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DÖYÜŞ TRAVMASI NƏTİCƏSİNDƏ QARIN BOŞLUĞU ORQANLARININ ZƏDƏLƏNMƏSİNİN DİAQNOSTİKASINDA ULTRASƏS, RENTGENOQRAFİYA VƏ KOMPÜTER TOMOQRAFİYASININ NƏTİCƏLƏRİNİN MÜQAYİSƏSİ

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Xülasə. *Məqalədə döyüş əməliyyatları zamanı qarın orqanlarının zədələnməsinin diaqnostikasında rentgenoqrafiyanın, ultrasəs müayinəsinin və kompüter tomoqrafiyasının nəticələri müqayisə edilib. Tədqiqata 63 xəstə cəlb edilmiş və ümumilikdə 107 zədələnmə qeydə alınmışdır. 13 xəstədə mədə, 39 nəfərdə nazik bağırsaq, 26 yaralıda yoğun bağırsaq, 13 nəfərdə qaraciyər, 3 xəstədə mədəaltı vəzi və 12 halda dalaq zədələnməsi qeydə alınıb.*

29 (93,5±4,4%) halda rentgenoqrafiya, 27 (87,1±6,0%) ultrasəs müayinəsi, 30 (96,8±3,2%) halda KT müayinəsi zamanı pnevmoperitonium müəyyən edilib. Müvafiq olaraq 21 (45,7±7,3%), 31 (67,4±6,9%) və 43 (93,5±4,4%) xəstədə hemoperitoneum diaqnozu qoyulub. Ultrasəs və KT-nin ($p<0,01$), ultrasəs və rentgenoqrafiyanın ($p<0,01$), KT və rentgenoqrafiyanın ($p<0,001$) arasında statistik əhəmiyyətli fərqlər alınıb.

Açar sözlər*: ultrasonoqrafiya, rentgenoqrafiya, kompüter-tomoqrafiya, qarın boşluğu organlarının döyüş zədələnməsi*

Ключевые слова*: ультрасонография, рентгенография, компьютерная томография, боевая травма органов брюшной полости*

Key words*: ultrasonography, radiography, CT scan, combat abdomen injuries*

COMPARISON OF THE RESULTS OF ULTRASONOGRAPHY, RADIOGRAPHY AND COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF ABDOMINAL ORGANS DAMAGE IN COMBAT TRAUMA

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Summary. *The article compared the results of radiography, ultrasonography and computed tomography in the diagnosis of abdominal organ injuries in 63 patients during combat operations. A total of 107 injuries were recorded. Damage to the stomach was noted in 13 cases, small intestine - in 39, colon - in 26, liver – in 13, pancreas – in 3 and spleen – in 12 cases.*

Pneumoperitoneum was diagnosed by radiography in 29 (93.5±4.4%), ultrasonography – in 27 (87.1±6.0%), CT – in 30 (96.8±3.2%) cases, respectively. Hemoperitoneum was diagnosed in 21

(45.7±7.3%), 31 (67.4±6.9%) and 43 (93.5±4.4%) cases, respectively. A statistically significant difference was obtained between the results of ultrasound and CT (P<0.01), ultrasound and radiography (P<0.01), CT and radiography (P<0.001).

In recent armed conflicts, there has been a decrease in mortality from abdominal wounds, while at the same time an increase in the frequency of combined and severe forms of injuries to the stomach, small and large intestine. This trend is due to the widespread use of high-energy automatic small arms, further improvement of the combat properties of shells, mines, and various explosives [1]. The frequency of injuries to individual organs of the abdominal cavity due to gunshot wounds ranges on average from 7.0% to 20.6%, in particular the duodenum – from 0.4% to 20.6%, distal parts of the small intestine – from 21.1% to 42.1%, colon - from 2.7% to 8.2% [2, 3].

In the diagnosis of injuries to the abdominal organs – stomach, esophagus, small intestine, colon, emergency radiodiagnosis plays a very important role from the moment the wounded person is admitted to a hospital of the IV level of medical care. In addition to assessing the nature and severity of damage to these organs, radiation diagnostic methods have prognostic value for determining the development of certain postoperative complications [4 -7].

