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Original Research Paper

Forensic Medical Examination of Severity at Closed Injuries of the Chest According to the Materials of the Specialized Clinic

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ABSTRACT

Introduction: A closed chest injury is a frequent type of damage to the organs of the external respiratory system. Victims with such an injury may become the object of a forensic medical examination. The aim of the work was to determine the severity of closed blunt trauma of the chest based on the materials of a specialized clinic in order to determine additional diagnostic criteria for the severity of such an injury.

Materials and Methods: 123 medical cards of inpatients department, patients with chest injuries, who were treated at the Kharkiv Institute of General and Emergency Surgery named after V.T. Zaitsev. Forensic evaluation of closed injuries of the chest organs was carried out according to the degree of severity of physical injuries based on the materials of clinical observations.

Results: Severe injuries were found in 22 (17.9%) cases of injuries with the occurrence of a life-threatening phenomenon, namely, acute respiratory failure. Injuries of medium severity were found in 71 (57.7%) cases of chest injuries, mainly with rib fractures, due to the absence of danger to life. Mild injuries were found in 30 (24.4%) cases of chest injuries without rib fractures with intrapleural injuries and complications or mild chest injuries without any complications.

Conclusions: It was determined that additional diagnostic criteria for closed injuries of the chest, which must be taken place when determining the severity of physical injuries, should be considered: dynamics and duration of restoration of post-traumatic morpho-functional changes of injured organs, loss of part or all of the respiratory organ (lungs), occurrence of life-threatening phenomenon.

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INTRODUCTION

The uninterrupted functioning of the external respiratory apparatus, which includes the airways, lungs, chest with muscles, ensures the normal vital activity of the human body.[1-2] At the same time, a frequent type of damage of organs of the external respiratory system is a closed chest injury, which is one of the leading causes of life-threatening consequences, both in peace time and in war time.[3-6] Victims with non-fatal closed blunt trauma of the chest (CBTC) become the object of a forensic medical examination to determine the severity of physical injuries.[7-10]

During the forensic medical evaluation of the specified injuries, when determining the severity of bodily injuries, the approaches of forensic doctors differ when applying certain qualifying signs of the severity of bodily injuries. This is evidenced by the study of special literary sources.[11-15] Forensic medical evaluation of CBTC when classifying them as life-threatening is controversial. Some experts suggest that serious bodily injuries should be classified as

life-threatening in all cases of CBTC with the occurrence of intrapleural injuries, in cases of hemopneumothorax, regardless of its nature and expressiveness and the presence or absence of life-threatening phenomena.[11-12] At the same time, in the opinion of other scientists and in accordance with the current normative documents of Ukraine, in direct, according to the "Rules of forensic medical determination of the severity of bodily injuries" (confirmed by the order of the Ministry of Health of Ukraine № 6 of 17.01.1995), severe bodily injuries it must be established only in the presence of life-threatening phenomena listed in paragraph 2.1.3 "o".[13-15]

The purpose of the work: forensic-medical determination of the severity of closed blunt trauma of the chest based on the materials of a specialized clinic to determine additional diagnostic criteria for the severity of such an injury.

MATERIAL AND METHODS

Present Retrospective study has been carried out from medical records of admitted patients of closed blunt trauma to chest during last ten years (2009-2018) at Kharkiv Institute of General and Emergency Surgery named after V.T. Zaitsev. The Institute receive on an average 18 patients of blunt trauma chest every year. But the data of only 123 patients (108 males and 15 females) could be archived and included in the present study.

The study cases were divided into 4 groups, depending on the dynamics of morpho-functional post-traumatic changes in the chest organs responsible for respiratory function, final results and the presence of life threatening phenomena in patients.

The First Group (subgroups a and b) included patients with full restoration of the functioning of the chest organs and disappearance of post-traumatic morphological changes up to 6 days (subgroup "a") and in the period from 7 to 21 days (subgroup "b").

