Original Research Article

Role of CT imaging in patients sustaining blunt injury of abdomen, retrospective analysis from a tertiary care hospital

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Abstract

Background: Blunt abdominal trauma is a frequently encountered emergency with associated significant morbidity and mortality. Since conservative nonsurgical therapy is preferred for all but the most severe injuries affecting the solid viscera, CT imaging is useful in detecting severe solid organ and bowel injuries which require surgical management.

Objective: To analyze the profile of abdominal injuries presenting to the emergency medicine department of a tertiary care teaching hospital.

Materials and methods: The study was a retrospective analysis of hospital records conducted in Velammal Medical College and Hospital, Madurai, which is a tertiary care teaching hospital in south India. The study was conducted from May 2014 to January 2016. People reporting to the emergency, with suspected abdominal injuries and evaluated for the same by CT abdomen were included in the study.

Results: CT had 100% negative predictive value and highly specific in ruling out significant abdominal injuries. Spleen was the most common organ injured in study population, seen in 32 (42.10%) patients. The other common organs injured were liver and kidneys, which were injured in 24 (31.57%) and 16 (21.05%) patients respectively. Only 25% of the patients in our study required surgical intervention, which was for Grade IV/V splenic injuries, hepatic injury with active contrast extravasation, hepatic pseudo aneurysm, bowel and diaphragmatic injuries.

Conclusions: CT is highly useful in evaluation of hemodynamically stable patients with suspected blunt abdominal trauma. Majority of the patients with abdominal injury were successfully managed conservatively.

Key words

Blunt trauma, CT, Abdominal injury, Hemoperitoneum.

Introduction

Blunt abdominal trauma is a frequently encountered emergency with associated significant morbidity and mortality [1]. Assessment of blunt abdominal trauma patients poses a significant diagnostic challenge to emergency physicians [2]. Various diagnostic procedures such as peritoneal lavage, computed tomography, and contrast studies of the gastrointestinal tract are useful in evaluation [3]. In last few decades imaging modalities have gradually replaced peritoneal lavage, which was once the modality of choice in the initial evaluation [4]. With the advent of multi detector CT scanners Computed tomography has emerged as the most useful modality of choice for evaluation of hemodynamically stable patients with suspected abdominal injury [5, 6].

Since conservative nonsurgical therapy is preferred for all but the most severe injuries affecting the solid viscera, CT imaging is useful in detecting severe solid organ and bowel injuries which require surgical management [7-9]. With this back ground the current study is undertaken in a tertiary care teaching hospital to document the profile of intraabdominal injuries in a tertiary care teaching hospital.

Aim

- To analyse the profile of abdominal injuries presenting to the emergency medicine department of a tertiary care teaching hospital.

Materials and methods

The study was a retrospective analysis of hospital records conducted in Velammal Medical College and Hospital, Madurai, which is a tertiary care teaching hospital in south India. The study was conducted from May 2014 to January 2016. People reporting to the emergency, with suspected abdominal injuries and evaluated for the same by CT abdomen were included in the study.

The criteria for inclusion in the study were

- Patients who were clinically suspected to have abdominal injuries.
- Hemodynamically stable patients.
- Patients with intra peritoneal free fluid on ultrasound.

Hemodynamically unstable patients with obvious clinical abdominal signs and intraperitoneal free fluid on ultrasound were directly taken up for surgery and did not undergo CT imaging, hence excluded from the study.

All the eligible 108 subjects were included in the study, hence no sampling was done. Considering the retrospective nature of the study neither ethical approval was not sought and informed written consent for the study was not possible. Confidentiality of the study participants was maintained throughout the study. All the patients included in the study underwent CT imaging in 128 slice multidetector CT Images were acquired in arterial phase (25 - 30 secs), Porto-venous phase (60-70 secs) following intravenous contrast administration of 80 - 100 ml. Delayed excretory images were acquired at 10 - 15 minutes for evaluation of the urinary tract. Descriptive analysis of various abdominal injuries was presented as frequencies and percentages.

Results

Of the 108 patients included in the study 28 (25%) of them who showed no evidence of

visceral injury or intra peritoneal free fluid on CT imaging were considered to be negative for abdominal injury. Patients with isolated vertebral fractures without significant abdominal findings were also considered as negative. Out of the 80 patients with positive study 4 (5%) of them showed isolated minimal to mild hemoperitoneum with no imaging evidence of visceral/ mesenteric injury. Rest of the 76 (70.38%) patients had different visceral injuries either in isolation or in combination. (**Table - 1**)

Spleen was the most common organ injured in study population, seen in 32 (42.10%) patients. The other common organs injured were liver and kidneys, which were injured in 24 (31.57%) and 16 (21.05%) patients respectively. (**Table - 1**)

Table - 1: Distribution of Visceral Involvement (N=108).

