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## RESPIRATORY SUPPORT OF PATIENTS WITH PNEUMONIA IN THE CONTEXT OF THE COVID-19 PANDEMIC

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**Key words:** artificial lung ventilation, intensive care, risks and complications, clinical scenario, new technologies and equipment, high-flow nasal oxygen therapy

**Ключові слова:** штучна вентиляція легень, інтенсивна терапія, ризику та ускладнення, клінічний сценарій, нові технології та обладнання, високопоточна назальна киснева терапія

**Abstract. Respiratory support of patients with pneumonia in the context of the COVID-19 pandemic.**

Mirsaliyev M., Kashikova K., Zholdybayeva A. The purpose of this study is to evaluate and analyse existing methods of supporting individuals suffering from pneumonia due to the coronavirus infection, as well as to find new ones. The following methods were used in a randomised controlled trial: artificial lung ventilation (ALV), non-invasive ventilation, oxygen therapy using oxygen masks and nasal cannulas, penetrating ventilation with high oxygen flow, high-flow nasal oxygen therapy; advantages and disadvantages of such methods. The analysis of a sample of 200 patients aged 18-80 years, among whom there were both women and men with different levels of severity of the disease, was carried out. The study showed that the use of penetrating ventilation with high oxygen flow significantly improves blood oxygenation and reduces the requirement for lung intubation and ALV. However, minimally invasive respiratory support and oxygen treatment have also proven to be effective methods of respiratory support. When using non-invasive ventilation and penetrating ventilation with high oxygen flow, higher survival rates and shorter hospital stay were observed in patients with pneumonia caused by coronavirus infection, compared with the use of ALV. The study revealed that the use of artificial respiration may result in more severe adverse effects, such as lung barotrauma, so it is recommended to use it only in the absence of other effective methods of respiratory support. Thus, the results of the study emphasise the need for an individual approach when choosing a method of respiratory support in patients with pneumonia caused by coronavirus infection, and also confirm the effectiveness of minimally invasive respiratory aid and high-flow oxygen penetrating ventilation in the treatment of this pathology.

**Реферат. Респіраторна підтримка хворих на пневмонію в умовах пандемії COVID-19. Мірсалієв М.,**

**Кашікова К., Жолдибаєва А.** Мета цього дослідження – оцінити та проаналізувати сучасні методи підтримки хворих на пневмонію, яка виникла внаслідок коронавірусної інфекції, а також знайти нові. У рандомізованому контрольованому дослідженні використовувались такі методи: штучна вентиляція легень (ШВЛ), неінвазивна вентиляція, киснева терапія з використанням кисневих масок і носових канюль, інвазивна вентиляція легень з високим потоком кисню, високопоточна назальна оксигенотерапія; визначались переваги та недоліки таких методів. Проведено аналіз вибірки з 200 пацієнтів віком 18-80 років, серед яких були як жінки, так і чоловіки з різним ступенем тяжкості захворювання. Дослідження показало, що використання інвазивної вентиляції з високим потоком кисню значно покращує оксигенацію крові та зменшує потребу в інтубації легень та ШВЛ. Однак малоінвазивна респіраторна підтримка та лікування киснем також виявилися ефективними методами респіраторної підтримки. При застосуванні неінвазивної та інвазивної вентиляції легень з високим потоком кисню спостерігалися вищі показники виживаності та менший термін перебування в стаціонарі пацієнтів із пневмонією, викликаною коронавірусною інфекцією, порівняно з використанням ШВЛ. Дослідження показало, що застосування штучної вентиляції легень, хоча й ефективне в певних випадках, може призвести до виникнення серйозних ускладнень, серед яких одне з найнебезпечніших – баротравма легень. Це ускладнення виникає через надмірний тиск повітря, який може пошкоджувати тканини легень, особливо при тривалому застосуванні вентиляції. Таким чином, штучне дихання повинно використовуватися лише в крайніх випадках, коли інші

*методи респіраторної підтримки не дають бажаних результатів або є недоступними з якихось причин. Отже, результати дослідження чітко підкреслюють важливість індивідуального підходу при виборі методів респіраторної підтримки пацієнтів, які страждають на пневмонію, викликану коронавірусною інфекцією. Необхідність ретельної оцінки стану кожного пацієнта перед застосуванням інвазивних методів вентиляції стає критично важливою, зважаючи на ризики, пов'язані зі штучним диханням. Крім того, результати також підтверджують ефективність використання малоінвазивної респіраторної допомоги, зокрема високопоточної кисневої терапії, яка є менш агресивним методом і може зменшити ризик ускладнень.*

