

# Sensitivity, Specificity and Accuracy of Ultrasonography Performed by Trainee Surgeons for the Initial Assessment and Monitoring of Blunt Abdominal Trauma

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Third year residents in surgery performed ultrasonography on fifty consecutive patients with suspected blunt injury to abdomen. Most common mechanism of blunt injury to abdomen was road traffic accidents. Most of the patients were males between the age of 10-70 years. After taking history and performing structured clinical examination, certain laboratory investigations were done for every patient. Ultrasonography was then performed to detect free intraperitoneal fluid or solid organ injuries and status of urinary bladder, diaphragm and pancreas. We found ultrasonography 89.28% sensitive, 90.90% specific and 90% accurate in detecting free intraperitoneal fluid. Its sensitivity, specificity and accuracy were 80%, 90% and 86% for detection of solid organ injuries. Pancreas could not be assessed in many patients. It is not a method of choice for the assessment of pancreatic or bladder injuries due to blunt abdominal trauma. We concluded that it could be performed by surgical residents, initially trained in ultrasonography, with fair sensitivity and good specificity and accuracy for the initial assessment and monitoring of blunt abdominal trauma.

**Key Words:** Ultrasonography, blunt abdominal trauma, Sensitivity, Specificity.

The specific and confirmatory tools for the assessment of blunt abdominal trauma are diagnostic peritoneal lavage (DPL), abdominal computed tomography (CT) and abdominal ultrasonography (USG). DPL is an invasive method of investigation. CT is an excellent but expensive method. USG is quicker, economical, easily available, easily repeatable and non invasive method of investigation for the victims of blunt trauma abdomen<sup>1</sup>. It can be used even in the resuscitation area in unstable patients of blunt abdominal trauma to detect free fluid in the peritoneal cavity as an indication of intra abdominal injury<sup>2</sup>. Emergency surgeons with minimal training in ultrasound can use it to detect free intraperitoneal fluid in victims of blunt abdominal trauma with fair sensitivity, specificity and accuracy<sup>3</sup>. The purpose of study was to find out sensitivity, specificity and accuracy of ultrasonography performed by surgeons in training for the initial assessment and monitoring of blunt abdominal trauma. Assessment included detection of intraperitoneal free fluid as well as organ injuries.

## Material and Methods

This study was conducted at Allied Hospital, Faisalabad. Irrespective of age, sex and mode of injury, fifty consecutive patients reporting to surgical emergency of Allied Hospital, with suspected blunt injury to the abdomen, were included in the study. All of them had one or more of the following symptoms: abdominal pain, vomiting, abdominal distention, absolute constipation.

After initial evaluation and resuscitation, detailed history was taken about the mode of injury and time lapse since injury was noted. Clinical examination of completely disrobed patient was done in every case. Complete blood examination complete urine examination, blood urea, blood sugar, serum electrolytes and serum

amylase checked in every case. Plain X-ray of the abdomen in erect and supine positions done. In this study third year trainee surgeons performed emergency abdominal sonography. Following sequence was adopted for ultrasound examination in very patient.

1. The probe was placed in subxiphoid position and density of blood present in the heart was taken as a standard.
2. The probe was then placed in the right midaxillary line in the region between 9<sup>th</sup> to 12<sup>th</sup> ribs to identify the liver, right kidney, diaphragm and blood in Morison's pouch
3. The probe was placed in left posterior axillary line in the area of 9<sup>th</sup> to 12<sup>th</sup> ribs to visualize the spleen, left kidney and any free fluid.
4. The probe was placed to just above the symphysis pubis to see fluid in recto vesicle pouch and urinary bladder.
5. The probe was placed in epigastrium and right hypochondrium to see pancreas and gall bladder.

## Results

Fifty patients were included in this study. Forty six were males and 4 were females. Age of the patients ranged from 10 to 70 years with the mean age of 31 years. Regarding the mode of injury, the distribution was as follows (Table 1).

Table No. 1

Mode of injury	No. of Pts.	%age
Road traffic accidents	35	70
Assaults	9	18
Falls	4	8
Crush injuries	2	4

The percentage of different organs injured as detected on abdominal ultrasonography, other method of investigation or laparotomy was as follows.

Table No. 2

Organ involved	n=	%age
Liver	9	18
Spleen	8	16
Kidneys	3	6
Urinary bladder	3	6
Small gut	2	4
Large gut	2	4
Mesenteric tears	2	4
Stomach tears	2	4
Stomach	1	2
Pancreas	1	2

Table 3. The percentage of symptoms present in different patients

Symptoms	=	%age
Pain abdomen	50	100
Absolute constipation	26	52
Vomiting	37	74
All three present	24	48

Table 4. Clinical examination &amp; the results.

