Review of the accuracy of FAST (focused assessment sonography in patients with blunt trauma)

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Accuracy of FAST in detecting intra-abdominal injury in patient with blunt trauma

Abstract:

Objectives: Performing an prolonged extended Focused Assessment with Sonography in Trauma (eFAST) examination is not unusual place initial assessment of trauma patients. The goal of this study was to systematically evaluate the posted literature on diagnostic accuracy of all components of the eFAST examination.

Methods: We searched Medline and Embase from inception via October 2018, for diagnostic research analyzing the sensitivity and specificity of the eFAST exam. After elimination of duplicates, 767 information remained for screening, of which 119 underwent complete textual content evaluation. Meta-DiScTM software programs become used to create pooled sensitivities and specificities for included studies. Study pleasant and assess the usage of the Quality in Prognostic Studies (QUADAS-2) device.

Results: Seventy-five research representing 24,350 patients satisfied our selection criteria. Pooled sensitivities and specificities had been calculated for the detection of pneumothorax (69% and 99% respectively), pericardial effusion (91% and 94% respectively), and intra-abdominal free fluid (74% and 98% respectively). Sub-group analysis was completed for detection of intra-abdominal free fluid in hypotensive (sensitivity 74% and speci- ficity 95%), adult normotensive (sensitivity 76% and specificity 98%) and pediatric patients (sensitivity 71% and specificity 95%).

Conclusions: Our systematic evaluate and meta-analysis sug- gests that e-FAST is a beneficial bedside device for ruling in pneumo- thorax, pericardial effusion, and intra-abdominal free fluid in the trauma setting. Its usefulness as a rule-out device is not supported via way of means of those results.

Introduction

Trauma: is a major cause of death during the first four decades of life and is often associated with permanent disability, resulting in the loss of productive years in young individuals [1]. It commonly affects the age group of 15–44 years, which is economically the maximum efficient age group [1]. The occurrence of abdominal trauma is 20 % of all trauma cases. Blunt injuries to the abdomen are most common following road traffic crashes and fall from heights [1, 2]. Clinical assessment of patients with blunt abdominal trauma is considered as a challenge for the most surgeons because the clinical findings stay unreliable (diagnostic accuracy of clinical findings is only 47-87%) in most of the patients because of altered consciousness, neurological deficit, medication or other associated injuries[3]The rapid diagnosis and appropriate and timely intervention of these patients are essential to avoid significant morbidity and mortality associated with delay in treatment [4].In this situation the modalities available to the clinician withinside the emergency room are Diagnostic Peritoneal Lavage (DPL), Ultrasonography in Casualty department and Computed Tomography (CT) scanning[5].

Diagnostic Peritoneal Lavage (DPL) has been used for decades to detect hemoperitoneum but is ineffective for detecting retroperitoneal injury and solid organs injuries not associated with hemoperitoneum[6,7]. Also DPL is an invasive method with sensitive however nonspecific findings that could result in needless laparotomies[8].

The noninvasive diagnostic strategies including CT scan have step by step changed the invasive one (lavage). CT can efficiently detect hemo, retroperitoneal injury and solid organ injury, however it has much less accuracy in showing pancreatic, diaphragmatic and hollow viscus injuries[9].

FAST:is a rapid bedside and reliable examination that has now become an extension of the physical examination of the patient with blunt trauma abdomen (BTA) and can be performed during the resuscitation of such patients [10].

Literature review of FAST:

It was popularized in the United States by Rozycki et al in the early 1990s[11]. Initial and follow up experience indicated that FAST was accurate, non invasive and expeditious in assessing the critically injured patient withinside the emergency department. The procedure can be performed by surgeons and radiologists with identical reliability and it was useful in detecting blood in the abdominal cavity. As a result of that, FAST has in large part outmoded diagnostic peritoneal lavage (DPL). FAST can also aid in early triage of patients for fast control choice saving time and lowering patient mortality and cost. It used to identify pneumothorax (PTX), pericardial effusions (PCE), and intra-abdominal free fluid (FF).Early detection of those findings can help clinicians prioritize the performance of further diagnostic and therapeutic interventions[12]. In this review we sought to decide the diagnostic accuracy of the eFAST examination for the detection of PTX, PCE, FF in undifferentiated blunt trauma patients.

