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EFFICACY OF THERAPEUTIC MEASURES IN ACUTE PURULENT-DESTRUCTIVE LUNG DISEASES IN PATIENTS WHO HAVE HAD SARS-COV-2

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ABSTRACT

Background. Since the discovery of SARS-CoV-2, purulent-destructive lung diseases have been increasingly diagnosed around the world in patients who have fallen ill or had COVID-19 pneumonia. The relevance of this pathology is because the pathology is painful for the patient, time-consuming for the doctor and expensive for the medical institution.

Material and methods. The results of a comprehensive examination and treatment of 128 patients with acute purulent-destructive lung diseases who had SARS-CoV-2 for the period 2020-2022 are analyzed. Differentiated therapies were used, which were assessed by immediate outcomes.

Results. As a result of the use of therapeutic and diagnostic measures developed by us based on the assessment of the degree of endothelial dysfunction in the lungs, it was possible to increase the level of complete recovery from 23.1% to 41.3%, clinical recovery from 35.4% to 44.4%, reduce the frequency of transition of the inflammatory process into a chronic form from 26.2% to 7.9% and, accordingly, the lethal outcome - from 15.4% to 6.3%.

Conclusion. The use of the treatment methods developed by us allows us to increase the positive results of treatment, and reduce the frequency of unsatisfactory treatment results and mortality.

Key words: acute purulent-destructive lung diseases, acute lung abscess, lung gangrene, abscessing pneumonia, intra-arterial catheter therapy.

INTRODUCTION

A feature of the course of SARS-CoV-2 lung infection is the consolidation of the inflammatory focus in the lungs, which can lead to the formation of lung abscesses and gangrene, and sepsis, which is associated with high mortality in the long-term period after SARS-CoV-2 disease [6].

At the moment, the exact mechanism of development is not known, but it may be associated with diffuse alveolar injury, intraalveolar bleeding, stenosis or occlusion of alveolar arterioles, their thrombosis and, as a consequence of the above, necrosis of the cell parenchyma. Another factor in the occurrence of acute purulent-destructive lung diseases is pneumofibrosis, which is a frequent occurrence after COVID pneumonia [8].

A lung abscess is a necrotic lesion that forms a cavity filled with pus in the lung parenchyma with a characteristic level of fluid in the air on a chest x-ray. Most often, the cause of severe COVID pneumonia is not only a virus but also a bacterial and fungal superinfection, including those associated with mechanical ventilation [12].

The standard treatment regimen for acute purulent-destructive lung diseases with/after SARS-CoV-2 infection is ineffective, which is due to pathogenetic factors. A serious problem arises here – antibacterial resistance, due to the unjustified use of antibacterial drugs, even in a mild form of SARS-CoV-2. This, in turn, presents difficulties in the treatment of acute purulent-destructive lung diseases, leading to the spread of infection and, as a result, the death of patients [5].

In this regard, the goal of our study was to improve the treatment outcomes of patients who have had SARS-CoV-2 by developing pathogenetically based methods for their diagnosis and treatment.

MATERIAL AND METHODS OF RESEARCH

The results of a comprehensive examination and treatment of 128 patients with acute purulent-destructive lung diseases who had SARS-CoV-2 for the period 2020-2022 are analyzed. The patients were treated and examined in the Department of Purulent Surgery of the Multidisciplinary Clinic of the Tashkent Medical Academy. Taking into account the different flow of patients depending on the SARS-CoV-2 pandemic situation, all patients were divided into 2 groups. The first group of patients (control) consisted of 65 (50.8%) patients with acute purulent-destructive lung diseases who had SARS-CoV-2 and were treated with traditional treatment methods from April to December 2020. In patients of this group, we used methods of examination and treatment by the medical and diagnostic standards "Provision of medical and diagnostic care to patients with surgical infection" of 2002.

The second group of patients (the main group) consisted of 63 (49.2%) patients with acute purulent-destructive lung diseases who had SARS-CoV-2, who underwent improved methods of diagnosis and treatment of these diseases, approved and recommended for practical use by the Ministry of Health of the Republic of Uzbekistan.

All patients were divided according to clinical and nosological forms of acute purulent-destructive lung diseases (Table 1).

