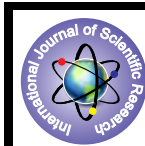


The Role of Computed Tomography in management of Blunt Abdominal Trauma conducted at Government tertiary hospital, Western India : A prospective observational study



Medical Science

KEYWORDS : Blunt abdominal trauma, CT Scan, Spleen, Hemoperitonium, Vadodara

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ABSTRACT

Background and objectives: Evaluating patients who have sustained blunt abdominal trauma (BAT) remains one of the most challenging and resource-intensive aspects of acute trauma care. Missed intra-abdominal injuries continue to cause preventable deaths. Objective is to assess efficacy of CT scan (computed tomography) as accurate diagnostic tool for blunt abdominal trauma patients.

Methods: 87 cases of blunt abdominal injury admitted in S.S.G hospital, Medical College, Baroda during the period of august 2010 to November 2012 were included in my study after taking written informed consent. All these patients were thoroughly investigated. CT Scan was done for all hemodynamically stable patients. Recorded data included age, sex, type of injuries and scan results. Organ injuries were graded using the OIS (Organ Injury Scale) guidelines.

Results: The study comprised of 87 patients having blunt abdominal injury. Majority of patients were in the age group of 20-29 years male. Most common organ injury were splenic (43%), liver (32%) and renal (11%). 95% (83 patients) were positive for abdominal injury and 5% (4 patients) were negative. The CT findings of hemoperitoneum and/or solid organ injury were confirmed in the 15 cases taken up for surgery.

Conclusions: In this study CT scan was 100 % sensitive in diagnosis of blunt abdominal trauma. Negative CT scan discourage unnecessary urgent abdominal exploration.

Introduction

The care of trauma patients is demanding and requires speed and efficiency. Blunt Abdominal Trauma usually results from motor vehicle collisions, assaults, recreational accidents, or falls. Men tend to be affected slightly more often than women.

Evaluating patients who have sustained blunt abdominal trauma (BAT) remains one of the most challenging and resource-intensive aspects of acute trauma care. Missed intra-abdominal injuries continue to cause preventable deaths. Neurological impairment due to the traumatic event itself or to concomitant factors such as intoxication markedly limits the usefulness of the clinical examination.

The most commonly injured organs are the spleen, liver, retroperitoneum, small bowel, kidneys, bladder, colon, diaphragm, and pancreas. Computed tomography (CT) scan remains the criterion standard for the detection of solid organ injuries. CT scan of the abdomen can reveal other associated injuries, notably vertebral and pelvic fractures and injuries in the thoracic cavity.

CT scans, unlike direct peritoneal lavage (DPL) or Focused Assessment with Sonography for Trauma (FAST) examinations, have the capability to determine the source of haemorrhage. Many retroperitoneal injuries go unnoticed with DPL and FAST examinations.

CT scans provide excellent imaging of the pancreas, duodenum and genitourinary system. The images can help quantitate the amount of blood in the abdomen and can reveal individual organs with precision. Imaging plays a critical role in the evaluation of patients with blunt abdominal trauma. CT as the sole modality, enables evaluation of other associated injuries in addition to global evaluation of abdominal trauma.

CT requires a cooperative, hemodynamically stable patient. CT scanners are now available in most trauma centers, and with the advent of helical scanners, scan time has been significantly reduced.

The accuracy of CT in hemodynamically stable blunt trauma patients has been well established. Sensitivity between 92% and 97.6% and specificity as high as 98.7% has been reported in patients subjected to emergency.⁽¹⁰⁾

Hence the current study is carried out to assess the role of CT Scan in a prospective observational manner.

Objective

To evaluate role of CT scan (computed tomography) in management of blunt abdominal trauma patients.

Materials and Methods

The prospective study of the role of CT Scan in case of blunt abdominal trauma was carried out in the department of surgery Shree Sayaji General Hospital (SSGH), Baroda, between august 2010 and November 2012. SSGH is the third largest government hospital in Gujarat, western India.

All patients who were admitted in the hospital during the above mentioned time frame with blunt abdominal trauma who were hemodynamically stable were considered in the study.

Patients were enrolled in the study after taking informed written consent.

All routine blood investigations were done. These includes Hb, TC, DC, blood urea, S.creat, LFT, RBS, blood grouping. Urine routine and microscopic examination Chest & abdominal X ray and USG were done. If vital signs of patient were found stable other related X-rays were done according to site of injury, CT Scan was advised for patient in whom USG was suggestive of any abnormality or there is any clinical doubt in hemodynamically stable vital signs.

TECHNIQUE OF CT SCAN STUDY: (3)

Preparation of patient:

Risks of contrast administration was explained to the patients and consent was obtained prior to the contrast study.

