Evaluation of Focused Abdominal Sonography for Trauma (FAST) in Baghdad Teaching Hospital

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ABSTRACT:

BACKGROUND:

Focused Abdominal Sonography for Trauma (FAST) is widely applied in the initial management of trauma patients, Being non invasive, repeatable and without risk of irradiation, make it attractive tool in evaluation of trauma patients.

OBJECTIVE:

Evaluation FAST sensitivity and specificity in detection of hemoperitoneum in abdominal trauma victims .

METHODS:

Prospective study conducted in the emergency department of Baghdad teaching hospital for one year period .The FAST done by a general surgeon or emergency physician during the secondary survey of blunt and penetrating abdominal trauma victims with equivocal clinical findings.

RESULTS:

Ninety three (93) patients included in the study, with over all sensitivity of FAST was 80.9 % and specificity 95.8 %. In blunt abdominal trauma the sensitivity was 92.3 % and specificity was 96 % while in penetrating abdominal trauma the sensitivity was only 62.5 % and specificity 95.2 %.

CONCLUSION:

FAST is highly sensitive and specific in detection of hemoperitoneum after blunt abdominal trauma ,but its lower sensitivity in penetrating abdominal injury require modification in the protocols like repetition of the scan or application of extra views. Its high specificity make it suitable as "rule in" test in both blunt and penetrating abdominal injury.

KEY WORDS: abdominal trauma, ultrasound, focused abdominal Sonography for trauma.

INTRODUCTION:

Careful history and physical examination is the mainstay in evaluating trauma patient, but it is subjective method and surgeons vary in their threshold for laparotomy [1]. A Dutch retrospective study found an incidence of equivocal physical examination of 45% in multiply injured patients, rising to 84% in those with lower rib fractures [2] The first published prospective study using the ultra sound in acute setting was in 1976 by Asher et al [3] . the development of portable , low cost and high quality machines during the 90s had a major influence on the increased use of ultrasound as a bedside examination [4]. The term 'focused abdominal: Sonography for trauma' (FAST) scan has been used since the early 1990s [1]. In this examination limited, focused views done to detect intraperitoneal fluid .The term 'Focused Assessment: with Sonography for Trauma' (FAST) was coined by Rozycki et al. in 1996 [5]. In this FAST scan, both intraperitoneal free fluid and pericardial fluid collection are searched for In the USA, Europe, Japan and Australia FAST is routinely used in the initial evaluation of blunt abdominal trauma patients [6] In Iraq the problem of multiple injured patients with equivocal clinical findings has been expanded during the last few years with limited availability of CT or formal ultrasound in emergency condition, hence the need for surgeon performed FAST appeared. In this paper we intended to evaluate the FAST as a part of initial management of trauma patients in Baghdad teaching hospital.

PATIENTS AND METHODS:

Prospective study conducted in the emergency department of Baghdad teaching hospital – medical city (Baghdad), for the period from the first of March 2008 to the first of March 2009 (one year period). The FAST examination performed by general surgeons or emergency physicians whom received four hours training by expert sonographer, including theoretical lectures and practical sessions, with sonographer supervision in first few cases in the study. The study included victims of blunt and penetrating abdominal trauma with one or more of the following features; (1) indefinite abdominal signs (2) altered level of

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Consciousness (3) associated extra abdominal injury. Patients with clear indication for laparotomy were excluded from the study. FAST scan was done during the secondary survey once for each patient. The study protocol did not mandate the repetition of the scan. Ultrasonic machine with 3.5 MHZ sector probe was used . The scan was done with the patient in supine position. If the urinary bladder was already evacuated by Foleys catheter its filled by 150-200 cc of sterile saline through the same Foleys catheter unless it is contra indicated such as in suspicion of urinary bladder injury. Four standard views were performed in each case, namely, (1) right upper quadrant view to include Morrison's pouch; (2) left upper quadrant view to include the splenorenal recess; (3) transverse pelvis view; (4) longitudinal pelvis view to visualize the pelvic space .The main focus of the FAST scan was to detect free intra-peritoneal fluid. The FAST considered positive when free fluid noticed at least in one view without any quantitative measures or specific attempt to identify solid organ injury (fig 1 and 2). The result of FAST did not allowed to interfere with standard diagnostic and therapeutic measures of the patients except when positive FAST noticed in a patient who otherwise will not be further investigated. The methods used to confirm the result of FAST examination were either laparotomy or observation for at least two days with or without a formal ultrasound and then follow up as an outpatient. The sensitivity and specificity were calculated according the following equations:

Sensitivity = true positive / true positive + false negative *100

Specificity = true negative / true negative + false positive *100

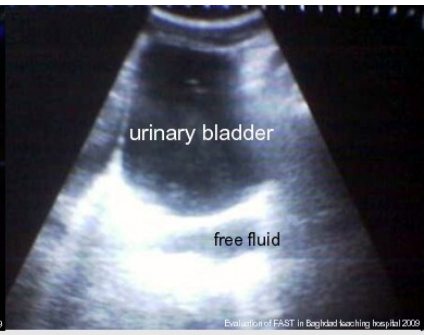
RESULTS:

During the study period 93 patients were included, 64 patients with blunt abdominal trauma and 29 patients with penetrating abdominal trauma. Their age ranged between 2–60 year with male to female ratio 2.4: 1 The demographic characteristics and classification of injury shown in (table 1).

