ORIGINAL RESEARCH

FAST GUIDED INITIAL TRIAGE OF POLYTRAUMA PATIENTS: A PROSPECTIVE EVALUATION OF DIAGNOSTIC TIMELINES

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Abstract

Background: Polytrauma remains a leading cause of mortality worldwide. Rapid triage and timely diagnostic evaluation are essential for improving survival outcomes. Computed tomography (CT) remains the gold standard imaging modality, but logistical limitations often delay diagnosis in resource-limited settings. Focused Assessment with Sonography for Trauma (FAST) enables rapid bedside evaluation and early detection of life-threatening injuries. The objective of this study was to evaluate the impact of FAST on triage timing, diagnostic efficiency, and early management of polytrauma patients.

Material and methods: This prospective study included 40 patients assessed with FAST upon admission. Evaluated variables included demographics, mechanism of injury, FAST duration, diagnostic timings, intervention times, accuracy, ICU admission, complications, and mortality. FAST was performed at five standard anatomical views by a single trained physician. Statistical analysis included descriptive methods and Wilcoxon testing.

Results: Mean FAST duration was 5.12 minutes. FAST did not delay CT imaging nor the total diagnostic process ($p > 0.05$). Accuracy was 92.5% for thoracic trauma and 85% for abdominal trauma. Surgical interventions were required in 42.5% of cases; while the median time to surgery was 2.42 hours. ICU admission was recorded in 55% of patients, and mortality reached 22.5%.

Conclusion: FAST significantly optimized early trauma triage without delaying CT or treatment. Its speed, accuracy, and bedside availability make FAST indispensable in emergency trauma care. The method is particularly beneficial in resource-limited environments. FAST should be integrated as a mandatory component of initial trauma protocols.

Key words: *Diagnostic technologies; Focused Assessment with Sonography for Trauma; Polytrauma patients; Triage.*

Introduction

Polytrauma is a major global health challenge and one of the leading causes of death in patients under 45 years of age (1). The "golden hour" concept emphasizes the urgency of rapid diagnosis and intervention to reduce mortality (2,3). Computed tomography (CT) is the diagnostic gold standard for trauma assessment due to its precision, but it requires patient transport and radiology resources that may not be immediately available, especially in unstable patients (4,5).

Focused Assessment with Sonography for Trauma (FAST) has emerged as a pivotal bedside diagnostic tool for early identification of hemoperitoneum, hemothorax, pneumothorax, and pericardial effusion (6–9,). It is fast, safe, repeatable, and can be performed within minutes during the primary survey. Its utility is particularly pronounced in systems with limited access to CT imaging.

The aim of this study was to evaluate the duration of initial triage and early management of polytrauma patients using the FAST protocol and to assess its diagnostic value and impact on clinical outcomes.

Material and methods

Study Design and Ethical Considerations

This study was designed as a prospective longitudinal clinical evaluation conducted at the Emergency Center within the University Clinic for Traumatology, Orthopedic Diseases, Anesthesiology, Reanimation, Intensive Care and Emergency Center, "Ss. Cyril and Methodius" University in Skopje. Prior to initiation, the study protocol received ethical approval from the Clinical Research Ethics Committee of the University. Informed consent was obtained from all participants or, when necessary, from legally authorized representatives, with full explanation of the voluntary nature of participation and the right to withdraw without consequences at any time.

Study Population and Eligibility Criteria

The study population consisted of consecutive polytrauma patients admitted to the Emergency Surgical Department. Inclusion criteria were: age $\geq$ 18 years, admission for polytrauma, and performance of FAST as part of the initial trauma evaluation. Pregnant patients, as well as patients requiring immediate transfer to the operating theater or intensive care unit without the possibility of performing FAST, were excluded.

