

DOI: <https://doi.org/10.34921/amj.2024.4.011>

ODLU SİLAHLA YARALANMA ZAMANI QARIN BOŞLUĞUNUN PARENXİMAL ORQANLARININ ZƏDƏLƏNMƏSİNİN ULTRASƏS VƏ KOMPÜTER-TOMOQRAFİYA VASİTƏSİLƏ DİAQNOSTİKASI

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Xülasə. Məqalədə 65 yaralı xəstədə qarın boşluğunun parenximal orqanlarının zədələnməsinin diaqnostikasında ultrasəs müayinəsinin nəticələri təqdim edilir. Göstərilmişdir ki, qaraciyərin zədələnməsi 35 (53,8%), mədəaltı vəzinin zədələnməsi 7 (10,8%), dalağın zədələnməsi 23 (35,4%) halda qeydə alınıb. Parenximal orqanların zədələnməsinin diaqnostikasında ultrasəsin həssaslığı müvafiq olaraq 93,1%, spesifikliyi 85,7%, dəqiqliyi 92,3% təşkil edib.

Müəlliflərin fikrincə, qarın boşluğunun parenximal orqanlarının döyüş xəsarətlərinin diaqnostikasında ultrasəs müayinəsi kifayət qədər həssaslığa, spesifikliyə və dəqiqliyə malikdir. Beləliklə, metoddan yalnız ilkin diaqnostika üçün deyil, həm də kompüterli tomoqrafın olmadığı xəstəxanalarda alternativ üsul kimi effektiv şəkildə istifadə edilə bilər.

Açar sözlər: ultrasonografiya, kompüter-tomoqrafiya, qarın boşluğu orqanlarının döyüş zədələnməsi

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

Key words: ultrasonography, computed tomography scan, combat abdomen injuries

ULTRASOUND AND COMPUTED TOMOGRAPHIC DIAGNOSIS OF DAMAGE TO PARENCHYMAL ORGANS OF THE ABDOMINAL CAVITY IN GUNSHOT WOUNDS

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Summary. The article presents the results of ultrasound examination in the diagnosis of damage to the parenchymal organs of the abdominal cavity in 65 wounded patients. It was shown that liver damage was registered in 35 (53.8%) cases, pancreas – in 7 (10.8%), spleen – in 23 (35.4%) cases. The sensitivity of ultrasound examination in diagnostics of damage to parenchymatous organs was - 93,1%, specificity – 85.7%, accuracy – 92.3%, respectively.

According to the authors, in the diagnosis of combat injuries of parenchymatous organs of the abdominal cavity, ultrasound has sufficient sensitivity, specificity and accuracy. Thus, the method can be effectively used not only in primary diagnostics, as well as in hospitals as an alternative method where CT is not available.

Gunshot wounds to the abdomen are difficult to choose an adequate surgical tactic. They also create certain difficulties for the effectiveness of diagnostic methods of medical imaging [1-3]. Gunshot wounds to the abdomen are characterized by the development of combined functional disorders and various complications, which lead to increased mortality [4]. The results of treatment of gunshot wounds of the abdomen closely correlate with the timing of the start of surgical care, its quality, the timing and type of medical evacuation from different levels of medical care and the ability of forces and means to provide medical care [5]. In the diagnosis of gunshot wounds to the abdomen, medical imaging methods are of great importance, including ultrasound, digital radiography, and multidetector computed tomography. These methods allow us to assess the nature of the damage, its localization, which makes it possible to refuse unnecessary laparotomy and conduct dynamic observation [6, 7].

Gunshot wounds to the abdomen are often combined with chest wounds, and thoraco-abdominal wounds account for about 5% of all wounds, while the mortality rate fluctuates between 28-31%. In this category of victims, the use of the FAST protocol (Focused Assessment with Sonography for Trauma) has reduced the duration of preoperative diagnostics and reduced the number of diagnostic errors. FAST protocols allow for rapid triage of the wounded to select tactics for further highly qualified diagnostics using more expensive methods in a clinical setting [8-11].

The use of FAST protocols is particularly effective in the evaluation of blunt abdominal trauma, and its role in penetrating trauma is somewhat limited. Computed tomography (CT) is considered the best imaging method for the evaluation of penetrating abdominal trauma in hemodynamically stable patients [12]. However, FAST remains the preferred imaging method in the study of hemodynamically unstable patients [1].

In addition to clinical assessment of the severity of the wound in the context of trauma, it is necessary to improve medical imaging methods, since the complexity of diagnosis is due to the large number of combined and multiple injuries. Given the multifactorial nature of gunshot wounds to the abdomen,

when performing CT, it is necessary to scan all organs, and, if necessary, perform a study with contrast enhancement [13].

Due to its high sensitivity, specificity in determining the trajectory of wound channels, localization and severity of damage to parenchymatous and hollow organs, detection of foreign bodies, hemorrhages, CT plays an important role in sorting and choosing the tactics of treating the wounded. In general, CT allows identifying more than 50% of injuries to internal organs, which cannot be provided by other methods of medical imaging [14].

