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Controversial Issues of Choosing a Method of Treatment of Acute Lung Abscesses in Patients with Diabetes Mellitus

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ABSTRACT

Methods of treating acute lung abscesses in many respects, despite their long history of solving the problem, are still far from perfect. Naturally, as in the case of any surgical infection, the discovery of antibiotics has made it possible to reconsider many aspects of treatment tactics, giving preference to the latter. However, it's not that simple here. In this review article, we tried to select relevant modern literature on controversial issues of methods for treating acute lung abscesses in diabetes mellitus. We conducted a critical analysis and summed up the relevant results of our research. We will be grateful if readers pay attention to provide their feedback on our work.

Keywords: Lung abscesses, diabetes mellitus, clinical signs, treatment, VAC-therapy

A group of European scientists led by N. Fernandez-Sabe in their studies proved that some species of *Bacteroides* and *Fusobacterium* can produce β -lactamase, so they are resistant to penicillin. About 15-20% of anaerobic bacteria, which are responsible for the formation of lung abscess, are resistant only to penicillin, so an alternative is a combination of penicillin and clavulanate or a combination of penicillin and metronidazole [4, 12]. But the research didn't stop there. D.W. Hecht assumed that metronidazole, as a monotherapy, does not seem to be particularly effective due to the polymicrobial flora, presumably microaerophilic streptococci such as *Streptococcus milleri* [17].

To date, one of the recommended combinations of antibiotics for the treatment of acute lung abscess is the combination of β -lactam with β -lactamase inhibitors

(Ticarcilin-Clavulanate, Ampicillin-Sulbactam, Amoxicillin-Clavulanate, Piperacillin-Tazobactam), Chloramphenicol, Imipenem or Meropenem, the second generation of cephalosporins (Cefoxitin, Cefotetan), a new generation of fluoroquinolones - Moxifloxacinacin, effective as a combination of Ampicillin-Sulbactam [29].

In 2004, a group of German scientists led by M. Allewelt, presented information on the effectiveness of macrolides (Erythromycin, Clarithromycin, Azithromycin) in the treatment of acute lung abscesses. They have been reported to have a very good therapeutic effect on microbial bacteria in acute lung abscesses, except for *Fusobacterium* species. Vancomycin is very effective for gram-positive anaerobic bacteria. Aminoglycosides are not recommended in the treatment of acute lung abscesses, as they do not pass well through the fibrous pyogenic membrane of a chronic abscess [3].

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Alternative therapy - Piperatsilin / Tazobactam 3.375 g IV for 6 hours or Meropenem 1 g IV for 8 hours was proposed by L.A. Mandell et al. [23].



Acute purulent abscess of the lung, drained through the bronchus

For the treatment of MRSA resistant bacteria in patients with acute lung abscesses, M.Z. David and R.S. Daum recommend the use of Linezolid 600 mg per 12 hours or Vancomycin 15 mg/kg every 12 hours intramuscularly [8].

An effective response to antibiotic therapy can be seen in 3-4 days, the general condition will improve in 4-7 days, but complete healing, with radiographic normalization can be seen in two months. If there is no improvement in the general condition or radiographic finding, it is necessary to perform a bronchoscopy due to some other etiological factor and change the antibiotics.

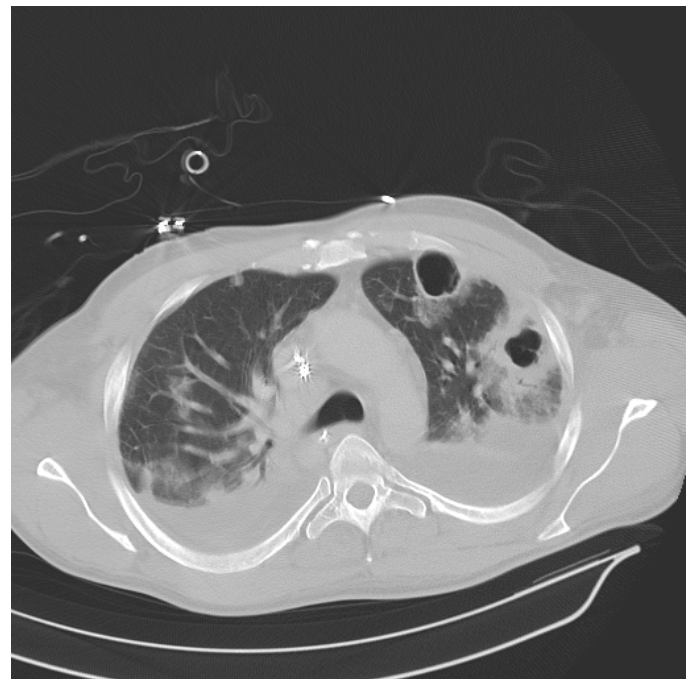
Bronchoscopy should be an integral part of the algorithm for the diagnosis and treatment of lung abscess. Common supportive measures include a hypercaloric diet, fluid and electrolyte correction, and respiratory rehabilitation. A lung abscess often ruptures spontaneously into the airways, which helps clear the infection, but can also cause the infection to spread to other parts of the lungs.

An abscess larger than 6 cm in diameter, or if symptoms last more than 12 weeks with appropriate therapy, there is little chance of conservative healing alone, and surgical therapy should be considered if the general condition allows. Surgical options include chest tube drainage or surgical resection of a lung abscess with surrounding tissues.

Endoscopic drainage of lung abscesses is described as an alternative to transthoracic tube drainage and is performed during bronchoscopy using a laser. It is recommended for patients with poor general condition, coagulopathies, and abscesses with a central location in the lungs. One of the possible complications of this method is the spillage of necrotic detritus in other parts of the lungs [13,18].

M. Yunus [51] and M. Kelogrigoris et al. [7] recommend transthoracic drainage of the lung abscess cavity under local anesthesia, and necessarily under the control of ultrasound or computerized tomographic scanning.

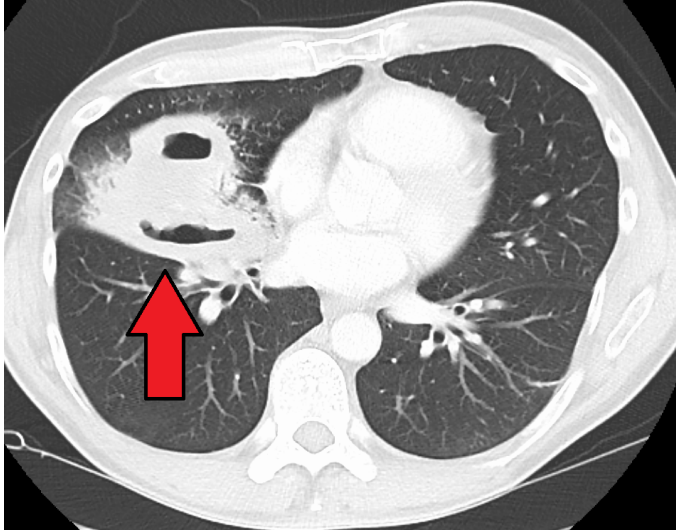
The first reports of this method of drainage were published in 1938 in the treatment of tuberculous pulmonary cavities. Subsequently, this method of treatment became a mandatory method of treatment until the widespread introduction of antibiotics into clinical practice. S.O. Wali, citing historical information about this method of treating acute lung abscesses, even now recommends using it as the main and non-alternative [49].



