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Possibilities of the Videothoracoscopy for the Post-Traumatic Clotted Hemothorax

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Abstract. Background. Among the complications of blunt thoracic trauma, hemothorax is the most common and serious problem of modern thoracic surgery. The frequency of this complication according to some authors, varies from 26% to 80% and is not connnected with nature of the trauma and patient's age.

804 patients with the chest injuries treated between 2006 and 2012 at the 2nd clinic Tashkent Medical Academy. 179 of patients had penetrating stab wounds, and 625 - blunt. The clotted hemothorax was diagnosed at 103 patients.

For all the patients with clotted hemotorax we performed videothoracoscopy. All the operations were ended with thoracostomy. Intraoperative complications were not observed. Postoperative complications were observed in 10 (10.2%) patients. In one case developed empyema, and in 9 - limited pleurisy.

Inclusion of the videothoracoscopy into the complex diagnostic and treatment algorithm for the patients with chest injuries allows not only to confirm the presence of the CH, but to eliminate it highly effectively and with minimal invasion, avoiding thoracotomy.

Keywords: chest injury; blunt thoracic trauma; stub wounds; clotted hemothorax; videothoracoscopy; video-assisted interventions.

Introduction

The thoracic injuries perform one the most severe forms of trauma and also a leading cause of morbidity and mortality. In the vast majority of traumatized patients, the traumatic force is applied to and through the chest wall, making trauma to the ribs and sternum.This kind of injury is the most common of all thoracic injuries and therefore is considered to be a subject of considerable importance. [1, 7]

Thoracic trauma represents a major diagnostic and therapeutic challenge to surgeons. Accurate assessment and treatment require detailed knowledge of the protean manifestations resulting from thoracic injuries. The trauma is known to be a leading cause of death in the first four decade of life. [3, 10]

Among the complications of blunt thoracic trauma (BTT), hemothorax is the most common and serious problem of modern thoracic surgery. The frequency of this complication according to some authors, varies from 26% to 80% and is not connected with the nature of the trauma and patient's age. In 0.5-30% of patients in this category further clotted hemothorax (CH) develops, leading, as known, to the collapse of the lung and mediastinal shift, contributing to the development of respiratory and heart failure, and at a later date – the development of empyema is observed in 50 % of cases. [2, 9]

It should be noted that, nevertheless, the true frequency of the CH, especially small volume that has no appreciable clinical and radiological symptoms, but is the cause of septic complications of chest trauma has not been fully established till nowadays. [1, 4, 8]

Using ultrasound, CT has extended the diagnostic of CH at chest trauma, but their ability, in some cases, are limited. [1]

Rapid improvements in endoscopic surgical technique and instrumentation expanded the indications of videothoracoscopy in the diagnosis and treatment of diseases of the chest, but its use remains controversial in the trauma setting. As well the role of thoracoscopy continues to expand in the practice of thoracic surgery, it is expanding in the management of the trauma patients. Thoracoscopy had added a new tool for diagnosis and therapy in the setting of both penetrating and blunt trauma. [1, 5, 6]

Recent publications suggested the interest of videothoracoscopy for the diagnosis or treatment of traumatic diaphragmatic injuries, clotted hemothorax, or continued hemothorax in hemodynamically stable patients. The introduction of the video endoscope technology into the diagnostic algorithm of patients with blunt thoracic trauma allowed not only to improve the diagnosis of CH, but also get a good therapeutic effect. In this regard, the study of the treatment results within patients with post-traumatic CH with using of videothoracoscopy is of particular interest. [1, 10]

The value of thoracoscopic (VATS) techniques in the treatment of CH has been examined by several investigators. These small series have shown that VATS is an effective method of intervention, particularly if utilized “on early stage”. Intrapleural fibrinolysis has also shown promise in single and multicenter trials for the treatment of CH following trauma. However, only one brief, retrospective study has directly compared the use of VATS and intrapleural thrombolysis in the treatment of CH to date. [3, 5, 7]

Material and methods

Between 2006 and 2012 the 2nd clinic Tashkent Medical Academy turned 804 patients with chest injuries. At the same time, 179 of them had penetrating stab wounds, and 625 - BTT. The CH was diagnosed at 103 patients of them.

