

DOI: <https://doi.org/10.34921/amj.2025.1.014>**QARIN NAHIYƏSİNDƏN TRAVMA ALMIŞ VƏ DAXİLİ QANAXMADAN ŞÜBHƏLİ  
OLAN XƏSTƏLƏRİN HOSPİTALİZASIYASININ ERKƏN MƏRHƏLƏSİNDƏ  
SONOQRAFİK MÜAYİNƏNİN PROQNOSTİK İMKANLARI****Y.V.Şkatula, İ.V.Bandura, Y.A.Tkaçenko, Y.V.Xijnya, C.O.Neqluşsenko***Sumı Dövlət Universiteti Təhsil-Elmi Tibb İnstitutu Təcili tibbi yardım və fəlakətlər təbabəti  
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*Məqalədə qarın nahiyəsindən travma almış və daxili qanaxmaya şübhə olan xəstələrin hospitalizasiyasının erkən mərhələsində ultrasəsle müayinənin effektivliyini və diaqnostik dəyərini müəyyənəşdirmək məqsədilə aparılmış tədqiqat işi haqqında məlumat verilmişdir.*

*2023-2024-cü illərdə qarın nahiyəsinin travmatik zədələnməsinə görə təxirəsalınmaz qaydada hospitalizasiya edilmiş 39 xəstə müayinə edilmişdir. Sonoqrafik tədqiqat FAST protokolu (Qlazqo Koma Şkalası – Glasgow Coma Scale) vasitəsilə aparılmışdır; travmatik zədələnmələrin ağırlıq dərəcəsi ISS (Injury Severity Score – zədələnmənin ağırlığı şkalası), zərərçəkmiş xəstələrin vəziyyətinin ağırlığı isə RTS (Revised Trauma Score – Travmanın yoxlanılması şkalası) vasitəsilə müəyyənəşdirilmişdir.*

*Tədqiqat nəticəsində hemodinamika göstəriciləri (sistolik təzyiqin azalması və ürək vurğularının tezləşməsi) FAST protokolu üzrə müayinənin nəticələrinin neqativ istiqamətdə dəyişməi arasında statistik baxımdan etibarlı əlaqə müşahidə edilmişdir. Bundan əlavə, metodun yüksək dərəcədə həssas olduğu aşkar edilmişdir. Praktik olaraq xəstələrin hamısının klinik simptomatikasının FAST protokolu üzrə müsbət nəticəsi (xüsusən qeyri-stabil hemodinamika şəraitində qarın boşluğu operasiyalarına (plerva boşluğunun drenaj edilməsi, laparoskopiya, diaqnostik peritoneal lavaj və ya laparotomiya) göstəriş hesab edilmişdir.*

*Travmatik zədələnmə ilə zərərçəkmişin vəziyyətinin ağırlığı (müxtəlif şkalalar – GCS, ISS, RTS) və FAST protokolu göstəriciləri arasında aşkar əlaqə müşahidə edilməmişdir. Bunu zərərçəkmişlərdə kəllə-skelet travmalarının da olması ilə izah etmək olar. Lakin bu travmaların tam diaqnostikası üçün tək sonoqrafiya kifayət etmir.*

*Müəlliflərin fikrincə, FAST protokolundan istifadə edilməklə aparılan sonoqrafik müayinənin müsbət nəticəsi hemodinamikası qeyri-stabil olan xəstələrdə operativ müdaxilənin zəruriliyini göstərə bilər.*

**Açar sözlər:** *təcili tibbi yardım, poliorqan və polisistem zədələnmələri, abdominal travma, qanaxma, sonoqrafiya, FAST protokolu*

**Ключевые слова:** *экстренная медицинская помощь, полиорганные и полисистемные повреждения, абдоминальная травма, кровотечение, сонография, протокол FAST*

**Key words:** *emergency medical care, early hospitalization, multiorgan and multisystem injuries, abdominal trauma, bleeding, sonography, FAST protocol*

