

ENGLISH VERSION: FEATURES OF THERAPEUTIC SUPPORT FOR PATIENTS WITH POLYTRAUMA*

Mormol I.A., Borzykh O.A., Kaidashev I.P.

Higher State Educational Establishment of Ukraine «Ukrainian Medical Stomatological Academy», Poltava, Ukraine

Today, the issue of timely diagnosis and treatment of polytrauma remains highly relevant. Polytrauma is a severe pathological process that involves simultaneous onset and development of several pathological conditions and is characterized by underlying disorders of all types of metabolism, changes on the part of central nervous system, cardiovascular and respiratory tract. The given clinical case proves us expediency of developing the personified approach to management of patients with polytrauma, using the individual algorithms.

Key words: polytrauma, hemopneumothorax, treatment tactics

Polytrauma is a set of injuries that are characterized by significant changes in the structure and function of organs and systems. In addition to mechanical damage, the state of the victim may be affected by a number of infectious specific severity of clinical manifestations, which are accompanied by the disorder of vital functions, the complexity of diagnosis and treatment, high percentage of disability and high mortality. Such lesions are often accompanied by traumatic shock, high blood loss, circulatory and respiratory disorders, and sometimes terminal conditions. In case of polytrauma, the course of traumatic disease is particularly severe, and the nature of the dominant damage may change [1,2].

The term "polytrauma" is a collective term that includes the following types of injuries: multiple, joint and combined.

Multiple mechanical traumas include injuries to two or more internal organs in one cavity (injury of the small and large intestines, rupture of the liver and spleen, damage to both kidneys), injuries within two or more anatomically functional formations of the locomotor system (fracture of the thigh, fracture of both heel bones).

Joint trauma is an injury of the internal organs in different cavities (trauma of the lungs and the liver, concussion of the brain and kidney injury), or damage to the internal organs and musculoskeletal system (damage to the chest and fracture of the extremity bones, cranio-cerebral injury, pelvic bone damage etc.).

Combined trauma involves the victim's simultaneous subjection to the action of two or more factors: fracture and burn of the thigh; acute radiation disease and spinal fracture. In other words, mechanical traumas can be part of combination injuries as one of the constituent components [3].

Polytrauma is primarily characterized by damage to the locomotor system. According to some authors, it prevails among young people (53%, mostly men) aged 14-45. The main cause of injury is traffic accidents – 80.6%.

In polytrauma, multiple lesions of the locomotor system affect the lower extremities in 49.4% of cases, the upper extremities – in 33.2%, pelvis – in 14.1%. In addition to these injuries, 75% of patients have concomitant lesions: of the head and brain – in 92.2%, of the chest – in 31.5%, of the abdomen – in 21.3%.

In the treatment of patients with polytrauma, the most important principles are to prevent the patient's death from shock and blood loss and to prevent complications in the early period from multiple organ failure and sepsis [4].

According to WHO, about 16 thousand people daily die as a result of traumas, annually – 300 thousand of able-bodied people, whereas 7-8 million people become

disabled.

Over the past 10 years, mortality from traumas in Ukraine has increased by 38.7%. According to the Ministry of Public Health of Ukraine, every year 31-44 thousand people die of injuries, out of which 20-25% – of joint injuries.

The frequency of polytrauma in recent years is 5.5-35% among all injured patients.

Mortality in polytrauma amounts to 12.2-63.4%, among them: 65.1-70.0% of victims die in the first 24-48 hours (out of which – 35.0% in the first 15 minutes from the moment of injury). [8]

In economically developed countries, traumatism is ranked 3rd among the causes of mortality after cancer and cardiovascular disease.

The polymorphism of injuries does not allow us to regulate to the fullest extent the volume and the procedure for application of instrumental examinations. In general, the diagnostic program includes:

1. general clinical examination;
2. catheterization of the bladder;
3. treatment of wounds with their re-examination;
4. ultrasound study;
5. X-ray of abdominal cavity organs and abdominal cavity;
6. thoraco- and laparocentesis;
7. diagnostic laparoscopy.

