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[1]Gubin M. V., [2]Malykhina O. I., [2]Voitov E. O., [2]Serbinenko I. Yu., [2]Gaynanova V. O.

FORENSIC DETERMINATION OF LIFE DANGER IN CHEST INJURIES IN PATIENTS OF A SPECIALIZED HOSPITAL

[1]Kharkiv National Medical University (Kharkiv, Ukraine)
[2]Kharkiv Regional Bureau of Forensic Medical Examination (Kharkiv, Ukraine)
n-gubin@ukr.net

The cause of life-threatening phenomena can be a closed blunt chest injury. Victims with a closed non-fatal chest injury become the object of forensic medical examination of living persons. The purpose of the work is to forensically determine the danger to life in closed blunt chest injuries in patients of a specialized hospital. The material for the work was the medical records of 20 inpatients of the V.T. Zaitsev Kharkiv Institute of General and Emergency Surgery. An analysis of available observations with acute respiratory failure was conducted. Clinical data were analyzed and digital indicators were processed. In victims with acute respiratory failure, the average SaO2% (oxygen saturation) 88.6+0.8% were significantly (P<0.01) increased compared to the control and indicators at discharge. After the treatment, these indicators returned to normal and did not differ significantly Pt>0.05 from the control group. The average SaO2% indicators corresponded to a third-degree respiratory failure. At the same time, the lowest SaO2% indicator in our observations was 80%, corresponding to respiratory failure of the IV degree, while the highest was 93%, corresponding to respiratory failure of the I degree. Severe body injuries according to the criterion of "danger to life" were established in 20 patients with closed blunt chest trauma, who had signs of acute respiratory failure. It was established that the presence of pneumothorax, hemothorax or hemopneumothorax in the victim with closed chest injuries without clinical signs of life-threatening phenomena does not yet give the expert the right to attribute these injuries to severe bodily injuries as life-threatening.

Key words: *chest trauma, forensic medical examination, acute respiratory failure, severity of bodily injuries.*

Connection of the publication with planned research works.

The scientific work is a fragment of the SRW "Forensic medical assessment of the statute of limitations of death and the severity of bodily injuries using modern expert diagnostic methods" (state registration number 0124U000904).

Introduction.

Victims with non-fatal closed blunt chest trauma (BCT) often become the object of forensic medical examination of living persons [1-3]. At the same time, one of the first questions that arises for the forensic medical expert is determining signs of danger to life in the victim [4, 5]. In particular, this may be acute respiratory failure (ARF), traumatic shock, acute blood loss, etc. This is necessary for the correct determination of the severity of bodily injuries [6-9].

However, there are different positions on whether it is necessary to establish life-threatening phenomena in all cases of BCT [9, 10]. Some researchers believe that the morphology of the injury itself is sufficient [11, 12], however, according to regulatory documents, in particular, according to the "Rules for Forensic Medical Determination of the Severity of Bodily Injuries" (enacted by the Order of the Ministry of Health of Ukraine No. 6 of 17.01.1995), severe bodily injuries can be established in the presence of life-threatening phenomena listed in clause 2.1.3 "o", in particular ARF. In addition, the "Rules..." do not contain a list of ARF signs that must be taken into account when determining the danger to life [13].

The aim of the study.

Forensic medical determination of life-threatening conditions in closed blunt chest injuries in patients of a specialized hospital.

Object and research methods.

During the scientific study, data from 20 medical records of patients treated at the V.T. Zaitsev Kharkiv Institute of General and Emergency Surgery over the past decade were processed. The following methods were used in the study: registration method – the obtained data were entered into specially developed registration cards; standard descriptive statistics method – extensive indicators of the structural distribution of patients by gender and age, the nature of injuries, and the severity of bodily injuries were described; comparative statistics method (Student's test) – the average respiratory rate, heart rate, blood pressure, and oxygen saturation were compared in patients; forensic – the morphology and nature of the injury were determined, and the severity of bodily injuries was established; clinical – clinical symptoms of the presence and degree of ARF were determined, pulse oximetry method – oxygen saturation was determined, respiratory rate, heart rate, and blood pressure were determined in order to establish the presence and degree of ARF in patients.

The study was conducted by the principles of bioethics outlined in the Declaration of Helsinki "Ethical Principles of Medical Research Involving Humans" and the "Universal Declaration on Bioethics and Human Rights (UNESCO)" and approved by the Bioethics Commission of the KhNMU (protocol No. 14 dated 11/22/2023). The patient's consent to conduct research, when conducting a forensic medical examination, is not provided for by

the "Rules..." (Order No. 6 of the Ministry of Health of Ukraine dated 01/17/1995).

Research results and their discussion.

