Original Article

Role of Ultrasonography & C.T Scan in Blunt Abdominal Trauma (BAT)

Nizamuddin Memon, Aneela Sheeba and Khairunissa Memon

ABSTRACT

OBJECTIVE: To evaluate the role of ultrasound and CT scan in the management of patients with blunt abdominal trauma (BAT) and to assess the diagnostic efficacy of ultrasonography in these patients.

MATERIAL & METHODS: This prospective study was conducted in the Department of Diagnostic Radiology LUMHS, Jamshoro - Pakistan from July 2006 to June 2008. Ultrasonography was performed in 1000 patients with blunt abdominal trauma to detect the free fluid in peritoneum (haemoperitoneum) and visceral injuries. Sensitivity and specificity of ultrasonography were calculated by comparing the results with findings from computed tomography (CT) scan, diagnostic peritoneal levage and laparotomy.

RESULTS: Out of 75 males and 25 females 60% had history of assault and 40 patients came with the history of road traffic accident. Ultrasonography was found to be 96.97% sensitive and 100% specific in detecting haemoperitoneum whereas it was 82.47% sensitive and 100% specific in diagnosing visceral injuries. Twenty-nine patients underwent laparotomy while the rest of the patients were managed conservatively.

CONCLUSION: The ultrasound and CT scan play important role in making appropriate decision to select management option for patients with blunt abdomen trauma (BAT) and can reduce negative laparotomy rate.

KEY WORDS: Ultrasonography (U/S), computed tomography (CT), haemoperitoneum, blunt abdominal trauma (BAT).

INTRODUCTION

Role of ultrasonography (U/S) and computed tomography (CT) scan is now widely accepted throughout the world to help the trauma surgeons to make timely decisions for the unstable patients with blunt abdominal trauma (BAT). The main diagnostic methods used for the diagnosis are ultrasonography, computed tomography and diagnostic peritoneal levage (DPL).[1] Patients with positive ultrasound findings of BAT have more mortality rate than the patients have negative findings of trauma and have higher rate of operative management[2]. Depending upon the condition of patient, availability of diagnostic tools, the choice of ultrasound or CT can be availed. These methods has replaced the diagnostic peritoneal levage, which can be indicated in the diagnosis of free fluid in the abdomen only when facility of ultrasound or CT is not readily available, or results of ultrasound are equivocal or due to technical limitations or when the patients can not be shifted to CT room[3]. Ultrasound has the advantages over the other modalities that it can be used in unstable, restless patient, patients going in hypovolemia, when patient can not be shifted to C.T room or when C.T machine is not available. U/S is also portable, non- invasive, painless, quick method, inexpensive, can be done at bed side, can be learned easily[3-5] and above all can integrate easily during resuscitation of injuries in patients without interfering in their life saving therapeutic procedures. Therefore now-a-days role of ultrasound is referred as an extension of the physical examination[6,7]. Ultrasound can detect retroperitoneal fluid as well **(Figure I & II)**. U/S can identify the haematoma within or surrounding the involved solid organ. Solid organal injuries as in liver, spleen and kidneys and to some extent pancreatic or gut injuries can be diagnosed **(Figure III & IV)** by ultrasound. CT abdomen with intravenous contrast medium should be the first modality of choice in stable patients of BAT when clinical findings are not satisfactory[3]. CT is accurate and has 100% overall sensitivity for trauma detection. CT can differentiate haemoperitoneum, from other fluid collection.[9] Traumatic bony lesion, solid visceral injuries i.e liver, pancreas, spleen and kidneys **(Figure V - IX),** diaphragmatic injuries, ruptured intestinal / mesenteric injuries, injury to urinary bladder / gall bladder as well as vascular injuries even can be detected by C.T that requires definite laparotomy. The purpose of this study was to evaluate the role of ultrasound and CT scan in the management of patients with blunt abdominal trauma and to assess the usefulness of ultrasonography in detection of free fluid in peritoneum (haemoperitoneum) and visceral traumatic injuries, which may be useful in

making the choice of management option (operative or conservative) thereby reducing the non-therapeutic laparotomy rates.

