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SURGICAL TREATMENT OF PATIENTS WITH DESCENDING PURULENT MEDIASTINITIS

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Key words: *acute mediastinitis, surgical treatment, intramediastinal administration of antibiotics, video-assisted thoracoscopy*
Ключові слова: *гострий медіастиніт, хірургічне лікування, інтрамедіастинальне введення антибіотиків, відеоасистована торакоскопія*
Ключевые слова: *острый медиастинит, хирургическое лечение, интрамедиастинальное введение антибиотиков, видеоассистированная торакоскопия*

Abstract. Surgical treatment of patients with descending purulent mediastinitis. Shevchuk I.M., Snizhko S.S. *The aim of the study was to improve the results of treatment of patients with descending purulent mediastinitis by means of individualized surgical tactics with the priority use of minimally invasive surgical interventions and developed methods of drainage of the mediastinum and pleural cavity. Examination and treatment of 73 patients with descending purulent mediastinitis receiving treatment in the department of thoracic surgery of Ivano-Frankivsk regional clinical hospital was carried out. Treatment of patients in the main group included intramediastinal administration of antibiotics, the use of the developed method of cascade drainage of the mediastinum and pleural cavity, the priority use of video-assisted thoracoscopy and surgical tactics aimed at anticipating the spread of the purulent process in the mediastinum. The rapid and reliable decrease in the indices of endogenous intoxication in the main group confirms the effectiveness of the developed tactics of surgical treatment of patients with mediastinitis, adequate sanation of purulent mediastinitis, complete removal of the purulent substrate from the mediastinum and pleural cavity. The developed tactics of surgical treatment of purulent mediastinitis allowed reducing the overall postoperative mortality from 26.3% in the comparison group to 11.4% in the main group of patients.*

Реферат. Хирургическое лечение больных нисходящим гнойным медиастинитом. Шевчук И.Н., Снижко С.С. *Цель исследования – улучшение результатов лечения больных низходящим гнойным медиастинитом путем индивидуализированной хирургической тактики с приоритетным применением мини-инвазивных оперативных вмешательств и разработанных методов дренирования средостения и плевральной полости. Проведено обследование и лечение 73 больных нисходящим гнойным медиастинитом, которые находились в отделении торакальной хирургии Ивано-Франковской областной клинической больницы. Лечение больных основной группы предусматривало интрамедиастинальное введение антибиотиков, использование разработанного способа каскадного дренирования средостения и плевральной полости, приоритетное использование видеоассистированной торакоскопии и хирургической тактики, направленной на опережение распространения гнойного процесса в средостении. Быстрое и достоверное снижение показателей эндогенной интоксикации в основной группе подтверждает эффективность разработанной тактики хирургического лечения больных с медиастинитом, адекватной санации гнойных очагов на шее и средостении, полноценное удаление гнойного субстрата со средостения и плевральной полости. Разработанная тактика хирургического лечения острого гнойного медиастинита позволила снизить общую послеоперационную летальность с 26,3% в группе сравнения до 11,4% в основной группе больных.*

The prevalence of acute purulent mediastinitis is 0.15-0.5 cases per 100,000 population and has no tendency to decrease [2, 4]. The disease is accompanied by sepsis – in 78-95%, purulent pericarditis – in 31-49%, pleural empyema – in 40-52%, pneumonia – in 60%, acute respiratory distress syndrome in adults – in 14.5% of patients, and mortality is from 16 to 85% [3]. The disease is

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polyetiological and often occurs in the practice of surgeons, therapists, dentists, maxillofacial surgeons, otolaryngologists, cardiac surgeons, endoscopists and others [4, 6].

Diagnosis of descending purulent mediastinitis (DPM) in the initial stages remains a difficult task that can be decisive for the treatment, prognosis and life of the patient [5]. Errors in diagnosis are determined by the lack of characteristic early clinical manifestations and insufficient knowledge of physicians about the features of the disease [6, 7]. The frequency of diagnostic errors among the dead reaches 97.4% [10]. Delay in the operation for only one day is accompanied by an increase in mortality by 4-10 times [8].

There are several options for surgical treatment of DPM using extrapleural or transpleural access. Each of these interventions has its disadvantages and advantages [8, 10]. In recent years, minimally invasive video-assisted thoracoscopic surgery (VATS) has been used [9].

