

UNRESOLVED PROBLEMS IN THE TREATMENT OF PATIENTS WITH THERMAL INHALATION INJURIES



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ТЕРМОИНГАЛЯЦИОН ЖАРОҲАТЛАР БИЛАН КАСАЛЛАНГАН БЕМОРЛАРНИ ДАВОЛАШДА ҲАЛ ҚИЛИНМАГАН МУАММОЛАР

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НЕРАЗРЕШЕННЫЕ ПРОБЛЕМЫ В ЛЕЧЕНИИ ПАЦИЕНТОВ С ТЕРМОИНГАЛЯЦИОННЫМИ ТРАВМАМИ

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Резюме. Термоингаляцион шикастланишлар (ТИТ) замонавий клиник комбустиологиянинг асосий муаммоларидан бири бўлиб қолмоқда, бу эса комбинацияланган термик шикастланишлар билан оғриган беморларни даволашга алоҳида эътибор беришни талаб қилади. Мақолада ТИТни таъхислаш, олдини олиш ва даволашнинг долзарб масалалари, жумладан асфиксия, нафас етишмовчилиги ва бошқа асоратларнинг олдини олиш усуллари кўриб чиқилган. Асосий эътибор нафас олишни қўллаб-қувватлашни оптималлаштириш, нафас йўллари тозалаш ва самарали антибиотик терапияси учун бронхоскопиядан фойдаланишга қаратилган. Азот оксиди, антиоксидантлар ва сурфактант ёрдамида юқори частотали вентиляция ва ингаляцияларни қўллаш истиқболли даволаш усуллари сифатида муҳокама қилинмоқда.

Калит сўзлар: термоингаляцион жароҳатлар, респиратор етишмовчилик, нафас йўллари санацисси, юқори частотали вентиляция.

Abstract. Thermal inhalation injuries (TII) remain one of the main problems in modern clinical combustiology, requiring special attention to the treatment of patients with combined thermal injuries. The article discusses current issues of diagnostics, prevention and treatment of TIT, including methods for preventing asphyxia, respiratory failure and other complications. The main attention is paid to the optimization of respiratory support, the use of bronchoscopy for airway sanitation and effective antibiotic therapy. The use of high-frequency ventilation and inhalations using nitric oxide, antioxidants and surfactant is discussed as promising treatment methods.

Keywords: thermal inhalation injuries, respiratory failure, airway sanitation, high-frequency ventilation.

The technogenic way of society development causes a high level of traumatism. According to the literature, injuries and poisonings have taken the first place among the causes of death of the population, ahead of cardiovascular and oncological diseases [3, 25]. Among the causes of trauma, burns occupy 4-5%, nevertheless, the number of patients with severe thermal injuries has increased, as well as lethality over the last decade [1, 7, 8, 38].

Literature data show that the combination of respiratory and cutaneous lesions occurs in about 30% of cases of severe burn injury. This is primarily due to the increasing number of burn victims who have been injured as a result of multifactorial injury from high temperature, toxic gases and others [23, 31].

Thermal inhalation injuries (TIT) are constant companions of road, aviation, railway, in mass disasters, indoor fires, explosions in mines, in the shops of factories and

plants and therefore remains a relevant section of clinical combustiology [13, 14, 15, 17, 18].

One of the most urgent problems of modern combustiology is the optimisation of treatment of severe thermoinhalation trauma [2, 4].

After diagnosing the area and depth of skin lesions, determining the severity of inhalation trauma, taking into account clinical and laboratory signs of carbon monoxide poisoning, the main tactical task in victims with combined thermal trauma is to prevent possible complications of inhalation trauma and to conduct antishock treatment. In the first hours from the moment of injury, the most formidable complication of upper respiratory tract damage is asphyxia caused by laryngeal oedema. The clinical picture develops quite rapidly, sometimes leaving the clinician no time to carry out conservative measures. In order to prevent upper airway obstruction, many authors recommend tracheal in-

tubation in case of endoscopic findings indicating a high risk of laryngeal oedema development in severe thermochemical damage of the respiratory tract [32, 41]. If fibrobronchoscopy or laryngoscopy cannot be performed at the time of admission, the doctor should be alerted to the possible need for tracheal intubation by such phenomena as dysphonia or aphonia, stridor breathing, and complaints of choking [34, 35].