Initial Patient Assessment and Data Collection

Upon arrival, all patients underwent standardized trauma evaluation following the established A–E protocol (Airway, Breathing, Circulation, Disability, Exposure). Demographic data (age, sex, BMI), mechanism of injury, initial hemodynamic status, and Glasgow Coma Scale (GCS) scores were recorded. Additional clinical variables included the presence of free intraperitoneal or intrathoracic fluid, pneumothorax, thoracic effusions, required interventions, and length of hospitalization.

FAST Protocol

FAST was performed immediately upon admission, at the bedside, and integrated into the primary trauma survey. To minimize operator variability, all FAST examinations were conducted by a single experienced physician trained in emergency ultrasonography. The protocol included visualization of five anatomical regions: the right upper quadrant, the left upper quadrant, the suprapubic region, the subxiphoid cardiac view, and bilateral thoracic views. Time intervals recorded included arrival-to-triage, triage-to-FAST, FAST-to-completion of diagnostics, and arrival-to-intervention.

Outcome Measures

Primary outcomes included diagnostic timing and time to intervention. Secondary outcomes included FAST accuracy, required interventions, ICU admission rates, complications, and mortality.

Statistical Analysis

The statistical analysis was conducted using STATISTICA version 10 and IBM SPSS 20.0. Descriptive methods assessed proportions, means, medians, and dispersion. Continuous variables were analyzed using Student's t-test or Mann–Whitney U test depending on normality (Shapiro–Wilk). Categorical variables were analyzed with Chi-square or Fisher's exact test. Correlations were explored using Pearson and Spearman coefficients. Multivariable comparisons used ANOVA with Tukey HSD. Significance was set at $p < 0.05$, and results were presented in tables and graphs.

Results

The study included 40 patients, 90% male and 10% female, with a mean age of 40.62 years. The hemodynamic parameters of the cohort are presented in table 1.

Table 1. Hemodynamic parameters (n=40)

Variable	Mean (Median) ± SD	Range
Heart rate (bpm)	107.25 (100) ± 19.44	75–165

Systolic BP (mmHg)	127.25 (130) ± 29.56	67–239
Diastolic BP (mmHg)	80.17 (81.5) ± 19.39	45–115
Mean arterial pressure (mmHg)	95.72 (100) ± 21.7	53–152
SaO_2 (%)	93.0 (93.5) ± 5.09	73–99

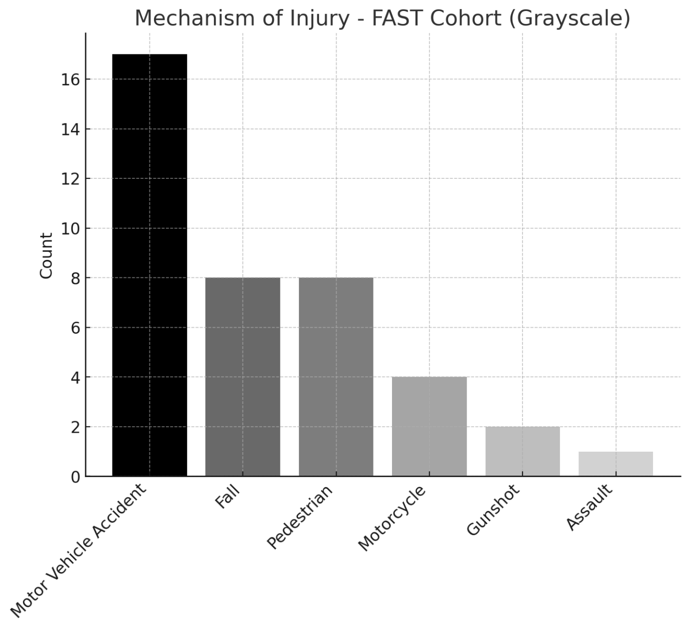
Comprehensive laboratory assessments, including hematological and biochemical markers, are presented in Table 2.