Table 1

Distribution of patients with acute purulent-destructive lung diseases

NATURE OF THE DISEASE	PATIENT GROUPS				TOTAL	
	CONTROL		MAIN			
	n	%	n	%	n	%
Abscessing pneumonia	21	32.3	19	30.2	40	31.3
Purulent lung abscess	18	27.7	24	38.1	42	32.8
Gangrenous lung abscess	17	26.2	16	25.4	33	25.8
Lung gangrene	9	13.8	4	6.3	13	10.2
TOTAL	65	50.8	63	49.2	128	100.0

Most of the patients were transferred to us directly from the specialized clinic after the exclusion of infectious pathology (subgroup I of patients – 51.6%). However, along with this, there was a cohort of patients who were admitted to the clinic from various therapeutic hospitals, where, as a rule, they underwent purely conservative therapy (subgroup II of patients – 48.4%). At the same time, patients of subgroup I (56.9%) prevailed in the control group, and patients of subgroup II (54.0%) prevailed in the study group.

The majority of patients were represented by acute purulent abscess (32.8%) and abscessing pneumonia (31.3%). To a lesser extent, there were patients with acute gangrenous lung abscesses (25.8%) and pulmonary gangrene (10.2%). At the same time, cases with abscessed pneumonia prevailed in the control group (32.3%), while in the main group – with acute purulent abscess (38.1%). There were 2 times more patients with lung gangrene in the control group than in the study group, which appears to have been related to the peak of the SARS-CoV-2 pandemic. Bilateral lung lesions were noted in 35.9% of cases, unilateral – in 64.1% of cases in the ratio of 0.56 units. Moreover, in the control group of patients, bilateral lesions were 5.2% higher than in the main group.

Men aged 31 to 60 years (81.3%) were the most susceptible to the disease. A total of 295 comorbidities were diagnosed. A total of 223 local complications of acute purulent-destructive lung diseases were diagnosed in patients who had SARS-CoV-2. With the help of bronchofibroscopy, 85.2% of patients were diagnosed with the presence of local or diffuse purulent endobronchitis, which indicated complete or partial natural drainage of the foci of destruction in the lungs. 83.4% of patients were diagnosed with pleural complications. At the same time, in 34.4% of cases, they were not purulent, in the form of exudative pleurisy (34.4%). Hemoptysis was observed in 6 (4.7%) patients.

The main rule in the treatment of acute purulent-destructive lung diseases in patients who had SARS-CoV-2 was early and adequate endobronchial or transthoracic drainage and sanitation of the purulent-necrotic focus in the lung.

Microtracheostomy was used for endobronchial catheterization of the destruction cavity. After it was performed, the catheter was guided into the destruction cavity under the guidance of fibro bronchoscopy and fluoroscopy. Endobronchial sanitation of destruction cavities in the lungs lasted 4-17 days. In patients of the main group, endobronchial sanitation was fractional, with the use of a composite solution consisting of proteolytic enzymes (trypsin or chymotrypsin 30 mg per 100 ml of basic solution) and antibiotics (cephalosporins at the first stage, followed by the selection of the drug according to the bacteriogram data) on a slightly alkaline basis. In the case of more severe conditions of patients, the Decasan solution was used as a basic solution as the main goal of endobronchial sanitation.

For transthoracic drainage, in most cases, we used a double lumen drain with a diameter of 0.5-1.0 cm. In patients with acute gangrenous lung abscesses in the study group, obturating drainage was used in combination with a hydrophilic polyurethane sponge installed on the working end of the tube, which allowed for debridement using controlled negative pressure.

In the presence of pleural empyema or pyopneumothorax, the use of thoracentesis methods by double-lumen drainage with an obturator made it possible to carry out both permanent evacuation of purulent contents and to carry out its sanitation both in fractional (in pleural empyema) and flow (in pyopneumothorax) modes, to influence the course of the purulent-destructive process with various drugs and physical factors, to control the dynamics of the purulent-wound process in the lung. After thoracentesis in patients with pyopneumothorax, the pleural cavity was thoroughly washed with ozonated 0.9% sodium chloride solution up to 2000 ml per day. Irrigation of the pleural cavity was carried out in the flow-drip mode at a rate of 3-4 ml/hour. After thoracentesis in patients with pleural empyema, lavage was performed with a 0.18% solution of sodium hypochlorite. Transthoracic drainage was connected to the active aspiration system with a dilution of 20-30 mm of water. and used it to drain the contents from the destruction cavity. The cavity was washed in the flow-fraction mode. After the reduction of purulent discharge, irrigation with ozonated 0.9% sodium chloride solution and 0.18% sodium hypochlorite solution was stopped. The reorganization regime was transferred exclusively to factional. A composition consisting of a 1% Dioxidine solution with the addition of a water-soluble ointment and proteolytic enzymes was introduced into the cavity. The exposure mode averaged 75±15

minutes. After this time, the drain was connected to active aspiration of 20-30 mm water. X-ray control is carried out every two days. When the lung was expanded and the residual cavity was eliminated, the drain was removed.

