EAS Journal of Anaesthesiology and Critical Care
Abbreviated Key Title: EAS J Anesthesiol Crit Care
ISSN: 2663-094X (Print) & ISSN: 2663-676X (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-7 | Issue-6 | Nov-Dec-2025 | DOI: https://doi.org/10.36349/easjacc.2025.v07i06.010

Original Research Article

Fast Ultrasound in the Initial Evaluation of Polytrauma Patients at The Emergency Department of Chu Gabriel Touré

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Article History
Received: 25.09.2025
Accepted: 18.11.2025
Published: 25.11.2025

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Background:*** Point-of-care ultrasound (POCUS), and particularly the Focused Assessment with Sonography in Trauma (FAST), is widely used for the rapid detection of life-threatening internal injuries in trauma settings. In low-resource environments, where access to whole-body computed tomography may be limited, FAST plays a pivotal role in early triage and therapeutic decision-making. This study aimed to assess the diagnostic contribution of FAST in the initial evaluation of polytrauma patients admitted to the Emergency Department of Gabriel Touré University Hospital. ***Methods:*** We conducted a prospective, observational, descriptive study over six months (July–December 2022) in the Emergency Department of CHU Gabriel Touré, Mali. All trauma patients presenting with hemodynamic instability (systolic blood pressure ≤ 90 mmHg) were eligible. Non-consenting patients or those who died before undergoing FAST were excluded. Ultrasound examinations were performed using a Siemens Acuson X300 device equipped with cardiac, linear, and convex probes. Clinical, epidemiological, FAST findings, CT scan results, therapeutic interventions, orientation, and outcomes were collected and analyzed using SPSS 26.0, applying chi-square and logistic regression tests (significance threshold $p < 0.05$). ***Results:*** A total of 42 polytrauma patients were included among 9050 trauma admissions (frequency 0.46%). Road traffic accidents predominated (80.95%), with high-energy mechanisms commonly observed: projection (35.71%), crushing (26.19%), and vehicle ejection (23.80%). Chest pain (90.50%) and dyspnea (42.85%) were the most frequent symptoms. FAST was pathological in 64.28% of patients, mainly showing hemoperitoneum (40.48%). Thoracic lesions detected on FAST included pneumothorax (9.52%), hemothorax (4.76%) and hemopneumothorax (9.52%). CT scans confirmed numerous severe injuries, including rib fractures (38.10%), flail chest (26.19%), and abdominal injuries in 78% of cases. Emergency interventions were frequent: oxygen therapy (85.70%), mechanical ventilation (57.10%), transfusion (52.40%), and surgery (42.85%). FAST directly triggered emergency procedures in 57.12% of cases. Overall mortality was 28.57%. ***Conclusion:*** FAST proved to be a valuable, rapid, and effective diagnostic tool for the early identification of life-threatening thoraco-abdominal injuries in polytrauma patients. Its integration into the initial trauma assessment significantly supported triage and early therapeutic decision-making, particularly in resource-limited settings.

Keywords: Polytrauma; FAST ultrasound; Point-of-care ultrasonography; Emergency medicine; Trauma imaging.

INTRODUCTION

Point-of-care ultrasound (POCUS) refers to the performance of ultrasound examinations at the patient's bedside.It is used by clinicians to guide diagnostic decisions and immediate management. A substantial body of evidence demonstrates that POCUS significantly improves the accuracy and timeliness of diagnostic evaluation in emergency settings (Rozycki et al., 1993a).

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FAST (Focused Assessment with Sonography in Trauma) has shown major advantages in the triage of patients with blunt abdominal trauma by rapidly identifying or ruling out the presence of intraperitoneal effusion (Yoshii et al., 1998a). In a cohort of 1,227 abdominal trauma patients, Rozycki *et al.*,reported that FAST performed by trauma surgeons was rapid, sensitive (83.3%), highly specific (99.7%), and demonstrated an excellent negative predictive value (95%) for detecting intra-abdominal and pericardial effusions (Rozycki et al., 1993b). Despite its high diagnostic performance for solid-organ injuries (hepatic, splenic, renal), with sensitivity ranging from 90–92%, FAST cannot replace whole-body CT scanning, which remains the gold standard for definitive diagnosis (Stengel et al., 2015; Yoshii et al., 1998b). Its utility is greatest in hemodynamically unstable patients, for whom rapid bedside decision-making is essential (McKenney et al., 2001). In Africa, ultrasound imaging is frequently limited by resource constraints and shortages of trained personnel, and Mali is no exception. We therefore undertook this study to assess the diagnostic value of FAST in polytrauma patients admitted to the Emergency Department of CHU Gabriel Touré, a facility functioning as a trauma center. The objective was to evaluate the diagnostic performance of FAST in the early management of polytrauma patients.

Patients and Methods:

Study setting: The study was conducted in the Emergency Department of CHU Gabriel Touré, one of Mali's national tertiary referral hospitals.

Study design and period: This was a prospective, observational, and descriptive study carried out over six months, from July to December 2022.

Study population: All trauma patients of any age and both sexes admitted during the study period were eligible.

