ROLE OF COMPUTED TOMOGRAPHY IN ASSESSMENT OF BLUNT TRAUMA ABDOMEN

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ABSTRACT

Objectives: The objective of the study was to evaluate the usefulness of computed tomography (CT) in assessment of blunt trauma abdomen by correlating their findings with operative findings.

Study Design: Validation study.

Place and duration of study: Radiology Department Combined Military Hospital Rawalpindi from Aug 2005 to Aug 2006.

Patients and Methods: This study involved 30 operatively managed patients. CT was carried out in all 30 patients. Sensitivity, specificity, positive predictive, negative predictive value and accuracy of CT for detection of blunt trauma abdomen were carried out by keeping operation findings as gold standard.

Results: CT had shown high sensitivity (88%) in defining solid visceral injuries. Bone injuries of the pelvis identified accurately on sections reviewed with bone window settings and also the sensitivity of CT was reasonably high for bowel and mesenteric injuries (75%)

Conclusion: We concluded that CT had a high sensitivity in detection of blunt trauma abdominal injuries.

Keywords: Blunt Abdominal Trauma, Computed tomography, Haemoperitoneum.

INTRODUCTION

Abdominal trauma remains a leading cause of death and disability for men and women under the age of 40 years, and approximately 10% of trauma deaths are due to abdominal injuries Blunt abdominal trauma is one of the commonest injuries[1]. Patients with abdominal trauma present a frequent diagnostic dilemma because of low accuracy of physical examination and clinical diagnosis[2]. The challenge in the imaging of abdominal trauma is to accurately identify injuries that require early exploration and at the same time avoid unnecessary operative intervention in cases that can be managed conservatively. In recent years Computed tomography and Ultrasound have to a great extent replaced all other modalities of investigation. However, the sensitivity of Ultrasound is inferior to that of Computed tomography, and there is user variability[3].

Computed tomography has become an integral part of the evaluation of patients with blunt abdominal trauma[4]. The rapid diagnostic capability afforded by has contributed toward a decrease in morbidity and mortality from abdominal injuries. Hemoperitoneum is easily identified with Computed tomography, as are injuries of the spleen, liver, gallbladder, kidneys, pancreas and diaphragm[5]. Computed tomography continued to evolve and can now help identify most significant traumatic bowel and mesenteric injuries in both children and adults[6].

The current surgery literature even suggests that a negative Computed tomography scan can be used as a screening tool to help identify patients who may be discharged without further evaluation[7].In our set up no study has been carried out on the role of CT in blunt trauma abdomen. This study would evaluate the importance of CT in assessment of blunt abdominal injuries.

PATIENTS AND METHODS

This validation study was carried out at the radiology Department Combined Military hospital Rawalpindi. The study duration was one year from Aug 2005 to Aug 2006. Thirty cases of blunt trauma abdomen that underwent surgery after CT scan were included. Informed consent was obtained from all patients. Blunt trauma abdomen was defined as direct trauma

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to abdominal wall not resulting in the breach of peritoneum.

Helical computed tomography (Asteion - Toshiba) was used for all patients. Computed tomography was performed from the dome of diaphragm to the symphysis pubis. A routine oral contrast agent was given 30-40 minutes before the study in alert patients. Oral contrast was not given in patients with repeated vomiting or patients having altered mental status. All patients received intravenous bolus 120-150 ml of iodinated contrast agents (Urografin) or non ionic (omnipaque / ultravist [300 mg I/mL with a power injector (vistron) at a flow rate of 3 ml/sec[8] Delayed CT scans were also incorporated whenever there was a suspicion of kidney or urinary tract injury.

CT scans were interpreted by a senior radiologist in our department. Image interpretation was based on transverse source images and multiplanar reconstructions performed at the workstation by the radiologists themselves. CT images were examined at soft-tissue window settings and at lung window settings; the latter were used primarily for the detection of pneumoperitoneum as well as bone window setting for pelvic fracture detection. CT were evaluated for the presence or absence of abdominal injuries and the type of injury (solid /hollow organ injury, hemoperitoneum, free fluid, suspected bowe injury and pelvic fracture The patients were followed up and operation findings were recorded and correlated with CT findings . SPSS version 11 was used for data analysis. Descriptive statistics was used to describe the data. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of computed tomography for solid/mesenteric injuries were determined by using operative findings as Gold standard.