FIGURE I:
FREE INTRAPERITONEAL FLUID IS SEEN BETWEEN LIVER AND KIDNEY IN MORRISONS POUCH

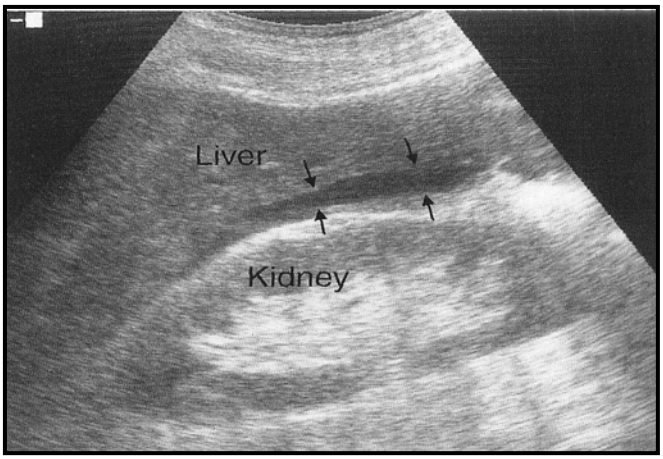


FIGURE II:
ANECHOIC FLUID SEEN SURROUNDING LIVER

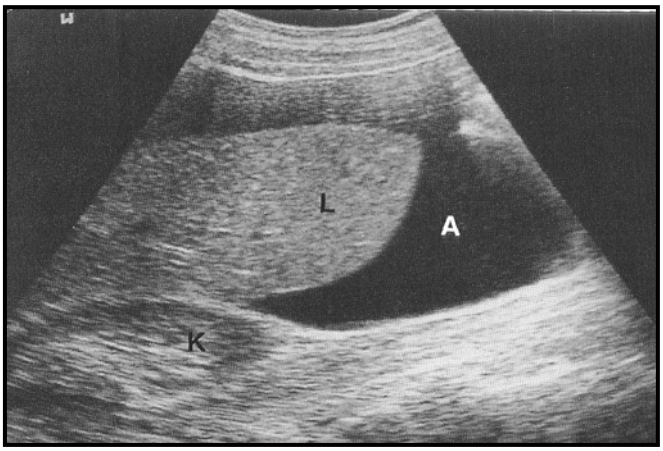


FIGURE III:
LIVER HAEMATOMA SEEN IN RIGHT

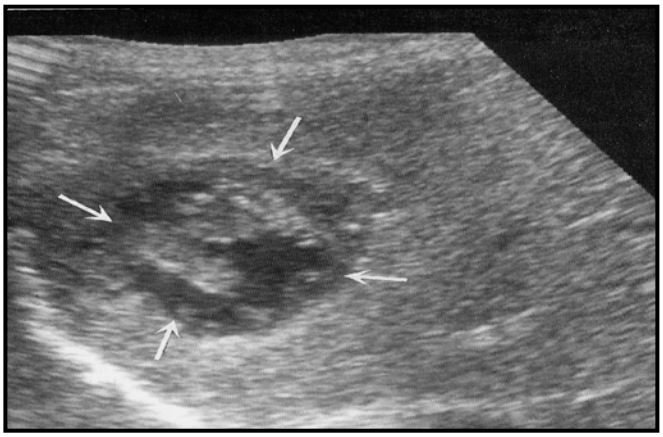


FIGURE IV:
ULTRASOUND SHOWS INTRAPERITONEAL FLUID LOBE OF LIVER WITH SOLID COMPONENTS OF HAEMOPERITONIUM WITH CLOTS

