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MEDICAL AND DIAGNOSTIC MEASURES FOR DAMAGE TO THE ABDOMINAL ORGANS IN THE WOUNDED AND VICTIMS WITH CATATRAUMA AGAINST THE BACKGROUND OF EXPLOSIVE AND TECHNOGENIC INJURIES

Summary. In the context of a large-scale war of the Russian Federation against Ukraine, the problem of injuries received as a result of catatrauma is urgent.

Materials and methods. 203 cases of catatrauma-related injuries were analyzed. 128 such wounded were examined and treated.

Results and their discussion. 4 clinical groups of wounded and injured people were identified. The severity of injuries was assessed by the number of affected abdominal organs (AO), the nature and extent of their injuries. There are 4 types of falls highlighted. Leading symptoms: peritoneal (16.3 % of cases), symptoms of intra-abdominal bleeding (38.6 %), urinary tract symptoms (3.2 %). In 50.2 % of cases, these symptoms were combined with simultaneous damage to the hollow and parenchymal organs. One of the most frequently damaged organs in catatrauma is the spleen. Surgical tactics for wounds associated with catatrauma are presented in detail, and an algorithm for the treatment and diagnostic process for catatrauma is developed.

Conclusions. In the conditions of war, there is a need to develop a clear algorithm of actions, which includes identification of the site of damage, a complex of studies and consultations of related specialists is necessary, taking into account the development of possible complications and deaths, which also requires a number of detailed diagnostic techniques. The developed algorithms of the diagnostic approach in various cases of catatrauma allow us to form practical actions for paramedics and medical personnel.

Key words: *catatrauma, explosive wounds, technogenic trauma, abdominal contusion.*

Introduction

In the conditions of a large-scale treacherous invasion of the Russian Federation troops, as well as various natural and technogenic disasters (explosive trauma, fires, destruction of buildings, earthquakes, etc.), severe traumatic injuries resulting from cataclysms are often caused [1]. It should be remembered that the process of falling from a height is one of the components of the mechanism of formation of explosive trauma [2, 3].

Catatrauma is one of the most complex and difficult to diagnose types of severe poly-traumatic injuries [4]. It occupies a special place in the structure of injuries, which is primarily due to a wide variety of mechanisms and circumstances of numerous and different localization and severity of morphofunctional injuries, which often lead to severe complications [5], fatal consequences [6-11], and in some cases – to persistent disability [12].

A huge amount of work on the study of various aspects of catatrauma was carried out by forensic doctors [13, 14].

It should be noted that the distribution of therapeutic and diagnostic tactics in successive stages with the allocation of resuscitation and diagnostic, resuscitation and post-shock stages was first provided by P. M. Zamyatin et al. (2006) [15]. The probability of survival of the wounded and injured largely depends on the measures taken at different stages of rescue and medical care [16, 17]:

1) preliminary diagnosis of the severity of the condition and the availability of qualified medical care, taking into account the location of the wounded and injured [18];

2) the possibilities of their movement and the level of equipment of medical institutions that receive the wounded and injured [19].

The resuscitation and diagnostic stage is limited to the time from the moment of hospitalization of the wounded and injured to the start of the operation. The main goal of this stage is to diagnose the received injuries with the probability of determining the optimal approach to surgical intervention, as well as the continuation of resuscitation measures



and intensive care, management of vital functions of the body of the wounded and injured [20, 21].

The main tasks in this case are: 1) resuscitation diagnostics and determination of lesions of the main vital functions in the shortest possible time, 2) initiation of resuscitation measures and treatment of identified disorders, 3) assessment of the amount of damage and determination of the optimal timing of surgical intervention [22].

E. M. Salonen et al. (2007) computed tomography was widely used at the diagnostic stage [23]. T. Arai et al. (2023) present their experience in using therapeutic and diagnostic tactics in catatrauma [24].

Materials and methods

The study is based on the results of an analysis of the medical records of 203 wounded and injured people. Clinical examination and treatment of 128 wounded and injured with traumatic injuries as a result of catatrauma, who were treated in the Department of emergency surgery, military surgery and emergency surgery of the state institution «V. T. Zaitsev Institute of general and emergency surgery of the National Academy of Medical Sciences of Ukraine», as well as in the surgical clinic of the Military Medical Clinical Center of the Northern Region of the Ministry of defense of Ukraine, Kharkiv.

The criteria for selection and inclusion in the study were: 1) cases of catatrauma with abdominal injuries; 2) availability of information on the main biomechanical traumatogenic factors: causes, circumstances, height of the fall, type of fall and landing, patient's body weight and surface characteristics of the landing site.

The research was carried out using clinical, laboratory, morphological, instrumental and statistical methods, as well as retrospective and prospective analysis of medical documentation, the method of interval retrospective continuous selection based on medical examination and forensic medical examination, taking into account the anthropometric method and calculation of body weight, an analytical practical method for assessing the scene of an accident with the determination of the physical properties of the surface of the landing site and measuring the height of the fall, which coincides with the data of literature sources of foreign researchers [25-29].

Results and discussion

The structure of diagnostic search for catatrauma was presented as follows:

1) primary determination of the nature of damage to the anatomical and functional area-AfD (priority rule of «four cavities»);

2) identification of injuries with an emphasis on syndromes that pose an immediate threat to life,

and determination of their impact on the severity of the victim's condition;

3) determination of indications for resuscitation measures and surgical intervention;

4) conducting diagnostics in order to identify competing and concomitant injuries that aggravate the victim's condition.

We have identified four clinical groups of wounded and injured people.

I group – wounded and injured in relatively satisfactory condition + with moderate injuries of one AfD, accompanied by a mild injury or two or more mild AFDS that require treatment. emergency qualified care.

