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EVALUATION OF THE QUALITY OF MEDICAL CARE IN CASES OF DEATH FROM ACUTE BLOOD LOSS (according to data of forensic-medical examinations)

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Ключевые слова: *судебно-медицинская оценка, медицинская помощь, дефект, острое кровотечение, смерть*

Abstract. Evaluation of the quality of medical care in cases of death from acute blood loss (according to data of forensic-medical examinations). Pletenetska A.O., Demchenko I.S., Ergard N.M. *The peculiarities and specificity of the medical field complicate not only the assessment of quality and timeliness of medical care, but also the correctness of the choice of the method of treatment and diagnosis of the disease. The number of forensic medical examinations in «medical cases» has the tendency to increase, and experts in this case face difficulties with forensic medical assessment of medical care provision. Forensic medical analysis of the medical care provision to patients who died of acute blood loss, based on examinations of different forensic medical bureaus of Ukraine has been analyzed. The aforementioned examinations related to the corpses of people who died as a result of acute blood loss, including shock (150 from the total number of 6129 medical examinations were selected). This cause of a death was chosen as one of the leading causes of death in trauma (including a combination with shock). When evaluating gross medical care defects that were found during the examinations that influenced the result, 40.0% (60) – in the form of improper provision (action) were noted in 10 cases (the case of incorrect diagnosis made by the doctors due to underestimation of examination data), defects in the form of non-provision of medical care (inactivity) – in 83.3% (15 cases). In the statistical analysis of defects in the provision of medical care, the majority of cases were connected with delayed provision of medical care – 41,7%. Defects in cases of blood loss were under the following conditions: a) lack of instrumental research, medical treatment and surgery, b) lack of medical treatment and surgery by indications (each of 3,3%). When considering the reasons that led to defects in cases of blood loss, the isolated underestimation of the examination data was in 16,7% (25), a combination of reasons: a) underestimation of the examination data together with the underestimation of additional research data – 16,7% (25); b) underestimation of the examination data together with the negligent attitude to the patient who had a sloppy appearance – 6,7%. The unprofessional nature of the medical staff was in 16,7% of acute blood loss. When providing medical care in cases of death from acute blood loss, defects in the provision of medical care are made by experienced medical professionals in city hospitals (especially large cities of Ukraine), where there are adequate conditions for the provision of medical care, more qualified specialists of different profiles, and there are protocols for providing medical care in acute blood loss.*

Реферат. Оцінка якості надання медичної допомоги у випадках смерті від гострої крововтрати (за даними судово-медичних експертиз). Плетенецька А.О., Демченко І.С., Ергард Н.М. *Особливості та специфіка медичної галузі ускладнюють не тільки оцінку якості та своєчасності надання медичної допомоги, але й правильність вибору методу лікування та діагностики захворювання. Кількість судово-медичних експертиз у «медичних справах» має тенденцію до збільшення, і експерти у цій справі мають труднощі з судово-медичною оцінкою медичної допомоги. Був проведений судово-медичний аналіз якості надання медичної допомоги пацієнтам, які померли від гострої крововтрати, за даними судово-медичних експертиз різних судово-медичних бюро України. Вищезазначені дослідження стосувались трупів людей, які загинули внаслідок гострої крововтрати, включаючи шок (було обрано 150 із 6129). Гостра крововтрата була обрана як основна причина смерті при травмі (включаючи поєднання з шоком). При оцінці грубих дефектів медичної допомоги, які були виявлені, що вплинули на результат, 40,0% (60) у вигляді неналежного надання (дії) були відзначені в 10 випадках (це випадок неправильного діагностування лікарями через заниження даних обстеження), дефектів у вигляді ненадання медичної допомоги (бездіяльність) – у 83,3% (15 випадків). У статистичному аналізі дефектів у наданні медичної допомоги більшість випадків були пов'язані із затримкою надання медичної допомоги – 41,7%. Дефекти у випадках крововтрати були за таких умов: а) відсутність інструментальних досліджень, медичного лікування та хірургічного втручання, б) відсутність медичного лікування та хірургічного втручання за показаннями (кожен з 3,3%). При розгляді причин, що призвели до дефектів у випадках крововтрати, поодиноке заниження даних обстеження було в 16,7% (25), поєднання причин: а) заниження даних обстеження разом із заниженням додаткових даних досліджень – 16,7% (25); б) заниження даних обстеження у зв'язку з недбалим ставленням до пацієнта, який мав недбалий вигляд – 6,7%. Непрофесійність медичного персоналу мала місце в 16,7% випадках гострої кровотечі. При наданні медичної допомоги у випадках смерті від гострої крововтрати дефекти в наданні медичної допомоги допускаються досвідченими медичними працівниками в міських лікарнях (особливо великих міст України), де є належні умови для надання медичної допомоги, більш висококваліфіковані спеціалісти різного профілю та існують протоколи надання медичної допомоги при гострій крововтраті.*

