THERMAL INHALATION INJURY

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Abstract

Victims with multifactorial lesions, who, in addition to skin burns, have inhalation damage, general overheating and carbon monoxide poisoning, belong to the category of the most severely burned. This paper discusses the diagnosis and treatment of patients with thermal inhalation trauma, indicates optimization methods in the diagnosis and treatment of such patients. In addition, some aspects of pathogenesis are highlighted, and high-tech diagnostic methods of treatment are considered.

Keywords: *thermal inhalation injury, intensive care, fibrobronchoscopy, burn disease.*

INTRODUCTION

Victims with multifactorial lesions, who, in addition to skin burns, have inhalation damage, general overheating and carbon monoxide poisoning, belong to the category of the most severely burned [1, 2, 3, 5, 11, 16]. The relevance of its study is associated with the severity of the clinical course, the frequency of infectious complications and, most importantly, high mortality, amounting to 20-30% of the total mortality. When combined with a ter-moingalation injury with extensive burns, the mortality, according to various authors, is 33.3-82.2% [6, 7, 8, 9, 14, 15, 19].

Thermal inhalation injury is considered as an additional burn wound that covers all parts of the respiratory tract, increases the total area of the burn surface and is one of the most significant factors aggravating the course of burn disease [10, 13, 18]. When combined with thermal inhalation trauma with extensive burns of the skin, the frequent development of purulent complications from the lungs and tracheobronchial tree leads to additional bacterial toxemia, which aggravates the condition of patients [13, 14, 17, 20]. In the early period of thermal inhalation trauma, bronchospasm, pulmonary edema, respiratory distress syndrome often develops, with mortality reaching 40-70%. In this regard, the relevance of the study of thermal inhalation injury does not lose its importance.

The aim of the study is to improve the diagnosis and evaluation of the effectiveness of complex

intensive antishock therapy for thermal inhalation injuries.

MATERIALS AND METHODS

Data on 110 victims with thermal inhalation trauma treated in the burn unit from 2000 to 2019 were used. The cause of respiratory tract damage in patients was the inhalation of smoke and gorenje products. It should be noted that all 110 people had skin burns and respiratory tract lesions. All the victims were divided into two groups depending on the method of treatment: 41 victims made up the I group of treated 2000-2010, and 69 patients were included in the II group of treated 2011-2019, they were comparable in area of deep burn, age and gender.

RESULTS AND DISCUSSION

If clinical material was accumulated and generalized in 2000-2010, homeostasis was studied, diagnostic and treatment methods were developed, and their introduction into practice was carried out, then in subsequent years (2011-2019) we had the opportunity to significantly improve the developed methods of anti-shock therapy.

The arsenal of medicines for general and local treatment of victims has been significantly expanded, infusions of hypertonic (7-10%) sodium chloride solution in the volume of 80-120 ml under the control of sodium levels in the blood (preventing natriemia of more than 160 mmol/l) have become more widely used in a full range of therapeutic measures. For the prevention of stress ulcers from the first hours of injury of H2-blockers of histamine receptors (pirenzipine, kvamatel, etc.). In 15 patients with thermal inhalation trauma in the first 8-10 hours there was a threat of pulmonary edema requiring ventilation. Glucocorticosteroids were also included in the complex of intensive infusion-transfusion therapy for these patients.

It is generally recognized that not only thermal factors have a damaging effect on the respiratory tract and lungs, but also chemicals formed during the combustion of synthetic materials. Soot, toxic gases and vapors, along with hot air, penetrate into the lower respiratory tract and cause not only local inflammatory and necrotic changes, but also general intoxication. Substances such as hydrogen cyanide, carbon monoxide, and acrylic acid nitrile most often affect the human body in toxic significant concentrations (Fayazov A.D. et al., 2012).

Significant exposure to the respiratory tract of carbon monoxide (CO), which is the most common component of smoke, causes almost all deaths during a fire. Carbon monoxide is an odorless and colorless gas that has a strong affinity for hemoglobin, and, displacing oxygen from it, causes asphyxia. Combining, CO and hemoglobin form carboxyhemoglobin (SONv), which cannot tolerate Oh. Since the affinity of CO to hemoglobin is 250 times higher than that of Og, the ability of blood to transfer Og is greatly reduced and the dissociation curve of oxygen to hemoglobin is noticeably shifted to the left.

