

## EFFICACY OF FOCUSED ASSESSMENT SONOGRAPHY IN TRAUMA (FAST) IN PATIENTS WITH BLUNT ABDOMINAL TRAUMA.

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### ABSTRACT

**Background & Objective:** Unrecognized blunt abdominal injuries are frequently the cause of preventable death. Clinical examination is often inaccurate and therefore, reliable, accurate and repeatable bedside diagnostic test should be selected such as Sonography. This study was undertaken to assess the efficacy of Focused Assessment Sonography in Trauma (FAST) examination for detection of free fluid in abdomen in patients with Blunt Abdominal Trauma.

**Methods:** This study is a prospective and observational study, conducted in the Department of Emergency Medicine, S.S.G. Hospital and Medical College, Baroda. All patients who were brought to us with definite or suspected blunt abdominal trauma brought during the study period from October 2014 to February 2016 were included. FAST with four standard views was performed using a low frequency curvilinear probe in all the patients and repeated after 30 minutes. Results were compared with CT, surgical findings, postmortem findings and the patient's clinical status after 24 hours of observation.

**Results:** Total of 256 patients were included in our study and the majority of them were males and the most common cause of injury was a Road Traffic Accident. The sensitivity and specificity of FAST were 97.6% and 100%, respectively, with an accuracy of 99.2%.

**Conclusion:** Our study shows that the FAST is a highly sensitive, specific, reliable and accurate initial bedside investigation in patients with blunt abdominal trauma, which can be performed rapidly even in haemodynamically unstable patients, making it a very useful tool in the Emergency Department.

**Key-words:** Blunt Abdominal Trauma, Emergency Department, FAST.

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### INTRODUCTION

Abdominal injuries rank third as a cause of traumatic death just after head and chest injuries. Undetected hemoperitoneum is

one of the most common causes of death in injured patients. Unrecognized abdominal injuries are frequently the cause of preventable death. The abdomen of trauma victims is routinely evaluated with

physical examination and clinical signs that have relatively low diagnostic accuracy (47% to 87%),<sup>1</sup> especially when the patient had a decreased consciousness level, neurological deficit, other associated injuries, or was under the influence of drugs or medications. Thus, diagnostic tests must be selected, performed and interpreted to reliably discriminate between patients who require therapeutic intervention or further study from those who do not. One of the most important tools for this purpose is sonography. Sonography is designed to complement other investigations: diagnostic peritoneal lavage (DPL) is very sensitive, but not without disadvantages, while CT will remain the gold standard, but there is usually some delay in obtaining a scan and necessitates a haemodynamically normal patient as it is not a bedside investigative procedure and patient needs to be shifted to the CT facility.<sup>2</sup> Blunt abdominal trauma (BAT) comprises 75% of all blunt traumas. The majority occurs in vehicular accidents, in which rapid deceleration may propel the driver into the steering wheel, dashboard, or seat belt causing contusions in less serious cases, or rupture of internal organs from briefly increased intraluminal pressure in the more serious, dependent on the force applied. Other causes of BAT include fall, assault, sports injury and accidental injuries with unusual objects.<sup>3</sup>

The focused assessment sonography in trauma (FAST) is a focused, goal directed, sonographic examination of the abdomen aimed at detecting the presence or absence of hemoperitoneum. It provides a viable alternative to other investigations in the blunt abdominal trauma patient, and can be integrated into the primary survey in

patients with signs of hemorrhagic shock or suspicion of intra abdominal injury. It has the additional advantages of being noninvasive, reproducible, and is capable of being rapidly performed at the patient's bedside by the Emergency Physician. A standard 4 view examination can be completed in approximately 2 minutes. Bedside sonography not only increases the speed of the patient management, but also lowers the costs in the Emergency Department, as well as it can be utilized in haemodynamically unstable patients also.<sup>4</sup>

Our center is a tertiary care hospital and one of the largest hospitals in central Gujarat, where many patients of Blunt Abdominal Trauma are referred from rural parts of central and south Gujarat region as well as from the border areas of nearby states like Madhya Pradesh, Maharashtra and Rajasthan also. Till date, no such study on FAST has been conducted at our center and perhaps in Gujarat. Therefore, this study was undertaken to assess the efficacy of FAST in patients with Blunt Abdominal Trauma and to define the utility of FAST as a screening test for detection of free fluid in abdomen.

