

Frequency of Abdominal Ultrasonographics Correct Findings as Compared with CT Scan in Detection of Solid Intra-Abdominal Visceral Injuries

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ABSTRACT

Aim: To determine the frequency of correct findings of abdominal ultrasonography compared with CT scan in detection of solid intra-abdominal visceral injuries in patients coming to emergency radiology (ER) wing of Nishtar Hospital, Multan.

Study design: Cross sectional study.

Setting: Radiology Department, Nishtar AIMCS Lahore

Duration with dates: Approx. five months duration from 16th January 2013 to 24th May 2013.

Methods: Patients were included in study on the basis of history and clinical examination reporting to ER of Nishtar hospital Multan with suspicion of solid visceral organ injuries (like liver, spleen, pancreas and kidneys) requiring abdominal USG evaluation. All ultrasound examinations were done free of cost by the researcher on FUKUDA DENSHI (Model: TELLUS, UF-550-XTD) followed by CT scans abdomen of all these patients free of cost on spiral CT scan (Model: TOSHIBA, AQUILION, 16 slices) using non ionic contrast media.

Results: Mean age of presentation of patients was 35.35±11.27 years. There were 63(75.90%) male and 20(24.10%) female. Free fluid was detected in 53(63.86%) patients on ultrasonography as well as on CT scan. Sensitivity and specificity of ultrasonography in detecting abdominal injuries were 68.97% and 88% respectively, whereas its PPV was 93.02% and NPV was 55%.

Conclusion: Ultrasonography is a reliable tool for detecting abdominal injuries.

Keywords: Intra-abdominal injury (IAI), Ultrasonography (USG), Computed tomography (CT) spiral

INTRODUCTION

Evaluation of patients who have sustained abdominal trauma may pose a significant diagnostic challenge to the most seasoned trauma surgeon to determine the extent of abdominal injury and the need for surgical intervention on the basis of clinical presentation alone¹. Abdominal injury usually occurs due to road traffic accidents (RTA), fall from heights or during sports². Clinical findings are often unreliable and have low sensitivity for diagnosis of intra-peritoneal injuries following such injuries. Prevalence of intra-abdominal injuries (IAI) varies widely, ranging from 7.7% to 65%³. Most frequently injured organs are spleen (40-55%), liver (35-45%), pancreas (29%), kidneys (11%) and small bowel loops (5-10%)³. In

United States, surgeons and emergency physicians have developed an interest in Ultrasonography (USG) and are attempting to incorporate it as an initial diagnostic study in the examination of patients with abdominal trauma or as an ancillary study to either Computed tomography (CT) or diagnostic peritoneal lavage⁴. The reported sensitivity and negative predictive value for USG in depicting hemoperitoneum vary from 78% to 99% and from 93% to 99%, respective. Ultrasound imaging is a common method of diagnosing intra-abdominal injuries. USG is rapid, noninvasive, and relatively inexpensive. It is also useful as an initial rapid screening procedure in abdominal injuries for surgeon decision making during resuscitation⁶. USG has been described as an accurate method for detection of hemoperitoneum in adults⁷. USG has a high specificity for diagnosing damage to the solid organs like spleen and for the presence of fluid (hemoperitoneum). USG is primary imaging modality of choice for diagnosis of IAI⁸. Overall, sonography has sensitivity between 71% and 88%, specificity