Table 2. Initial Laboratory Findings (n=40)

Variable	Mean (Median) ± SD	Range
Hemoglobin (g/L)	117.67 (124) ± 25.29	73–152
Hematocrit (L/L)	0.35 (0.36) ± 0.09	0.19–0.51
Erythrocytes ($\times 10^{12}$/L)	3.92 (3.94) ± 0.98	2.2–5.7
Platelets ($\times 10^{9}$/L)	248.93 (218) ± 93.75	94–419
Leukocytes ($\times 10^{9}$/L)	15.01 (15) ± 5.96	6.4–31
CRP (mg/L)	10.96 (5.2) ± 12.33	0.2–40
Glucose (mmol/L)	7.47 (7.05) ± 2.43	3.5–13
LDH (U/L)	427.8 (426.5) ± 121.61	250–665
ALP (U/L)	66.58 (64.5) ± 31.23	22–162
AST (U/L)	87.65 (58.5) ± 66.31	16–237
ALT (U/L)	73.55 (44.5) ± 64.09	20–250
Creatinine (µmol/L)	91.05 (88) ± 26.69	55–184
Urea (mmol/L)	6.27 (6.0) ± 1.83	3.7–10.5
Sodium (mmol/L)	139.18 (139) ± 3.6	130–149
Potassium (mmol/L)	3.79 (3.9) ± 0.48	2.5–4.7
Calcium (mmol/L)	2.05 (2.1) ± 0.22	1.5–2.4
Chloride (mmol/L)	104.55 (105) ± 4.14	94–111

Mechanisms of injury included motor vehicle accidents (42.5%), falls (20%), pedestrian collisions (20%), motorcycle accidents (10%), gunshot wounds (5%), and assaults (2.5%).

Graph 1. Mechanisms of injury



Mean FAST duration was 5.12 minutes. FAST did not delay the total diagnostic process ($p = 0.67$). Classification of trauma by anatomical region is presented in table 3. Diagnostic accuracy of FAST, reached 92.5% for thoracic trauma and 85% for abdominal trauma, with FAST–CT concordance of 97.5%, presented in table 4.

Table 3. Classification of Trauma by Anatomical Region (n=40)

Type of Trauma	n	%
Thoracic injuries	32	80%
Locomotor system injuries	34	85%
Abdominal trauma	12	30%
Head injuries	12	30%

Table 4. FAST Diagnostic Accuracy (n=40)

Trauma Type	Accuracy (%)
Thoracic Trauma	92.5
Abdominal Trauma	85.0

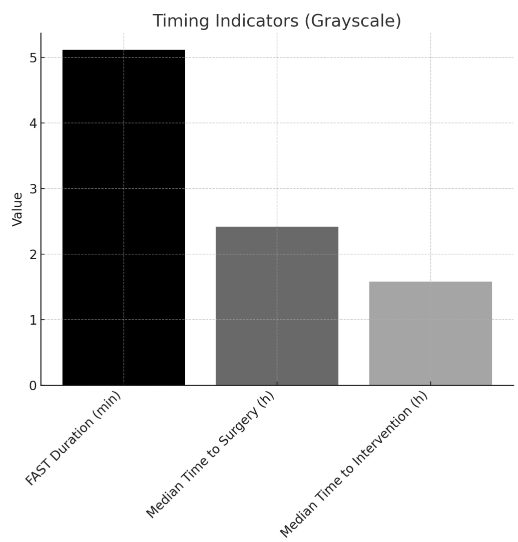
Seventeen patients (42.5%) necessitated surgical intervention. The majority of procedures pertained to the locomotor system (n = 9, 22.5%), followed by abdominal surgery (n = 4, 10%) and combined thoracoabdominal interventions (n = 3, 7.5%). Furthermore, one patient (2.5%) received urological surgery.

The duration between admission and surgical intervention demonstrated significant variability. The mean time to surgery was 7.86 hours, with a median of 2.42 hours (range: 1–90.6 hours; SD: 21.37), indicating variability in injury severity and the urgency of necessary interventions.