The Second Group (subgroups a to g) included patients with positive dynamics, but incomplete restoration of the function of the chest organs and the disappearance of posttraumatic morphological changes: in the period up to 6 days (subgroup "a"), in the period from 7 to 21 days (subgroup "b"), in the period of more than 21 days to 31 days (subgroup "c"), in the period of more than 1 month up to 2 months (subgroup "d"), in a period of more than 2 months up to 3 months (subgroup "e"), in a period of more than 3 months, up to 1 year (subgroup "f"), in the period of more than 1 year (subgroup "g").

The Third Group included patients who lost part or their entire respiratory organ (lung) as a result of the injury.

The Fourth Group included patients who developed an acute life-threatening condition, namely, acute respiratory failure, as complication of CBTC.

RESULTS

The Institute receives on an average 18 patients with CBTC for treatment annually, which is 0.3% of the total number of patients undergoing treatment in the clinic. Out of 123 study patients 108 were males (87.8% of cases) and 59 were of age 20-50 years (47.9%). The impact of blunt hard objects on the thorax was the commonest mechanism of injury.

We systematized the identified lesions in the patients in the observation groups and highlighted the morpho-clinical variants of CBTC **(Table 1)**. It can be seen from the table that more than half of the patients with the investigated injury - 71 (57.7%) observations, mainly in the patients of the second group had rib fractures. At the same time, 55 (44.7%) patients with rib fractures had intrapleural injuries and complications. It is worth noting that the patients of the first group had no damage to the bones of the skeleton. In 22 (17.9%) cases of CBTC in the absence of rib fractures mainly in patients of the second group, in 1 (0.8%) case in patients of the first group, in 3 (2.4%) cases in patients of the third group, in 5 (4.1%) in cases of patients of the fourth group, intrapleural injuries and complications occurred. In 16 (12.7%) cases of CBTC in patients of the first and second groups, it was noted that the chest was contused, without any complications. Rib fractures were present in some patients of the fourth group - 13 (10.6%) of observations.

Post-traumatic morphological changes were detected mainly by X-ray examination of chest organs, which was carried out in all patients. This study revealed rib fractures, air, blood, fluid in the pleural cavity, and changes in the parenchyma of lung tissue. In 17 (13.5%) observations, a computed tomographic study was carried out in order to clarify the results of the radiological examination, or in those cases when the radiological examination was not sufficiently informative.

Among the medical care provided to patients in the observation groups, conservative therapy was provided in 51 (41.4%) cases.

Among the surgical treatment, the largest number of manipulations performed was drainage of the pleural cavity according to Bülau - 57 cases (46.3%). Drainage of the pleural cavity according to Seldinghir was performed

Table 1: Morpho-Clinical Variants of Closed Blunt Chest Injuries

The Details of the Injuries	Groups of Observations											In Total	(%)
	I		II							III	IV		
	a	b	a	b	c	d	e	f	g				
CBTC, rib fractures			4	12								16	13.0
CBTC, rib fractures, presence of intrapleural injuries and complications:													
- hemothorax				7	1			1			1	10	8.2
- clotting hemothorax					2	3				1	2	8	6.5
- pneumothorax						1					3	11	9.0
- hemopneumothorax			2	5		2	2	1			6	21	17.1
- encapsulated pleurisy, hydrothorax			3	7		1	1					2	1.6
- post-traumatic rib chondroma								1			1	1	0.8
- bronchopleurothoracic fistula												1	0.8
- pneumonia, sternum fracture						1						1	0.8
CBTC, without fractures of the ribs, the presence of interpleural injuries and complications:													
- hemothorax			2	3	1	1						7	5.7
- clotting hemothorax				1		1						2	1.6
- pneumothorax	1		2	1		1					1	6	4.9
- pneumothorax, lung rupture												1	0.8
- hemopneumothorax			1	1	1					1	2	5	4.1
- post-traumatic pleural empyema					1							1	0.8
- relaxation of the dome of the diaphragm											1	1	0.8
- post-traumatic lung abscess						1						1	0.8
- diaphragmatic hernia								1	1			2	1.6
- encapsulated pleurisy						1		1				2	1.6
-sternum fracture											1	1	0.8
CBTC, contusion without complications	2	3	4	6	1							16	13.0
CBTC, contusion & presence of intrapleural injuries:													
-pulmonary contusion, pulmonary hemorrhage										1		1	0.8
- post-traumatic pneumonia				4	1							5	4.1
- contusion, lung gangrene, hemothorax										1		1	0.8
Total	**3**	**3**	**18**	**47**	**8**	**13**	**3**	**5**	**1**	**4**	**18**	**123**	**100**