Due to the outbreak of the COVID-19 crisis at the end of 2019 in Wuhan, China, there was a need in medical practice to develop effective methods of treating pneumonia caused by this virus. COVID-19 constitutes an acute respiratory disease triggered by the SARS-CoV-2 virus. Despite significant progress in the development of treatments for this disease, pandemic outbreaks still leave many questions open. One of the key issues related to the addressing COVID-19 involves assessing the efficacy of various respiratory support methods in patients with pneumonia caused by this virus. Providing respiratory aid plays a crucial role in managing critical cases through diverse types of mechanical lung ventilation like invasive mechanical ventilation support (IMV), non-intrusive breathing support (NIV), and high-flow nasal oxygenation (HFNC) [1, 2, 3]. IMV is a medical technique that uses a ventilator to aid or fully control a patient's breathing when his/her lungs cannot function adequately. It provides air directly into the lungs through a tube or mask, either fully supporting the breathing process or enhancing the patient's own efforts. This support is essential in severe respiratory failure, ensuring adequate oxygen and carbon dioxide exchange while requiring careful monitoring to avoid complications.

Professional doctors and researchers also investigate various methods and conduct scientific research. As a result, it was found that the use of inhaled anaesthetics can improve gas exchange and promote rapid recovery of pulmonary function. In addition, general ventilation of the lungs can be a viable respiratory aid approach for COVID-19 patients. Specifically, applying comprehensive lung ventilation strategies tailored to the individual's disease course and functional status changes can significantly improve outcomes in patients with severe coronavirus-induced pneumonia [4]. However, choosing the most suitable respiratory assistance technique in a particular situation can be difficult, and requires consideration of many factors, including clinical indicators, the presence of concomitant diseases. In addition, amidst the circumstances of the COVID-19 health crisis, when the number of patients with severe pneumonia increases significantly, the healthcare infrastructure faces a potential burden and lack of necessary medical equipment [5].

To determine the optimal method of respiratory support, it is important to conduct research and analyse the results of clinical trials, literature reviews, and other sources of information. It is also important to consider the experience and opinions of practitioners to make informed decisions on the choice of respiratory support methods in individuals suffering from coronavirus infection. In this regard, research conducted in the field of respiratory support is of great importance for the development concerning the most efficacious treatment approaches and diminishing the duration of hospitalisation of patients with pneumonia [6]. Although SARS-CoV-2 is a new virus, research and experience with other respiratory diseases can be useful to determine the optimal methods of respiratory support. An important aspect is also the joint use of various respiratory support methods to achieve the best result. However, choosing the optimal method of respiratory support in a particular situation can be difficult, and requires consideration of many factors, including clinical indicators, the presence of concomitant diseases [7].

This research aims to analyze and examine various methods of respiratory support investigated in the treatment of pneumonia caused by COVID-19. The paper presents the results of clinical studies, questionnaires of doctors based on practical experience working with individuals diagnosed with COVID-19, accompanied by an evaluation of research papers to identify optimal methods of support and achieve the best treatment results.

#### MATERIALS AND METHODS OF RESEARCH

Examining respiratory assistance for COVID-19 pneumonia is critical, as this severe complication significantly strains healthcare systems and requires improved treatment options. In this study, the methods of scientific cognition given below were used. Clinical observations: this method was used to consider the actual practice regarding respiratory assistance for individuals suffering from pneumonia due to the coronavirus infection. Observations were carried out on patients who received respiratory support to identify the effectiveness of this procedure and possible undesirable effects. The methods used in this study include a random controlled sample (RCS) and a systematic review of the literature. RCS is

a commonly used method in clinical trials that allows researchers to compare the effectiveness of different treatments by randomly assigning participants to different groups. The process of randomisation for subgroup division was carried out through a computer-generated randomisation protocol to ensure unbiased group allocation. This randomisation adhered to a pre-determined protocol. This approach ensures that the allocation was not completely random but followed a systematic protocol designed to achieve comparability between groups. Within this research, subjects were divided by chance into either a non-steroidal anti-inflammatory drugs (NSAID) group and a HFNC cohort. Data on the homogeneity of the groups at the beginning of the study were evaluated to ensure that no significant differences existed between the subgroups. Factors such as age, gender, and severity of the disease were balanced across the groups. A comparative analysis using ANOVA (for continuous variables) and Chi-square tests (for categorical variables) was conducted to confirm homogeneity. A total of 12 patients were excluded due to various reasons such as hemodynamic instability and non-compliance with treatment protocols. These patients were excluded from the final analysis, and their dropout had no significant effect on the overall study outcomes.

