

ROLE OF MULTIDETECTOR CT SCAN IN DETECTION OF SOLID VISCERAL INJURIES OF BLUNT ABDOMINAL TRAUMA

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ABSTRACT

OBJECTIVE: To determine the role of MDCT in the detection of solid visceral injuries in blunt abdominal trauma patients. **METHODS AND MATERIALS:** A Comparative cross sectional prospective study was performed in 4 months' period (10th February to 10th June 2006). All patients referred for CT scan from emergency department within 24 hours of blunt abdominal trauma were included in the study while patients who presented 24 hours of trauma, hemodynamically unstable patients, patients in which diagnostic lavage was performed and patients who died were excluded from the study. All patients were scanned with Toshiba Asteions multi detector computed tomography. Scans were obtained from domes of diaphragm to symphysis pubis. Scans were obtained at 0.8 cm/interval with a delay scan time of 50-55 seconds. A slice collimation of 5 mm and pitch of 1.5 were used. 500 ml of diluted oral contrast material sodium amidotrizoate 0.1 grams, meglumin amidotrizoate 0.66 grams was administered through nasogastric tube 60 minutes prior to the study. Another 250 ml oral contrast was given immediately before CT scan while the patient was on the CT table. Scans were performed before and after administration of I/V contrast. Iodinated contrast (1.5 -2.0 ml/ kg) was injected with power injector at the rate of 2-3 ml / sec. Images were acquired in soft tissues and lung window setting. In case of suspected fractures, images in bone window were also acquired. The CT results were compared with surgical/ clinical follow up (which are the gold standard reference) for the study. Data was collected with the help of Performa. Statistical analysis was performed with SPSS version 10. Sensitivity, Specificity, negative, positive predictive values and accuracy were calculated. **RESULTS:** 81 Patients were selected for the study. Out of these 6 patients were excluded from the study as 2 did not give consent for the study, one expired due to head injury and one presented after 24 hour of trauma and 2 patients had diagnostic peritoneal lavage at some other institution before coming to our hospital. Out of 75 patients, there were 60 males and 15 were females with mean age 39 ± 1 years. All patients either had surgical diagnosis of the injured organ involved along with its grading or associated injury of other than solid organs. Correct assessment was made in 72 out 75 scans (96%). Incorrect assessment was made in 3 scans (4%). Out of the 72 scans correctly evaluated, 58 were true positive and 14 were true negative. Out of the 3 CT scans proven to be incorrectly evaluated, indirect evidence of free fluid was falsely interpreted as solid visceral injury in one patient and delayed rupture of the spleen as negative in two patients. The individual sensitivity, specificity, accuracy, negative and positive predictive values of solid visceral injuries were 98.3 %, 87.5 %, 96%, 93.33% and 96.66%. **CONCLUSION:** CT has proved to be extremely useful tool in evaluating a wide variety of abdominal traumatic injuries. This study shows that CT has major advantages over plain radiography, radionuclide studies and angiography. Since it is noninvasive and appears to be highly sensitive and specific. This study also proves that CT is a vital imaging tool for early decision making and can also be used for follow up.

Key words: MDCT scan, blunt abdominal trauma, surgery.

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Background

Trauma is the leading cause of death under the age of forty, of all traumatic deaths, abdominal trauma is responsible for 10%. Spleen is most frequently injured organ in blunt abdominal trauma and was the most common type of injury in our series as well. Abdominal injury may cause splenic laceration or produce hematoma which is limited by the splenic capsule.¹ Hepatic injuries are less frequent than those of the spleen but are more significant in terms of mortality. If patient condition does not warrant immediate exploratory surgery, CT has much to offer, certain types of limited hepatic parenchymal injuries such as small intra parenchymal injuries or sub capsular hematoma, may be best managed conservatively² and in our study CT proved useful in such management decisions. Injury to the kidney is seen in 8-10% of patients with blunt or penetrating abdominal injuries.³ Unlike ultrasound examination (FAST) CT provides anatomic and functional information that allows for accurate grading of the renal injury which is partly responsible for the growing trend towards conservative management (intravenous fluids, close monitoring, watchful waiting of renal trauma).⁴ CT affected the treatment of renal trauma in our study also. CT may demonstrate pancreatic contusions and lacerations and help in distinguishing minor traumatic lesions without involvement of duct (organ injury scale grade 1 and 2) from deep injury with ductal involvement grade 3 and 5.⁵ Images were also evaluated for associated injuries in addition to the other organs including bowel, mesentery, diaphragm, urinary bladder, gall bladder, bony fractures and soft tissue injuries.