To achieve the maximum concentration of the injected drugs in the focus of inflammation, according to the indications, an intra-arterial catheter was inserted at the mouth of the bronchial artery (in the unilateral process) or in the aortic arch (in the bilateral process) with long-term intra-arterial catheter therapy by the angiographic method with transfemoral access. Infusion of drugs into the bronchial artery was carried out in a continuous round-the-clock mode by intra-arterial injection of fluids by the device "drug dispenser 1" or by the "high bottle" method. After the intra-arterial infusions were completed, the catheter was removed. Fixation of the artery at the puncture site was carried out after receiving a stream of blood.

The choice of antibiotics during treatment was based on the express bacterioscopic picture of the punctate and the antibiogram data. At the same time, the main and goal of antibiotic therapy was a gradual transition to oral maintenance doses. If fungi were detected, Diflucan or Flukazanol were added. Initially, antibiotic therapy was carried out in a combined version. In the main group of patients, selective endoarterial catheter therapy was supplemented by the intra-arterial connection of protein-synthetic enhancement agents and endovenous infusion of fat emulsion preparations. Another main attribute of this treatment regimen was the intravenous use of dilute alcohols (sorbitol, xylitol).

To determine the incidence of sepsis and organ failure associated with its presence, we used the R.C. Bone classification of sepsis [3].

Immediate outcomes were assessed based on these gradations, according to the following criteria:

Complete recovery is the disappearance of clinical manifestations of the disease and endoscopic signs of the inflammatory process in the bronchi. Radiographically, the changes at the site of the former abscess either completely disappeared or persisted in the form of a small area of pneumosclerosis. Angiography and bronchography do not show any pathology, or a slight deformation of the subsegmental branches is revealed.

Clinical recovery – against the background of the complete disappearance of clinical signs of inflammation, a thin-walled "dry" cavity is X-rayed, and the complete disappearance of inflammatory changes in the bronchi is endoscopically observed. Angiography does not show changes in the angioarchitectonics of the lung vessels in the peripheral zone with the cavity. Bronchography reveals a

contrast depot with clear contours, an unexpressed deformation of the subsegmental branches in the perifocal zone.

Transition to a chronic form means the preservation of an unexpressed clinical picture, and its complete disappearance is possible. Radiographically, a residual "dry" cavity is preserved in the lung or pleural cavity. An area of subtle perifocal infiltration is usually identified. Endoscopically, signs of moderately pronounced, severely limited endobronchitis remain, but they may be absent. Angiopulmonography shows a pronounced disturbance of blood supply in the perifocal cavity, zone amputation of lobar or segmental or subsegmental branches of the pulmonary artery, absence of capillary phase, presence of arteriovenous fistulas. Bronchial arteriography shows pronounced hypervascularization of the branches of the bronchial artery in the perifocal zone. Bronchography shows pronounced deformity of the segmental and subsegmental bronchi.

The data obtained during the study were subjected to statistical processing on a Pentium-IV personal computer using the Microsoft Office Excel-2016 software package, including the use of built-in statistical processing functions and BioStat for Windows (version 2007). The methods of variational parametric and nonparametric statistics were used with the calculation of relative values (frequency, %).

RESULTS

A comparative assessment of the dynamics of purulent-septic complications of acute purulent-destructive lung diseases in patients who had SARS-COV-2 showed that in the case of sepsis syndrome, the initial level of patients in the study group exceeded that of the control group by 5.98%. However, already on the 3rd day of treatment, this value in the study group decreased by 12.7% compared to the previous period, and by 2.1% about the control group of patients. Subsequently, on the 7th day of treatment, only 7 (11.1%) remained in the main group of patients with sepsis, which was 3 times less than in the previous study period and 2 times less than among patients in the control group. Already on the 14th day of treatment, we did not note cases with sepsis syndrome in the main group of patients, while in the control group, they were still present during the next 2 weeks of treatment.