RESULTS

A total of 30 patients were studied from who presented with blunt trauma abdomen for which an operation was carried out. Age ranges for these patients were 5 - 61 yrs and mean was 37.7 yrs. Male were 27(90%) and female were 3(10%). Mode of trauma is presented in Fig 1. 22 out of 30 patients had solid or hollow visceral injuries on CT. While operation revealed 25 visceral injuries. Computed tomography missed one spleen, one renal and one bladder injury. This is represented in Figure 2. Bowel and mesenteric injuries were detected in 8 patients on operation, while computed tomography detected 6 cases of bowel and mesenteric injury. Frequencies of CT findings in Bowel and mesenteric injuries are shown in Table 1.There was one case in which suspicion of bowel injury along with splenic injury was given on computed tomography, but operation revealed only splenic injury and this case was false positive for bowel/mesenteric injury. Four out of 30 patients showed unstable pelvic fracture which required surgical intervention. Haemoperitoneum seen in 28 out of 30 patients on operation and CT detected hemoperitoneum in all these patients. Sensitivity for computed tomography for pelvic fracture detection was 100% and specificity was also 100%.

The sensitivity of CT for identification of solid/hollow organ was 88% specificity was

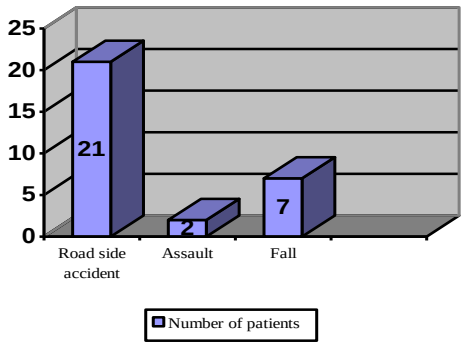

Fig.1: Modeo of Trauma In Patients (N=30)

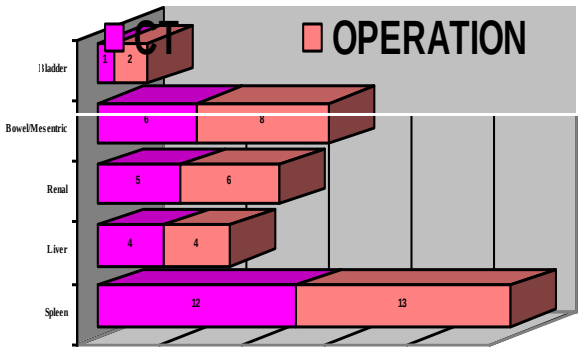

Fig-2: Frequency of visceral injuries detected on CT and Operation (n=30)

100%, positive predictive value was also 100%,

negative predictive value was 62.5% and accuracy was 90%. The sensitivity of CT for detection of bowel injury was 75% specificity was 95.4%, positive predictive value was 85.7%, negative predictive value was 91.3% and accuracy was 90%.This is shown in table 2

DISCUSSION

Computed tomography has been very sensitive in detection of blunt abdominal injuries. The sensitivity of computed tomography for detection of visceral organs in our study was about 88% and specificity was 100%. This is near to a study carried out by Stafford et al[9] which showed Sensitivity for solid organ injury 88.9% and specificity was 94%. Our results are also comparable to study carried out by Kailidou et al[10].

The sensitivity of CT in detection of hemoperitoneum was 100% in our study which is similar to study of Kshitish et al[11].

There were 4 cases of pelvic fractures for which operation was carried out and computed tomography detected all of these cases and the sensitivity of computed tomography was 100%. Eugene E et al[12] study also showed the 100% sensitivity of CT in detection of pelvic fracture.

