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THE SELECTION OF PARAMETERS OF INVASIVE PULMONARY VENTILATION IN PATIENTS WITH PULMONARY CONTUSION COMPLICATED BY THE DEVELOPMENT OF ACUTE RESPIRATORY DISTRESS SYNDROME

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Background. Pulmonary contusion is a typical complication of both blunt and penetrating chest trauma. Pulmonary contusion is the cause of death of patients with chest trauma in 25% of all cases of fatal injury. Regardless of the mechanism of application of force during a pulmonary contusion, pulmonary capillaries have crushed with subsequent hemorrhage into the lung tissue. Hemorrhages in the lung tissue trigger the initiation of inflammatory mechanisms, as a result of which massive production and release of a number of inflammatory mediators occur, which have responsible for a pathological increase in capillary permeability, the formation of pulmonary edema. These disorders worsen both the diffusion of gases from the alveoli into the blood, and worsen lung compliance and breathing mechanics. In the lungs, the percentage of venous-arterial shunting increases due to the fact, that the proportion of alveoli decreases and does not function, but the blood flow remains through the alveolar capillaries, which are adjacent to the alveoli, which have not ventilated. The result is arterial hypoxemia, which in itself contributes to increased capillary permeability, fluid loss from vessels, pulmonary edema, and deterioration of cardiac output due to myocardial hypoxia. Acute respiratory distress syndrome (ARDS) is one of the severe complications of pulmonary contusion. The formation of ARDS is always associated with a significant increase in morbidity and mortality in patients with trauma, regardless of its severity [1, 2].

According to the Berlin definitions of 2012, ARDS in adults has characterized by the following signs. 1) The lungs damage with an acute onset, which occurs within 1 week after an obvious clinical lesion with progression of signs of respiratory dysfunction. 2) The presence of bilateral darkening during chest X-ray imaging, the occurrence of which cannot be explained by another lung pathology; 3) The presence of signs of acute respiratory failure, the occurrence of which cannot be associated with a significant decrease in the contractility of the myocardium or excessive fluid load. The decrease in the oxygenation index (PaO_2/FiO_2, arterial oxygen pressure / fraction of inhaled oxygen) in ARDS has divided into 3 degrees of severity, each of which corresponds to a certain degree of severity of the course of ARDS: 1) moderate severity – PaO_2/FiO_2 within 201-300; 2) medium severity – PaO_2/FiO_2 within 101-200; 3) severe course – $PaO_2/FiO_2 \leq 100$. The Berlin definition requires the measurement of PaO_2/FiO_2 under the conditions of creating a positive end-expiratory pressure (PEEP) at the level of 5 cm H_2O [3, 4].

The main method of intensive therapy for patients with ARDS is respiratory support with the creation of constant positive pressure in the respiratory tract. The opening of the collapsed alveoli, which provides such respiratory support, contributes to the improvement of the ventilation-perfusion ratio in the lungs and the reduction of venous-arterial shunting in the small circle of blood circulation. Effective respiratory support helps eliminate venous hypoxemia and, along with it, reduce the permeability of the walls of capillaries and venules. As a result, the loss of fluid from the pulmonary venules to the interstitium has reduced, and at the same time, pulmonary edema and the severity of inflammation have reduced. To carry out respiratory support for patients with pulmonary contusion, intensive care specialists use: 1) humidified oxygen inhalations through nasal catheters; 2) a high-flow nasal cannula; 3) a helmet for oxygen therapy; 4) oxygen breathing with a tight mask with the creation of a constant positive pressure in the respiratory tract; 5) non-invasive mask ventilation; 6) invasive pulmonary ventilation with tracheal intubation or through a tracheostomy cannula. [1, 4, 5]. The use of a high-flow nasal cannula as well as helmet oxygen therapy has not yet become widespread in Ukraine. The broadest types of respiratory support in ARDS are oxygen therapy through nasal catheters, mask oxygen therapy by creating constant positive airway pressure, and invasive pulmonary ventilation through tracheal intubation and through a tracheostomy cannula in urainian hospitals. Non-invasive ventilation is associated with high oxygen consumption and the inability to create myorelaxation in patients with severe ARDS and moderate ARDS. In severe cases, invasive respiratory support is always more effective. We set the goal of our work to develop tactics of invasive respiratory support in patients with pulmonary contusion, which has complicated by ARDS, based on the most authoritative international guidelines and our own experience of working with such a contingent of patients.