The clinical picture of gunshot wounds to the abdomen depends on the nature (penetrating or non-penetrating) of the wound, the presence and degree of damage to internal organs. However, with multiple and combined injuries, the clinical differentiation of penetrating and non-penetrating wounds is significantly difficult due to the layering of symptoms of damage of different locations [8, 9]. In this case, the clinical picture largely depends on the localization of the dominant damage, leading to bleeding, shock or peritonitis [10]. Clinical methods of examining patients with injuries to the abdominal organs are always complemented by invasive ones, such as laparoscopy, laparocentesis and surgical exploration of the wound [11].

Radiation research methods, such as radiography, ultrasound (US) and multidetector computed tomography (MDCT) are important in diagnosing the nature of damage to the abdominal organs in abdominal wounds. In addition to damage to the esophagus, stomach, small and large intestines, with abdominal wounds there is a need to establish the localization of the wound channel, the presence of free fluid and gas in the abdominal cavity and retroperitoneal space [12, 13]. X-ray contrast studies of wounds are used at levels II-III of medical evacuation and are carried out in two projections. To clarify damage to internal organs in abdominal wounds, endovideosurgical methods of diagnosis and treatment are actively used [14, 15].

The diagnostic ability of medical imaging methods for damage to the stomach, small and large intestines is complicated in the case of multiple and combined injuries without a dominant abdominal component of the injury. Thus, with traumatic brain, spinal or pelvic trauma, damage to the abdominal organs is masked by neurological symptoms [16].

Assessing the significance of radiation research methods in diagnosing the nature of damage to the abdominal organs, determining the presence and localization of free liquid and gas is an urgent task in combat trauma to the abdomen.

The purpose of the study is to evaluate of the possibility of radiation research methods in the diagnosis of damage to the abdominal organs as a result of combat trauma.

Material and methods. The study included data from radiography, ultrasonography and computed tomography of 63 patients with traumatic injuries to the abdominal organs as a result of combat operations. The age of the patients ranged from 29-46 years.

Statistical analysis was carried out using the method of variation statistics. Student's t test was used to assess differences in quantitative indicators between groups. Differences were considered significant at $p<0.05$.

Results and discussion. Table 1 presents data on the incidence of abdominal organ injury. The total number of injuries to the abdominal organs was 107 cases: of which the stomach in 13 (12.1%), small intestine in 39

(36.4%), colon in 26 (24.3%), liver in 14 (13.1 %), pancreas in 3 (2.8%), spleen in 12 (11.2%) cases, respectively.

As can be seen from the table, gastric injuries were diagnosed using ultrasonography in 8 (61.5±13.5%) cases, with radiography in 11 (84.6±10.0%) and computed tomography in all 13 (100.0±2 .8%) cases. There were no statistically significant differences between the results of radiography and ultrasonography, as well as between radiography and computed tomography. However, the difference between the results of ultrasonography and computed tomography was statistically significant (P<0.01). In the diagnosis of small intestinal injuries, the results of the presented methods were 18 (46.2±8.0%), 34 (87.2±5.3%) and 36 (92.3±4.3%), respectively. For the colon, the results were 15 (57.7±9.7%), 23 (88.5±6.3%) and 25 (96.2±3.7%), respectively. With ultrasonography, damage to the small and large intestines was diagnosed significantly (p<0.01) worse than with radiography and computed tomography.

X-ray examination of the parenchymal organs clearly identified the presence of explosive fragments and bullets, however, direct visualization of the rupture of the parenchymal organs is usually limited, so we compared only the results of ultrasonography and computed tomography. As can be seen from the table, using ultrasonography, only in one case damage to the liver, spleen and pancreas were not diagnosed. However, the difference between the results of ultrasonography and computed tomography was not statistically significant.

Table 2 presents the results of radiography, ultrasonography and computed tomography in the diagnosis of free gases, blood and foreign bodies in the abdominal cavity. Pneumoperitoneum (gas in the abdominal cavity) X-ray was diagnosed in 29 (93.5±4.4), with ultrasound – in 27 (87.1±6.0), with computed tomography – in 30 (96.8±3. 2%) cases, respectively. The difference between them was not statistically significant. Hemoperitoneum (blood in the abdominal cavity) was diagnosed in 21 (45.7±7.3%), 31 (67.4±6.9%) and 43 (93.5±4.4%) cases, respectively. There was a statistically significant difference between the results of ultrasonography and computed tomography (P<0.01), ultrasonography and radiography (P<0.01), and computed tomography and radiography (P<0.001).