According to B.C. Ilichkin (1993), the affinity for hemoglobin, CO is 200-300 times higher than that of oxygen. Inhalation of a mixture with a concentration of 0.2-1% is fatal within 3-60 minutes. CO blocks oxygen transport, causes tissue hypoxia. At a concentration of 60% of NSOS, convulsions and coma develop and are characterized by high mortality.

The high affinity of CO to iron ensures its reaction with tissue respiratory enzymes containing divalent iron, which leads to impaired tissue respiration and tissue hypoxia. In this regard, carbon monoxide poisoning

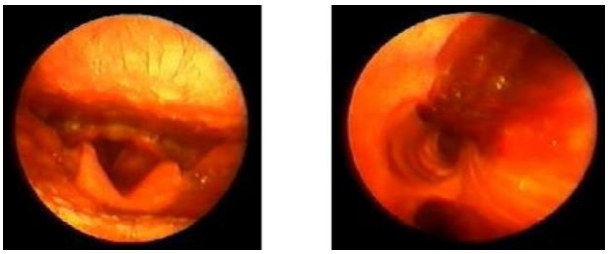
leads to severe cerebral hypoxia, as well as myocardial ischemia.

The clinical picture of CO poisoning depends on the concentration of carboxyhemoglobin in the blood. At 10-30% concentration of carboxyhemoglobin, confusion, headache, dizziness, tinnitus, lethargy, tachycardia, tachypnea occur. At 30-60% concentration, consciousness is lost, vomiting is possible, the skin is bluish-purple, pupils are dilated, blood pressure is elevated. An increase in the concentration of carboxy hemoglobin to 60-80% leads to the development of seizures, the color of the skin turns scarlet, paresis and paralysis, cardiac arrhythmias, inspiratory shortness of breath and respiratory arrest are noted. When examining venous blood for the content of carboxyhemoglobin, it was revealed that carbon monoxide poisoning of a more severe degree was significantly more common in the second group. Although the level of carboxyhemoglobin determined at the hospital stage does not always correspond to the severity of inhalation injury, the revealed fact reflects the dependence of the severity of respiratory tract damage on exposure.

Thus, the causes of hypoxia (hypoxic, tissue, circulatory) in the first hours after injury are carbon monoxide poisoning, cyanides, burn shock, respiratory failure against the background of laryngeal edema, obstruction of the respiratory tract by combustion products, fibrin and desquamated bronchial epithelium, acute lung injury syndrome. Gorenje. Subsequently, the cause of hypoxia becomes respiratory failure, which developed against the background of purulent complications from the respiratory system, sepsis. During fibroblast bronchoscopy with a BF-IT-10 endoscope from Olimpus (Japan), clinical signs of thermal inhalation injury were found in 62 patients. According to the degree of severity of visible changes, it was possible to distinguish mild, moderate and severe thermal inhalation injury.

According to the form of lesion of the tracheobronchial tree (TBD), catarrhal (in 9), erosive (in 24) and ulcerative necrotic (in 29) were distinguished, which corresponded to mild, moderate and severe severity of thermal inhalation injury or I, II, III degree of lesion (Fig. 1 A, B).

Fig. 1. A. Endophoto of the vocal cords - gaping of the vocal cord. B. Endophoto of the trachea with a picture - fibrin plaque, ligaments, fibrin plaque on the edges, erosion, light bleeding



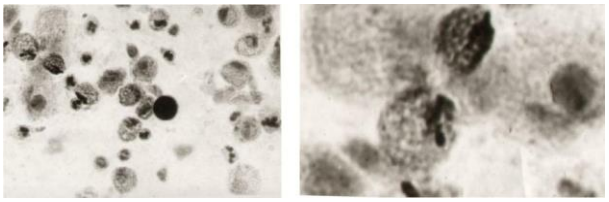
A total of 107 fibrobronchoscopies were performed, of which 73% of all FBS were performed on the first 3 days. Upon admission to the injured, if possible, FBS was performed in the first 6 hours from the moment of injury, it was then that soot was easily removed during sanitation (in 18 patients), fibrobronchoscopy was performed 1 time a day in 24 patients with moderate TBD lesions, 2-3 times a day in 29 patients with severe TBD lesions.

