



## FOCUSED ABDOMINAL SONOGRAPHY IN TRAUMA (FAST) IN PATIENTS WITH BLUNT TRAUMA ABDOMEN IN RURAL AREA- A PROSPECTIVE STUDY

### General Surgery

**Dr. Prashant Pandey**

Assistant Professor, General Surgery, Uttarpradesh University of Medical Sciences, Saifai, Etawah

**Dr. Rajesh Verma\***

Associate Professor, General Surgery, Uttarpradesh University of Medical Sciences, Saifai, Etawah \*Corresponding Author

### ABSTRACT

**Background:** Unrecognized blunt abdominal injuries are often causing of the preventable death. Clinical examination is frequently inaccurate and therefore, the reliable, accurate and repeatable bed-side diagnostic test should be chosen such as Sonography. This study was under-taken to assess Focused Assessment Sonography in Trauma (FAST) examination for in rural area in the patients with Blunt Abdominal Trauma.

**Material and Methods:** This was the prospective study including all the trauma team cases in a 24 months period between March 2016 to February 2018 in emergency department of a Uttarpradesh University of Medical Sciences & hospital, Saifai. The results of the FAST scans were analyzed and when the FAST was positive or followed by the period of the clinical observation when FAST was negative. Descriptive statistics & sensitivity, specificity, & predictive values were calculated.

**Results:** Total of 100 patients were included in our study and the majority of them were males and the commonest cause of injury was a Road Traffic Accident. The sensitivity & specificity of FAST were 92.68% and 98.31%, respectively, with an accuracy of 96.0%.

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

### KEYWORDS

Blunt Abdominal Trauma, FAST, Ultrasonography, CT scan, Liver injury, Spleen injury

### INTRODUCTION

Abdominal trauma contributes to 10% of overall trauma mortality & considerably more in terms of morbidity. The under appreciation of abdominal injuries represent a significant cause of preventable trauma deaths. Abdominal trauma could be blunt or penetrating. Blunt trauma occurs in approximately 2/3<sup>rd</sup> of abdominal injury patients. Road Traffic Accidents (RTA) account for up to 80% of blunt trauma with the remainder being caused by falls, assault & industrial accidents. Penetrating injuries commonly result because of gunshot injuries & stab wounds.<sup>1</sup>

Evaluating the patients who sustained the blunt abdominal trauma (BAT) remains most challenging and resource-intensive aspects of the acute trauma care. Missed intra-abdominal injuries persist to cause the preventable deaths. Physical examination observations are notoriously untrustworthy for various reasons; some examples are presence of distracting injuries, the altered mental state, drug and the alcohol intoxication in patient. Coordinating trauma resuscitation demands a thorough understanding of pathophysiology of the trauma and shock, the excellent clinical and diagnostic acumen, skill with the complex procedures, compassion and ability to think rationally in the chaotic milieu.<sup>2</sup>

Ultrasound has become the common part of initial assessment of the blunt abdominal trauma. Ultrasound in form of the Focused Abdominal Sonography for Trauma (FAST) in combination with the clinical assessment is the effective method for the early diagnosis. The areas observed in FAST include: Pericardium; paracolic gutters, hepatorenal space; splenorenal space; and rectovesical pouch or pouch of Douglas.

Though FAST is very highly sensitive for the detection of free intra-peritoneal fluid, it is the operator dependent and lacks the specificity with high false negative results and uncertain sensitivities. Also the grades of the organ injury, upon which standard management protocols are based, cannot be predicted with the precision by it. Finally, the ultrasound has the questionable results in diagnosis of diaphragmatic ruptures, pancreatic, vascular injuries, mesenteric injuries and adrenal.<sup>3</sup> However Following clinical evaluation, USG is still the primary modality of the choice for diagnosis due to its being the non-invasive, easily accessible and less costly tool which yields rapid results in screening.<sup>4</sup>

USG evaluation for pneumo-thorax has been added to the FAST examination what is called the Extended Fast (E-FAST) & has proven to be a powerful additional adjunct to BAT evaluation by USG. It has greater sensitivity as compared to supine chest x-ray for pneumothorax.