Viscera involved	**Frequency**	**%**
No obvious visceral injury	**32**	**29.62**
Visceral Injury	**76**	**70.38**
• Spleen	32	42.10
• Liver	24	31.57
• Bowel	4	5
• Mesentery	8	10
• Kidneys	16	21.05
• Adrenal	6	7.5
• Diaphragm	5	6
• Pancreas	3	4

Out of 32 patients with splenic injuries, 7 people with grade IV/ V injury (**Figure - 1, 2**) and one patient with grade III injury and active extravasation (**Figure - 3**) underwent laparotomy and surgical repair. Remaining 24 (75%) of the patients had grade I, II / III injury with associated mild to moderate hemoperitoneum and were managed conservatively. (**Table - 2**)

Liver was the second commonly injured organ. Majority (22/24) of the patients with hepatic injury (Grade I - V injuries) were managed conservatively (**Figure - 4A, 4B**). They were associated with mild to moderate hemoperitoneum. One of the patient with active contrast extravasation and another patient with small hepatic artery pseudo aneurysm underwent surgical repair. (**Table - 3**)

Table - 2: Descriptive analysis of splenic injuries in study population (N=32).

Grade of splenic injury	**No. of patients**	**%**
I	4	12.5
II	12	37.5
III	8	25.00
IV	6	18.75
V	2	6.25
Total	32	100

Table - 3: Descriptive analysis of liver injuries in study population (N=24).

Grade of liver injury	**No. of patients**	**%**
I	3	12.5
II	8	33.33
III	10	41.66
IV	1	4.1
V	2	8.3

Kidney was injured in 21% of the patients (16/76). In majority of the cases (15/16), renal injuries were associated with other visceral injuries, commonly liver and spleen. 10 patients (62%) had Grade I - II injury. One patient with subtotal infarct of the injured kidney underwent nephrectomy (**Figure - 5**). Rest of the patients were managed conservatively. (**Table - 4**)

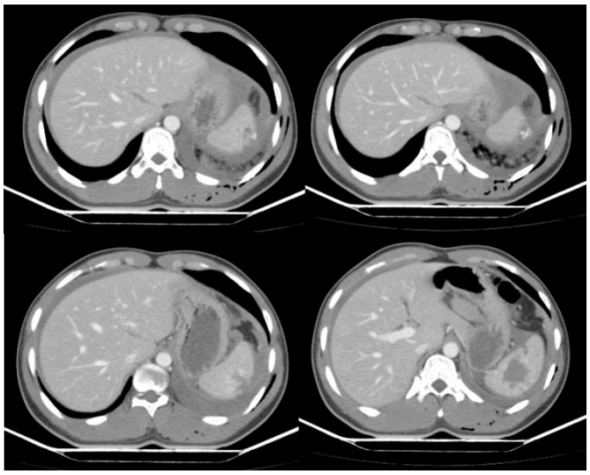
Table - 4: Descriptive analysis of kidney injuries in study population (N=16).

Grade of kidney injury	**No. of patients**	**%**
I	6	37.5
II	4	25
III	5	31.25
IV	1	6.25
V	0	0

Figure - 1: Grade IV splenic injury with segmental devascularisation.

Figure - 2: Post splenectomy surgical specimen of a different patient showing splenic lacerations and contusions.

Figure - 3: Grade III splenic injury with active contrast extravasation and hemoperitoneum.



Bowel injury comprised 5% of the total injuries in our study. It was associated with pneumoperitoneum and bowel wall thickening of the involved segment in all the patients. Focal wall defect/ discontinuity were seen as the direct evidence of bowel injury in 3 out of 4 patients. One patient with ileal injury showed only wall thickening with associated pneumoperitoneum (**Figure - 6**). 10% of the patients had mesenteric hematoma which was seen associated with bowel injury or as an isolated finding. When present in isolation, mesenteric hematoma was successfully managed conservatively (**Figure - 7**).

Figure - 4A & 4B: Multiple lacerations in the right lobe of liver. Grade IV injury.