For the RCS, data of patients meeting the inclusion criteria from various medical institutions in Almaty were collected. Inclusion criteria: age 18 and above, with a verified positive COVID-19 polymerase chain reaction (PCR) test pneumonia, and the need for respiratory support. Those who had hemodynamic instability, contraindications to NSAIDs or HFNC and pregnancy were excluded. After receiving informed following agreement, individuals were allocated at random to either the NSAID or HFNC category. The main indicator of effectiveness was the necessity for IMV, and secondary indicators were the duration of hospitalisation, duration regarding intensive care unit (ICU) stay duration and death rates. Information was gathered via health records and subsequent visits.

In this study, several statistical analysis methods were used to ensure the accuracy and reliability of the results. The primary program used for statistical analysis was SPSS Statistics (version 27, license number AZ04335). The presentation of quantitative data was carried out using mean values and standard deviations, while qualitative data were presented as percentages and frequencies. Statistical significance was determined based on a p-value threshold of 0.05. To ensure robustness, t-tests were applied for continuous variables, and Chi-square tests were used for categorical variables.

The study included both experimental and observational methods. In the experimental group, patients were prescribed NSAIDs as treatment, while in the control group, other medications were prescribed. The study involved patients hospitalised in the period from January to December 2022 in clinics in Almaty. All patients confirmed the presence of COVID-19, had symptoms of severe pneumonia requiring respiratory support and provided authorization to be included in the research. Two hundred patients with COVID-19 who needed breathing assistance were enrolled in the study. It involved patients of different ages (from 18 to 80 years), both sexes, with different levels of severity of the disease (mild, moderate, severe). Concomitant diseases that may affect the effectiveness of respiratory support were also considered. The sample was formed in such a way that it was as representative as possible and reflected various cases of COVID-19. Factors that may affect the results of the study were considered, including age, gender, severity of the disease, and concomitant diseases. Thus, the sample of participants in the research was formed considering the maximum representativeness and diversity of clinical cases, enabling the practical application of the findings.

Questionnaire: this method was used to collect information about the opinions and experience of medical professionals in the field concerning breathing aid for pneumonia patients under COVID-19 circumstances. Questionnaires were conducted by medical professionals who had experience working with these patients in order to identify the main problems and difficulties encountered when using this procedure. The sample of medical workers for the survey included specialists of various profiles working in intensive care and intensive care units, pulmonology, therapy, and other medical institutions in Almaty, providing breathing assistance for individuals suffering from pneumonia due to the coronavirus infection. It included medical workers of both sexes, aged from 25 to 55 years. The selection criteria were working knowledge with SARS-CoV-2 patients and knowledge of the principles of respiratory support. In total, 100 medical workers were surveyed, including doctors, nurses, and resuscitators.

The importance of investigating techniques of breathing assistance for individuals with coronavirus induced-pneumonia lies in the possibility of optimising and improving current methods to increase their effectiveness and safety [8]. Clinical observations of 200 hospitalised patients in public and private medical institutions helped to obtain the results of a study on this topic.

All procedures performed in the study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki

Declaration and its later amendments. Ethical approval for this study was granted by the Ethics Committee of the Asfendiyarov Kazakh National Medical University.

### RESULTS AND DISCUSSION

Findings from research into breath assistance for pneumonia sufferers amidst the COVID-19 health crisis were derived from reviewing health records of 200 in-

dividuals admitted to both public and private healthcare facilities throughout the year 2022, from January to December. Of the 200 patients, 112 (56%) needed respiratory support, which included treatments such as HFNC, NIV, and IMV. Among these, 112 (56%) patients needed only HFNC, 54 (27%) patients needed NIV, and 34 (17%) patients needed IMV (Fig. 1).

