

Role of ultrasonography in the evaluation of blunt abdominal trauma

Ashwin Kumar Patil¹, Devaraja S M^{2*}

¹Assistant Professor, Department of Radiodiagnosis, Basaveshwara Medical College, Chitradurga, Karnataka, INDIA.

²Assistant Professor, Department of Radiodiagnosis, SDM Medical College, Dharwad, Karnataka, INDIA.

Email: krupanandadiagnostics@gmail.com

Abstract

Background: The aims of the present study are to evaluate the ability of US in detecting Haemoperitoneum and Intra-peritoneal visceral injuries. Analysis of sonographic findings and its correlation with clinical background, laboratory investigations, conventional and contrast radiographic procedures, CT-scan and operative findings wherever possible. To evaluate the role of US in the follow-up of patients with BAT. **Methods:** The present study was a prospective study carried out on 40 patients with history of blunt abdominal trauma. All patients included in the study were subjected to Transabdominal US using 3.5– 12 MHz transducer. In this series a total number of 40 patients of BAT were evaluated by real time US. **Results:** Road traffic accident was the major cause. US was able to identify free fluid, solid organ injuries (lacerations, contusions, hematomas and rupture) and perivisceral fluid collection. Amongst the visceral injuries, spleen, liver and kidney were the most common abdominal organs injured with incidence of 25%, 20% and 10% respectively. Also plays a major role in follow up of patients with BAT. **Conclusion:** Thus the ability of US to accurately detect the presence of free fluid and to pin point the injured organ, helps the clinician in contemplating and planning the appropriate therapeutic approach to a patient with suspected blunt abdominal trauma.

Key Words: Blunt trauma, Abdomen; Injuries, abdominal; abdominal sonography; solid organ injury; haemoperitoneum.

*Address for Correspondence:

Dr. Devaraja S M, Assistant Professor, Department of Radiodiagnosis, SDM Medical College, Dharwad, Karnataka, INDIA.

Email: krupanandadiagnostics@gmail.com

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INTRODUCTION

Blunt injuries of the abdomen constitute those cases where there is injury to one viscus or more viscera without any external penetrating injury. Today the most common cause of blunt abdominal trauma (BAT) are: motor vehicular accidents, blows and kicks over abdomen, fall from height, fall of heavy objects over abdomen, crush and blast injuries. As the world wide population has increased, there is an increased incidence of road traffic accidents and violent assaults. This leads to

popular quote “civilization and violence seem to advance hand in hand”. The detection of an intra-abdominal injury is a frequent diagnostic problem in multiply injured patients. Delay in diagnosis and treatment of abdominal injuries substantially increases morbidity and mortality in trauma patients due to bleeding from solid organ or vascular injury, or infection from perforation of a hollow viscus. Physical examination is often unreliable especially when there is associated head injury, spinal cord injury, or drug ingestion and intra-abdominal injuries may be missed in 16 to 45% of patients.^{1,2,3} The amount of imaging used to evaluate a trauma victim must be inversely proportional to severity of injuries, so that diagnostic studies do not interfere with resuscitation. The most important pre-operative management of patients with BAT is to ascertain the need for laparotomy. Thus screening test must be highly sensitive and quick. It is clear advantage to the operating surgeon if the same test is sensitive enough for citing the organ of injury, especially when conservative approach towards trauma is being popularized today. Diagnostic peritoneal lavage (DPL) was first described by Root *et al*^{4,5} in 1965. It is

sensitive in ascertaining the presence of intraperitoneal hemorrhage, but is invasive and has a significant rate of non-therapeutic laparotomies. Computed tomography (CT) scan is non-invasive and accurate but costly, time consuming, requires injection of contrast, exposure to radiation and patient transport thereby limiting its use.^{6,7} With the development of Ultrasonography (US) it is possible to evaluate and help in the management of patients with BAT. In recent years abdominal US has taken quantum leaps in its utility, accuracy and acceptance by the clinical community as it is easy to perform, quick, cost-effective, non-invasive, no ionizing radiation or toxic contrast material is needed and can be repeated as often as required.^{8,9,10} US combines the advantages of DPL (Fast and accurate) with those of CT (Non-invasive and accurate).¹¹ However, evidence exists that appropriate training plays a role in the sensitivity and specificity of ultrasonography. Sonographic results have been shown to be highly variable and dependent on technical expertise of the examiner.^{9,12} The present study outlines the role of US in the evaluation of BAT and to assess the diagnostic validity of US imaging, thus helping the surgeons in making an accurate diagnosis and proper management of cases.

MATERIAL AND METHODS

The present study was carried out on 40 patients with history of blunt abdominal trauma referred to the Department of radio diagnosis

Inclusion Criteria

- All patients with blunt abdominal trauma
- Cases are included irrespective of age and sex.

Exclusion Criteria

- Penetrating abdominal injuries.
- Dead on arrival.

All patients included in the study were subjected to Transabdominal ultrasonography using 3.5 – 12 MHz transducer.

All the cases were critically evaluated and correlated with clinical background, laboratory investigations, conventional and radiographic procedures, CT scan and operative findings wherever possible.