CT scans, unlike the direct peritoneal lavage (DPL) or the Focused Assessment with Sonography for Trauma (FAST) examinations, have capability to determine source of haemorrhage. Also in addition, many retro-peritoneal injuries go un-noticed with DPL & FAST examinations.

The limitations of the CT scans include the marginal sensitivity for diagnosing diaphragmatic, hollow viscus injuries and pancreatic. Also, they are expensive relatively and also time consuming and require the oral or intravenous contrast, which can cause adverse reactions.<sup>4</sup>

The present prospective study is to outline the role of imaging modalities in evaluation of BAT and to access focused abdominal sonography in trauma (fast) in the patients with blunt trauma abdomen in rural area.

### MATERIAL AND METHODS

This prospective study was carried out on 100 male-female patients of BAT of all age meeting the inclusion criteria, who were visited to department of radio-diagnosis under the aegis of Uttarpradesh University of Medical Sciences & hospital. An informed consent was taken from all patients or his attendant before the patient was subjected for evaluation. The research procedure followed was in accordance with the approved ethical standards of Uttarpradesh University of Medical Sciences, Saifai, Ethical Committee (Human).

### Inclusion & Exclusion criteria:

Patients of with clinically suspected BAT were included whereas patients who had been previously investigated or explored and managed, pregnant women, patients who were hemodynamically unstable were excluded from the study.

### Procedure methodology

There were 111 BAT patients were enrolled in this study, 7 patients were refused to participate in the study, and 4 were not fit in the inclusion criteria. Finally 100 patients were taken. Detailed history and physical examination was performed and recorded on predesigned proforma that was prepared in English and local language which was used during an interview from each patient. Patient's personal history, physical examination findings like name, age, sex, demographic profile, Height, Weight, BMI, blood pressure and all relevant clinical and radiological examination was done & recorded.

### Radiological examinations

All 100 patients were subjected to imaging modality for confirmation of diagnosis. Plain X-Ray of abdomen, if required was

performed. USG/FAST scanning was performed using SAMSUNG MEDISON USG Accuvix 30 unit. Non-Contrast and contrast enhanced CT scan, was performed and axial sections were taken. Coronal and Sagittal reformatting was done with the help of MDCT: Philips ingenuity core 128 slice. The criteria for selection for CT in patients with abdominal trauma included: Clinical suspicion of intra-abdominal injury, haemodynamically stable patient and multi-trauma patients.

#### FAST Technique:

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.

#### CT technique:

All examinations were done on MDCT with patients in supine position. Opacification of digestive tract was achieved by oral administration of 15-20 ml Gastroscan diluted in 2 lts of water (done only in suspected bowel injury, if requested by clinician). Non-contrast CT was done by serially scanning from diaphragm to pubis symphysis. Contrast enhanced CT scans were obtained after I.V administration of 80ml Optiscan 350mg/ml, injected at a rate of 3-5 ml/ sec using pressure injector. Arterial phase images were acquired 25sec after start of injection. Venous phase images were required 50sec after start of injection. Delayed scan (required in pelvi-calyceal and ureteric injury) was done after 10 min after start of injection. Abdomen was scanned from diaphragm to pubic symphysis in 15- 20 sec approximately. Contiguous serial scans were taken from the diaphragm to pubic symphysis and 8-10 mm contiguous axial sections were obtained of whole abdomen.