We found that BCT was more prevalent in men – 14 (70%) cases, with 12 (60%) patients of working age (20-50 years). Among the causes of BCT, domestic injuries ranked first. The leading mechanism of injury in all cases was blunt force trauma to the chest with a hard object. Analysis of the observations revealed the following morpho-clinical variants of BCT in patients with ARF (**table 1**).

Table 1 shows that in 13 (65%) cases, patients had rib fractures. All patients with rib fractures had intrapleural injuries and complications. In 7 (35%) cases of BCT without rib fractures, intrapleural injuries and complications were present.

To assess the presence of life-threatening conditions in patients, based on an analysis of current specialised literature on the diagnosis of emergency conditions, we identified and grouped all signs of ARF, as reflected in our previous publications [14].

Next, we analysed the available observations of BCT with ARF; no other life-threatening conditions were found in patients. We analysed the clinical data and processed the numerical indicators. The data obtained were summarised in **tables 2** and **3**.

As can be seen from **table 2**, the corresponding clinical manifestations were expressed at hospitalization mainly in patients with ARF 1-2 degrees. Upon discharge after appropriate surgical procedures, they all returned to normal.

As can be seen from **table 3**, in patients with ARF, the average respiratory rate was significantly (P<0.01) higher than in the control group and at discharge. After treatment, these indicators returned to normal and did not differ significantly P>0.05 from the control group. The average heart rate was also significantly (P<0.01) higher compared to the control group and the values at discharge. After treatment, these values returned to normal and did not differ significantly Pt>0.05 from the control group. However, it should be noted that the average heart rate values were close to and corresponded to the values of heart rhythm disturbances in stage I ARF. The average blood pressure readings at hospitalization did not differ significantly P>0.05 from the control group and the readings at discharge. This basically corresponded to the pattern of blood pressure readings in ARF. In patients with ARF, the average SaO2% (oxygen saturation) values of 88.6+0.8% were significantly (P<0.01) higher than in the control group and at discharge. After treatment, these values returned to normal and did not differ significantly Pt>0.05 from the control group.

It should be noted that the average SaO2% values corresponded to grade III ARF. At the same time, the lowest SaO2% value in our observations was 80%, which corresponded to grade IV ARF, and the highest was 93%, which corresponded to grade I ARF. It should be noted that we were unable to measure other instrumental indicators characterizing ARF. This is because these indi-

Table 1 – Morphological and clinical variants of closed chest injuries in patients with ARF

Type of injury	Total	%
BCT, rib fractures, intrapleural injuries and complications:		
- hemothorax	1	5
- coagulated hemothorax	2	10
- pneumothorax	3	15
- hemopneumothorax	6	30
- bronchopleurothoracic fistula	1	5
BCT, no rib fractures, presence of intrapleural injuries and complications:		
- pneumothorax	1	5
- hemopneumothorax	2	10
- post-traumatic relaxation of the diaphragm dome	1	5
- fracture of the sternum	1	5
BCT, scapula fracture, presence of intrapleural complications and injuries:		
- pleurisy,	1	5
- pneumothorax	1	5
Total	20	100

Table 2 – Results of clinical data processing for ARF

Clinical indicators for ARF					
№	Signs of ARF	Severity of ARF			
		I	II	III	IV
1.	Complaints	Lack of air	For severe shortness of breath		
	Before hospitalization (n)	18	2		
	Upon discharge (n)	0	0		
2.	Skin covers	Pale, moist, mild acrocyanosis	Pronounced acrocyanosis, hyperemia, profuse sweating	Diffuse cyanosis	
	Before hospitalization (n)	17	2	1	
	Upon discharge (n)	1	0	0	
3.	Breathing	Superficial, rapid, shortness of breath, decreased or absent breath sounds			Rare, pathological in character
	Before hospitalization (n)	20			0
	Upon discharge (n)	0			0
4.	Activity of accessory muscles	Noticeable activity of the abdominal, trunk, chest, and neck muscles			
	Before hospitalization (n)	20			
	Upon discharge (n)	1			
5.	Symptoms of CNS dysfunction	Euphoria, drowsiness, anxiety, alternating with lethargy, loss of consciousness, delirium, hallucinations		Convulsions, involuntary urination, defecation	Unconsciousness, areflexia, mydriasis
	Before hospitalization (n)	20		0	0
	Upon discharge (n)	0		0	0

