Original Research Paper

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Radio-Diagnosis

EVALUATION OF BLUNT ABDOMINAL TRAUMA BY COMPUTED TOMOGRAPHY SCAN IN TERTIARY MEDICAL CENTRE.

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ABSTRACT **Introduction:** Trauma is one of the major diagnostic challenges faced by both surgeons and the radiologist. It is a common cause of death, ranging from 15-50 years in developing countries. Abdominal trauma (AT) is one of the common reasons of death in India. Abdominal injuries account for 10% of all deaths attributed to trauma. Most of the deaths occur at the scene of accident and result from neurological injuries, haemorrhage and multi-organ failure. **Aim And Objective:** To assess the role of Computed tomography as a primary diagnostic modality in the evaluation of blunt abdominal injury in hemodynamically stable patients. **Material And Methods:** In this study 140 cases of blunt abdominal injury admitted in trauma ward in Narayan medical college were selected. In all these cases, CT scans will be performed based on the clinical suspicion of intra-abdominal injury. All of the scans will be 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. **Results:** In the present study out of 36 study subjects with liver injury, majority of study subjects (10 subjects) had grade III liver injury. Out of this 10 subjects 4 subjects managed conservatively and 6 subjects had surgical management, out of 8 grade II liver injury, 6 subjects were managed conservatively. On CT scan 129 subjects out of 140 subjects were had abnormal findings, whereas 130 subjects had abnormal findings on USG, The SENSITIVITY- 97.69%, SPECIFICITY- 80%, PPV- 98.45%, NPV- 72.73%,and ACCURACY- 96.43%. **Conclusions:** Multidetector CT is highly sensitive, specific and accurate in detecting the presence or absence of abdominal injury and defining its extent. With the decline in use of Diagnostic peritoneal lavage and the current preference for conservative management, diagnosis is heavily reliant on the findings of CT studies that are acquired in a timely fashion and adequately performed and the results of which are accurately interpreted

KEYWORDS : CT Scan, Abdominal Injury, Splenic Injury, Liver Injury

INTRODUCTION

Despite its proximity with man, trauma has been called the neglected illness of modern society. In developed countries, trauma is the leading cause of death and disability, and is the most common cause of death below the age of 45.

Trauma is one of the major diagnostic challenges faced by both surgeons and the radiologist. It is a common cause of death, ranging from 15-50 years in developing countries. Abdominal trauma (AT) is one of the common reasons of death in India. Abdominal injuries account for 10% of all deaths attributed to trauma. Most of the deaths occur at the scene of accident and result from neurological injuries, haemorrhage and multi-organ failure[1]

The third most frequently wounded part of the body is the abdomen following damage to the limbs and head. Abdominal trauma can be divided into two main categories: 1) Penetrating abdominal trauma; 2) Blunt abdominal trauma. Of the two, the most common type of injury is blunt trauma to the abdomen. Popular modes include road traffic accidents, combat accidents, battering, dropping from heights, sporting accidents, martial arts, athletics, mountaineering, etc., among the many causes of blunt abdominal trauma. The most common cause of blunt trauma to the abdomen is road traffic collisions. The deceleration, crushing or external compression mechanism may result in blunt abdominal trauma.[2]

To maximise the probability of patient recovery, blunt trauma to the abdomen needs to be carefully assessed. Swift use of medical techniques and vigorous counselling should be administered to resolve urgent life-threatening issues. In the assessment of blunt abdominal injury, centred assessment with sonography for trauma or Quick has emerged as a useful method. Diagnostic modalities are not available or unaffordable and include opening the abdomen for diagnosis rather than waiting for diagnosis.

The second most common cause of death after blunt abdominal trauma is hidden haemorrhage, and missing abdominal injuries are a frequent cause of morbidity and late mortality in patients living early after injury. Near vigilance and early administration of effective treatment contribute to reduced morbidity and mortality.[3]

The role of the radiologist is to look for the following aspects that are to be expected in abdominal blunt trauma: hemoperitoneum, contrast blush consistent with active bleeding, lacerations, contusions, parenchymal hematomas, subscapular hematomas, devascularisation of organs or part of organs, free intraperitoneal or retroperitoneal air, and diaphragmatic rupture.[4]

New research aimed at researching the blunt trauma abdomen with regard to management and outcome in a tertiary care hospital, aiming to study the pattern of blunt abdominal injury and the mode of injury and involvement of different abdominal organs, to study the different modalities of investigation and their application in the management of blunt abdominal trauma, to study the post-traumatic trauma, with respect to conservative and surgical modalities in patients of blunt abdominal trauma and to study the morbidity and mortality among patients admitted to our hospital with blunt injury abdomen.