Computed tomography (CT) scan of chest showing bilateral pneumonia with abscesses, effusions, and caverns. 37-year-old male.

Meanwhile, current literature data indicate that most clinicians prefer the use of antibiotic therapy as the main method of treating lung abscesses. For example, a group of German surgeons led by R.P. Mueller, provide information about the possible complications of such methods of treating acute lung abscesses and conclude that it is necessary to resort to the use of the transthoracic method

of drainage of lung abscesses only in cases without the effectiveness of antibiotic therapy. It is argued that transthoracic drainage of lung abscesses is indicated only in 11-21% of patients after without effective antibiotic therapy [30].



Pulmonary abscess on CT scan

At the same time, according to the observations of S.O. Wali, transthoracic methods of drainage of lung abscesses were effective in 84% of patients, and the level of complications of this method of treatment was 16%. In 4% of patients with acute lung abscesses after transthoracic drainage, complications were fatal. The main complications of transthoracic methods of drainage of lung abscesses were the spread of necrotic destruction and infection of the lungs into the pleural cavity, with the formation of pyopneumothorax, pleural empyema, formation of bronchopleural fistula and bleeding [49].

Given such a high proportion of complications of transthoracic methods of drainage of lung abscesses, to date, a few clinical recommendations have been developed regarding the tactical algorithm for performing this small operation. One of these recommendations is the mandatory use of ultrasound scanning of the abscess cavity and the entire process of drainage of the abscess. According to D. Feller-Kopman [15], such manipulation can be performed under local anesthesia and under the control of a permanent ultrasound scanner.

Along with these recommendations, we found more information regarding the use of ultrasound scanning of lung abscesses only to determine the drainage point. This method is recommended by a group of surgeons led by Y.H.Liu [46].

Another innovation was the use of the Seldinger technique (drainage of a lung abscess through a wire or silicone conductor) to drain lung abscesses. Proponents of this technique have shown that with the use of this technique, a significant reduction in the number of complications of this operation was achieved [45].

Transthoracic drainage of lung abscesses using the trocar technique is recommended only for thoracic surgeons. This conclusion was made especially if the trocar will pass through the thickness of the lung tissue.

Sanitation of the cavity of the lung abscess has today a large arsenal of effects on the course of the purulent-destructive process. Many of the proposed methods of sanitation of the lung abscess cavity remain controversial today. Such moments of sanitation as the choice of the method of influencing the course of the purulent-destructive process in the lungs, depending on the phase of the inflammatory process, have not been fully studied, questions about the timing of the cessation of sanitation while maintaining a stable residual cavity remain controversial. For example, M.J. Hogan and B.D. Coley [19] do not recommend the use of any intracavitary fibrinolytic or proteolytic enzymes, since because of lysis of destructive tissue, the formation of a bronchial fistula is possible. They proved about the possible complications with the use of streptokinase and urokinase.

As for the timing of the application of sanitation, to date, data indicate that, on average, it takes from 10 to 16 days to clean the destruction cavity in the lung. In cases where, even after cleaning the lung cavity, there is still air flow through the drainage, it is recommended not to remove the transthoracic drainage, leaving it in the passive valve mode according to Heimlich [19].

F. Herth et al. [18] also describe the possibility of using thoracoabscessostomy as a method of drainage of a peripherally located lung abscess. However, the authors point out that this method of surgical treatment can be performed only if there are adhesions between the parietal and visceral pleural sheets. Such an operation was proposed by Monaldi and bears the same name. It resembles a classic operation - pneumotomy, which, due to the presence of a large disability, already wears only historical character. Nevertheless, in the literature there are reports of a modified technique, with the use of high-tech endovisual technologies in the treatment of this category of patients.

Lung resections, as a method of treating abscesses, are presented in the studied literature in a matter of quantity. To date, on average, it is used only in 10% of patients with acute lung abscesses and have direct indica-

tions, such as profuse bleeding from the cavity of a lung abscess. As relative indications, the authors recommend the use of volumetric surgical interventions in a prolonged septic process with persistent fever, the presence of a bronchopleural fistula, a breakthrough of a lung abscess into the pleural cavity with the development of pyopneumothorax or pleural empyema. It should be noted here that the return to this method of treatment, in our opinion, is associated with the widespread introduction of minimally invasive videoscopic surgical technology, which allows combining the technique of traditional and minor surgery.

Also, radical methods of surgical intervention in the treatment of patients with lung abscesses, according to various authors, are shown when the rehabilitation of the lung abscess is not effective for more than 6 weeks, that is, in fact, when the transition to the chronic form of the disease, with stable pneumorrhage and the preservation of a residual cavity with a diameter of more than 6 cm, stable ongoing leukocytosis, despite the ongoing antibiotic therapy.

P.B. Pages et al. It is recommended to use atypical lung resections or segmentectomy if it is possible to remove the focus of destruction along with peripheral necrotic areas of the lung tissue. At the same time, lobectomies are shown as more radical ways to remove necrotic lobes of the lung, provided they are large or centrally located [35].

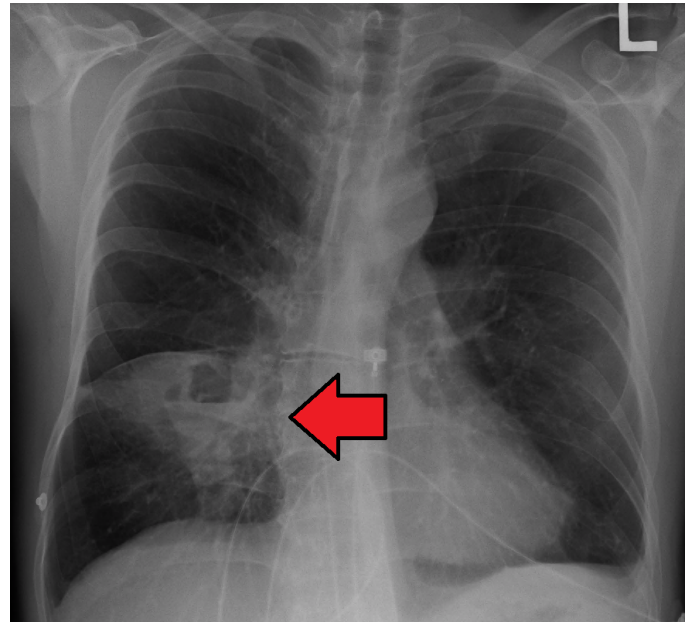
The results of surgical treatment depend mainly on the general condition and immunity of the patient. Elderly patients, malnutrition, and alcoholism are poor prognostic factors. Mortality after surgical resections is about 11-28% [18].

Minimally invasive surgical procedures, such as videothoracoscopy, are the preferred method of peripheral lung abscess surgery without pleural adhesions and fibrothorax. The results of this surgical procedure are satisfactory, but this intervention requires general anesthesia, a double-lumen endotracheal tube, or a single-lumen endotracheal tube with carbon dioxide insufflation. One of the possible complications is the spillage of the purulent contents of the lung abscess into the pleural cavity [31].

The overall mortality in the treatment of lung abscesses, according to various authors, is about 2.0-38.2% and depends on the patient's age, malnutrition, comorbidity, immunity, appropriate and timely antibiotics, and supportive therapy.