The method of intubation (transoral, nasotracheal or tracheostomy) does not matter, because the incidence of purulent complications, according to T.Lund et al. (1985), is primarily related to the duration of intubation, not the method of endotracheal tube insertion. At the same time, some authors do not recommend resorting to tracheostomy even during prolonged ventilatory support because of the high probability of developing such serious complications as tracheostomy infection, necrotising tracheobronchitis, pneumonia, pressure sores, and tracheal strictures [9, 37].

According to many authors [5, 16, 22, 26], timely initiation and adequate respiratory therapy in victims with multifactorial respiratory tract injuries has a positive effect on the course and outcome of burns disease. Indications for tracheal intubation and various types of respiratory support (assisted, high-frequency, controlled ventilation) for severely burned patients are:

- signs of respiratory failure;
- lack of consciousness;
- severe thermal damage to the upper respiratory tract and combustion product damage throughout the respiratory tract.

Clinical experience testifies that the use of high-frequency ventilation (HFVL) is preferable in victims with inhalation trauma. A.G.Klimov et al. (2006), E.F.Haponic et al. (1993), T.Shimazu et al. (1998) in experiments and clinical studies showed that this type of respiratory support has a beneficial effect on the condition of burned people, as it allows to provide adequate oxygenation and ventilation using low concentrations of inhaled oxygen and peak pressure in the airways. In addition, this mode of ventilation increases the clearance of endobronchial secretion, prevents atelectasis, being one of the ways to prevent the development of pneumonia and acute lung injury syndrome [39, 41,].

One of the ways to prevent the development of SOPL is to improve pulmonary microcirculation and reduce hypertension in the small circle of blood circulation [32]. For this purpose, B.A.Pruitt et al. (1995) recommended inhalation of nitric oxide (NO - concentration in the breathing mixture 20 parts/million), which, according to J.Rodriguez et al. (1993), A.M.Schultz (1997), M.J.Saliva (1997), prevents platelet aggregation, has a bronchodilating effect without affecting systemic haemodynamics. In the same work the authors studied anti-inflammatory and antioxidant mechanisms of action of pentoxifylline. The results obtained indicate the effectiveness of antioxidant protection of this drug in victims with a high risk of acute lung injury syndrome [5, 6].

A promising direction in the treatment of this formidable complication is the use of exogenous surfactant and its precursors. Positive results were obtained with endobronchial administration of exogenous dipalmitylphosphatidylcholine (DPPC) in experiment [40]. N.Pallua et al. (1997) reported the successful use of exoge-

nous surfactant in victims with inhalation trauma complicated by the development of distress syndrome.

Y.M.Tarasenko et al. (2005) published a report on successful long-term inhalation application of exogenous surfactant (surfactant BL) in the treatment of acute lung injury syndrome developed against the background of reperfusion syndrome.

No less serious problem in burned patients with respiratory tract lesions are purulent complications (pneumonia, purulent tracheo-bronchitis), which develop early enough and give a high percentage of mortality. The basis of prevention and treatment of these complications is regular sanitation of the tracheobronchial tree, as well as rational antibiotic therapy. The frequency of performing sanitation fibrobronchoscopy depends on the severity of airway damage, the severity of purulent inflammatory processes in the mucosa of the trachea and bronchi, the use of an intubation tube or tracheostomy cannula during treatment. In severe cases, sanitation fibrobronchoscopy is performed several times a day. During sanitation 2% solution of soda, physiological solution, antiseptic solutions - 0.5% solution of dioxidine, 0.5% solution of metrogil are used. To stimulate reparative processes of the mucous membrane of the tracheobronchial tree 10% actovegin solution is widely used [27].

The choice of antibiotics is no less important. Most authors recommend prescribing antibacterial drugs only after bacteriological examination and determination of sensitivity of microflora isolated from bronchial flushes [38]. Taking into account the significant frequency of pneumonia development in victims with severe and extremely severe respiratory tract damage, as well as the high risk of generalisation of the infectious process when combining skin burns and respiratory tract damage, it is reasonable to start antibiotic therapy from the first day from the moment of injury [27, 30]. 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 the contamination of the respiratory tract as early as 12-24 hours after admission of the victim [25,30].