Methods. We summarized our experience of conducting intensive care in 112 patients with pulmonary contusion and signs of ARDS in the department of anesthesiology and intensive care for patients with combined trauma of a multidisciplinary city hospital of emergency medical care. We compared our experience with modern recommendations and guidelines for the treatment of patients with ARDS, which are available on websites for medical professionals on the Internet. We performed respiratory support in our patients with the help of Uvent TS, Hamilton

C1, Löwenstein Elisa 500, Mindray SV600 respirators. In patients with ARDS, we recorded indicators of ventilation: peak airway pressure (Pp), positive end-expiratory pressure (PEEP), driving pressure (Pd), tidal volume (Vt), minute respiratory volume (Vm), respiratory rate (f), oxygen content in the inhaled gas mixture (FiO_2), static lung compliance (Cs), airway impedance (Rp). We also monitored the oxygen saturation (SpO_2%) of peripheral arterial blood using a photoplethysmometeric pulse-oxymeter, carbon dioxide tension using a capnograph (ECO_2), monitored heart rate according to ECG data and pulse rate according to plethysmogram data, arterial blood pressure indicators non-invasively, the value of central venous pressure (CVP) by direct measurement.

Results and their discussion. At the core of modern recommendations for respiratory support in patients with ARDS is the concept of the baby's lungs. During the development of ARDS, specialists found that up to 80% of lung tissue has damaged by the inflammatory process. Thus, large respiratory volumes are not applicable for patients with ARDS, as this can cause ventilator-associated damage to healthy parts of the lungs, which has realized through barotrauma. Due to the loss of elasticity, as a result, of inflammation during forced ventilation, there is preferential swelling of undamaged parts. Large volumes of gas can overstretch intact parts of the lungs and damage them. That is why specialists in intensive care for the implementation of respiratory support in patients with ARDS use ventilation with small volumes of air-oxygen mixture, namely at the rate of 4-8 ml/kg of predicted body weight (PBW) [5-7].

The PBW calculation was as follows:

For females: PBW (kg) = 45.5 + 0.91 * (height [cm] - 152.4) (1)

For males: PBW (kg) = 50 + 0.91 * (height [cm] - 152.4) (2)

In the process of forced controlled ventilation, we use two modes: with regulation of ventilation by volume (volume controlling ventilation, VCV) and with regulation of ventilation by pressure (pressure controlling ventilation, PCV). The respiratory volume can be more easily selected and adjusted during exercise VCV. But when carrying out ventilation with volume control, it is more difficult to control the pressure in the respiratory tract. Therefore, we use ventilation with pressure control much more often-PCV. In order for suppression ventilation to provide the necessary amount of respiratory volume, in the first two days of respiratory support, we use deep drug sedation with benzodiazepines and antidepolarizing muscle relaxants to adapt patients to the respirator. When performing respiratory support using the ventilation mode with pressure regulation (PCV), it is necessary that the selected peak pressure and drive pressure provide the respiratory volume calculated for the PBW. When using ventilation in small volumes, in order to avoid CO_2 retention in the body, it is necessary to choose a higher, in contrast to the traditional frequency of ventilation. We ventilate our patients with a frequency of 22-25 respiratory cycles per minute [1, 5, 8].

When choosing FiO_2, intensive care specialists traditionally try to ensure that the value of FiO_2 does not exceed 0.6. However, with a severe course of ARDS and even with ARDS of moderate severity, this may not be enough. We have made sure that within 24 hours patients can be ventilated perfectly with pure oxygen without risk, i.e. FiO_2 can reach 1.0 during the day [4, 6, 8].