Features of the course of acute purulent-inflammatory lung diseases in patients with diabetes mellitus

As with any surgical infection, inflammatory lung diseases in patients with diabetes mellitus have a complex and protracted manifestation. The reasons for such a complex course of the disease in patients with diabetes mellitus have not been sufficiently studied.

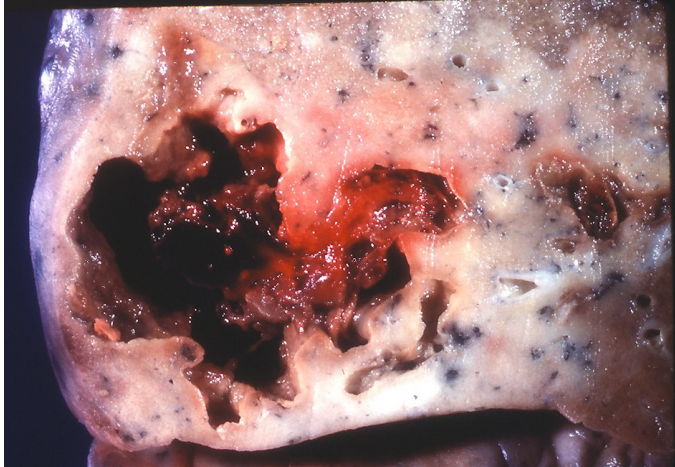


Pulmonary abscess on CXR

In most cases, acute purulent-destructive lung diseases in patients with diabetes mellitus become chronic. There are many reasons for this outcome of the disease. According to the majority of clinicians, a significant role is played, first of all, by inadequate conservative treatment in the acute period of the disease [44]. Among the reasons for the transition of an acute abscess to a chronic one in patients with diabetes mellitus may be: insufficient drainage and outflow of pus from the abscess cavity; the presence of necrotic sequestrations in the cavity; the presence of dense pleural adhesions; large size of the destruction cavity; violation of the patency of the draining bronchus due to overgrowth with granulation tissue [42].

Employees of the Department of Thoracic Surgery of the Moscow Regional Research Clinical Institute named after M. F. Vladimirov noted that in patients with staphylococcal pneumonia against the background of diabetes mellitus, there was a deterioration in lipid metabolism, a decrease in the concentration of cholesterol,

lipoproteins, triglycerides and especially phospholipids with a clear tendency to disrupt the concentration of synthesis. According to the results obtained, these patients suffered from diabetes mellitus Type 2, all of them were disabled and were on insulin replacement therapy.



Pathology image of a lung abscess

To date, in the literature there is no clear idea of the criteria for the transition of an acute purulent-destructive process in the lungs to a chronic one in patients with diabetes mellitus. Until now, the generally accepted calendar period of 4-6 weeks is used. But as most researchers point out, this approach does not reflect the essence of morphological changes in each case.

There is no consensus in the literature on the tactics of treating acute purulent-destructive lung diseases in patients with diabetes mellitus. It is pointed out that in the process of treatment one should focus not on anyone, albeit quite effective method of treatment, but on a system of therapeutic measures to influence the largest possible number of links in the pathogenetic mechanism of the development of this disease [40].

Unfortunately, in the available classifications, assessments of the course, proposed methods of treatment of acute purulent-destructive processes in the lungs, diabetes mellitus is practically not considered. This disease is described only as the morbid background of the patient and is evaluated only in severe and complicated course of acute purulent-destructive lung diseases.

The first attempts to consider the peculiarities of the course of acute purulent-destructive lung diseases in patients with diabetes mellitus led to the opinion that early lung resections were expedient within 3 to 6 weeks from the onset of the disease [38].

At the same time, several other authors believe that the expansion of indications for surgical treatment often

brings more harm than good to such patients. Moreover, this is explained by the fact that lung resections, performed before the stabilization of the suppurative process and the elimination of acute inflammatory phenomena in the bronchial tree and pulmonary parenchyma, turn out to be high-risk interventions, accompanied by a large percentage of complications and high mortality [37].

Research in this direction continues. Great success was achieved in the study of the features of the course of surgical infection in patients with diabetes mellitus. Currently, most clinicians are inclined to believe that indications for emergency operations in the acute stage of acute purulent-destructive lung diseases in patients with diabetes mellitus arise only with the progression of the process against the background of low effectiveness of the therapy, and/or in the event of profuse pulmonary hemorrhage [36].

A critical analysis of the literature allowed us to determine that the optimal method of treating patients with acute lung abscesses against the background of diabetes mellitus, at the present stage, is predominantly conservative. This tactic has been approved at several conferences, forums, and congresses on respiratory diseases [33].

Of course, success in the use of conservative therapy of patients with acute purulent-destructive lung diseases against the background of diabetes mellitus largely depends on the use of antibacterial drugs. Antibiotic therapy should be rational and based on several principles. The choice of the drug should be carried out considering the sensitivity of the microflora sown from the contents of the purulent cavity. At the same time, the species resistance of microbes to certain antibiotics, their spectrum of action, as well as in each specific case, antibiograms data are considered [32].

Unfortunately, there is still no consensus on the duration of antibiotic therapy for acute purulent-destructive lung diseases in patients with diabetes mellitus. In this aspect, the main approaches to antibiotic therapy are characterized using a combination of antibiotics. This approach to treatment is based on the polyvalent and polymorphic microbial composition of the destruction focus [27].

However, the presence of angiopathy with a progressive violation of the microvasculature, characteristic of patients with diabetes mellitus, leads to failures of antibiotic therapy. It is with the difficulties of achieving adequate concentrations of antibacterial drugs in the pathological focus that many authors consider the main

reason for the failure of this type of treatment in patients with diabetes mellitus [26]. Along with the standard intravenous method of administering antibacterial drugs, today there is information regarding the effectiveness of intra-arterial, endolymphatic and intracavitary administration.

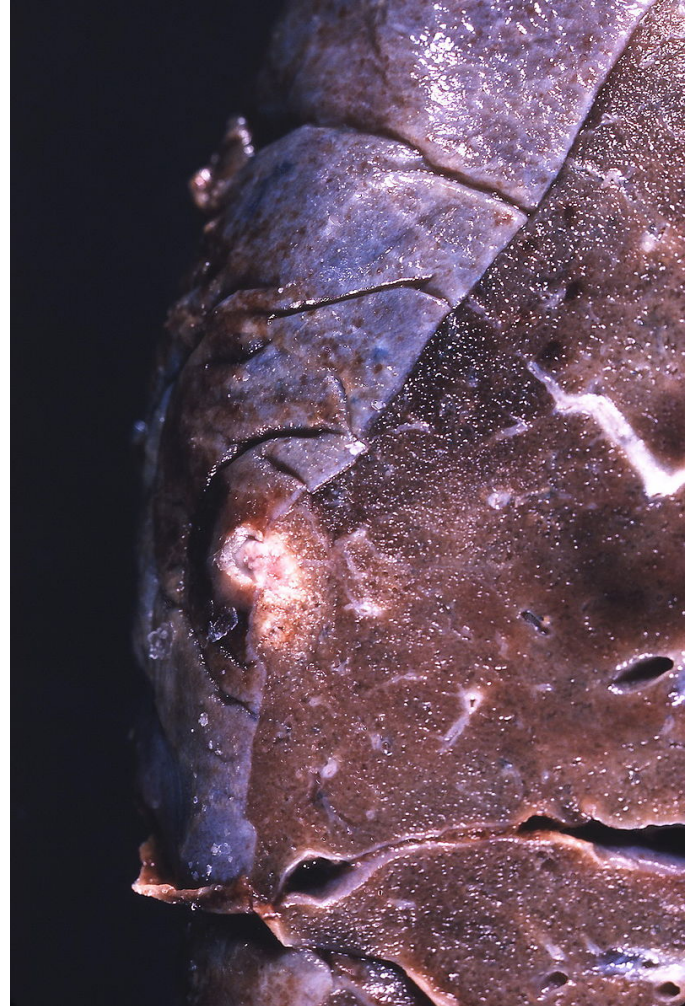
One of the ways to solve this problem was announced in the method of applying the method of administering antibacterial drugs by regional infusion therapy against the background of the use of drugs that improve the microvasculature [25].