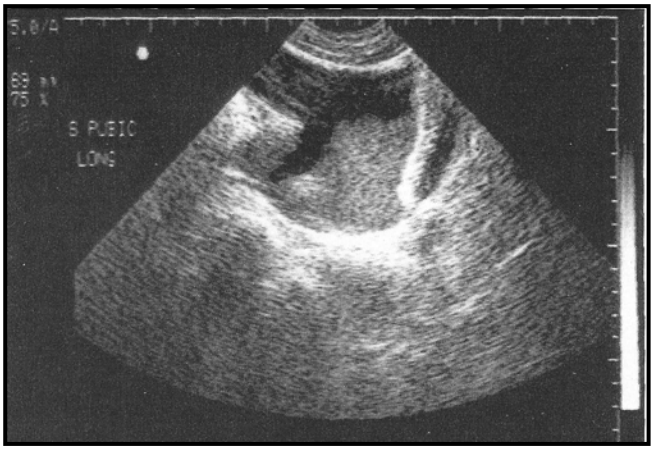


FIGURE V:
ULTRASOUND SHOWS LOBULATED CYSTIC LESION IN THE BODY OF PANCREAS – PSEUDO CYST

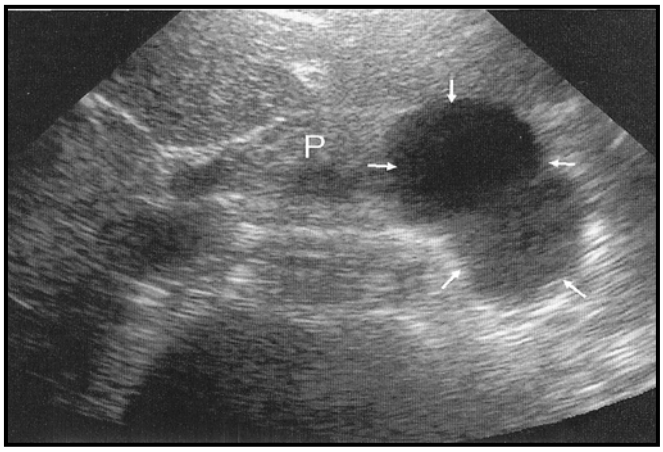


FIGURE VI:
CT SCAN SHOWS PSEUDO CYST OF PANCREAS CLEARLY

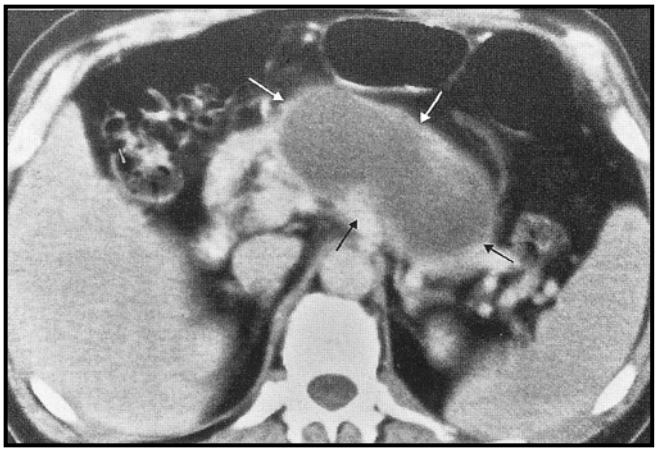


FIGURE VII:
CT SCAN SHOWS RUPTURED RIGHT KIDNEY AND HAEMATOMA SURROUNDING THE KIDNEY

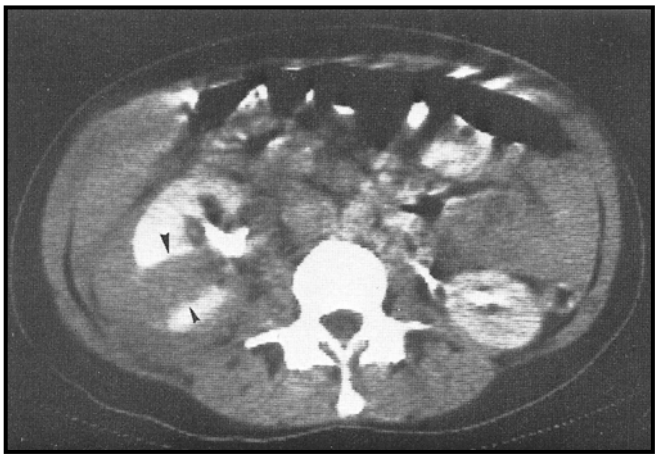
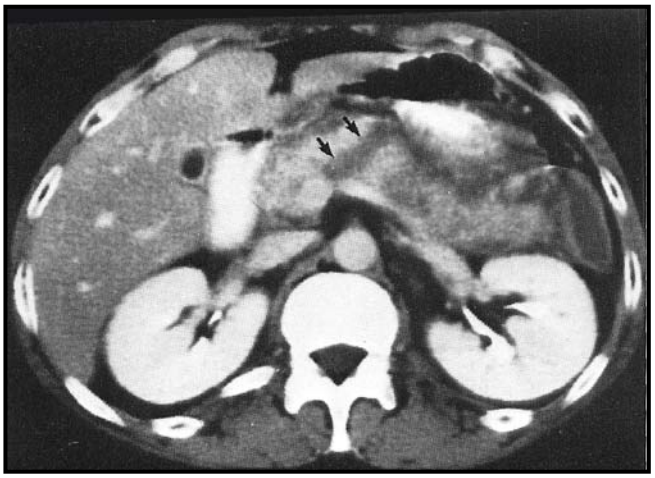