As a rule, during fibrobronchoscopy, the trachebronchial tree was sanitized from soot (in 18), formed scab (in 19), sputum (in 62).

Therapeutic fibrobronchoscopy was performed under local anesthesia with a 2% lidocaine solution (trimecaine) with independent breathing in 53 patients and through an intubation tube in 9 patients with a ventilator.

For endobronchial treatment of thermal inhalation trauma and their complications, bronchial lavash was used with subsequent cytological examination: isotonic sodium chloride solution, Ringer-Locke solution, 0.25% novocaine solution, furacilin 1:5000 solution, 0.5% dioxidine solution, 0.5% metrogil solution and 0.5% propolis solution. In addition, instillation of mucolytics and antibacterial drugs. At the same time, the administration of non-critical drugs was carried out with caution (in 11 patients), due to the danger of asphyxia by rejected necrotic masses (Fig. 2. A, B).

Fig. 2. A. The image shows macrophages, polymorphically nuclear and rod-nuclear neutrophils, lymphocytes. B. The picture shows macrophages and polymorphically nuclear neutrophils



All patients underwent oxygen therapy, inhalation of mucolytics, antibiotics and corticosteroids - according to indications using ultrasound; up to 6-8 times a day for 5-7 days, depending on the severity of TBD lesion.

In severe thermal inhalation injury in combination with skin lesions, infusion-transfusion therapy was carried out in the amount of 50% of the calculated for burn disease. At the same time, preference was given to a drug with a sufficiently high oncotic pressure, a concentrated glucose solution, a dextran solution, and a protein preparation.

In case of grade II-III thermal inhalation injury (in 53), the use of heparin in normal dosages was mandatory, as well as symptomatic therapy aimed at relieving bronchospasm and improving the drainage function of the tracheobronchial tree.

All the victims underwent early prevention of infectious complications with broad-spectrum antibiotics, followed by a switch to an antibiotic in accordance with the results of the culture media for sensitivity.

To assess the effectiveness of therapeutic fibrobronchoscopy, a comparative analysis of mortality in representative groups of patients was performed. 2000-2010, when fibrobronchoscopy was not used, the mortality rate of burned patients with thermal inhalation injury was 21.19±1.0% ($p<0.05$), and in 2011-2019 -11.59+0.9% ($p<0.05$). Thus, the introduction of diagnostic and therapeutic FBS into clinical practice made it possible to reduce the mortality rate of burned patients with thermal inhalation injury by 13.19%.

We have developed an algorithm for the examination and procedure for providing assistance to such victims in the lesion, during evacuation and treatment in the conditions of the burn department of the Samarkand branch of the RNCEMP.

An important stage in the diagnosis of thermal inhalation injury is to determine the severity of the lesion of the respiratory tract. The criteria for thermal inhalation injury are: complaints of sore throat, a feeling of tickling in the throat, difficulty breathing, hoarseness and loss of voice, chest pain, dry cough, the presence of sputum with an admixture of soot, as well as the detection of singed hair in the nasal passages, lesions of the nasal mucosa, hyperemia and swelling, erosive and ulcerative lesions oral cavity, pharynx, epiglottis, larynx, traces of soot, which make it possible to diagnose a ingalation injury and determine indications for fibro bronchoscopy.

At the initial examination of the combustiologist and ENT doctor, thermal inhalation injury was detected in 45 victims. 42 of them underwent primary fibrobronchoscopy in the first 6 hours after the injury, the rest - within the next 24 hours. With moderate and severe lesions of the tracheobronchial tree, fibrobronchoscopy was performed daily for 3-5 days, and then according to indications. Three patients with extremely severe thermal inhalation lesion were treated with FBS 2 times a day.

Infusion-transfusion therapy for thermal inhalation trauma with skin lesions (69 people - group II) was carried out in the volume from the calculated one for burn shock (scheme A.J. Evans, 1952), taking into account that preference was given to drugs with sufficiently high oncotic pressure - concentrated glucose, dextran, protein preparations.

In order to prevent swelling of the respiratory tract mucosa, inhalations are also indicated: sodium bicarbonate solution, euphyllin 2.4%-10 ml, adrenaline 0.1%-1.0 ml. When conducting infusion therapy in the first 8-12 hours after injury, we adhere to a colloid-free scheme, since colloids contribute to the accumulation of water in the lungs (C.W. Goodwin et al., 1983).