II group – wounded and injured in a moderate condition with moderate injuries of two or more AFDS, requiring urgent qualified and specialized first aid.

III group – wounded and injured with damage to one AO in critical condition or moderate severity, accompanied by damage to other AO of mild or moderate severity, or severe or moderate injury that requires specialized rescue assistance.

IV group – wounded and injured in extremely serious or terminal condition with severe damage to two or more AO, who were provided with emergency care in the intensive care unit of the emergency department, according to the results of which it is possible to determine: a further approach to diagnosis and treatment.

Assessment of the overall severity of injuries was carried out by listing the damaged AO, assessing the nature of the damage, and then identifying all damaged AO by severity.

The study identified the following types of falls:

I. By the presence of obstacles on the trajectory of the catatrauma: a) direct fall from a height (the human body on the trajectory of the fall did not meet any obstacles and the injury was received only at the moment of collision with the final landing site) – 194 (95.6 %) injured and injured; b) indirect fall from a height (during the fall, the body hits some obstacles or objects, such as trees, poles, wires, etc.) – 9 (4.4 %) injured and injured.

II. By the presence of objects that accompany the body of a person falling from a height: a) free fall (when the victim falls independently) is not accompanied by anything else – 199 (98.0 %) cases; b) non free fall (when the victim's body falls together with the object or into it), for example, in a car when falling from a bridge, in an elevator, falling with parts of a construction beam – 4 (2.0 %) cases.

III. According to the ability of the wounded and injured to pull up to the moment of impact: a) a coordinated fall, in which the victim manages to realize that he is falling, and take a more or less physiologically prepared body position (with the mobilization of the appropriate muscles) before a direct impact on the surface of the final land-

ing-31 (15.3 %) cases; B) a coordinated fall, during which the victim cannot for any reason get close to the impact on the surface of the final landing – 72 (84.7 %) cases.

IV. By the presence of acceleration before free fall: a) active catastrauma: acceleration precedes the fall of the victim, for example, active jump, push, impact, reset – 23 (11.3 %) cases; b) passive cata-

trauma, that is, without prior acceleration of the injured person to separation from the edge of a higher place – 180 (88.7 %) cases.

Thus, a large discrepancy between external and internal damage was observed in the situation of an intermediate landing on the limb. External injuries in all victims are localized on the upper and lower extremities. All the victims were found to have frac-

Table 1

Distribution of injured depending on the type of landing and anatomic and functional area

Type of landing	Anatomic and functional area	Number of injured		
		Main group, %	Control group, %	Total, %
Vertical upper	The head, neck, hands, elbows or simultaneously the head and hand (situation, standing on the head bearing on hands and elbows))	24 (11.8)	22 (10.8)	46 (22.6)
Vertical lower	Buttocks, knees, feet, or simultaneously buttocks and feet (sitting position), knees and feet (kneeling position), buttocks and extremities	30 (14.8)	28 (13.8)	58 (28.6)
Horizontal anterior	Anterior area of the body	14 (6.9)	16 (7.9)	30 (14.8)
Horizontal posterior	Posterior area of the body	12 (5.9)	8 (3.9)	20 (9.8)
Horizontal lateral right	Right lateral area of the body	11 (5.4)	9 (4.4)	20 (9.8)
Horizontal lateral left	Left lateral area of the body	8 (3.9)	10 (4.9)	18 (8.9)
Intermediate upper angular	Simultaneously head and chest	2 (1.0)	—	2 (1.0)
Intermediate lower angular	Simultaneously pelvis and lower extremities	4 (2.0)	2 (1.0)	6 (3.0)
Intermediate on extremity	Simultaneously upper and lower extremities (position on all fours)	1 (0.5)	2 (1.0)	3 (1.5)
TOTAL		106 (52.2)	97 (47.8)	203 (100.0)

Table 2

Frequency of external damage in different types of landing

Type of landing	Quantity of damaged anatomic and functional areas (%)						Number of injured		
	head	chest cavity	abdomen	Pelvis	Extremities		Main group, %	Control group, %	Total, %
					upper	lower			
Vertical upper	27 (12.0)	4 (1.8)	2 (0.9)	8 (3.6)	12 (5.3)	8 (3.6)	32 (14.2)	29 (12.9)	61 (27.1)
Vertical lower	10 (4.4)	3 (1.3)	3 (1.3)	4 (1.8)	5 (2.2)	14 (6.2)	21 (9.3)	18 (8.0)	39 (17.3)
Horizontal anterior	12 (5.3)	4 (1.8)	2 (0.9)	4 (1.8)	6 (2.7)	4 (1.8)	15 (6.7)	17 (7.5)	32 (14.2)
Horizontal posterior	9 (4.0)	5 (2.2)	4 (1.8)	3 (1.3)	3 (1.3)	2 (0.9)	14 (6.3)	12 (5.3)	26 (11.6)
Horizontal lateral right	8 (3.6)	5 (2.2)	1 (0.4)	2 (0.9)	1 (0.4)	3 (1.3)	11 (4.9)	9 (4.0)	20 (8.9)
Horizontal lateral left	11 (4.9)	6 (2.7)	1 (0.4)	1 (0.4)	2 (0.9)	3 (1.3)	12 (5.3)	12 (5.3)	24 (10.7)
Intermediate upper angular	5 (2.2)	2 (0.9)	1 (0.4)	4 (1.8)	3 (1.3)	1 (0.4)	7 (3.1)	9 (4.0)	16 (7.1)
Intermediate lower angular	—	1 (0.4)	—	1 (0.4)	1 (0.4)	1 (0.4)	3 (1.3)	1 (0.4)	4 (1.8)
Intermediate on an extremity	—	—	—	1 (0.4)	—	2 (0.9)	2 (0.9)	1 (0.4)	3 (1.3)
TOTAL							117 (52.0)	108 (48.0)	225 (100.0)