The aim of the work is to improve the results of treatment of patients with descending acute purulent mediastinitis by introducing individualized surgical tactics with priority use of minimally invasive surgical interventions and developed methods of rehabilitation and drainage of the mediastinum and pleural cavity.

MATERIALS AND METHODS OF RESEARCH

73 patients with DPM who were in the department of thoracic surgery of Ivano-Frankivsk Regional Clinical Hospital from 2004 to 2019 were treated. Among them 46 (63%) men, 27 (37%) women aged 21 to 72 years, on average 41.3±3.9 years. All patients were divided into 2 groups: the main – 35 (47.9%), in which treatment was performed using VATS, intramedial antibiotic administration (IMAA) and developed method of cascading drainage of the mediastinum and pleural cavity. The comparison group consisted of 38 (52.1%) patients treated with conventional methods.

The study was conducted in accordance with the principles of bioethics set out in the Helsinki Declaration on Ethical Principles for Human-Based Medical Research and the Universal Declaration on Bioethics and Human Rights (UNESCO).

To assess the level of endogenous intoxication, serum C-reactive protein (CRP) was determined using the CRP-latex test kit (Ukraine). The concentration of procalcitonin in the serum of patients was determined on the analyzer and test system Cobas 6000 (601 modules), Roche Diagnostics (Switzerland) by enzyme-linked analysis. Assessment of organ dysfunctions and severity of patients was performed by the APACHE II scale in the modification of Radzikhovsky AP and by the SOFA scale [11].

For statistical processing of the results we used the license program Open Value Subscription for Microsoft® OfficeProPlus Education AllLng License / Software AssurancePack Academic OLV 1License LevelE Enterprise 1 Year (license program number is confidential). To objectively judge the reliability of the results of the study there was used a variational-statistical method of analysis of the results with a personal computer IBM 586 and an application program for working with spreadsheets Microcoft Exel [1].

RESULTS AND DISCUSSION

In the descending way of spreading the infection to the mediastinum from the interfascial spaces of the neck, anterior-upper mediastinitis (AUM) was diagnosed in 28 (38.3%), upper (UM) – in 20 (27.4%), total mediastinitis (TM) – in 14 (19.2%), posterior mediastinitis (PM) – in 11 (15.1%) patients.

In all patients of the main group immediately after surgery, IMAA was used, which involved intramediastinal administration of 1.0 g of thienam, diluted in 100 ml of 0.9% sodium chloride solution, twice a day by drop infusion for one hour. The course lasted from 5 to 10 days (Ukrainian patent for utility model № 128808). Upon receipt of the antibioticogram, the drugs were prescribed according to the results.

For AUM and UM, the main surgical approach was peritoneal mediastinotomy on the affected side according to Razumovsky I.I. Opening and drainage of abscesses only through cervical access was performed in 15 (53.6%) of 28 patients with AUM and in 8 (40%) of 20 patients with UM.

However, this approach is not always effective. This is due to the depth of the wound canal, insufficient visual control during manipulations, dangerous proximity of important anatomical formations. Thus, in the comparison group, 13 (46.4%) out of 28 patients with AUM and 12 (60%) out of 20 patients with UM underwent recurrent operation (RO) due to the spread of purulent process below the bifurcation of the trachea. In particular, lateral thoracotomy was performed in 17 (68%), VATS with mediastinotomy, drainage of the mediastinum and pleural cavity – in 6 (24%), bilateral thoracotomy – in 2 (8%) patients. The mortality in the comparison group was 16.6% (4 out of 24 patients with AUM and UM died).

To date, our surgical tactics are aimed at preventing the spread of purulent process in the mediastinum through the timely implementation of additional surgical interventions. Thus, in 15 (62.5%) of 24 patients of the main group with AUM and UM with doubts about the prevalence of

purulent process and insufficient effectiveness of perineal mediastinotomy according to Razumovsky II, additional single-step surgical interventions were performed. In particular, lateral thoracotomy with mediastinotomy – in 9 (37.5%), VATS with mediastinotomy – in 6 (25%) patients.