The approximate list of the priority diagnostic tests for a patient with an unstable condition is as follows:

1. defining the symptoms of brain dislocation;
2. thoracopuncture, thoracocentesis;
3. laparocentesis, laparoscopy.

There are a large number of scales to assess the severity of the injury: AIS (Abbreviated Index Severity), ISS (Injury Severity Score), CITO, NISS (New Injury Severity Score), ICISS (International Classification Injury Severity Score), OIS (Organ Injury Scaling) and others.

The TRISS (Trauma Injury Severity Score) scale is the most commonly used for assessing the severity of an injury. At present, the features of therapeutic support for patients with polytrauma are important. The clinical case given below illustrates the significance of this issue.

A patient, born in 1974, was hospitalized on 14.11.16 at 18:00 at the emergency room of the City hospital with complaints of pain in the chest, cough, and shortness of breath. From the anamnesis it is known that he sustained a chest injury when diving into water. On objective examination: the patient's general condition is severe. The patient is conscious and balanced. The skin and visible mucous membranes are pale pink, wet to the touch. Independent respiration, Respiratory rate – 22 per 1 min.

* To cite this English version: I.A. Mormol, O.A. Borzykh, I.P. Kaidashev. Features of therapeutic support for patients with polytrauma. // *Problemy ekologiyi ta medytsyny*. - 2018. - Vol 22, № 1-2. - P. 28–32.

On auscultation: weakened breath and wet rattles in the lungs, more on the right. On percussion: limits of the heart are within the age norm. Heart tones are rhythmic, weakened, dulls. Blood pressure – 100/60 mmHg, pulse – 106 per 1 minute, SpO₂ – 87%. The abdomen is soft and painless.

Clinical blood analysis: erythrocytes – $4.9 \times 10^{12}/l$; leukocytes – $15.2 \times 10^9/l$; erythrocyte sedimentation rate (ESR) – 4 mm/h, hemoglobin concentration (Hb) – 158 g/l; color index (Cl) – 0.96; leukocyte formula: stab cell (s/c) – 3%; segmented (s) – 81%; eosinophils – 1%; lymphocytes – 10%; monocytes – 5%.

Biochemical blood analysis: bilirubin: total – 16.5; direct – 3.1; indirect – 13.4 $\mu\text{mol}/l$; creatinine – 80.5 $\mu\text{mol}/l$; urea – 4.9 mmol/l; residual nitrogen – 25 mg%; total protein – 66 g/l. Coagulogram: fibrinogen – 1.7 g/l, prothrombin – 61%.

ECG results: sinus tachycardia, heart rate – 128 per 1 minute, the electrical axis of heart is not deviated. Disrupted intraventricular conduction. Signs of left ventricular myocardial hypertrophy.

The ultrasound data of the abdominal cavity and kidneys: the liver is not enlarged, the placement is typical, the shape is normal, the contours are clear; dimensions: right lobe – 12.6 cm, left lobe – 6.2 cm; parenchyma: normal echogenicity, homogeneous structure. The intrahepatic ducts are not dilated, the walls are unchanged, choledoch duct – 0.4 cm, vessels are not dilated. Gallbladder: the placement is typical, the shape is ovoid, the wall thickness – 0.2 cm, densified, bile sediment by $\frac{1}{2}$ of the gallbladder. The pancreas is not enlarged. Dimensions: head – 2.8 cm, body – 1.3 cm, tail – 2.7 cm. The contours are clear, echogenicity is normal, heterogeneous structure. Wirsung's duct is not dilated. The spleen is not enlarged, the contours are clear, normal echogenicity, the structure is homogeneous. The right kidney is not enlarged, the contours are clear, parenchyma – 1.5 cm, the central complex area is enlarged, 1.9 cm, due to microlites 0.1 cm. The left kidney is not enlarged, the contours are clear, parenchyma – 1.8 cm, the central complex area is enlarged, 2.0 cm, due to microlites 0.1 cm. Free fluid in the abdominal cavity: not found. Conclusion: ultrasound signs of chronic cholecystopancreatitis, uratic diathesis, free fluid in the abdominal cavity was not detected.

