



TREATMENT OF ABSCESSING PNEUMONIA AFTER COVID-19

Bobokulova Shokhista Abdualimovna

Assistant of the Department of General and Pediatric Surgery of the Tashkent
Medical Academy, Tashkent, Republic of Uzbekistan

Tashkent Medical Academy, Farobi street 2, Almazar district, Tashkent city, postal
code - 100109, Republic of Uzbekistan, phone: +998781507825; e-mail -
info@tma.uz

Sugali-ota street 87-21, Chilanzar district, Tashkent city, postal code - 100208,
Republic of Uzbekistan. Phone: +998972623181; e-mail -
shokhista.bobokulova@gmail.com

Abstract

Background. The effects of SARS-CoV-2 (COVID-19) have increasingly challenged physicians in recent years. The variation of their possible effects is endless. However, lung damage as a primary target organ in coronavirus infection remains a major problem, which often takes the form of a fatal process, determining the further health condition of the patient in general. Therefore, the aim of our study was to develop and evaluate the effectiveness of endovascular catheter therapy in patients with abscessed pneumonia who had had COVID-19.

Methods. This paper presents data on the comprehensive examination and treatment of 67 patients with abscessed pneumonia after COVID-19 for the period from 2020 to 2022.

Results. The two-stage injection of drugs should also be referred to the peculiarities of our developed method of treatment of abscessed pneumonia in patients who suffered from COVID-19. At the first stage (1-2 days) - drugs that improve microcirculation and detoxifying agents. At the second stage, we supplemented treatment with protein-synthetic enhancement agents. Antibacterial therapy was carried out by bolus injection of drugs directly into the lung tissue.

Conclusions. Application of the developed method of pulmonary endotheliitis treatment in patients with abscessed pneumonia after COVID-19 allowed reducing the period of catheter therapy and accelerating the process of purulent-destructive process restriction, increasing the rate of complete and clinical recovery by 15,6%, reducing the rate of chronicity by 5,5% and mortality by 15,7%.

Keywords: COVID-19, abscessed pneumonia, endotheliitis, prolonged intraarterial catheter therapy





INTRODUCTION

Lung damage in SARS-CoV-2 is often characterized by the development of acute respiratory distress syndrome.¹ As statistics of studies show, the extent of lung damage in this disease can range from mild forms of respiratory inflammation to progressive and life-threatening viral pneumonia.² Patients affected by 2019 coronavirus infection (COVID-19) often need to be placed on artificial respiration due to the development of progressive respiratory failure during treatment. This can be caused by difficulty in breathing and progressive hypoxia.³

The Berlin criteria remain the basis for the diagnosis of acute respiratory syndrome in patients with COVID-19, based on the results of chest computed tomography with the detection of the intensity of lung blackouts of the so-called "frosted glass" type.⁴ At the same time, histological studies of the lungs of patients who died of COVID-19 more often reveal distinctive signs of the early phase of acute respiratory distress syndrome as diffuse alveolar lesions with pronounced peripheral edema, hemorrhages and intraalveolar fibrin deposits. These signs were described much earlier in the works of Katzenstein et al.⁵ At the same time, diffuse alveolar lesions are a nonspecific sign, since these changes can occur both in non-infectious and infectious lung lesions, including Middle East respiratory syndrome coronavirus - MERS-CoV,⁶ SARS-CoV,⁷ SARS-CoV-2^{8,9,10} and even in influenza viruses.¹¹

However, a distinctive feature of COVID-19 is the progressive development of vascular endotheliitis, which is accompanied by a high rate of thrombosis and thromboembolic pulmonary vascular lesions.¹² Use of prolonged artificial ventilation in such patients facilitates development of ventilator-associated pneumonia.¹³ The need for antibiotic therapy in patients with this complication does not always give the desired results, since if endotheliitis develops in the lungs, the process of penetration of antibiotic drugs directly into the parenchyma of the organ is complicated, contributing to the abscess of the inflammatory process.¹⁴

The aim of our study was to develop and evaluate the effectiveness of endovascular catheter therapy in patients with abscessed pneumonia after COVID-19.

MATERIALS AND METHODS

Currently, we have experience in treating 67 patients with abscessed pneumonia after COVID-19. All patients had a severe form of COVID-19. The disease was confirmed by polymerase chain reaction assays at the Infectious Disease Clinic during hospital admission.

Patients were treated against COVID-19 when they were in intensive therapy units. Artificial lung ventilation was used during treatment in 32.8% of cases. Bronchoscopic





airway sanitation was used in 45 patients (67.2%). A total of 35.8% of patients were discharged from the Infectious Disease Clinic with the recommendation to undergo treatment at the place of residence, but the majority of patients (64.2%) were hospitalized at our clinic from specialized Covid-Centers.

