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Significance of Ultrasound Finding of Minimal Free Fluid in Pelvis in Paediatric Blunt Trauma Abdomen Patients: A Retrospective Study and Review of Literature

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Abstract

Aim: The aim of this study is to evaluate the significance of the minimal pelvic free fluid finding on ultrasound. Method - The clinical and imaging data of 102 patients with blunt trauma abdomen were evaluated retrospectively. All children had an abdominal ultrasound. The ultrasound examination results were divided into 2 groups. Group 1 included normal examination: group 2 included minimal free fluid in pelvis only. Result - Data of both groups was compared. No statistical significant difference was seen between group 1 and group 2 (p value 0.914). Conclusion – finding of minimal free fluid on ultrasound is non-significant and decision for CT scan should be based on clinical findings.

Keywords: Ultrasonograghy, Contrast enhanced computed tomography, Blunt trauma abdomen.

Introduction

Motor vehicle accidents are responsible for the majority of blunt abdominal injury with slightly more occupant injuries (41%) than pedestrian (33%). Falls make up the next highest group (8%) followed by bicycle injury (7%) [1].Computed tomography (CT) of the abdomen can depict such injuries accurately and is relatively non-invasive, but it is relatively expensive and requires radiation exposure, injection of contrast material, and patient transport [2].For rapid triage of patients with blunt trauma abdomen, focused abdominal ultrasound for trauma (FAST) has become a common diagnostic modality. Ultrasound has many advantages. It is expedient and non-invasive. FAST involves scanning the right upper quadrant including the hepatorenal fossa, the left upper quadrant including the perisplenic region, the right and left paracolic gutters, and the pelvis to detect free fluid [3].

Aim: The aim of this study was to evaluate the significance of minimal free fluid in peritoneal cavity as ultrasound finding in blunt trauma patients in children.

Method: This retrospective study was conducted at a pediatric centre in Rajasthan, India. All patients with blunt trauma abdomen, such as motor vehicle and motorcycle accidents, falls, automobile vs. Pedestrians and bicycle

injury were included. The clinical and imaging data of 102 patients admitted from 2011 to 2015 were reviewed retrospectively. All children had an abdominal ultrasound as the primary screening study. The ultrasound results were divided into two groups:

Group 1 – normal study

Group 2 – minimal free fluid in abdomen

Ultrasound was performed as soon as possible after the patient's arrival at the emergency room. The on call faculty or resident radiologist made the initial ultrasound interpretation. Patients with obvious head injury, penetrating injury or perforation were excluded from study. Patients with ultrasound finding of organ injury and gross or moderate amount of fluid were also excluded from study. All patients with normal or minimal free fluid on ultrasound abdomen were hemodynamically stable at the time of presentation.

Patients with finding of minimal free fluid in abdomen were managed conservatively. Those patients who had suspicious of organ injury on clinical examination were re valuated by repeat ultrasound or CT scan. The results of the initial ultrasound examination were compared with findings of the CT scan, or a second ultrasound examination or the clinical course of patient during the hospitalization.

Sometimes ultrasound show only minimal free fluid in abdomen without any solid organ injury. In this study we compared ultrasound finding of minimal free fluid in abdomen with normal ultrasound finding.

Results - A total of 102 patients of blunt trauma abdomen were admitted and underwent for ultrasound examination from 2011 to 2015. 30 (29.4%) patients had normal ultrasound examination and 15 (14.7%) patients had finding of minimal free fluid. Rest of patients had solid organ injury or gross or moderate fluid as ultrasound finding. Mean age for entire group was 6.297 years.

Group 1

A total of 30 (29.7%) patients had normal ultrasound examination. In group 1 CT scan was required in 4 patients out of 30 patients because 3 patients developed pain abdomen on second day of admission and one patient developed tachycardia on third day. Patients diagnosed with liver injury and pancreatic injury had injury with bicycle handle and Patient diagnosed with renal injury had injury due to fall from height.

Group 2

A total of 15 patients had minimal free fluid in peritoneal cavity as ultrasound finding. 6 Patients in group 2 required CT scan because they were complaining of pain abdomen. Two patients were diagnosed with pancreatic injury had injury by bicycle handle. 2 patients diagnosed with pancreatic injury had injury due to fall from height. Patient diagnosed with bowel injury had trauma due to vehicle accident.

Most of the patients were presented within the first day of injury (70% and 53.3% in group 1 and group 2 respectively). Data of both groups was compared. No statistical significant difference was seen between group 1 and group 2 (p value 0.914).