Non-operative invasive procedures were also commonly conducted. A total of 14 patients (35%) received these therapies. The predominant procedure was unilateral thoracic drainage (n = 15, 37.5%), whereas bilateral thoracic drainage was necessitated in seven individuals (17.5%). Supplementary procedures comprised thoracic drainage with immobilization (n = 1, 2.5%) and nasal tamponade for the management of epistaxis (n = 3, 7.5%).

The timing of these non-surgical therapies was timely and consistent. The average duration from admission to the initial invasive operation was 1.57 hours (median: 1.58 hours; range: 0.87–2.52 hours; standard deviation: 0.41), highlighting the importance of prompt ultrasonographic evaluation in accelerating treatment decisions and prioritizing urgent interventions.

Graph 2. Diagnostic and Intervention Timing Metrics



The cohort exhibited a mean hospitalization duration of 16.82 days (median: 13.5 days; range: 1–53 days; SD: 12.85). This diversity indicates disparities in injury complexity, necessary postoperative care, and clinical recovery pathways.

Discussion

The findings of our inquiry validate previously published data, strengthening existing evidence. The results demonstrated that the male demographic is more often affected by trauma. Literature indicates that trauma primarily affects the male population and younger age groups. The mean age of the patients in our study was 40. This corresponds with previous research suggesting that men are more often subjected to trauma, primarily due to their participation in outdoor activities, vehicular accidents, and other traumas, since fewer women experience accidental traumatic injuries. The higher incidence of younger participants is ascribed to their increased outdoor exercise relative to older adults (10,11).

Despite the significant benefits of FAST, physicians must be aware of its limitations. A negative FAST examination cannot conclusively rule out minor or progressive injuries, particularly those involving hollow organs, retroperitoneal structures, or modest fluid collection. Thus, professional judgment and ongoing evaluations are essential components of trauma management. Literature outlines situations in which FAST may fail to accurately detect certain injuries, such as cases of little hemorrhage, poor acoustic windows, subcutaneous emphysema, obesity, or limited patient mobility (12-15). Technical factors, including probe frequency, resolution, sonographer proficiency, and anatomical variability, may also influence image quality.

The study's findings reveal that specific critically injured patients cannot safely undergo advanced imaging due to hemodynamic instability or time limitations. For these patients, rapid FAST assessment allows physicians to swiftly commence life-saving surgical or procedural procedures, avoiding delays linked to extensive diagnostic imaging. Prompt recognition of intra-abdominal bleeding or thoracic complications is crucial, since timely care greatly affects survival and long-term outcomes.

Time is essential in reducing mortality in these individuals; therefore, it is vital to quickly identify trauma and determine the need for intervention as rapidly as possible. The first sixty minutes following trauma are termed the “golden hour” because of their critical importance in providing timely and suitable medical intervention, hence improving survival rates and reducing the likelihood of long-term complications. To provide timely and effective treatment during this period, rapid assessment, diagnosis, and stabilization are essential (3,16-19). Our study is deficient in data about the duration of the prehospital period owing to numerous affecting factors. The variability of medical history, lack of information due to inadequate victim support, distance to tertiary healthcare, and inter-facility transfers are potential variables.

FAST has become an essential tool in trauma evaluation due to its rapid bedside application. In contrast to traditional imaging methods that require patient transfer, external personnel, and logistical preparations, FAST can be performed immediately upon arrival in the emergency room. This capability is especially beneficial in resource-limited settings, where imaging delays might significantly impact outcomes. FAST enables swift identification of patients requiring immediate care and aids in guiding resuscitation, prioritizing triage, and continuous assessment.

The results of our study demonstrated that the FAST technique neither prolonged the length of stay in the Emergency Surgical Center nor delayed the conclusive diagnosis via CT in trauma patients. The average time of the FAST examination was 5.12 minutes (median 5.08; range 3.92–6.7; SD 0.71). The time to final diagnosis via CT was statistically negligible ($p < 0.05$), suggesting that the use of the FAST technique did not prolong or potentially delay definitive diagnosis and treatment. These results correspond with those documented in the literature (20,21). The mortality rate in our cohort was 22.5 percent.