**PROGNOSTIC POSSIBILITIES OF SONOGRAPHIC EXAMINATION AT THE EARLY  
HOSPITAL STAGE IN PATIENTS WITH ABDOMINAL TRAUMA WITH SUSPECTED  
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*The article presents the findings of a study conducted to assess the efficacy and diagnostic value of ultrasound examination during the early hospitalization stage in patients with abdominal trauma and suspected internal bleeding. The research involved 39 patients who were urgently hospitalized due to traumatic abdominal injuries during 2023-2024. Sonographic evaluation was conducted following the FAST protocol (Focused Assessment with Sonography for Trauma). The degree of impairment of consciousness of*

the victims was assessed by the GCS (Glasgow Coma Scale). The severity of traumatic injuries was determined by the ISS (Injury Severity Score) scale, and the revised RTS (Revised Trauma Score) scale was used to determine the severity of the victim.

A statistically significant relationship was established between hemodynamic parameters (lower systolic pressure and increased heart rate) and a positive result of the Fast protocol examination compared to a negative one. The method was also found to be highly sensitive. In almost 100% of cases, a positive FAST result in combination with clinical symptoms (especially unstable hemodynamics) was an indication for abdominal surgery (pleural drainage, laparoscopy, diagnostic peritoneal lavage or laparotomy).

There was no significant correlation between the severity of traumatic injuries, the severity of the victim's condition (according to different scales – GCS, ISS, RTS) and FAST results, which can be explained by the presence of cranio-skeletal injuries in victims, which sonography is not sufficient to detect. A positive result of a sonographic examination using the FAST protocol in a hemodynamically unstable patient may indicate the need for immediate surgical intervention.

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**INTRODUCTION.** Traumatic injuries are the leading cause of death among people under 45 years of age [1,2]. According to the authors, 80% of traumatic injuries are blunt, and most deaths are the result of bleeding, blood loss, and related circulatory and metabolic disorders [3-6]. Open and closed abdominal trauma in the structure of traumatic injuries ranges from 1.5 to 36.5% of all peacetime injuries, and in the structure of emergency abdominal surgery, it accounts for up to 12%. In victims who sustained blunt abdominal trauma, the spleen (40-55%), liver (35-45%), and small intestine (5%-10%) are most often injured. In addition, 15% of patients with blunt abdominal trauma who underwent laparotomy have retroperitoneal hematoma [7]. Gunshot wounds dominate the structure of combat abdominal trauma and can cause additional intra-abdominal injuries, the severity of which is influenced by the type of weapon, bullet trajectory, and kinetic energy. Gunshot wounds mostly affect the small intestine (50%), colon (40%), liver (30%), and intra-abdominal vessels (25%). Victims with blast trauma may suffer additional lung and intestinal injuries due to the overpressure of the blast wave.

In contrast to penetrating abdominal wounds, when the decision to operate is made relatively quickly, victims who sustain blunt abdominal trauma pose a serious diagnostic challenge. To this day, diagnostic peritoneal lavage (DPL), which has high specificity and sensitivity, and computed tomography (CT) are used for this purpose [7-10]. A diagnostic peritoneal lavage is an invasive emergency procedure to detect hemoperitoneum and determine the need for laparotomy. A catheter is inserted into the

abdominal cavity with subsequent aspiration of the intraperitoneal contents. It should be noted that DPL does not allow the detection of retroperitoneal injuries, and there is a risk of iatrogenic damage to the abdominal organs during the procedure.

Computed tomography, which is still the gold standard for diagnosing intraperitoneal injuries, is not always available, and the main problem is transportation, especially for hemodynamically unstable patients. Ultrasound diagnostics for the detection of intra-abdominal fluid was first described in Europe in the 1970s.

The Focused Assessment with Sonography in Trauma (FAST) is an ultrasound protocol developed to diagnose hemopericardium and hemoperitoneum. Studies show a sensitivity of 85-96% and a specificity of more than 98%. In the traditional FAST protocol, four areas must be examined: the pericardium (to detect cardiac tamponade), the right upper abdomen, the upper left abdomen, and the pelvis (to detect hemoperitoneum) [11-13].