AIMS AND OBJECTIVES OF STUDY

1. To assess the role of Computed tomography as a primary diagnostic modality in the evaluation of blunt abdominal injury in hemodynamically stable patients
2. 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 Narayan medical college and hospital, Jamuhar, South Bihar.

Design Of Study:
Prospective comparative study

Period Of Study: 1 year

Inclusion Criteria:
CT scan will be performed in hemodynamically stable blunt abdominal injury cases in whom findings on clinical abdominal examination are equivocal.

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

Sample Size:
Sample size is calculated depending upon the prevalence of blunt abdominal trauma. It was found in the previous study that Abdominal injuries account for 10% of all deaths attributed to trauma (As per study by Divya Y et al "Ultra Sonographic Eveluation and Computed Tomography of Abdominal Trauma - A Comparative Study") the maximum error in the estimate we were willing to tolerate, say ± 5%, at 2-sided test with 95% confidence level (α=5%) and design effect =1, expected sample size is 139 patients.so total 140 sample size were taken.

Formulas
Following formulas is used to compute sample size
n = deff* Npq /(d2 /z2 *(N-1)+pq)

where,
n is sample size
deff is design effect
N is population size
P is estimated prevalence
q= 1-p
d = absolute level of precision

METHODOLOGY:
In this study 140 cases of blunt abdominal injury admitted in trauma ward in Narayan medical college will be selected. In all these cases, CT scans will be performed based on the clinical suspicion of intra-abdominal injury. All of the scans will be 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.

Plan For Data Analysis
The data obtained were entered and analysed using Microsoft excel and Epi info 7.2.1 software. Results were expressed in frequencies and percentages. Sensitivity, Specificity, PPV and NPV were estimated.

RESULT AND DISCUSSION
The study group consisting of 140 patients referred as a case of blunt abdominal injury from trauma ward to Department of Radio diagnosis at Narayan meal college were studied and were followed up till management of the condition either surgically or conservatively.

The mean age of the study subjects was 37.92 yrs, with SD- 14.30 yrs, 73.57% study subjects were male whereas rest 26.43% were female in our study.

Table 1: Distribution Of Study Subjects As Per Visceral Injury Found On CT Scan

Visceral injury	Yes	No
LIVER INJURY	35(25%)	105(75%)
SPLEEN	56(40%)	84(60%)
KIDNEY	21(15%)	119(85%)
BLADDER	12(8.6%)	128(91.4%)
PANCREAS	1(0.7%)	139(99.3%)
BOWEL MESENTERY	10(7.1%)	130(92.9%)
HEMOPERITONEUM	112(80%)	28(20%)
PNEUMOPERITONEUM	14(10%)	126(90%)

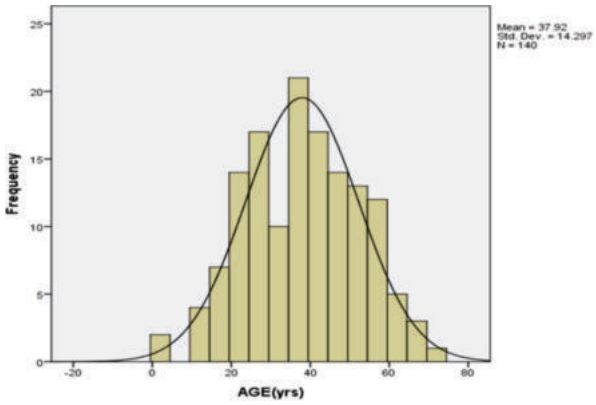

Fig 1: Distribution Of Study Subjects As Per Age

In this study most common findings were hemoperitoneum(80%), followed by spleen injury(40%), liver injury (25%), kidney injury (15%), pneumoperitoneum (10%), bladder injury(8.6%) followed by others.

Table 2: Type Of Management In Study Subjects With Liver Injury On CT Scan

		Management		Total
		Conservative	Surgery	
LIVER injury	No	67	38	105
	Yes	28	7	35
Total		95	45	140
Chi-square value – 3.16, p value- 0.076, non-significant				

Table 2 shows type of management of liver injury, out of 35 study subjects with liver injury, 28 subject had conservative management whereas 7 subjects had surgical management. Out of 105 subjects without liver injury, 67 subjects had conservative management and 38 subjects had surgical management, on applying chi-square it was non-significant association with p value -0.076

Table 3: Type Of Management In Study Subjects With Spleen Injury Found On CT Scan

		Management		Total
		Conservative	Surgery	
SPLEEN injury	N	51	33	84
	Y	44	12	56
Total	95	45		140
Chi-square value- 4.91, p value- 0.027, significant				

Table 3 shows Type of management in study subjects with spleen injury found on CT scan, out of 56 subjects with spleen injury, 44 subjects had conservative management whereas 12 subjects had surgical management, 84 subjects were do not had splenic injury, in which 51 study subjects were managed conservatively whereas 33 subjects had surgery, on applying chi-square it was significant with p value 0.027.