Methods:

This study was a prospective study and was carried out in Baquba teaching hospital between October 2020 and May 2021 after collecting data from another article talking about accuracy of FAST in blunt abdominal trauma. We adhered to the Preferred Reporting Items for Sys- tematic Reviews and Meta-Analyses (PRISMA) while undertaking this review[13].

Study selection:

Our population of interest was trauma patients (blunt, penetrating, or polytrauma), who were assessed in an emergency department (ED) or trauma centre, underwent an ultrasound examination during their initial assessment, and subsequently had a gold standard test performed. The ultrasound was considered positive for PTX if a lung point or lack of a lung slide was seen, and positive for PCE or FF when hypoechoic fluid was seen in appropriate anatomical location. The gold standard comparator for PTX was a computed tomography (CT) scan or chest tube insertion with gush of air. For FF, the gold standard was positive laparotomy findings, diagnostic peritoneal lavage(DPL), or CT scan and for PCE, it was a CT scan or positive intraoperative findings.

Discussion:

The undifferentiated trauma patient can present several simultaneous diagnostic and disposition challenges. The FAST exam provides trauma practitioners with a bedside device that can provide adjunctive information to the primary survey and help in determining the priority in the care.

Two recent reviews evaluated components of the eFAST exam, and although methodologically different from this review, they reach similar conclusions.[14,15].

- Staub et al. investigated detection of both PTX and hemothorax (which was not a focus of this review) and reported a sensitivity of 81%, a specificity of 98%.
- Stengel et al.15 examined the use of ultrasound in blunt thoracoabdominal trauma patients.

Their analysis had two subgroups:

1. All abdominal injury (FF, organ injury , vascular injury) sensitivity 68% & specificity 95% .
2. Abdominal FF &/or intra abdominal free air : sensitivity 78% & specificity 97% .

Direct comparison to our review is difficult as we did not look at ultrasound use for the detection of free intra-abdominal air, organ injury, or vascular injury.

Regardless of these differences, the reported sensitivities and specificities are very similar to our findings.

Identification of Pneumothorax:

Our study results suggest a moderate sensitivity and good specificity in detecting pneumothorax in the trauma settings, corresponding to a positive likelihood ratio of 62.57 and a negative likelihood ratio of 0.256 . Our results suggest that the FAST lacks adequate sensitivity to be used as a rule-out test while it can be used as a rule-in test for the detection of PT. Further, it should be noted that depending on the patient's age and comorbidities, Several false positives (prior pleurodesis and interstitial lung disease) and negatives (small PTX, and subcutaneous air) can occur[16].

