Resident-performed FAST Scan for the Detection of Free Fluid

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Citation

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Abstract

Objective: The purpose of this study was to assess the accuracy of resident-performed focused abdominal sonography for trauma (FAST) exams for the detection of intraperitoneal free fluid (FF) in selected patients.

Methods: This was a retrospective review of patients presenting as victims of abdominal trauma or complaining of abdominal pain who underwent resident-performed FAST exam prior to operative exploration or department of radiology evaluation, which were considered gold standard.

Results: The overall sensitivity for the detection of FF was 87.6% (95% CI (81.6-91.9%)) with a specificity of 98.5% (95% CI (96.9-99.3%)). In the setting of traumatic abdominal pain, the sensitivity and specificity were 81.8% (95% CI (70.0-89.9%)) and 98.7% (95% CI (95.9-99.7%)) for the detection of FF. In the setting of penetrating trauma, the sensitivity and specificity for FF were 95.2% (95% CI (74.1-99.8%)) and 93.9% (95% CI (78.4-98.9%)), compared to 78.0% (95%CI (63.7-88.0%)) and 99.5% (95% CI (96.7-100%)) in blunt abdominal trauma. Among those patients presenting with non-traumatic abdominal pain, the sensitivity and specificity for FF were 91.0% (95% CI (83.7-95.4%)) and 98.3% (95% CI (96.0-99.4%)) respectively.

Conclusion: Residents can accurately perform FAST scans in selected patients, which were not previously established.

INTRODUCTION

Focused abdominal sonography for trauma (FAST) has assumed an increasing role in the management of patients presenting to the ED. Primary application has been in the evaluation of patients presenting with blunt abdominal trauma but has expanded to include patients with penetrating trauma and abdominal pain.

Unfortunately, only one study, involving 67 patients, has evaluated the accuracy of FAST scans performed by emergency medicine residents (EMRs) ([1]). The purpose of this study was to assess the sensitivity and specificity of EMR-performed FAST scan in the detection of intraperitoneal free fluid (FF).

MATERIALS AND METHODS

This was a retrospective review of patients presenting to an urban, academic ED as victims of abdominal trauma or complaining of abdominal pain. All patients who underwent documented EMR-performed FAST scans prior to operative exploration or department of radiology evaluation were included. Patients triaged by nursing staff to a walk-in urgent care were not included in this study.

Standardized data forms included in patient files were reviewed with predesigned data sheets. These forms included documentation of fluid in (A) Morison's Pouch, (B) the splenorenal recess, (C) subxiphoid or parasternal views, and (D) suprapubic views, along with the overall diagnostic impression as determined by the EMR.

All EMRs participated in a two-hour introduction to the operation of the Aloka SSD-1400 and basic FAST scan techniques prior to the study period. US examinations were performed using a 3.5 MHz curved linear array probe and recorded with a Sony thermographic printer.

The results of the EMR-performed FAST scans were compared against operative findings when available, otherwise department of radiology CT or US were used as gold standards for the presence of FF. Statistical analysis

was done using VassarStats. This study was approved by the IRB at our institution

RESULTS

From April 2000 to March 2002, 707 patients were evaluated with EMR-performed FAST scan prior to gold standard evaluation. 294 patients presented as victims of abdominal trauma and 413 patients presented with non-traumatic abdominal pain.

Overall, 177 of the 707 patients had FF on gold standard evaluation. EMR-performed FAST scans had a sensitivity and specificity for FF of 87.6% (95% CI (81.6-91.9%)) and 98.5% (95% CI (96.9-99.3%)) respectively (table 1). In the setting of abdominal trauma, EMR-performed FAST scans had a sensitivity and specificity for FF of 81.8% (95% CI (70.0-89.9%)) and 98.7% (95% CI (95.9-99.7%)). In the setting of penetrating abdominal trauma, however, the sensitivity and specificity for FF were 95.2% (95% CI (74.1-99.8%)) and 93.9% (95% CI (78.4-98.9%)) (table 2), compared to 78.0% (95%CI (63.7-88.0%)) and 99.5% (95% CI (96.7-100%)) in the setting of blunt abdominal trauma. Among the 413 patients with non-traumatic abdominal pain, the sensitivity and specificity for FF were 91.0% (95% CI (83.7-95.4%)) and 98.3% (95% CI (96.0-99.4%)) (table 1).

