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Review Article

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Unsolved Problems Treatment of Patients with Thermal Inhalation Injuries (Literature Review)

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Abstract

Despite the achieved certain successes in the treatment of victims with combined thermal trauma, a wide arsenal of modern pharmacological agents and medical equipment, it should be recognized that the existing principles of treatment of this severe category of victims are mainly syndromic in nature, and treatment-tactical algorithms require further development, depending on the severity of damage to the respiratory system and prognostic assessment of the outcome of combined thermal injury.

Keywords: Thermal Inhalation, Tracheobronchitis, Pneumonia, Respiratory Tract, Treatment.

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Introduction

The technologic way of development of society causes a high level of injuries. According to the literature, injuries and poisoning ranked first among the causes of death of the population, ahead of cardiovascular and oncological diseases. Among the causes of injury, burns account for 4-5%, however, the number of patients with severe thermal injuries has increased, as well as mortality over the past decades.[1]

Literature data show that the combination of respiratory tract and skin lesions occurs in about 30% of cases of severe burn injury. First of all, this is due to an increase in the number of burned people who were injured as a result of multifactorial damage from exposure to high temperature, toxic gases, and others.[1,2]

Thermoingalation injuries (TIT) they are constant companions of road, aviation, railway, mass disasters, fires in closed rooms, explosions in mines, in the workshops of factories and factories, and therefore remain a relevant section of clinical kombustiology.[3–5]

One of the most urgent problems of modern kombustiology is optimization of treatment of severe thermoingalation injury.[6–9]

After diagnosing the area and depth of skin damage, determining the severity of inhalation trauma, and taking into account clinical and laboratory signs of carbon monoxide poisoning, the main tactical task for victims with combined thermal trauma is to prevent possible complications of inhalation trauma and conduct anti-shock treatment. In the first hours after the injury, the most serious complication of upper respiratory tract damage is asphyxia caused by laryngeal edema. The clinical picture develops quite quickly, sometimes leaving the clinician no time for conservative measures. With the goal to prevent upper airway obstruction, many authors recommend tracheal intubation in case of endoscopic data indicating a high risk of laryngeal edema in severe thermochemical damage to the respiratory tract.[10–15] If it is impossible to perform fibrobronchoscopy or laryngoscopy at the time of admission of the victim, the doctor should alert and focus on the possible need for tracheal intubation such phenomena as dysphonia or aphonia, stridorous breathing, complaints of suffocation.[16–18]

The method of intubation (transoral, nasotracheal or superimposed tracheostomy) does not matter, since the frequency of purulent complications, according to T.Lund et al. (1985), is primarily related to the duration of intubation, and not the method of introduction of the endotracheal tube. At the

same time, some authors do not recommend applying a tracheostomy even during prolonged mechanical ventilation due to the high probability of developing such serious complications as tracheostomy infection, necrotizing tracheobronchitis, pneumonia, bedsores, and tracheal strictures.[19,20]

Our experience confirms the expediency of performing preventive tracheal intubation in the endoscopic picture of pronounced edema of the vocal cords and the surrounding ligamentous space or severe damage to the lower respiratory tract by combustion products. Moreover, if prolonged mechanical ventilation is necessary, the tactic of applying a tracheostomy, from our point of view, is justified, since this significantly improves and facilitates not only the rehabilitation of the tracheobronchial tree, but also the synchronization of the victim with the ventilator, without requiring the introduction of large doses of sedatives and muscle relaxants.[21–23]

An equally dangerous complication of respiratory tract damage caused by combustion products (thermochemical or toxic chemical damage to the lungs) is the syndrome of acute lung damage (APL) and as a more severe form of it – adult respiratory distress syndrome (RDSS). RDSV complicates the course of severe and extremely severe IT in 20% of patients. With untimely-qualified assistance to the victim, the clinical picture of this complication manifests itself 12-24 hours after the injury. In this case, the main preventive therapeutic actions are timely diagnosis and assessment of the severity of the lesion using fibrobronchoscopy aimed at restoring airway patency and eliminating toxic combustion products, and performing respiratory therapy.[24,25]

According to many authors,[26] timely initiation and adequate implementation of respiratory therapy in patients with multifactorial airway lesions has a positive effect on the course and outcome of burn disease. Indications for tracheal intubation and various types of respiratory support (auxiliary, high frequency, controlled Mechanical ventilation SYSTEM) heavily burned are:

- Signs respiratory system deficiencies;
- Absence consciousness;
- Heavy ones thermal solutions upper body lesions respiratory systems paths and defeats products burning conditions on everyone length respiratory system the road.