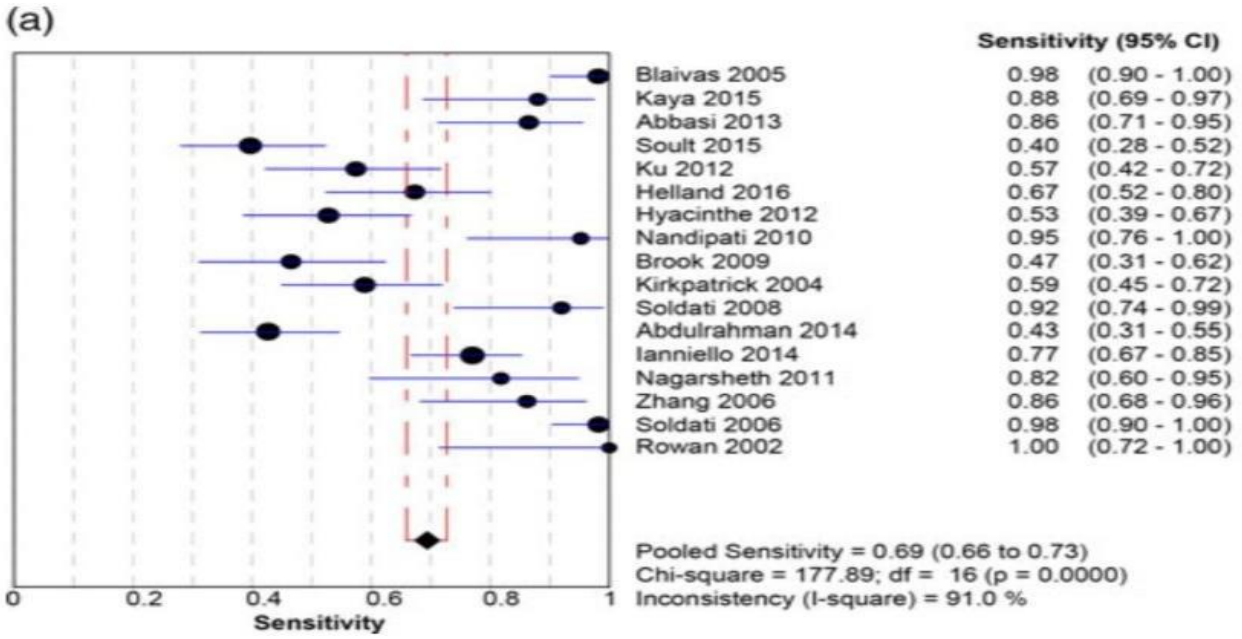

figure 1.(a): Forest plot the sensitivity of ultrasound identification of PTX in trauma patients.

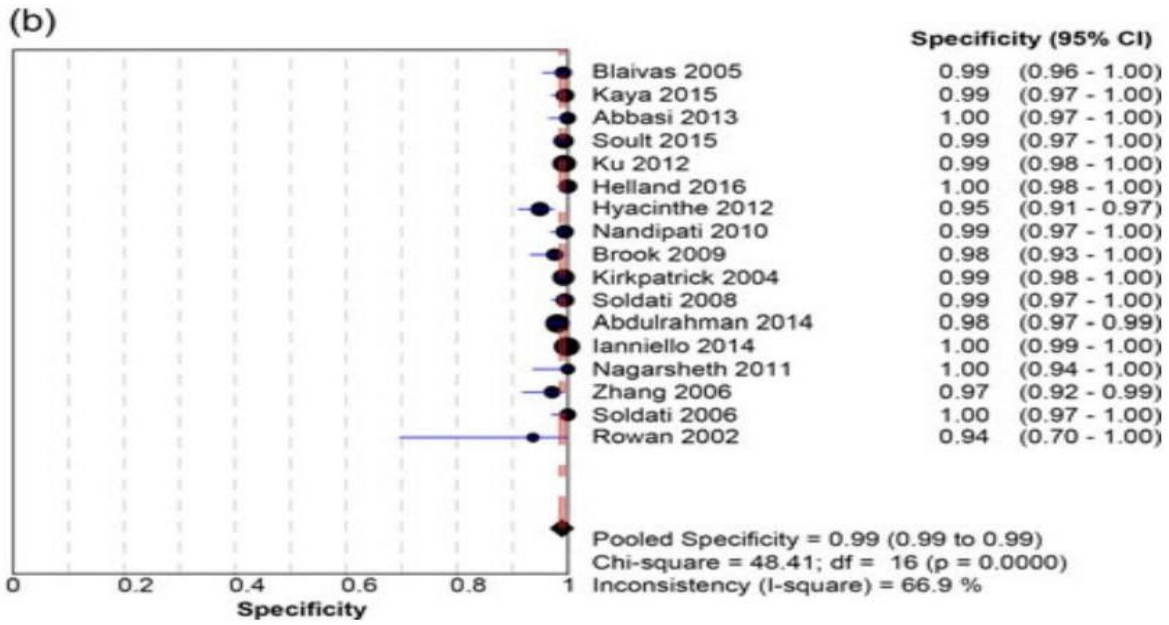

figure 1.(b): Forest plot the specificity of ultrasound in PTX identification in trauma patients.