Ultrasound cannot be carried out thoroughly for technical reasons (due to malfunction of the device), but it is impossible to exclude pneumothorax of the chest or the presence of subcutaneous emphysema.

The results of chest X-ray: the pulmonary pattern increase. Roots are dilated. Sinuses are free. The heart is enlarged in diameter.

Diagnosis at admission: Severe combined trauma. Severe combined cranio-thoracic trauma. Closed cranio-cerebral injury: brain concussion. Closed chest trauma: fracture of the third rib to the right, bilateral hemopneumothorax. Contusion of the heart and lungs. Barotrauma of the lungs. Bilateral pneumonitis.

The following treatment was prescribed: glucose, amikacin, maxicin, lasolvan, lazix, tugina, potassium preparations, controloc. Consultation of thoracic surgeon, pulmonologist, cardiologist, traumatologist and computer tomography (CT) of the chest organs and bronchoscopy were recommended.

Puncture and drainage of the pleural cavity to the right was conducted.

On 15.11.16, the general condition of the patient is severe. The patient is conscious, accessible for productive contact. Complaints of pain in the chest, suffocation, expressed general weakness. Respiration – mechanical ventilation through the intubation tube. SpO₂ – 98%. Auscultatory in the lungs – harsh respiration, weakened in the lower parts. Through drainage of the pleural cavities, hemorrhagic fluid is discharged to the right – 70 ml, to the left – 100 ml. Hemodynamics is stable. Tones of the heart are rhythmic, weakened. The abdomen – no abnormalities.

Clinical blood count: the level of leukocytes increases to $19.0 \times 10^9/l$ and the level of Hb decreases – 105 g/l. Coagulogram: fibrinogen – 2.87g/l, prothrombin – 101.4%.

Biochemical blood analysis: the level of creatinine is increased to 109 $\mu\text{mol}/l$, the residual nitrogen is up to 52 mg% and the total protein is reduced to 59 g/l. The results of electrolytes blood test: potassium – 4.32 mmol/l; sodium – 147.7 mmol/l; chlorides – 101 mmol/l; calcium – 1.0 mmol/l.

The ultrasound study of the heart: ultrasound signs of reduced contractile capacity of the myocardium, heart contusion.

ECG results: sinus tachycardia, heart rate – 103 beats per minute, the electrical axis is not deviated. Disruption of intraventricular conduction. The signs of left ventricular myocardial hypertrophy.

Bronchofiberscopy. Conclusion: bleeding from the right bronchus.

The patient was examined by the thoracic surgeon. Diagnosis: Severe combined trauma. Severe combined cranio-thoracic trauma. Closed cranio-cerebral injury: brain concussion, facial skull concussion. Closed chest trauma: fracture of the third rib to the right, bilateral hemopneumothorax. Contusion of the heart and lungs. Barotrauma of the lungs. Bilateral pneumonitis. It was recommended to conduct CT of the brain and chest, bronchoscopy, consultation of the cardiologist.

Transfusion of fresh frozen plasma in the amount of 300.0 ml was conducted.

On 16.11.16, the general condition of the patient is extremely severe. The patient is in the state of medicinal sedation, respiration – mechanical ventilation through the intubation tube. From pleural cavities through drainage, hemorrhagic exudate is discharged: to the left – 100 ml, to the right – 190 ml. SaO₂ – 92%. Hemodynamics is stable.

Clinical blood count: the number of leukocytes continues to increase to $16.7 \times 10^9/l$ (due to s/c – 12%) and ESR – 12 mm/h.

Biochemical analysis of blood: urea remains elevated up to 12.0 mmol/l and residual nitrogen – up to 46 mg%, no other significant changes were detected. Coagulogram: fibrinogen – 4.99 g/l, prothrombin – 59.1%.