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between 92% and 97%, and is 91% to 96% accurate⁹. CT is the diagnostic modality of choice for non-operative management of solid visceral injuries but it is not usually the first option, because it is relatively expensive, requires radiation exposure, injection of contrast material and patients' transport^{10,11}. But CT has higher accuracy in assessment of solid organ injuries and other related to trauma¹². IV contrast-enhanced CT is even more sensitive for detecting solid visceral injury¹³. With the use of dynamic CT and power injection of IV contrast material, high CT attenuation can be achieved within the vascular system during scanning¹⁴. The high attenuation of intravascular contrast material aids in the imaging of visceral injury by increasing the attenuation of normal parenchyma and also permits sites of active hemorrhage to be visualized. Identification of the exact anatomic site on sites of active hemorrhage, the presence and extent of abdominal visceral injury, and the quantity of hemoperitoneum influences the decision about whether to use surgical intervention or not¹⁵. The accuracy of CT in hemodynamically stable abdominal trauma patients has been well established. Sensitivity between 92% and 97.6% and specificity as high as 98.7% with a negative predictive value (99.63%) of CT has been reported in patients subjected to emergency CT¹⁵. USG can aid in early triage of patients for speedy management decision saving time and reducing patient mortality as well as cost. CT abdomen is relatively a more costly investigation and not universally present. The results of study would serve to establish the accuracy of abdominal ultrasonography vs CT scan and may help patients presenting at tehsils and district head quarter hospitals in this condition where CT scan facility may not be available and can also reduce the burden in tertiary care hospitals.

MATERIALS AND METHODS

This cross sectional study was carried out in the Radiology wing of Emergency Department, Nishtar Hospital Multan which is a tertiary care referral center having equipped with Ultrasound and CT scan facilities. It was completed approx. five months duration after the approval of synopsis from 26th August 2009 to 14th January 2010 as the number of patients completed according to sample size. Non probability purposive sampling technique was used. Patients of either sex with ages between 14-70 years reporting to ER with history of abdominal injuries were included in the study. Hemodynamically unstable patients, post-operative, pregnant females and patients of less than 14 years and more than 70 years excluded.

A total of 83 patients were included in the study on the basis of history and clinical examination reporting to ER of Nishtar hospital Multan with suspicion of solid visceral organ injuries (like liver, spleen, pancreas and kidneys) requiring abdominal USG evaluation. Proper permission was taken from institutional ethical committee to conduct the study. Before inclusion in the study informed consent was taken from each patient's attendants describing them procedures of the study ensuring confidentiality and fact that there is no risk involved to the patient while taking part in this study. All ultrasound examinations were done free of cost by the researcher on FUKUDA DENSHI (Model: TELLUS, UF-550-XTD). Patients were examined using 2.5–5.0 MHz convex probe. Standard USG protocol for abdomen was used to evaluate every patient for any free fluid or solid abdominal visceral injury. Free fluid (> 200 ml) in the peritoneal cavity was taken as positive finding which was later confirmed by CT examination. CT scans of abdomen were done free of cost to all patients on spiral CT scan (Model: TOSHIBA, AQUILION, 16 slices). In trauma patients usually fasting status of the patients could not be achieved so in these cases non ionic oral contrast was given approx. half an hour before study. Computed tomography images were acquired after giving intravenous non ionic contrast in dose of 1 ml/kg body weight. All these findings were recorded on a proforma prepared for collection of patient's data. CT scan findings were noted for confirmation of USG findings.

Data were entered in computer and analyzed by using statistical software SPSS 10.0. Frequencies and percentages were calculated for outcome variables like correct findings of USG. Descriptive statistics was applied to calculate mean and standard deviation for age of the patients. Stratification was done for age and gender to see the effect of these on outcome as well as type of injury.

RESULTS

Present study included 83 patients of either sex with abdominal trauma. Mean age (\pm SD) of presentation of the patients was 35.35 \pm 11.27 years. Majority of the patients 33(39.76%) were between 25–34 years of age. Followed by 20(24.10%) patients who were 35-44 years of age. There were 13(15.66%) patients between the age of 15-24 years, 12(14.46%) patients between the age of 45-54 years and 5(6.02%) patients of the age of 55 years or above (Table 1). There were 63(75.90%) male and 20(24.10%) female. Free fluid was detected in 53(63.86%) patients on ultrasonography as well as on CT scan (Table 2). Abdominal injury was evident in 43(51.80%) patients on USG while ultrasound scans

showed no injury in 40(48.20%) patients (Table 3) while abdominal injury was apparent in 58(69.90%) patients on CT scans and 30(36.14%) patients without any injury. Out of 43 patients with abdominal trauma detected on ultrasound, USG revealed splenic injury in 21(48.84%) patients, liver injury in 12(27.91%) patients, kidney injury in 6(13.95%) and pancreatic trauma in 4(9.30%) patients respectively in patients with abdominal trauma. Out of 58 patients with abdominal injury on CT scan, spleen was the most commonly injured organ 31(53.45%) patients detected on CT scans followed by liver injury in 16(27.59%) patients. Kidney was detected in 7(12.07%) patients and pancreatic injury was detected in 4(6.89%) patients on tomography scans.