Men aged 21 to 60 years (83.6%) were the most susceptible to the disease, with a predominance of individuals in physical labor (68.7%), employed in industry and agriculture. Intellectual workers accounted for 23.9%, while students and retired people accounted for 7.4%.

The period of the disease on admission varied from 14 days to 1 month. In 56.7% of cases abscessed pneumonia was localized in the right lung, predominantly in the lower lobe. High frequency of lesions of lower (gravity-dependent) lung segments (67.2%) should be noted, which is associated with anatomic features of the tracheobronchial tree structure and indirectly confirms the important role of aspiration factor in the pathogenesis of pneumonia development. In 4 (5.97%) patients there was a two-sided process in lung lesions. There were 11 (16.4%) patients with associated diseases, diabetes mellitus being the most common.

The clinical symptoms of abscessed pneumonia in patients after COVID-19 were largely influenced by the nature of the disease and the presence of complications. The main ones were acuteness, severity and prevalence of purulent-destructive process in the lung tissue, the extent of pleural cavity lesions.

Most patients (52.2%) were admitted to our clinic in a severe condition, with sepsis phenomena, which made abscess pneumonia worse. For 26 (38.8%) patients the condition was classified as moderate severity, and for 3 (4.5%) patients it was severe. All patients had cough with sputum, weight loss, and a fatigue. The amount of sputum varied from 20-30 to 500 ml per day. In patients with severe sepsis the number of sputum exceeded 100 ml in 58.8% of cases, and in 28.8% of cases it was more than 200 ml. In gangrenous processes and the presence of septic shock or severe sepsis, the sputum in 100% had a foul-smelling odor.

Chest pain was observed in 8.9% of cases and, commonly, in patients with pleural complications (pleurisy, pleural empyema).

The temperature response in patients in remission was usually subfebrile, while during the development of pleural complications it ranged from 38–38,5°C.

The main rule in the treatment of patients with abscessed pneumonia was early and adequate endobronchial drainage and sanitation of the abscessed nidus in the lung. Microtracheostomy was used for endobronchial catheterization of the destruction cavity. Once it was performed, the catheter was guided into the destruction cavity





under the control of fibrobronchoscopy and fluoroscopy. Endobronchial sanation of destruction cavities in the lungs lasted 4-17 days.

In order to achieve maximum concentration of injected drugs in the inflammation area, all patients, upon admission to the hospital, had an intraarterial catheter installed using angiographic method with transfemoral access at the mouth of the bronchial artery with prolonged intraarterial catheter therapy. Infusion of drugs into the bronchial artery was carried out in a continuous round-the-clock mode by intra-arterial injection of fluids with the help of dispenser.

In the early treatment period, the choice of antibiotic therapy was reduced to an empirical approach, which consisted of a combination of Cephalosporins, Aminoglycosides, and Metronidazole. If fungal infection was detected, Diflucan or Fluconazole was included in the treatment. In the following periods of treatment, antibiotic therapy was carried out according to the results of bacteriograms.

Immediate results were estimated on the basis of these gradations according to the following criteria: complete recovery - disappearance of clinical symptoms of the disease and endoscopic signs of inflammatory process in the bronchi. By X-ray - in such case changes at the place of former abscess either completely disappeared or persisted in the form of a small area of pneumosclerosis.

No pathology has been observed in angiography and bronchography, or a slight deformity of subsegmental branches has been detected. Clinical recovery - against the background of complete disappearance of clinical symptoms of inflammation a thin-walled "dry" cavity is determined by X-ray, and complete disappearance of inflammatory changes in the bronchioles is observed endoscopically. Angiography does not show changes in angioarchitectonics of lung vessels in the peripheral cavity zone. Bronchography reveals contrast deposit with clear contours, unexpressed deformation of subsegmental branches in perifocal zone. Transition to the chronic form - preservation of unexpressed clinical picture, and its complete disappearance is also possible. There is a residual "dry" cavity in the lung or pleural cavity in X-ray examination. Usually there is a zone of insignificant perifocal infiltration. The signs of moderately pronounced severely limited endobronchitis are observed endoscopically, but they may be absent. During angiopulmonography there is significant impairment of blood supply in the perifocal cavity, zone - amputation of lobe or segmental or subsegmental pulmonary artery branches, absence of capillary phase, presence of - arteriovenous fistulas. At bronchial arteriography - pronounced hypervascularization of the bronchial artery branches in the perifocal zone. During bronchography there is a pronounced deformation of segmental and subsegmental bronchioles.