Identification of Pericardial Effusion (PCE):

Our study results suggest excellent sensitivity and specificity of FAST in the detection of a PCE in the trauma setting (98.2% sensitivity & 98.5% specificity) with a positive likelihood ratio of 34.169 and negative likelihood ratio of 0.110. A false positive PCE scan can result from epicardial fat or pleural fluid, but false negatives could be because of small volumes of PCE or pericardial lacerations.

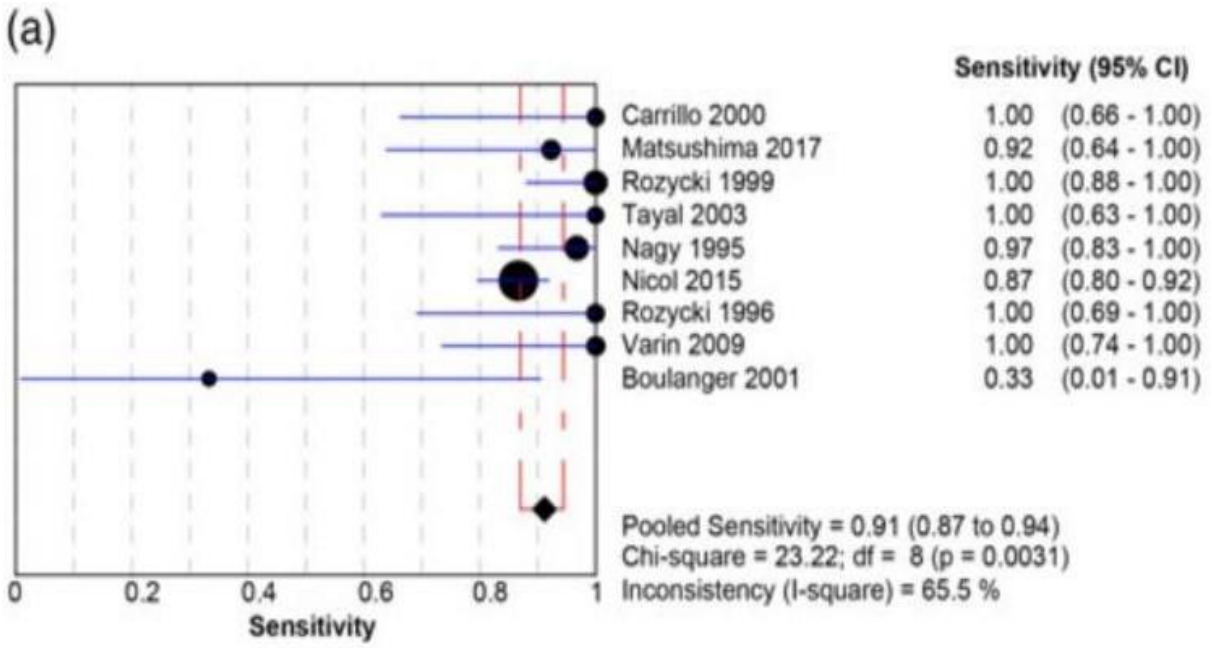

figure 2.(a): The sensitivity of ultrasound for identification of PCE in blunt trauma.