#### USG technique:

The referred patient was taken for USG examination, done with patient lying in supine position. Examination was performed using 3.5 Mhz convex probe or if required high frequency 7.5Mhz linear probe is used. FAST scans involved scanning in 4 acoustic windows (pericardiac, peri-hepatic, peri-splenic, pelvic, pleural spaces). For liver, longitudinal scan was done from outer margin of left lobe to the outer margin of right lobe and transverse scans with probe angled cephalic to include superior margin to inferior margin to the left & right lobe of the liver. Sub costal scan was done to examine whole of right lobe. Spleen was examined in right lateral decubitus, either obliquely or longitudinally in coronal plane. Pancreas was scanned in transverse or sagittal plane in epigastric region. Right kidney was seen in either in supine or in oblique position. Left kidney was seen in right lateral decubitus position using coronal axis. Bladder was scanned in Transverse & longitudinal scan planes.

#### X-ray technique:

Patient stands erect with their back against the receptor with vertical Bucky. Median sagittal plane was adjusted right-angles & coincident with the midline of the vertical bucky. The collimated horizontal beam was directed so that it is coincident with the center of receptor in the midline.

#### Data analysis:

All the findings were recorded and evaluated and analyzed for drawing the diagnostic accuracy, sensitivity and specificity of each modality. Data was analyzed using Statistical Package for Social Sciences, version 23 (SPSS Inc., Chicago, IL). Results for continuous variables are presented as mean  $\pm$  standard deviation, whereas results for categorical variables are presented as number (percentage). The level  $P < 0.05$  was considered as the cutoff value for significance. True positive, false negative, true negative, false positive would be calculated from comparing the results of the modalities (USG and CT) with surgical findings.

#### RESULTS/OBSERVATION

Table No. 1 shows that among 100 patients, the majority of the patients were males (66.0%) and the rest were females (34.0%). Table No. 2 shows that the commonest mechanism of the injury was RTA (65.0%) in the male patients, followed by fall from height (24.0%), assault (9.0%), & others (2.0%) while in case of the female patients was fall from height (49.0%) was commonest mechanism of injury followed by RTA (39.0%) and assault (12.0%).

On abdominal examination, the abrasion/contusion (58.0%) was most

common inspeactory findings, while, tenderness (40.0%) was the most common palpatory finding, followed by guarding (34.0%) and rigidity (23.0%). As most of the patients were brought from the nearby area, most (96.0%) of the patients were examined with FAST within 6 hours of injury. Out of which, (27.0%) patients had FAST within 1 hour and (26.0%) patients had FAST within 1-2 hours.

The most common adverse factor for Sonography in males was bowel gas (13.0%), followed by obesity (12.0%); while in females, obesity (27.0%) was the adverse factor in the majority. In the present study, two serial FAST were performed in all 100 patients. The patients in whom first FAST was negative, second FAST (after 30 minutes of first FAST) turned out to be positive only in 1.0% patients.

**Sensitivity of FAST =  $(38 \times 100) / 41 = 92.68\%$**

**Specificity of FAST =  $(58 \times 100) / 59 = 98.31\%$**

**Positive Predictive value =  $(38 \times 100) / 39 = 97.44\%$**

**Negative Predictive value =  $(58 \times 100) / 61 = 95.08\%$**

**Accuracy =  $(96 \times 100) / 100 = 96.0\%$**

#### DISCUSSION

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. Trauma commonly affects the age group of 15-44 years, which is economically the most productive age group. The incidence of abdominal trauma is 20% of all trauma cases, and the relative incidence of blunt/penetrating abdominal trauma differs according to the geographic area. In urban areas, the incidence of gunshot and stab wounds (penetrating wounds) is higher than blunt trauma, and the reverse is the case in rural areas.<sup>6</sup>

We have used the prospective observational study design similarly **Kumar MM et al<sup>7</sup> & Shah S et al<sup>8</sup>, Suman S et al<sup>9</sup> and Kumar S et al<sup>10</sup>** did study on BAT patients.

After explaining the study and getting written consent, all patients who had a FAST, ultrasonography, ordered in the Blunt Abdominal Trauma was identified using a query of electronic medical record and the Department database. Similarly, most of the studies prospectively assessing these scoring systems showed sensitivity & specificity of around 80.0%-90.0%, which was similar to that of experienced clinicians. **Kumar S et al<sup>7</sup>, Kumar MM et al<sup>8</sup> and Suman S et al<sup>9</sup>** have also used the similar tools in their respective study to combat Blunt abdomen Trauma. The above mentioned tools were used as the gold standard for evaluating the Blunt abdomen Trauma in both males and females.

