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SECTION: MEDICINE

THE INTENSIVE CARE PROTOCOL FOR PATIENTS WITH THORACIC TRAUMA COMPLICATED BY HEMOPNEUMOTHORAX AND PULMONARY CONTUSION

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Background. Trauma is the most common cause of death among young people, and among all types of traumatic injuries, chest injuries occur in 5% of cases. One of the most serious complications of chest injuries is the formation of pulmonary contusion. Pulmonary contusion has formed due to multiple ruptures of small vessels of the lungs, as a result, of high-energy mechanical impact. Small hemorrhages in the lung tissue cause the development of inflammation, traumatic inflammatory edema, a deterioration of the elasticity of the organ, which has called a decrease of lung compliance. The formation of a pulmonary contusion focus contributes to the deterioration of the function of external breathing, the emergence and progression of systemic arterial and venous hypoxemia, the deterioration of functioning and inhibition of the recovery of all other organs and systems. The development of acute respiratory failure and acute respiratory distress syndrome (ARDS) is one of the most serious complications of pulmonary contusion, which cause the need for special respiratory support, an increase in the time of stay in the intensive care unit and in the hospital as a whole, a significant increase in the cost of treatment, an increase in other complications and mortality. Therefore, the development and improvement of intensive care measures for patients with pulmonary contusion is an actual problem for specialists in emergency medicine. The probability of pulmonary contusion formation is always higher in those patients who have rib fractures and compression of the lungs with blood and gas due to the formation of a hemopneumothorax. The purpose of our work was to improve the measures of intensive care in patients with chest trauma and pulmonary contusion against the background of traumatic hemopneumothorax with the development of a protocol for use in the department of anesthesiology and intensive care for such a contingent of patients [1-3].

Methods. We included 192 patients of the polytrauma department of the city multidisciplinary hospital in the study. All these patients had signs of chest trauma with formation of pulmonary contusion and hemopneumothorax. We established the diagnosis of pulmonary contusion based on the results of a series of overview radiographic studies of the chest and the results of multispiral computed tomography, as well as the results of lung auscultation and pulse oxymetry. We determined the severity of acute respiratory failure syndrome clinically during the examination and auscultation of patients, and by determining the oxygen tension in arterial blood and oxygen saturation of peripheral atrial blood. Based on the calculation of the ratio of the oxygen tension in the arterial blood (PaO_2) to the oxygen fraction inhaled by the patients at the time of examination (FiO_2), we determined the oxygenation index (PaO_2/FiO_2). We interpreted the value of the oxygenation index according to the classification of the severity of ARDS acute respiratory syndrome of the Berlin consensus conference of 2012. We used the classification of determining the severity of the degree of arterial hypoxemia according to the value of oxygen saturation of the peripheral arterial blood. The normal value of SpO_2% when breathing air is 95-100%. The value of SpO_2% in the range of 90-94% is a sign of the presence of arterial hypoxemia of the first degree of severity. The value of SpO_2% in the range of 75-89% is a sign of the presence of arterial hypoxemia of the second degree of severity. The value of SpO_2% less than 75% is a sign of arterial hypoxemia of the third degree of severity [4-6].

The surgeons of the polytrauma department performed urgent surgical intervention in the volume of pleural cavity drainage according to Bülau to all patients. It was only one surgical intervention that the patients underwent in 64 cases. In other cases, several urgent surgical interventions were performed. Urgent surgical interventions were as follows: laparocentesis, median laparotomy with revision of the abdominal cavity, stopping bleeding in case of damage to the liver, spleen, intestines; primary surgical treatment of extracavitary wounds, suturing of ruptures of the urinary bladder with epicystostomy, extrafocal metalloosteosynthesis for fractures of the pelvis, hip, and lower leg, insertion of Kirschner needles, dislocation repair, double-jaw splinting, resection craniotomy with removal of epidural and subdural hematoma, etc. Drainage of the pleural cavity has performed always first by surgeons. We have developed a protocol for providing anesthetic care and intensive care for patients with thoracic trauma, pulmonary contusion, and hemopneumothorax after treating and examining 80 such patients. After that, we evaluated the effectiveness of the measures included in the protocol in 112 patients with thoracic trauma, pulmonary contusion, and hemopneumothorax. We have checked the adequacy and effectiveness of all our prescriptions against modern guidelines developed by groups of authoritative international experts and published in authoritative sources of specialized scientific information, as well as on websites for medical professionals on the Internet.