in 6 (4.9%) cases. More difficult surgical interventions, such as lobectomy, diaphragm plastic surgery, unilateral pulmonectomy, decortication, lobe resection, lung apices, and others, were performed in 9 (7.3%) cases.

Based on the results of the forensic medical evaluation of the clinical observations of CBTC, we established the following degree of severity of bodily injuries. Severe bodily injuries according to the "danger to life" criterion of paragraph 2.1.3. "o" "Rules..." were established in 18 (14.6%) patients with CBTC, who had signs of acute respiratory failure. At the same time, 13 (10.6%) patients had rib fractures, intrapleural complications and injuries were present: in 1 (0.8%) case hemothorax, in 2 (1.6%) cases clotting hemothorax, in 3 (2.4%) cases of pneumothorax, in 6 (4.8%) cases of hemopneumothorax, in 1 (0.8%) case of bronchople-urothoracic fistula. In 5 (4.1%) patients there were no rib fractures, but there were intrapleural injuries and complications: in 1 (0.8%) case pneumothorax, in 2 (1.6%) cases hemopneumothorax, in 1 (0.8 %) relaxation of the dome of the diaphragm, in 1 (0.8%) case, sternum fracture. 1 (0.8%) patient had pleurisy, and 1 (0.8%) patient had pneumothorax.

Also, we estimates severe injuries in 4 (3.2%) cases in patients of the third clinical group with CBTC according to the criterion "health disorder associated with permanent loss of working capacity by more than one third" paragraph 2.1.6 "The rules...". At the same time, 1 (0.8%) patient had a pulmonary contusion, pulmonary

hemorrhage, and underwent surgical intervention - "Left sided lobectomy". 1 (0.8%) patient had contusion, lung gangrene, collapsed hemothorax, empyema of the pleura, surgical intervention - "Unilateral pulmonectomy" was performed. In 1 (0.8%) patient, there was a rupture of the apex of the lung, a total right-sided pneumothorax, surgical intervention was performed - "Resection of the apex of the lung". 1 (0.8%) patient had multiple rib fractures, hematoma, lung contusion, pulmonary hemorrhage, and the operation was performed - "Resection of the lower lobe of the lung".

As injuries of moderate severity, which caused a long-term health disorder for a period of more than 3 weeks (more than 21 days), paragraph 2.2.1 "b" of the "Rules...", we assessed: 16 (13.0%) cases of CBTC with rib fractures, without complications; 41 (33.3%) cases of CBTC with rib fractures, the presence of intrapleural complications and combined injuries, of which 9 (7.3%) cases of hemothorax, 5 (4.1%) cases of clotting hemothorax, 8 (6.5%)) cases of pneumothorax, 15 (12.1%) cases of hemopneumothorax, 2 (1.6%) cases of encapsulated pleurisy, 1 (0.8%) case of rib chondroma, 1 (0.8%) case of sternum fracture, pneumonia.