In patients with inflammatory lung diseases, risk factors such as coronary heart disease, hypertension, diabetes mellitus and dyslipemia are associated with impaired endothelium-dependent vasodilation. In patients with purulent-inflammatory lung diseases due to type 2 diabetes mellitus, these risk factors are often grouped. P.J. Bijlstra et al. It was investigated whether long-term treatment with the angiotensin-converting enzyme inhibitor perindopril can improve endothelium-dependent vasodilation in this group of patients [11].

They selected 10 patients with acute purulent-destructive lung diseases against the background of diabetes mellitus and hypertension (age 59.4 +/- 3.2 years, body mass index 29.7 +/- 1.5 kg m.m.2, blood pressure 169 +/- 6/92 +/- 1 mm Hg, total cholesterol 6.6 +/- 0.3 mM). Using venous occlusive plethysmography, they recorded an increase in forearm blood flow in response to three vasodilation stimuli: (a) 5 minutes of forearm ischemia, (b) infusion of endothelium-dependent methacholine vasodilator (Mch) into the brachial artery, and (c) intra-arterial infusion of endothelium-independent sodium nitroprusside. This procedure was repeated after 6 hours of treatment. It has been proven that the use of treatment methods considering the endothelium-dependent factor has significantly improved the results of achieving the required concentration of antibacterial drugs in the focus of lung destruction in patients with diabetes mellitus.

It is believed that the effectiveness of intra-arterial injections is associated not only with the achievement of a high 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 is much less blocked by plasma proteins. This position is confirmed by the data of other authors [24] who studied the distribution of antibiotics in the body and their concentration in the blood and tissues with different routes of administration. As a result of these studies, it was proved that intra-arterial administra-

tion creates the highest concentration of drugs in the lesion compared to other methods, and this, in turn, leads to the neutralization of toxins faster, significantly reduces their absorption, Stimulates phagocytosis, limits tissue necrosis.



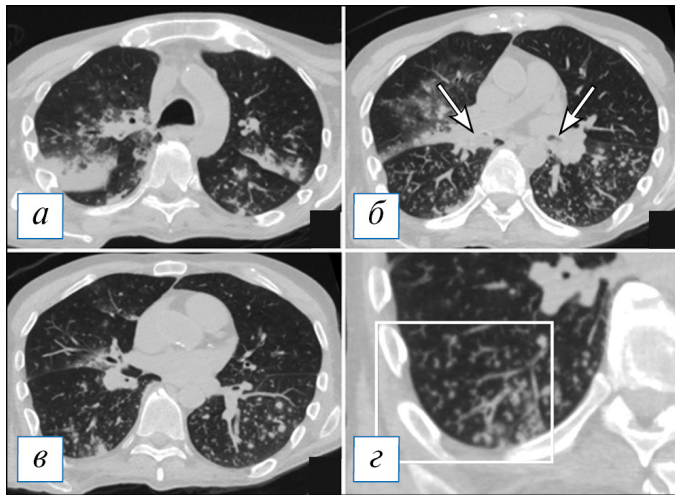
A subpleural abscess

The positive effect of long-term infusion of drugs into the pulmonary artery system, according to N.F. Krotov [22], began to effect on the 2nd-3rd day, and with infusion into the vena cava – on the 3rd-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 infusion of antibiotics through the central arterial bed (aorta or bronchial artery) for the treatment of purulent-destructive lung diseases [21].

It is believed that catheterization of bronchial arteries is a valuable auxiliary method for the treatment of sup-

purative lung diseases, accompanied by severe purulent intoxication. At the same time, the 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 treatments. There is no information in the literature about the possibility of intra-arterial therapy of patients with acute purulent-destructive lung diseases against the background of diabetes mellitus.



Chest CT, axial projection (a–r). Bilateral bronchopneumonia and bronchiolitis (with the etiology of *S. pneumoniae* and *S. aureus* confirmed by a sputum test). On both sides, more in the lower lobes against the background of bronchial sputum obturation (arrows), there are peribronchial nodules of various sizes, including a “tree in bud” sign (frame). In the upper lungs areas the nodules formed infiltrates. [53]

An analysis of modern methods of treatment of acute purulent-destructive lung diseases in patients with diabetes mellitus showed that most of the interventions are aimed at combating infection and intoxication [20].

This is necessary, but not always successful antibiotic therapy will provide the patient with recovery, if you do not act purposefully on other parts of the pathogenesis, including metabolic processes, the state of the microvasculature and endothelial system.

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

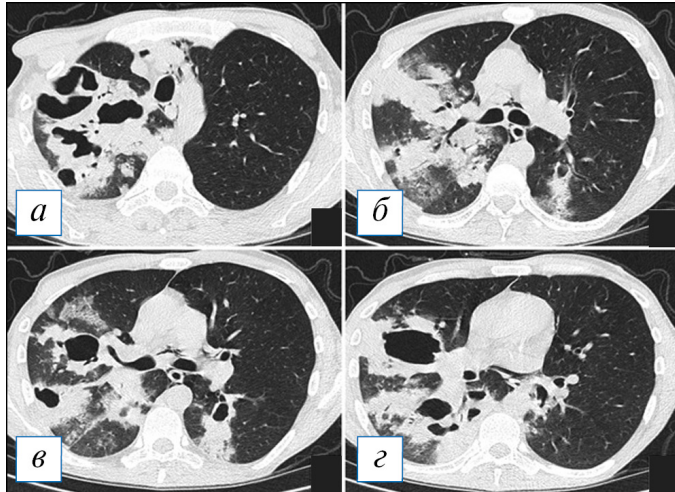
In the published works of G. Schierhout and I. Roberts [14], devoted to the evaluation of the effectiveness of intra-arterial infusion of albumin solution in patients with surgical infection who are in critical condi-

tion, it had a wide response among doctors of various specialties. In patients with acute purulent-destructive lung diseases on the background of diabetes mellitus, an inverse correlation of albumin concentration in plasma with the risk of death was revealed. Systematic review of several studies showed that a decrease in the concentration of plasma albumin for every 2.5 g/l is accompanied by an increase in the risk of death by 24-56% [10].

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 in this process - antioxidant protection [28].

