

## COMPARATIVE STUDY OF MULTIDETECTOR COMPUTED TOMOGRAPHY AND ULTRASONOGRAPHY FINDINGS IN BLUNT ABDOMINAL TRAUMA

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### ABSTRACT

#### BACKGROUND

Blunt abdominal trauma usually has low sensitivity on physical examination and also subtle clinical manifestations. Improved resolution of the ultrasound machines and availability of multiple frequency probes has improved the specificity of ultrasound evaluation in blunt abdominal trauma. Despite this about 50% of the solid organ injuries are missed. Computed tomography has been used with better specificity to evaluate patients with blunt abdominal trauma who are FAST (Focused Assessment with Sonography for Trauma) positive as well as indeterminate and clinically suspicious cases of solid organ, hollow viscera, spine and pelvic injury.

#### AIM AND OBJECTIVES

The purpose of this study was to determine sensitivity, specificity and diagnostic accuracy of USG and MDCT and compare the efficacy of the two imaging modalities in blunt abdominal trauma.

#### METHOD

A prospective observational study of 100 patients was conducted in the Department of Radiodiagnosis, Bharati Hospital, Pune. All patients with blunt abdominal trauma were included. FAST screening was done with ANTARES ACUSON SIEMENS followed by MDCT on 16-Slice Philips Brilliance. Sensitivity, specificity and diagnostic accuracy of USG and CT were determined by comparing with laparotomy findings.

#### RESULTS

Although USG was sensitive, specific and accurate in detecting free fluid in abdomen, CT was found better and also superior in detecting solid organ injury in patients with blunt abdominal trauma.

#### CONCLUSION

Ultrasound is an efficient modality in the initial evaluation of blunt abdominal trauma. But CT is the superior diagnostic modality and must be performed in symptomatic patient with ultrasound negative report and suboptimal ultrasound examination. CT scan thoroughly scrutinizes entire abdomen including retroperitoneum with additional assessment of thoracic trauma and bony pelvic trauma. Hence, CT increases diagnostic confidence and influences management decision.

#### KEYWORDS

Blunt Abdominal Trauma, MDCT, USG, FAST.

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#### INTRODUCTION

Ultrasound is rapid, reliable, cost effective and easily available imaging modality with unique ability to detect free fluid in abdomen.<sup>(1)</sup> Comprehensive evaluation of actively injured patient is frequently impossible due to rib fracture, wounds and gaseous distension of bowel. CT is not only sensitive and specific, but also provides global evaluation of abdomen and retroperitoneum. CT provides exact location of injury and its extent, so trend towards conservative management of liver, spleen and kidney injuries is increasing and also number of negative laparotomies are reduced.<sup>(2)</sup>

“Focused Assessment with Sonography for Trauma” (FAST) is a method to detect intraperitoneal fluid in an emergency setting. Second generation ultrasound with improved resolution and multiple frequency probes improve the specificity of ultrasound evaluation in blunt abdominal trauma.<sup>(3,4)</sup> Even with improved ultrasound machines about 50% of the solid organ injuries are missed, hence cannot replace CT. Computed tomography has been introduced to evaluate patients with blunt abdominal trauma among the FAST positive, indeterminate and clinically suspicious cases of solid organ, hollow viscera, spine and pelvis injury.<sup>(5,6)</sup>

#### AIM AND OBJECTIVES

The purpose of this study was to evaluate sensitivity, specificity and diagnostic efficacy of USG and CT in detecting free fluid in abdomen and abdominal organ injuries in patients with blunt abdominal trauma and then compare the sensitivity, specificity and diagnostic accuracy of the two imaging modalities in detecting free fluid in abdomen and abdominal organ injury.

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**MATERIALS AND METHOD**

A prospective observational study of 100 patients of blunt abdominal trauma with suspected abdominal organ injury was conducted over a period of 2 years from July 2010 to August 2012 in the Department of Radiodiagnosis and Imaging, Bharati Hospital, Pune. Ethical clearance was taken from College Ethical Committee. Informed written consent was taken from patient or relative.

FAST screening was done with ANTARES ACUSON SIEMENS followed by MDCT study on 16 SLICE PHILIPS BRILLIANCE.

**USG Technique**

FAST was done as a quick screening test and abdomen was screened for free fluid in peritoneal cavity and abdominal organ injuries.

**CT Scan Technique**

Scan protocol: 120-140 KVP, 200-250 mAs, Pitch 1.5, Field of view 240-300 mm, Collimation 2.5 mm (3.2 mm effective). Initially unenhanced images of the abdomen and pelvis were obtained. Subsequently, non-ionic contrast of concentration 400 mg/mL was administered at 1.5 mL/kg body weight in adults and children, and was injected @ 2-3 mL/second through intravenous cannula using a pressure injector. Multiphase contrast study was done in each patient.