ECG results: sinus tachycardia, heart rate – 100 beats per 1 min, sinus tachycardia, atrial extrasystole, the electrical axis of the heart is vertical. Compared with the ECG results as of 15.11.16, there is a deterioration of the coronary blood flow over the posterior wall of the left ventricle.

The ultrasound study of the heart: signs of moderate decrease of contractile capacity of the myocardium, hypertrophy of the posterior wall of left ventricle. Hydrothorax in the right sinus of the chest.

The chest X-ray findings: pneumothorax to the right (the lung is reduced by 2/3 of its volume). Subcutaneous

and muscular emphysema. There are profuse drainage infiltrations to the left.

Transfusion of fresh frozen plasma in the amount of 300.0 ml was conducted.

Results of bronchoscopy: bleeding from the right and left bronchi. Bilateral diffuse endotracheitis.

The general condition of the patient remains extremely severe on 17.11.16, the patient is in the state of permanent medicinal sedation. Respiration – mechanical ventilation, SpO₂ – 96%. Auscultatory in the lungs: harsh respiration, a large number of dry and wet rales, sharply weakened respiration to the right. The drainage system operates from both pleural cavities, with 300 ml of hemorrhagic exudate discharged from the right and left lungs.

Clinical blood count: the number of leukocytes increases to $21.2 \times 10^9/l$ and ESR – 17 mm/h, Hb decreases to 100 g/l and Cl – to 0.85.

Biochemical analysis of blood: no significant changes over the day were detected. The level of electrolytes in the blood increases: potassium – 4.55 mmol/l; sodium – 152.5 mmol/l; chlorides – 112.8 mmol/l; calcium – 1.20 mmol/l. Coagulogram: fibrinogen – 7.71 g/l, prothrombin – 90.0%.

Fibergastroscopy results: no data on trauma of the GIT were detected.

ECG results: sinus tachycardia, heart rate – 103 beats per minute. In comparison with the ECG as of 16.11.16, there is a change in the electrical axis of the heart (shift to the left) – the reliable conductivity change over the front branch of the left crus of the His bundle.

Results of chest X-ray: the dynamics is negative, focal infiltration is preserved on all pulmonary fields of both lungs. The heart – nil significant. Subcutaneous emphysema increases.

Transfusion of fresh frozen plasma in the amount of 300.0 ml was conducted. Results of bronchoscopy: bleeding from the segmental bronchi of the right lung. Bilateral diffuse endotracheitis of II degree.

On 18.11.2016, there are no changes in the objective status of the patient. The patient undergoes parenteral nutrition through the extragastric probe. Intubation tube replacement was replaced. Through drainage from each pleural cavity, 400 ml of hemorrhagic fluid is discharged. SpO₂ 98%.

Clinical blood count: leukocytosis persists – $17.3 \times 10^9/l$, increased ESR – 11 mm/hr, decrease in Hb – 112 g/l.

Biochemical analysis of blood: no clinically significant changes in comparison with the previous day. Coagulogram: fibrinogen – 4.99 g/l, prothrombin – 53.6%.

Results of bronchoscopy: bleeding from the segmental bronchi of the lower lobe of the right lung. Bilateral diffuse endotracheitis.

Taking into account the condition of the patient and the long period of mechanical ventilation, on 19.11.16, a tracheostomy was performed, through which a large number of hemorrhagic sputum was sanated. Through drainage from the pleural cavity, the fluid with a hemorrhagic component continues to be discharged: to the right in the amount of 500 ml., to the left – 500 ml. SpO₂ – 95%.

Clinical blood count: erythrocytes – $4.2 \times 10^{12}/l$; leukocytes – $18.6 \times 10^9/l$; ESR – 5 mm/h, Hb – 128 g/l; Cl – 0.95; s/c – 8%; segmented – 70%; eosinophils – 1%; lymphocytes – 15%; monocytes – 6%.