Table 3 – Results of processing instrumental indicators at ARF

Instrumental indicators in ARF in affected individuals			
1.	RR (M+m) (breathing movements)	Before hospitalization	24,25±06 Pt1<0,01 Pt2<0,01
		Upon discharge	18,4+03 Pt1>0,05
		Control	17,9+0,07
2.	HR (M+m) (beats per minute)	Before hospitalization	98,55+2,7 Pt1<0,01 Pt2<0,01
		Upon discharge	77,85+0,3 Pt1>0,05
		Control	77,7+0,3
3.	BP (M+m) (mmHg) Systolic	Before hospitalization	128,35+6,4 Pt1>0,05 Pt2>0,05
		Upon discharge	120,85+1,0 Pt1>0,05
		Control	121,85+0,1
4.	AT (M+m) (mmHg) Diastolic	Before hospitalization	75,9+2,2 Pt1>0,05 Pt2>0,05
		Upon discharge	75,65+1,5 Pt1>0,05
		Control	75,5+1,1
5.	SaO_2%	Before hospitalization	88,6+0,8 Pt1<0,01 Pt2<0,01
		Upon discharge	98,45+0,2 Pt1>0,05
		Control	98,4+0,1

Notes: Pt1 – significance of differences according to Student's criterion in comparison with control indicators; Pt2 – significance of differenc es according to Student's criterion in comparison with indicators at admission and discharge.

cators were not included in the medical documentation available to us for analysis. Some indicators could have been obtained if the patient was on a ventilator, but we were unable to record these indicators either. Therefore, we relied on the clinical and instrumental indicators that were available to us. It should be noted that, regarding the degree of ARF, as established in our observations, 16 (80%) patients had ARF of I-II degree, 2 (10%) patients had ARF of III degree, and 2 (10%) patients had ARF of IV degree.

Based on the results of the forensic medical assessment of clinical observations of BCT, we established the following degree of severity of bodily injury. Severe physical injury according to the criterion of "life-threatening" in section 2.1.3, sub-section 'o' of the "Rules..." was established in 20 patients with BCT who had signs of acute respiratory failure.

Conclusions.

1. A comprehensive forensic medical assessment of acute respiratory failure should be carried out, based on the proposed clinical, instrumental, and laboratory signs.

2. The established signs of ARF will assist forensic medical experts in substantiating its presence in victims, increase the objective value of expert conclusions, and help avoid errors in determining the severity of body injuries.

3. In the forensic medical assessment of the severity of body injuries caused by BCT, it is advisable to employ a morpho-functional approach to determine the severity of these injuries. In this approach, the indicator of severe body injury is a functional sign of a morphologically determined injury, as determined by an expert, in the form of clinical symptoms that indicate a threat to life.

4. The presence of pneumothorax, hemothorax, or hemopneumothorax in a victim with closed chest injuries without clinical signs of life-threatening conditions does not give the expert the right to classify these injuries as serious body injuries that are life-threatening.

5. The proposed sequence of forensic medical diagnosis for victims with ARF in cases of BCT will enable the identification of diagnostic criteria for their severity, justify prognoses for the final outcomes of these injuries, and enhance the evidential value of expert conclusions.

Prospects for further research.

Investigation of all possible clinical manifestations of ARF in the studied trauma and development of a clear forensic medical technology for conducting expert examinations.

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[1]Губін М. В., [2]Малихіна О. І., [2]Войтов Є. О., [2]Сербіненко І. Ю, [2]Гайнанова В. О.

СУДОВО-МЕДИЧНЕ ВИЗНАЧЕННЯ НЕБЕЗПЕКИ ДЛЯ ЖИТТЯ ПРИ ТРАВМАХ ГРУДНОЇ КЛІТКИ У ПАЦІЄНТІВ СПЕЦІАЛІЗОВАНОГО СТАЦІОНАРУ

[1]Харківський національний медичний університет (м. Харків, Україна)
[2]Харківське обласне бюро судово-медичної експертизи (м. Харків, Україна)
n-gubin@ukr.net

Причиною виникнення небезпечних для життя явищ може стати закрита тупа травма грудної клітки. Постраждалі з закритою нелетальною травмою грудної клітки стають об'єктом судово-медичної експертизи живих осіб. Мета роботи полягає у судово-медичному визначенні небезпеки для життя при закритих тупих травмах грудної клітки у пацієнтів спеціалізованого стаціонару. Матеріалом для роботи стали медичні карти 20 стаціонарних хворих Харківського інституту загальної та невідкладної хірургії імені В.Т. Зайцева. Проведено аналіз наявних спостережень с гострою дихальною недостатністю. Проаналізовано клінічні данні та опрацьовано цифрові показники. У постраждалих з гострою дихальною недостатністю середні показники SaO2% (сатурації кисню) 88,6+0,8% були достовірно (P<0,01) підвищені в порівнянні з контролем та показниками при виписці. Після проведеного лікування ці показники прийшли до норми та вже достовірно не відрізнялись Pt>0,05 від контрольної групи. Середні показники SaO2% відповідали дихальної недостатності третього ступеня. Разом з тим найменший показник в наших