Regarding the dynamics of changes in clinical and laboratory manifestations of severe sepsis in patients with acute purulent-destructive lung diseases who had SARS-COV-2, it should also be noted that the percentage value among patients in the main group was exceeded (by 5.8%). However, starting from the 3rd day of complex treatment, the frequency of registration of this type of complication decreased by 14.3% compared to the previous study period, and by 7% compared

to the control group of patients. Already on the 7th day of treatment in the main group of patients, severe sepsis was registered only in 3 (4.8%) patients, which was 4.95 times less compared to the previous study period, compared to the control group of patients - 2.6 times. These were the last dates of registration of cases of severe sepsis in the study group, while in the control group of patients such complicated courses were noted on the 14th day of the disease.

As a result of the use of a set of therapeutic measures developed by us, we managed to avoid long periods of stay of patients in an extremely serious condition, manifested by septic shock. Already on the 3rd day of treatment, we have not noted such cases.

In patients with abscessed pneumonia in the main group, an increase in the proportion of patients with complete recovery by 27.6% was achieved due to a decrease in cases with clinical recovery.

Comparative assessment of clinical recovery showed a decrease in the proportion of patients of subgroup I in the study group by 25.0% and complete exclusion of such cases among patients of subgroup II. There were no results of transition to the chronic form of the disease and mortality among patients with abscessing pneumonia after SARS-COV-2.

In the treatment of patients with acute purulent lung abscesses after SARS-COV-2, a total of 19.1% of cases achieved complete recovery. Among the patients of the control group, 4.8%, and among the patients of the main group – 14.3%.

Clinical recovery was achieved in a total of 28 (66.7%) patients. At the same time, in the main group of patients, this treatment result was achieved 1.8 times more than in the control group. The transition to the chronic form of the disease was noted only among patients in the control group and amounted to 14.3%.

In terms of variance, the excess of positive treatment results among both patients of subgroup I and subgroup II was significantly higher than the values between the control and study groups.

Among patients with acute gangrenous lung abscesses of the main group, in 9.1% of cases, the result of complete recovery was achieved, which was not noted among the patients of the control group. All of them were among patients of subgroup II. The number of patients with clinical recovery increased from 15.2% (in the control group) to 18.2% (in the study group). Against this background, a decrease in the number of cases of the disease becoming chronic was achieved from 33.3% in patients in the control group to 15.2% in patients in the main group.

However, unfortunately, among the patients of the main group, cases with lethal outcomes prevailed, which were noted in 2 patients from the first subgroup. In both cases, the patients had bilateral acute gangrenous lung abscesses against the

background of a severe morbid background and advanced cases after aspiration of vomit, which led to the progression of the purulent-putrefactive process in the lungs.

A different nature of treatment results was achieved among patients with pulmonary gangrene. In the overall structure, among all 13 patients with lung gangrene, 84.6% of cases were fatal. At the same time, in 68.2% of cases, it occurred in patients of the control group, while among patients of the main group, mortality was only in 15.4% of cases, which was 4.4 times less than in the control group. Also, among the patients of the main group, in 15.4% of cases, clinical recovery of patients was achieved in the form of the development of pneumofibrosis of the affected part of the lung.

The general picture of the comparative assessment of the effectiveness of therapeutic and diagnostic measures in acute purulent-destructive lung diseases in patients who have had SARS-COV-2 is presented in Table 2.

Table 2

Comparative assessment of the effectiveness of therapeutic and diagnostic measures in acute purulent-destructive lung diseases in patients who have had SARS-COV-2

TREATMENT RESULTS	ГРУППЫ БОЛЬНЫХ			
	CONTROL		MAIN	
	n=65	%	n=63	%
Full recovery	15	23.1	26	41.3
Clinical recovery	23	35.4	28	44.4
Transition to a chronic form	17	26.2	5	7.9
Lethality	10	15.4	4	6.3
Average bed-days	32.8±12.3		21.1±5.1	

Complete recovery in the main group of patients was 41.3%, while in the control group it was 23.1%. Clinical recovery, in which the residual effects of the inflammatory process persisted, was increased in the study group to 44.4%, while in the control group, they were only 35.4%. The transition to chronic lance was reduced to 7.9% in the study group, in contrast to the control group, in which this type of treatment completion was noted in 17 (26.2%) patients. The mortality rate in the main group of patients was 6.3%, while in the control group, it was significantly higher and reached the level of 15.4%. The average number of days patients stay in the clinic has significantly decreased by 1.5 times.