Biochemical analysis of blood: bilirubin: total – 13.5 $\mu\text{mol/l}$; direct – 3.1 $\mu\text{mol/l}$; indirect – 10.4 $\mu\text{mol/l}$;

creatinine – 80.1 $\mu\text{mol/l}$; urea – 6.3 mmol/l; residual nitrogen – 29 mg%; total protein – 65 g/l; potassium – 4.7 mmol/l; sodium – 143.8 mmol/l; chlorides – 100.7 mmol/l. Coagulogram: fibrinogen – 4.5 g/l, prothrombin – 52%.

On 20.11.16, the general condition of the patient is severe. The patient is in the state of permanent medicinal sedation. Respiration – mechanical ventilation, SpO₂ – 95%. Through drainage from the pleural cavity, the fluid with a hemorrhagic component continues to be discharged: to the right – 500 ml, to the left – 500 ml. Hemodynamics is stable. Tones of the heart are rhythmic, weakened. The abdomen – no abnormalities.

Clinical blood count: leukocytosis is maintained up to $11.7 \times 10^9/l$, increased ESR – 19 mm/hr, Hb – 122 g/l; Cl – 0.91; s/c – 12%; s. – 72%; e. – 1%; l. – 13%; m. – 2%.

Biochemical analysis of blood: elevated level of residual nitrogen is observed – 30 mg%. Coagulogram: fibrinogen – 4.6 g/l, prothrombin – 57%.

On 21.11.16, the general condition of the patient remains extremely severe. The patient is in the state of permanent medicinal sedation. Respiration – mechanical ventilation, SpO₂ – 96%. The pastosity of the upper and lower extremities, swelling of the scrotum are observed.

Clinical blood test: there are signs of anemia: erythrocytes – $3.64 \times 10^{12}/l$ and Hb – 118 g/l; the elevated level of leukocytes persists – $10.6 \times 10^9/l$; ESR – 40 mm/hr, s/c – 33%.

Biochemical analysis of blood: elevated level of residual nitrogen – 51 mg% and urea – 13.6 mmol/l. Coagulogram: fibrinogen – 7.71 g/l, prothrombin – 77.6%.

Hearth ultrasound results: the heart is not located – artefacts (narrow USD window), possibly due to pneumothorax or subcutaneous emphysema.

Transfusion of fresh frozen plasma in the amount of 300.0 ml was conducted.

Results of bronchoscopy: bilateral diffuse endotracheitis.

The patient was examined by the urologist and diagnosed with reflex urinary retention. Urethritis. Urethral catheter. Swelling of the scrotum. It is recommended to continue the antibiotic and diuretic therapy, and control diuresis.

On 22.11.16, the general condition of the patient is severe. The patient is in the state of permanent medicinal sedation. Respiration – mechanical ventilation, SpO₂ – 93%. Body temperature increased to 38.0°C. Through tracheostomy tube, hemorrhagic sputum is sanated. Through the drainage of the pleural cavities, hemorrhagic fluid is discharged to the right – 500 ml, to the left – 500 ml. Hemodynamics is stable. Tones of the heart are rhythmic, weakened. PS – 120 bpm. The abdomen – no abnormalities.

Clinical blood count: elevated levels of leukocytes are $19.6 \times 10^9/l$; ESR – 35 mm/hr, s/c – 22% and reduction of Hb – 115 g/l.

Biochemical analysis of blood: elevated level of residual nitrogen – 56 mg% and urea – 15.2 mmol/l. Coagulogram: fibrinogen – 10.17 g/l, prothrombin – 68.5%.

On 23.11.16, the general condition of the patient is severe. The patient is in the state of permanent medicinal sedation. Respiration – mechanical ventilation. Through the drainage of the pleural cavities, hemorrhagic fluid is discharged to the right – 500 ml, to the left – 500 ml. Hemodynamics is stable. Tones of the heart are rhythmic, weakened. The abdomen – no abnormalities.

Clinical blood count: leukocytes – $51.0 \times 10^9/l$; ESR – 41 mm/h, Hb – 104 g/l; Cl – 0.93; s/c – 18%; s. – 52%; e.