During the period of our study, out of a total 100; 66.0% patients were males and 34.0% were females. Almost similar findings were noticed by **Betul Gulalp et al, Nauman Al Qamari et al and Navid Farahmand et al** showing that Blunt Abdominal Trauma is more common in males.

Our study shows that Road Traffic Accident (RTA) is the major contributor in injuries causing Blunt Abdominal Trauma. **Brooks et al, J. Branchley et al, M. Jawed et al and Nauman Al Qamari et al<sup>7</sup>** also found RTA as a most common cause of Blunt Abdominal Trauma in their studies.

The present study also shows, similar to the finding of **J. Branchley et al<sup>10</sup>** that around about one third to one fourth patients 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.

In 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>7</sup>** reviewed that the time elapsed between injury and first FAST examination was similar to present study.

This study is similar to the observations of studies conducted by others, e.g. **Ali Feyzi et al<sup>6</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 Department of Surgery and almost similar findings were observed by **Richards JR et al<sup>17</sup>, Dolich MO et al<sup>18</sup> Sanjeev Bhoi et al<sup>19</sup>, Majid Zamani et al<sup>20</sup>, Nural MS et al<sup>21</sup>, Bowra J et al<sup>22</sup> and Branchley et al.**

**Limitations of the study**

- Sample size of the study was small

**Strengths of the study**

- The analysis was performed on the basis of consent proforma
- This study may be helpful to form a management protocol which includes FAST as a screening test, in the Department for the patients of Blunt abdomen trauma in various health centers

**Recommendations of the study**

- USG should be the initial investigation tool in the traumatized patients
- Larger study may be better undertaken to correlate findings of our study

**CONCLUSION**

From this study, it can be reliably concluded that FAST is a feasible investigation in patients with BTA, and it can be performed easily and quickly in the emergency room with a reasonable sensitivity, specificity, and accuracy. It is easy to learn, readily available, repeatable, and non-invasive. 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

**Table No 1 Demographic profile of the studied patients**

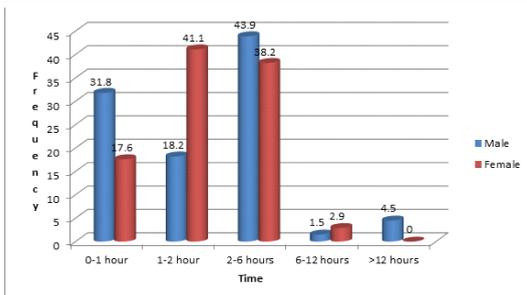
Gender	No. of Patients	Percentage	
<b>Males</b>	66	66.0	
<b>Females</b>	34	34.0	
<b>Age in years</b>	<b>2-10</b>	21	21.0
	<b>11-20</b>	12	12.0
	<b>21-30</b>	23	23.0
	<b>31-40</b>	29	29.0
	<b>41-50</b>	5	5.0
	<b>51-60</b>	10	10.0

**Table No. 2 Distribution of Patients, According to Mechanism of Injury Causing BAT**

Mechanism of Injury	Males (66)	Females (34)	Total (100)	Percentage (%)
<b>Road Traffic Accident (RTA)</b>	43	11	54	54.0
<b>Fall from height</b>	15	16	31	31.0
<b>Assault</b>	6	7	13	13.0
<b>Others</b>	2	0	2	2.0

**Table No. 3 Sensitivity and Specificity of FAST**

FAST	Positive	Negative	Total
<b>Positive</b>	38	1	39
<b>Negative</b>	3	58	61
<b>Total</b>	41	59	100



**Figure No. 1 Time between Injury and Fast Examination**

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