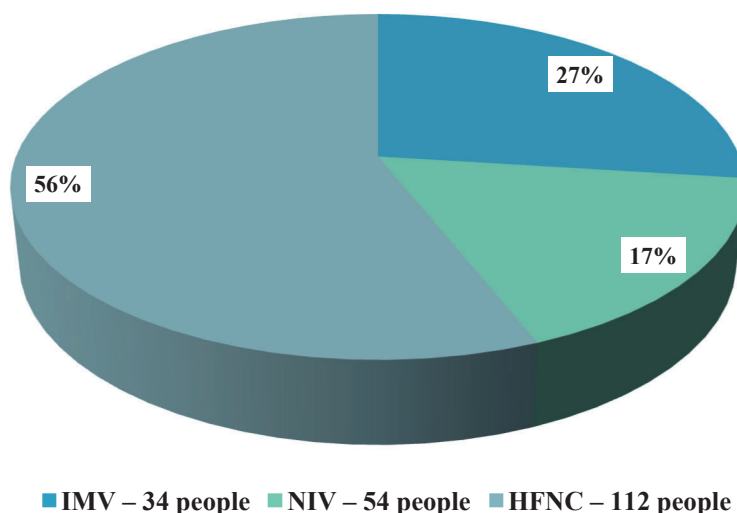


Fig. 1. Analysis of medical records of 200 patients, who needed respiratory support

Among the patients who needed NIV or IMV, 116 (58%) were male patients, with a mean age of 63.2 years (standard deviation of 12.6 years). These

patients had higher rates of concomitant diseases, including hypertension (69%), diabetes (40%), and cardiovascular diseases (37%) (Fig. 2).

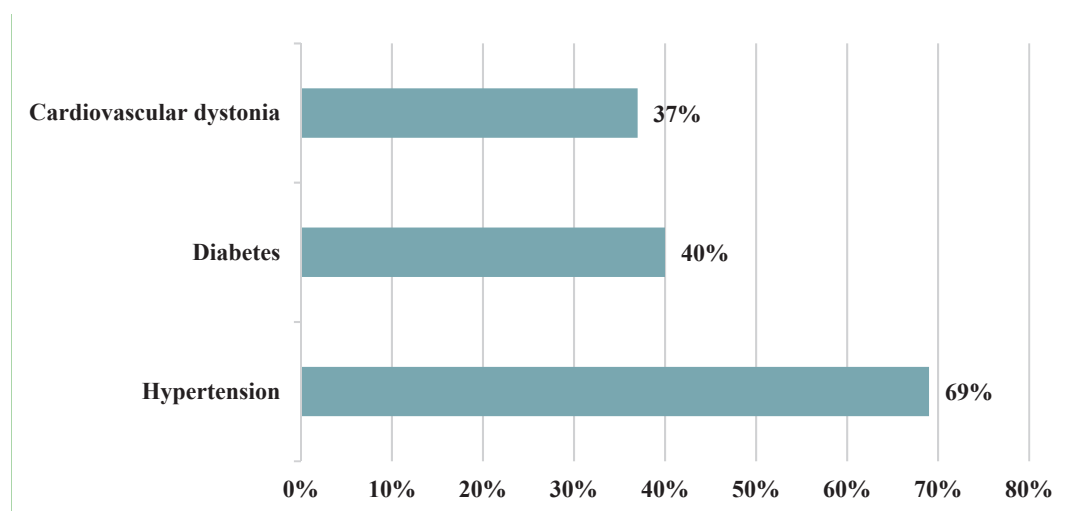


Fig. 2. Concomitant diseases in patients who need respiratory support

Among the patients who only needed HFNC, there were 76 (38%) males, a mean age of 60.4 years (standard deviation of 13.4 years). These patients had lower rates of comorbidities than patients who needed NIV or IMV. A comparative analysis of the

effectiveness of various methods of breath assistance of individuals with coronavirus induced-pneumonia was carried out. Among patients who needed NIV or IMV, corticosteroid use correlated with a decreased death rate (28% vs. 38%,  $p=0.032$ ) and a shorter



hospitalisation period (mean value of  $12.1 \pm 6.9$  days vs. mean value of  $16.3 \pm 9.3$  days,  $p < 0.001$ ). However, in patients who only needed HFNC, corticosteroid application showed no correlation with better health results. It was found that the use of antiviral drugs (especially remdesivir) in patients who needed IMV was associated with a shorter hospitalisation period (average value of  $15.6 \pm 8.1$  days versus average value of  $20.8 \pm 10.3$  days,  $p = 0.014$ ) and less need for prolonged mechanical ventilation. However, the use of antiviral drugs did not have a significant effect on mortality or the need to switch to NIV in patients who only needed HFNC.