Tenderness	n=	%age
Generalized	11	22
Localized	38	76
Could not be assessed	1	2

Results of emergency abdominal ultrasonography performed by trainee surgeons for the initial assessment of blunt abdominal trauma (Table 5).

Table No. 5

USG Findings	True	False	True	False
	+Ve	+Ve	-ve	-Ve
Free intraperitoneal fluid	25	2	20	3
Liver injury	8	2	39	1
Spleen injury	6	1	41	2
Kidney injury	2	0	47	1
Urinary bladder	2	2	45	1

Table 6. Analytical statistics of the result

USG Findings	Sensitivity	Specificity	Accuracy
Free intraperitoneal fluid	89.28%	90.90%	90%
Liver injury	88.88%	95.12%	94%
Spleen injury	75%	97.6%	94%
Kidney injury	66.66%	100	98%
Urinary bladder	66.66%	95.74%	94%
Overall results	80%	90%	86%

Diaphragm was found intact in all cases so the specificity as well as accuracy was found to be 100%. Only one out of fifty patients had a pancreatic injury (complete transection at the level of neck of pancreas). This injury was missed

initially on abdominal ultrasonography and found later laparotomy. Pancreas could not be assessed in 17 out of 50 patients included in this study.

### Discussion:

In the study the demonstration of free fluid in the abdomen or a solid organ injury was taken as the end point. Determination of the need for laparotomy was not taken as the end point as in other studies available on role of ultrasonography in blunt abdominal trauma<sup>4</sup>. In our study ultrasonography was performed by third year trainee surgeons. Free intraperitoneal fluid was defined as presence of an anechoic stripe in the hepatorenal, splenorenal or the rectovesical pouch and constituted a positive study<sup>3</sup>. Abdominal ultrasonography was found to be 89.28% sensitive, 90.90% specific and 90% accurate in the detection of free intraperitoneal fluid. The positive predictive value and negative predictive values were 92.59% and 86.95% respectively in our study. This figure is comparable with 81.8% sensitivity, 93.93% specificity and 90.9% accuracy of bedside sonography in detecting intraperitoneal hemorrhage<sup>5</sup>. Jehle et al based their study on detection of free intraperitoneal fluid in the hepatorenal pouch only. In our study, the presence of free fluid in the hepatorenal, splenorenal or the rectovesical pouch was taken as a positive study. Boulanger et al have mentioned that ultrasound had an accuracy of 94% for detection of free fluid with a positive and negative predictive values of 82% and 96% respectively.<sup>6</sup> Narain et al reported to have picked 19 out of 29 intra-abdominal hematomas. This is only local study available. Unfortunately it has certain flaws. Firstly, patients were included in the study only when they became hemodynamically stable while we performed bedside sonography even in hemodynamically unstable patients. Secondly, they have not mentioned the results in a statistical manner. Because of these reasons, the comparison of the results of two studies is not possible.

Of all the solid organs, liver was the most frequently injured organ in this study<sup>7,8</sup>. There was sensitivity of 88.88%, specificity of 95% and accuracy of 94%, which is comparable with 88% sensitivity, 99% specificity and 97% accuracy.<sup>9</sup> Sensitivity is the primary measure of accuracy of a screening test<sup>4</sup>. When overall analytical statistics for all the solid organ injuries are considered, we are at par as the sensitivity, specificity and accuracy were 80%, 90% and 86% respectively in our study. The drop in sensitivity rate, in this instance, is attributable to decreased sensitivity for the splenic and renal injuries being 75% and 66.66% respectively. In smaller number patients with a particular injury, such results are likely.

In this study, pancreas could not be assessed on ultrasound in 17 patients. Only one patient presented with pancreatic injury, and that too was missed on abdominal ultrasonography. So, by definition sensitivity would have been zero percent, but, no conclusion can be drawn on the basis of results of ultrasound in a single patient. Ultrasound is not a good method of investigation for detection of pancreatic injuries in blunt trauma<sup>9</sup>.

## Ultrasonography for Blunt Abdominal trauma

In our study, urinary bladder was found intact on ultrasonography in 45 patients. The sensitivity, specificity and accuracy of the ultrasonography for bladder injuries in blunt injured patients were 66.66%, 95.74% and 94% respectively. Results were confirmed on cystography, as cystography is the investigation of choice for detecting bladder injuries<sup>10,11</sup>.

Ultrasound is a reliable diagnostic tool for the follow up assessment of the patients with blunt abdominal trauma<sup>10,12</sup>. Because of its easy repeatability, ultrasound allows monitoring of improvement or deterioration. So repeat ultrasound is of value. We concluded that abdominal ultrasonography should be the first step in the radiological assessment of all the patients presenting with blunt abdominal trauma.

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