Table 3

Frequency of internal injuries in different types of landing

Type of landing	Anatomic and functional area								Number of injured		
	liver	spleen	intestine	mesentery	bladder	stomach	kidneys	pancreas	Main group, %	Control group, %	Total, %
Vertical upper	26	16	7	3	—	—	—	—	27 (10.7)	25 (9.9)	52 (20.6)
Vertical lower	26	14	6	9	4	1	1	—	30 (11.9)	31 (12.3)	61 (24.1)
Horizontal anterior	14	6	6	8	1	3	1	1	19 (7.5)	21 (8.3)	40 (15.8)
Horizontal posterior	10	6	7	2	—	—	1	—	15 (5.9)	11 (4.3)	26 (10.2)
Horizontal lateral right	16	4	4	4	1	2	2	—	17 (6.7)	16 (6.3)	33 (13.0)
Horizontal lateral left	2	10	5	7	—	1	—	—	14 (5.5)	11 (4.3)	25 (9.8)
Intermediate upper angular	2	1	1	—	2	—	—	—	3 (1.2)	4 (1.6)	7 (2.8)
Intermediate lower angular	2	1	—	1	2	—	—	—	3 (1.2)	3 (1.2)	6 (2.4)
Intermediate on an extremity	—	1	2	—	—	—	—	—	3 (1.2)	—	3 (1.6)
TOTAL									131 (51.8)	122 (48.2)	253 (100)



tures of the bones of the hand and foot, forearm, shoulder and hip. Negative acceleration at the moment of impact led to damage to the internal organs of the abdomen, which were represented by ruptures of the bladder and mesentery of the colon. All the wounded and injured were found to have contusion injuries to the heart and lungs, as after the examination, the body returned to a horizontal position.

The final diagnosis was made by describing each injury in detail. Assessment of the overall range of diagnosis and treatment of patients was carried out in groups with an identical code, which made it possible to increase the reliability of statistical data and contributed to improving the organization of emergency medical care for the wounded and victims of this category.

При цьому складала інформативність клінічних даних $38,6 \pm 2,2$ %. This can be explained by the lack of objective data on damage to the abdominal organs, since with some extra-abdominal injuries, fractures of the lower ribs, lower thoracic and first lumbar vertebrae, pelvic bones and retroperitoneal hematomas, unconscious victims have a clear picture of an “acute abdomen”, the so-called “pseudo-abdominal syndrome”.

Variants of the leading symptoms were also identified, such as peritoneal (with injuries to hollow organs), detected in 16.3 % of cases, symptoms of intra-abdominal bleeding (with injuries to parenchymal organs) in 38.6 %) and symptoms from the urinary tract (urinary retention, painful urination, hematuria), observed in 3.2 % of cases.

In 50.2 % of cases, these symptoms were combined with simultaneous damage to the hollow and paranchymal organs. The nature of damage to parenchymal organs using echosonography was determined by changes in size and configuration, violation of structural uniformity, absence of a typical ultrasound picture of the studied area, the presence of anechoic or hypoechoic areas characteristic of subcapsular hematomas and areas of increased echogenicity.

Thus, the spleen hematoma was visualized as a double contour of the echonegative structure (fig. 1).



Fig. 1. Subcapsular hematoma of the spleen (victim P., 30 years old)

The rupture of the spleen looked like an anechoic defect of the edge and parenchyma (fig. 2).



Fig. 2. Rupture of the spleen in the gate area (victim O., 41 years old)

In case of combined injuries to the abdomen, retroperitoneal space, small pelvis, as well as with an unidentified source of bleeding due to catatrauma, angiographic examination was performed, starting with abdominal aortography or arteriography of pelvic vessels.

Indications for emergency angiography were considered:

- 1) suspected damage to a large vessel;
- 2) progressive increase in the volume and size of Central or subcapsular hematomas of parenchymal organs;
- 3) increase in limb ischemia due to compression of the main vessel by a pulsating hematoma;
- 4) the threat of early secondary bleeding;
- 5) combined damage to the pelvic bones, internal organs and blood vessels.

Bruising of the spleen on angiograms was manifested by spasm of the splenic artery, as well as its intraorgan branches up to arterioles, an increase in the size of the spleen, straightening of intraorgan arteries, breaks in intraorgan arteries, and slowing of spleen-venous shunts

Subcapsular rupture of the spleen was characterized by the detection of areas of uneven contrast of the parenchyma (a symptom of the «starry sky»), early arteriovenous discharge, extravasation of contrast agent in the spleen parenchyma, occlusion of intraorgan arteries of various calibers (fig. 3).

In spleen ruptures with capsule damage, along with the above hagiographic signs, extravasation of the contrast agent outside the organ contour and its fragmentation or defects in the spleen contour were noted in accordance with the site of damage.

At the same time, stage I of two-stage spleen rupture was characterized by splenomegaly with signs of subcapsular rupture, displacement of the spleen and left kidney.

Stage II was characterized by extravasation of the contrast agent into the retroperitoneal space, as well as fragmentation of the spleen due to organ rupture with damage to its capsule (fig. 4).