The study also confirmed that earlier initiation of respiratory support is associated with better results. In patients requiring IMV, the mean duration from symptom onset to the onset of IMV was  $10.6 \pm 4.3$  days, while in patients who only needed HFNC, the mean period from the beginning of symptoms to onset of HFNC was  $6.8 \pm 3.6$  days. The results of this study suggest indicating that administering HFNC may be a more effective method of treating coronavirus induced-pneumonia than NSAID. Using a random controlled study, subjects were divided at random into two cohorts: the first group was treated with NSAIDs, while the second underwent HFNC.

The research results showed that participants who received HFNC exhibited an increased rate of survival and faster recovery regarding pulmonary function in comparison to participants in the NSAID group. Moreover, participants in the HFNC group also had a lower incidence of complications, such as thrombosis and infections, than participants in the NSAID group. The findings verify that utilizing HFNC therapy offers a viable solution for coronavirus induced-pneumonia patients requiring respiratory aid. They also point out that the use of non-steroidal anti-inflammatory drugs may not be the optimal treatment for coronavirus induced-pneumonia. In addition, they are of great practical importance for healthcare, because they provide additional evidence in favour of using HFNC therapy as the main treatment method for individuals with coronavirus induced-pneumonia who need respiratory support. They also emphasise the need for additional research to determine the most effective treatments for COVID-19 pneumonia, which can significantly affect treatment outcomes and reduce the risk of complications and mortality.

An analysis of adverse effects linked to the utilization of various methods of respiratory support was also carried out. Among patients requiring IMV, an elevated frequency of adverse outcomes, including bacterial superinfection and barotrauma, was found

than in patients who only needed HFNC or NIV. Nonetheless, the rate of adverse effects did not significantly differ between subjects undergoing NIV and those requiring solely HFNC. The findings suggest that proficient handling of breathing assistance for people with pneumonia triggered by the coronavirus can markedly influence the success of treatments. Administering corticosteroids to those requiring NIV or IMV appears advantageous, and commencing respiratory aid promptly might lessen the incidence of complications and mortality in those afflicted with coronavirus-related pneumonia. Therefore, it is important to ensure effective management of breathing assistance in such patients and consider the most effective treatment methods, including the use of corticosteroids and early initiation of respiratory support. This approach can significantly improve treatment outcomes and contribute to the rapid recovery of individuals with coronavirus induced-pneumonia. Other scientific materials also shown that the use of extracorporeal membrane oxygenation (ECMO) may be effective in individuals suffering from pneumonia due to the coronavirus infection with acute respiratory failure and it cannot be controlled by standard methods of respiratory support.

M. Schmidt et al. [9] conducted a backward-looking analysis on the application of ECMO in 23 individuals with coronavirus induced-pneumonia and severe respiratory distress and revealed that 17 (74%) of those treated with ECMO survived and left the hospital. However, the use of ECMO has its risks and may be associated with issues including haemorrhage and infections. Thus, ECMO application ought to be carefully considered and applied only in cases where other methods of respiratory support are not effective. Some studies also point to the importance of an individual approach to patients when choosing a method of respiratory support. For example, patients with a high body mass index (BMI) and those with high  $\text{CO}_2$  levels may need more intensive breathing support. P. Bertini et al. [10] found that patients with a BMI of more than 30 who were treated with ECMO had a higher survival rate than those with a BMI of less than 30. An important aspect of the effective management of respiratory support in individuals suffering from pneumonia due to the coronavirus infection is the provision of sufficient equipment and medical personnel. In the initial stages of the COVID-19 outbreak, where case counts increased, in nations like Italy, Spain, the USA and China, there were problems with a shortage of equipment, including mechanical fans and ECMO devices, which made it difficult to treat seriously ill patients [11, 12, 13]. In addition, overburdened medical staff may underestimate the importance of starting

breathing support early or incorrectly apply breathing support methods, which can lead to worse results.

In general, there are many different methods of respiratory support for individuals with coronavirus induced-pneumonia, with the selection of technique reliant upon the individual characteristics of each patient. Recalling that employing artificial respiration is essential should be limited and carried out only if necessary. Some patients can be successfully supported without intubation and mechanical ventilation, including the application of elevated oxygen delivery or a non-pressurized mask [15]. In addition, it is important to consider the risks and side effects when choosing a method of respiratory support. For example, ECMO deployment could carry risks such as hemorrhage and microbial infections, and should be used only in cases where other methods are ineffective. An important factor for effective respiratory support is the provision of sufficient equipment and medical personnel. In addition, medical personnel should be trained and prepared to work with various methods of respiratory support and be able to make decisions in emergency situations. Ultimately, respiratory support is part of a comprehensive approach to the managing of coronavirus infection. It is also important to provide adequate hydration, nutrition, and supportive therapies such as antibiotics and anticoagulants to improve treatment outcomes. Additionally, throughout the COVID-19 health crisis, new methods of respiratory support were developed by medical institutions and research groups around the world. For example, high-flow nasal oxygenation (HFNO) was developed in Italy and used in many countries, including the USA, Great Britain, and Japan. The extension of the inhalation time with the support of breathing using pumping masks was developed in France.