Drainage of a purulent-destructive focus in the lung is one of the main methods of achieving positive treatment results. Of course, in the case of a spontaneous breakthrough of a lung abscess into the bronchial tract, the need for drainage becomes more anatomical. Nevertheless, this method of treatment of acute lung abscesses in patients with diabetes mellitus allows not only to evacuate purulent-necrotic contents from the focus of destruction, but to use antibacterial drugs in the form of local administration. Of course, this variant of exposure in patients with diabetes mellitus should be performed considering the state of the microvasculature and endothelial system. However, as shown by the results of treatment of patients with acute lung abscesses on the background of diabetes mellitus, often, due to the presence of deep disorders in the endothelial system, the effectiveness of this effect on the course of the wound process is very low. As pointed out by several researchers, such a conclusion can be made in comparison with patients who do not have diabetes. In other words, the currently known effective methods of treating lung abscesses, in the case of diabetes mellitus, cannot always be considered highly effective. Hence, the proposal naturally arises about the need to perform more radical surgical interventions on the lungs of a resection nature [9].

The currently known methods of drainage of lung abscesses in patients with diabetes mellitus remain the same. Among them, we can recall transthoracic drainage methods as an abscess there and the pleural cavity, in the presence of an abscess breakthrough into the pleural cavity. Puncture as a local method of treating lung abscesses has not yet been widely used due to its low effectiveness and can only be used in the conditions of preparing the patient for drainage of the abscess or purely for diagnostic purposes.



Chest CT, axial projection (a–r). Bilateral polysegmental pneumonia. On both sides in the lungs, more to the right, there are infiltrates and cavities of various sizes without liquid content. Minor pneumomediastinum. [53]

Endobronchial methods of drainage remain in the arsenal of small surgical interventions, as they can be not only therapeutic, but also diagnostic in nature. The most used are endobronchial administration of drugs, inhalations, microtracheostomy, transnasal administration of drugs into the draining bronchus, and sanitation fibrobronchoscopy [5].

The positive side of this method of drainage, in contrast to the transthoracic, is the ability to act on the mucous membrane of the tracheobronchial tree and thereby create conditions for the sanitation of such a large array of the source of surgical infection in purulent endobronchitis. At In this case, the proposed methods of combined drainage, i.e., endobronchial, and transthoracic, although highly effective, are not always feasible [5].

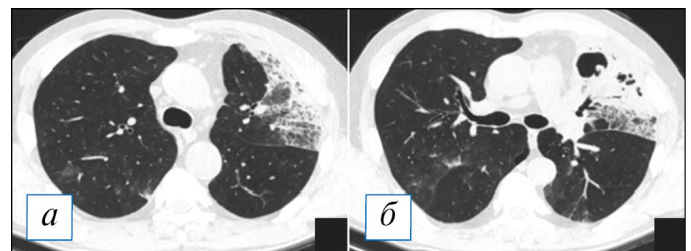
This is since in the case of drainage of an abscess through the respiratory tract, often, such abscesses are located closer to the root zones of the lung, while lung abscesses that are possible for transthoracic drainage are located on the periphery.

There are reports stating the need for mandatory drainage of acute lung abscesses in patients with diabetes mellitus. Proponents of this statement rely on the low effectiveness of conservative therapy while maintaining the source of infection and its progression, capturing more and more areas of lung tissue. We adhere to this approach in our clinic in the case of pleural complications of acute lung abscesses (pyopneumothorax, pleural empyema). However, with lung abscesses, especially

with their small size, our clinic is of the opinion of the need for endobronchial drainage.

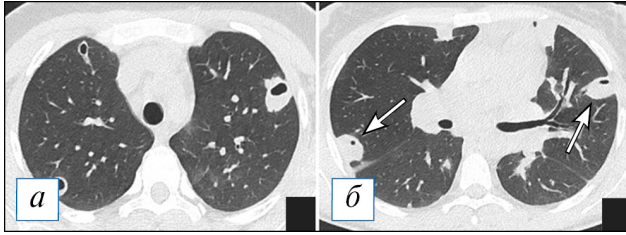
Another unresolved and controversial point in the treatment of patients with acute purulent-destructive lung diseases against the background of diabetes mellitus is the issue related to the timing of the rehabilitation of the lung abscess. There are a large number, sometimes even mutually denying, opinions regarding the indications for the use of a particular method of treatment and the timing of its implementation. These issues remain controversial.

Difficulties in choosing a treatment method are also associated with a high risk of developing phlegmon of the chest wall. The incidence 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 [2].

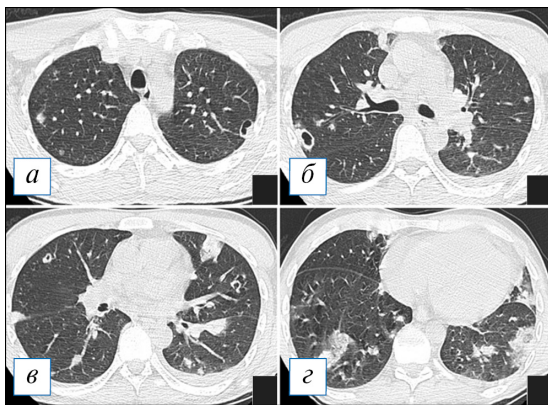


Chest CT, axial projection (a, б). Pneumonic infiltration in the upper lobe on the left with destructions. There are areas of a «crazy paving» sign in combination with consolidation, against the background of which one can see destructive cavities of various sizes without content, their outer contour is not traced. [53]

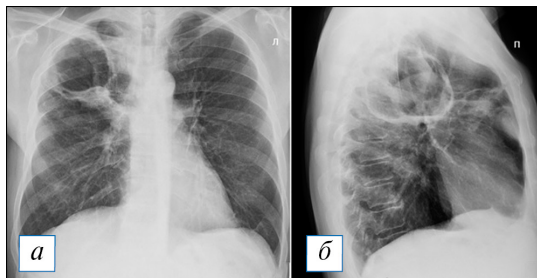
The development of phlegmon of the chest wall in patients with lung abscesses after transthoracic drainage depends on the nature of the virulence and the conditions of the habitat of the microflora in the focus of destruction. It is also often due to the failure of tubular drains in gangrenous destruction 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 unretrieved pulmonary sequestration and massive purulent-fibrin deposits is dangerous and tactically incorrect. In this case, the priority is the phenomenon of surgical infection in patients with diabetes mellitus - a rapidly progressing course of the process with systemic generalization of the inflammatory process.



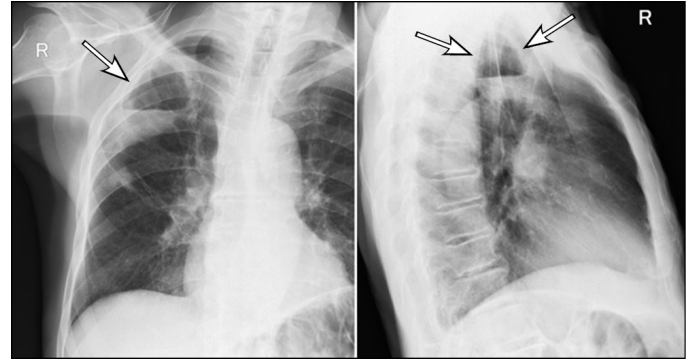
Chest CT, axial projection (a, б). Septic embolism in a patient with infectious endocarditis of the tricuspid valve. In the picture of the lung damage, one can see predominance of both completely formed rounded cavities and those formed from subpleural opacities with clear contours (arrows). [53]



