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## MODERN VIEW ON THE PROBLEMS OF ETIOPATOGENESIS AND TREATMENT OF DESTRUCTIVE FORMS OF PNEUMONIA IN CHILDREN

Submission Date: October 25, 2022, Accepted Date: October 30, 2022,

Published Date: November 08, 2022

Crossref doi: <https://doi.org/10.37547/ijmscr/Volume02Issue11-04>

Mekhriddinov M.K.

Bukhara State Medical Institute, Republic Of Uzbekistan

### ABSTRACT

The author made a study of modern literature on the problems of etiopathogenesis and treatment destructive forms of pneumonia in children.

### KEYWORDS

pneumonia, bacterial destruction of the lungs, surgical infection, staphylococcus aureus.

### INTRODUCTION

According to modern studies, today among the diseases with frequent visits, hospitalization and infant mortality, the leading place is occupied by diseases of the respiratory system [3,10], in which the complication in the form of the development of destructive forms against the background of pneumonia reaches 10%, and the mortality rate is about 2 -5.4% [21,22,27]. At the same time, the process of development of destruction and involvement in

pathological processes of extrapulmonary organs, such as the pleural cavity against the background of a complication of pneumonia in children, is called "bacterial destruction of the lungs" (BDL) [11].

One of the main clinical symptoms of BDL is the progression of respiratory failure, chest pain, fever for a long time, deterioration of the child's condition, and involvement in the pathology of the pleural cavities,

despite ongoing antimicrobial therapy [20,29]. The presence of these clinical symptoms and signs is a direct indication for chest computed tomography, which should be performed, despite the absence of signs of destruction on chest radiography in direct and lateral positions, since this research method is less sensitive to detecting the initial stages of lung necrosis [3]. However, there are a number of limitations for performing computed tomography in children, such as high radiation exposure, high cost of the study, and the lack of a CT machine in all regions.

Over the past decades, significant changes have occurred in the structure of BDL pathogens [1,12,14]. In the microbial mirror, such diverse forms of microorganisms as: proteus, streptococci, *Pseudomonas aeruginosa*, pneumococci, *E. coli*, Friedlander's bacilli, fungi, mixed and protozoa are found. Recent studies have shown that strains of staphylococcus, which in the 80s of the 20th century was detected in 65% of cases of observation, play to a large extent in the development of the processes of suppuration of the lung tissue [19,20,21]. The development of modern medicine and the emergence of new knowledge in the field of the study of pneumonia, and BDL, in particular, as well as the development of technologies in the field of medicine, have made it possible to establish new tactics and approaches for the treatment of these pathologies.

As is already known, BDL occurs against the background of acute respiratory diseases, the incidence of which is 84-86% [17]. Basically, the microbial agent enters the lungs by airborne droplets, the so-called aerogenic route. At the same time, viruses, causing pathological changes in the upper parts of the respiratory system and reducing local immunity, create conditions for the penetration and reproduction of bacteria in the lower parts of the

respiratory system, in particular in the lung tissue [15,16]. With the development of medicine, the etiological view of the development of the disease also changed, in which an increase in the role of opportunistic gram-negative flora in the development of pathological processes was observed [8]. Conducted studies in determining the causative agents of surgical infections in children [3] have established a decrease in the etiological significance of *Staphylococcus aureus*. Wherein,

In addition, an increase in the occurrence of obligate anaerobic pathogens of surgical infections contributes to an increase in the frequency of sterile cultures. This process is still observed today. Therefore, it is necessary to carry out microbiological monitoring in this category of patients. Under the leadership of S. G. Libov in 1962, the term "staphylococcal destruction of the lungs" was proposed, which was recognized at the All-Union Symposium of Pediatric Surgeons in Dushanbe and was widely used. At that time, this term included almost all forms of acute pulmonary complications and suppuration processes in children, which fully reflected the true situation. Since, at present, staphylococcus is not the main form of the causative agent of purulent-septic pathologies of the pulmonary parenchyma and pleura, many scientists have abandoned this term, preferring to use the concept of "bacterial destruction of the lungs", since this term generalizes and combines various forms of destructive lesions of the lungs and pleural cavity. When studying the pathogenesis of the development of destructive forms of pneumonia, scientists have identified several main links:

1. Violation of the microcirculation process due to damage to the lung tissue by bacterial flora;

2. Morphological and functional dysfunctions in the upper parts of the respiratory system against the background of SARS;

3. Violation in the drainage function of the bronchial system with signs of impaired microcirculation at the level of bronchioles;

Among other things, in the pathogenesis of gram-negative microflora, a special place belongs to endotoxin, which causes degenerative changes in the mucous membranes, as well as causing multiple microhemorrhages in them, contribute to the accumulation of hemorrhagic exudate in serous cavities [2,3,12]. In most cases, researchers distinguish between primary and secondary lesions of the lung parenchyma [14,28]. The most widespread belong to the classifications that distinguish pulmonary and pulmonary-pleural forms of destructive pneumonia [23]. The classification of M.R. Rokitsky, which includes 5 groups of complications that developed against the background of pneumonia:

1. Pre-destructive form, which includes confluent infiltrative pneumonia, as well as lobitis.
2. Pulmonary form, including small-focal destruction inside the lobules and cortical abscess)
3. Pulmonary-pleural forms of complications, which include such pleural pathologies as pneumothorax, pyothorax and pyopneumothorax.
4. Chronic forms, including fibrinothorax, secondary cysts, pleural empyema and bronchiectasis.
5. Complications against the background of acute purulent destructive pneumonia. These complications include progressive mediastinal emphysema, pericarditis, perforating pleural empyema.

The advantage of this classification is the definition of therapy depending on the form and state of inflammatory-destructive processes in the lungs and pleura [26].

As a result of dysfunction of fibrinolytic indicators in the blood at the stage of infiltration, the process of hypercoagulation is observed, leading to the development of thrombosis and microembolism of the vessels of the lungs and bronchi, as a result of which there is a violation of blood circulation and the development of destructive processes [26]. In this case, pathological agents penetrate into the lung tissue by bronchogenic or hematogenous routes, causing inflammatory processes. In young children, this process is aggravated against the background of low development of natural immunity and its decrease against the background of viral processes in the upper respiratory tract as a result of SARS. As a result of acute respiratory viral infections in young children, catarrh of the upper respiratory tract and nasal breathing are often observed, which directly leads to a decrease in lung capacity. Edema, developed against the background of inflammatory processes and hyperemia of the organs of the respiratory system leads to narrowing and increased resistance of the respiratory tract due to their obstruction. According to Poiseuille's law, the narrowing of the bronchial lumen by half leads to an increase in air resistance by 16 times. Also, against the background of inflammatory processes, hypersecretion of mucus and their accumulation in the lumen are observed, as a result of which there is a deterioration in the state of mucociliary clearance, thereby reducing immune processes. These violations occur in three stages. At the first stage, there is a spasm, swelling and accumulation of secretion in the lumen of the bronchi, which leads to a decrease in the flow of air into the distally located alveoli, as a result of which the airiness in the distal parts of the lungs

decreases and obstructive hypoventilation occurs. In the second stage, incomplete obturation is observed on the basis of a developed broncho-obstructive syndrome, leading to the formation of a valvular process and the development of obstructive emphysema. At the third stage, complete total obturation is observed, leading to the development of obstructive atelectasis. All of the above violations lead to impaired circulation and damage to the corresponding area of the lung tissue, the volume of which depends on the level of obstruction (segmental, lobar or subsegmental) [8,13,17,25].

As a result of broncho-obstructive disorders, there is dysfunction and changes in the blood supply to these areas of the lungs and the defeat of their pathogenic bacterial flora [14,35].