Table 1. Informativeness of radiography, ultrasonography and computed tomography in the diagnosis of damage to abdominal organs

Localization	X-ray	Ultrasound	CT	Total (n = 107)
	1	2	3	
Stomach	11 (84,6±10,0%)	8 (61,5±13,5%)	13 (100,0±2,8%) P3-2 <0,01	13
Small intestine	34 (87,2± 5,3%) P1-2<0,01	18 (46,2±8,0%)	36 (92,3±4,3%) P3-2<0,01	39
Colon	23 (88,5± 6,3%) P1-2<0,01	15 (57,7± 9,7%)	25 (96,2± 3,7%) P3-2<0,01	26
Liver	-	12 (85,7± 9,4%)	13 (92,9± 6,9%)	14
Pancreas	-	2 (66,7±27,2%)	3 (100,0±5,8%)	3
Spleen	-	11 (91,7± 8,0%)	12 (100,0± 2,9%)	12

Table 2. Results of X-ray, ultrasound and computed tomography in the diagnosis of gas, blood and foreign bodies in the abdominal cavity in combat abdominal trauma

Localization	X-ray	Ultrasound	CT	Total
	1	2	3	
Pneumoperitoneum	29 (93,5±4,4%)	27 (87,1±6,0%)	30 (96,8±3,2%)	31
Hemoperitoneum	21 (45,7± 7,3%)	31 (67,4±6,9%) P2-1 <0,01	43 (93,5±4,4%) P3-2 <0,01 P3-1 <0,001	46
Foreign bodies (bullets, fragments and others)	47 (90,4± 4,1%) P1-2 <0,01	36 (69,2± 6,4%)	51 (98,1± 1,9%) P3-2 <0,001	52

Computed tomography is the gold standard for determining traumatic injuries of the abdominal organs, in particular rupture of hollow organs. A gastric rupture was visualized on CT as an intermittent image of its wall (Fig. 1).

A survey polypositional x-ray examination in combination with clinical data, revealing free gas, liquid (blood, intestinal contents) in the abdominal cavity or in the retroperitoneal space, bloating of the stomach and intestines, their displacement, can indirectly determine the presence of serious injury to these organs. The sensitivity of radiography in detecting free gas in the abdominal cavity and retroperitoneal space is very high. Free gas is identified radiographically as a dark zone, and on ultrasonography as a hyperechoic line with a dorsal track (Fig. 2).

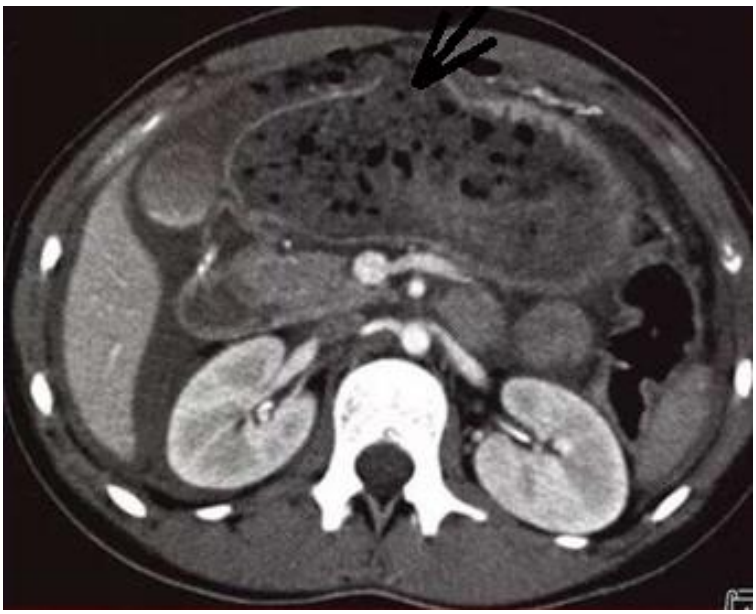

Fig. 1. CT scan of the abdominal organs, axial projection. Visible discontinuity in the image of the anterior wall of the stomach, the release of stomach contents beyond its limits into the abdominal cavity (arrow).