Results. For all patients, we used intravenous combined anesthesia based on ketamine. Premedication in patients included intravenous administration of 0.3-0.5 mg of atropine sulfate, 10 mg of diphenylhydramine, 10 mg of metoclopramide, 4 mg of dexamethasone, and 10 mg of morphine hydrochloride. Additional analgesia with metamizole sodium in a dose of 1000-2000 mg. Ketamine for anesthesia we had used in a dose of 2.0±0.2 mg/kg. Then the injection had repeated every 15 minutes in a dose of 1.3±0.1 mg/kg. At the same time, fentanyl had administered in a dose of 100-200 μg for analgesia. Before establishing the drainage to the pleural cavity, the patients had led to self-breathe with the supply of 60% and then 100% oxygen with a loose mask. After ensuring drainage of the pleural cavity, forced ventilation with a tight mask had used. Part of the patients underwent tracheal intubation and forced artificial ventilation of the lungs with FiO_2=1.0. Intravenous administration of fentanyl at a dose of 100 μg had repeated every 15-20 minutes.

The rate and volume of infusion therapy depends on the rate and volume of blood loss. The best variant is to use blood components as early as possible. However, because of the procedure for determining the blood group and Rh factor, the targeted acquisition of blood components for the patient in the blood transfusion department and blunt thawing is impossible. Therefore, we used plasma substitutes for infusion. Colloidal plasma substitutes are stored longer in the vascular bed, and therefore the volume of infusion is always smaller than when using crystalloids. Among crystalloid solutions, we chose balanced isotonic solutions. After all, these solutions are the closest to the normal electrolyte composition of blood plasma, and do not threaten the development and progression of metabolic acidosis due to the absence of an excess of chlorine. In addition, balanced isotonic saline solutions usually contain anions of weak organic acids, which are precursors of bicarbonate formation. In this way, the main buffer system of the extracellular fluid has not depleted. Fluid resuscitation should be restrictive if possible. In case of a lung injury, the volume of fluid injected into the body should not significantly exceed the volume of blood loss. Therefore, it is desirable to start the transfusion of fresh frozen plasma and erythrocytes as soon as possible. To preserve the coagulation potential, patients received intravenously 1000 mg of tranexamic acid in 200 ml of normal saline and 1000 mg of ethamsylate.

Respiratory support started in the operating room by anesthesiologists should be continuing in the intensive care unit. In the first day after injury, it is possible fully provide controlled ventilation at the expense of 100% oxygen. It does not pose a threat of hyperoxic damage. However, it is advisable to determine what oxygen saturation of peripheral arterial blood is achieved during ventilation of the patient with air. If it is possible to determine the oxygen tension in arterial blood, it is necessary to determine the value of the oxygenation index PaO_2/FiO_2. On the first day after receiving a thoracic injury, the clinical manifestations of the syndrome of acute respiratory failure, those caused by a pulmonary contusion, in a large number of cases are very weak. However, it is possible to observe a periodic short-term decrease in SpO_2%. Prolonged invasive forced invasive support contributes to a significant reduction in the risk of ARDS formation. In the process of respiratory support with positive pressure at the end of exhalation (PEEP), the resistance of the small airways decreases, more and more alveoli are involved in ventilation. With this ulcer, the ratio between the volume of ventilation and the volume of blood flow in the lungs has reduced. Due to this, venous hypoxemia has eliminated, which contributes to the reduction of inflammation and the growth of inflammatory capillary permeability and the formation of pulmonary edema. For better adaptation of the patient to the respirator, we use benzodiazepines and analgesia with morphine. Further tactics of respiratory support depend on the dynamics of the process. If there are no signs of the progression of the acute respiratory failure syndrome, the formation of ARDS, the patient can be transferring to independent breathing with oxygen inhalation through a nasal catheter or use a tight mask with the creation of a respectable positive pressure in the respiratory tract (CPAP). Inhalation of oxygen with the help of catheters ensures the value of FiO_2 up to 0.4. When using CPAP, it is possible to achieve FiO_2 values in the range of 0.6-0.8. A disadvantage of the CPAP technique is the poor adaptation of many patients to it.

To improve the drainage of the tracheobronchial tree, we widely use N-acetyl cysteine, which can be administering to patients intravenously. After restoring the possibility of enteral administration of liquid, we prescribe N-acetyl cysteine enterally in a dose of 600-1200 mg per day. We also use bromhexine hydrochloride and ambroxol. Bromhexine has used in a dose of 16 mg 3 times a day. The dose of ambroxol in the form of syrup is 30 mg 3-4 times a day. If there are suspicions of the presence of bronchospasm, we prescribe theophylline intravenously at 100 mg 3-4 times a day. The drugs has administered through a probe to patients in an unconscious state.