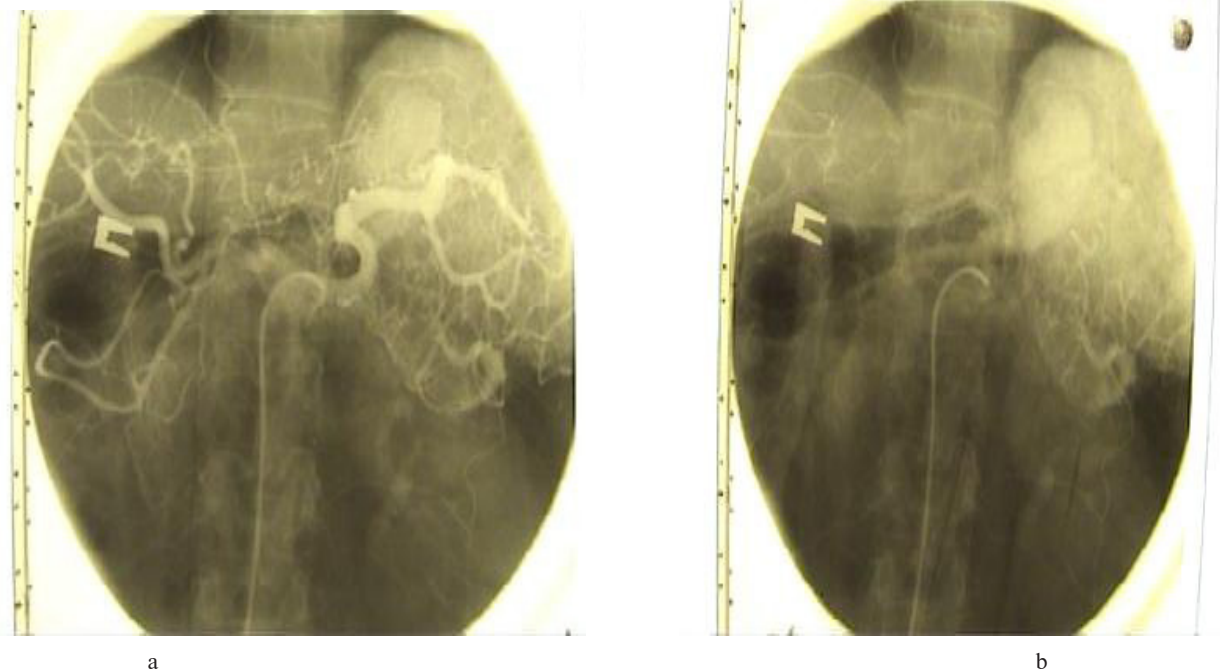


Fig. 3. Splenoarteriograms of the victim T., 34 years old: a) angiographic picture of subcapsular rupture of the spleen in the arterial Phase; B) extravasation of the contrast agent in the upper pole of the spleen (Black Arrow), early arteriovenous bypass surgery (white arrow), deformity of the vascular pattern due to subcapsular hematoma (parenchymal phase)

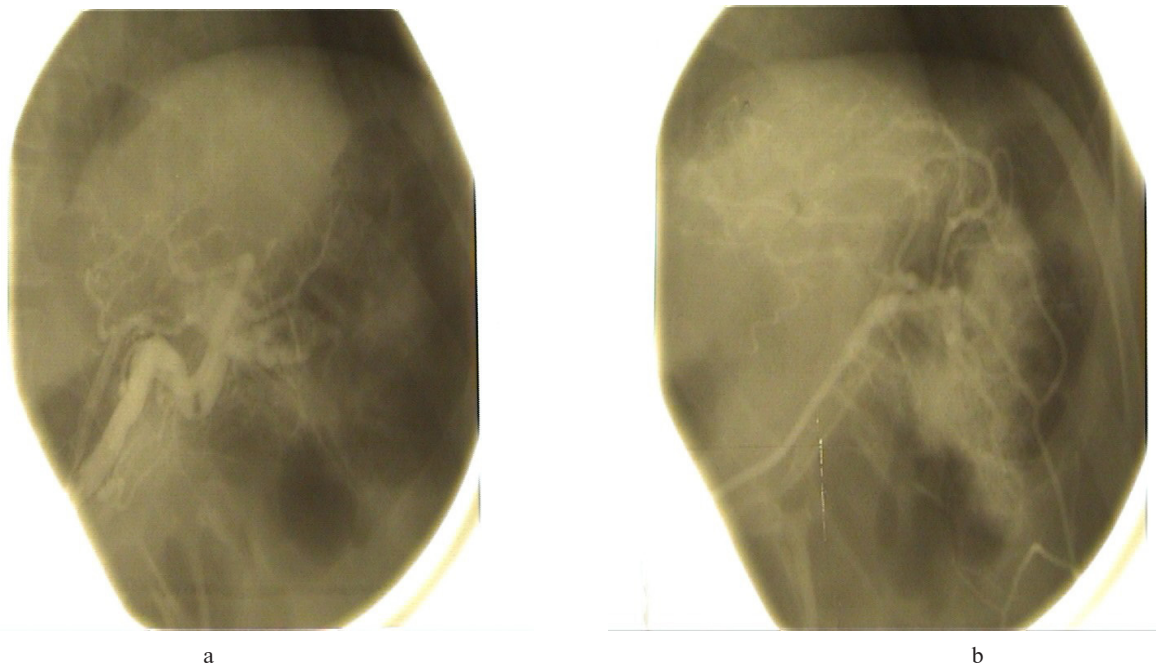


Fig. 4. Splenoarteriogram of the victim T., 41: a) early arteriovenous blood bypass surgery(arrow), spasm of segmental branches, deformity and depletion of the vascular pattern; B) picture of the “starry sky”, fragmentation of the spleen (Arrow) and an increase in its size

Liver contusion on arteriohepaticograms was manifested by spasm of the abdominal trunk, common hepatic artery, as well as intraorgan branches of a smaller order up to arterioles. There was also a slowdown in intrahepatic blood flow, uneven contrast of the parenchyma, and early contrast of the hepatic veins due to the opening of arteriovenous shunts.

Liver rupture on angiograms was detected by occlusion of arteries of various calibers up to occlusion

of the main trunk of the common hepatic artery, the presence of arteriovenous and arteriohepatic shunts, vascular displacement and deformity of the vascular pattern due to Gez.