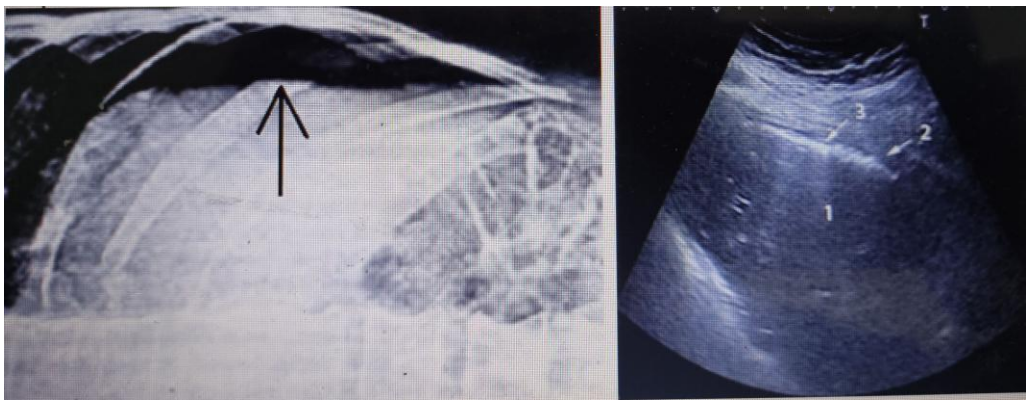

Fig. 2. On the left side of the image, X-ray detection of free gas in the right subdiaphragmatic zone with the patient lying on his left side. On the right side of the image, the echogram shows free gas in the form of a hyperechoic line (3) with a dorsal track (1).

In computed tomography and ultrasonography, signs of damage to parenchymal organs are contusion in the form of a violation of their architectonics, subcapsular, transcapsular, intraparenchymal rupture with the formation of a hematoma, the appearance of rupture lines, tissue heterogeneity, and the presence of free fluid in various pockets (Fig. 3, 4).

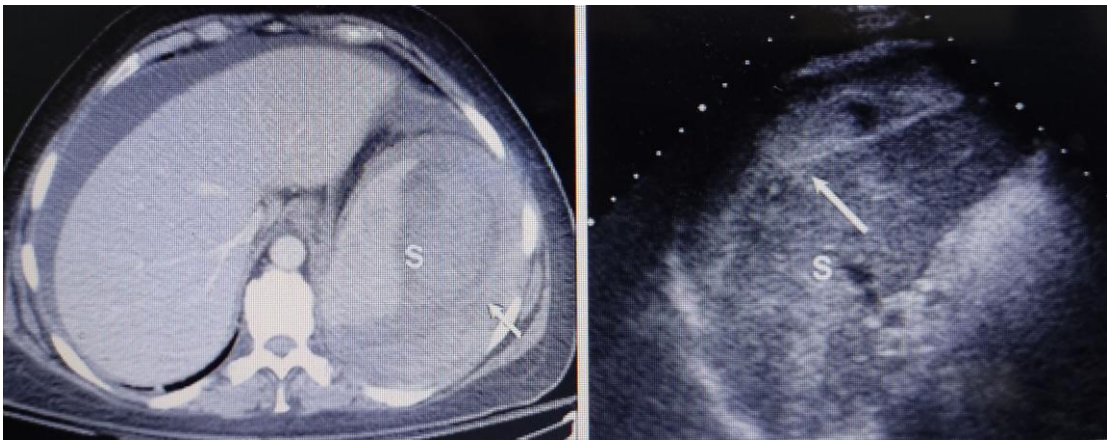

Fig. 3. On the left side of the image is a CT view, on the right side is an echographic view of a splenic rupture (s) with the formation of a subcapsular hematoma (arrow).