The findings of USG were compared with those of MDCT in detail. Confirmatory correlation was made with laparotomy findings in available cases. Statistical analysis was performed pertaining to sensitivity, specificity and diagnostic accuracy of USG and MDCT separately and the two results were compared.

Statistical analysis was done using the formula: Sensitivity=true positive/(true positive + false negative) x100, Specificity=true negative/(true negative + false positive)x100, Diagnostic accuracy=(true negative + true positive)/(true negative + true positive + false negative + false positive).

**RESULT**

Of the total 100 patients, 52 patients were in the age group of 21-40 years, which is the most active span of life. Of 100 patients, 78 were male and 22 were female with male:female ratio of 3.5:1 and the most common mode of trauma was road traffic accident (66%) followed by fall from height (28%). Of all the patients, 90% had abdominal organ injury and haemoperitoneum was found in 90% of cases.

The most common organs injured were spleen and liver, 34 patients each followed by kidney 24 patients. USG showed sensitivity of 100%, specificity of 62.5% and overall diagnostic accuracy of 94% as compared to that of CT, which showed 100% sensitivity, 100% specificity and diagnostic accuracy of 100% for detection of free intraperitoneal fluid. Also, USG showed sensitivity of 68.8%, specificity of 80% and overall diagnostic accuracy of 70% as compared to CT which showed 97.7% sensitivity, 100% specificity and overall diagnostic accuracy of 98% for detection of abdominal organ injuries.

Sl. No.	Age Group (Years)	Male	Female	Total
1	0-10	12	8	20
2	11-20	12	2	14
3	21-30	30	4	34
4	31-40	12	6	18
5	41-50	6	0	6
6	51-60	6	0	6
7	61-70	0	0	0
8	71-80	0	2	2
<b>Total</b>		<b>78</b>	<b>22</b>	<b>100</b>

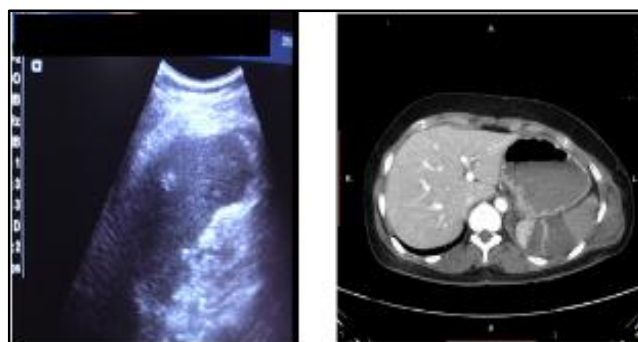
*Table 1: Age and Sex Distribution (n=100)*

Sl. No.	Mode of Trauma	No. of Patients
1	Road traffic accident	66
2	Fall from height	28
3	Fall of heavy object on abdomen	4
4	Others	2
<b>Total</b>		<b>100</b>

*Table 2: Distribution of Patients According to Mechanism of Injury (n=100)*

Sl. No.	Organ	Positive on Ultra-sound	Positive on CT Scan	No. of Cases Confirmed
1	Spleen	24	34	34
2	Liver	22	34	34
3	Kidney	20	24	24
4	Pancreas	4	6	6
5	Retroperitoneal Haematoma	2	6	6
6	Urinary Bladder	0	2	2
7	Mesentery	0	6	6
8	Bowel	0	2	2
9	Pleural Collection	14	16	16
10	Psoas Haematoma	4	8	8
11	Ureter	0	2	2
12	Adrenal Gland	2	4	4
13	Uterus	2	2	2

*Table 3: Distribution of Patients According to Organ Injury (n=100)*



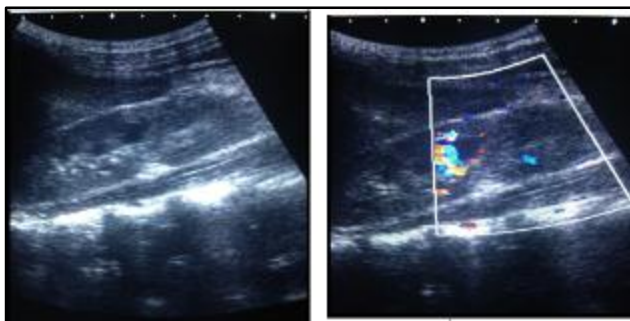
*Image 1: USG and CT showing Splenic Contusion of the Same Patient*



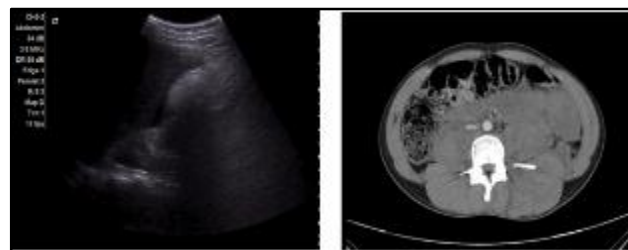
**Image 2: USG and CT showing Contusion of Right Lobe of Liver of the Same Patient**