Along with this, extravasation of the contrast agent was detected in the liver parenchyma during subcapsular ruptures and outside the organ contour during capsule damage. Post-traumatic arterial aneurysms of various calibers were significantly less common (fig. 5).

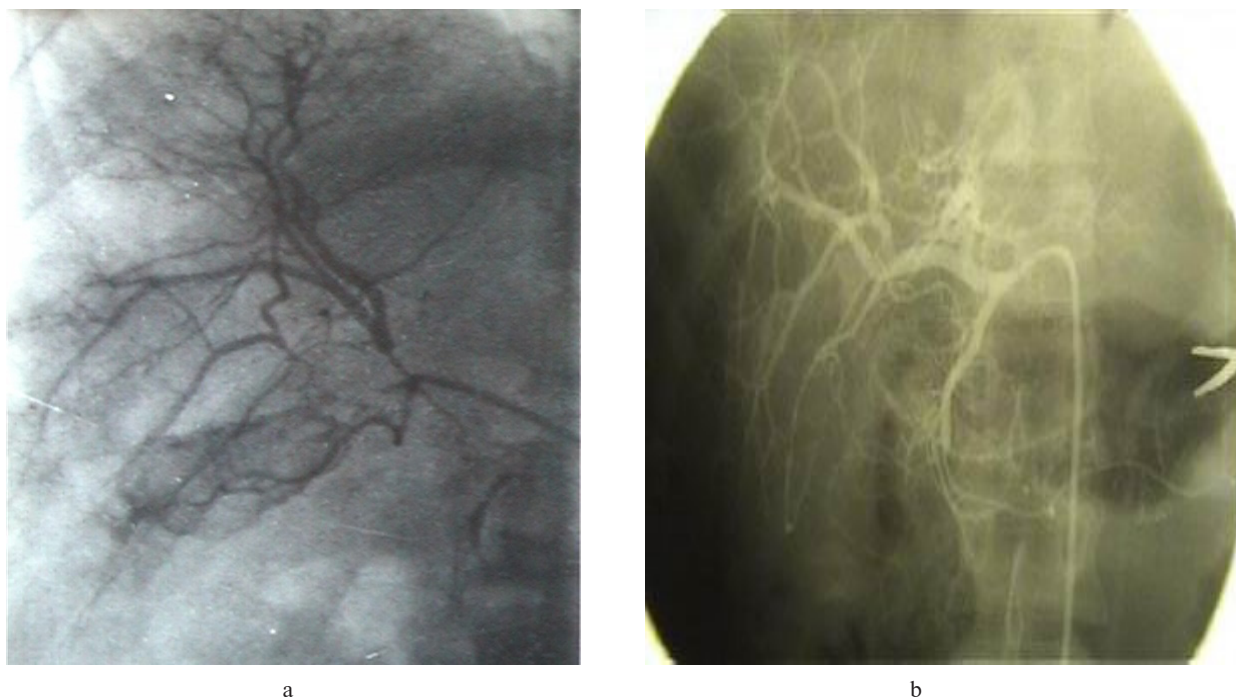


Fig. 5. Arteriohepaticogram a) victim M., 32 years old: extravasation of the contrast agent (Black Arrow), spasm of the segmental branches of the hepatic artery proper (white arrow) after rupture of the right lobe of the liver; B) victim S., 17 years old: arc-shaped displacement of the segmental branches of the hepatic artery around the intrahepatic hematoma (black arrows), spasm of the gastro-duodenal artery, contrast of false post-traumatic arterio-biliary fistula (white arrow)

Determination of anatomical variants of bleeding arteries detected during angiography, as well as detailed further analysis, made it possible to choose the appropriate method of endovascular hemostasis in each specific case.

Thus, occlusal and superselective angiography are the most informative studies for minimally invasive diagnosis of catrauma injuries. A higher percentage of direct signs of ongoing bleeding in traumatic injuries is associated with damage to larger arterial trunks and, as a result, a higher rate of bleeding itself.

A comprehensive approach was to observe the principle of prioritizing the diagnostic process, resuscitation measures and emergency surgical intervention from more severe and dangerous injuries to less dangerous ones. Priority functional diagnostic and resuscitation measures were aimed at identifying and eliminating violations of vital functions. Diagnostic measures were aimed at identifying possible damage to the chest, abdomen and retroperitoneal organs.

One of the most frequently damaged organs in catrauma is the spleen. According to the types of morphological disorders in spleen injury, different tactical approaches were used.

When the capsule breaks without violating the integrity of the parenchyma, that is. Type i and Type II rupture, which does not extend to the gate of the organ, sutures were applied to the entire depth of the rupture.

With Type III-pole rupture extending to the spleen gate, the victims underwent pole resection with wrapping the wound surface with a strand of the large omentum.

In Type IV, complete destruction of the spleen and its separation from the leg were observed, and therefore they underwent splenectomy.

Difficult to suture ruptures of the spleen in the area of its gate. To stop bleeding in such situations, a simple and effective method was used, developed by the staff of our clinic (patent of Ukraine 25964) (fig. 6 a, b).

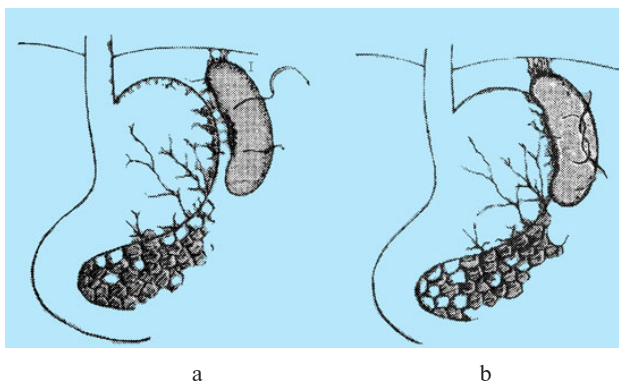


Fig. 6 a, b. Method of suturing a rupture of the spleen in the gate area

The method is as follows: a gray-serous suture was applied with a large curvature of the stomach near the location of the spleen rupture, with both ends of the thread passing through the spleen (a). The spleen tear was tamponaded with the gastro-

splenic ligament and the anterior wall of the stomach (B). This made it possible to reduce damage to the spleen tissue and achieve stable hemostasis.