In our study most of the patients were male 90%. This is in accordance to study of Willmann[13]. The mean age of patients was 37.7 yrs, which is nearly same as shown in most studies[14].

In our study most of cases of blunt trauma abdomen were due to road side accidents (70 %).Dattani et al[15] study also showed that road side accident was the most common mechanism of injury to cause abdominal injuries

Splenic injury was the most common organ injury in our study, Our findings were correlated well with the study of Kumar (2005)[16]. A study carried out in Mayo hospital Lahore also showed that splenic injury was the commonest visceral injury in blunt trauma patients[17]. CT missed one case of splenic injury. In this case operation revealed very small splenic laceration and no blood was oozing at the laceration site, this might be reasoned for missing this case..

In our study one case of renal injury was missed. The reason of missed renal injury on CT might be that post contrast film was taken very early about 30 seconds. While the literature[18] shows that for proper renal contrast enhancement, exposure should be done slightly late as compared to normal CT abdomen i.e. about 70 seconds after start of infusing IV contrast.

Two cases of bowel and mesenteric injuries were missed on CT so the sensitivity and specificity of CT in bowel/ mesenteric

Table-1: Frequencies of CT findings in Bowel and mesenteric injuries (n=6)

CT Findings in Bowel and Mesentric Injuries	**Freq**
Pneumoperitoneum	2
Mesenteric / bowel hematoma	2
Bowel wall thickening	3
Contrast Extravasation	1

Table-2: Sensitivity, specificity, positive predictive value, negative predictive and accuracy for CT in detection of visceral and bowel injury. (n=30)

Visceral Injuries

	positive	**Negative**
positive	True positive (TP) 22	False negative (FN) 3
negative	False positive (FP) 0	True negative (TN) 5

Bowel/ Mesenteric Injuries

	Positive	**Negative**
Positive	True positive (TP) 6	False negative (FN) 2
negative	False positive (FP) 1	True negative (TN) 21

	Visceral Injury %	**Bowel Injury %**
Sensitivity = TP/ TP+ FN	88	75
Specificity = TN / TN + FB	100	95.4
Positive Predictive Value = TP/ TP + FB	100	85.7
Negative Predictive Value = TN/ TN + FN	100	91.3
Accuracy = TP + TN / TP+FN+FP +TN	90	90

injuries was 75% and 100% respectively in our study. Our results for bowel and mesenteric injuries detection by CT are comparable to a study carried by Steven R et al[19], The sensitivity of CT in bowel and mesenteric injuries was 75% which is less when we compare the results of studies[20,21], which showed the sensitivity of CT for bowel and mesenteric injuries up to 95 to 98%.There was one case of false positive for bowel injury in which bowel thickening on CT suspected as bowel injury, but on laparatomy no bowel/mesenteric injury was found .This bowel wall thickening was infact secondary to profound hypovolemia (shock bowel). .

The limitation of our study was that sample size was small consisting of 30 operated cases. The reason for being nowadays blunt trauma abdomen patients are usually managed conservatively and operation for blunt trauma is usually not carried out especially those patients having normal CT scan abdomen. and the other reason that despite high sensitivity of CT, in our set up surgeons routinely preferred ultrasound for blunt trauma abdomen because resuscitation can be carried out during ultrasound as well as it can be performed at patient bed side and there is no requirement of transferring patient from trauma centre to CT scan room.

The other limitation of our study was lower sensitivity in detection of bowel/mesenteric injuries and bladder injuries. This is similar to results of Kumar et al[16]

To summarize, no local study has been conducted before in determining the role of CT in blunt trauma abdomen, however few studies has been carried out to assess the role of US in blunt trauma abdomen. Despite its limitations this remains the pioneer local study to determine the role of CT in assessing blunt trauma abdomen.

CONCLUSION

CT has been shown to be very sensitive in defining visceral injuries as well as associated hemoperitoneum. Injuries of the bowel and mesenteric injuries were detected with reasonably high sensitivity.

We conclude that CT had a high accuracy in detection of blunt trauma abdominal injuries.

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