Table – 1 Comparison of two groups

Group	Group 1 (n=30)	Group 2 (n=15)
CT scan required	4 (13.33%)	6 (40%)
Organ injury	3(10%)	5(33.33%)

Table - 2 Showed delay between injury and time of presentation

Delay b/w injury and presentation	Group 1	Group 2
1 day	21 (70%)	8 (53.3%)
1-2 days	7 (23.3%)	5 (33.3%)
>2 days	2 (6.6%)	2 (13.3%)

Table – 3 Showed mode of injury

Mode of injury	Group 1	Group 2
Road traffic accident	16 (53.3%)	4 (26.6%)
Fall from height	11 (36.6%)	7(46.6%)
Bicycle injury	3 (10%)	4(26.6%)

Discussion - With sensitivity ranging from 63–100% and specificity 90% or greater in several studies, FAST has become an important screening tool in the diagnosis and triage of patients with intra-abdominal injury from BAT [3,4]. CT remains the gold standard in the evaluation of patients with BAT. However, CT requires patient transport away from the resuscitation suite and use of iodinated contrast, which carries with it the risk of anaphylaxis and renal toxicity.

The main focus of FAST has been the detection of FF, which is assumed to represent hemoperitonium [5]. FF may accumulate as an isolated finding in the pelvis because it is the most dependent portion of the torso. The clinician must determine whether isolated pelvic FF is physiological or pathological.

Akgur and colleagues reported 60 abnormal sonograms in their prospective study of 217 children, and they recommended its routine use for the evaluation of potential blunt abdominal injury [6]. Luks et alexamined 259 children admitted for blunt trauma who underwent US, and intra-abdominal injury was detected in 81. Their calculated sensitivity, specificity, and accuracy for detection of hemoperitoneum, but not parenchymal injury, were 89%, 96%, and 94%, respectively. In three of nine patients with initial negative US results, intra-abdominal injury was detected at repeat US [7].

Thourani and associates analyzed results at surgeon-performed US in 192 children with blunt abdominal trauma; free fluid was detected in eight. There were two were false-positive results and no false-negative results in their study. Sensitivity and specificity were 80% and 100%, respectively [8]. A smaller study with different results was published by Mutabagani and colleagues who performed focused abdominal sonography for trauma, or FAST, in 46 children. Sensitivity and specificity were 30% and 100%, respectively, and there were nine false-negative US results. They concluded that US could not be relied on as a screening examination for intraabdominal injury in children [9].

Solid organ injuries may result in hemoperitoneum that may not be detectable at US. These injuries may be depicted at US as aberrations of the normal parenchymal architecture of such organs as the liver, spleen, and kidney. Hematomas may be identified as mixed echogenic or, less commonly, cystic areas in a subcapsular or intraparenchymal distribution [10]. Certain injuries, such as subcapsular hematomas or bowel perforations, may not result in appreciable hemoperitoneum and may be missed at US.

Krupnick and associates compared CT with US in a blinded study, and 12 of 32 pediatric splenic injuries were missed at US, with seven injuries having no associated free fluid [11]. Richards and colleagues determined the most commonly identified parenchymal abnormality for hepatic injury was a discrete hyperechoic focus, followed by a diffuse hyperechoic pattern. In their study, US had a sensitivity of 98% for detection of high-grade hepatic injuries [12].

Scanning solely for hemoperitoneum will lead to missing a number of intraabdominal injuries. Shanmuganathan and co-workers[13] identified a group of patients with visceral injury, and more than a quarter of them had no hemoperitoneum detected at screening US. In addition to helping scrutinize the parenchyma of the liver, spleen, and kidney for the detection of abnormalities, serial US over time may help in detection of hemoperitoneum as the peritoneal cavity fills with blood [13]. Siniluoto et al

detected two of five splenic injuries with serial US, and Henderson and co-workers identified four patients whose initial US results were negative for hemoperitoneum and later became positive at serial examinations [14,15].

In our study Ultrasound was performed in all patients. In patients with organ injury or hemoperitoneum finding on ultrasound, CT was done in all. Patients with finding of normal or minimal fluid in peritoneal cavity on ultrasound and clinically normal, CT was not done initially. Only CT was done in patients who developed symptoms such as tachycardia or abdominal pain. So if patient is clinically normal and no significant finding on ultrasound we can avoid CT scan. It reduces the cost of treatment as most of patients come to our hospital are poor.

Conclusion - Finding of minimal free fluid on ultrasound in trauma patients is nonspecific finding. Finding of minimal free fluid is equivalent to normal ultrasound finding and decision for CT scan should be based on clinical examination. In our hospital most of patients come from lower socio-economic status. They cannot afford cost of CT scan. So we can avoid it if patient is clinically stable and ultrasound not suggestive of organ injury.

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