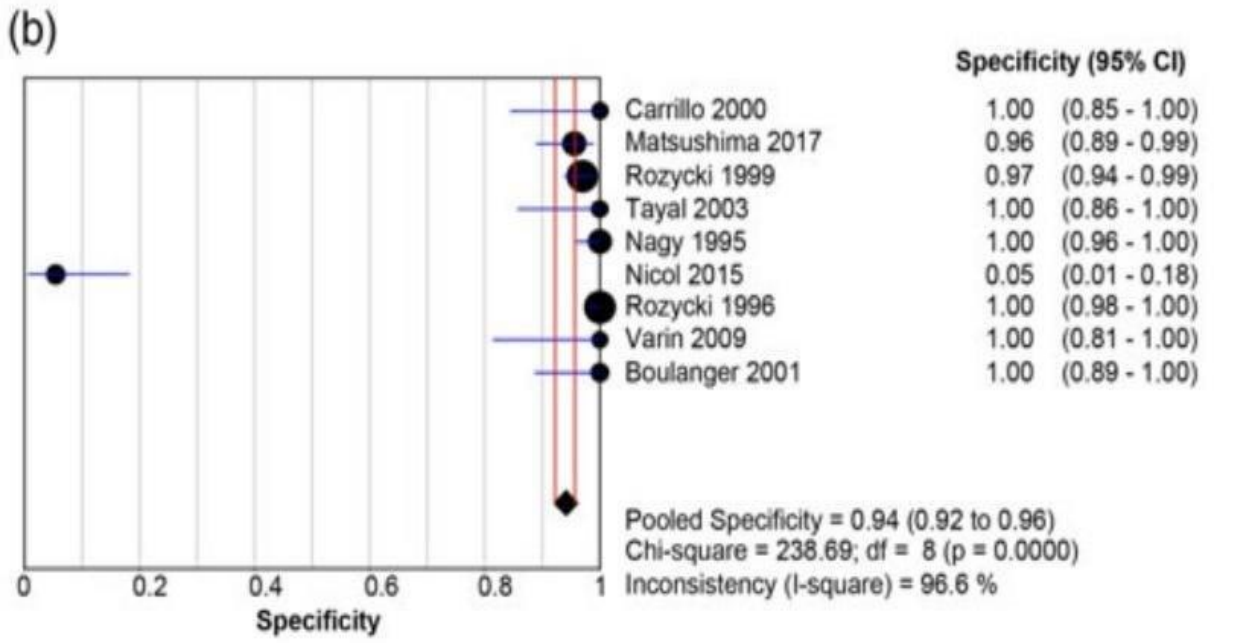

figure 2.(b): The specificity of ultrasound in identification of PCE in blunt trauma.

Identification of Free Intra-abdominal Fluid:

Our results suggest a moderate sensitivity and excellent specificity of FAST in the detection of FF corresponding to a positive likelihood ratio of 20.3 and negative likelihood ratio of 0.25. These test characteristics did not change significantly if pediatric, hypotensive, and normotensive adults subgroups were considered. If considering use, it should be noted again that there is the potential for false positives ,(peri- nephric fat and abdominal ascites) and false negatives (a small volume of fluid).