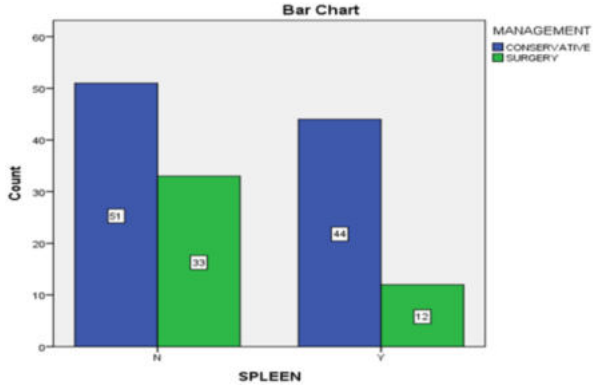

Fig 2: Type Of Management In Study Subjects With Spleen Injury Found On CT Scan

Table 4 : Management Of Study Subjects As Per Grade Of Liver Injury

		Liver injury						Total
		grade II liver injury	GRADE III Liver injury	grade IV Injury	grade liver I injury	grade V liver injury	liver hematoma	
Management	Conservative	6	4	4	3	2	0	19
	Surgery	2	6	2	4	2	1	17
Total		8	10	6	7	4	1	36
Chi-square value- 4.11, p value- 0.53, non-significant								

Table 4 shows Management of study subjects as per grade of liver injury, out of 36 study subjects with liver injury, majority of study subjects (10 subjects) had grade III liver injury. Out of this 10 subjects 4 subjects managed conservatively and 6 subjects had surgical management, out of 8 grade II liver injury, 6 subjects were managed conservatively and 2 subjects were managed by surgery. on applying chi-square it was non-significant with p value 0.53

Table 5: Association Of CT Findings With USG Findings

		USG Finding		Total
		Abnormal	Normal	
CT Finding	Abnormal	127	2	129
	Normal	3	8	11
Total	130	10		140

Table 5 shows Association of CT findings with USG findings, on CT scan 129 subjects out of 140 subjects were had abnormal findings, whereas 130 subjects had abnormal findings on USG, The SENSITIVITY- 97.69%, SPECIFICITY- 80%, PPV- 98.45%, NPV- 72.73%,and ACCURACY- 96.43%

