COMPUTED TOMOGRAPHY EVALUATION OF BLUNT ABDOMINAL INJURY

INTRODUCTION

Trauma is the leading cause of death in persons under 45 years of age, with 10% of these fatalities attributable to abdominal injury(1). Indian statistics reveal disproportionate involvement of younger age groups (15-25 yrs). The Indian fatality rates for trauma are 20 times more than that for developed countries(2).Of this,the deaths that are preventable is about 30%. The swift recognition of life-threatening injuries and rapid commencement of appropriate treatment increases the chances of survival in these patients. However, multiple internal injuries caused by Blunt abdominal trauma may be difficult to recognize accurately as they may be masked by external injuries.

Blunt abdominal trauma(BAT) usually results from motor vehicle collisions, falls, assaults, sports and recreational accidents. The most commonly injured organs are the spleen, liver, small bowel, retroperitoneum, bladder, kidneys, diaphragm and pancreas. Clinical assessment alone in patients with blunt abdominal injury is associated with diagnostic delays and may sometime lead to missed intra-abdominal injuries due to the neurological impairment caused by the traumatic event.

In this modern era of conservative non- operative management of BAT,even in presence of solid organ injuries,the role of imaging is essential as the radiologist is

asked not only to find out the signs of internal injuries but also the severity of such lesions, detecting those requiring an immediate operative treatment.

CT is the diagnostic tool of choice for the evaluation of abdominal injury due to blunt trauma in haemodynamically stable patients(3). CT scans can provide a rapid and accurate appraisal of the abdominal viscera,retroperitoneum and abdominal wall(4). In addition,an abdominal CT scan can assist in coexisting thoracic injuries and unsuspected pelvic and spinal fractures(5).

Most trauma centers now have CT machines and with the advent of helical scanners, time for scanning is reduced significantly. The accuracy of CT in hemodynamically stable BAT has been well established with sensitivity between 92% and 97.6% and specificity as high as 98.7% have been reported in patients subjected to emergency(6).Hence,this prospective observational study is done to assess the role of CT scan in BAT.

AIMS AND OBJECTIVES OF STUDY

- To assess the role of Computed tomography as a primary diagnostic modality in the evaluation of blunt abdominal injury in hemodynamically stable patients
- To determine the choice of management (Operative versus conservative) by using the information provided from CT by grading the visceral injuries using The American Association for the Surgery of Trauma(AAST) classification.
- To compare intra operative findings with CT findings to assess the sensitivity and specificity of CT scan as a gold standard modality in blunt trauma.

MATERIALS AND METHODS

SOURCE OF STUDY:

Data consists of primary data collected by the principal investigator directly from blunt abdominal injury cases admitted in the trauma ward in Coimbatore Medical College Hospital.

DESIGN OF STUDY:

Prospective study

PERIOD OF STUDY:

One year

METHODOLOGY:

In this study 190 cases of blunt abdominal injury admitted in trauma ward in CMCH are selected. In all these cases ,CT scans are performed based on the clinical suspicion of intra abdominal injury. All of the scans are performed using a TOSHIBA 16 slice CT scanner with a slice width of 10 mm, a 2.5 mm collimation, a 0.75 s rotation time, a table feed of 15 mm and a 3mm reconstruction interval. Pre and post contrast scans will be routinely performed. The CT scans are acquired through portal venous phase approximately 80 seconds after contrast injection. When necessary,sagittal and coronal images will be acquired using the maximum intensity projection (MIP) and MPR techniques.

All the test done with due permission from the Institutional Ethical Committee and informed consent from the subject/attenders.

INCLUSION CRITERIA:

CT scan is performed in hemodynamically stable blunt abdominal injury cases in whom findings on clinical abdominal examination or sonologic findings are equivocal, in those with significant pelvic fractures, patients in whom important signs such as guarding/rigidity could not be adequately evaluated due to altered mental status, patients in whom ultrasound findings are positive yet still further information regarding grading of injury are sought by clinician.

EXCLUSION CRITERIA:

Patients with any of the following conditions were excluded:

1. Hemodynamically unstable patients
2. Patients with obvious signs of peritonitis who require immediate surgery
3. Consent not given

The data obtained were analysed using SPSS version 21.0 software. Results were expressed in frequencies and percentages.