The incidence of CH after penetrating stab wounds was higher and occurred at 42 (23.4%) of patients, whereas in patients with closed injuries it observed at 61 (9.7%) patients.

Age of victims ranged from 16 to 84 years, and in the age group up to 45 years CH was marked mainly after penetrating stab wounds, while at the BTT, this complication was observed mainly in the age of 45.

Among the victims 89 were males (85%), 14- females (14.9%).

Results and Discussion

One of the main factors contributing to the formation of CH in patients with chest injuries was late delivery (over 24 hours).

Revealed the following relationship: the later the patient applies to the hospital, the higher is the probability of detecting it CH. Although the CH after the stab wounds occurred in early terms too. The relationship between the time of hospitalization and type of the trauma is shown in Table 1.

Table 1: Relationship between the frequency of the post-traumatic hemothorax and terms of the hospitalization of the patients with chest injuries

Terms of hospitalization	Penetrative stub wounds		Blunt thoracic trauma		Total number of CH
	Number of the patients	Number of CH (%)	Number of the patients	Number of CH (%)	
To 6 hours	129	16 (12,4%)	90	0	16 (7,3%)
To1 day	32	11 (34,4%)	377	16(4,2%)	27 (6,6%)
To3 days	7	5 (71%)	67	5 (7,5%)	10 (13,5%)
To5 days	5	4 (80%)	42	11 (26,2%)	15 (31,9%)
To10 days	3	3 (100%)	28	14 (50%)	17 (54,8%)
over 10 days	3	3 (100%)	21	15 (71,4%)	18 (75%)
Total	179	42 (23,4%)	625	61 (9,7%)	103 (12,8%)

It should be noted that the patients with stab wounds in time for more than 3 days, were received mainly from other clinics, where they were executed on first surgical processing without identification of the penetration.

Another important factor in the development of CH, to our opinion, was a violation of the function of the drainage introduced into the pleural cavity. Thus, from 187 cases of drainaged pleural cavity because of hemothorax or pneumo-hemothorax for the BTT, at 8 in the future, due to prolonged passive aspiration or compression of the drainage, CH developed.

The cases of CH after BTT were often marked at multiple rib fractures, when high opportunity of development of the pneumo-hemothorax exists. Thus, when a single rib fracture or without it, CH developed at 18 (29.5%) patients with BTT, when the plural –at 43 (70.5%).

Thus, the major risk factors for development of CH at the patients with chest injuries in our study were: late hospitalization of the patients, a violation of the established into the pleural cavity drainage and the presence of multiple rib fractures.

Examination of patients with CH at the BTT, as well as the patients with the stab wounds at the late terms of the hospitalization, was complex and involved general clinical examination, laboratory, and noninvasive (ultrasound, radiography, CT) and invasive (puncture of the pleural cavity, videothoracoscopy) methods.

In the cases of penetrating stab wounds in terms before the 1st day after injury and stabile hemodynamic, was performed urgentvideothoracoscopy. So urgent videothoracoscopy was performed in 161 cases with the identification of the CH andvideothoracoscopic liquidation of it at 27 cases.

Among 76 patients the CH was diagnosed correctly with assistance of clinical and X-ray methods in 28 cases, mainly when its volume was more than 500 ml. The sensitivity of this method to identify the CH according to data of the original study was 37%.

Basing on ultrasound, it was possible to suggest the presence of CH from this number of patients in 65 cases, while the diagnosis was established, regardless of its volume. At the same time, ultrasound was not effective in case of subcutaneous emphysema. The sensitivity of this method to identify the CH was 85.5%.

The puncture of the pleural cavity allowed to confirm the presence of CH. The reliable sign of CH at a puncture of the pleural cavity was the identification of the clots in aspirated blood. Furthermore, to suggest the presence of the CH was possible from significantly lower volume of aspirated blood than was anticipated before.