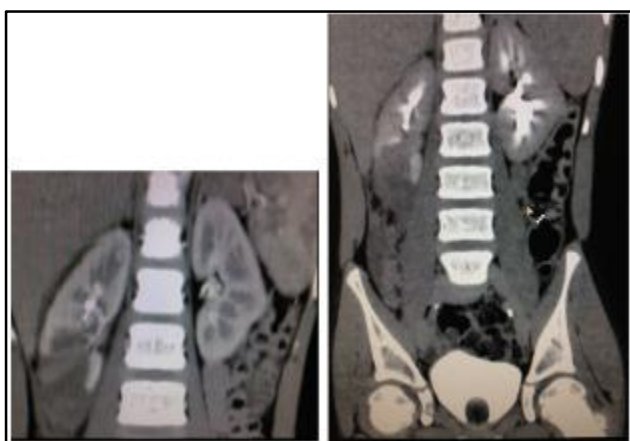
**Image 6: CT showing Extra-Peritoneal Bladder Rupture, USG was Normal**



**Image 3: USG showing Right Renal Lower Pole Contusion with Perinephric Haematoma with Reduced Perfusion**



**Image 7: USG showing Free Fluid in Morrison's Pouch and CT showing Retroperitoneal Haematoma of the Same Patient**



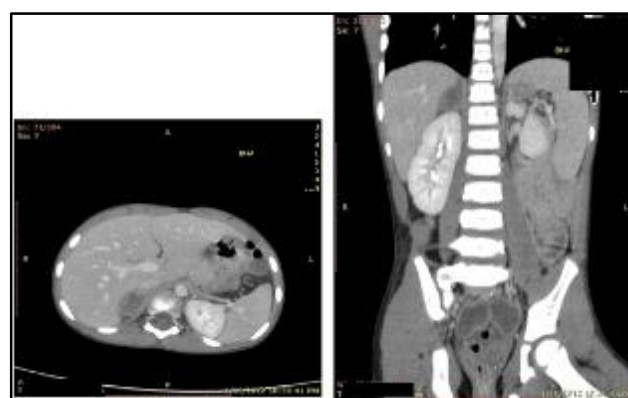
**Image 4: CT showing Right Renal Lower Pole Contusion (Grade III Injury) of the Same Patient**



**Image 8: USG showing Enlarged Hypochoic Right Adrenal Gland**



**Image 5: USG showing Bulky, Oedematous Pancreas with Contusion and CT showing Pancreatic Fracture of the Same Patient**



**Image 9: CT showing Right Adrenal Gland Haematoma of the Same Patient**

**DISCUSSION**

In this study, a male predominance was found with male:female ratio of 3.5:1, which was also noted by William Pevec, Andres Peitzman, Anthony Udekwu et al and Srisussadaporn S.<sup>(7,8)</sup>

Fifty two percent (52%) patients were in the age group of 21-40 years, the most active span of life, when people are prone for injuries, also demonstrated by Stuart E. Mirvis, Nancy O. Whitley, David R. Gens.<sup>(9,10)</sup>

The commonest mode of trauma was road traffic accident accounting for 66% of total cases. This is similar to findings by Srisussadaporn S.<sup>(8)</sup>

In this study, spleen and liver were the most common organs injured followed by kidney, which was similar to study by Barry D. Toombs, Richard G. Lester, Yoram Ben Menachem et al.<sup>(11)</sup>

In this study USG showed sensitivity of 100%, specificity of 62.5% and overall diagnostic accuracy of 94% as compared to that of CT, which showed 100% sensitivity, 100% specificity and diagnostic accuracy of 100% for detection of free intraperitoneal fluid, which were very well comparable with other studies by Paolo Lucciarini, Schmucl Katz, Sattam S. Lingawi, Vivian W. Wing, Paul A. Kearney, William Pevec and S. Srisussadaporn.<sup>(8,12,13,14,15,16)</sup>

In this study USG showed sensitivity of 68.8%, specificity of 80% and overall diagnostic accuracy of 70% as compared to CT which showed 97.7% sensitivity, 100% specificity and overall diagnostic accuracy of 98% for detection of abdominal organ injuries, which were very well comparable with other studies by Paolo Lucciarini, Schmucl Katz, Sattam S. Lingawi, Vivian W. Wing, Paul A. Kearney, William Pevec and S. Srisussadaporn.<sup>(8,12,13,14,15,16)</sup>

**CONCLUSION**

Ultrasound is an efficient imaging modality in the initial evaluation of patients with blunt abdominal trauma. But CT is the superior diagnostic modality. CT scan thoroughly scrutinizes entire abdomen including retroperitoneum with additional assessment of thoracic trauma and bony pelvic trauma. Hence, CT increases diagnostic confidence and influences management decision.

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