Also, according to the same criterion, 13 (10.6%) cases of CBTC, without rib fractures, with the presence of intrapleural injuries and complications from them were classified as moderate injuries: 2 (1.6%) cases of diaphragmatic hernia, 1 (0.8 %) case of clotting hemothorax, 2 (1.6%) cases of hemothorax, 1 (0.8%) case of hemopneumothorax, 3 (2.4%) cases of pneumothorax; 1 (0.8%) case of pleural empyema, 1 (0.8%) case of lung abscess, 2 (1.6%) cases of encapsulated pleurisy. In addition, 1 (0.8%) case of chest injury with pneumonia was assigned to the same degree of severity.

9 (7.3%) cases of CBTC were assessed as mild bodily injuries that caused a short-term health disorder lasting more than 6 days, but less than 3 weeks (21 days) in paragraph 2.3.2 "a" "Rules..." without rib fractures, the presence of intrapleural injuries and complications, of which: 5 (4.1%) cases of hemothorax, 1 (0.8%) case of clotting hemothorax, 1 (0.8%) case of pneumothorax; 2 (1.6%) cases of hemopneumothorax. Also, 14 (11.4%) cases of chest contusion without complications, 4 (3.2%) cases of chest contusion with intrapleural complications, of which 2 (1.6%) cases of pneumonia, 2 (1.6%) cases of pneumonia, pleurisy.

2 (1.6%) cases of chest contusion without complications, 1 (0.8%) case of CBTC, without rib fractures, with the presence of pneumothorax were assessed as mild bodily injuries under paragraph 2.3.2 "b" of the "Rules...".

DISCUSSION

The conducted scientific work and modern literature show that the search for objective forensic medical diagnostic criteria for determining the severity of injuries in this type of injury remains one of the most relevant and promising areas of research in forensic medicine.[2-3,5,9] Our study provides insight into the nature of chest injuries in living persons, whereas the forensic literature[7-9] tends to focus on characterizing injuries in cases of fatal injuries. There are few publications on the topic of forensic medical evaluation of closed chest injuries in living persons.

There are few scientific works in which the data of the forensic medical assessment of the clinical current of chest injuries, possible consequences, final results and determination of their severity are considered.[5-6,9] In separate publications[9,13] there was a description of cases in which the course of some chest injuries was discussed, but there was no forensic medical assessment. In our study, the results of the forensic medical examination and evaluation of such injuries are preferred. Our observations indicated the need to establish links with clinicians to allow them to provide a more detailed description of the clinical manifestations of life-threatening events in the medical documentations of chest trauma victims. The importance and necessity of conducting objective research methods, including computer tomography, is shown. At the same time, it was also noted by other authors.[2,6,12,14]

CONCLUSION

1) Patients with injuries of the organs of the external respiratory system (CBTC) on average, make up 0.3% of their total annual number in a specialized surgical hospital.
2) According to their morphology, injuries with fractures of the rib cage of the chest (56.7%), including the presence of intrapleural injuries and complications (44.7%) prevail in patients with CBTC undergoing inpatient department treatment. Injuries with signs of danger to life make up 14.6%.
3) In the structure of the forensic medical evaluation of CBTC, based on clinical observations, severe injuries taken place for 17.9% of cases and are established mainly in the event of acute respiratory failure. 57.7%

of cases of CBTC, mainly with rib fractures, qualify as medium-severity injuries due to the lack of danger to life. 24.3% of cases of CBTC without rib fractures with the presence of intrapleural injuries and complications or light injuries without any complications qualify as mild bodily injuries.

4) The available scientific and methodical literature does not contain strong diagnostic morpho-clinical signs for qualitative forensic medical assessment and prediction of the final results of CBTC.

5) The following additional diagnostic criteria for the evaluation of CBTC, which must be taken place when determining the severity of physical injuries, should be considered: the dynamics and duration of restoration of post-traumatic morpho-functional changes of injured organs, loss of part or all of the respiratory organ (lungs), occurrence of life-threatening phenomena.

The perspective of further research consists in conducting scientific work on the study of all possible morpho-clinical manifestations of the studied injury with the subsequent development of a strong algorithm for conducting forensic medical expert research in these cases.

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