We are convinced that for the selection of other PCV parameters, namely the PEEP level, it is best to use the Murray lung damage severity scale. According to Murray's lung damage severity scale, there are 4 gradations of reduction in the value of the oxygenation index (PaO_2/FiO_2): 1) 225-299; 2) 175-224; 3) 100-174; and 4) <100. According to the severity of the lung's lesion, in order to improve the ventilation-perfusion ratio and eliminate hypoxemia, during respiratory support, the PEEP level will be needed, which is: 1) 6-8 cm H_2O; 2) 9-11 cm H_2O; 3) 12-14 cm H_2O; 4) 15 or more cm H_2O. Gradations of decrease in static lung compliance (Cs) according to the severity of the lesion are: 1) 60-79 ml/cm H_2O; 2) 40-59 ml/cm H_2O; 3) 20-39 ml/cm H_2O; 4)19 ml/cm H_2O and less. We have never observed a decrease in pulmonary compliance to 19 cm H_2O or less, but we note that in 42% of our patients with pulmonary contusion and ARDS, the level of static pulmonary compliance was within 20-39 ml/cm H_2O [8-9].

Plateau pressure is the pressure that the ventilator applies to the small airways and alveoli. Plateau pressure has measured at the end of inspiration with a ventilator hold maneuver of 0.5–1 second. A meta-analysis demonstrated a significant correlation between plateau pressures greater than 35 cm H_2O and the risk of barotrauma. The creation of a plateau pressure is extremely important for improving alveolar opening and ventilation-perfusion ratios in the lungs. This significantly reduces venous-arterial shunting in the vessels of the lungs. In this way, we eliminate hypoxemia, which contributes to the improvement of the functioning of all systems of the patient's body. Eliminating hypoxemia also helps reduce the production of pro-inflammatory mediators, reduce pathological vascular permeability, and eliminate pulmonary edema. Currently, intensive therapy specialists recommend not exceed the plateau pressure level of 30 cm H_2O during respiratory support in patients with ARDS. We always try to use a plateau pressure in the range of 22-27 cm H_2O, depending on the severity of ARDS manifestations in the patient. The more severe the course of ARDS, the higher the level of chamber pressure should selected during emergency respiratory support. Long-term coat pressure has better formed during respiratory support in the PCV mode. At the same time, the value of the plateau pressure often coincides with the value of the peak or inspiratory pressure. [5, 8, 10].

The value of the plateau pressure is equal to the sum of the PEEP pressure and the drive pressure. From here:

The magnitude of the driving pressure = P plateau —PEEP (3)

The optimal value of the drive pressure, that is, the pressure within which the lungs has inflated during respiratory support, is considered by most experts to be 9-13 cm H_2O. Lower drive pressure may not provide effective ventilation. Higher driving pressure is associated with increased risk of barotrauma and patient mortality [11]. That is why, when eliminating severe hypoxemia, we first increase the value of PEEP, not driving pressure. However, recently in specialized scientific publications there have been reports that the amount of drive pressure is not associated with an increase in the mortality rate [12]. We had to carry out respiratory support in patients with signs of severe ARDS against the background of pulmonary contusion, and we successfully applied a driving pressure of 15-16 cm H_2O. Such a high driving pressure was necessary for these patients in order quickly eliminate arterial hypoxemia. We believe that an increase in the driving pressure may be a necessary measure depending on the severity of ARDS, as well as an increase in plateau and PEEP pressures.

In this way, it is possible to determine the following algorithm of actions to eliminate severe systemic hypoxemia in patients with ARDS. First, we provide inhalations of humidified oxygen through nasal catheters. In case of failure, we apply the regime of constant positive pressure in the respiratory tract against the background of independent breathing (CPAP). If this is not enough, we intubate the trachea and transfer the patient to forced ventilation with the selection of its parameters according to the Murray scale. We provide FiO_2 1.0 for the first day. The next step is the deepening of drug sedation and myorelaxation with atracurium for better adaptation of patients to the respirator. If this is not enough, we gradually increase the PEEP. The last step is to increase the drive pressure. At the same time, the plateau pressure should not exceed 27 cm H_2O. With a good adaptation of the patient to the respirator and a certain level of PEEP, the need to use pure oxygen quickly disappears. The most severe patients need a FiO_2 of 0.8-0.6 on the second day, which fully meets the requirements of modern guidelines. Among 112 patients with chest trauma and pulmonary contusion, which worsened with the development of ARDS, to whom we provided intensive therapy, none of the patients died, as a result, of the progression of the acute respiratory failure syndrome. The death of 4 patients was caused by other causes, namely the progression of hemodynamic disorders against the background of a concomitant severe brain injury. Therefore, we believe that the developed algorithm of actions for the selection of measures of intensive therapy in patients with ARDS showed a full capacity.