Indications for VATS in AUM and UM are insufficient disclosure of mediastinal tissue in peritoneal mediastinotomy, doubts about the prevalence of DPM below the tracheal bifurcation, exudative pleurisy / empyema, the spread of purulent process in the posterior mediastinum. When using VATS in 6 patients with AUM and UM, the need for RO arose in one (16.6%) patient with the spread of the process in the lower mediastinum with the development of TM. All patients of the main group with UM and AUM recovered.

In 11 (15.1%) patients PM was diagnosed. Surgical access, which provides the most complete visualization of the posterior mediastinum, is considered to be lateral thoracotomy on the side of the lesion or VATS. Lateral thoracotomy in PM was performed in 9 (81.8%), VATS – in 2 (18.2%) patients. Due to the ineffectiveness of surgical treatment, RO was performed in 4 (57.1%) patients of the comparison group. Mortality in the comparison group was 28.6% (2 of 7 patients died).

The high frequency of RO in the comparison group forced us to reconsider the tactics of surgical treatment of PM. In all patients of the main group with PM, we performed single-step additional surgical interventions aimed at preventing the spread of purulent process, namely: lateral thoracotomy – in 2 (50%) and VATS – in 2 (50%) patients. All patients of the main group with PM recovered.

In 14 (19.2%) patients total mediastinitis (TM) was diagnosed. Surgical treatment of TM is the greatest difficulty due to purulent lesions of all mediastinum, accompanied by sepsis, multiorgan dysfunction/insufficiency, severe endogenous intoxication. The primary task was to eliminate the source of infection in the interfascial spaces of the neck, so as a primary surgery all patients underwent cervical mediastinotomy according to Razumovsky I.I.

Surgical tactics in TM provided an aggressive nature of surgical interventions with maximum disclosure of all mediastinal abscesses. Transpleural lateral thoracotomy is considered to be a surgical approach that provides examination of all mediastinum departments and full disclosure of abscesses.

Using unilateral lateral thoracotomy, we were able to open and repair the mediastinum in 8 (57.1%) patients. Two (14.3%) patients underwent bilateral thoracotomy due to doubts about the effectiveness of unilateral thoracotomy. This operation is quite traumatic and leads to significant disorders of the cardiovascular and respiratory systems, which requires long resuscitation measures (both patients of the comparison group died).

To date, when determining the effectiveness of unilateral mediastinal drainage in TM, we use VATS on the opposite side. This intervention was performed in 3 (21.4%) patients. Indications for the use of VATS on the opposite side in patients with TM are the presence of pleural exudate on the opposite side, purolonecrotic process by the type of necrotizing fasciitis, significant fiber tissue edema. The use of VATS on the other hand has undoubted advantages over thoracotomy due to less trauma, reduced surgery time, sufficient visualization of the affected areas of the pleura and minimally invasive drainage of the pleural cavity. In all patients, purulent exudate in the pleural cavity and areas of purulent lesions of the mediastinal pleura were detected on the opposite side during VATS.

Exudative pericarditis was detected in 13 (92.8%) patients with TM. Therefore, all patients underwent pericardial fenestration. In thoracotomy fenestration of the pericardium was performed in 8 (61.5%), in VATS – in 5 (38.5%) patients. For the fenestration of the pericardium with the help of VATS, we have proposed a method of surgical treatment of acute exudative pericarditis (Ukrainian patent for utility model No. 54201).

We have developed a method of "cascade" drainage for drainage of the mediastinum and pleural cavities in TM. The first drainage ensured the lavage and removal of pus from the anterior mediastinum. The second drainage removed the purulent exudate from the posterior mediastinum, as well as the remnants of purulent exudate and "used" solution from the anterior mediastinum. The third drainage removed the contents of the pleural cavity and provided the evacuation of the remains of spent washing antiseptic solutions. The fourth drainage was placed in the posterior-inferior pleural sinus to remove the remnants of lavage solutions and purulent contents from all parts of the mediastinum and pleural cavity.

Patients of the main group (n=8) with TM, who underwent the developed surgical tactics with IMAA, cascade drainage of the mediastinum and pleural cavity, did not undergo RS. In the comparison group (n=6) – RS were performed in 3 (50%) patients. Mortality in TM among patients of the main group was 37.5% (3 out of 8 patients

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died), in the comparison group – 66.7% (4 out of 6 patients died).