Inclusion criteria: Hemodynamic instability characterized by hypotension (SBP ≤ 90 mmHg) in the context of trauma.

Non-inclusion criteria:

- Patients or guardians who did not provide consent.
- Patients who died before receiving a FAST examination.

Ultrasound acquisition: Examinations were performed using a Siemens Acuson X300 machine equipped with three probes: a cardiac probe (1.4–3.3 MHz), a linear probe (3–7 MHz), and a convex probe (2.0–5.0 MHz).

Data collection: Data were extracted using a standardized case form completed from medical records, emergency registers, and referral notes.

Data analysis: Data were analyzed using SPSS version 26.0. Descriptive statistics were performed, and comparisons were based on chi-square testing and binary logistic regression. A p-value <0.05 was considered statistically significant.

Ethical considerations: Data confidentiality was ensured, and each patient form was anonymized.

RESULTS

A total of 42 polytrauma patients were included over six months, among approximately 9,050 trauma-related admissions, representing a frequency of 0.46%.

1. Causes and Injury Mechanisms

Road traffic accidents (RTAs) were overwhelmingly the leading cause, accounting for 80.95% (n=34) of cases. This confirms that RTAs remain the dominant source of severe trauma in our setting. Other mechanisms were far less common: gunshot wounds (9.53%), landslides (4.76%), and falls from height ≥6 m (2.38% each). High-velocity trauma indicators were frequent: projection (35.71%), crushing (26.19%), and vehicle ejection (23.80%), the latter being a strong predictor of severe internal injury according to ATLS guidelines. Nearly 75% of patients were admitted within 60 minutes of injury.

2. Clinical Presentation at Admission

Chest pain was the most common symptom (90.5%), followed by dyspnea (42.85%). Abdominal pain was present in 40.47% of cases.

Severe neurological impairment (GCS ≤ 8) was noted in 40% of patients, reflecting major trauma. The mean FAST completion time was 35.71 minutes, with 39.95% performed within 30 minutes. Hemoglobin was <10 g/dl in 54.8% of cases. Overall, 64.28% of patients had a positive FAST examination. Hemoperitoneum was the most frequent finding (40.48%). Thoracic pathologies identified by E-FAST included pneumothorax (9.52%), hemopneumothorax (9.52%), and isolated hemothorax (4.76%),

with 23.8% presenting thoracic injury on ultrasound. A normal FAST was recorded in 35.72% of cases. Thoracic CT revealed numerous lesions, predominantly rib fractures (38.10%), flail chest (26.19%), and subcutaneous emphysema (64.28%). Pulmonary contusions were documented in 7.14%. Chest radiographs also revealed significant lesions, including sternal fractures (21.43%) and clavicular fractures (16.66%).

Abdominopelvic CT findings showed traumatic injury in 78% of assessed patients (17/22), including hemoperitoneum (45.45%), hepatic contusions (18.18%), and splenic contusions (13.63%). Therapeutic interventions reflected the severity of trauma: oxygen

therapy (85.70%), mechanical ventilation (57.10%), volume resuscitation (92.9%), vasopressors (92.9%), chest drainage (11.90%), and surgery (42.85%). Over half the patients required transfusion. FAST triggered emergency interventions in 57.12% of cases. Length of stay in the emergency department exceeded 48 hours in 78.6% of cases. Most patients (59.52%) were admitted to the ICU; specialized surgical referrals included thoracic (7.14%), general surgery (4.76%), and pediatric surgery (4.76%). Mortality was 28.57%.

Table I. Surgical Management

Surgical Procedure	n	%
Thoracic drainage	5	17.86
Chest decompression (exsufflation)	5	17.86
Damage control surgery	8	28.57
Laparotomy	10	35.71
Total	28	100

Table II. Transfused Blood Products

Blood product	n	%
Packed Red Blood Cells (PRBC)	20	47.62
PRBC + Fresh Frozen Plasma	2	4.76
Non-transfused patients	20	47.62
Total	42	100