Based on the analysis of the results of the conducted clinical studies, the diagnostic, therapeutic, and prophylactic efficacy of fibrobronchoscopy in 62 severely burned patients in combination with thermal inhalation trauma was studied. The use of FBS allows you to accurately determine the degree, depth (hyperemia, edema, erosion), the prevalence of inhalation damage (larynx, trachea, bronchi), which makes it possible to develop criteria for assessing changes for pathogenetic justification and determining treatment tactics, its effectiveness, taking into account subsequent complications..

In this regard, it seemed appropriate to evaluate the effectiveness of treatment in 2 groups of patients with thermal inhalation trauma. Comparative analysis data showed that the course of thermal inhalation injury was complicated by the development of necrotic tracheobronchitis in 10 (4.4%) patients of group I and in 7 (10.1%) patients of group II, pneumonia occurred in 8 (19.5%) and 7 (10.1%), respectively, acute respiratory failure - in 20 (48.8%) and in 8 (11.6%), fatal outcome - in 9 (21.19%) and 8 (11.59%) patients. It is characteristic that the majority of patients (8 out of 9) of group I died from acute respiratory failure on the first day after the injury, while only 1 patient out of 8 victims of group II died on the first day of the injury.

Normalization of diuresis (the rate of diuresis is 50 ml/ h or more), stabilization of hemodynamics (normalization of blood pressure, pulse, positive CVD value), decrease in hemo concentration, increase in body temperature by at least 1 ° C from the norm, symptoms of a pale spot for less than 1 sec, cessation of dyspeptic disorders and assimilation of the liquid consumed are indicators adequacy of treatment and recovery of the patient from the state of burn shock.

Treatment of patients with thermal inhalation trauma should be aimed at restoring bronchial patency, normalization of microcirculation in the lungs and prevention of inflammatory complications. Upon admission to the victims, lavage with the rehabilitation of the tracheobronchial tree was carried out simultaneously with the FBS. At the same time, a large amount of soot, desquamated epithelium, formed crusts, fibrin plaque, sputum and other secreted tracheobronchial

tree in the lumen is removed. Instillation of mucolytics, antibiotics, and bronchodilators is carried out, which makes this procedure an indispensable measure in the treatment of thermal inhalation trauma of varying severity.

The severity and prevalence of hyperemia and edema of the mucous membrane of the tracheobronchial tree, the presence of erosions, gorenje products, fibrin, the nature and quantity of discharge, as well as the degree of edema, bronchospasm and obturation of the secret were taken into account. Inhalations of corticosteroids, antibiotics, expectorants are of great importance in the treatment of patients with thermal inhalation trauma. In addition, all patients with a combination of TIT with skin lesions received standard treatment: infusion-transfusion therapy in normal dosages or with a 15-25% reduction in calculated doses according to the Evans formula in our modification with a preference for colloidal solutions with high oncotic pressure, broad-spectrum antibiotics, heparin, glucocorticoids, eufillin.

CONCLUSION

Timely objective assessment of the severity of thermal inhalation injury and the possibility of developing tracheobronchial and pulmonary complications is an important component in the diagnosis and treatment of patients with thermal trauma, and helps to predict the course of burn disease and prescribe adequate intensive therapy. The algorithm we used for the diagnosis and treatment of thermal inhalation trauma in patients allowed us to reduce the treatment time of patients by 10.6-2.7 bed days and reduce the mortality rate for thermal injuries from 21.19±1.0% in 2001 to 11.59± 0.9% in 2019, pulmonary complications in this group - 4.3 times.

REFERENCES

Abduraxmanov, D.S., Kurbaniyazov, Z.B., Davlatov, S.S., & Rakhmanov, K.E. (2020). Criteria for choosing surgical treatment of patients with ventral hernias and obesity// International Journal of Pharmaceutical Research, 12, – P. 4057–4066.

Akhmedov B. A. et al. Advanced long-tension hernioalloplasty method for inguinal hernia //Volgamedscience. – 2021. – C. 335-336.

Akhmedov B. A. et al. Combination of mini-invasive interventions in the treatment of varicosis of the lower limbs //Volgamedscience. – 2021. – C. 337-338.

Akhmedov B. A. et al. Surgical approach to the treatment of patients with posttraumatic scar structures of the main bile ducts //Volgamedscience. – 2021. – C. 341-342.