Also, in the development of an acute purulent-destructive form of pneumonia, the occurrence of violations in the drainage function of the bronchi, which occurs against the background of viral bronchitis and microaspiration syndrome, plays a dominant role [3,24,31].

In children in the development of destructive processes, there are combined factors of violations of the ventilation and drainage functions of the lungs and microcirculation disorders in the small circle, which occur against the background of a hyperergic reaction involving viral and bacterial infections. With an infiltrative lesion, the development of purulent-destructive processes is also negatively affected by excessive infusion-transfusion therapy, which aggravates microcirculation disorders in the pulmonary circulation in this group of patients [5,8,31]. All of these processes undoubtedly play a major role in the pathomechanism of the development of acute purulent-destructive processes, while the impact of

pathogenic bacteria, in particular, staphylococci, play a dominant role in the destruction of lung tissue [30,32].

In early December 2019, an epidemic of COVID-19 infection (atypical pneumonia) occurred in the city of Wuhan in China, the causative agent of which was SARS – CoV – 2 coronavirus. On December 31, 2019, an outbreak of unknown pneumonia was reported to WHO by the Chinese authorities. On February 11, 2020, this disease became known as coronavirus pneumonia. Subsequently, Chinese scientists identified a new type of coronavirus - SARS - CoV-2, by studying the structure of the genome of this virus. This infection is one of the dangerous pathogens that causes acute respiratory infections, occurring both in mild form (classic SARS) and in more severe forms. The most common clinical variant of this disease is the development of viral pneumonia [18,34].

It is well known that older age and a number of chronic diseases, including diabetes mellitus, coronary heart disease, arterial hypertension, and chronic obstructive pulmonary disease are considered risk factors for pneumonia today [10,20,21]. However, inflammation of the lungs with a new coronavirus infection is observed against the background of acute respiratory infections and infectious-allergic diseases, causing an immune imbalance in the body of children [16,17].

Against the background of the effect of the virus on the lung parenchyma, destruction of the alveolar membranes is observed, with the filling of the alveoli with liquid and a violation of gas transport functions. These disorders can be seen on computed tomography, which are called "ground glass effect", in which the affected areas resemble "foggy seals" [18,21].

Depending on the size and number of "ground glasses" and seals, determined in the affected area of the lung



on a computer thermogram, the degree of damage to the lung tissue and the stage of the disease are determined [18,21].

1. Light stage - compaction zone less than 25%
2. Average degree - compaction zone is 25-50%
3. Severe degree - compaction zone is 50-75%
4. Critical degree - the compaction zone is more than 75%

Conclusions: Acute purulent destructive pneumonia in children includes complications that have developed against the background of pneumonia of various etiologies, which proceeds with the destruction of the lung tissue and the involvement of the pleural cavity in this process against the background of exposure to various pathological microorganisms.

Over time, there is a change in the etiological factors of the disease. If in the middle of the last century, staphylococcal infections were most often observed in the structure of etiological factors, then by the 70s, a very significant weight of gram positive and gram negative (*Streptococcus pneumoniae*, *Klebsiella pneumoniae*, *Proteus*, *Pseudomonas aeruginosa* and *E. coli*) joined the structure of pathogens. With the development of pharmacology, in particular the production of broad-spectrum antibiotics, the "pathogenization" of conditional forms of microorganisms has led. In addition, the above factors led to the addition of fungal microorganisms, most often saprophytes, to the pathological process.

Based on the studied scientific literature, in recent years there has been a significant increase in viral infection in the development of destruction in the lungs. Since the 2000s, mutations in various viruses have made many scientists think about revising

traditional methods of treatment. A striking example is the new type of coronavirus infection (Covid-19).

In this way, the treatment of inflammatory diseases of the lung tissue requires a comprehensive measure aimed at identifying, first of all, the causative agent of the disease, which requires specific treatment and an individual approach in eliminating the pathological focus in order to prevent complications and further destruction of the lungs.

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