In patients of the main group with the use of VATS, IMAA and "cascade" drainage of the mediastinum and pleural cavity, there was a faster normalization of the analyzed parameters from the first days after surgery. In particular, a faster decrease in the severity state by the APACHE II scale in the modification of Radzikhovsky AP (Fig. 1): from 14.19±1.80 points at the time of hospitalization to 7.8±0.3 points on the second day after surgery (p<0.001).

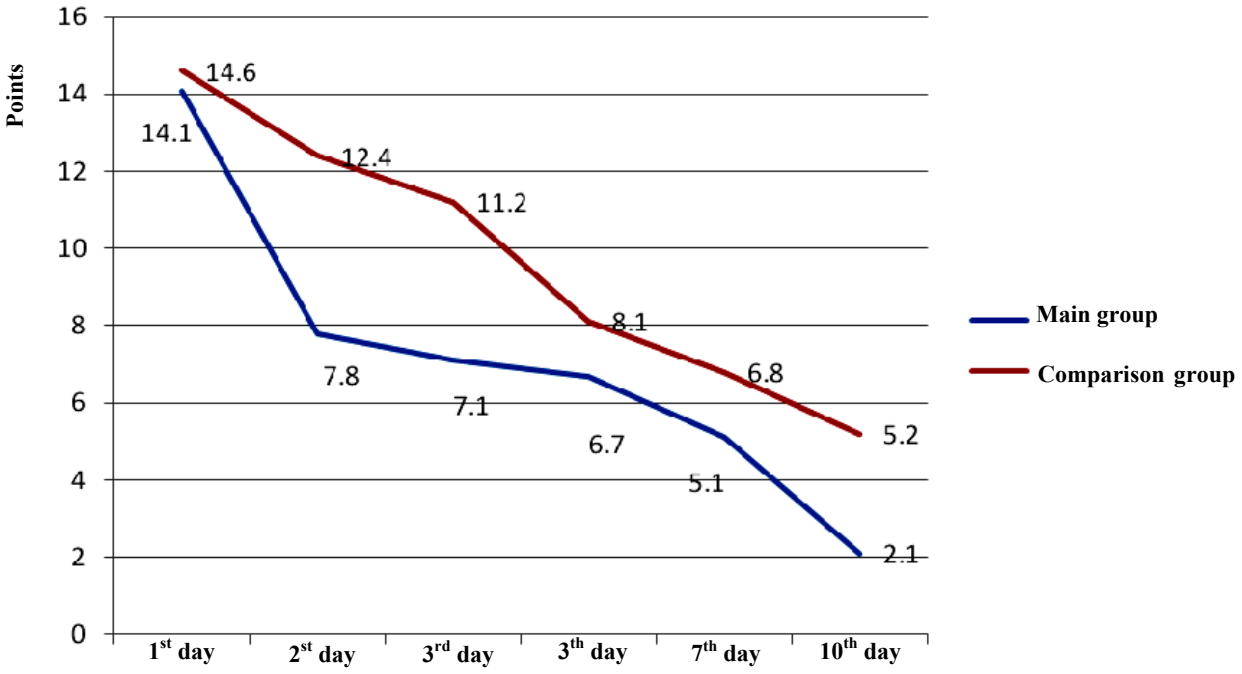

Fig. 1. Dynamics of severity state of patients of the main and comparison group by APACHE II scale in modification of Radzikhovsky AP

In the main group of patients there was also a decrease in the severity state of by the SOFA scale to 3.221±0.445 points on the third day, on the fifth day – 1.832±0.219 points. In the comparison group, the severity state the third day (Fig. 2) was 6.781±0.526 points and remained high on the fifth day – 4.537±0.521 points (p<0.001).

The level of CRP in patients of the main group on the 2nd day after surgery decreased from 236.2±21.4 mg/l to 144.3±9.3 mg/l and on the 3rd day it was 112.1±7.2 mg/l (in both cases p<0.001) with normalization of the indicator on the 10th day. In the comparison group, the level of CRP on the 2nd day remained high, being 212±11.3 mg/l and gradually has been decreasing by the 15th day from the time of surgery, reaching the upper limit of normal in not all patients.