RESULTS

Among the key elements of our developed scheme of prolonged intraarterial catheter therapy in patients with abscessed pneumonia after COVID-19 were:

1. Establishment of high concentrations of antibacterial drugs in the inflammatory site by bolus intra-arterial administration. The advantage of bolus injection is the ability to create a rapid and high saturation of tissue destruction foci with antibacterial drugs, as well as the ability to regulate the daily and maximum doses of administered drugs.
2. Reduction of the duration of prolonged intra-arterial catheter therapy (up to 7 days) by developing a new pathogenetically justified scheme of intra-arterial correction of endothelial dysfunction.
3. Development of ways to purposefully increase the local concentration of high-plastic metabolic drugs (Albumin, Alvesin, etc.), which are natural inhibitors of kinins. They are known to be biochemically active substances, products of proteolysis that intensify during inflammatory process.¹⁵
4. Inclusion of medications with a pronounced anti-inflammatory effect, relieving tissue edema and stopping exudation processes (corticosteroids) into the scheme of prolonged intraarterial catheter therapy.

The specific features of the developed method of treatment of abscessed pneumonia in patients after COVID-19 should be attributed to the stage of drug therapy. At the first stage (1-2 days) of prolonged intraarterial catheter therapy we administered drugs improving microcirculation, since without it all other medications administered simply do not reach the lesion and are removed from the body, getting into the general bloodstream through bypass arteriolo-venular shunts. This was accompanied by detoxification drugs in order to evacuate toxic metabolic products, microbial toxins and excessive inflammatory mediators. Bolus administration of antibacterial drugs was mandatory. At the second stage (3-4 days) during the restored microcirculation and achievement of saturation of the lung tissue with antibacterial drugs, the catheter therapy was supplemented with protein preparations (Albumin, Alvesin, etc.).

Treatment included intraarterial bolus injection of antibacterial drugs in 2-3 combinations. Cephalosporins (Ceftriaxone, Lendacin, Fortum, Rocephin) and aminoglycosides (Amikacin, Amikine, Gentamicin, Netromycin) were administered intraarterially in maximum shock doses during the first day respectively since bactericidal action could be achieved at blood concentrations of antibiotic 2-4 times higher than average therapeutic ones. Subsequently, antibiotic therapy was corrected depending on the bacteriogram data. To date, the role of non-clostridial anaerobic





microorganisms in the development of pulmonary destruction is undeniable, so we used intraarterially metronidazole (Metrogil, Efloran, Clion) up to 3000 mg per day. The following observation is an illustration of the effectiveness of the therapy:

Patient S. A, 1953 year of birth, (ID #1261/1170) was transferred from Pulmonology Department of Multidisciplinary Clinic of Tashkent Medical Academy with the diagnosis "Abscessed pneumonia of right lung" on 05.11.2021 year where he was treated from 24.10.2021. The disease was diagnosed after the patient was discharged from the Infectious Disease Clinic, where he was treated against COVID-19. The conservative therapy was having little effect. When the patient was transferred to our clinic, his condition was critical. He complained of cough with purulent sputum up to 200 ml per day, increased body temperature up to 39.50°C, fatigue, shortness of breath, palpitations, loss of appetite. Objectively: general condition of the patient is severe, visible skin and mucous membranes are pale with cyanotic tint. Tachypnea up to 25 times per minute. Pulse rate 120 beats per minute. An X-ray image shows non-homogeneous darkening of the right lung with areas of lucidity, mainly in the upper lobe. The auscultatory examination revealed a mass of variously scattered moist rales in the upper right lung against the background of sharply impaired vesicular breathing, no breathing is heard in the lower lung. The diagnosis stated: "Disseminated purulent destruction (abscessed pneumonia) of the right lung. Sepsis. State after the COVID-19". Fibrobronchoscopy report: catarrhal endobronchitis on the right side of the patient. A catheter of the tracheobronchial tree was installed. On November 07, 2021, catheterization of the right bronchial artery was performed (Fig. 1) with prolonged intraarterial catheter therapy. There was a visible positive dynamic. On 12.11.2021 - control bronchial arteriography (Fig.2) - sharp decrease of infiltration of the right lung.

The intra-arterial catheter was removed. The patient did not have any special complaints. Control chest X-ray showed pneumofibrosis in the upper lobe of the right lung. After 3, 6 and 12 months of outpatient observation the patient did not have any complaints, he was almost in good health.