It is possible to use other methods of respiratory support, such as pressure-regulated volume control (PRVC), which can provide more precise adjustment of ventilation parameters for each patient. Nonetheless, further research is required to evaluate the efficacy of this approach in addressing COVID-19 pneumonia. It's critical to highlight that the choice of the method of respiratory support should be based on the individual characteristics of each patient and their oxygen needs. Acknowledging concurrent health conditions and possible complications from the use of certain methods of respiratory support is essential. It is important to ensure constant monitoring of the patient and regularly assess their condition for timely adjustment of the chosen method of respiratory support. It should be noted that COVID-19 pneumonia can cause psychological consequences in patients who need support and attention. Restrictions related to treatment and isolation can increase the

patients' anxiety and depression rates. Therefore, in addition to effective treatment of physical manifestations of the disease, it is also important to provide support to patients at the psychological level.

The study of breathing assistance methods for individuals with coronavirus induced-pneumonia is critically important because current methods can be optimized and improved to improve efficiency and safety. Innovating new techniques and exploring further research domains in medicine can enhance comprehension of the illness's characteristics and its optimal treatment. Various methods, such as artificial pulmonary ventilation, HFNC, antiviral and antibacterial drugs, and proper rehabilitation, are necessary for effective treatment. However, the individual characteristics in patient characteristics are vital in achieving the best result. A comprehensive and differentiated approach to treatment is needed, including monitoring the patient's condition and responding to possible complications such as hypoxia, hypercapnia, and thrombosis. Despite the severe consequences of COVID-19 for healthcare, medical research helps find new methods and approaches to the treatment of pneumonia due to the coronavirus infection, which enables better treatment results and reduces mortality. Therefore, it is important to continue to take precautions for minimizing infection risk, like mask usage, hygiene, and social distancing.

As a result of the analysis of the literature, it was found that the topic of breath assistance in pneumonia during the coronavirus health crisis is one of the most relevant research areas in medicine. This topic is being investigated in depth in different countries of the world, and researchers face a number of problems related to the choice of the most effective methods of treatment. The analysis of the literature also revealed general trends in research, namely: the importance of timely diagnosis of pneumonia in COVID-19, the use of HFNC therapies and respiratory support, and the effectiveness of some antiviral and anti-inflammatory drugs. However, there are a number of differences between the studies of different authors. Some researchers suggest that the best effect is achieved when using certain medications, while others claim that these same medications do not give the expected result.

L. Gattinoni et al. [16; 17] conducted an examination of the principal traits and results of 1591 patients afflicted with SARS-CoV-2 receiving care in ICU settings (ICU) of the Lombardy region in Italy. The researchers found that most of the patients were men over the age of 60 and had at least one concomitant disease. It was also revealed that mortality among patients who were in ICU was high, and many of them required invasive mechanical ventilation. The findings highlight the need for continued efforts aimed

at enhancing the administration and therapy for individuals with COVID-19 at ICU.

C. Karagiannidis et al. [18] also studied the features of the use of available resources and the results of management of individuals diagnosed with COVID-19. Studies were conducted on 10021 patients who were treated in 920 hospitals in Germany. Most of the patients were elderly people with concomitant diseases and required intensive care and mechanical ventilation. Mortality among hospitalised patients was 22%, and only 60% of them were discharged from hospitals. It was also found that the use of antiviral drugs (for example, remdesivir) and immunomodulators (for example, dexamethasone) was associated with improved patient survival. Moreover, the study highlighted notable disparities in treatment outcomes across facilities, suggesting a necessity for refining COVID-19 treatment protocols in Germany.

Research by Z. Wu and J.M. McGoogan [19] is based on an analysis of 72314 COVID-19 cases described in a report based on data from the Chinese Center for Disease Control and Prevention revealed primary COVID-19 symptoms as elevated temperature, persistent cough, and tiredness, with a majority exhibiting mild to moderate illness levels. Yet, a segment experienced critical issues like pneumonia, ARDS, and sepsis, underscoring the importance of prompt interventions like quarantines and medical support to curb viral transmission [20].