This study demonstrated that FAST demonstrated a high diagnostic accuracy for traumatic injuries, particularly in thoracic trauma, attaining an accuracy of 92.5%. The identification of abdominal injuries demonstrated a somewhat diminished accuracy of 85%, consistent with earlier published studies (20,22-25). Literature indicates that repeated FAST examinations—one of its primary advantages—can improve diagnostic accuracy to nearly 100%, especially when serial evaluations are performed under continuous hemodynamic monitoring.

A positive FAST scan result requires immediate reporting and intervention, owing to its significant positive predictive value and high specificity. It is prudent to thoroughly assess the suitable course of action, taking into account the method's sensitivity and the incidence of false negatives in 25% of the results (9,20-22). Literature reveals that the sensitivity of the FAST approach varies from 85% to 96%, but its specificity surpasses 98% (20). In trauma patients, the diagnosis demonstrates 100% sensitivity (21, 26). This diagnostic procedure, when performed by proficient clinicians, is accomplished in less than 5 minutes (21). FAST is especially beneficial in healthcare systems with limited resources where access to CT scans may be postponed.

The median duration to surgical intervention (2.42 hours) indicates effective triage enabled by FAST results. Evidence suggests that decreasing time-to-intervention markedly reduces mortality rates (3,25-28). FAST is contingent upon the operator and may overlook injuries that do not result in free fluid. Frequent FAST exams can enhance sensitivity.

Despite these limitations, global statistics consistently validate FAST as a crucial diagnostic tool in trauma care (29,30). The speed, availability, and ability for immediate repetition make it very beneficial for unstable patients. In resource-limited trauma environments, FAST often serves as the primary imaging technique guiding first treatment decisions. The findings of this study align with international experiences, highlighting the importance of FAST in identifying patients requiring urgent intervention, monitoring those at risk of decline, and enabling swift triage decisions (31).

However, the execution of FAST in resource-limited healthcare institutions has specific obstacles. Ensuring ongoing availability of functional ultrasound equipment, preserving high-quality probes, and providing enough training for technicians and doctors are essential. Limited access to formal ultrasound education may hinder wider adoption, underscoring the need for structured training programs and ongoing professional development. Moreover, integrating FAST into emergency procedures requires careful organization. Although FAST can be performed swiftly at the patient's bedside, problems like overcrowding, insufficient workspace, and suboptimal patient flow may impede its effectiveness. Optimal diagnostic efficacy requires proper equipment positioning, explicit protocols, and cohesive collaboration among trauma teams.

The time needed for completing diagnosis and therapy was the main motivation for conducting this research and integrating it into trauma procedures. This assessment, classified as a "point-of-care" evaluation performed at the patient's bedside, requires no expensive equipment and is easily replicable. FAST evaluation is integrated into trauma protocols worldwide (2,5–7,26,27).

Conclusion

FAST represents a fundamental component of the initial trauma evaluation. Its rapidity, diagnostic accuracy, and non-invasive nature enable timely decision-making without impeding subsequent CT imaging or definitive management. Owing to these advantages, FAST should remain an integral element of early trauma protocols, particularly in resource-limited environments where efficient triage is essential.

References:

1. World Health Organization. https://www.who.int/ Assessed November, 2025.
2. Melniker LA, Leibner E, McKenney MG, Lopez P, Briggs WM, Mancuso CA. Randomized controlled clinical trial of point-of-care, limited ultrasonography for trauma in the emergency department: the first sonography outcomes assessment program trial. Ann Emerg Med. 2006 Sep;48(3):227-35. doi: 10.1016/j.annemergmed.2006.01.008.
3. Lerner EB, Moscati RM. The golden hour: scientific fact or medical "urban legend"? Acad Emerg Med. 2001 Jul;8(7):758-60. doi: 10.1111/j.1553-2712.2001.tb00201.x.