Human factor is still the component of the medical care that sometimes leads to disability, extension of the treatment period or even death that causes damage to the state and worsens the demographic situation in the country [3]. Also, it is necessary to note the complexity of the problem of offenses committed by medical personnel from a legal point of view [1, 2, 6, 13]. The peculiarities and specificity of the medical field complicate not only the assessment of quality and timeliness of medical care, but also the correctness of the choice of the method of treatment and diagnosis of the disease. But even with a clear definition of the fault of a health worker, there are difficulties in determining his/her responsibility, that is due to the imperfection of the legal framework, in particular,

which clearly articulates a single approach to conducting forensic examinations for «medical matters» [4, 11]. It should be noted that the number of forensic examinations in «medical cases» has the tendency to increase, and experts in this case have difficulty in forensic medical assessment of medical care [5, 12]. The aim of the study was to conduct forensic medical analysis of the provision of medical care to patients who died of acute blood loss, according to the forensic medical examinations of different forensic medical bureaus of Ukraine for further identifying health care professionals' errors and the reasons for these mistakes in order to improve health care delivery in Ukraine at all levels. Death from acute blood loss, as deaths from hemorrhage [8] is potentially preventable, so this study also focuses on opportunities for preventing death from acute blood loss.

MATERIALS AND METHODS OF RESEARCH

This paper deals almost exclusively with the evaluation of materials of forensic medical examinations. This article excludes questions regarding effectiveness of healthcare delivery at population level, physician-patient interactions and quality control mechanisms (internal and external ones).

The materials of the research were the forensic medical examinations for «medical cases» over the current 10 years, executed at «The Main Bureau of Forensic Medical Examination of the Ministry of Health of Ukraine», Kyiv City Clinical Bureau of Forensic Medical Examination, Zhytomyr regional Bureau of Forensic Medical examination, Kharkiv Regional Bureau of Forensic Medical Examination. The aforementioned examinations related to the corpses of people who died as a result of acute blood loss, including shock (150 of the total number of 6129 medical examinations were selected). This cause of a death was chosen as s one of the leading causes of death in a trauma (including a combination with shock).

In the process of research, the data from the examinations were distributed according to the following criteria: year, sex, date of death, time of death, presence or absence of concomitant pathology, age of the deceased, date of injury, time of injury, date of arrival of ambulance, time of arrival of ambulance, the level of the medical institution (city clinic, central district hospital, regional clinical hospital, specialized (institutes of neurosurgery, traumatology, etc.), dispensary, emergency medical aid (EMA), time of delivery to the hospital, time of medical aid, delivery, APS (arterial pressure systolic), APD (arterial pressure diastolic), heart rate, state of the patient, consciousness, presence of the described bodily injuries, expert examination, additional research, presence of a defect in medical care.

For the analysis of the received material its grouping on attributive and variational signs was carried out. As a result of summarizing the material when calculating the units of observation, absolute numbers were obtained, which expressed descriptive and quantitative features. Further processing of experimental data was carried out in accordance with the rules of variation statistics as described in the manuals [1, 7].

Statistical processing included the calculation of primary statistics (arithmetic mean M (X) and error of mean or standard error (mM)).

When characterizing the values and properties of the alternative variation, the proportion of variants with the studied characteristics (p) was expressed as a percentage (%) to their total number by the formula:

$$p = \frac{n}{N} 100\% ,$$

where n – an absolute number of variants having the required feature,
N – the total number of analyzed sample objects.

The average percentage error (mp) was calculated by the formula:

$$m_p = \sqrt{\frac{p(1-p)}{N}} ;$$

$$m_p = \sqrt{\frac{p(100-p)}{N}} \ (\%)$$

In addition, for all samples, the conformity of empirical distributions to the normal law (Gaussian distribution) was assessed according to the Kolmogorov-Smirnov criteria.

According to the results of the analysis, it was found that the distribution of most indicators did not comply with the normal law, so when describing them, the median (Me) and interquartile range (IQR) were indicated.

To test the hypothesis of equality of the general means of two independent (unrelated) samples, which are distributed according to the normal law, we used the Student's two-sample criterion. If the probability of coincidences did not exceed 5% ($p \leq 0.05$), the null hypothesis was rejected, the difference between the samples was considered not random and the average samples were considered to be significantly different from each other.

The difference between the percentages of the variants, expressed as a percentage, was estimated using the agreement criterion (chi-square) and the analogue of the Student's criterion, the z criterion. The results were considered statistically significant at $p \leq 0.05$.

Data processing and analysis were performed in OpenOffice software packages (Base, Calc, Writer, Draw, Math), GNU Octave with saving of source documents in *.doc, * .xls format. This software is open source and used under the GNU General Public License.