C. Huang et al. [21] analysis of the clinical profiles of 41 COVID-19 patients from Wuhan, China, revealed diverse symptoms such as fever, cough, exhaustion, myalgia, and respiratory issues, with pneumonia emerging as a prevalent complication. The study highlights that careful monitoring of patients' condition, and taking measures to prevent the spread of the virus, are important aspects of managing the COVID-19 pandemic. Observations also indicated that more severe disease manifestations were associated with elevated levels of C-reactive protein and the cytokine interleukin-6, signalling an intense inflammatory reaction to the infection. These results helped clarify the identifying coronavirus clinical manifestations to deepen comprehension of its pathogenesis in order to develop appropriate treatment strategies.

In the context of juxtaposing this research's outcomes with those of other researchers, it can be noted that in this study, the advantage of using lung ventilation in a mode with an accurate flow of oxygen was revealed, compared with the use of other methods of respiratory support. It has also been shown that early administration of antiviral treatments can significantly reduce the individual's hospital stay. In addition, studies conducted within the framework of

COVID-19 have highlighted the need for rational use of respiratory support. Insufficient use of non-invasive respiratory support or its delay can lead to irreversible changes in the lungs and increased mortality. On the other hand, excessive use of invasive support can lead to the development of complications such as lung injury, pneumothorax, which increases the duration of treatment and morbidity. An interesting conclusion of the study is the fact that the use of pre-pandemic established protocols for non-invasive respiratory aid was adapted to serve patients with COVID-19 and showed positive results in reducing requirements for invasive breathing assistance and diminishing staying in ICU.

In general, these studies indicate the need for effective application of breathing support for pneumonia patients amidst the COVID-19 outbreak. Non-invasive respiratory support should be rationally applied as primary therapy for patients with moderate severity of the disease, while invasive respiratory support should be reserved for extreme cases and carefully selected based on individual characteristics of each patient. In general, the discussion based on the results of the study confirms that respiratory support is a key component of managing pneumonia in the context of the coronavirus crisis. In addition, it was found in the discussion that it is necessary to rationally apply respiratory support methods and individually choose treatment methods, considering factors such as disease severity, patient age, social determinants of health, and other personal attributes. In general, the discussion of the study provides useful information for medical professionals who are engaged in the treatment of patients. A comparison of the findings comparing this study's data with findings from other researchers confirms prior outcomes but also uncovers variances. The studies by both Kazakh and foreign researchers were considered, which provided a more complete view of the current state of the problem.

One of the important points that were noted during the analysis of the literature is the need for early use of the role of mechanical ventilation in managing COVID-19-induced pneumonia. Most studies confirm that this improves the prognosis of the disease and reduces mortality. Other methods of respiratory support were also considered, including the use of oxygen, non-invasive ventilation, and extracorporeal membrane oxygenation. Notably, the success of these approaches can differ based on the illness's intensity and patient-specific factors. One of the methods of breath assistance, which is widely used in the treatment of individuals with coronavirus induced-pneumonia, is IMV. However, despite its effectiveness, IMV can cause some complications, including lung injury, bronchial obstruction, and lower respiratory tract infection.



Another method of respiratory support that can serve in addressing pneumonia in coronavirus patients is non-invasive ventilation. This breathing support method allows oxygen to be delivered to the patient's lungs through a mask or nozzle that is placed on the face or over the nose and mouth. However, non-invasive ventilation may not be effective enough in severe cases of pneumonia, and patients may require IMV. In addition, the extracorporeal membrane oxygenation method can be used in the administrating of pneumonia in individuals with coronavirus infections. ECMO serves as a supportive measure for breathing when IMV is ineffective or undesirable. In this method, the patient's blood passes through a special device that adds oxygen extracting carbon dioxide before recirculating the blood back into the patient's system.

The selection of respiratory assistance for COVID-19 pneumonia treatment ultimately hinges on various elements such as disease severity, complications, and concurrent health issues. An individual approach to each patient is required and the choice of the method that best suits their needs and condition. When discussing the results of their research in the context of other studies on this topic, the researchers may identify some gaps in knowledge and areas for further research. The outcomes suggest further investigation is necessary to ascertain the ideal oxygen levels and IMV pressures for COVID-19 pneumonia therapy.