The small number of spleen resections is due to the complexity of the intervention. Isolation of segmental arteries and veins, their treatment and subsequent resection of the spleen are practically impossible due to ongoing bleeding, damage to the vascular pedicle, the presence of a hematoma and the serious condition of the victim.

In such situations, the victims used the method of wedge-shaped resection of the spleen also developed in the clinic (patent of Ukraine 26233), which consists in achieving temporary hemostasis, for which a hemostatic clamp was applied as close as possible to the spleen gate, the vascular pedicle and Wedge were squeezed. the gastro-splenic ligament (fig. 7 a, b, c).

Performing these two types of organ-preserving operations to achieve hemostasis in case of spleen injuries depended on the condition of the victims and the severity of their condition. The preserved part of the spleen remains well supplied with blood, as was usually indicated by the bleeding wound surface and its normal color. Final hemostasis was achieved by applying a wrap suture and bringing the edges of the wound closer together, which has the appearance of a truncated cone. It should be noted that in this case, the gastro-splenic ligament played the role of a vascular pedicle for the preserved area of the spleen. A differentiated approach to the tactics of surgical interventions in victims with ruptured spleen made it possible to preserve it for the most part.

Thus, the introduction of modern technologies at the resuscitation and surgical stage in the form of emergency angiographic examination followed by endovascular hemostasis, as well as the use of developed methods of organ-preserving interventions on the spleen increased the informative value of clinical data, which amounted to $98.3 \pm 3.6\%$.

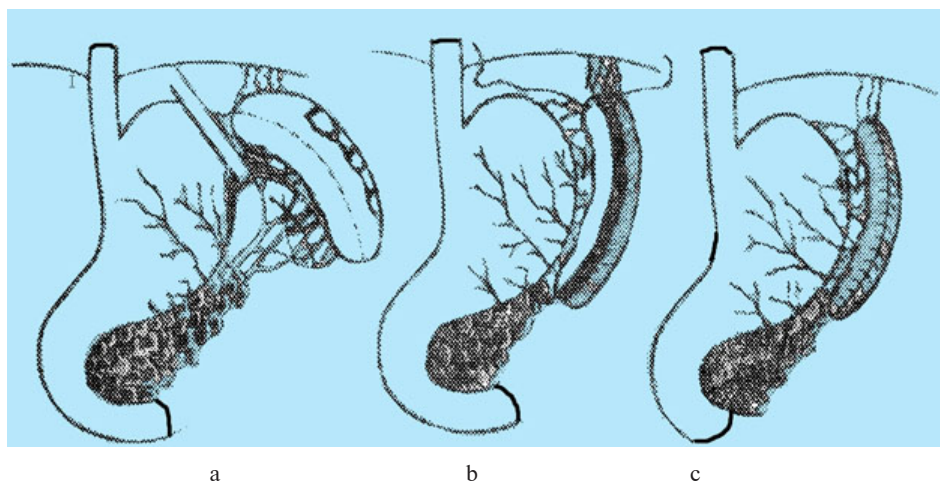


Fig. 7. Method of wedge-shaped resection of the spleen: a – to illustrate the level of ligature application to the vascular pedicle, the gastro-splenic ligament is pulled back by a farabef hook; the volume of the intended resection is indicated as a dotted line; b – the view of the stump of the spleen after resection in the form of a truncated cone; a continuous wrapping suture is applied; c – the final view of the preserved area of the spleen after wedge-shaped resection

As a result of our research, we have developed an algorithm for the treatment and diagnostic process for catatrauma, which is shown in fig. 8.

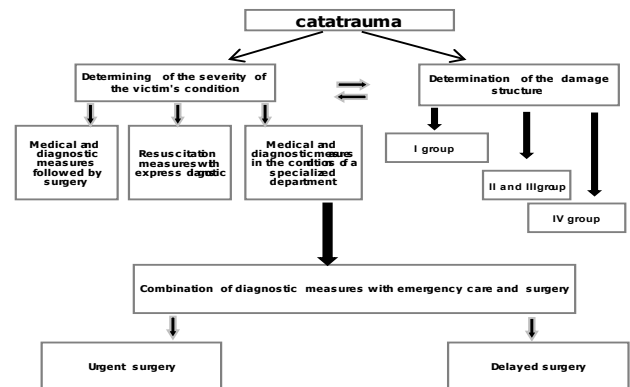


Fig. 8. Algorithm of the treatment and diagnostic process for catatrauma

Based on the measures given in the algorithm of the treatment and diagnostic process developed by us for catatrauma, it should be noted that the continuity and complexity of diagnostic manipulations, resuscitation measures and emergency surgical intervention were a complex rule of emergency care for catatrauma.

Conclusions

Taking into account that paramedics and related medical specialists participate in the Diagnostic and therapeutic processes for catatrauma, this study determined the need to develop a clear algorithm of actions for each of them.

Based on the study of traumatogenic factors, we have developed an algorithm for their application in the diagnostic approach for catatrauma, identification of the site of injury, the necessary complex of studies and consultations of related specialists, as well as taking into account the development of pos-



sible complications and deaths, which also requires a number of detailed diagnostic techniques.