## MATERIAL & METHODS

This prospective and longitudinal study had been conducted in the Department of Emergency Medicine, SSG Hospital & Medical College, Baroda during the period of one year from 1<sup>st</sup> October 2014 to 29<sup>th</sup> February 2016. Total 256 patients, which were brought to us with definite or suspected blunt abdominal trauma during this period were included in the study. Ethical clearance from the institutional review committee was taken before starting the study and informed and written

consent was taken from the patient or relatives of the patient. The patient's general details, mechanism of injury, primary survey details, examination findings and initial management details were filled in the predesigned proforma.

FAST protocol examination with four standard views (subxiphoid, right upper quadrant, left upper quadrant and pelvic) was performed using a low frequency curvilinear probe (3-5 MHz) in all the patients and repeated after 30 minutes. In some patients, a third FAST was also performed according to the need. Any anechoic strip or collection in the peritoneal space was considered as free fluid and the related solid organ injuries were identified. In trauma patients, the fluid is always assumed to be blood. As many patients may be emergently transferred to Operation Theatre and many of the patients remain stable clinically, third FAST was not required in many patients. The results of the FAST were compared with the findings of clinical examination after 24 hours as well as with the observations of CT scan findings or surgical findings or postmortem findings.

Data collection was done and proforma filled and data were analyzed using Medcalc Version 12.5.0 Software and appropriate statistical tests were applied. The findings of this study were compared with the similar type of studies done by the Indian and foreign authors.

## RESULTS

Table 1 shows that among 256 patients, the majority of the patients were males (66%) and the rest were females (34%).

Table 2 shows that the most common mechanism of injury was RTA (65%) in male patients, which was followed by fall from height (24%), assault (9%), and others (2%) while in case of female patients the most common mechanism of injury was fall from height (49%) followed by RTA (39%) and assault (12%).

**Table-1 : Distribution of Patients According to Sex**

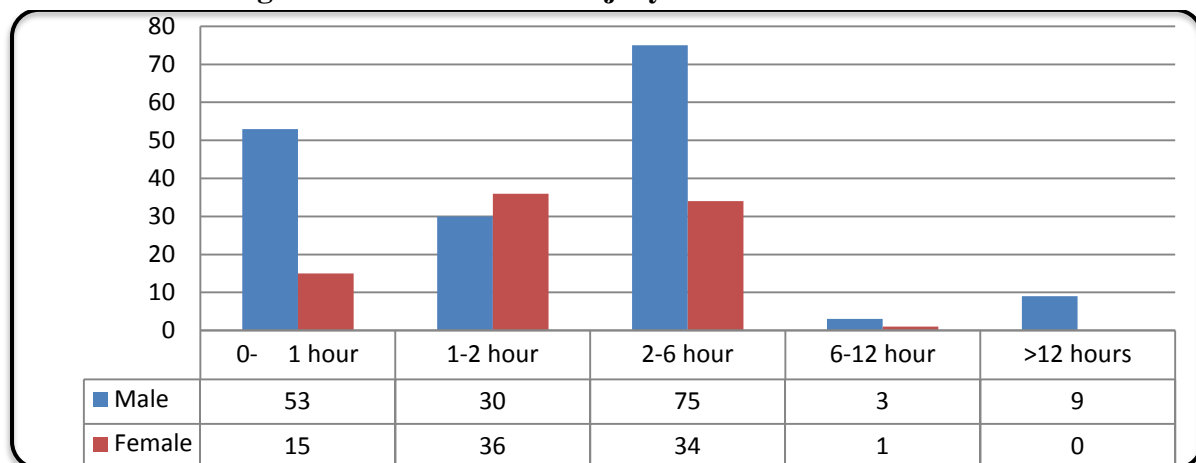
Male		Female		Total
170	(66%)	86	(34%)	256

**Table-2 : Distribution of Patients, According to Mechanism of Injury Causing BAT**

Mechanism Of injury	Male	(% among males)	Female	(% among females)	Total	(% among total patients)
Road Traffic Accident (RTA)	111	(65%)	34	(39%)	145	(57%)
Fall from height	40	(24%)	42	(49%)	82	(32%)
Assault	16	(9%)	10	(12%)	26	(10%)
Others	3	(2%)	0	(0%)	3	(1%)
Total	170		86		256	