Sonographic scans detected abdominal injuries in 20(46.51%) patients between 25–34 years followed by 9(20.93%) patients between 15–24 years of age. There were 7(16.28%) patients in 35–44 years age group, 4(9.30%) patients in 45-54 years and 3(6.98%) patients above 54 years of age. Ultrasonography scans revealed 32(74.42%) males and 11(25.58%) females with abdominal trauma out of 43 patients. Ultrasonography detected 12 patients with splenic injury, 4 patients with liver injury, 2 patients with kidney and 2 patients with pancreas in 25–34 years of age. Out of 32 males with abdominal trauma, 16 had splenic injury, 8 had liver injury, 5 had kidney and 3 had pancreatic trauma. Similarly 5 women had splenic injury, 4 had liver, 1 had kidney and 1 had pancreatic injury. Sensitivity and specificity of ultrasonography in detecting abdominal injuries were 68.97% and 88% respectively, whereas its PPV was 93.02% and NPV was 55%. Diagnostic accuracy of USG was 74.70%.

Table 1: Age distribution of patients with abdominal trauma (n=83)

Age (in years)	=n	%age
15 — 24	13	15.66
25 — 34	33	39.76
35 — 44	20	24.10
45 — 54	12	14.46
55 and above	5	6.02

Mean age ± S.D. = 35.35±11.27 years

Table 2: Free Fluid detected on ultrasound in patients with abdominal trauma (n=83)

Free Fluid	=n	%age
Yes	53	63.86
No	30	36.14

Table 3: Abdominal injury detected on ultrasound in patients with abdominal trauma (n=83)

Presence of abdominal injury	=n	%age
Yes	43	51.80
No	40	48.20

DISCUSSION

Abdomen is one of the most common and important regions in respect to trauma. Abdominal injuries are often confounded by altered mental status, distracting injuries, or lack of historical information, and may present challenges in management. Early diagnosis and treatment of abdominal injuries affects the prognosis of patients significantly. Historical data, while often lacking, may provide invaluable information when evaluating a patient with abdominal trauma. Physical findings may be unreliable because of decreased patient consciousness, neurologic deficits, medications, or other associated injuries. Some studies cite physical examination as only 55% to 65% sensitive for diagnosing injury in those sustaining abdominal trauma, however, it is still the cornerstone for primary assessment. In hemodynamically stable patients with abdominal injuries abdominal pain, tenderness, and peritoneal signs are the most reliable findings for intra-abdominal injury and can be found in up to 90% of those with injury. However, several studies demonstrate that even in these patients, significant injury may be missed with physical exam alone. Therefore, absence of physical findings does not preclude injury and the need for further observation and diagnostic testing. The choice of the right method at the right time is crucial in the treatment of patients with blunt abdominal trauma. A reliable, bedside, economic, and rapidly performed screening test can be pivotal. This test should differentiate between patients needing emergency laparotomy, patients who are improved with additional diagnostic workup, and patients in whom further diagnostic workup is not required, without putting in danger the patients' clinical outcome. In the last several years new approaches to the diagnosis and management of abdominal trauma, including bedside ultrasound, newer generation computed tomography scans, laparoscopy, and the ability for selected nonoperative management expedite identification of life threatening injury and offer new options in treatment.

CONCLUSIONS

Ultrasonography was able to detect 63.86% free fluid and 68.97% solid intraabdominal visceral injuries correctly. Thus ultrasonography is a reliable tool for detecting free fluid and intra-abdominal injuries. Also this examination is a rapid, noninvasive and cost effective tool which may be used as an initial examination in critically injured patients presenting with history of trauma to abdomen.

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