Plain scans were followed by intravenous contrast scans.

Scout	:	Craniocaudal AP and Lateral
IV Contrast	:	Iopamidol 350 70 ml , 3.5 ml/sec

- Start location: Diaphragm
- End location: Symphysis pubis
- Kv : 120 mA : Auto

Sections were taken in arterial (30 sec) and portal venous (60 – 90 sec) phases. Delayed scanning (5-7 minutes) was not routinely performed. It was done only in suspected cases of renal or bladder trauma.

Artifact Reduction Techniques

- Decompress stomach with a nasogastric tube to prevent air-fluid artefact.
- Withdraw nasogastric tube into the esophagus immediately before scanning to prevent artefact.
- Remove electrocardiographic leads from the scan field.
- Raise the patient's arms (if tolerated) out of the scan field.

Post study reconstructions were done at 2.5 mm. Sagittal and coronal reconstructions were made wherever necessary.

The patients with hemoperitoneum or abdominal visceral injury or both were considered as positive for intra abdominal injury. The patients with neither visceral injury nor hemoperitoneum were considered as negative for intra abdominal injury.

Table 1: CT quantification of hemoperitoneum⁽¹⁷⁾

Location of hemorrhage	CT Quantification	Approximate Quantity
Fluid in only one space*	Mild	100-200 ml
Fluid in two or more spaces and in Pelvis	Moderate	250-500 ml
Fluid in all spaces or pelvic fluid anterior/superior to urinary bladder	Gross	>500 ml

* Location of hemorrhage in one space: Perisplenic or Perihepatic / Morrison's Pouch or Right / Left paracolic gutter

Table 1 shows CT quantification of hemoperitoneum⁽¹⁷⁾

Management was divided in 2 types:

Criteria for Conservative management: Stable vital signs, Per abdomen: absence of severe tenderness, guarding, rigidity and normal bowel sound, Normal X-ray abdomen standing, CT Scan suggestive of solid organ injury without active bleeding.

The patients managed conservatively were monitored in the form of Vital signs, Clinical examination of per abdomen including abdominal girth and bowel sound, Hematological investigation and repeat USG abdomen whenever indicated.

Criteria for operative management: Unstable vital signs, Per abdomen: Presence of severe tenderness, guarding and rigidity, Free gas in X-ray abdomen standing, CT Scan suggestive of active bleeding and CT-diagnosed injury requiring surgery, i.e., jejunal perforation; duodenal rupture. Management of associated injury was done simultaneously. Patients were followed up to discharge.

CT findings are compared with operative findings and with the clinical outcome and follow-up in conservatively managed patients. The overall imaging findings are analysed for their role in guiding the therapeutic options, whether conservative or surgical.

Results

A total of 87 patients were enrolled in the study. Blunt abdominal injury was most common in age group of 20-29 years (36%). The incidence of abdominal trauma in male population is 87%. 38 patients had splenic injury, 28 patients had liver injury and 10 patients had renal injury. There were 6 cases of small bowel injury in which jejunal perforation was most common. There were 3 cases of pancreatic, 2 cases of bladder and 2 cases of retroperitoneal injury. 95% (83 patients) were positive for abdominal injury and 5% (4 patients) were negative.

The CT findings of hemoperitoneum and/or solid organ injury were confirmed in the 15 cases taken up for surgery in this study. CT was 100% sensitive in detecting haemoperitoneum. As shown in figure 1 out of 87 cases 15 patients need to go for laparotomy. All other cases were managed conservatively well.

Majority (49 cases) of the visceral Injuries were Grade II injuries. There were no grade V & VI injuries (complete devascularization following transection at hilum) in this study. None of the Injuries graded I to II required surgery. Hence, visceral injuries graded I to III can be managed conservatively and only rarely require surgical intervention as shown in table 2.

Table 2: Relation between Grading and Management

Grade of injury	Liver		Spleen		Kidney	
	Conservative management	Operative management	Conservative Management	Operative management	Conservative Management	Operative management
I	5	-	1	-	2	-
II	18	-	25	-	6	-
III	5	3	12	3	1	-
VI	-	-	1	1	1	-
V	-	-	-	-	-	-
VI	-	-	-	-	-	-

40 % (35 patients) had mild hemoperitoneum, 41 % (36 patients) had moderate hemoperitoneum and 19 % (6 patients) had gross hemoperitoneum. 33 % (2 out of 6 patients) with gross hemoperitoneum, 25 % (9 out of 36 patients) with moderate hemoperitoneum and 8 % (3 out of 35 patients) with small hemoperitoneum required surgery.