Clinical experience shows that the use of high-frequency ventilation (HF) is preferable in patients with inhalation trauma. (2006), E. F. Haponic et al. (1993), T. Shimazu et al. (1998) experiments and clinical studies have shown that this type of respiratory support has a beneficial effect on the condition of the burned, as it allows you to provide adequate ventilation, oxygenation and ventilation when using low concentrations of inhaled oxygen and peak airway pressure. In addition, this ventilation mode increases the clearance of endobronchial secretions, prevents atelectasis, and is one of the ways to prevent the development of pneumonia and acute lung injury syndrome.[27–30]

One of the ways to prevent the development of the main goal of this method is to improve pulmonary microcirculation and reduce hypertension in the small circulatory circle.[31] To this end, B. A. Pruitt et al. (1995) recommended inhalation of nitric oxide (NO is the concentration in the respiratory mixture of 20 parts/million), which, according to J. Rodriquez et al. (1993), A.M. Schultz (1997), M. J. Saliva (1997), prevents platelet aggregation, has a bronchodilating effect, without affecting systemic hemodynamics. In the same study, the authors studied the anti-inflammatory and antioxidant mechanisms of action of pentoxifylline. The results obtained indicate the effectiveness of antioxidant protection of this drug in patients with a high risk of developing acute lung injury syndrome.[32–34]

A promising direction in the treatment of this terrible complication is the use of exogenous surfactant and its precursors. Positive results were obtained with endobronchial administration of exogenous dipalmitoylphosphatidylcholine (DPPC) in the experiment.[35] N. Pallua et al. (1997) reported on the successful use of exogenous surfactant in patients with inhalation trauma complicated by the development of distress syndrome.

Yu. M. Tarasenko et al. (2005) a report was published on the successful long -term inhaled use of exogenous surfactant (surfactant BL) in the treatment of acute lung injury syndrome that developed against the background of reperfusion syndrome.

Purulent complications (pneumonia, purulent tracheobronchitis), which develop quite early and give a high percentage of mortality, are an equally serious problem in those who are burned with respiratory tract lesions. The prevention and treatment of these complications is based on regular rehabilitation of the tracheobronchial tree, as well as rational antibiotic therapy. The frequency of performing rehabilitation fibrobronchoscopy depends on the severity of airway damage, the severity of purulent-inflammatory processes in the tracheal and bronchial mucosa, and the use of an intubation tube or tracheostomy cannula in the treatment process. In severe cases, rehabilitation fibrobronchoscopy is performed several times a day. During sanitation, a 2% solution of soda, saline solution, antiseptic solutions are used-0.5percentage dioxide solution, 0.5% metrogyl solution. To stimulate the reparative processes of the tracheobronchial tree mucosa, a 10% solution of actovegin is widely used.[23]

Equally important is the choice of antibiotics. Most authors recommend prescribing antibacterial drugs only after a bacteriological study and determining the sensitivity of microflora sown from bronchial flushes.[30] Given the significant inci-

dence of pneumonia in patients with severe and extremely severe respiratory tract damage, as well as the high risk of generalization of the infectious process with a combination of skin burns and respiratory tract damage, it seems advisable to start antibacterial therapy from the first day of treatment. From the moment of injury.[19,22] When conducting empirical antibiotic therapy, it is recommended to prescribe drugs taking into account the data of epidemiological monitoring of the department, since the analysis of the results of bacteriological examination of bronchial flushes and lavage fluid confirms contamination of the respiratory tract as early as 12-24 hours after the victim's admission.[17,22]

According to A. A. Filimonov et al. (2004) in the treatment of TIT, the only reliable method for detailed diagnosis of its severity and effective pathogenic treatment is sanitization FBS, supplemented by multiple US inhalations up to 8 times a day with antibiotics, bronchodilators, and mucolytics performed against the background of multicomponent therapy, anti-shock, detoxification, antibacterial and immune corrective systemic therapy.