Materials & Methods

This comparative cross sectional prospective study was conducted in 4 month's periods (10th Feb to 10th June 2006). The patients who had blunt abdominal trauma were identified and included in the study. All those patients selected for the study were scanned with Toshiba Asteion multidetector Computed Tomography. Scans were obtained from domes of diaphragm to symphysis pubis. Scans were obtained at 0.8 cm/ interval with a delay scan time of 50-55 se-

conds. A slice collimation of 5 mm and pitch of 1.5 were used. 500 ml of diluted contrast material sodium amidotrizoate 0.1 grams, meglumin amidotrizoate 0.66 grams was administered through NG tube 60 minutes prior to the study. Another 250 ml was given immediately before CT scan while the patient was on the CT table. Scans were performed before and after administration of I/V contrast. Iodinated contrast (1.5 to 2.0 ml / kg) was injected with the help of power injector at the rate of 2-3 ml/ kg. Images were acquired in soft tissues and lung window settings. In case of suspected fractures images were also acquired in bone window. CT results were compared with surgical/ clinical follow up (which are the gold standard reference).

Data was collected on performa. The final number of patients comprising the study was 75, out of these 60 patients were males and 15 were females. The age ranged from 16 to 70 years and mean age was 39 ± 1 years. Statistical analysis was performed with SPSS version 10. After entering data in the SPSS, different percentages and frequencies were obtained. All the graphs and charts were also obtained on SPSS. Later sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated.

Results

81 patients of recent blunt abdominal trauma were selected for the study. Out of these, 6 patients were excluded. Out of these 6 patients, 2 patients did not give consent for study, One patient expired due to head injury and one patient presented after 24 hours of trauma and two patients had diagnostic peritoneal lavage (DPL) at some other institution before coming to our hospital. The final number of patients comprising the study was 75. All patients either had surgical diagnosis of the injured organ involved along with its grading or associated injury of other than solid organs. Correct assessment was made in 72 out of 75 scans. Incorrect assessment was in 3 scans (4%). Out of the 72 scans correctly evaluated, 58 were true positive and 14 were true negative. Out of the 3 CT scans proven to be incorrectly evaluated indirect evidence of free fluid was falsely interpreted as solid visceral

injury in one patient and delayed rupture of the spleen as negative in two patients. Solid visceral injury was correctly diagnosed prospectively in 58 of 60 patients using MDCT (sensitivity 98.30%). Solid organ injury was correctly excluded prospectively in 14 of 15 patients (specificity 87.50%). The overall accuracy was 96%. The positive and negative values were 96.60% and 93.30% respectively. The sensitivity, specificity accuracy, negative and positive predictive values of hepatic injury is 100%, 98%, 98.60%, 100% and 96% respectively. Pancreatic injuries showed sensitivity, specificity, accuracy, negative and positive predictive value of 100% respectively. The sensitivity, specificity, accuracy, PPV and NPV in splenic injuries are 97.40%, 97.20%, 97.30%, 97.40% and 97.20% respectively.

Discussion

Abdominal trauma has long been a challenge for both clinicians and radiologists. Blunt abdominal trauma (BAT) is regularly encountered in emergency department with a reported mortality rate of around 11%.⁶ According to Wiener and Barrett in civilians, blunt trauma is caused primarily by road traffic accidents (14%) and falls (10%). Similarly, in other studies road traffic accident is also commonest mechanism of injury as compared to falls and blows to abdomen.^{7,8,13,14} Patients with multiple injuries are known to have a high incidence of injuries to the thoracic and lumbar spine. The risk of missing a vertebral fracture in these patients is higher than in patients presenting with injury to only one organ.^{9,10,11,12} In our study no other imaging was performed and management was based primarily on clinical and CT findings. In 1982 Federle et al in 1980's reported the use of CT in more than 200 cases of blunt abdominal trauma showing very high sensitivity and specificity with no false positive or false negative scans and this launched the interest in CT as an alternative to DPL.¹⁵ Mayer et al prospectively studied 301 patients, comprising the results of CT and DPL using the DPL criteria advocated by Root et al, sensitivities were 95.9% for DPL and 74.3% for CT, specificities were 99% for DPL and 99.5% for CT with accuracies of 98.2% and 92.6% respectively.¹⁶ Pietzman et al found