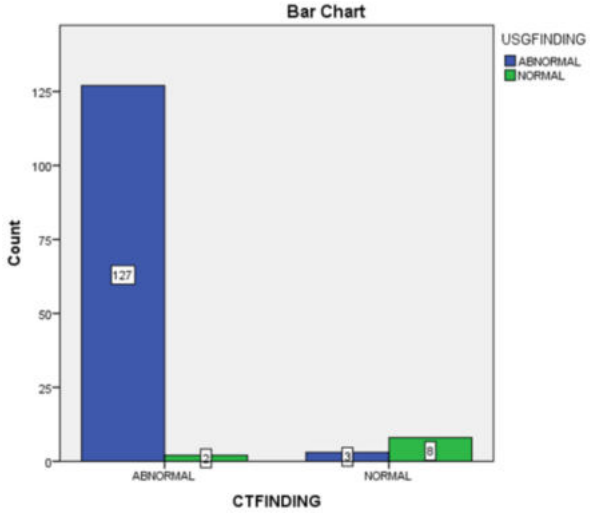

Fig 3: Association Of CT Findings With USG Findings

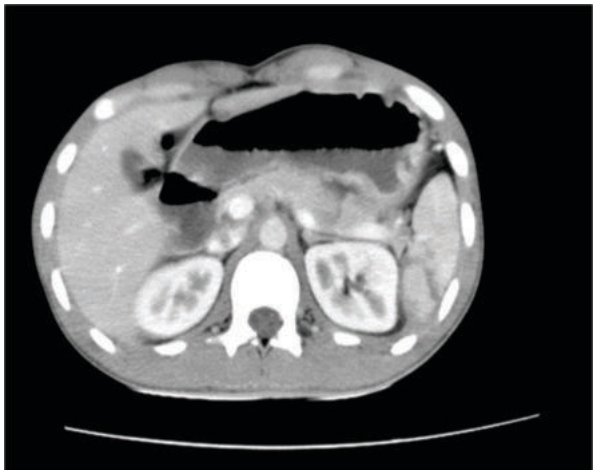

Fig1: Splenic Injury

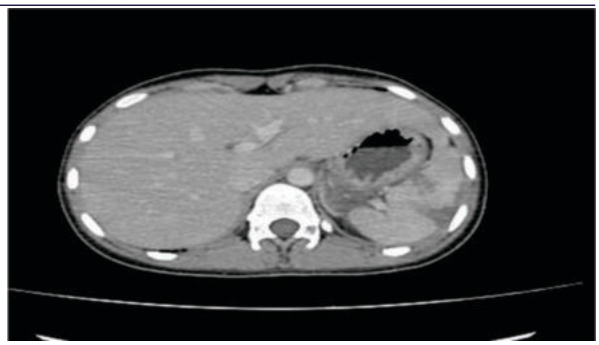

Fig 2: Axial CECT Of A 13yrs Old Female Showing Grade II Splenic Injury

DISCUSSION

The mean age of the study subjects was 37.92 yrs, with SD- 14.30 yrs, 73.57% study subjects were male whereas rest 26.43% were female in our study. This is correlated with the results of study done by **Wing *et al.***[6] who had predicted 26% of normal cases in a study population of 125. Motor vehicle injuries and falls from height were more among males whereas assault cases were reported more among females. In accidents due to MVA, among males, Among blunt abdominal trauma cases due to fall from height, Among blunt trauma due to assault cases, all cases were observed to be centred in age span of 21-60 years.

CT has become the definitive imaging modality of choice when intra-abdominal injury is suspected. CT is rapid and highly sensitive and specific for many important injury types. The informations provided by CT allow prognosis of injury and selective non-operative management in blunt trauma.[7]

Visceral Injury

In our study,129 study subjects out of 140 were had abnormal findings on CT scan, in which 84 study subjects managed conservatively while 56 patients undergo surgery. This is superior to the study done by MM Kumar *et al*[8]. 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.

In this study most common findings were hemoperitoneum(80%), followed by spleen injury(40%), liver injury (25%), kidney injury (15%), pneumoperitoneum (10%), bladder injury(8.6%) followed by others. Our study also correlates with the findings of **MM Kumat *et al.***[8] who accounted 26% of splenic injuries among other visceral organs in his study. Grade 1 and 2 visceral injuries were managed conservatively whereas grade 5 visceral injuries were managed surgically. Grade 3 and 4 were managed conservatively or surgically depending upon the patient condition. This is consistent with the study done by **Aziz *et al*[9].** who have shown that upto 80% of liver injuries in adults and upto 97% of liver injuries in children can be treated without surgery, **Jansen JO et al**[10] and **Isenhour JL et al**[11] stated that the most common injured organ in blunt abdominal trauma is the spleen. In 50% of cases, it is the only intra-peritoneal injured organ. Also **Cahir JG** [12] reported that the spleen is the most commonly injured solid abdominal organ following blunt abdominal trauma. But in our study the liver was the most commonly injured organ representing 40% of all our cases, this is because the majority of our cases belonged to the first decade.

In our study,10 (7.6%) subjects had bowel injury. This is consistent with the study done by **Brasel KJ et al**.[13] 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.

A quantification system devised by **Federle et al**[14]. was used to grade the haemoperitoneum, used as an indicator to predict the need for laparotomy in patients with haemoperitoneum.

The current study had good correlation of CT quantification of hemoperitoneum with management approach. Presence of pneumoperitoneum was also assessed in CT, was present in 10% and absent in rest 90%. Visceral injury was present in 71% with pneumoperitoneum and absent in rest of the cases.

Association Of CT Scan With USG

In our study, CT is highly accurate in identifying visceral and bowel injuries compared to USG. on CT scan 129 subjects out of 140 subjects were had abnormal findings, whereas 130 subjects had abnormal findings on USG, The SENSITIVITY- 97.69%, SPECIFICITY- 80%, PPV- 98.45%, NPV- 72.73%,and ACCURACY- 96.43%, 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. Ilahi O et al[15], in their study reported that that CT scan was 68% accurate moderately sensitive and in detecting pancreatic injury. Though there are numerous studies in the literature comparing either CT or US with surgical findings, but there are very few studies comparing CT and US with operative findings in the literature Mallik K et al.[16]

CONCLUSION

Multidetector CT is highly sensitive, specific and accurate in detecting the presence or absence of abdominal injury and defining its extent. With the decline in use of Diagnostic peritoneal lavage and the current preference for conservative management, diagnosis is heavily reliant on the findings of CT studies that are acquired in a timely fashion and adequately performed and the results of which are accurately interpreted. However to maximize the diagnostic potential of the examination and at the same time to minimize risks, CT protocols need to be tailored to match the need of each individual patient. Hence, Multidetector CT can be recommended as primary diagnostic modality for all hemodynamically stable blunt trauma cases. CT grading combined with clinical status is the single most determinant in management of cases, whether surgical or conservative.

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