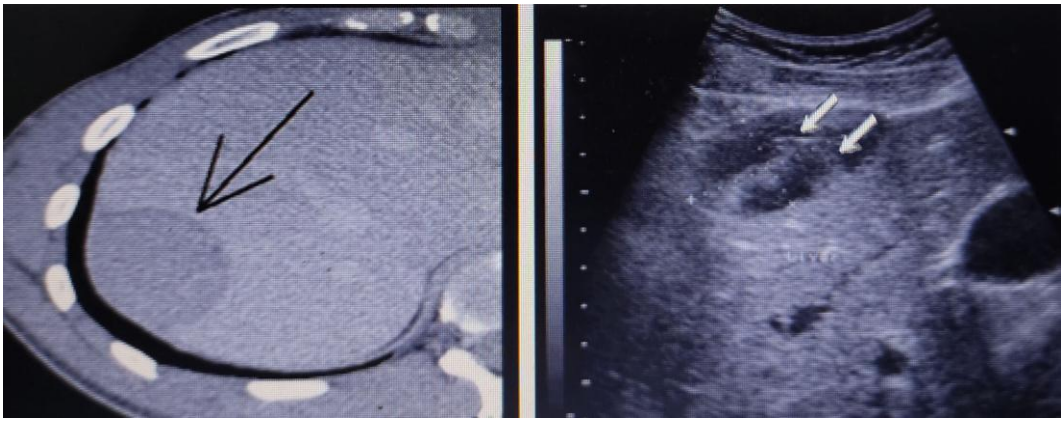

Fig. 4. On the left side of the image is a CT view (black arrow), on the right side is an echographic view of a liver rupture with the formation of a subcapsular hematoma (white arrows).

Discussion. The increase in the structure of modern combat trauma, the presence of multiple and combined wounds leads to significant difficulties in the treatment and evacuation of the wounded and injured, difficulties in providing surgical care and causes errors both in the treatment process and in the organizational one [17].

The current stage of optimization and improvement of the system for providing surgical care to victims with gunshot wounds of the abdomen is characterized by the widespread introduction of radiation research methods [18].

Currently, ultrasound is the main method of primary research for the rapid detection of free fluid or gas in the abdominal cavity in patients who have received various types of trauma, in particular during combat operations. On the one hand, effusion in the pockets of the abdominal cavity is an indirect sign of damage to internal organs, on the other hand, the method makes it possible to identify ruptures of parenchymal organs [19, 20].

Conclusions

1. In diagnosing damage to hollow organs during combat injuries, radiography has a significant advantage over ultrasound, but it is also significantly inferior to it in detecting blood in the abdominal cavity.

2. There are no significant differences between computed tomography and ultrasound in the diagnosis of damage to parenchymal organs.

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СРАВНЕНИЕ РЕЗУЛЬТАТОВ УЛЬТРАСОНОГРАФИИ, РЕНТГЕНОГРАФИИ И КОМПЬЮТЕРНОЙ ТОМОГРАФИИ В ДИАГНОСТИКЕ ПОВРЕЖДЕНИЙ ОРГАНОВ ЖИВОТА ВО ВРЕМЯ БОЕВОЙ ТРАВМЫ

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Резюме. В статье представлены сведения об исследовании, проведенного с целью сопоставления результатов рентгенографии, ультрасонографии и компьютерной томографии в диагностике повреждений абдоминальных органов у 63 пациентов во время боевых действий. Всего регистрировалось 107 повреждений. Повреждения желудка отмечалось в 13 случаев, тонкой кишки – в в 39, толстой кишки – в 26б печени – в 13, поджелудочной железы – в 3 и селезенки – в 12 случаев, соответственно.

Пневмоперитонеум при рентгенографии диагностирован в 29 (93,5±4,4%), ультрасонографии – в 27 (87,1±6,0%), КТ – в 30 (96,8±3,2%) случаев, соответственно. Гемоперитонеум был диагностирован в 21 (45,7± 7,3%), 31 (67,4±6,9%) и в 43 (93,5±4,4%) случаев, соответственно. Было выявлено статистически достоверное различие между результатами ультрасонографии и КТ ($P<0,01$), ультрасонографии и рентгенографии ($P<0,01$), а также КТ и рентгенографии ($P<0,001$).

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