

An Umbrella Review of Systematic Review and Meta-Analysis Studies of Focused Assessment with Sonography for Trauma (FAST) Accuracy

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The advent of Focused assessment with sonography for trauma (FAST) scan over the past decade has enabled physicians to be rapidly used in the context of vulnerable patients, especially those who are difficult to transport in hemodynamics. Identification of free fluid inside the peritoneal cavity, pericardium, and pleural spaces can be performed immediately upon admission to the hospital. Other uses for FAST include diagnosing organ damage, pneumothorax, fractures, and as a triage tool. However, radiologists are widely concerned about the use of ultrasound in trauma because there is more trust in CT scans. Various articles on the use of FAST have been published for the initial evaluation of patients with blunt abdominal trauma and many systematic review and meta-analysis studies have been

published. In this review, we aimed at reviewing the systematic review and meta-analysis about the FAST accuracy in blunt trauma. Eight meta-analysis studies were included in this study. Despite significant advances in trauma management in the field of prehospital care, rapid transfer of casualties, management of patient fluid therapy, and life-saving surgical techniques, the leading cause of death in trauma remain hemorrhagic shocks. Free intra-abdominal fluids and findings suggesting solid organ damages, pneumothorax, hemothorax, and hemoperitoneum following the abdominal trauma, mostly getting first diagnosed by the FAST sonography before the computerized tomography (CT) scan, could be enigmatic findings for medical decision making. With the presence of massive amounts of free fluid within the abdomen, rapid

deterioration of the patient's condition could be inevitable leading to hemorrhagic shock within minutes to hours (1). Time-critical diagnosis, treatment, and effective control of bleeding will save patients' lives and get them out of life-threatening situations. Successful and rapid clinical decision-making in stable patients with positive findings in FAST sonography or unstable patients with negative FAST findings is a difficult and complex process based on available scientific evidence, personal experience, and current rules and regulations (2). Due to the explosive increase in clinical pieces of

evidence on the application of FAST sonography in blunt trauma, multiple systematic reviews have been published and there is a need for conclusions to be drawn. A systematic review study is the answer to clinical questions based on valid and up-to-date clinical evidence. Systematic review studies fill the gap between genuine research studies and patient bedside decisions with the best up-to-date clinical evidence. In this review, we critically evaluated these studies on the FAST sonography's place in the clinical management of trauma.

Table 1. studies included in our review

Author	number of studies	number of participants	condition	sensitivity	heterogeneity	specificity	heterogeneity	bias
Stengel et al. (4), 2001	123	9047	blunt abdominal trauma	for organ lesions Q* =0.91, 95%CI:0.76-1.07; for free fluid (Q* = 0.89 95%CI: 0.73-1.05)).	+	NA	NA	NA
Stengel et al. (5), 2005	62	18167	blunt or penetrating abdominal trauma	78.9% (95% CI: 74.9%, 82.9%)	+	99.2% (95% CI: 99.0%, 99.4%)	-	+
Quinn et al. (6), 2011	8	565	penetrating trauma	28.1–100%	NA	94.1–100.0%	NA	NA
Lee et al. (7), 2019	5	4263	blunt abdominal trauma	92.1% (87.8–95.6)	+	98.7% (96.0–99.9),	+	-
Staub et al. (8), 2018	19	1731	17 assessing pneumothorax and 5 assessing hemothorax	pneumothorax, with a sensitivity of 0.81 ([95%CI], 0.71–0.88, hemothorax with sensitivity of 0.60 (95%CI, 0.31–0.86	-	pneumothorax with a specificity of 0.98 (95%CI, 0.97–0.99), hemothorax with specificity of 0.98 (95%CI, 0.94–0.99	+	NA
Holmes et al. (9), 2007	25	3838	Pediatric blunt trauma, hemoperitoneum	80% (95% [CI95%] 76%-84%);	-	96% (95% CI 95%-97%);	-	-
Schöneberg et al. (10), 2013	9	1514	Pediatric blunt abdominal trauma	56.5%	NA	94.68%,	NA	NA
Qi et al. (11), 2020	6	NA	FAST in the military settings	0.66	+	0.98	+	NA

NA: not addressed.

Our literature review in PubMed and EMBASE with keywords of the “Abdominal trauma”, “Systematic review”, “meta-analysis”, and “FAST sonography” was accompanied with 8 studies from 2001 till 2020 (Table 1). Blunt abdominal trauma was assessed in 6 studies and 2 studies evaluated penetrating abdominal trauma. Sensitivity-specificity pooling meta-analyses were performed for diagnostic accuracy of FAST in detecting solid organ lesions, free fluid within the abdomen, pneumothorax, hemothorax, and hemoperitoneum. Two studies were on the pediatric age group. In the case of the diagnostic test accuracy results, studies reported FAST Sensitivity and Specificity in different conditions of blunt or penetrating abdominal trauma, pediatric blunt trauma, and chest trauma.

Systematic reviews were assessed for publication bias and heterogeneity presence, where in most cases publication bias was not fully assessed. As well as what we find in our review, Van et al. showed that there is a struggle in systematic review and meta-analysis studies of diagnostic test accuracy addressing publication bias assessment. These studies mostly rely on inadequate approaches such as the Begg and Egger tests, which were not designed for diagnostic test accuracy meta-analyses. Van et al.’s analysis of the Begg, Egger, and Deek’s tests revealed that they produce distinct findings and are hence incompatible. But they suggested Deeks’ test to be used (3). The meta-analysis studies we reviewed show that over time the number of articles included in the meta-analysis has decreased. While in 2001, the meta-analysis study by Stengel et al. included 123 studies, more recent studies in the last 5 years have all included less than 20 studies in their meta-analysis. Interpretation of this issue is difficult given that there is no detailed publication bias in the studies. It seems that the study field for FAST sonography is closing as researchers are working on newer methods and more advanced modalities and some recent works are applying FAST as a prognostic factor (12). Studies showed

that precise meta-analysis data pooling methods are needed as in the case of the heterogeneity or various types of bias, results would extremely be different.

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Not applicable.

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