In doubtful cases, and when was necessary to determine the volume of CH was performed CT of the thorax. This technique has revealed CH at 31 patients among 32 cases. The sensitivity of the CT in the detection of CH was 97%.

Thus, basing on the effectiveness of non-invasive methods of examination, we can conclude that only CT has high resolution capabilities in identifying of CH. Although ultrasound, in case of subcutaneous emphysema absence, may be the screening method in its diagnosis.

With the help of preoperative methods of investigation, we were able to identify the presence of CH at 75 patients among 76 cases. In one case, the diagnosis of CH was established only during videothoracoscopy undertaken regarding the post-traumatic hemothorax.

The treatment intervention in patients with CH started with videothoracoscopy. Only at 5 patients with small volume of CH and very hard general condition was performed conservative treatment, which consists of thoracentesis for local pleuroclysis. Fibrinolytics on background of antibacterial therapy were introduced into the pleural cavity for the lysis of CH.

Thus, 98 patients were undertaken videothoracoscopic intervention (VTI).

The technique of its performance was the following. The first trocar for optics was introduced in the most remote from the localization of CH area. Only in cases of stab wounds at the early terms (up to 6 hours), the trocar was introduced with closed method, in a standard point - the 5th intercostal space by the mid-axillary line. Then we introduced two working trocars, respecting the principle of the triangle. The blood clots were fragmented with the endoscopic clip, and then aspirated with the endo-aspirator. We usually used for aspiration "Bryusan" type.At the cases of identifying the wounds in the lungs or chest wall, the correction has been performed by videothoracoscopy: VATS stop bleeding from an intercostal artery (26 cases), suturing wounds of the lung (25 cases) and other. All the operations were ended with thoracostomy.

From 98 cases taken VTI, at 86 patients we continued minimally invasive surgery. In 12 cases there was a need of conversion. The cases of conversion directly depend on the period of the development of the CH. Types of surgical procedures performed for the posttraumatic CH SG are reflected in Table 2.

Table 2: Types of performed surgical interventions for the posttraumatic CH depending on the time of its development

Time of the development of the CH	Videothoracoscopicintervantion	Video-assisted intervention	Thoracotomy	Total
To 1 day	22	19	1	42
To 3 days	8	1	1	10
To 5 days	13	1	0	14
To 10 days	12	2	0	14
Over 10 days	0	8	10	18
Total	55	31	12	98

As performed in Table 2, in terms of up to 10 days almost all patients undertaken VTI ,the procedure completed with minimal invasion . Cases of conversion in these terms were associated with the need of suture of the wounds of mediastinum.

In terms of more than 10 days clot was usually infected, fibrin has settled at parietal and visceral pleura and developed adhesive process, which was difficult to destroy. In this connection it was necessary to perform the partial pleurectomy, which we performed in 10 of 18 cases by wide thoracotomy. In 8 cases this volume of intervention was done with video-assisted intervention.

Intraoperative complications were not observed by us. (during the study)

Postoperative complications were observed in 10 (10.2%) patients. In one case developed empyema, and in 9 - limited pleurisy.

In case of pleural empyema further pleurectomy and decortication were performed by thoracotomy. Limited pleurisy was eliminated by conservative methods. It should be noted that the majority of occurred complications (6 of 10) were after the video-assisted interventions performed in terms of more than 10 days after injury.

Fatal outcome occurred in one case because of acute myocardial infarction.

Conclusions:

1. The main causes of CH after chest injury are: late hospitalization of the patients, a violation of the established drainage into the pleural cavity, and the presence of multiple rib fractures.

2. CT has the high diagnostic sensitivity among the non-invasive methods of diagnosis.

3. Inclusion of the videothoracoscopy into the complex diagnostic and treatment algorithm for the patients with chest injuries allows not only to confirm the presence of the CH, but to eliminate it highly effective and minimally invasive, avoiding thoracotomy, according to our data, in 88% of cases.

4. Optimal terms of videothoracoscopic liquidation of the CH are up to 10 days from the time of its development. Performing of the VATS intervention in a later terms, in most cases, accompanied by complications and conversion, respectively, were observed in 10 (10.2%) and 12 (12.2%) cases.

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