– 6%; l. – 16%; m. – 2%, there is a toxic granularity of neutrophils. Biochemical analysis of blood: creatinine – 237 $\mu\text{mol/l}$; urea – 25.6 mmol/l; residual nitrogen – 87 mg%; total protein – 46 g/l. Coagulogram: fibrinogen – 7.71 g/l, prothrombin – 80.8%.

The patient was re-examined by the thoracic surgeon at 15:00 on 23.11.16: the patient had recurring massive hemopneumothorax, the patient underwent the hemopneumothorax draining to the right, replaced drainages. With active aspiration, it was possible to expand the right lung, which was accompanied by improvement of cardio-respiratory indicators. At 16:39, when the electric pump was switched off, the lung collapsed, there was a massive air output. According to vital indicators, the patient underwent emergency thoracotomy. During the anterior-lateral thoracotomy, the heart arrest was recorded. Despite the implementation of resuscitation measures, natural death was registered at 18:00.

Postmortem epicrisis:

Extremely severe combined trauma. Extremely severe cranio-thoracic trauma.

Closed craniocerebral injury: brain concussion, multiple contused wounds of the facial skull. Closed chest trauma: multiple fragmentary fractures of the II-III-IV ribs to the right; bilateral hemopneumothorax, bilateral contusion of the lungs; contusion of the heart with the rupture of the pericardium. Traumatic shock, III degree (14.11.16). Post-traumatic bilateral pneumonia. RDS, type II. RF III Recurrent resistant right-sided pneumothorax as of 23.11.2016. Barotrauma of the lungs as of 14.11.16.

Forensic diagnosis.

Bruises on the left anterior-lateral surface of the chest. Extensive hemorrhages in the soft tissues of the thorax in the projection of 2-8 ribs, from the midclavicular to the midinguinal lines to the right and 2-7 ribs, from the midclavicular to the posterior inguinal lines to the left. Multiple fractures of the sternum and ribs over several anatomical lines. Rupture of the pericardial sac over the left side surface. Hemorrhage in the left ventricular epicardium of the heart, at the level of the anterior coronary artery. Extensive hemorrhages and ruptures of the upper and middle lobes of the right lung. Acute pulmonary and heart failure. Sero-hemorrhagic impregnation with congestive pneumonia in the lower lobe of the right lung. Fibrinous pleuritis of the right lung. Serous inflammation of the lungs with minute foci of acute emphysema. Serous epicardium. Insignificant coronary sclerosis. Perivascular cardiosclerosis. Uneven blood filling with dystrophy and focal fragmentation of cardiomyocytes in the swollen myocardium. Venous plethora, parenchymatous dystrophy of the internal organs. The condition after provision of medical care and resuscitation measures.

Hemopneumothorax is the presence of air and blood in the pleural cavity, which usually occurs as a result of a trauma and is caused by bleeding from the vessels of the lungs, the intrathoracic branches of the large vessels (aorta), thoracic wall, mediastinum, heart or diaphragm [5,6].

Unlike pneumothorax, whose mechanism of occurrence is similar to hemothorax, with the accumulation of blood in the pleural cavity, the symptoms of respiratory failure move to the foreground, and the hypovolemic symptom complex is often complicated by the development of signs of hemorrhagic shock and fatal outcome. The clinical presentation of hemothorax depends on the

volume of blood that flew to the pleural cavity, the presence or absence of the disrupted integrity of the pulmonary tissue, as well as the state of the mediastinum structures [7,8].

Traumatic hemothorax is virtually in 70-80% of cases due to fractures of ribs of different localization with the displacement of bone fragments. The frequency of this pathology is not less than 25% among all cases of thoracic trauma. There are minor hemothorax (the level of fluid is lower than the angle of the shoulder blade, its volume is up to 500 ml), moderate (the level of fluid up to the angle of the shoulder blade, its volume – up to 1000 ml) and major (the liquid occupies the entire or almost the entire pleural cavity, its volume is more than 1000 ml). Hemothorax may occur in the controlled and continued bleeding [9,10].