RESULTS AND DISCUSSION

The results of medical care delivery in terms of recovery, restoration of function and of survival, has been frequently used as an indicator of the quality of medical care [9, 10]. Forensic medical examination also allows to evaluate the quality of medical care based not on outcomes (which is, obviously – death of the person), but on reasons. However, such evaluation is based on the autopsy performed. The results of forensic medical examination make it possible to assume that the organizational and / or clinical actions of medical personnel are erroneous. However, it is impossible to unambiguously state that at the time the medical personnel provided assistance in acute blood loss, the actions of the medical personnel were deliberately erroneous.

Acute blood loss is arbitrarily defined as the loss of one blood volume within a 24 h period, the normal adult blood volume being approximately 7% of ideal body weight in adults and 8-9% in children. Alternative definitions that may be more helpful in the acute situation include a 50% blood volume loss within 3 h or a rate of loss of 150 ml/min. Acute blood loss could be an immediate cause of death or a contributing factor to another primary cause of death. In this study, acute blood loss is an immediate cause of death.

In the statistical analysis of the commission of forensic medical examinations the following was revealed. Among all investigated cases of blood loss, 66.7±8.5% were men (100) and 33.3±8.6% were women (50).

The time of death in acute blood loss from 8.00 to 17.00 (during working hours) was 16.7±6.8% (25 cases), from 17.01 to 7.59 – 60.0±8.9% (90 cases), in 23.3±7.7% (35 cases) time of death was not specified. Thus, mortality is higher at night ($p<0.05$), which is broadly in line with generally available worldwide data. The groups did not differ in age ($p>0.05$). In the blood loss group, the minimum age was 9 years, the maximum age was 77, Me=34.0, IQR: 27.0-50.0.

Concomitant pathology was present in deaths from acute blood loss – 23.3±7.7% (35). It should be noted, that in medical records the date and time of arrival of the outpatients in cases of acute blood loss – the date was stated only in 26.7±8.1% (40), and the time – in 23.3±7.7% (35), in the other cases, the accompanying ambulance cards did not have any medical records with data (although in all investigated cases patients were delivered to the hospital by ambulances), which is the crucial point in assessing the timeliness of medical care delivery. So, in the absence of such data, shortly after the injury, the forensic evaluation of the provision of medical care is complicated.

It should be noted that all of the world's standards of trauma care (Advanced Trauma Life Support) assistance are performed by the CABC algorithm, where the first C is critical bleeding. Thus, not specifying the start of bleeding and medical assistance delivery is the violation of these standards of care, and on the other hand, complicates the legal classification in the case of the criminal nature of the injury: homicide or bodily injuries causing death.

When evaluating the medical institutions in which the victims were located, the following were found: in most cases patients were taken to the city clinical hospitals – 36.7±8.8% (55) (Table 1).

When evaluating gross medical care defects found during the examinations that influenced the result (almost half of all cases), 40.0% (60), in the form of improper provision (action) were noted in 10 cases (this is a case of incorrect diagnosis made by doctors due to underestimation of survey data), defects in the form of non-provision of medical care (inactivity) – in 83.3% (15 cases). In the statistical analysis of defects in the provision of medical care, the majority of cases were connected with delayed provision of medical care – 41.7%.

The set of defects in cases of blood loss was the following: a) lack of instrumental research, medical treatment and surgery, b) lack of medical treatment and surgery by the indications (each of 3.3%) (Tab. 2).

It should be noted that in these cases, improper treatment, as a defect in the provision of medical care was not at the first place, because the investigated patients had lethal blood loss with urgent conditions, which needed, first of all, adequate examination and urgent surgery. At blood loss, however, cases of inadequate medical treatment still account for a quarter of all cases. These were cases of inadequate and incorrectly chosen treatment, such as hemopoetic therapy, the introduction of drugs for blood replenishment and detoxification, etc., antibiotic therapy. The antibiotic therapy in blood loss was defined as a defect in those isolated cases when the patient lived after the operation for a certain time, and a connection with death was due to secondary bacterial infection.

Table 1

Distribution of patients delivered to different medical institutions

Hospitals	abs.	P, %	m, %
City clinical hospitals	55	36.7	8.8
Central clinical hospitals	25	16.7	6.8
Regional clinical hospitals	10	6.7	4.6
Specialized medical institutions	5	3.3	3.3
Emergency hospital	30	20.0	7.3
Not specified	25	16.6	5.5

Note: the difference between the relevant indicators of patients in different institutions is significant ($p<0.05$).

When considering the reasons that led to defects in blood loss, the isolated underestimation of the survey data was in 16.7% (25), a combination of reasons: a) underestimation of the survey data together with the underestimation of additional research data – 16.7% (25); b) underestimation of the survey data in due to the negligent attitude to the patient who had a sloppy appearance (homeless, bad smill from the body, smell of alcohol, etc.) – 6.7%.