Discussion

No age is bar for blunt abdominal trauma. The maximum abdominal trauma occurs in age group 20-29. This was because patient in this age group lead more active life and have more outdoor activities. Patient in age group > 50 yrs, lead a less active life, have less incidence of trauma. In this study, nearly 70 % of patients were from age group 10-39 years. This age represent working population. Thus trauma is not only a problem for individual but also social, as society loses a large amount of human resources. In a study by S. Gupta et al. (1995)⁽⁹⁾ maximum cases (40 %) of abdominal trauma were in age group 20-29yrs.

In this study, 87 % of patients were males. The incidence of abdominal trauma in male population is higher because in our country male leads more active life and has more outdoor activities. Women are usually housewives, majority of injuries in women are due to vehicular accident and fall from height.

In present study, CT scan had detected additional injuries in 18 % patients (16 out of 87), which were missed by USG. Out of these 16 patients, 7 patients needed surgery. In another three patients, USG finding was hemoperitoneum, but CT Scan was absolutely normal as shown in table 3.

Table 3 : Comparision of CT Scan & USG findings

USG FINDINGS		CT SCAN FINDINGS		Total
		Abnormal	Normal	
	Abnormal	67	3	70
	Normal	16	1	17
	Total	83	4	87

Poor results of USG may be due to overlying bowel shadow, surgical emphysema, empty bladder and lack of skilled radiologist at emergency hours.

Mallik K et al.⁽¹⁵⁾ study demonstrates the superiority of CT over USG as diagnostic tool in blunt abdominal trauma. CT Scan altered the diagnosis and choice of management in 7 patients.

Mc Nemar Chi square: 14.94

P value= 0.0044 (<0.05)

So the test is highly significant and it indicates that CT scan is better investigation as compared to USG abdomen in cases of blunt abdominal trauma.

CT scan is superior diagnostic modality in the diagnosis of abdominal trauma. USG can be a valuable initial investigation; however, USG can miss crucial injuries and may lead to inappropriate management in some patients. Hence it is imperative that all USG positive cases should be followed by CT. Similarly CT must also be performed in symptomatic patients with negative USG scans and in patients with suboptimal USG scans.

Solid organ injury like spleen, kidney were more accurately detected by CT scan than USG. CT scans provide excellent imaging of the pancreas, duodenum and genitourinary system. The images can help quantitate the amount of blood in the abdomen and can reveal individual organs with precision

The decision to proceed with urgent surgery depends on the identification of specific CT criteria that predict that the surgery will be therapeutic:

- Active hemorrhage
- Perforation of a hollow viscus
- Parenchymal "blush" or pseudoaneurysm

All the CT findings of hemoperitoneum and/or solid organ injury were confirmed in the 15 cases taken up for surgery. CT was 100% sensitive in detecting haemoperitoneum. Out of 15 cases operated, small bowel perforation was found in 6 patients, spleen laceration present in 4 patients and in 3 patients liver laceration with active hemorrhage was present. There was one case of diaphragmatic tear and one case of urinary bladder injury.

The decision to operate urgently does not solely depend on the identification of hemoperitoneum or the identification of paren-

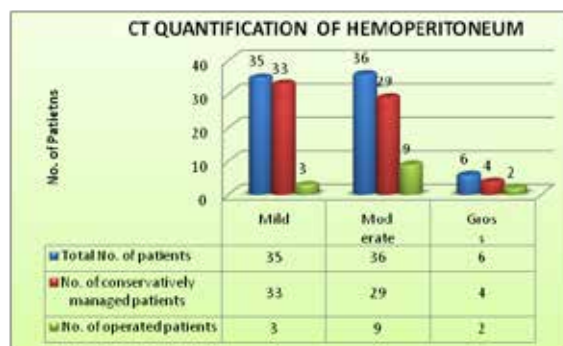
chymal injury to the liver or spleen, because most patients in this category ultimately do not need surgery.

However, accurate identification of hemoperitoneum or organ injury is important because patients with these findings require at least a period of close observation. Patients with multiple organ injury or significant active bleeding may need surgery even if they are hemodynamically stable. Conversely, stable patients with isolated organ injury may not need surgery even with a gross amount of hemoperitoneum.

Conclusion

In this study CT scan was 100 % sensitive in diagnosis of blunt abdominal trauma. OIS(organ injury scale) grading, quantification of hemoperitoneum and anatomical site of organ injury predict the management protocols in the majority of our patients. Result of this study shows that CT scan is a superior diagnostic modality in the diagnosis and management of blunt abdominal trauma. Spleen is the most commonly injured organ in blunt abdominal trauma. Negative CT scan discourage unnecessary urgent abdominal exploration.

Figure 1: CT Quantification of Hemoperitoneum



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