Figure 1

Table 1: overall sensitivity and specificity of resident-performed FAST scans (95% CI)

	FP	FN	TP	TN	Sensitivity	specificity
Total (N=707) (for free fluid)	8	22	155	522	87.6% (81.6-91.9%)	98.5% (96.9-99.3%)
Trauma patients (N=294) (for free fluid)	3	12	54	225	81.8% (70.0-89.9%)	98.7% (95.9-99.7%)
Abdominal pain (N=413) (for free fluid)	5	10	101	297	91.0% (83.7-95.4%)	98.3% (96.0-99.4%)

Figure 2

Table 2: sensitivity and specificity by trauma mechanism

	FP	FN	TP	TN	Sensitivity	specificity
Penetrating Trauma (for free fluid)	2	1	20	31	95.2% (74.1-99.8%)	93.9% (78.4-98.9%)
Blunt Trauma (for free fluid)	1	11	39	190	78.0% (63.7-88.0%)	99.5% (96.7-100%)

DISCUSSION

This study found that EMRs could accurately perform FAST scans in selected patients for the detection of FF. Our sensitivity and specificity were consistent with a prior study involving EPs with more training ([2]) and studies from the surgical literature using well-trained non-radiologists ([3,4,5,6,7,8,9]). In the setting of trauma, our sensitivity and specificity for FF in patients subsequently requiring laparotomy were 98.2% (95% CI (96.4-100%)) and 98.7% (95% CI (98.0-99.4%)). It seems, therefore, that minimally trained EMRs can accurately utilize FAST scans for the evaluation of selected patients in the ED.

One concern that has been raised is that EMRs might miss FF indicative of the need for laparotomy. In our sample, only one such case would have been missed based on the FAST scan findings alone. The patient had a perforated duodenum due to assault with a bat and presented with peritoneal signs. The EMR performing the FAST scan had difficulty due to the patient's pain and did not detect free fluid, thus, recording a “negative” scan. However, given the patient's exam and history, he was taken to the OR where a perforated duodenum with moderate free fluid was found and repaired. Furthermore, of the 11 remaining trauma patients with “false negatives”, all were admitted without the need for subsequent laparotomy or operative treatment (table 3). Thus, no case requiring laparotomy was missed in our sample. Of interest, however, all 12 “false negatives” were obtained by operators who had performed less than 20 prior FAST exams.

Figure 3

Table 3: “False Negatives” among patients presenting after trauma (MVC motor vehicle crash, GSW gun shot wound, FU follow up); (**patient had peritoneal signs limiting the exam due to pain)

	Level	Cause	FU	Positive Findings
1	I	MVC	CT	small amount of free fluid seen in the pelvis
2	I	MVC	CT	"slight" amount of perisplenic free fluid seen with a "mild" perisplenic laceration
3	I	MVC	CT	"tiny" amount of free fluid seen around the liver
4	I	MVC	CT	"mild" splenic laceration with "mild" amount of free fluid seen
5	I	MVC	CT	"small" splenic laceration with "small amount" of free fluid seen in the pelvis
6	I	MVC	CT	"Grade I" liver laceration with a "small amount" of free fluid seen in the abdomen
7	I	MVC	CT	"Grade I" liver laceration with a "tiny amount" of free fluid seen in Morison's pouch
8	I	GSW buttock	CT	small amount of free fluid in the pelvis
9	II	MVC	CT	"slight" amount of free fluid seen in the cul-de-sac
10	II	MVC	CT	"small" amount of perisplenic fluid seen without splenic laceration seen
11**	II	Assault	OR	"perforated" duodenum with "moderate free fluid"
12	III	MVC	CT	"small" amount of free fluid seen in pelvis

This is the first study involving only inexperienced residents and a large patient sample. The EMRs had limited didactic training (2 hours) and performed, on average, less than three prior US exams. Likewise, this study involved EMRs practicing in a busy, urban ED rather than a specific research protocol involving a few specially trained EPs. 100% of the EM residents (60 of 60) performed FAST exams during the study period, although 407 of the exams were done by residents who had previously performed 10 proctored exams.

LIMITATIONS AND FUTURE QUESTIONS

There were several limitations to this study. First, a retrospective convenience sample was used. While this does limit the study, our data was consistent with prior research demonstrating improved accuracy with greater operator confidence ($_{10}$). It is likely that those patients a particular EMR feels comfortable evaluating with US can be accurately assessed for FF with FAST. Reserving more difficult patients (eg, morbidly obese patients) for formal radiographic evaluation might allow for better utilization of resources in the ED. Likewise, among the patients evaluated in this study, no DPLs were done. It is unclear how this may have effected our data.

CONCLUSION

Our data demonstrate that EMRs can accurately perform FAST scans for the detection of FF in selected patients and confirmed the pilot study findings of Humphries and colleagues (1). It appears that the increasing use of FAST exams by residents is appropriate.

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