CT to be 98.3% accurate, 97.6% sensitive and 98.7% specific in a prospective study of 120 patients with blunt abdominal trauma. In our study MDCT for blunt abdominal trauma showed sensitivity of 98.3%, specificity of 87.5% and accuracy of 96%.¹⁷

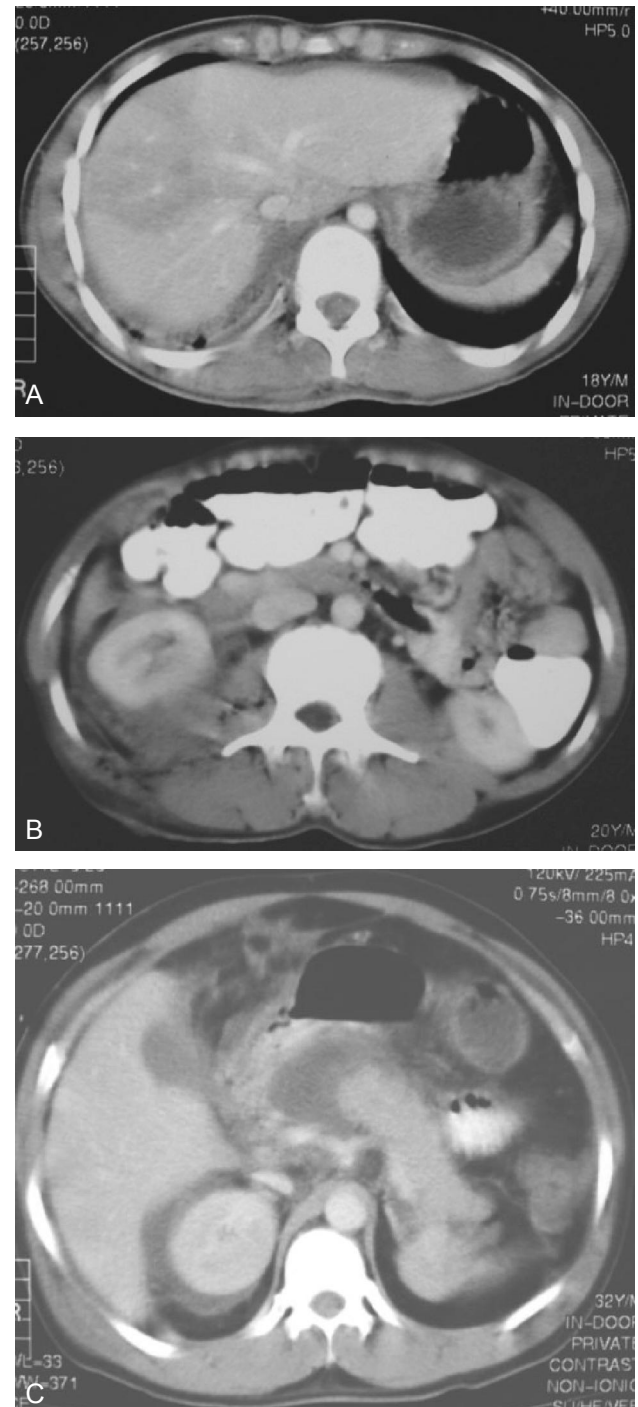


Figure A,B,C: laceration of right lobe of liver, renal laceration with subcapsular hematoma, laceration of head of pancreas with subcapsular hematoma

Conclusion

CT has proved to be an extremely useful tool in evaluating a wide variety of abdominal traumatic Injuries. This study shows that CT has major advantages over plain radiography, radionuclide and is capable of rapidly surveying the entire abdomen and retro peritoneum for possible associated injuries. This study also proves that CT is a vital imaging tool for early decision making and can also be used for follow up in patients who are being managed conservatively.

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