Conclusion. When choosing the parameters of invasive ventilation in patients with pulmonary contusion complicated by ARDS, it is advisable to use the Murray scale and modern guidelines for respiratory support. Small deviations from the recommendations caused by the severity of ARDS are quite acceptable and do not contribute to an increase in mortality.

References

1. Prediction of respiratory complications by quantifying lung contusion volume using chest computed tomography in patients with chest trauma / N.H. Lee et al. Scientific Reports. 2023. Vol.13. Article number: 6387.

1. URL: https://www.nature.com/articles/s41598-023-33275-z

2. Choudhary S., Pasrija D., Mendez M.D. Pulmonary Contusion. National Library of Medicine: StatPearls. Last Update: February 5, 2023. URL: https://www.ncbi.nlm.nih.gov/books/NBK558914/

3. Nationwide Cohort Study of Independent Risk Factors for Acute Respiratory Distress Syndrome after Trauma / Tignanelli C.J., Hemmila M.R., Rogers M.A.M., Raghavendran K. Trauma Surg Acute Care Open. 2019. Vol.4, №1. Article e000249. Doi:10.1136/tsaco-2018-000249

4. Acute respiratory distress syndrome: new definition, current and future therapeutic options / V. Fanelli et al. J Thorac Dis. 2013. Vol.5, №3. P.326-334. Doi: 10.3978/j.issn.2072-1439.2013.04.05
5. Respiratory support in patients with acute respiratory distress syndrome: an expert opinion / D. Chiumello et al. Critical Care. 2017. Vol.21, P.240-247. Doi: 10.1186/s13054-017-1820-0
6. Rendeki S., Molnár T.F. Pulmonary contusion. J Thorac Dis. 2019. Vol.11, Suppl. 2. S141-S151. Doi: 10.21037/jtd.2018.11.53
7. The "baby lung" became an adult / L. Gattinoni et al. Intensive Care Med.2016. Vol.42, №5. P.663-673. Doi: 10.1007/s00134-015-4200-8
8. The British Thoracic Society & Intensive Care Society. Guidelines on the Management of ARDS. The British Thoracic Society. July 2018. URL: https://www.brit-thoracic.org.uk/quality-improvement/guidelines/acute-respiratory-distress-syndrome-ards/
9. Choudhury S.K. Murray Score for Acute Lung Injury - An Overview. iCliniq. The Virtual Hospital. Last reviewed on July 11, 2023. URL: https://www.icliniq.com/articles/respiratory-health/murray-score
10. Optimal Upper Limits of Plateau Pressure for Patients With Acute Respiratory Distress Syndrome During the First Seven Days: A Meta-Regression Analysis / H. Yasuda et al. J Clin Med Res. 2021. Vol.13, №1. P.48-63. Doi: 10.14740/jocmr4390
11. Driving Pressure Is Associated with Outcome during Assisted Ventilation in Acute Respiratory Distress Syndrome / G. Bellani et al. Anesthesiology. 2019. Vol.131. P.594-604. URL: https://doi.org/10.1097/ALN.0000000000002846
12. Driving Pressure and Mortality / Kunadu A.Q., Nalamalapu S.R., Hafiz M., Sahebazamani M. Am J Respir Crit Care Med. 2022. Vol.206, №1. P.105-107. URL: https://www.atsjournals.org/doi/pdf/10.1164/rccm.202102-0376RR

ВЛИЯНИЕ АТЕРОФИТОНА НА ГИСТОЛОГИЧЕСКУЮ СТРУКТУРУ ПЕЧЕНИ В УСЛОВИЯХ ЕКСЕРИМЕНТАЛЬНОГО МЕТАБОЛИЧЕСКОГО СИНДРОМА

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Актуальность работы. В эпоху динамичного развития научно-технического прогресса во всем мире с каждым годом растет численность так называемых «болезней цивилизации», к которым относится и метаболический

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