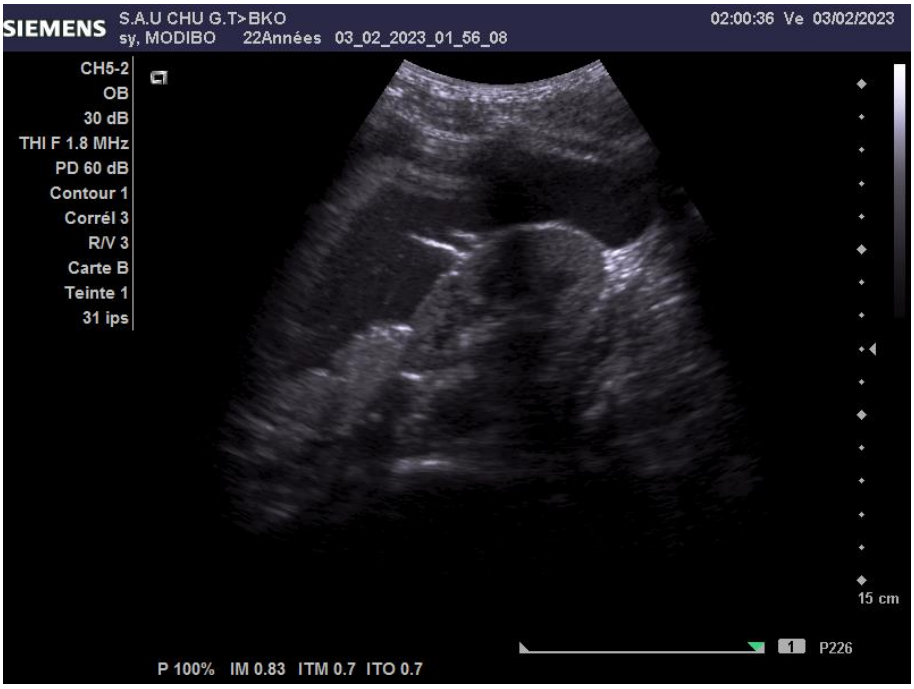

Image 1: Post-traumatic fluid collection in the Morrison's pouch

DISCUSSION

This study of 42 polytrauma patients over six months provides important insights into the epidemiology, clinical presentation, diagnostic performance of FAST, CT correlations, and early management strategies.

1. Epidemiological Profile and Injury Mechanisms

The predominance of RTAs (80.95%) mirrors findings from similar settings (Kim et al., 2023; Zhang et al., 2017), where road injuries are the leading cause of polytrauma. High-energy mechanisms—projection, crushing, and ejection—were frequent, consistent with the severity of lesions observed. Vehicle ejection, in particular, is recognized in ATLS guidelines as a marker of major trauma requiring heightened suspicion of internal injury. Rapid admission (<60 min in 75% of cases) suggests an efficient prehospital response system.

2. Clinical Presentation

Respiratory and thoracic manifestations dominated initial clinical findings, reflected in the high prevalence of chest pain and dyspnea and confirmed by imaging. Abdominal pain, although frequent, remained nonspecific. Severe neurological impairment (GCS ≤ 8) in 40% of cases underscores the need for rapid diagnostic

tools such as FAST. Hemodynamic instability and anemia were common, suggesting significant internal bleeding.

3. Diagnostic Contribution of FAST

FAST was positive in 64.28% of cases, confirming its utility in detecting life-threatening internal hemorrhage (Stengel et al., 2018). Hemoperitoneum was the most common finding (40.48%), in higher proportion than many Western series, possibly reflecting more violent mechanisms and delayed prehospital stabilization. Thoracic injuries identified by E-FAST reinforced clinical suspicions. A negative FAST (35.72%) does not exclude major injury, consistent with its limitations in detecting small or retroperitoneal hemorrhage (Dammers et al., 2017). FAST should therefore be integrated into a multimodal algorithm combining clinical assessment, laboratory findings, and CT imaging.

4. CT Correlations

Thoracic CT identified high rates of severe lesions—rib fractures, flail chest, pulmonary contusion—aligned with high-velocity trauma mechanisms (Kim et al., 2023). Abdominopelvic CT confirmed traumatic injury in 78% of evaluated patients, with hemoperitoneum, hepatic, and splenic contusions predominating.

5. Initial Therapeutic Management

Management required intensive resuscitative measures, including oxygen therapy, mechanical ventilation, fluid resuscitation, vasopressors, and blood transfusion in over half the patients. The need for surgical intervention (42.85%) and chest drainage/exsufflation highlights the severity of injuries. FAST played a decisive role, initiating urgent interventions in 57.12% of cases. Prolonged ED stays (>48h) likely reflect resource constraints contributing to morbidity.

6. Orientation and Prognosis

ICU admission was required in nearly 60% of cases, consistent with severe trauma burden. Mortality (28.57%) remains high but comparable to similar resource-limited settings (Simel, 2012; Kim et al., 2023).

7. Strengths and Limitations

This study provides real-world data on FAST performance in a low-resource trauma center. Limitations include small sample size, the absence of long-term follow-up, and operator-dependent variability in ultrasound expertise.

CONCLUSION

FAST plays an essential role in the early triage of polytrauma patients by rapidly identifying life-threatening internal injuries. While highly beneficial, FAST should be complemented by CT scanning whenever available. High rates of thoracic and abdominal injuries and the substantial mortality observed reflect the violent mechanisms involved and highlight the need for rapid, integrated, multidisciplinary trauma care.

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Cite this article: Almeimoune Abdoulhamidou, Mangané Moustapha, Diop Thierno Madane, Coulibaly Mahamadoun, Dembele Aladji Seidou, Sogoba Youssouf, Kassogue André, Gamby Amadou, Traore Aliou Yacouba, Sanogo Dramane, Soumare Alfousseini, Diallo Boubacar, Diallo Daouda, Diango Djibo Mahamane (2025). Fast Ultrasound in the Initial Evaluation of Polytrauma Patients at The Emergency Department of Chu Gabriel Touré. *EAS J Anesthesiol Crit Care*, *7*(6), 205-208.