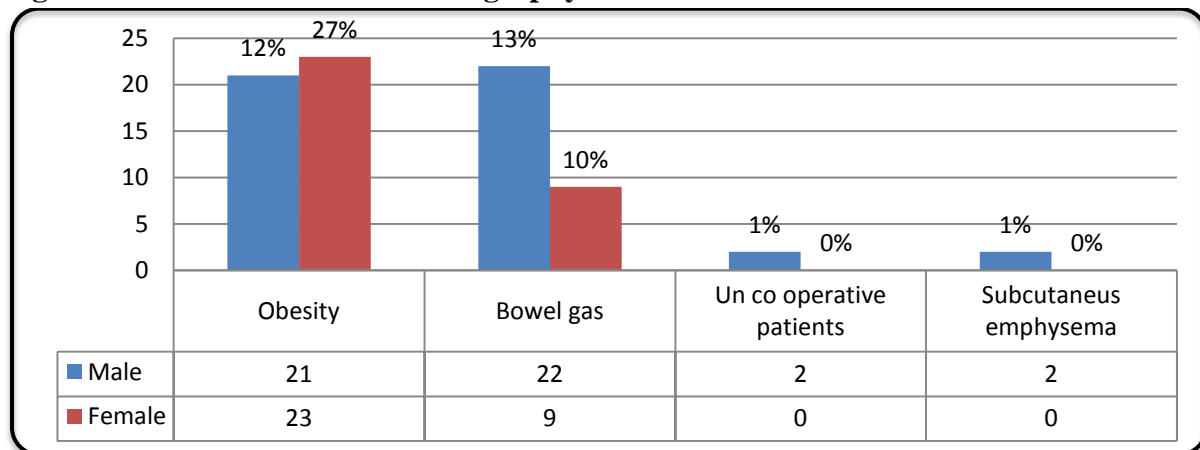
**Table-3 : Distribution of Patients According to Clinical Examination Findings**

Examination	Male	(% among total male patients)	Female	(% among total female patients)	Total	(% among total patients)
Tenderness	77	(45%)	25	(29%)	102	(40%)
Rigidity	45	(26%)	15	(17%)	60	(23%)
Guarding	61	(36%)	27	(31%)	88	(34%)
Absent bowel sounds	63	(37%)	27	(31%)	90	(35%)
Abdominal Distension	34	(20%)	10	(12%)	44	(17%)
Dull note on percussion	34	(20%)	10	(12%)	43	(17%)
Abrasion/contusion	99	(58%)	49	(57%)	148	(58%)
blood at urethral meatus	5	(3%)	0	(0%)	5	(2%)
swelling or bruise over perineum, vagina, rectum, buttocks	0	(0%)	3	(3%)	3	(1%)

**Figure-1 : Time Between Injury and Fast Examination**

On abdominal examination, abrasion/contusion (58%) was the most common inspectory findings, while, tenderness (40%) was the most common palpatory finding, followed by guarding (34%) and rigidity (23%). This time duration is between injury and first FAST performed in the Emergency Department,

which includes the time for transport from the injury site. As most of the patients were brought from the nearby area, most (243) (96%) of the patients were examined with FAST within 6 hours of injury. Out of which, 68 (27%) patients had FAST within 1 hour and 66 (26%) patients had FAST within 1-2 hours.

**Figure-2 : Adverse Factor for Sonography**

The most common adverse factor for Sonography in males was bowel gas (13%), followed by obesity (12%); while in females, obesity (27%) was the adverse factor in the majority. In the present study, two serial FAST were performed in all 256 patients. Out of 177 patients in whom first FAST was negative, second FAST (after 30 minutes of first FAST) turned out to be positive only in 2 (1%) patients.

**Table-4 : Sensitivity & Specificity of Fast**

FAST	Positive hemoperitoneum	Negative hemoperitoneum	Total
Positive	81	0	81
Negative	2	173	175
Total	83	173	256

- Sensitivity =  $\frac{81 \times 100}{83}$   
= 97.6% (95% CI = 91.5% - 99.7%)
- Specificity = 100% (95% CI = 97.9% - 100%)
- Positive Predictive value = 100% (95% CI = 95.55% - 100%)

- Negative Predictive value =  $\frac{173 \times 100}{75}$   
= 98.8%  
(95% CI = 95.9% - 99.88%)
- Positive Likelihood ratio- As specificity is 100%, positive likelihood ratio cannot be calculated
- Negative Likelihood ratio  
= 1- sensitivity/specificity  
= 0.024 (95% CI = 0.01-0.09)
- Accuracy  
= True positive+ True negative/ Total patients  
= 254/256 =99.2%  
(95% CI = 97.2% - 99.9%)

#### Among All (256) Patients irrespective of FAST findings

- 44 (17%) patients had CT scan positive for hemoperitoneum
- 25(10%) patients had operative findings positive for hemoperitoneum, out of them 11 (4%) patients had CT scan done
- 7 (3%) patients had Post Mortem reports positive for hemoperitoneum.