In 2023, the previous version of this guideline was updated in light of the latest published evidence, using a structured consensus approach. The guideline contains 39 recommendations that have been developed using evidence-based medicine methodology based on evidence of their reliability and validity. The recommendations are addressed to physicians who provide care to victims of post-traumatic bleeding at the initial diagnostic and therapeutic stages of patient management.

In the 2023 guideline "Management of Bleeding and Coagulopathy in Severe Trauma" of the international initiative STOP the Bleeding Campaign, recommendation 8

appeared: "We recommend the use of percutaneous on-site ultrasound (POCUS), including FAST, in patients with thoraco-abdominal injuries" [14,15].

**The objective** of this study was to investigate the effectiveness and diagnostic value of ultrasound examination at the early hospital stage in patients with abdominal injuries with suspected internal bleeding.

**Material and Methods.** The study of sonography capabilities was conducted in two multidisciplinary hospitals with several specialized departments that admit patients with multiorgan and multisystem injuries (intensive care, surgical, neurosurgical, trauma). The results of 39 studies of victims admitted on an emergency basis with abdominal trauma for the period 2023-2024 were analyzed. Ultrasound diagnostics were performed using the Batefly IQ+Specifications device, a convection transducer with a frequency of 1-10 MHz.

The study was performed by the FAST protocol, according to which a sequential search for free fluid (blood) is performed in the hepatorenal pocket and right pleural cavity, splenorenal pocket and left pleural cavity, suprapubic region, subcostal region and upper chest.

The examination was performed in a limited period (3-3.5 minutes), without preparation, which complicated the diagnostic process. At the same time, the ultrasound picture of parenchymal organs (liver, spleen, kidneys, pancreas) was evaluated. The results were recorded on a specially designed form and compared with clinical data and hemodynamic parameters. The degree of impairment of consciousness of the victims was assessed by the GCS (Glasgow Coma Scale). The severity of traumatic injuries was determined by the ISS (Injury Severity Score) scale, and the Revised Trauma Score

(RTS) was used to determine the severity of the victim's injury [16].

The data obtained were processed on a personal computer using the IBM SPSS Statistics subscription trial for Microsoft Windows 64-bit statistical program (legal program for temporary use as of October 10, 2024). In the statistical processing of the study results and description of the sample, the arithmetic mean (M) and standard deviation ( $\sigma$ ), as well as the median with interquartile range - Me (Q25; Q75) were used. The nature of the data distribution was assessed using the Kolmogorov-Smirnov test. Since most of the data did not follow a normal distribution, the statistical significance of the results was assessed using the Mann-Whitney test. Differences were considered statistically significant at  $p < 0.05$ .

**Research results and discussion.** The total study population was 39 victims with suspected intra-abdominal injuries with internal bleeding. The average age was  $(39.59 \pm 1.37)$  years with a range of 24 to 53 years. In the vast majority of cases, the victims were men (92.3%) (Table 1).

Penetrating injuries predominated by the nature of the injury – 92.3% of the total number of injuries, mostly gunshot shrapnel wounds. The analysis of the data obtained shows that most often, abdominal trauma was a component of multisystem and multiorgan injuries (89.74% of the total). Damage to two anatomical and functional areas was detected in 43.59% of cases, three anatomical and functional areas were detected in 23.07%, and four anatomical and functional areas were also detected in 23.07% of cases. Most often, a combination of abdominal and skeletal trauma was recorded.