FIGURE VIII:
CT SCAN SHOWS LEFT RENAL TRAUMA WITH EXTENSIVE HAEMATOMA SURROUNDING THE LEFT KIDNEY

FIGURE IX:
CT SCAN SHOWS SWELLING WITH HAEMATOMA WITHIN THE BODY OF PANCREAS



MATERIAL AND METHODS

This prospective study was carried out at Department of Diagnostic Radiology, Liaquat University of Medical and Health Sciences, Jamshoro – Pakistan from July 2006 to June 2008. All cases of blunt abdominal trauma were initially evaluated by a consulting surgeon and those haemodynamically stable patients who had clinical suspicion of intra-abdominal injury and/or multiple trauma were included in the study. The haemodynamically unstable patients with obvious peritoneal signs and progressive abdominal distension were taken up for immediate laparotomy and were excluded from the study. The real-time ultrasonography was performed by registered sonographers with Vivid 3 Pro Six Sigma GE Medical System and subsequent CT scan was performed with CT Max. Ultrasonography findings were reviewed and compared with results of CT scan, DPL and laparotomy. The ultrasonographic images were reviewed by experienced radiologist blinded to clinical outcome, CT and results of other methods. Data were used to calculate sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of ultrasonographic findings for detecting free fluid (haemoperitoneum) and visceral injuries.

RESULTS

It was observed in this study that out of 100 subjects 75 were males and 25 were females (male-female ratio 3:1). Sixty patients came with history of assault and 40 patients came with history of road traffic accident. Of 100 cases included, haemoperitoneum was detected in 96 cases by ultrasonography and in 99 cases by CT scan. In 1 case haemoperitoneum was not detected at all. Sensitivity and specificity of ultrasonography in detecting haemoperitoneum was 96.97% and 100% respectively, whereas its PPV was 100% and NPV was 25%. Visceral injuries were detected by ultrasonography in 80 cases and by CT scan in 97 cases. In 3 cases no visceral injury was detected at all. Sensitivity and specificity of ultrasonography in detecting visceral injuries were 82.47% and 100% respectively. In detecting visceral injuries PPV of ultrasonography was 100% whereas its NPV was 15%. Twenty-nine cases were decided to undergo laparotomy while rest of the cases were managed conservatively.

TABLE I:
SCREENING RESULTS OF ULTRASONOGRAPHY

	Haemop-eritoneum	Visceral Injuries
Sensitivity	96.97%	82.47%
Specificity	100%	100%
Positive predictive value	100%	100%
Negative predictive value	25%	15%

DISCUSSION

The prompt detection and treatment of abdominal injury remains among the most important challenges to trauma care. Ultrasonography and CT scan are currently used at several trauma centers to aid objective evaluation of the abdomen after BAT.[10] The rate of negative laparotomy can be reduced by avoiding surgical intervention in cases that can be managed conservatively. Despite of the ability to assess the severity of trauma and providing a guide to further management, CT scan still has its pitfalls due to limited availability - especially in developing countries like Pakistan, and difficulty of transportation to CT room. At our institution ultrasonography is used as a screening tool in patients with suspected BAT. The examination is performed rapidly in trauma room simultaneous to and without interfering with ongoing resuscitation. The ability to screen the abdomen portably is of particular benefit in patients with multiple injuries, in situations in which multiple patients are injured, and in haemodynamically unstable patients who cannot be shifted conveniently for CT scan. Because ultrasonography is used as screening tool rather than as a mean of definitive assessment, patients with negative ultrasound findings are kept under observation, generally for minimum of 12 hours. The practice of trauma ultrasonography varies greatly among centers, as does the reported accuracy. In present study haemoperitoneum was evident in 96% patients on ultrasonography. Brown MA and co-workers reported that in 74% cases of BAT, ultrasonography showed haemoperitoneum.[10] The sensitivity and specificity of ultrasonography in screening haemoperitoneum were 96.67% and 100% respectively, whereas for visceral injuries it was 82% sensitive and 100% specific. In comparison to these results Abu-Zaidan FM and colleagues have reported 85% sensitivity and 100% specificity of ultrasonography in BAT.[4] Low sensitivity and high specificity of ultrasonography for the detection of both free fluid and visceral injuries is also documented by Stengel D and associates.[11] It should be emphasized that the ultrasonography was performed by experienced registered sonographers only and not by surgeons, and also that only haemodynamically stable patients were included in this study. Accurate evaluation and interpretation of findings other than free fluid require more ultrasonography experience and training than screening free fluid alone. Consistent evaluation of findings other than free fluid increased our sensitivity. If ultrasonography is to be used as a screening examination for abdominal trauma, we think it should be used to its full potential by experienced sonographers to maximize sensitivity. Screening for fluid is an important part of the examination, but other potential signs of injury should not be ignored or go unrecognized because of haste or lack of experience.