For analgesia, we use 100 mg of dexketoprofen intravenously 3-4 times a day. Analgesia can be intensified at any time by the introduction of metamizole sodium in a dose of 1000 mg. Narcotic analgesics suppress breathing in patients and contribute to hypoventilation and slowing down the restoration of normal ventilation-perfusion relations. If necessary, it is possible to use morphine intravenously in a dose of 2-5 mg. Paracetamol does not provide reliable analgesia and has a weak anti-inflammatory effect. Effective analgesia improves drainage of the tracheobronchial tree. The effect of analgesia has enhanced by magnesium sulfate, thiamine, cyanocobalamin, and benzodiazepines. We use antipsychotics very rarely and only when there is psychosis. Ketamine anesthesia with subsequent prolonged controlled mechanical pulmonary ventilation in the conditions of neurovegetative blockade by benzodiazepines, intravenous administration of magnesium sulfate together with pyridoxine and thiamine significantly reduce the risk of psychosis after injury.

Infusion therapy after surgery should be restrictive. The target minimum concentration of hemoglobin in the blood is 10 g/dL. It is advisable to transfuse red blood cells with a lower concentration of hemoglobin. Losses due to the drainage of the pleural cavity are usually 150-300 ml per day. However, sometimes they can reach 500 ml per day. To reduce blood loss, it is advisable to continue the administration of tranexamic acid intravenously for 2-3 days at a dose of 500-750 mg per day after surgery. During the first day after surgery, it is also advisable to use etamsylate 250-500 mg intravenously every 4 hours. The best hemostatic effect has provided by transfusion of fresh frozen plasma. Infusion therapy has best provided by balanced isotonic saline solutions. We also administer 40-60 g of dextrose along with a solution of potassium chloride and magnesium sulfate to stabilize the heart rate and prevent the development of ketosis. A large volume of infusion after surgery is associated with the accumulation of fluid in the interstitium, including in the interstitium of the lungs, which impairs the efficiency of external breathing. For heart rhythm disorders, we use an infusion of 300-600 mg of amiodarone in a 5% dextrose solution per day.

Prevention of the formation of stress erosions and ulcers in the gastrointestinal tract consists in the appointment of proton pump inhibitors twice a day or blockers of histamine receptors of the second type. Antacids have prescribed orally or through a probe in the first two days after the operation. When the ability to absorb enterally administered liquid has restored, it is advisable to start enteral nutrition with the appointment of enzymes that help improve the absorption of energy substrates as early as possible.

Prevention and treatment of infectious complications begins in the operating room. We usually prescribe third-generation cephalosporins with an infusion of 500 mg of metronidazole during surgery. After surgery, administration of third-generation cephalosporins and metronidazole continues. In case of severe combined injuries, we use, in addition to cephalosporins, fluoroquinolones of the second or third generation already on the first day. The most used combination of antibacterial drugs: ceftriaxone + levofloxacin + metronidazole. In the absence of sufficient effect, we prescribe carbepenems. In case of suspicion of pleural empyema formation, we used the introduction of dioxidine solution through a catheter inserted into the pleural cavity with the subsequent outflow of fluid through the Bülau drainage. In case of concomitant open craniocerebral injury, we used antibacterial therapy consisting of ceftriaxone, aminoglycoside amikacin, and metronidazole.

Prevention of thrombus formation and thromboembolic complications begins on the first day after surgery. We use low molecular weight heparins, and most often enoxaparin at a dose of 4000 anti-Xa IU/0.4 ml (40 mg) per day. Patients with a body weight of more than 100 kg may need a higher dose.

Conclusion. Application of the protocol, the content of which have presented for patients with thoracic trauma, thoracic contusion and hemopneumothorax allowed us to obtain the following results. Of the 112 patients with this pathology, none died from the progression of the acute respiratory failure syndrome or from the development of pulmonary sepsis. The deaths of white patients were due to other causes. The most common of them is the syndrome of acute cerebral insufficiency and organ dysfunction in patients with severe brain trauma.

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СУЧАСНІ ТЕХНОЛОГІЇ ОБРОБКИ ПОВЕРХОНЬ В ЗАКЛАДАХ ОХОРОНИ ЗДОРОВ'Я - ЯК ВАЖЛИВИЙ ЕЛЕМЕНТ МОНІТОРИНГУ РУТИННОГО ЕПІДНАГЛЯДУ ІНФЕКЦІЙНОГО КОНТРОЛЮ

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Декілька років поспіль медична система охорони здоров'я України перебудовується. Виникають заклади та відділи інфекційного контролю, які наразі створюють умови для виконання процесів і практик регламентованих

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