DISCUSSION

Critical analysis of the results of traditional prolonged intra-arterial catheter therapy for treatment of patients with abscessed pneumonia revealed a number of advantages of our proposed technique. The main advantage of prolonged intraarterial catheter therapy in patients with abscessed pneumonia after COVID-19 is an opportunity to provide high concentration of drugs in the pathological focus.¹⁶ This is achieved through the pathogenetic-based methods of correction of microcirculatory disorders





with elimination of arteriolo-venular shunting.¹⁷ Under these conditions, methods of drug therapy (intravenous, intramuscular, endolymphatic), as well as intra-arterial administration of antibiotic solutions alone cannot provide therapeutic antimicrobial effect, because the medication will be discharged into the venous channel bypassing the capillary networks of the pathological focus.¹⁸

The mode of intravenous drug administration with the inclusion of rheological drugs provides primarily correction of the above microcirculatory disorders, which are basically protective reactions of the body aimed at preventing the entry of toxins and infection into the central bloodstream and thereby reducing intoxication and sepsis.¹⁹ Obviously, early adequate drainage and sanation of destruction focus should be an obligatory attribute in complex treatment of patients with abscessed pneumonia.^{20,21} Under these conditions, the opening of the microcirculatory channel of the focus cannot be accompanied by the progression of intoxication and septicemia.^{22,23} Because of such a comprehensive solution to the problems of local surgical intervention and intra-arterial introduction of medications, the prerequisites for ensuring high concentrations of drugs in the affected area are created.

On the other hand, analysis of the effectiveness of traditional schemes of prolonged intraarterial catheter therapy has also revealed a number of its drawbacks:^{24,25,26,27}

1. Unified pattern of intra-arterial influence on the purulent-inflammatory process progression.
2. Long duration of prolonged intra-arterial catheter therapy (12-14 days) accompanied by passive bed rest, high risk of complications such as bleeding or femoral artery thrombosis, negative emotions, fear.
3. Insufficient concentration of medications and, in particular, antibiotics in the lesion due to drip injection of 200-400 ml dilution of solvent (Reopolyglucin, Disol, Acesol, etc.). Under these conditions, drip administration of such volume of solution with antibiotics is possible for 1-2 hours with its dilution in all-circulating blood, which negates the advantage of intra-arterial administration compared to the intravenous one.

The high rate of development of endotheliitis in the lungs encouraged us to reconsider the attitude to this method of treatment.

CONCLUSION

Application of the suggested method of pulmonary endotheliitis treatment in patients with abscessed pneumonia after COVID-19 allowed reducing the terms of catheter therapy and accelerating the process of purulent-destructive process restriction,





increasing the rate of complete and clinical recovery up to 15,6%, reducing the rate of transition to the chronic form by 5,5% and decreasing the mortality by 15,7%.

Conflict of interest - The authors declares no conflict of interest.

Financing - The study was performed without external funding.

Compliance with patient rights & principles of bioethics - All patients gave written informed consent to participate in the study.

REFERENCES

1. Zhu N., Zhang D., Wang W., et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med* 2020; 382:727-733
2. Chen N., Zhou M., Dong X., et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020;395:507-513.
3. Raptis C.A., Hammer M.M., Short R.G., et al. Chest CT and coronavirus disease (COVID-19): a critical review of the literature to date. *AJR Am J Roentgenol* 2020 April 16 (Epub ahead of print).
4. Thompson B.T., Chambers R.C., Liu K.D. Acute respiratory distress syndrome. *N Engl J Med* 2017;377:562-572.
5. Katzenstein A.L., Bloor C.M., Leibow A.A. Diffuse alveolar damage — the role of oxygen, shock, and related factors: a review. *Am J Pathol* 1976;85:209-228.
6. Alsaad K.O., Hajeer A.H., Al Balwi M., et al. Histopathology of Middle East respiratory syndrome coronavirus (MERS-CoV) infection — clinicopathological and ultrastructural study. *Histopathology* 2018;72:516-524.
7. Nicholls J.M., Poon L.M., Lee K.C., et al. Lung pathology of fatal severe acute respiratory syndrome. *Lancet* 2003;361:1773-1778
8. Barton L.M., Duval E.J., Stroberg E., et al. Ghosh S., Mukhopadhyay S. COVID-19 autopsies, Oklahoma, USA. *Am J Clin Pathol* 2020;153:725-733.
9. Menter T., Haslbauer J.D., Nienhold R., et al. Post-mortem examination of COVID19 patients reveals diffuse alveolar damage with severe capillary congestion and variegated findings of lungs and other organs suggesting vascular dysfunction. *Histopathology* 2020 May 4 (Epub ahead of print).
10. Tian S., Hu W., Niu L., et al. Pulmonary pathology of early-phase 2019 novel coronavirus (COVID-19) pneumonia in two patients with lung cancer. *J Thorac Oncol* 2020;15:700-704.
11. Voltersvik P., Aqrawi L.A., Dudman S., et al. Pulmonary changes in Norwegian fatal cases of pandemic influenza H1N1 (2009) infection: a morphologic and molecular genetic study. *Influenza Other Respir Viruses* 2016;10:525-531.