- 18 (7%) patients were kept on conservative management without any CT scan.
- All 52 (20%) patients who were on conservative management were stable after 24 hours.

#### **Among FAST Positive Patients (81)**

- 42 (52%) patients had CT scan positive for hemoperitoneum
- 24(30%) patients had operative findings positive for hemoperitoneum, out of them 10 (12%) patients had CT scan done
- 18(22%) were patients were kept on conservative management without any CT scan.
- All 50 (62%) patients who were on conservative management were stable after 24 hours.
- 7 (9%) patients had Post Mortem reports positive for hemoperitoneum.

#### **DISCUSSION**

During the period of our study, out of a total 256; 66% patients were males and 34% were females. Almost similar findings were noticed by Betul Gulalp et al,<sup>5</sup> Nauman Al Qamari et al<sup>2</sup> and Navid Farahmand et al<sup>6</sup> showing that Blunt Abdominal Trauma is more common in males. The present study shows that Road Traffic Accident (RTA) is the major contributor in injuries causing Blunt Abdominal Trauma. Brooks et al,<sup>7</sup> J. Branchley et al,<sup>8</sup> M. Jawed et al<sup>9</sup> and Nauman Al Qamari et al.<sup>(2)</sup> also found RTA as a most common cause of Blunt Abdominal Trauma in their studies. In our study, we observed that Road Traffic Accident (RTA) was the most common cause of injury in males (65%) while in

females fall from height (49%) was the major contributor.

In the present study, the time elapsed between injury and first FAST examination (including transport from the injury site) was less than 1 hour in 27% patients, 1-2 hour in 26% patients, 2-6 hours in 43% patients, 6-12 hours in 1% patients and >12 hours in 3% patients. The study performed by Nauman Al Qamari et al<sup>2</sup> reviewed that the time elapsed between injury and first FAST examination (including transport from the injury site) is less than 1 hour in 4% patients, 1-2 hour in 9% patients, 2-6 hours in 41% patients, 6-12 hours in 29% patients and >12 hours in 18% patients. The present study also shows, similar to the finding of J. Branchley et al<sup>8</sup> that around about one third to one fourth patient have adverse factor for sonography in blunt abdominal trauma victims. Obesity and bowel gases were the major contributors among these adverse factors, but even after the presence of these adverse factors for sonography, the FAST results in our study were accurate and no false positive or false negative FAST results were obtained from these patients.

This study is similar to the observations of studies conducted by others, e.g. Ali Feyzi et al<sup>10</sup> showed the importance of serial FAST examination. The present study shows that FAST is a highly sensitive, specific and accurate tool for detecting free fluid in the abdomen and so can be used as a rapid screening test in the Emergency Department and almost similar findings were observed by Richards JR et al,<sup>11</sup> Dolich MO et al<sup>12</sup> Sanjeev Bhoi et al,<sup>13</sup> Majid Zamani et al,<sup>14</sup> Nural MS et al,<sup>15</sup> Bowra J et al<sup>16</sup> and Branchley et al.<sup>8</sup>



This study may be helpful to form a management protocol which includes FAST as a screening test, in the Emergency Department for the patients of polytrauma in various health centers like ours at SSG Hospital, Baroda.

## CONCLUSION

FAST is proven to be highly sensitive, specific, reliable and accurate initial bedside investigation in patients with blunt abdominal trauma. It can be done bedside with least disturbance to the patients as there is no need for patient shifting and hence is useful in acute care settings and is particularly useful as a screening test and to triage patients who urgently need to undergo CT scan and/or emergency laparotomy. Reliance on a single FAST examination can be misleading and hence serial examination with FAST should be done to rule out the false positive and false negative results. This study needs to be further evaluated in a larger group of patients to validate the results at this center as well as other centers.

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**Conflict of Interest:** None.

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