DISCUSSION

The use of Computed tomography has a tremendous impact on the evaluation and management of blunt abdominal trauma because the rapid identification of life

threatening injuries and prompt initiation of appropriate care may increase the chance of survival for patients with trauma. It is highly sensitive, specific and accurate for use in detecting the presence or absence of injury and defining its extent.CT scans can provide a rapid and accurate appraisal of abdominal viscera, retroperitoneum and abdominal wall. Also associated thoracic injuries and unsuspected pelvic and spinal fractures can be identified by CT. The ability of CT to perform and produce fast processing images such as multiplanar reconstruction(MPR) is important for accurate interpretation of abnormalities.

A total of 190 patients who were referred for emergency CECT abdomen and pelvis as a case of blunt abdominal injury from trauma ward to Department of Radiodiagnosis at Coimbatore Medical College Hospital were studied.All the scans were performed using TOSHIBA 16 slice CT scanner with a slice width of 10mm,2.5mm collimation,0.75 second rotation time and 3mm reconstruction interval.Pre and Post contrast scans were routinely performed.

The findings are interpreted according to AAST grading system and these patients were followed up till management of the condition either surgically or conservatively.

Of the total 190 patients included in the study,131 patients were males(69%) and 59 patients were females(31%).

Among the 190 patients included ,majority belonged to the age group between 21 to 40 years accounting for about 54%. 63 patients (33%) belonged to age group of 41 to 60 years and 17 patients (9%) were of age group less than 20 years. The least

number of patients belonged to the age group of more than 60 years corresponding to 4%.This is correlated with the study done by S.Gupta et al(1995) who encountered 40% of patients between 21-40 years.

The patients with haemoperitoneum or demonstrable abdominal visceral injury or both were considered as positive for intra abdominal injury. The patients whose examination did not reveal either visceral injury or haemoperitoneum were considered as negative for intra abdominal injury.

The CT results were interpreted and out of the total subjects studied, 154 patients (81%) had abnormal CT findings whereas rest 36 patients(19%) who underwent CT had no abnormality detected.This is correlated with the results of study done by Wing et al(1995) who had predicted 26% of normal cases in a study population of 125.

Among the 190 patients,140 patients (74%) were managed conservatively and 50 patients (26%) were taken up for surgery based on the CT findings.

In our study, visceral injury was present in 121 patients (67%) and absent in 69 patients (33%). Out of the 121 patients in whom the visceral injury was present, 31 patients were taken up for surgery and the remaining 90 patients were treated conservatively. Out of 69 patients in whom visceral injury was absent, 14 patients were taken up for surgery and the rest 50 patients were treated conservatively. This is superior to the study done by MM Kumar et al(2005) in which 40 out of 47 visceral injury cases were taken up for surgery. This may be due to more conservative

approach towards blunt abdominal injury cases with appropriate monitoring and follow up in the present era.

Out of the visceral organs involved ,spleen is the predominant organ to be involved accounting for 31% (59 out of 190) followed by liver (39 patients-21%), kidney (21 patients-11%), bladder (12 patients-6%), bowel/mesentery (10 patients-5%) and pancreas (1%). So pancreas among the visceral organs is the least organ to be involved.This is consistent with the study done by Radhiana Hassan et al(2010) who encountered pancreatic injury in only 3% of the cases.Our study also correlates with the findings of MM Kumat et al(2005) who accounted 26% of splenic injuries among visceral organs in his study.

Among the 39 patients who had liver injury, 32 were managed conservatively while 7 patients were taken up for surgery.46 patients who had splenic injury were managed conservatively while 13 patients were managed by performing surgery. The one patient with the pancreatic injury was managed conservatively. Out of 21 patients who had renal injury, 9 were managed conservatively and 12 were taken up for surgery. 10 patients with bladder injury were taken up for surgery whereas the rest 2 were managed conservatively. All the patients who had bowel/mesentery injury were managed surgically.

While analyzing the splenic injury patients, they were classified into five grades. The most common grade was grade 2 which was present in 20 patients (34%). 16 patients (27%) had grade 3 and 10 patients had grade 1. The least common grades were grade 4 and grade 5 present in 8 patients (14%) and 5 patients (8%) respectively.