The purpose of the study is to evaluate of the possibility of ultrasound in the diagnosis of damage to the parenchymal organs of abdominal cavity as a result of gunshot wounds.

Material and methods. The study included data from ultrasound and computed tomography of 65 patients with traumatic injuries to the parenchymal organs of abdominal cavity as a result of gunshot wounds. The age of the patients ranged from 27-48 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 $p < 0.05$. The sensitivity, specificity, and accuracy of ultrasound in diagnosing damage to the parenchymal organs of abdominal cavity as a result of gunshot wounds.

Results and discussion. The results of a comprehensive study of 65 wounded patients with complex combat injuries to the abdomen were analyzed. All patients underwent ultrasound and computer tomography. The mechanism of injury and the nature of the wound channel were taken into account when analyzing the results. The wound channel in 23 (35.4±5.9%) patients was through, blind in 24 (36.9±5.8%), and combined in 18 (27.7±5.6%) patients. No significant differences were found between the frequency of occurrence of different types of wound channel. According to the mechanism of injury, 17 (26.2±5.4%) of the patients had bullet injuries, 29 (44.6±6.2%) had shrapnel injuries and 19 (29.2±5.6%) had explosive injuries. Shrapnel wounds were statistically significantly ($p < 0.05$) more common than bullet wounds.

Liver damage was observed in 35 (53.8±6.2%) cases, pancreas – in 7 (10.8±3.8%) cases, spleen – in 23 (35.4±5.9%) cases, respec-

tively. As can be seen from the table, damage to the liver and spleen was observed significantly more often than to the pancreas ($p<0.001$). The difference between the frequency of damage to the liver and spleen also had a statistically significant ($p<0.001$) value.

Table 1 presents the results of USG in diagnostics of damages of parenchimal organs of abdominal cavity, which were revealed by CT with contrast. In 58 cases the results of USG were true positive (TP), in 4 cases false negative (FN), in 6 cases true negative (TN), in 1 case false positive (FP). The sensitivity of USG was 93.1%, specificity - 85.7%, accuracy - 92.3%, respectively (Table).

Table. Results of USG in diagnosing injuries of large abdominal vessels

Trauma of parenchimal organs of abdominal cavity by contrast-enhanced CT (n=65)			
Yes		No	
58		7	
TP	FN	TN	FP
54	4	6	1
Sensitivity		93,1%	
Specificity		85,7%	
Accuracy		92,3%	

Note: TP – true positive, FN – false negative, TN – true negative, FP – false positive.

During the passage of a projectile near the liver, without damaging its capsule and

parenchyma, but with damage to adjacent organs, the main sign is hemorrhage foci - diffuse or formed in the form of hematomas. They look like accumulations of fluid or clots, with a density of 20 to 80 HU. Hemorrhages can be located under the capsule, they have a sickle-shaped form (repeating the line of the capsule), adjoin it and have a density of 30 to 50 HU. White hematomas can also be located in the parenchyma of an organ; they look like homogeneous, relatively low-density masses of various shapes - from round to irregular. Intrahepatic ruptures look like cracks, often along vessels and straits. They are visible as sharply defined lines (often branched) of reduced density. If the liver is damaged by a projectile (ball, fragments), the visualized wound channel is filled with blood, detritus, and air bubbles. In case of a blind wound, at the end of the wound channel the wounding projectile or its fragments (Fig. 1, 2).

The spleen is most often damaged in the case of a closed abdominal injury. Its main symptom is severe intraperitoneal bleeding. This happens when the organ ruptures with damage to the capsule and parenchyma. In case of complete rupture of the organ, blood without gas bubbles is detected in the abdominal cavity.

In the case of subcapsular ruptures and the formation of an intra-organ hematoma, the picture is different: a significant increase in the contours of the spleen with preservation of their integrity is determined (Fig. 3, 4).



Fig. 1. CT scan of abdominal organs, axial projection. Penetrating gunshot wound to the abdominal cavity, injury to the right lobe of the liver, hemopneumoperitoneum (arrows).

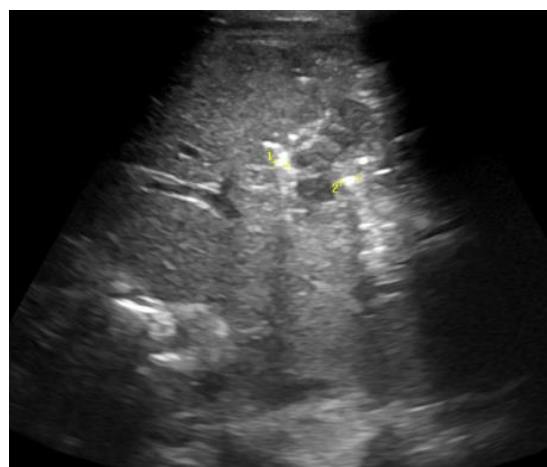


Fig. 2. Shrapnel wounds of the liver. On ultrasound, fragments in the liver are visible as luminous inclusions with the acoustic phenomenon of a “comet tail”.