The total no of FAST examinations were 93 from these examinations 86 examinations were true (17 true positive and 69 true negative) and 7 examinations were false (3 false positive and 4 false negative). with over all sensitivity 80.9 %, specificity 95.8 % in patients with blunt abdominal trauma the results of FAST are shown in (table2). The sensitivity was 92.3 % and specificity was 96 %. While in penetrating abdominal trauma patients (table3) the sensitivity was only 62.5 % and specificity was 95.2 %.

Laparotomy done in 23 patients (24.8%). 17 positive laparotomies for positive FAST examinations, four positive laparotomies for negative FAST examinations .two negative laparotomies for two patients with negative fast (the first one has multiple shell injuries in the abdomen and lower limps , the second has associated chest injury) , the decision for exploration relied on clinical examination . 48 patients (51.6 %) were admitted and formal ultrasound done for them all the formal ultrasounds were negative (three for positive FAST and 45 for negative FAST) , 22 patients (23.6 %) admitted and observed at least for two days during which the clinical findings subsided completely and discharged well without squally during the follow up . Regarding the false positive cases (2 blunt and 1 penetrating injuries), all of them treated conservatively based on clinical background and discharged well after negative formal ultrasound. while the false negative cases (1blunt and 3 penetrating injuries) all of them explored when the clinical findings of abdominal injury became more obvious and the operative findings varied between injured spleen required splenectomy (2cases), gastric perforation (1case) and liver injury with bleeding required suturing (1case).

(FIG 1) free fluid in Morrison's pouch



(FIG 2) free fluid in the pelvis

Table 1: clinical and demographic characteristics of the injured patients .

characteristics		No of patients (and %)
Total no of patients		93
Age range in years		2-60
Mean age in years		24.27
Male : female ratio		66: 27 (2.4:1)
Blunt abdominal trauma	Road traffic accidents	60 (93.7 %)"
	Fall from height	4 (6.3 %)"
	total	64 (68.8 %)*
Penetrating abdominal trauma	Shell injuries	15 (51.7 %)†
	Bullets	9 (31 %)†
	Stab wounds	5 (17.3)†
	total	29 (31.2 %)*
Associated extra-abdominal injury	Chest	25 (51%)‡
	Head injury (GCS <13)	11 (22.4%)‡
	Pelvic or long bones fractures	9 (18.4%)‡
	More than two regions	4 (8.2%)‡
	total	49 (52.6 %)*

* of all patients " of blunt trauma patients †of penetrating injury patients
‡ of extra-abdominal injury patients

Table 2: diagnostic performance of FAST in blunt abdominal trauma patients.

FAST exam	Definitive test* positive	Definitive test* negative	Total
Positive	12 (true)	2 (false)	14
Negative	1 (false)	49 (true)	50
Total	13	51	64

Definitive test is either laparotomy or observation for at least two days with or without formal ultrasound

Table 3: diagnostic performance of FAST in penetrating abdominal trauma patients

FAST exam	Definitive test* positive	Definitive test* negative	Total
Positive	5 (true)	1 (false)	6
Negative	3 (false)	20 (true)	23
Total	8	21	29

Definitive test is either laparotomy or observation for at least two days with or without formal ultrasound

Table 4: comparison of FAST results in blunt abdominal trauma patients In different studies.

study	No of patients	sensitivity	specificity
Our study	64	92.3	96
Rozycki (1993) [8]	402	80	90
Chi Leung 2008 [1]	242	86	99
J Brenchley 2006[10]	153	78	99
Michael 2004 [11]	65	43	100
Bakshi 2003 [12]	56	91	100
Mckenney(2001)[13]	996	88	99
Bodes (1993) [14]	338	92	100
Rothlins (1993) [15]	312	98	99.5

DISCUSSION:

Emergency ultrasound differs from formal ultrasound in fundamental aspects, it is performed at the bed side in the emergency room simultaneously or shortly after the initial resuscitation and clinical evaluation and described as an extension of the palpating hand and a "visual stethoscope" [7] trying to answer a specific questions. For example: in situation of trauma, is there any free intraperitoneal fluid (blood). Being non invasive , repeatable and without risk of irradiation make it attractive tool in evaluation of trauma patients.[1,8] In our study , FAST examination in blunt abdominal trauma patients , was highly sensitive (92.3 %) and specific (96 %) in detection of free intraperitoneal fluid .While in penetrating abdominal trauma patients, the sensitivity was only 62.5 %, which is less encouraging to consider the FAST as a screening tool in penetrating abdominal trauma victims , but it is highly specific (95.2 %) . These results are comparable to the results of other international studies [1,8-15] . Rozycki et al [8] studied 402 with blunt trauma and 74 patients with penetrating trauma using four views protocol and demonstrated an over all sensitivity 79% and specificity 96%, in blunt abdominal trauma alone showed 80 % sensitivity and 90 % specificity, while his result in penetrating abdominal trauma alone showed sensitivity of 74 % and specificity 87% and concluded that US can be used in evaluation of blunt abdominal trauma patients. Ma et al [9] studied 200 patients including both blunt and penetrating abdominal trauma by six views protocol and showed 90 % sensitivity and 99 % specificity, and concluded that FAST can be used in evaluation of both blunt and penetrating abdominal injuries. If we consider the blunt trauma alone, the sensitivity in multiple articles ranged from 43% to 98 % and specificity ranged from 90% to 100% as shown in table 4. the high specificity shows the appropriateness of FAST scan as " rule in " technique in evaluating trauma victims [1,10] and many international studies concluded that the FAST scan can be used effectively in initial screening of blunt abdominal trauma patients [1,8,10-15] . FAST is operator dependent [1,4,16] and operators vary in their expertise , performance and their training.

There is no universal agreement about how long and how many FAST scans a surgeon should perform to be accredited to do the scan [1].

An international consensus conference in 1999 [17] recommended a 4-h didactic component, a 4-h practical component, and 200 supervised examinations, while the study from Shackford et al. suggested that the error rate was stabilized after only ten scans [18].

In our study the training lies within the wide range of training proposals. FAST has it's own limitations, for example it is relatively poor in detection of injuries without enough hemoperitoneum at time of examination such as ; hallow viscus, diaphragm, retroperitoneal structures injuries and concealed hematoma of the liver and spleen [1,19,20] . This explains our false negative cases where an injury to hallow vicus (stomach) in one patient and solid organ injury in other three patients were missed , its also reflect the importance of the amount of hemoperitoneum at time of FAST examination, though Goldberg [1] showed that a 100 cc of free fluid can be seen by ultrasound ,but many studies suggest that the amount of blood needed to be detected ranged from 250 to 600 cc [4,16,19]. Early FAST before the accumulation of blood can be negative, and proper timing and repetition of the scan in suspicious cases increase its sensitivity [1,10,19]. In our study FAST performed during the secondary survey and if we took in consideration the time of transportation from the trauma site to the emergency room we can conclude that, at time of FAST scan is performed already enough time had passed for blood to accumulate in most of our patients, and that explain the fact that the sensitivity in our study is higher than many other studies (table4). Other limitation is some anatomical facts such as the perinephric fat and fluid in the intestine and stomach which may be misdiagnosed as free fluid [1] especially when inappropriate gain setting is applied [8]. This explain our false positive cases , where scans for two patients with blunt abdominal trauma considered as positive based on the pelvic view only where the fluid in the bowel can be mistaken as free fluid. The third scan is for a patient with bullet injury to the right lower chest, considered as positive based on the right upper quadrant view alone where the perinephric fat can be mistaken as free fluid. Some limitations are related to the patient such as: morbid obesity, surgical emphysema, wounds and dressing close to the sites of the FAST examination, all of these factors affect on the "echoic windows " through which the scan is done and affect its accuracy and even it may preclude its use [1,16] under such circumstances other modality of investigation is required such as DPL or CT scan. It is well accepted that hemoperitoneum per se following trauma is not necessarily an indication for immediate laparotomy and some quantitative measures are required in

order to assist the surgical decision [16],for this reason different authors described some scoring systems for hemoperitoneum.such as Huang scoring system[1] and McKenney scoring system [13] , in which five regions were assessed: right subphrenic space, subhepatic space, left subphrenic space, perisplenic area, and pelvis. One point was granted to each positive area, and the final score was the summation of total positive areas plus the depth of largest collection in centimeters. The conclusion was that 87% with a score ≥3 required a therapeutic laparotomy.

CONCLUSIONS:

Surgeon-performed FAST is highly sensitive and specific, it can be used in the initial management of blunt abdominal trauma patients .While In patients with penetrating abdominal trauma, it has lower sensitivity but still highly specific so it can be used as "rule in" test in equivocal cases. However FAST is operator dependent and has its own limitation, in hemodynamically stable patients with suspicious clinical findings a repetition of FAST ,application of extra views and the use of scoring system will assist the surgical decision .

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