12. Magro C., Mulvey J.J., Berlin D., et al. Complement associated microvascular injury and thrombosis in the pathogenesis of severe COVID-19 infection: a report of five cases. *Transl Res* 2020 April 15 (Epub ahead of print).
13. Wicky P.H., Niedermann M.S., Timsit J.F. Ventilator-associated pneumonia in the era of COVID-19 pandemic: How common and what is the impact? *Crit Care*. 2021; 25:153
14. Beaucoté V., Plantefève G., Tirolien J.A., et al. Lung Abscess in Critically Ill Coronavirus Disease 2019 Patients with Ventilator-Associated Pneumonia: A French Monocenter Retrospective Study. *Crit Care Explor*. 2021 Jun 29;3(7):e0482. doi: 10.1097/CCE.0000000000000482. PMID: 34235460; PMCID: PMC8245113.
15. Babadzhanov B.D., Kasymov, U.K. Modern principals of antibacterial therapy of suppurative-septic diseases | Sovremennye printsipy antibakterial'noi terapii gnoino-septicheskikh zbolevanii // *Likars'ka sprava / Ministerstvo okhorony zdorov'ia Ukraïny*, 2003, (7), pp. 70–73
16. Sayfullaeva S. Activity of monooxygenase and nitrogenous systems in liver microsomes under the influence of inducers and inhibitors of medicinal metabolism on the organism in conditions of liver pathology // *International Journal of Psychosocial Rehabilitation* 24, 416-421
17. Atakov, S., Bobokulova, S., Kasimov, U., et al. (2022). Difficult aspects of treatments patients with acute lung abscesses who survived COVID -19. *Journal of Education and Scientific Medicine*, (1), 57-60. Retrieved from <https://journals.tma.uz/index.php/jesm/article/view/292>
18. Babaiarova, S.U., Komarin, A.S. Activity of the NO-system in lung after pneumectomy of various volumes // *Patologicheskaiia fiziologiiia i èksperimental'naia terapiia*, 2012, (1), pp. 29–32
19. Khamdamov Sh. A. Immediate results of endovascular and little invasive methods of treatment of lung purulent diseases with diabetes mellitus. *Journal Of Education and Scientific Medicine* 2 (2022): 63-65.
20. Israilov R., Razzakov S. Morphological characteristics of intestinal vessels of animals with an experimental model of diabetes mellitus type 2 complicated by microangiopathy // *Indian Journal of Forensic Medicine and Toxicology*, 2020, 14(4), pp. 7348–7353.
21. Okhunov A.O. The choice of method of surgical correction of complicated forms of diabetes type 2 // *International journal of diabetes and metabolic disorders* 4 (4), 1-3.
22. Okhunov A.O. Morphological characteristics of results of treatment of diabetic angiopathy // *International journal of diabetes and metabolic disorders* 4 (4), 1-3.





23. Karimov K.I., Babadzhanov B.D. Surgical aspects of non-respiratory activity of the lungs during acute pyonecrotizing diseases | *Khirurgicheskie aspekty nerespiratornoï deiatel'nosti legkikh pri ikh ostrykh gnoïno-destruktyvnykh zabolevaniakh // Likars'ka sprava / Ministerstvo okhorony zdorov'ia Ukraïny, 2004, (1), pp. 38–40*
24. Babadzhanov B. D., Pulatov U. I. The reasons for the generalization of infection in patients with purulent-inflammatory diseases of soft tissues against the background of diabetes mellitus. *Bulletin of the Tashkent Medical Academy 4 (2016): 89-93.*
25. Bozorov S. Pathophysiological transformations in the endothelial system under different types of nephropathies // *XXXIX international scientific and practical conference European research: innovation in science, education and technology – 2018-#4-P 3.*
26. Kasymov A.K. Some pathogenic aspects of changes in non-respiratory function of the lungs in sepsis // *Likars'ka sprava / Ministerstvo okhorony zdorov'ia Ukraïny, 2006, (7), pp. 45–47*
27. Israilov R.I., Khamdamov S.A. Treatment of acute lung abscesses considering their non-respiratory function in patients with diabetes // *Indian Journal of Forensic Medicine and Toxicology, 2020, 14(4), pp. 7465–7469.*

