диагностика, лечение, осложнения, патогенетический подход к лечению