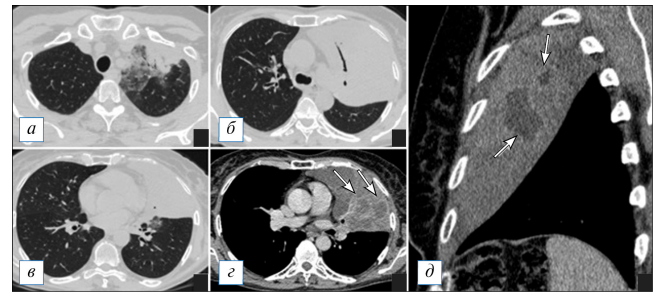
Chest CT, axial projection (a–г). Septic embolism in a patient with infectious endocarditis. In both lungs, with a predominance in the peripheral parts, foci, small cavities, as well as opacities of a mixed type (consolidation in combination with «ground glass») are determined, reflecting the areas of infarcts. Minor pleural effusion on the left. [53]



Chest X-ray. Acute abscess in the upper lobe of the right lung. In the upper lobe on the right there is a ring-shaped shadow with a small horizontal level of fluid, which indicates almost complete drainage of the abscess. In S3, next to the cavity, there is a non — uniform shading and thickening of the pulmonary pattern. [53]



Chest X-ray. Acute abscess in the upper lobe of the right lung. The cavity in the upper lobe on the right is filled with liquid by 1/3 with a horizontal level that corresponds to the position of the patient during the image acquisition (arrows). [53]

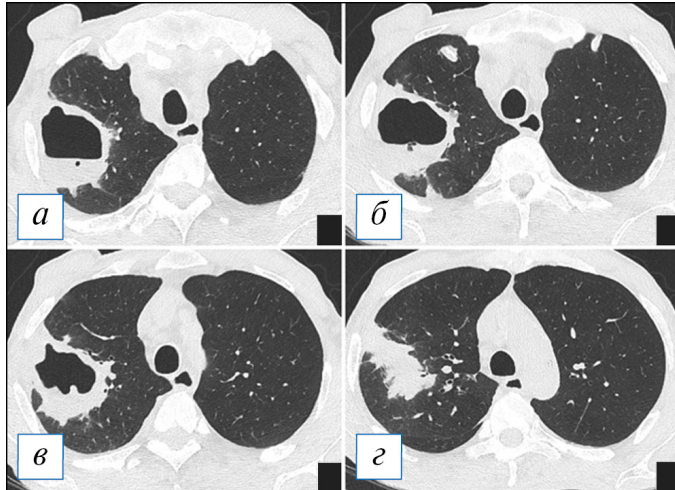


Axial (a–г) and sagittal (д) chest CT images. Forming abscesses in the extensive infiltrate of the upper lobe of the left lung. After an intravenous contrast enhancement, there are areas of reduced density (arrows), which correspond to purulent delimited foci, likely to turn into abscesses. Along the border of these areas, the contrast is somewhat enhanced, which may indicate the formation of a pyogenic membrane. [53]

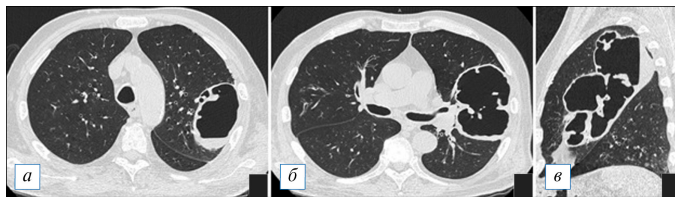
In addition, the spread of infection into soft tissues can be facilitated by a few technical errors made during the installation of drains, when the hole in the intercostal space is larger than the outer diameter of the drainage tube, when the drainage is inserted too deep or, conversely, superficially, 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 saves patients from developing breast phlegmon, which in most cases is a lethal complication for this group of patients [1].

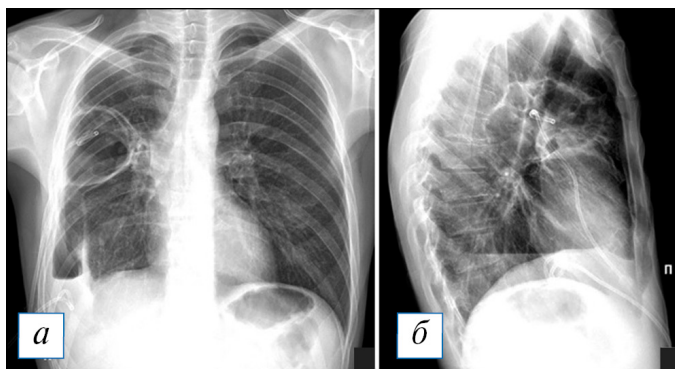
It should be noted that in recent years, most clinicians use thoracoabscessostomy to drain gangrenous abscesses. There are reports on the effectiveness of this technique [21].



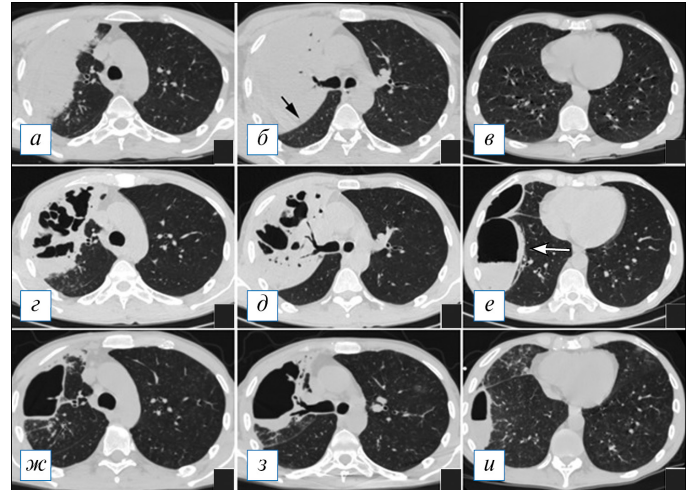
Chest CT, axial projection (a–г). A typical picture of an acute abscess. In the upper lobe on the right there is a filled cavity the outer and inner wall of the cavity having fairly clear contours, pericavitic infiltration is poorly expressed. [53]



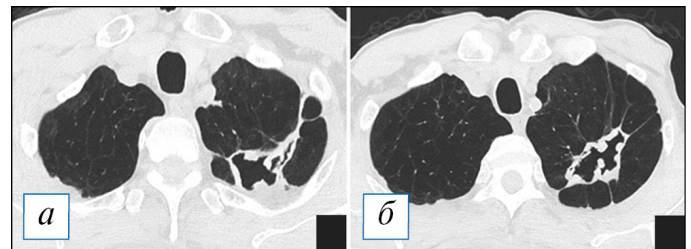
Axial (a, б) and sagittal (в) chest CT images. Multi-chamber «ladder» acute abscess in the upper lobe of the left lung. There is a small amount of fluid in the abscess, and there is no infiltration around the cavity. [53]



Chest X-ray. Abscess in the upper lobe of the right lung, communicating with the pleural cavity on the right with the formation of a single combined space (confirmed by CT). There are drains both in the cavity of the abscess and in the cavity of the empyema. In the pleural cavity — a certain amount of fluid. [53]