**Table 1.** Demographic and epidemiological characteristics of the abdominal trauma population

| Demographic indicator          | Number of casesn (%) |
|--------------------------------|----------------------|
| Total number of victims        | 39 (100)             |
| Gender:                        |                      |
| men                            | 36 (92,3)            |
| women                          | 3 (7,7)              |
| Average age ( $M \pm \sigma$ ) | $39,59 \pm 1,37$     |
| Circumstances of injury:       |                      |
| catastrophe                    | 1 (2,56)             |
| road traffic accidents         | 2 (5,13)             |
| gunshot shrapnel wounds        | 36 (92,31)           |
| Type of damage:                |                      |
| blunt trauma                   | 3 (7,7)              |
| penetrating injury             | 36 (92,3)            |

**Table 2.** Results of the assessment of the condition and severity of injuries of victims depending on the results of the FAST protocol

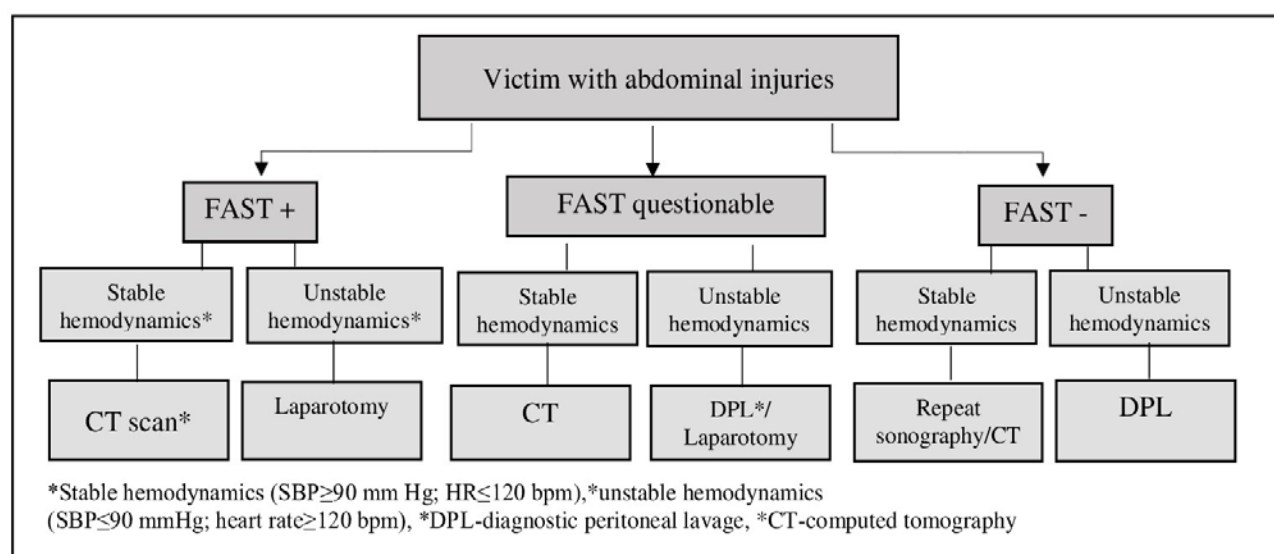
| Indicator             | Fast +         | Fast – or ?     | <i>p</i> |
|-----------------------|----------------|-----------------|----------|
| Number of cases n (%) | 12 (30,8)      | 27 (69,2)       |          |
| BP, mm Hg             | 98 (92; 100)   | 110 (100; 130)  | 0,04     |
| Heart rate, bpm       | 110 (100; 124) | 105 (90; 108)   | 0,02     |
| GCS scale, points     | 11 (10; 13)    | 13 (11; 15)     | 0,35     |
| RTS scale, points     | 6,6 (6,1; 7,4) | 7,6 (6,8; 7,65) | 0,24     |
| ISS scale, points     | 17 (15; 18)    | 12 (10; 14)     | 0,27     |

**Note:** Quantitative data are presented in Me format (Q25; Q75), the significance of the difference in quantitative indicators (*p*) in the groups with positive and negative FAST results was determined by the Mann-Whitney test.

In 12 patients (30.8% of the total study population), a positive result was obtained during sonographic examination according to the FAST protocol (Table 1). All of them underwent urgent surgical interventions on the abdominal organs. The group of patients who received a negative or doubtful result (27 or 69.2%) after additional examination underwent interventions: in 4 cases on the abdominal organs. All victims with multiorgan and multi-system injuries underwent interventions in compliance with damage control tactics in other anatomical and functional areas, mainly wound debridement, osteosynthesis of fractures, and amputations.

