Non-invasive ventilation (NIV) is a method of respiratory support, in which a mask is used as the main interface, which can be easily applied and also easily disconnected from the patient's respiratory tract. The study included patients admitted to the intensive care unit of the surgical clinic of the AMU from April 1 to May 1, 2020. NIV has significant advantages over traditional mechanical ventilation. But it must be remembered that even in experienced hands, NIV is successful only in 75%–90% of all cases, which depends on many factors, such as the severity of acute respiratory failure, training and experience of medical personnel, and the place of respiratory support. As with many types of therapy, operations, and technologies, improvement in the results of this method can be expected as experience is gained.

Keywords: COVID-19, Non-invasive ventilation, Mechanical ventilation.
Study Material
The study included patients admitted to the intensive care unit of the surgical clinic of the AMU from April 1 to May 1, 2020.

The Results of the Study
Our experience with NIV has shown that most patients treated with NIV tolerate this procedure relatively well already at the initial stage. However, in a number of patients, during the first minutes or hours of NIV, no improvement (clinical indicators and gas exchange) is observed or the procedure is poorly tolerated, the proportion of such patients is usually about 15%–35%. Usually, a respiratory support session of 2–3 hours is sufficient to predict the success of the NIV or response to the NIV. In normal practice, the effectiveness of NIV therapy is obvious with a simple examination - there is a decrease in the frequency of respiratory movements and the work of auxiliary respiratory muscles. Objective markers of the effectiveness of mask ventilation are changes in arterial blood gas parameters: an increase in pH and a decrease in PaCO₂. A short NIV session allows you to identify not only patients who can be effectively managed with NIV in the future, but also patients with a poor response who subsequently need urgent tracheal intubation and connection to a ventilator. Experience shows that longer attempts to use NIV without achieving a noticeable improvement only delay the time of the use of mechanical ventilation, which significantly increases the risk of increased respiratory failure, an adverse outcome, up to a lethal one. Using NIV, we came to the conclusion that, in most cases, NIV therapy failures are detected quite early - in the first hours from the initiation of respiratory support, however, in some patients, NIV therapy failure manifests itself later 24–48-72 hours after the initial improvement. Lack of improvement in consciousness or respiratory acidosis 24 hours after onset is NIV another predictor of NIV failure. Indications for the implementation of NIV are as follows:

Symptoms and signs of ONE: a) severe shortness of breath at rest; b) BH>25/min, participation in the breathing of the auxiliary respiratory muscles, paradoxical breathing.

Signs of gas exchange disturbance: a) PaCO₂>45 mm Hg. Art., pH<7.35; b) PaO₂/FiO₂<200.

The criteria for the exclusion of NIV in acute respiratory failure are as follows:

Stop breathing.

Unstable hemodynamics (hypotension, uncontrolled arrhythmias or myocardial ischemia).

Inability to protect the respiratory tract (cough and swallowing disorders).

Excessive bronchial secretion.

Signs of impaired consciousness (agitation or oppression), the patient's inability to cooperate with medical personnel.

Facial trauma, burns, anatomical disorders that prevent masking.

The criteria for termination of NIV and the transition to traditional mechanical ventilation include the following:

The patient's inability to carry the mask due to discomfort or pain.

The inability of the NIV to improve gas exchange within 2 hours: an increase or preservation of hypoxemia, despite the high values of PEEP and FiO₂.

Inability to mask ventilation to ease dyspnea.

The need for endotracheal intubation to remove secretions or protect the respiratory tract.

Instability of hemodynamics and ECG, instability with the phenomena of ischemia or clinically significant ventricular arrhythmias.

The increase in encephalopathy.

The physiological effects of NIV are as follows:

Preservation of spontaneous breathing and independent movements of the diaphragm.

Reduction of negative effects on hemodynamics.

Reduced work to ensure breathing.

NIV also has the following economic significance:

Reduction in the average length of stay in the intensive care unit compared with mechanical ventilation.

Reduction in the duration of hospitalization.

50% reduction in the need for mechanical ventilation.

Reduction in treatment costs.

Mortality reduction in professional use of NIV.

The study identified the following benefits of non-invasive ventilation:

Prevention of “mechanical” and infectious complications associated with intubation, reducing the risk of developing infectious complications and mechanical damage (trauma to the larynx and trachea, stenosis and bleeding from the upper respiratory tract).

Preservation of natural protective reflexes of the upper respiratory tract.

Preservation of physiological cough, the patient's ability to talk, swallow, eat, cough up sputum.

Increase patient comfort.

Reduced need for muscle relaxants, opioids and tranquilizers.

The possibility of discrete use and weaning from the apparatus.

In our clinic, NIV was performed using Salvia Elisa ventilator respirators in CPAP+PSV mode through a face mask. Used standard masks from Drager (Germany) or Respironics (USA).

To determine the parameters of the gas and acid-base composition of the blood, an ABL500 gas analyzer with an OSM3 oximeter (Radiometer, Denmark) was used. Indicators
of the function of external respiration were recorded from the display of the respirator. All data were recorded immediately before the start of ventilation. The level of PEEP and pressure support was set individually, based on the specific clinical situation. The ventilation parameters required by patients were as follows: PEEP from 5 to 12 cm of water, PSV from 0 to 14 cm of water. 

Art, FiO2 - from 0.3 to 0.6. At the initial stage, auxiliary ventilation was carried out in a continuous mode. Further, a gradual decrease in respiratory support was carried out in accordance with the degree of clinical improvement, after which they switched to NIV sessions for several hours a day until it was completely cancelled. The criterion for successful NIV was the improvement of the arterial blood gas composition and the ability to avoid endotracheal intubation.

**Clinical Case**

Patient - a man aged 60 years, with complaints of alternating chronic cough, temperature 38.6°C, chills, headache, and shortness of breath. During auscultation of the lungs, crepitus was observed, moist rales in the lower lobes of the lungs, oxygen saturation 90%, and respiratory rate 28-30 per minute. Admission laboratory tests included: WBC-14.47 × 10⁹/L, LYM-0.81 × 10⁹/L, albumin-3.19 g/dL, P-151.7%, PT-13.8 sec., INR-1.37, Fibrinogen-138 mg/L, GRP 17.4 mg/L, D-Dimer>7500 ng/mL, Ferritin-1092 ng/mL, P/F>150. Chest x-ray and CT are shown in the following Figures 1-5.
Non-invasive ventilation was carried out by an oral-nasal mask with a ventilator ELISA. Installation and adjustment of the parameters was carried out according to the general condition and according to the data of blood gases: respiratory rate <35, pH>7.30, neurological dysfunction according to the Kelly scale >3-5, a modified scale for determining the participation of auxiliary respiratory muscles <3 points. For hypercapnia, the following parameters were set: Ps-12, PEEP-5 cm water column, FiO2-30%-40%, and with hypoxemia Ps-12, PEEP-5 cm water column, FiO2-50-60 %. The median treatment period with NIV was 6 days. The average daily treatment time with NIV on the first day was 17.3 hours, on the second day - 18.2 hours and on the third day 16.7 hours. The patient was discharged on the 12th day with improvement.

**Discussion and Conclusion**

NIV has significant advantages over traditional mechanical ventilation. But it must be remembered that even in experienced hands, NIV is successful only in 75%–90% of all cases, which depends on many factors, such as the severity of acute respiratory failure, training and experience of medical personnel, and the place of respiratory support. As with many types of therapy, operations, and technologies, improvement in the results of this method can be expected as experience is gained.

The use of NIV in severe respiratory distress syndrome is uncertain. High minute lung ventilation (>11 L/min) during NIV can predict non-invasive lung ventilation.

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