In 16 (45.7%) patients of the main group the dynamics of procalcitonin concentration in the blood was assessed. At the same time, a rapid significant decrease in the procalcitonin content was noted in all examined patients of the main group. At the time of hospitalization, the average content of procalcitonin was 8.7±0.9 ng/ml, on the 1st day after surgery there was a decrease to 3.828±0.251 ng/ml, on the 3rd day – to 2.392±0.373 ng/ml and normalization on the 7th day – 1.253±0.095 ng/ml (p<0.001).

Such a rapid and significant decrease in EI, namely CRP and procalcitonin, in the main group confirms the effectiveness of the developed tactics of surgical treatment of patients with DPM, the adequacy of sanation of purulent lesions on the neck and mediastinum, complete removal of purulent substrate from the mediastinum and pleura.

Postoperative mortality among patients with DPM was 19.2% (14 of 73 patients died), 3 (11.4%) – in the main group, 10 (26.3%) – in the comparison group.

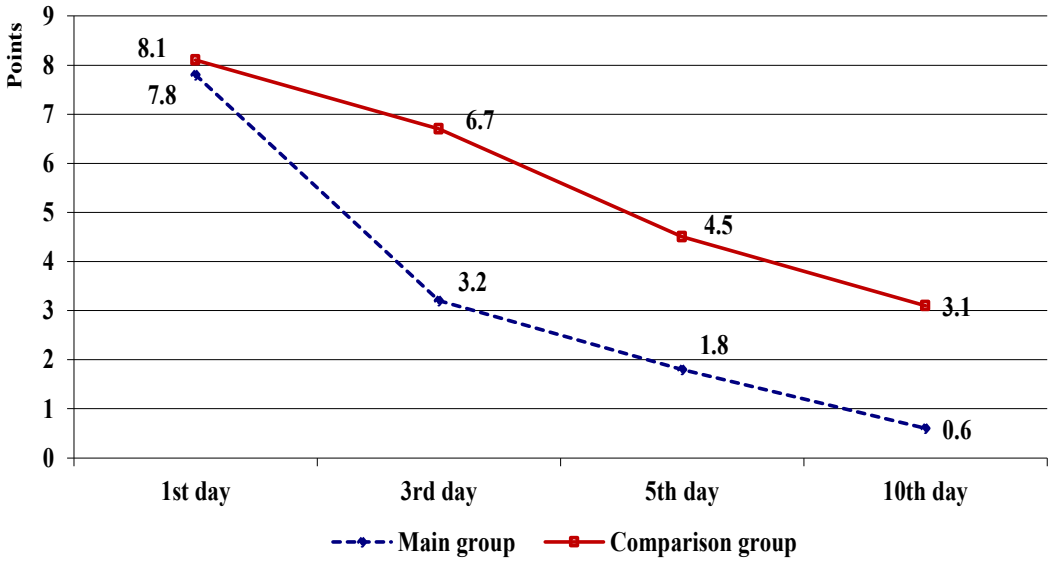

Fig. 2. Changes in the severity state of patients of the main and comparison group by the SOFA scale

CONCLUSIONS

1. The use of intramediastinal administration of antibiotics contributes to the rapid elimination of purulent-inflammatory process in the mediastinum, reducing the severity of the condition and reducing the level of endogenous intoxication.
2. Surgical treatment of upper purulent mediastinitis involves the elimination of the primary source of infection in the neck and the opening of the abscess in the mediastinum by transcervical mediastinotomy according to Razumovsky I.I. or its combination with video-assisted thoracoscopy.
3. In the surgical treatment of posterior purulent mediastinitis, the use of video-assisted thoracoscopy or lateral thoracotomy is a priority.
4. In total purulent mediastinitis, the use of video-assisted thoracoscopy or lateral thoracotomy is a priority. When the purulent process spreads to the opposite side, single-step video-assisted thoracoscopy is required.
5. The developed tactics of surgical treatment of descending purulent mediastinitis allowed to reduce postoperative mortality from 26.3% in the comparison group to 11.4% in the main group of patients ($p<0.05$).

Conflict of interests. The authors declare no conflict of interest.

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