It was found that TIT is accompanied by a stress reaction, hypoxia, and inflammation, which are the main triggers of active lipid peroxidation. Therefore, the inclusion of the antioxidant mexidol in the complex therapy of patients with TIT significantly reduces the severity of respiratory lipid peroxidation/ antioxidant system.[25]

In order to prevent edema of the respiratory tract mucosa, inhalations of sodium bicarbonate solution, eufillin 2.4% - 10 ml, epinephrine 0.1% -1 ml are also indicated. If the respiratory tract is affected, it is advisable to apply a micro tracheostomy for injecting medicinal mixtures containing muco - and bronchodilators, antibiotics and an antiseptic directly into the trachea.[11]

Whereas V. P. Lapshin et al. (2000) electrostimulation of the trachea-bronchi-lungs zones of Zakhariev-Ged with the Electronika-2M device in patients with TIT and noted an improvement in external respiration indicators due to improved respiratory cycles and an increase in respiratory volume, which led to an increase in maximum ventilation of the lungs.

Healing of tracheobronchial tree mucosal defects in patients with TIT is achieved by including reflex stimulation of low-intensity laser irradiation in the complex of therapeutic measures.[16]

Using nebulizer therapy in patients with TIT V. A. Efremov et al. (2004), Ch.R. Khodzhakulov et al. (2004) there was an improvement in the drainage function of the bronchi and a decrease in bronchorrhea.

Respiratory tract injuries in combination with skin burns significantly affect the course of burn disease, aggravating the severity of burn shock and leading to the development of life-threatening conditions. Accordingly, the treatment tactics of these victims have certain features. First of all, they relate to such issues as the volume and composition of infusion therapy, indications for artificial ventilation, and prevention of possible complications.

The volume of infusion therapy in burned patients with inhalation trauma is recommended to be increased by 40% from the calculated one. T. L. Lee-Chiong (1999) N. T. Dai et al. suggests increasing the amount of transfused solutions in case of respiratory tract damage by 2 ml/% of burn wounds/kg of body weight, achieving a steady rate of diuresis of at least 0.3-0.5 ml/kg/h. (1998) we recommend using the formula Parkland (4 ml / kg / % burn) when monitoring diuresis of 0.5-1 ml / kg / h At the same time, P. Reper et al. (1998) suggests to carry out infusion of solutions in volumes exceeding 10 ml / kg / day, while achieving hemodilution with a hematocrit not exceeding 35%.

The composition of transfused solutions should be selected taking into account water-electrolyte disturbances, shifts in the acid-base state and increased energy requirements. To improve the rheological properties of blood and microcirculation, it is recommended to use colloidal solutions in the amount of 5-7 ml / kg / day.[17] It is preferable to use fresh frozen plasma, human albumin, but not earlier than 8 hours from the moment of injury.[33]

The question of the expediency of prescribing glucocorticoids in patients with inhalation trauma is unresolved and controversial, given the high risk of developing purulent-septic complications in this category of burned patients.

G. W. Welch et al. (1977), B. A. Pruitt et al. (1995) in their experimental works and in the clinic proved that the use of glucocorticoids significantly increases mortality and doubles the number of positive hemocultures sown, which is accompanied by an increase in the number of purulent complications. Based on this, glucocorticoids should be used only in patients with grade III-IV burn shock and in patients with TIT requiring mechanical ventilation.[4,12]

Thus, despite some progress made in the treatment of victims with a wide range of modern pharmacological tools and medical equipment, it should be recognized that the existing principles of treatment of this severe category of victims are mainly syndromic in nature, and therapeutic and tactical algorithms require further development, depending on the severity of respiratory damage and prognostic assessment of the outcome of combined thermal injury.

Conclusion

In summary, it should be noted that thermal lesions of the respiratory tract have their own well -defined clinic, diagnostic

features, course, and pronounced treatment specifics. At the same time, they have a significant impact on the course of burn disease, and require medical rehabilitation in the relevant medical and preventive institutions of the regions and the republic. Only an integrated approach to solving these issues, the participation of specialists of various profiles - kombustiologists, bronchologists, internists, and physiotherapists - can accelerate the recovery, return to social, and labor activities of this difficult contingent victim.

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