Hemothorax belongs to the category of urgent nosological diseases, requiring early diagnosis and emergency medical intervention. According to the statistics, the diagnosis of hemopneumothorax is 67.66% higher for men than for women. Mortality in men with hemopneumothorax is 0.76%, and in women – 1.07%. In the risk group to hemopneumothorax are men aged 65-69 years and women aged 80-84 years.

Among all known laboratory and instrumental methods of hemothorax diagnosis, the most expedient are: radial imaging methods (X-ray, ultrasound scanning of pleural cavities, computed tomography and magnetic resonance imaging), bronchoscopy with concomitant biopsy, cytological sputum analysis to determine the presence of atypical cells, diagnostic thoracocentesis with the Ruvelua-Gregoir and Petrov samples [11,12].

Standard X-ray allows us to evaluate only the presence of fluid levels in the pleural cavity and to detect the amount of accumulated blood. Thus, the total eclipse of the entire half of the chest indicates that there is not less than two liters of blood in the pleural cavity, and if the upper limit of the eclipse is at the level of the posterior segment of the second rib, then the volume of blood is from one to two liters. The ultrasound diagnosis specialist assesses the presence of even minor amount of blood.

After determining the possible presence of blood in the pleural cavity, it is expedient to carry out diagnostic pleurocentesis with aspiration of the contents of the pleural cavity. This manipulation is performed to determine the duration of bleeding and signs of infection of the pleural folia. The criterion for infectious hemothorax is the positive Petrov test, which shows a decrease in transparency and the presence of aspirated blood sediment. In case of suspected infections of the pleural cavity, it is necessary to perform not only cytological but also bacterial examination of aspirates. A definitive sign of ongoing intra-pleural bleeding is the positive Ruvelua-Gregoir test, which suggests the presence of signs of blood coagulation [13,14].

The modern tactics of hemopneumothorax treatment involves the rapid removal of blood and gas from the pleural cavity in order to expand the lungs. For this purpose, the pleural cavity is drained by the method of active aspiration through drainage with the help of an electric pump.

Indications for thoracotomy include the lung injury, prolonged intrapleural bleeding, ineffectiveness of conservative tactics. Elimination of hemopneumothorax and lung expansion in the first 3-5 days contribute to the prevention of emphysema development in the pleura and complete restoration of the lung function.

Treatment of patient with hemothorax should be performed by a multidisciplinary team of doctors: surgeons, pulmonologists and rehabilitation specialists.

The success in using certain therapeutic techniques in hemothorax depends, first of all, on the early diagnosis of this life-threatening condition, as well as the timely provision of qualified medical care.

Treatment of any form of hemothorax should be carried out as soon as possible, since blood is one of the most beneficial nutrient media for the propagation of pathogenic microorganisms. Obligate anaerobic flora is the most commonly found as a pathogen of infectious hemothorax [15,16].

Conservative methods of treatment with the use of antibacterial and anti-inflammatory drugs are used only in the case of minor hemothorax, with no severe disorders in patient's health. Conservative treatment should be performed under obligatory X-ray monitoring. The optimal term for minor hemothorax resorption is from two weeks to one month. In order to accelerate the process of blood clots resorption in patients with signs of reduced hemothorax, it is advisable to prescribe proteolytic enzymes parenterally (Chymotrypsin 25 mg intramuscularly once daily for a course of at least 15 injections), as well as by direct irrigation of the pleural cavity with solutions of urokinase and streptokinase.

Thus, in order to provide qualified medical aid to patients with polytrauma, it is necessary to develop a personalized approach with the compilation of individual algorithms involving a multidisciplinary team.