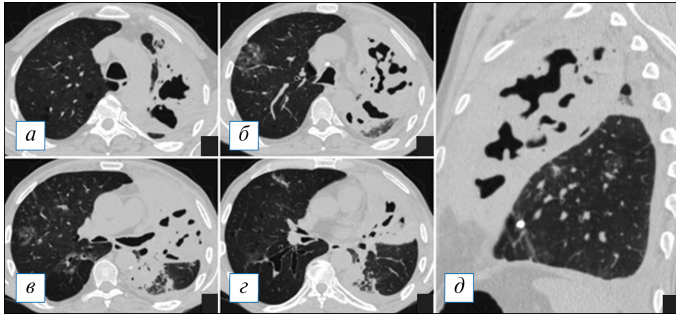
The same patient one presented in Fig. 11. Chest CT, axial projection from 14.12.2020 (a–в), 23.12.2020 (г–e) and 18.01.2021 (ж–и) at the corresponding levels. A typical course of staphylococcal pneumonia. Against the background of a massive infiltrate in the upper lobe on the right (with «sagging» of the pleura; arrow), multiple destructions were formed, which later merged into a single abscess cavity, also complicated by pleural empyema (arrow head). [53]



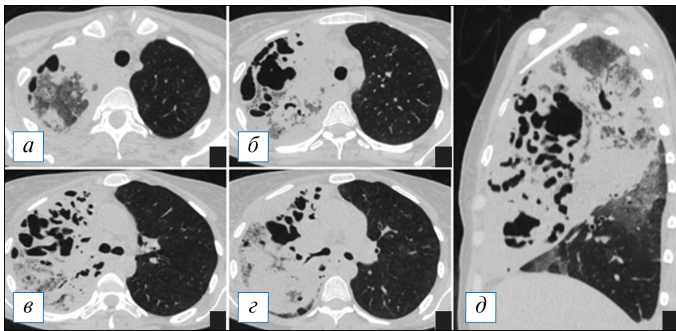
Chest CT, axial projection (a, б). Chronic abscess of the upper lobe of the left lung in the period without exacerbation. There is an irregular cavity with clear outer and inner edges, the inner contour is bay-shaped. The contents in the cavity are absent, the lung tissue around it is deformed by strands and fibrous areas. [53]

The promising possibilities of laser radiation in the complex treatment of patients with surgical lung diseases deserve attention [33].

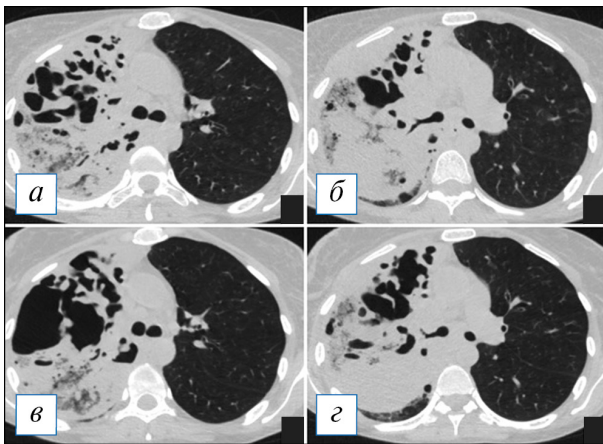
In recent years, for the treatment of such complications, more and more information has appeared regarding the possibility of using therapy with controlled negative pressure, which we decided to present separately.



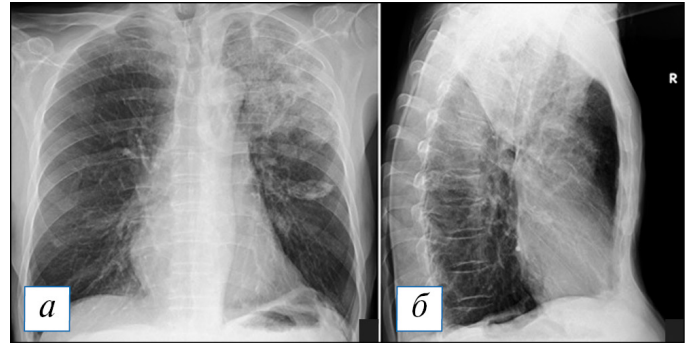
Axial (a–r) and sagittal (π) chest CT images. Gangrene of the upper lobe of the left lung. There is a total infiltration of the upper lobe with the presence of multiple irregular-shaped destructive cavities, as well as little areas of infiltration in other parts of the lungs. A small pleural effusion is seen on the left. [53]



Axial (a–r) and sagittal (π) chest CT images. Gangrene of the upper and middle lobes of the right lung at its initial stage. There is a total infiltration of the lobes in the form of ground glass opacity and consolidation, against which there are oddly shaped cavities that tend to merge. [53]



Chest CT, axial projection from 14.09.2020 (a, б) and 22.09.2020 (b, r). Negative dynamics of lung gangrene. Small cavities confluence into larger ones, irregular shapes, the contents in the cavities are absent. [53]



In the upper lobe on the left, a non-uniform limited opacity is clearly visible, however, it is difficult to reliably judge the formation of the sequester against this background. [53]

Possibilities of treatment of surgical infection using controlled negative pressure

The basis of pathogenetic treatment of lung abscesses is the sanitation of the abscess [38]. However, the choice of the method of sanitation of the abscess is still at a debatable level. At the same time, over the past decades, a method of treatment with negative pressure – vacuum therapy – has been widely used in clinical practice in the treatment of wound infection.

It is known that the principle of operation of the vacuum therapy method is based on the use of a closed drainage system that maintains controlled negative pressure in the wound area. As a result of the impact of negative pressure in the drained zone, favorable conditions are created for cleansing from necrotic masses and evacuation of purulent contents, which ultimately can be interpreted as favorable conditions for the course of the wound process. Along with this effect, the growth of granulation tissue is stimulated, which actively closes the wound and creates conditions for performing plastic surgical interventions.

Vacuum therapy, according to the descriptions of A.Ch. Chasnoit et al., allows you to influence all phases of the wound process [47].

According to D. Othman, controlled negative pressure in the treatment of wound infection significantly reduces inflammatory edema and enhances the process of microcirculation [34].

M.Malmsjo et al. It is believed that the combination of vacuum therapy with antiseptics helps to reduce the level of microbial contamination of wounds, reduces the size of the affected area [6].

The key to achieving successful wound regeneration with the use of vacuum therapy is a decrease in exudation in the wound area while maintaining an optimal humid environment.

To date, vacuum therapy is used in wide clinical practice in many surgical areas associated with the presence of a wound inflammatory process. For example, A.J. DeFranzo et al. Vacuum therapy has been successfully used in the treatment of deep wounds of the limbs with exposed bone [43].

N. Kairinos et al. studied the comparative aspects of the use of vacuum therapy in experimental conditions in vitro, which allowed them to develop indications and contraindications for the use of this method of treatment in the treatment of chronic limb ulcers [41].

The medical literature describes examples of the successful use of negative pressure in the treatment of trophic venous ulcers of the lower extremities, diabetic foot ulcers, infected wounds, bedsores, burns and postoperative wounds. All this testifies to the effectiveness of this method of local treatment at the present stage of development of the doctrine of wound and wound infection.

A.Y. Gritsyuta conducted research on the possibility of using vacuum therapy in the local treatment of chronic pleural empyema [16].