4. Shanmuganathan KS, Mirvis E, Sover ER. Value of contrast-enhanced CT in detecting active hemorrhage in patients with blunt abdominal or pelvic trauma. AJR Am J Roentgenol 1993;161(1):65e9. doi: 10.2214/ajr.161.1.8517323.
5. Diercks DB, Mehrotra A, Nazarian DJ, Promes SB, Decker WW, Fesmire FM. College of Emergency Physicians. Clinical policy: critical issues in the evaluation of adult patients presenting to the emergency department with acute blunt. Ann Emerg Med. 2011 Apr;57(4):387-404. doi: 10.1016/j.annemergmed.2011.01.013
6. Radwan MM, Abu-Zidan FM. Focussed Assessment Sonograph Trauma (FAST) and CT scan in blunt abdominal trauma: surgeon's perspective. Afr Health Sci. 2006 Sep;6(3):187-90. doi: 10.5555/afhs.2006.6.3.187.
7. Fleming S, Bird R, Ratnasingham K, Sarker SJ, Walsh M, Patel B. Accuracy of FAST scan in blunt abdominal trauma in a major London trauma centre. Int J Surg. 2012;10(9):470-4. doi: 10.1016/.ijsu.2012.05.011.
8. Hoff WS, Holevar M, Nagy KK, et al. Blunt Trauma Working Group. Practice management guidelines for the evaluation of blunt abdominal trauma: the East Practice Management Guidelines Work Group. J Trauma. 2002 May;53(5):602-15. doi: 10.1097/00005373-200211000-00001.
9. Bahner D, Blaivas M, Cohen HL, et al. AIUM practice guideline for the performance of the focused assessment with sonography for trauma (FAST) examination. J Ultrasound Med. 2008 Feb. 27(2):313-8. doi: 10.7863/jum.2008.27.2.313.
10. Dixon JR, Lecky F, Bouamra O, et al. Age and the distribution of major injury across a national trauma system. Age Ageing. 2020 Feb 27;49(2):218-226. doi: 10.1093/ageing/afz151
11. Hermosilla S, Choi KW, Askari MS, et al. What can we learn about polytrauma typologies by comparing population-representative to trauma-exposed samples: A Nepali example. J Affect Disord. 2022 Oct 1;314:201-210. doi: 10.1016/j.jad.2022.07.006.
12. Petticrew MP, Sowden AJ, Lister-Sharp D, Wright K. False-negative results in screening programmes: systematic review of impact and implications. Health Technol Assess. 2000;4(5):1-120
13. Petticrew M, Sowden A, Lister-Sharp D. False-negative results in screening programs. Medical, psychological, and other implications. Int J Technol Assess Health Care. 2001 Spring;17(2):164-70.
14. Cooper GC, Harvie MN, French DP. Do negative screening test results cause false reassurance? A systematic review. Br J Health Psychol. 2017 Nov;22(4):958-977. doi: 10.1111/bjhp.12265.
15. Kornmann VN, van Ramshorst B, Smits AB, Bollen TL, Boerma D. Beware of false-negative CT scan for anastomotic leakage after colonic surgery. Int J Colorectal Dis. 2014 Apr;29(4):445-51. doi: 10.1007/s00384-013-1815-5