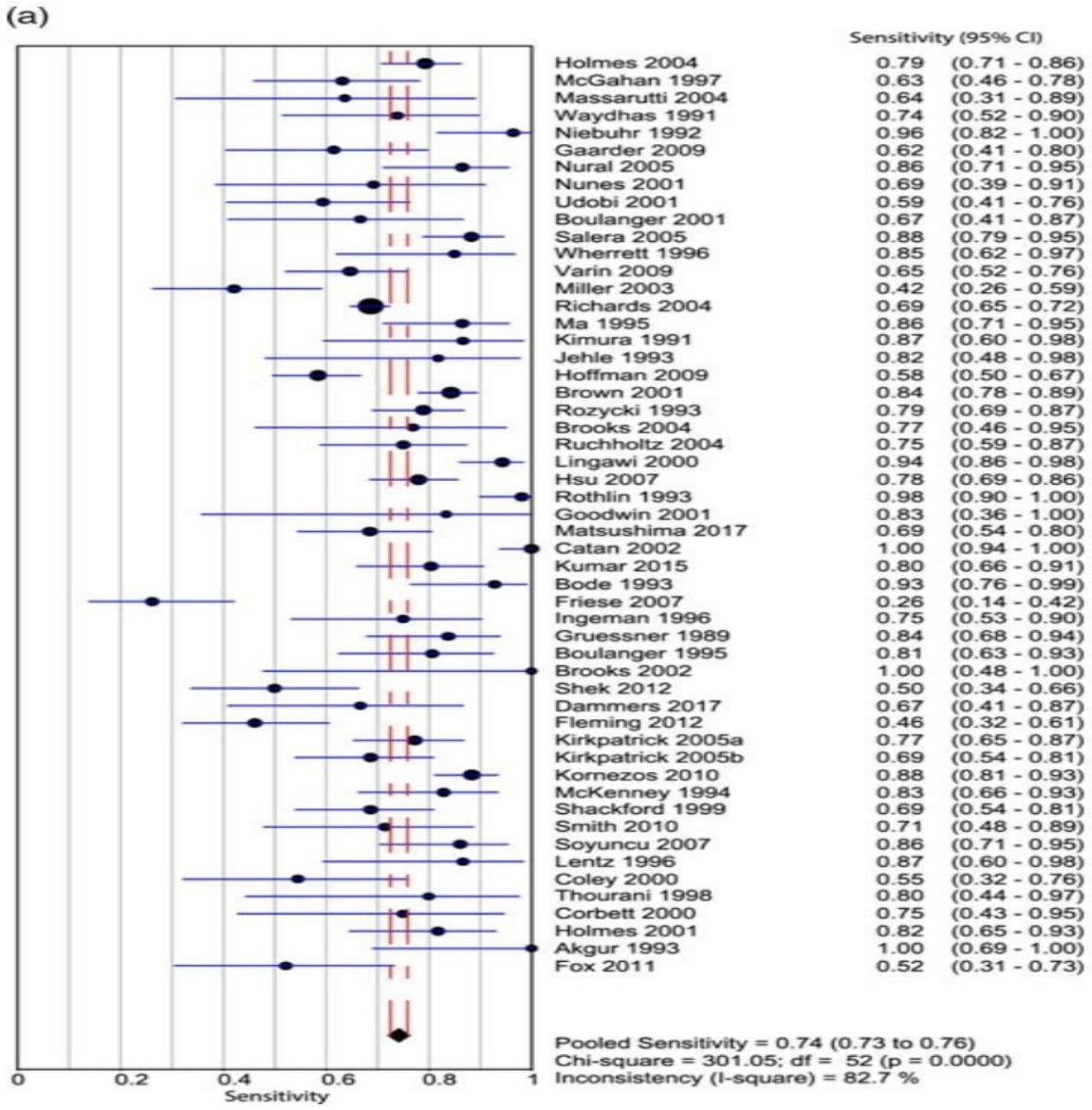

figure3. (a): Sensitivity of ultrasound in detecting FF in patient with blunt trauma