The developed algorithm of medical and diagnostic approaches in various cases of catatrauma allows for the formation of practical actions for paramedics and medical personnel that take into account the as-

essment of the severity of the victim's condition for the purpose of their possible transportation, equipping local, central institutions and specialized medical centers with the necessary medical and diagnostic means, as well as conditions and personnel to provide appropriate types of emergency medical care.

REFERENCES

- Hula I. Problemy viiskovoi medytsyny v ukraini ta shliakhy vyrishennia v suchasnykh umovakh zbroinoho konfliktu 199-203. V kn.: Aktualni problemy ta perspektyvy rozvytku medychnoi nauky ta osvity: zb. nauk. prats, prysviachenyi 75-richchiiu kafedry medytsyny katastrof ta viiskovoi medytsyny Lvivskoho natsionalnoho medychnoho universytetu imeni Danyla Halytskoho / [uporiadnyk: V.V. Humeniuk]. Lviv, 2019. 235 c. [In Ukr.]
- Boiko V.V., Zamiatin P.M., Nehoduiko V.V. ta spivavt., Atlas boiovoi khirurhichnoi travmy (dosvid antyterorystychnoi operatsii/operatsii obiednanykh syl) Pid zahalnoiu redaktsiieiu V.I. Tsybaliuka. – Kharkiv; Kolehium, 2021. – 385 s. ISBN 978-617-7687-16-9. [In Ukr.]
- Boiko V.V., Zamiatin P.M., Nehoduiko V.V. ta spivavt., Likuvannia poranenykh z boiovyimy ushkodzhenniamy zhyvota (za dosvidom ATO/OOS): monohrafiia / za red. K.V. Humeniuka, I.P. Khomenka, I.A. Lurina ta in.; za zah. red. V.I. Tsybaliuka. – Kherson: Oldi+, 2022, - 194 s. ISBN 978-966-289-621-3. [In Ukr.]
- Boiko V.V., Zamiatin P.M., Ovusu F. Structure of injuries and the factors of traumatogenesis in catatrauma. *Klin Khir.* 2008 Jan;(1):43-5. PMID: 18610856.
- Faggiani M, Petruccelli E, Conforti LG, Massi A. Fall from heights: possible factors influencing the onset of complications. *Musculoskelet Surg.* 2022 Sep;106(3):297-301. doi: 10.1007/s12306-021-00701-2. Epub 2021 Feb 12. PMID: 33580450.
- Tsai WT, Chang CY, Hu CI. J Forensic Application of Analytical Mechanics in Fatal Fall From a Height. *Forensic Sci.* 2019 Jul;64(4):1230-1233. doi: 10.1111/1556-4029.14022. Epub 2019 Feb 8. PMID: 30735577.
- Zdarnlek M, Očko P, Jbikuta J, Nižnanská E, Jbidlo J. Addictive substances in fatal cases of fall/jump from height. *Soud Lek.* 2017 Spring;62(2):14-17. PMID: 28597664.
- Milaszkiwicz A, Cywka T, Teresiński G. Verification of usefulness of the method for determining the height of fatal falls proposed by Lau et al. *Arch Med Sadowej Kryminol.* 2019;69(3):93-99. doi: 10.5114/amsik.2019.94226. PMID: 32264659.
- Tsai WT, Hu CI, Chang CY. Effect of Wind on Horizontal Displacement of Fatal Fall from a Height. *J Forensic Sci.* 2020 Jan;65(1):255-258. doi: 10.1111/1556-4029.14169. Epub 2019 Aug 14. PMID: 31411743.
- Tsai WT, Chang CY, Hu CI. Forensic Application of Analytical Mechanics in Fatal Fall From a Height. *J Forensic Sci.* 2019 Jul;64(4):1230-1233. doi: 0.1111/1556-4029.14022. Epub 2019 Feb 8. PMID: 30735577.
- Casali MB, Blandino A, Grignaschi S, Florio EM, Travaini G, Genovese UR. The pathological diagnosis of the height of fatal falls: A mathematical approach. *Forensic Sci Int.* 2019 Sep;302:109883. doi: 10.1016/j.forsciint.2019.109883. Epub 2019 Jul 29. PMID: 31450068.
- Hsieh TM, Tsai CH, Liu HT, Huang CY, Chou SE, Su WT, Hsu SY, Hsieh CH. Effect of Height of Fall on Mortality in Patients with Fall Accidents: A Retrospective Cross-Sectional Study. *Int J Environ Res Public Health.* 2020 Jun 11;17(11):4163. doi: 10.3390/ijerph17114163. PMID: 32545236.
- Lohanathan A, Hazra D, Jyothirmayi CA, Kundavaram AP. An Elucidation of Pattern of Injuries in Patients with Fall from Height. *Indian J Crit Care Med.* 2020 Aug;24(8):683-687. doi: 10.5005/jp-journals-10071-23520. PMID: 33024375.
- Holubovych LL, Olkhovskiy VO, Herasymenko OI, Holubovych PL, Holubovych AL. ta in. *Osnovy sudovoi medytsyny /Kharkiv: FOP Brovin O.V., 2021. – 535 s. [In Ukr.]*
- Zamiatyn P.N., Boiko V.V., Holoborodko N.K., Zaitsev A.E. Khirurhiya domsnrnyushchskh povrezhdeniy hrudi i zhyvota pri politravme. Kharkov. 2006 – 182 s. [In Russ.]
- Çakı İE, Karadayı B, Zetin G. Relationship of injuries detected in fatal falls with sex, body mass index, and fall height: An autopsy study. *J Forensic Leg Med.* 2021 Feb;78:102113. doi: 10.1016/j.jflm.2020.102113. Epub 2021 Jan 15. PMID: 33485089.
- Fujii M, Shirakawa T, Nakamura M, Baba M, Hitosugi M. the injury severity score and the probability of survival in patients who fell from height. *Sci Rep.* 2021 Jul 30;11(1):15561. doi: 10.1038/s41598-021-95226-w. PMID: 34330987.
- Likuvannia poranenykh z boiovyimy ushkodzhenniamy zhyvota (za dosvidom ATO/OOS): monohrafiia / za zah. red. V. I. Tsybaliuka. – Kherson: Oldi plus, 2022. – 194 s.
- Hatamabadi H, Arhami Dolatabadi A, Atighinasab B, Safari S. Baseline Characteristics of fall from Height Victims Presenting to Emergency Department; a Brief Report. *Emerg (Tehran).* 2017;5(1):e55. Epub 2017 Jan 31. PMID: 28894771.
- Thoracic trauma in fatal falls from height - Traumatic pneumopericardium correlates with height of fall and severe injury. Heimer J, Gascho D, Thali MJ, Schweitzer W. *Forensic Sci Med Pathol.* 2018 Jun;14(2):188-193. doi: 10.1007/s12024 -018-9977-7. Epub 2018 May 3. PMID: 29725818.
- Cardiac Rupture Due to a Fall from Height: The 'Water Hammer' Effect. Sharma MD, Gupta N, Rajkumar T, Sharma A. *Aerosp Med Hum Perform.* 2022 Oct 1;93(10):755-757. doi: 10.3357/AMHP.6054.2022. PMID: 36243914.
- Merryweather AS, Morse JM, Doig AK, Godfrey NW, Gervais P, Blowski DS. Effects of bed height on the biomechanics of hospital bed entry and egress. *Work.* 2015;52(3):707-13. doi: 10.3233/WOR-152110. PMID: 26409356.
- Salonen E. M., Koivikko M. P., Koskinen S. K. Multidetector Computed Tomography Imaging of Facial Trauma in Accidental Falls from Heights // *Acta Radiologica* 2007. - Vol.48. – P. 449 – 455.
- Arai T, Fujita H, Maruya K, Morita Y, Asahi R, Ishibasi H. Loss of height predicts fall risk in elderly Japanese: a prospective cohort study. *J Bone Miner Metab.* 2023 Jan;41(1):88-94. doi: 10.1007/s00774-022-01383-x. Epub 2022 Dec 13. PMID: 36513883.
- Abe T, Nakamae A, Toriyama M, Hirata K, Adachi N. Effects of limited previously acquired information about falling height on lower limb biomechanics when