Bagnenko S.F., Krylov K.M., Shilov V.V., etc. Organization of assistance to victims of severe combined trauma with mass admission // Collection of scientific papers of the III Congress of combustiologists of Russia. Moscow, 2010; 10-12.

Boenko S.K., Speransky I.I., Trofimova E.N., Gushchin I.V. Ingalation lesions in explosive mine trauma: diagnosis and treatment. // Collection of scientific papers of the II Congress of combustiologists of Russia. Moscow, June 2-5, 2008 - p. 7778.

Cancio L.C. Airway management and smoke inhalation injury in the burn patient // Clin. Plast. Surg., 2009; 36(4): 555-567.

Davlatov, S., Rakhmanov K., Qurbonov N., Vafayeva I., & Abduraxmanov D. (2020). Current State of The Problem Treatment of Mirizzi Syndrome (Literature Review)// International Journal of Pharmaceutical

Research, 12, – P. 1931-1939. DOI:https://doi.org/10.31838/ijpr/2020.SP2.340

Davlatov, S., Rakhmanov, K., Usarov, S., Yuldoshev, F., Xudaynazarov, U., & Tuxtayev, J. (2020). Inguinal hernia: Modern aspects of etiopathogenesis and treatment. International Journal of Pharmaceutical Research, 12, 1912-1921. doi:10.31838/ijpr/2020.SP2.338

Davlatov, S., Teshayev, Sh, Fayziev, X., & Khamidova, N. (2020). Inguinal hernia: Modern aspects of etiopathogenesis and treatment. International Journal of Pharmaceutical Research, 13, 970-976. doi.org/10.31838/ijpr/2021.13.02.147

Degtyarev D.B., Koroleva E.G., Palamarchuk G.F., Shlyk I.V. Organization of the endoscopic service in case of mass admission of victims with combined thermal inhalation trauma. // Collection of scientific papers of the III Congress of combustiologists of Russia. Moscow, 2010; 16-17.

Fayazov A.D., Kamilov U.R., Abdullaev U.H. Features of the course of burn disease in those burned with a ingalation lesion // Mat. of the 1st Congress of emergency medicine doctors of Russia. Moscow, 2012; p. 85.

Krutikov K.G., Starkov Yu.G., Domarev L.V., etc. Inhalation injury. // Collection of scientific papers of the III Congress of combustiologists of Russia. Moscow, 2010; 101-102.

Kudratova, D. Sh, Ikhtiyarova, G.A., & Davlatov, S.S. (2021). Medical and social problems of the development of congenital malformations during a pandemic. International Journal of Pharmaceutical Research, 13(1), 756-760. doi: 10.31838/ijpr/2021.13.01.130

lichkin B.C. Toxicity of gorenje products of polymeric materials. // St. Petersburg: "Chemistry", 1993. -131 s.

Novikov M.A., Korostelev M.Yu., Ugnevenko M.I. Features of the bronchoscopic picture and treatment tactics for combined respiratory tract injury on the background of burn injury. // Collection of scientific papers of the III Congress of combustiologists of Russia. Moscow, 2010; 116-117.

Oripov, F., Blinova, S., Dekhkanov, T., & Davlatov, S. (2020). Development of immune structures of the leaning intestine of rabbits in early postnatal ontogenesis. International Journal of Pharmaceutical Research, 13(1), 299-301. doi:10.31838/ijpr/2021.13.01.042

Skvortsov Yu.R., Shpakov I.F., Venevitinov N.O., Tarasenko M.Yu. Organization of bronchoscopic care for the mass admission of burned from the hearth of a man-made disaster of peacetime. // Collection of scientific papers of the III Congress of combustiologists of Russia. Moscow, 2010; 34-35.

Titov A.S., Skvortsov Yu.R., Tarasenko M.Yu. Assessment of the mechanisms of respiratory function disorders in burned patients with thermal inhalation trauma. // Collection of scientific papers of the III Congress of combustiologists of Russia. Moscow, 2010; 139-141.

Tursunov B.S., Mustafakulov I.B., Karabaev H.K. Pathomorphological changes in the organs of patients with thermal inhalation trauma // Collection of scientific papers of the I Congress of combustiologists of Russia. Moscow, 2005; pp. 209-210.