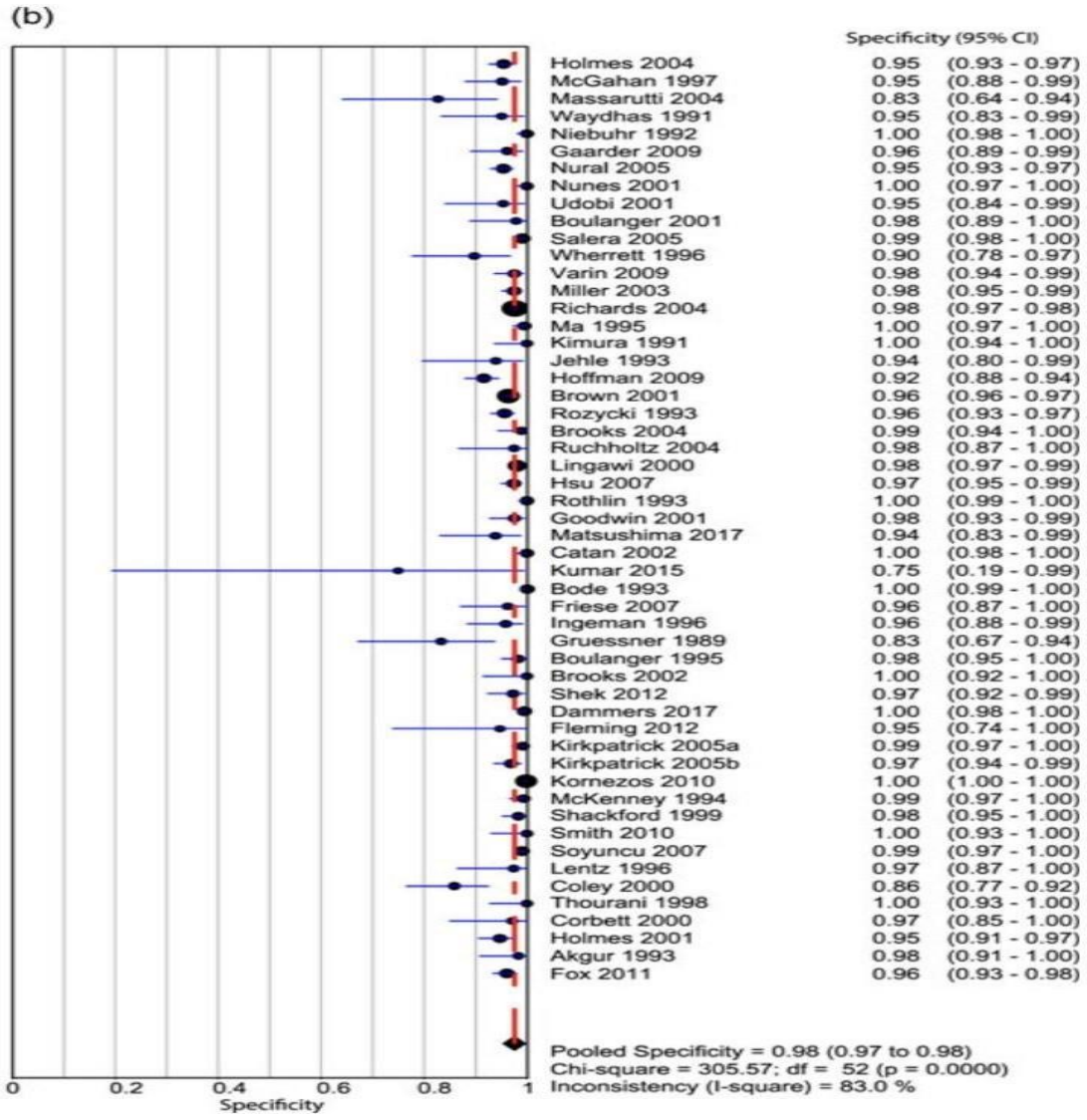

figure3. (b): Specificity of ultrasound in detecting FF in patient with blunt trauma.

Limitations:

Our study had several potential limitations. First and foremost, the study was potentially limited by our search strategy. The quality of the included studies is always a concern in systematic reviews and meta-analyses. As with study quality, we are also unable to control the statistical heterogeneity of the presented studies, by which this study is limited. If compared to the entire group of studies examining FF, the subgroup analyses had similar results, yet

improved heterogeneity. While the large group was heterogeneous, those similar results in the less heterogeneous subgroups give some reassurance to our findings.

Conclusions:

Our findings suggest that FAST can be used as a rule-in test for PTX, FF, or PCE in a trauma setting. This is supported by the high specificities and high positive likelihood ratios for each scan. Its usefulness as a rule-out tool in the trauma setting is not supported by our findings in this study.

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