It is established that TIT is accompanied by stress-response, hypoxia and inflammation, which are the main triggering mechanisms of active lipid peroxidation. Therefore, the inclusion of the antioxidant mexidol in the complex therapy of patients with TIT significantly reduces the degree of expression of respiratory lipid peroxidation/ antioxidant system [33].

Inhalation of sodium bicarbonate solution, eufylline 2.4%-10 ml, adrenaline 0.1%-1 ml are also indicated to prevent mucosal oedema of the respiratory tract. If the airways are affected, it is desirable to apply a microtracheostomy to inject directly into the trachea medicinal mixtures containing mucosal and bronchodilators, antibiotics and antiseptics [19].

Whereas V.P.Lapshin et al. (2000) electrostimulation with "Elektronika-2M" apparatus of Zakhariyev-Ged zones of trachea-bronchi-lungs at TIT and noted improvement of external respiration indices due to improvement of respiratory cycles and increase of respiratory volume, which led to increase of maximal lung ventilation.

Healing of tracheobronchial mucosa defects in patients with TIT is achieved when reflex stimulation of low-intensity laser irradiation is included in the complex of treatment measures [24].

Using nebuliser therapy in patients with TIT V.A.Efremov et al. (2004), Ch.R.Hodzhakulov et al. (2004) observed improvement of bronchial drainage function and reduction of bronchorrhoea.

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

The volume of infusion therapy in burned patients with inhalation injury is recommended to be increased by 40% of the calculated [16,]. T.L.Lee-Chiong (1999) suggests increasing the amount of transfused solutions, in case of respiratory tract lesions, by 2 ml/% of burn wounds/kg body weight, achieving a steady rate of diuresis of at least 0.3-0.5 ml/kg/hour. N.T.Dai et al. (1998) recommend using the Parkland formula (4 ml/kg/% burn) while monitoring diuresis at 0.5-1 ml/kg/hour. At the same time, P.Reper et al. (1998) suggests infusion of solutions in volumes exceeding 10 ml/kg/day, while achieving haemodilution with haematocrit not exceeding 35%.

The composition of transfused solutions should be selected taking into account water-electrolyte disorders, shifts in acid-base state and increased energy requirements.

To improve blood rheological properties and microcirculation it is recommended to use colloidal solutions in the volume of 5-7 ml/kg/day [25]. The use of fresh frozen plasma, human albumin is preferable, but not earlier than 8 hours from the moment of injury [30].

Unresolved and controversial is the question of the advisability of prescribing glucocorticoids in victims with inhalation trauma, given the high risk of purulent-septic complications in this category of burn victims.

G.W.Welch et al. (1977), B.A.Pruitt et al. (1995) in their experimental work and in the clinic [21] proved that the use of glucocorticoids significantly increases mortality and doubles the number of positive haemocultures, which is accompanied by an increase in the number of purulent complications [12, 20].

Thus, 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 recognised that the existing principles of treatment of this severe category of victims are mainly syndromal in nature, and therapeutic and tactical algorithms require further development, depending on the severity of respiratory trauma and prognostic assessment of the outcome of combined thermal trauma.

In summary, it should be noted that thermal lesions of the respiratory tract have a clearly defined clinic, features of diagnosis, course and a pronounced specificity of treatment. Only an integrated approach to solving these issues, participation of various specialists - combustiologists, bronchologists, therapists, physiotherapists - can accelerate recovery and return to social and labour activity of this severe contingent of victims.

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НЕРАЗРЕШЕННЫЕ ПРОБЛЕМЫ В ЛЕЧЕНИИ ПАЦИЕНТОВ С ТЕРМОИНГАЛЯЦИОННЫМИ ТРАВМАМИ

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Резюме. Термоингалиционные травмы (ТИТ) остаются одной из главных проблем в современной клинической комбустиологии, требуя особого внимания к лечению пациентов с комбинированными термическими травмами. В статье рассматриваются актуальные вопросы диагностики, профилактики и лечения ТИТ, включая методы профилактики асфиксии, респираторной недостаточности и других осложнений. Основное внимание уделено оптимизации дыхательной поддержки, использованию бронхоскопии для санации дыхательных путей и эффективной антибиотикотерапии. Применение высокочастотной вентиляции и ингаляций с использованием оксида азота, антиоксидантов и сурфактанта обсуждается как перспективные методы лечения.

Ключевые слова: термоингалиционные травмы, респираторная недостаточность, санация дыхательных путей, высокочастотная вентиляция.