**Discussion.** A statistically significant relationship was found between hemodynamic parameters (lower systolic pressure and increased heart rate) and a positive result of the

FAST protocol examination compared to a negative one. The method was also found to be highly sensitive. In almost 100% of cases, a positive FAST result in combination with clinical symptoms (especially unstable hemodynamics) was an indication for abdominal surgery (pleural drainage, laparoscopy, diagnostic peritoneal lavage or laparotomy). There was no significant correlation between the severity of traumatic injuries, the severity of the victim's condition (according to different scales - GCS, ISS, RTS) and FAST results, which can be explained by the presence of cranio-skeletal injuries in victims, which sonography is not sufficient to detect. Based on the results of the study, we can recommend the following algorithm for the treatment of patients with abdominal injuries (Fig. 1).



**Figure 1.** Algorithm of actions in the treatment of a patient with abdominal injuries

## CONCLUSIONS

1. As a result of the study, it was found that there have been changes in the clinical and nosological characteristics of abdominal trauma in the current conditions – 92.30% of all injuries were penetrating injuries.

2. A positive result of a sonographic examination using the FAST protocol in a hemodynamically unstable patient may indicate the need for immediate surgical intervention.

## PROSPECTS FOR FUTURE RESEARCH

It is planned to search for and study informative methods for assessing internal

bleeding that can be used IN PREHOSPITAL EMERGENCY CARE.

## CONFLICT OF INTEREST

*The authors declare no conflict of interest.*

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## AUTHOR CONTRIBUTIONS

All authors have made substantial contributions to the original and revised versions of this article. They are solely responsible for all aspects of the work and for resolving issues related to the accuracy or integrity of the information presented.

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## ПРОГНОСТИЧЕСКИЕ ВОЗМОЖНОСТИ СОНОГРАФИЧЕСКОГО ИССЛЕДОВАНИЯ НА РАННЕМ ГОСПИТАЛЬНОМ ЭТАПЕ У ПОСТРАДАВШИХ С АБДОМИНАЛЬНОЙ ТРАВМОЙ С ПОДОЗРЕНИЕМ НА ВНУТРЕННЕЕ КРОВОТЕЧЕНИЕ

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**Резюме.** Представлены результаты исследования проведенного с целью изучить эффективность и диагностическую ценность ультразвукового исследования на раннем госпитальном этапе у пострадавших с абдоминальными повреждениями с подозрением на внутреннее кровотечение.

Проанализированы результаты 39 обследований пострадавших, поступивших в ургентном порядке с травмой брюшной полости, за период 2023-2024 гг. Сонографическое обследование проводили в соответствии с разработанным FAST-протоколом. Степень нарушения сознания пострадавших оценивали по шкале GCS (Шкала Комы Глазго – Glasgow Coma Scale). Тяжесть травматических повреждений определяли по шкале ISS – Шкала тяжести повреждения – Injury Severity Score), а для установления степени тяжести потерпевшего использовали пересмотренную шкалу травм RTS (Revised Trauma Score)

Установлена статистически достоверная связь между показателями гемодинамики (снижение систолического давления и увеличение частоты сердечных сокращений) и положительным результатом исследования по протоколу FAST (Focused assessment with sonographu for trauma) по сравнению с отрицательным. Также обнаружена высокая чувствительность метода. Практически в 100% случаев положительный результат FAST в совокупности с клинической симптоматикой (особенно нестабильной гемодинамикой) являлся показанием для проведения полостных операций (дренирование плевральной полости, лапароскопия, диагностический перитонеальный лаваж или лапаротомия).

Между тяжестью травматических повреждений, тяжестью состояния пострадавшего (по разным шкалам – GCS, ISS, RTS) и результатами FAST, не выявлена достоверная зависимость, что можно объяснить наличием у пострадавших кранио-скелетной травмы, для обнаружения которой сонографии недостаточно.

По мнению авторов, положительный результат сонографического исследования с использованием протокола FAST у гемодинамически нестабильного пациента может указывать на необходимость оперативного вмешательства.

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