Table 2

Distribution of defects of medical care to patients with acute blood loss

Type of defect	Blood loss (n=60)	
	abs.	P, %
Lack of instrumental research	15	25.0
Lack of medical treatment	15	25.0
Lack of operation	15	25.0
Delay in the provision of medical care	30	20.0

Note: the difference between the relevant indicators of defects of medical care is significant ($p<0.05$).

Unprofessionalism of the medical staff took place in 16.7% of the blood loss. It should be noted that unprofessionalism was not connected with the qualification of medical workers, but rather with the imperfect possession of professional skills (incorrectly chosen treatment tactics, mechanical and other mistakes in conducting surgical interventions), as well as ignorance of their duties, job descriptions, etc.

In assessing the timeline of the provision of medical care, it should be noted that untimely medical care was provided to patients with a loss of blood in 36,7% (55 cases).

Of the cases investigated, a direct causal relationship between the defect of medical care and the adverse effect was established in 66.7% (40), indirect – in 33.3% (20).

In a more detailed analysis, it turned out that most cases of a direct causal relationship in blood loss – 75% (30) are in the form of non-provision of medical care and only 25% – action (inappropriate medical care). In the presence of a direct causal relationship in acute blood loss – 33,33% is the in discrepancy between the clinical diagnosis and forensic medical, 66.67% (30) in incomplete compliance, no cases of full compliance of diagnosis.

In case of acute blood loss, in half (20) of cases, no surgery was performed when indications were present, and in half of cases (4) was performed untimely. In 37.5% (15) of cases, the patients were in moderate condition and only 28.7% were in severe condition. In the vast majority of cases – 87.5% (35) they had no additional studies or they were

underestimated, in most cases – 75% (30) there was a delay in the provision of medical care, in 25% – lack of medical treatment. In 37.5% (15 cases), patients had normal systolic, diastolic, pressure and heart rate, and 87.5% (35) patients were conscious, in 37.5% (15) patients' state was regarded as moderate. That is, patients at the time of admission to the hospital were stable. In blood loss in 75% (30) of all patients, bodily injuries were not described completely. At the same time, it should be noted that in blood loss in the overwhelming majority of cases – 75% (30) patients had no concomitant pathology and all were of able-bodied age (up to 50 years).

Patients were delivered to various treatment facilities in cases of acute blood loss: 12.5% – specialized medical institutions and institutions for emergency medical care, 37.5% – city hospitals of large cities and central regional hospitals.

In the analysis of cases with the indirect causal relationship, it turned out that in case of blood loss – all cases were cases of inactivity. In 75% (15) – incomplete compliance between the clinical and forensic diagnosis, only in 25% compliance between the diagnoses. In case of acute blood loss, in half of the cases, no surgery was performed by the indications, and in half of cases it was carried out untimely. In the case of acute blood loss, in a quarter of cases, there was an incorrect medical treatment. In 75% (15) in blood loss, bodily injuries have not been fully described, and in 25% – not described at all. In this case, it should be noted that in all cases, patients did not have concomitant pathology and in the vast majority were of able-bodied age (up to 40 years old).

In all these cases, the medical staff had sufficient experience and qualification categories (not lower than the first), among them there were no inexperienced specialists (interns). In half of the cases in acute blood loss patients were the of in city hospitals (especially in large cities), in the second half of the cases – in central district hospitals.

However, it should be noted that the above data are not categorical, only the so-called «high-profile cases» with criminal proceedings were analyzed. It is clear that with insufficient capacity to provide adequate medical care, healthcare workers are sometimes unable to perform their professional duties perfectly. Therefore, first of all, it is desirable that these studies help practical clinicians avoid typical mistakes; this will increase quality of medical care in Ukraine, as it is also one of the main tasks of forensic medicine and expertise alongside the assistance of investigative bodies in crime solutions.

CONCLUSIONS

Thus, in the statistical analysis of the forensic medical examinations carried out in different bureaus of Ukraine, it was found that in Ukraine there is a low level of medical care with under-examination of patients and their condition, and delay in care provision as well. Contrary to the general opinion, that mostly mistaken are young and inexperienced doctors working in small regions of Ukraine, where there are no proper conditions for providing the appropriate level of medical care, the mistakes are made by quite experienced medical professionals in city hospitals (especially large cities of Ukraine), where there are adequate conditions for the provision of medical care, highly qualified specialists of different profiles, and there are protocols for providing medical care in acute blood loss. This could be basis for criminal proceeding because medical negligence, as medical personnel performed their duties bellow acceptable standard of care. The poor quality of the medical records greatly complicates the forensic assessment of the provision of medical care.

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

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