16. Delgado MK, Staudenmayer KL, Wang NE, Spain DA, Weir S, Owens DK, Goldhaber-Fiebert JD. Trauma center care is associated with reduced readmissions after injury. J Trauma Acute Care Surg. 2013 May;74(5):1295-9; discussion 1299-300. doi: 10.1097/TA.0b013e31828c7b07.
17. Brown JB, Stassen NA, Bankey PE, Sangosanya AT, Cheng JD, Gestring ML. Mechanism of injury and special consideration criteria still matter: an evaluation of the National Trauma Triage Protocol. J Trauma. 2011 Oct;71(4):S62-8. doi: 10.1097/TA.0b013e318232e1e4.
18. Mackersie RC. History of trauma field triage development and the American College of surgeons' criteria Prehosp Emerg Care. 2006;10:287–94. doi: 10.1080/10903120600721636.
19. Sivanandan A. Early management of trauma: the golden hour. Current medical issues 18(1):p 36-39, Jan–Mar 2020. | DOI: 10.4103/cmi.cmi_61_19
20. Pearl WS, Todd KH. Ultrasonography for the initial evaluation of blunt abdominal trauma: A review of prospective trials. Ann Emerg Med. 1996 Mar;27(3):353-61. doi: 10.1016/s0196-0644(96)70273-1.
21. Boulanger BR, McLellan BA, Brenneman FD, et al. Emergent abdominal sonography as a screening test in a new diagnostic algorithm for blunt trauma. J Trauma. 1996 Jun;40(6):867-74. doi: 10.1097/00005373-199606000-00003.
22. Savatmongkorngul S, Wongwaisayawan S, Kaewlai R. Focused assessment with sonography for trauma: current perspectives. Open Access Emerg Med. 2017. 9:57-62.
23. Grünherz L, Jensen KO, Neuhaus V, et al. Early computed tomography or focused assessment with sonography in abdominal trauma: what are the leading opinions. Eur J Trauma Emerg Surg. 2017 Jul 20. doi: 10.2147/OAEM.S120145
24. Brzanov N, Labachevski N, Antovik S, Trpevski S, Jovanovska Srceva M, Georgiev A, Ognjenovic Lj, **Gavrilovska Brzanov A**. Thoracic point of vare ultrasonography a reliable diagnostic technique for traumatic pneumothorax.MIT 2024;18: 9-17.ISSN: 1857-8128.
25. Von Kuenssberg Jehle D, Stiller G, Wagner D. Sensitivity in detecting free intraperitoneal fluid with the pelvic views of the FAST exam. Am J Emerg Med. 2003 Oct;21(6):476-8. doi: 10.1016/s0735-6757(03)00162-1.
26. Poletti PA, Mirvis SE, Shanmuganathan K, Takada T, Killeen KL, Perlmutter D, Hahn J, Mermillod B. Blunt abdominal trauma patients: can organ injury be excluded without performing computed tomography? J Trauma. 2004 Nov;57(5):1072-81. doi: 10.1097/01.ta.0000092680.73274.e1.
27. Teixeira PG, Inaba K, Hadjizacharia P, Brown C, Salim A, Rhee P, Browder T, Noguchi TT, Demetriades D. Preventable or potentially preventable mortality at a mature trauma center. J Trauma. 2007 Dec;63(6):1338-46; 1346-7. doi: 10.1097/TA.0b013e31815078ae.

28. Savatmongkorngul S, Wongwaisayawan S, Kaewlai R. Focused assessment with sonography for trauma: current perspectives. Open Access Emerg Med. 2017. 9:57-62.
29. Matsushima K, Inaba K, Dollbaum R, Khor D, Jhaveri V, Jimenez O, Strumwasser A, Demetriades D. The role of computed tomography after emergent trauma operation. J Surg Res. 2016 Dec;206(2):286-291. doi: 10.1016/j.jss.2016.08.033.
30. Willett JK. Imaging in trauma in limited-resource settings: A literature review. Afr J Emerg Med. 2019;9(Suppl):S21-S27. doi: 10.1016/j.afjem.2018.07.007.
31. Brzanov N, Labacevski N, Antovik S, Trpevski S, Ognjenovic Lj, Gavrilovska –Brzanov A. Implementation of focused assessment with ultrasonography in trauma patients in university surgical emergency department. MJA, 2023; vol 7(3): 77-83.