DISCUSSION

Selective endoarterial catheter therapy in patients with endothelial dysfunction made it possible to create high concentrations of drugs directly at the

focus of destruction and to have a targeted effect on the endothelial system of the lungs. A decrease in the volume of microcirculation through arteriovenous shunts and the opening of the microcirculatory capillary system of the lungs made it possible to saturate the concentration of drugs in the shortest possible time (on average up to 4.2±0.8 days) hotbed of destruction [15]. The use of protein synthetic enhancement agents, which we used in patients with a compensated degree of endothelial dysfunction in the lungs, has its prerequisites in the form of known facts of high efficiency of their use for anabolizing purposes, an active effect on the balance of metabolic processes. One of the most rational means of protein-synthetic enhancement is the combined injection of 100 ml of a 10% albumin solution against the background of intramuscular injection of Retabolil [11]. Also, the developed method purposefully increases the local concentration of highly plastic metabolic drugs, which are natural kinin inhibitors, since they are biochemical active substances, products of proteolysis, which is enhanced by endothelial dysfunction against the background of an inflammatory process.

In patients with decompensated endothelial dysfunction in the lungs, as is known, the priority of pathogenetic mechanisms of damage was already dominated by disorders of surfactant-forming lung function [17]. This was the basis for the use of protein and synthetic enhancement in combination with fat emulsion preparations in the treatment of patients with acute purulent-destructive lung diseases. A prerequisite in the program we developed was the use of alcohol-containing medicines or alcohol in its pure form. As is known, the combined combination of such agents increases the caloric content of metabolic agents and contributes to the formation of acetyl-coenzyme-A [18]. This approach, in turn, has a nitrogen-saving effect, sedation, analgesia, tones the cardiovascular system, stimulates pulmonary ventilation and has a foaming effect.

Suppression of the toxic effect of lysophosphatidylcholine is achieved by administering Dekasan solution, which has a pronounced specific effect on the processes of lipogenesis and lipolysis occurring in the body [13]. There is also evidence of a positive effect of this drug in the prevention and treatment of pulmonary atelectasis [9, 10, 19].

This method also affected the endothelial system in the lungs by improving microcirculation due to its antifoaming and angiospasmolytic effect [2].

As you know, the water-soluble ointment has an antimicrobial, anti-inflammatory, and dehydration effect, and is active against gram-positive and gram-negative microorganisms - staphylococci, Pseudomonas aeruginosa and Escherichia coli. The drug easily penetrates deep into tissues without damaging biological membranes. In the presence of pus and necrotic tissues, the antibacterial

effect of the drug is preserved. Dimexide solution has long been known as a highly effective antiseptic, detergent, which also has an anti-inflammatory, distracting, dehydrating effect. It has been proven that in the presence of Dimexide, the duration of action of antibiotics increases by 2 to 3 times [14].

The use of ozonated 0.9% sodium chloride solution as flowing lavage allows not only to carry out mechanical cleaning (due to washing) of the pleural cavity, but also to create the effect of pathogenetic effect on the purulent-inflammatory process itself. This is achieved because of local hyperoxygenation after the release of atomic oxygen in a gas/liquid environment and has a detrimental effect on anaerobic flora, including facultative flora. Also, the constant presence of the air layer in the inflammatory cavity creates the effect of foaming and cavitation, which also increases mechanical cleaning during the sanitation process [4]. The diffusion of atomic oxygen into the walls of the purulent cavity accelerates the processes of metabolism, and tissue regeneration, and therefore accelerates the processes of its obliteration [7].

The positive properties of the use of 0.18% sodium hypochlorite solution are due to its bactericidal effect [1]. It inhibits infection and, having oxidative properties, destroys necrotic moorings, liquefies viscous pus, and contributes to increased exudation and early cleansing of the empiematous cavity. In this concentration, the drug also has fibrinolytic properties and its use in conditions of endothelial dysfunction in the lungs avoids the use of expensive fibrinolytic drugs for debridement of the pleural cavity. At the same time, the transition of purulent cavity sanitation to ointment compositions makes it possible to accelerate the processes of wound cleansing, cellular regeneration, stimulation of cellular and humoral protection factors, and transition to the second phase of the inflammatory process [16].

CONCLUSION

A targeted study of the features of the course of acute purulent-destructive lung diseases in patients who had SARS-CoV-2 using the developed therapeutic and diagnostic algorithms, including improved methods of endobronchial, transthoracic and endovascular correction of endothelial lung dysfunction, compared to the control group, made it possible to increase the level of complete recovery by 1.8 times, clinical recovery by 9.0%, and reduce the frequency of the chronic process by 18.3% and mortality by 2.4 times. The widespread use of sparing treatment methods with a decrease in the percentage of chronic processes and the proportion of radical lung surgeries has made it possible to significantly reduce the number of inpatient bed days.

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