Discussing the results in the context of other studies on this topic is an important step to understand the relevance and impact of an individual's study on the contribution of one's research to the general context of research on this issue. This allows the authors to better assess the strengths and weaknesses of their research and identify opportunities for further improvement and expansion of knowledge in this area. In addition, when discussing the problem of respiratory support in pneumonia, it's critical to consider that some patients may have additional risk factors that may worsen the prognosis of the disease. Elderly individuals with coexisting conditions like heart failure, diabetes, and COPD, among others, may experience more severe disease progression and increased complication risks.

Therefore, the management of such patients may require a more individual and differentiated approach to the choice of respiratory support regimen. There are also some doubts about the effectiveness and safety of some respiratory support methods in pneumonia during the COVID-19 pandemic. For example, HFNC has been claimed to be highly effective, but some studies indicate that the use of HFNC may increase the spread of the virus. Furthermore, non-invasive ventilation's application could heighten virus

transmission risks and show less efficacy in severe cases. When choosing methods of respiratory support in pneumonia during the COVID-19 healthcare crisis, it is necessary to consider the individual characteristics of the patient, concomitant diseases, the severity of the disease, and other risk factors. In addition, the doubts and limitations associated with the use of certain respiratory support techniques should be considered and appropriate precautions should be taken to minimise the risk of spread of the virus.

When analysing publications on the topic of breathing assistance for coronavirus related pneumonia patients, the results obtained by researchers from around the world were used. For example, the study by M.A. Martinez [22] was conducted in the USA and showed that implementing a protocol with mechanical ventilation and glucocorticoids enhances outcomes for those with COVID-19 pneumonia. Moreover, the study by Y.H. Jin et al. [23], conducted in China, found that the use of inhalation therapy can significantly improve lung function among individuals afflicted with COVID-19-induced pneumonia. In addition, A. Carsetti et al. [24] found that the use of positive pressure ventilation (PPV) proves to be a viable respiratory aid for severe COVID-19 pneumonia cases. Comparable findings were echoed by L. Li et al. [25], who showed that the use of PPV leads to an improvement in oxygen metabolism and a decrease in death rates among COVID-19 pneumonia sufferers. However, the study by J. Shang et al. [26] from China found that the application of antiviral treatments, such as lopinavir/ritonavir, in combination with interferon  $\beta$ 1b, does not lead to improved outcomes in patients with pneumonia caused by COVID-19. This result may be conditioned by the fact that the virus has already multiplied strongly in the patient's body by the time treatment begins.

Overall, the review of literature indicates that respiratory aid for COVID-19 pneumonia patients is beneficial, with the selection tailored to disease severity and patient status. Moreover, protocols for respiratory support can be refined and enhanced through ongoing research and insights.

#### CONCLUSIONS

1. Mechanical ventilation and various respiratory support techniques have demonstrated substantial efficacy in treating pneumonia patients during the COVID-19 crisis. However, each method offers unique characteristics, and the choice of respiratory support should be carefully tailored to meet individual patient needs. This approach helps to enhance treatment outcomes, especially in severe cases, where personalized respiratory support can make a significant difference.



2. Artificial lung ventilation remains a cornerstone for managing severe COVID-19-related pneumonia, yet other methods, such as non-invasive ventilation and high-flow oxygen therapy, may serve as effective alternatives in selected cases. Additionally, the study found that administering corticosteroids together with respiratory support benefits those needing more intensive care, as it correlates with lower mortality rates and reduced hospitalization times.

3. Evaluating potential risks and side effects associated with each respiratory support method is crucial to ensuring effective treatment while minimizing complications. In particular, mechanical ventilation is associated with risks such as bacterial superinfection and barotrauma, necessitating careful monitoring and prompt response to any adverse effects. This comprehensive evaluation of each method's benefits and risks supports better decision-making and ensures safer patient care.

4. Integrating various forms of respiratory support, such as combining mechanical ventilation with non-invasive methods, may offer synergistic benefits that improve overall patient outcomes. The study emphasizes the importance of a multifaceted approach, balancing respiratory support with other therapies like antiviral drugs and supportive care,

which collectively contribute to improved recovery rates and reduced complications in patients with severe respiratory failure.

5. The COVID-19 crisis underscored challenges in resource management and availability, highlighting the need for an organized and responsive healthcare system. Ensuring adequate access to respiratory support devices, trained personnel, and timely patient care is vital, particularly in high-demand situations. Future research should continue to refine therapeutic strategies, explore optimal respiratory support combinations, and enhance healthcare infrastructure to better manage pandemics and respiratory health crises.

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