References

- Kavalersky G.M., Garkavy A.V. 7.1 Klassyfykatsyya polytravm. Osobennosty klynicheskoho techenyya y dyahnostyky [7.1 Classification of polytrauma. Features of clinical course and diagnostics] // Medytsyna chrezvychnykh sytuatsiy. Khyrurhyia katastrof [Medicine of emergency situations. Surgery of disasters]. – Moscow: Medical information agency, 2015. – 376 p.
- Fil A.Yu., Fil Yu.Ya. Suchasna taktyka nadannya dopomohy pry skeletnykh travmi postrazhdalym iz politravmoyu (ohlyad literatury) [Modern tactics of assistance in case of skeletal trauma suffered from polytrauma (review of literature)]//Trauma. – 2014. – N 1. – P. 125-128
- Guriev S., O. Tanasienko, Suchasna klasyfikatsiya infektsiynykh uskladnen' u postrazhdalym iz politravmoyu [Modern classification of infectious complications in patients suffering from polytrauma]//Trauma. – 2013. – T. 14, No. 6. – P. 21-23.
- Pathophysiology of polytrauma — Keel, M. & Trentz O. — Injury, Volume 36, Issue 6. – P. 691-709
- Ahmad T., Ahmed S.W., Soomro N.H., Sheikh K.A. Thoracoscopic evacuation of retained posttraumatic hemothorax//Journal of the College of Physicians and Surgeons Pakistan. - 2013. - Vol. 23 (3). - P. 234-236.
- de Rezende-Neto J.B., PastoreNeto M., Hirano E.S., Rizoli S., Nascimento B. Jr., Fraga G.P. Management of retained hemothoraces after chest tube thoracostomy for trauma//Rev Col Bras Cir. - 2012. - Vol. 39 (4). - P. 344-349.
- DuBose J., Inaba K., Demetriades D., Scalea T.M., et al. Management of post-traumatic retained hemothorax: a prospective, observational, multicenter AAST study//Trauma Acute Care Surg. - 2012. - Vol. 2 (1). - P. 11-22.
- Hsing-LinLin, Wen-Yen Huang, ChyanYang, Shih-MinChou et al. How early should VATS be performed for retained hemothorax in blunt chest trauma?//Injury. - 2014. Vol. 45 (9). - P. 13591364.
- Karmy-Jones R., Holevar M., Sullivan R.J., Fleisig A., Jurkovich G.J. Residual hemothorax after chest tube placement correlates with increased risk of empyema following traumatic injury//Can Respir J. - 2008. - Vol. 15 (5) - P. 255-258.
- Meyer D.M., Jessen M.E., Wait M.A., Estrera A.S. Early evacuation of traumatic retained hemothoraces using thoracoscopy: a prospective, randomized trial//Ann Thorac Surg. - 1997. - Vol. 64(5). - P. 1396-1400.
- Morales Uribe C.H., Villegas Lanau M.I., Petro Sánchez R.D. Best timing for thoracoscopic evacuation of retained post-traumatic hemothorax//SurgEndosc. - 2008. - Vol. 22 (1). - Pp. 91-95.
- Navsaria R.H., Vogel R.J., Nicol A.J. Thoracoscopic evacuation of retained posttraumatic hemothorax. Ann ThoracSurg. - 2004. - Vol. 78 (1). - P. 282-285.
- Nathan T.M., Oliver L.G., Bryan R.C., Jose J.D. et al. Пра[^] Management Guidelines for Management of Hemothorax and Occult Pneumothorax//The Journal of Trauma Injury, Infection, and Critical Care. - 2011. Vol. 70 (2). - P. 510-518.
- Smith J.W., Franklin G.A., Harbrecht B.G., Richardson J.D. Early VATS for blunt chest trauma: a management technique underutilized by acute care surgeons//Trauma. - 2011. - Vol. 71 (1). - P. 105-107.
- Abakumov, A.M. Travmaticheskiy Svernuvshiysya Gemotoraks (diagnostika i lechenie) Dis. ... Kand. Med.nauk [Traumatic Hemothorax Coagulated Dissertation of the Candidate of Medical Sciences]. – Moscow, 2003. 168 p
- Dergunova, S.A. Optimizatsiya Khirurgicheskoy Taktiki Pri Razlichnykh Vidakh Gemotoraksa Dis. ... Kand. Med.nauk [Optimization of Surgical Tactics for Different Kinds of Hemothorax Dissertation of the Candidate of Medical Sciences]. – Samara, 2005. 130 p.