Among grade1,2 and 3 splenic injury patients, all were managed conservatively except 2 patients were taken up for surgery because of the associated grade 5 renal injury present in them. Among grade 4 injury patients, 6 were managed conservatively and 2 were managed surgically. All the patients with grade 5 splenic injury were taken up for surgery.In our study, grade 3 and 4 patients were managed either conservatively or surgically depending upon the hemodynamic status and other associated injuries.

While analysing the grades of liver injury, Grade 2 injury was predominant and found in 11 patients (28%) closely followed by Grade 3 injury which was present in 10 patients (27%). Grade 1 injury was present in 8 patients (21%) and grade 4 injury in 7 patients (18%). Grade 5 injury is relatively uncommon found in 3 patients (8%).

Grade 1,2 and 3 liver injuries were managed conservatively whereas grade 5 liver injuries were managed surgically. Grade 4 were managed conservatively or surgically depending upon the patient condition. This is consistent with the study done by Aziz et al(2010) who have shown that upto 80% of liver injuries in adults and upto 97% of liver injuries in children can be treated without surgery.

While classifying renal injury into five grades, the most common grade was grade 5 present in 9 patients (43%) followed by grade 2(24%) and grade 3 (19%). The least common grades were grade 4 and grade 1 found in 2 patients (9%) and 1 patient (5%) respectively.

All grade 1 and 2 patients were managed conservatively. 3 patients of grade 3 injury were managed conservatively and 1 patient was taken up for surgery because of

associated grade 5 splenic injury in the patient. Among the 2 patients with grade 4 injury, 1 was managed conservatively and 1 was managed surgically. All the grade 5 injury patients were managed surgically.This is in concordance with the study done by Kalpesh Vadodariya et al(2014).

Out of 10 bowel/mesentery injury patients, 8 patients (80%) had bowel perforation and 2 patients (20%) had mesenteric tear. In our study, we were able to found out only 6 out of 10 cases of bowel/mesenteric injury. This is consistent with the study done by Brasel KJ et al(1998) who detected 6 out of 13 cases of bowel injury with sensitivity ranging from 40-70% and specificity of 94-100%.Hence CT images must be carefully examined to detect injuries and close attention should be paid to scanning techniques and optimal bowel contrast.

On assessing the CT for hemoperitoneum , 118 patients out of 190 (62%) had hemoperitoneum. Out of these 118 patients, 108 patients (92%) had visceral injury and the rest 10 patients (8%) were without associated visceral injury. While assessing the severity of hemoperitoneum, 67 patients (57%) had mild and 34 patients (29%) had moderate and 17 patients (14%) had severe hemoperitoneum. In patients with mild hemoperitoneum, 13 were taken up for surgery while majority (54 patients) were managed conservatively. In patients with moderate hemoperitoneum, 10 patients were taken up for surgery while 24 patients were managed conservatively. All the 17 patients with severe hemoperitoneum were managed surgically. A quantification system devised by Federle et al [2] was used to grade the hemoperitoneum in these cases. This grading was used as an indicator to predict the need for laparotomy in

patients with hemoperitoneum.Our study had good correlation of CT quantification of hemoperitoneum with management approach.

Presence of pneumoperitoneum was also assessed in CT and the following findings were noted. Pneumoperitoneum was present in 14 patients (7%) and absent in rest 176 patients (93%). Visceral injury was present in 10 patients (71%) with pneumoperitoneum and absent in rest of the cases.

In our study,among EFAST and CT, CT is highly accurate in identifying visceral and bowel injuries compared to EFAST. The sensitivity, specificity, positive predictive value, negative predictive value, accuracy for predicting visceral and bowel injuries by CT are 100%, 98%, 92.5%, 100%, 98.42% compared to 84.9%,98.06%,93.75%,95%,94.71% seen in EFAST. Around 20 cases of visceral and bowel injuries were missed in ultrasound in our study. This is because most of the ultrasounds are done by junior residents and first year senior residents in institutions on a twenty four hour basis.Also even skilled radiologists find it difficult to predict bowel injuries by ultrasound in the presence of subtle findings which could easily be picked up in CT scan.