Fig. 3. CT scan of abdominal organs, axial projection. Penetrating abdominal gunshot (bullet), splenic rupture, hemopneumoperitoneum (inferior arrows).

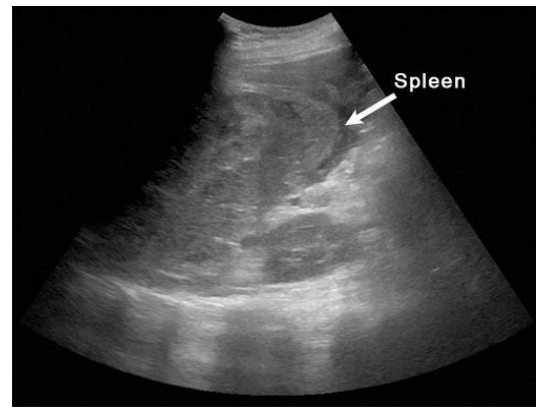


Fig. 4. Penetrating abdominal gunshot wound. Ultrasound view of the splenic rupture, hemoperitoneum (arrow) in B mode.

Foreign bodies (balls, metal fragments, bone fragments, etc.) were most often found in the liver and lungs. Metal fragments were found in 2/3 of those injured as a result of ammunition explosions in unprotected areas of the body (Fig. 5, 6).



Fig. 5. CT scan of abdominal organs, axial projection. Penetrating gunshot (shrapnel) injury to the abdominal cavity, injury to the right lobe of the liver

In the case of pancreatic injuries caused by hydrodynamic impact, swelling of the gland, the appearance of local pathological formations in the parenchyma, and peripancreatic fluid accumulations are determined. When destroyed by a wounding projectile, a violation of the integrity of the organ parenchyma with massive peri-organ hemorrhages is determined (Fig. 7).



Fig. 6. Ultrasound visualization of a bullet in the right part of the liver in the form of a hyperechoic linear formation with an acoustic shadow (arrow).



Fig. 7. CT scan of the abdominal cavity, axial projection in the case of a penetrating gunshot wound to the abdomen with damage to the pancreas.

Discussion

Computed tomography is an important in diagnosing the nature of damage to the abdominal organs in abdominal wounds. There is a need to establish the localization of the wound channel, the presence of free fluid, bullet and foreign bodies [15]. Direct signs of damage to internal organs were violations of their integrity, in the form of changes in architecture, blurring of the outer contour, and the appearance of a hematoma [13].

In determining the trajectory of wound channels, localization and severity of damage to parenchymal organs, detection of foreign bodies, hemorrhages, CT has high sensitivity, specificity and accuracy [14]. Currently, CT with contrast is the main method of non-invasive diagnosis of abdominal organ damage [16].

In the detection of free fluid or gas in the abdominal cavity in patients who have received various types of trauma, in particular during combat operations, ultrasound is recognized as the primary imaging method [11].

Our studies have shown that ultrasound in the diagnosis of damage to parenchymatous organs in patients with a gunshot wound to the abdomen has sufficient sensitivity, specificity and accuracy, which allows it to be used when CT scanning is unavailable.

Conclusions

In diagnosing damage to parenchymal organs of the abdominal cavity during combat injuries, ultrasound has a sufficient sensitivity, specificity and accuracy, which allows it to be an effective diagnostic method before the hospital stage and in institutions where CT scanning is unavailable.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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УЛЬТРАЗВУКОВАЯ И КОМПЬЮТЕРНО-ТОМОГРАФИЧЕСКАЯ ДИАГНОСТИКА ПОВРЕЖДЕНИЙ ПАРЕНХИМАТОЗНЫХ ОРГАНОВ БРЮШНОЙ ПОЛОСТИ ПРИ ОГНЕСТРЕЛЬНЫХ РАНЕНИЯХ

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Резюме. В статье представлены результаты ультразвукового исследования при диагностике повреждений паренхиматозных органов брюшной полости у 65 раненных. Показано, что повреждение печени зарегистрировано в 35 (53,8%), поджелудочной железы – в 7 (10,8%), селезенки – в 23 (35,4%) случаев. Чувствительность ультразвукового исследования в диагностике повреждений паренхиматозных органов составила 93,1%, специфичность – 85,7%, точность – 92,3%, соответственно.

По мнению авторов, в диагностике боевых травм паренхиматозных органов брюшной полости УЗИ обладает достаточной чувствительностью, специфичностью и точностью. Тем самым метод может эффективно использоваться не только при первичной диагностике, а также в госпиталях в качестве альтернативного метода, где отсутствует КТ.

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