RESULTS

Table 1: Age distribution

Age (Years)	No of Cases (n=40)	Percentage
1-10	4	10
11-20	5	13
21-30	10	25
31-40	14	35
41-50	5	13
51-60	1	3
61-70	1	3

In our study, the youngest patient was of age 4 yrs, and eldest of 67 years. The peak incidence of 35% was present in the 4th decade and a second peak of 25% in the 3rd decade of life.

Table 2: Cause of trauma

Causes of Trauma	No of Cases (n=40)	Percentage
Road Traffic Accident	24	60
History of Assault	10	25
History of Fall	4	10
Fall of Object	2	5

Thus, road traffic accidents were the commonest cause of blunt abdominal trauma (60%), followed by history of assault (25%) in our study.

Table 3: Type of lesions

Type of Lesion	No of Cases (n=40)	Percentage
Haemoperitoneum	20	50
Spleen	10	25
Liver	8	20
Kidney	4	10
Pancreas	2	5
Bowel Perforation	1	2.5
MesentricHaematoma	1	2.5
Adrenals	0	0
Urinary Bladder	0	0

Free fluid was detected in 20 cases (50%). Among abdominal viscera, solid organs (spleen, liver, kidneys and pancreas) taken together (92%), were more often injured than hollow viscus. Hollow viscus (Bowel) was injured in 8%. Spleen, liver and kidneys are the organs commonly injured with spleen (25%) most often injured followed by liver (20%) and kidney (10%).

Table 4: USG Detected Solid Organ Injury And Characterization

Type of Lesion	No of Cases	Percentage
Spleen		
Laceration	1	11%
Rupture	4	44%
IntraparenchymalHaematoma	3	33%
SubcapsularHaematoma	1	11%
Liver		
Laceration	4	57%
Haematoma	2	28.5%
Contusion	1	14%
Kidney		
Laceration	1	20
Haematoma	2	40
Perinephric Collection	2	40
Pancreas		
Pseudopancreatic Cyst	2	100

Spleen was injured in 10 cases (25%), out of these 9 were detected on US. The commonest type detected was splenic rupture (44%) followed by intraparenchymalhaematoma (33%). The other injuries present were subcapsularhaematoma (11%) and laceration

(11%). Hepatic injuries were demonstrated in 8 patients (20%). Out of these 7 cases were detected on ultrasonography. The commonest lesion detected was laceration (57%), followed by haematoma (28.5%) and contusion (14%). In our study 4 patients had renal injuries (10%). Out of these haematoma and perinephric collection was noted in 2 cases each (40%) and 1 case of renal laceration noted. (renal laceration and perinephric collection was noted together in one case). US detected all cases of renal injuries.

DISCUSSION

Blunt abdominal trauma is still a major diagnostic challenge, even to the experienced surgeon. The low sensitivity of clinical examination in detecting intra-abdominal injuries calls for additional diagnostic methods especially in comatose patients with multiple injuries. Timely management is very important because blood loss is time dependent and diagnostic procedures must be quick and accurate and decision making must be prompt and correct. The most important objective in management of the patient with blunt abdominal trauma is to ascertain whether or not a laparotomy is needed and not the diagnosis of the specific organ injury.¹³ Ultrasonography examination is non invasive, rapid to perform, relatively inexpensive, portable for bed side evaluation in the emergency room, free from radiation and can be repeated at any time without contraindications.¹⁴ In this series, a total number of 40 cases of blunt abdominal trauma were evaluated by real time sonography. In our series, out of 40 patients there were 29 male and 11 female patients. Thus an overall male predominance (72.5%) over female was found. The higher incidence of males could be attributed to more outdoor nature of occupation, alcohol addiction and involvement in violence in males than compared to females. In our series, the youngest patient's age was 4 years and the eldest 67 years. A peak incidence of 35% was found in 4th decade of life and a second peak of 25% was found in the 3rd decade of life. The problem of blunt trauma assumes its importance because it affects the young productive members of the society. In this series, road traffic accident was the commonest cause of the injury. Out of 40 cases, in 24 cases (60%) vehicular accident was responsible for trauma followed by injury caused due to assault (25%). The reasons for which could be an increase in the population leading to an increase in number of vehicles on the road with poor maintenance of roads and rash, drunken driving. Out of 40 patients in our study, 33 patients came with symptoms of pain abdomen and on examination 26 patients had guarding and rigidity. Pain abdomen (82.5%) and guarding and rigidity (65%) were the most predominant signs and symptoms in our study followed by abdominal distention (32.5%). Out of 4

patients with renal injury, 3 presented with history of haematuria. 15 patients (37.5%) were hemodynamically unstable with falling blood pressure and low pulse rates and all underwent exploratory laparotomy. X-ray chest AP views showed, out of 8 cases of hepatic injury 2 cases were associated with right lower rib fractures (25%). Out of a total of 10 splenic injury, 2 cases were associated with left lower rib fractures (20%). 1 case of bowel perforation was associated with pneumoperitoneum (100%). Findings on ultrasound included hemoperitoneum, solid organ injuries (lacerations, contusions, haematomas, rupture) and perivisceral collections.

CONCLUSION

Amongst the visceral injuries, spleen, liver, kidney were the most common abdominal organs injured with incidence of 25%, 20% and 10% respectively. The percentage of false positive in our study was 6.2% and the percentage of false negative was 16%. But as compared to the sensitivity (83%) and specificity (93.7%), this percentage is negligible.

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