CONCLUSION

Despite of their limitations ultrasonography and CT scan can reduce negative laparotomy rate and are useful in detecting free fluid (haemoperitoneum) and visceral injuries. The sensitivity of ultrasonography is higher in detecting haemoperitoneum, than in detecting visceral injuries. Even then it is useful as an initial rapid screening procedure in BAT patients for trauma surgeons in early decision making during resuscitation.

REFERENCES

1. Kumar MM, Venkataramanappa M, Venkataratnam I, Kumar NV, Babji K. Prospective evaluation of blunt abdominal trauma by computed tomography. Indian Journal of Radiology and Imaging 2005; 15: 167-73.
2. Brown MA, Sirlin CB, Hoyt DB, Casola G. Screening ultrasound in blunt abdominal trauma. J Intensive Care Med 2003;18:253-60.
3. Dittrich K, Abu Zidan FM. Role of ultrasound in mass casualty situations. Int J Disaster Med 2004; 2: 18-23.
4. Abu-Zidan FM, Al-Zayat I, SHaikh M, Mousa I, Behbehani A. Role of ultrasonography prospective study. Eur J SUrg. 1996; 162: 361-5.
5. Sirlin CB, Casola G, Brown MA, Patel N, Bendavid EJ, Hoyt DB. Quantification of fluid on screening ultrasonography for blunt abdominal trauma: a simple scoring system to predict severity of injury 2001. J Ultrasound Med 2001;20:359-64.
6. John MAO, Kefer MP, Stevison KF, Mateer JR. Operative versus non-operative management of

blunt abdominal trauma: Role of ultrasound measured intraperitoneal fluid levels. Am J Emerg Med 2001; 19: 284-6.
7. McKenney KL, McKenney MG, Nunez DB, McDowell L, Martin L. Interpreting the trauma ultrasound observations in 62 positive cases. Emerg Radiol 1996; 3: 113-7.
8. Huang MS, Liu M, Wu JK, Shih HC, Ko TJ, Lee CH. Ultrsonography for the evaluation of hemoperitoneum during resuscitation: a simple scoring system. J Trauma 1994; 36: 173-7.
9. Tiling T, Boulion B, Schmid AI. Ultrasound in blunt abdominal thorasic trauma. In: Border JR, ed. Blunt multiple trauma: comprehensive pathophysiology and care. New York, Mareel Dekker, 1990: 415-33.
10. Brown MA, Casola G, Sirlin CB, Hoyt DB. Importance of evaluating organ parenchyma during screening abdominal ultrasonography after blunt trauma. J Ultrasound Med 2001; 20 (6): 577-83.
11. Stengel D. Bauwens K, Sehouli J, Porzsolt F, Rademacher G, Mutze S, et al. Systemic review and meta-analysis of emerge blunt abdominal trauma. Br J Surg 2001; 88: 901-12.

AUTHOR AFFILIATION:

Dr. Nizamuddin Memon *(Corresponding Author)*
Department of Radiology & Imaging
Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, Sindh-Pakistan.

Dr. Aneela Sheeba
Department of Radiology & Imaging
LUMHS, Jamshoro, Sindh-Pakistan.

Dr. Khairunissa Memon
Department of Gynaecology & Obstetrics
Nawabshah Medical College
Nawabshah, Sindh-Pakistan.