Based on the results of the study, it was concluded that the use of vacuum therapy can reduce the time interval before performing reconstructive surgery and reduce the frequency of relapses in patients with chronic pleural empyema without bronchopleural fistula. It was the presence or absence of a fistula that was for researcher of the criteria for the successful application of vacuum therapy. As a practical recommendation, the author suggests that in the absence of a bronchopleural fistula, preparation for the final stage of surgical treatment should include the use of a vacuum bandage in the residual pleural cavity.

To date, several mechanisms and positive properties of vacuum therapy are known. One of the first discoveries was made in such a mechanism as the active evacuation of the produced wound discharge. At the same time, along with the evacuation of pus, biologically active substances responsible for inhibiting wound regeneration are also removed.

Thanks to the use of the controlled negative pressure method, there is a continuous evacuation of wound exudate. It has been proven that exudate contains many inflammatory mediators and proteolytic enzymes. It is the accumulation of such exudate in the wound that leads to inhibition of the healing of the purulent cavity. As the

exudation process in the wound prolongs, the cumulation of oxidative enzymes, cytokines, leukocytes, and proteases acquires a peak value. This creates a vicious circle in the obstacle to the healing of the wound cavity [39, 52].

The transition of the inflammatory process into a chronic form, the wound surface is enriched with cells capable of producing cytokines. The latter, in turn, attract more and more neutrophils, macrophages and lymphocytes to the wound.

In the studies of L. Labler et al. [48] and C. Willy et al. [50] It has been proven at the molecular level about the important role of the imbalance between the concentration of proteases, their inhibitors, and pro-inflammatory cytokines in the protracted course of the wound process and the transition of the process to the chronic phase. It has been proven that the use of vacuum therapy can significantly reduce the level of pro-inflammatory cytokines both in wound exudate and in peripheral blood on the 10th day of treatment. Regular cases of a drop in the level of tumor necrosis factor in wound exudate as early as day 2 of guided vacuum therapy were described. In the future, over the next 7 days, the nature of the changes did not change. The intensity of these processes directly depended on the increase in the level of negative pressure.

On experimental models of the course of the wound process, the use of controlled negative pressure at maximum values up to -125 mm Hg, made it possible in the shortest possible time (within 48 hours of therapy) to achieve a decrease in the intensity of exudation by 80% in relation to the control value, taken conditionally as the maximum value. Reducing the level of negative pressure to -25 mm Hg. made it possible to reduce the volume of wound exudation by 50%. Based on these data, the researchers concluded that it was necessary to use differentiated controlled pressure with a gradual decrease in the level of vacuum therapy.

The rate of evacuation of wound exudate depends on the type of wound. In the case of treatment of extensive superficial wounds, evacuation occurs faster than, for example, from the abdominal cavity.

It has been proven that maintaining the moisture of the wound environment enhances the process of angiogenesis and fibrinolysis, which contributes to the normal functioning of growth factors.

The use of controlled negative pressure accelerates bacterial decontamination of wound tissues, increases local blood circulation, and reduces local interstitial tis-

sue edema, reduces the wound area, enhances the effect of drug treatment.

Thus, the above analysis of the literature on the possibilities of using controlled vacuum therapy, it can be noted that local prolonged treatment of wounds using controlled negative pressure, at present, is a detailed, reliable, effective, and professional technology for treating wounds of various etiologies. Promising developments in this direction are the study of opportunities to improve the results of treatment of abscesses of internal organs, in particular the lungs, which will reduce the time and reduce the cost of treatment.

CONCLUSION

Among patients with suppurative lung diseases, the most severe in the course of the disease and prognosis are patients with acute lung abscesses against the background of diabetes mellitus.

Even with the achievement of success in the technique of surgical interventions, the use of powerful antibiotics and new antiseptics, the achievement of the effectiveness of treatment among patients with acute purulent-destructive lung diseases against the background of diabetes mellitus remain far from their solution. A special role in maintaining a high level of negative results in the treatment of patients with lung abscesses against the background of diabetes mellitus is played by several pathogenetic mechanisms, such as progressive endotoxemia and generalization of the inflammatory process, due to a long period of preservation of the source of infection. At the same time, the traditional conservative treatment of acute purulent-destructive lung diseases in patients with diabetes mellitus can be confidently considered ineffective, since they are often fatal.

Meanwhile, to date, the possibilities of using controlled negative pressure in the treatment of acute lung abscesses in patients with diabetes mellitus remain unclear. On the one hand, the available information regarding the high effectiveness of this method of treatment in the treatment of the wound process, suggests the idea of its possible continuity. However, even with the use of controlled vacuum therapy in the treatment of patients with pleural empyema, complications are possible in the form of bronchopleural fistula and bleeding.

It seems to us that the solution to this problem is possible by selecting the optimal modes, timing, and methods of using controlled vacuum therapy in the treatment of acute lung abscesses in patients with diabetes mellitus, based on the assessment of the morphological picture of

the lung tissue with an assessment of the phases of regenerative processes.

Consent for publication - The study is valid, and recognition by the organization is not required. The author agrees to open the publication.

Availability of data and material – Available.

Competing interests – No.

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QANDLI DIABET BILAN OG'RAYOTGAN BEMORLARDA O'PKA O'TKIR XO'PPOZLARINI DAVOLASH USULINI TANLASHNING BAHSLI MASALALARI

Xamdamov Sh.A.
Toshkent tibbiyot akademiyasi
ABSTRAKT

Muammoni hal qilishning uzoq tarixiga qaramay, o'pka o'tkir xo'ppozlarini ko'p jihatdan davolash usullari hali ham mukammal. Tabiiyki, har qanday jarrohlik infeksiyasida bo'lgani kabi, antibiotiklarning kashf etilishi ham davolash taktikasining ko'plab jihatlarini qayta ko'rib chiqishga imkon yaratdi, bu esa ikkinchisiga afzallik berdi. Biroq, bu erda unchalik oddiy emas. Ushbu ko'rib maqolada qandli diabetda o'pka o'tkir abscessini davolash usullarining bahsli masalalari bo'yicha tegishli zamonaviy adabiyotlarni tanlashga harakat qildik. Tanqidiy tahlil o'tkazdik va tadqiqotimizning tegishli natijalarini keltirdik. O'z ishimiz yuzasidan o'z mulohazalarini bildirishga e'tibor bersalariz, minnatdor bo'lamiz.

Tayanch iboralar: o'pka xo'ppozlari, qandli diabet, klinik belgilar, davolash, VAK-terapiya

СПОРНЫЕ ВОПРОСЫ ВЫБОРА СПОСОБА ЛЕЧЕНИЯ ОСТРЫХ АБСЦЕССОВ ЛЕГКИХ У БОЛЬНЫХ САХАРНЫМ ДИАБЕТОМ

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АБСТРАКТ

Способы лечения острых абсцессов легких во многом, несмотря на свою долголетнюю историю решения проблемы, все еще далека от совершенства. Естественно, как и в случае с любой хирургической инфекцией, открытие антибиотиков позволило пересмотреть многие аспекты лечебной тактики, придавая предпочтение последним. Однако из здесь все не так просто. В данной обзорной статье мы постарались подобрать актуальную современную литературу относительно спорных вопросов способов лечения острых абсцессов легких при сахарном диабете. Мы провели критический анализ и подвели соответствующие итоги нашим исследованиям. Будем признательны, если читатели уделят внимание для представления своих отзывов по нашей работе.

Ключевые слова: абсцессы легких, сахарный диабет, клинические признаки, лечение, ВАК-терапия