In our study, among visceral and bowel injuries, CT is highly sensitive in identifying visceral injuries more than bowel injuries. The sensitivity, specificity, positive predictive value, negative predictive value, accuracy for predicting visceral injuries are 100%, 98.04%, 92.5%, 100.00%, 98.42% compared to 100.0%, 98.36%, 70%, 100%, 98.42% seen in bowel injuries. Other findings like hemothorax, pelvic fracture, rib fracture, pneumothorax and liver hematoma were present in 84

patients (44%) and were absent in 106 patients (56%). Hemothorax was present in 6 patients (1.5%), pelvic fracture in 18 patients (10%), rib fracture in 25 patients (13%), pneumothorax in 4 patients (2%) and old liver hematoma in 1 patient (0.75%).

We had a mortality of two patients with history of blunt abdominal injury in our study. One of them was a case of polytrauma with ileal perforation diagnosed in CT, but couldn't be taken up for surgery due to poor hemodynamic status and the patient succumbed due to multiple internal injuries.Another patient was a case of sigmoid perforation with peritonitis diagnosed by CT ,operated and died in fourth postoperative day due to sepsis.

CONCLUSION

Multidetector CT technology offers unique and comprehensive imaging capabilities that can be readily applied for optimal evaluation of blunt abdominal injury. It is highly sensitive, specific and accurate for use in detecting the presence or absence of injury and defining its extent. CT scans can provide a rapid and accurate appraisal of abdominal viscera, retroperitoneum and abdominal wall. Also Associated thoracic injuries and unsuspected pelvic and spinal fractures can be identified by CT. With the decline in use of diagnostic peritoneal lavage and the current preference for conservative management, diagnosis is heavily reliant on the accurate interpretation of a timely and technically sound CT study .However to maximize the diagnostic potential of the examination and at the same time, minimize risks, CT protocols need to be tailored to match the need of each individual patient.

SUMMARY

The use of Computed tomography has a tremendous impact on the evaluation and management of blunt abdominal trauma because the rapid identification of life threatening injuries and prompt initiation of appropriate care may increase the chance of survival for patients with trauma.It is highly sensitive,specific and accurate for use in detecting the presence or absence of injury and defining its extent.

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The findings are interpreted according to AAST grading system and these patients were followed up till management of the condition either surgically or conservatively.

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- Majority belonged to the age group between 21 to 40 years accounting for about 54%
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- Out of the 121 patients in whom the visceral injury was present, 31 patients were taken up for surgery and the remaining 90 patients were treated conservatively. Out of 69 patients in whom visceral injury was absent, 14 patients were taken up for surgery and the rest 50 patients were treated conservatively.
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- All the patients with grade 5 splenic injury were taken up for surgery.In our study, grade 3 and 4 patients were managed either conservatively or

surgically depending upon the hemodynamic status and other associated injuries.

- Grade 1,2 and 3 liver injuries were managed conservatively whereas grade 5 liver injuries were managed surgically. Grade 4 were managed conservatively or surgically depending upon the patient condition.
- Out of 10 bowel/mesentery injury patients, 8 patients (80%) had bowel perforation and 2 patients (20%) had mesenteric tear.In our study, we were able to found out only 6 out of 10 cases of bowel/mesenteric injury.
- On assessing the CT for hemoperitoneum , 118 patients out of 190 (62%) had hemoperitoneum. Out of these 118 patients, 108 patients (92%) had visceral injury and the rest 10 patients (8%) were without associated visceral injury.
- Pneumoperitoneum was present in 14 patients (7%) and absent in rest 176 patients (93%). Visceral injury was present in 10 patients (71%) with pneumoperitoneum and absent in rest of the cases.
- Other findings like hemothorax, pelvic fracture, rib fracture, pneumothorax and liver hematoma were present in 84 patients (44%) and were absent in 106 patients (56%).
- In our study,among EFAST and CT, CT is highly accurate in identifying visceral and bowel injuries compared to EFAST. The sensitivity,specificity,positive predictive value,negative predictive value,accuracy for predicting visceral and bowel injuries by CT are

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