- individuals are landing with limited visual input. Clin Biomech (Bristol, Avon). 2022 Jun;96:105661. doi: 10.1016/j.clinbiomech.2022.105661. Epub 2022 May 7. PMID: 35588585.
26. Miura Y, Shinya M. Foot clearance when crossing obstacles of different heights with the lead and trail limbs. Gait Posture. 2021 Jul;88:155-160. doi: 10.1016/j.gaitpost.2021.05.020. Epub 2021 May 24. PMID: 34052473.
27. Komisar V, Nirmalanathan K, Novak AC. Influence of handrail height and fall direction on center of mass control and the physical demands of reach-to-grasp balance recovery reactions. Gait Posture. 2018 Feb;60:209-216. doi: 10.1016/j.gaitpost.2017.12.009. Epub 2017 Dec 14. PMID: 29277059.
28. Jachowicz M, Owczarek G. Int J Studies of Acceleration of the Human Body during Overturning and Falling from a Height Protected by a Self-Locking Device. Environ Res Public Health. 2022 Sep 24;19(19):12077. doi: 10.3390/ijerph191912077. PMID: 36231379.
29. Lim KT, Choi WJ. Effect of fall characteristics on the severity of hip impact during a fall on the ground from standing height. Osteoporos Int. 2020 Sep;31(9):1713-1719. doi: 10.1007/s00198-020-05432-x. Epub 2020 Apr 28. PMID: 32346772.

ЛІКУВАЛЬНО- ДІАГНОСТИЧНІ ЗАХОДИ ЗА ПОШКОДЖЕННЯ ОРГАНІВ ЧЕРЕВНОЇ ПАРОЖНИНИ У ПОРАНЕНИХ ТА ПОТЕРПІЛИХ З КАТАТРАВМАМИ НА ФОНІ ВИБУХОВО- ТЕХНОГЕННИХ ТРАВМ

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Резюме. В умовах широкомасштабної війни Російської Федерації проти України актуальною є проблема поранень, отриманих внаслідок кататравми.

Матеріали та методи. Проаналізовано 203 випадки кататравматичного ушкодження. Оглянуто та проліковано 128 таких поранених.

Результати та їх обговорення. Виявлено 4 клінічні групи поранених і травмованих. Ступінь тяжкості ушкоджень оцінювали за кількістю уражених органів черевної порожнини (АТ), характером і ступенем їх пошкоджень. Виділено 4 типи падінь. Провідні симптоми: перитонеальні (16,3 % випадків), симптоми внутрішньочеревної кровотечі (38,6 %), симптоми сечовивідних шляхів (3,2 %). У 50,2 % випадків ці симптоми поєднувалися з одночасним ураженням порожнистих і паренхіматозних органів. Одним з найбільш часто ушкоджуваних органів при кататравмі є селезінка. Детально викладено хірургічну тактику при ранах, пов'язаних з кататравмою, та розроблено алгоритм лікувально-діагностичного процесу при кататравмі.

Висновки. В умовах війни необхідно розробити чіткий алгоритм дій, який включає ідентифікацію місця ураження, необхідний комплекс досліджень і консультацій профільних спеціалістів з урахуванням розвитку можливих ускладнень і летальних випадків, що також вимагає ряду детальних діагностичних методів. Розроблені алгоритми діагностичного підходу при різних випадках кататравми дозволяють сформулювати практичні дії середнього та медичного персоналу.

Ключові слова: кататравма, вибухові поранення, техногенна травма, забій живота.