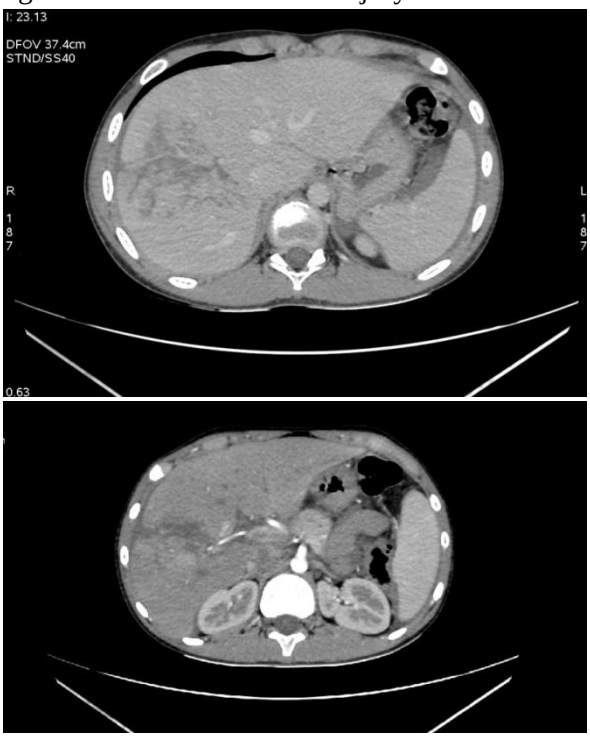
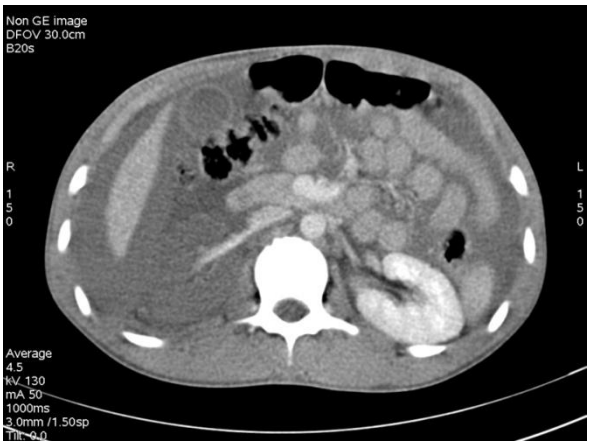


Figure - 5: Grade IV renal injury with subtotal devascularisation.

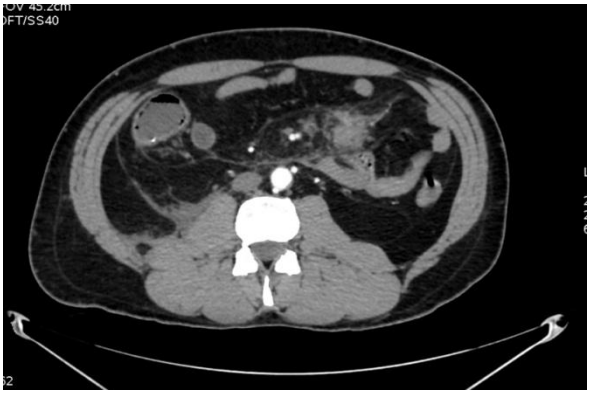


Out of the 76 patients 5 patients had diaphragmatic injury. One of the patients had small <2 cm diaphragmatic defect and was

conservatively managed. The other 4 patients underwent surgical repair of which one patient had associated gastric volvulus (**Figure – 8A, 8B**).

Figure - 6: Bowel injury seen as ileal wall thickening and associated minimal pneumoperitoneum. No focal wall defect/ disruption were seen in this case. Intra operatively there was ileal perforation.

Figure - 7: Mesenteric hematoma with surrounding fat stranding. No pneumoperitoneum was noted.



Three patients had pancreatic injury of which 2 of them had minor lacerations not involving the main pancreatic duct. One patient had deep laceration reaching up to the main pancreatic duct. All the three patients were managed conservatively. The latter patient developed pseudocyst as delayed complication on follow up. All the 6 (7.89%) patients, who had adrenal hemorrhage had other visceral injuries.

Figure - 8A & 8B: Diaphragmatic injury with herniation of the stomach (arrow) and bowel loops with associated gastric volvulus.

Discussion

Evaluation of the patients with blunt injury abdomen is a challenging task for the clinician. Clinical examination and diagnostic peritoneal lavage are often insufficient to assess patients and to decide on the need for surgical management [10, 11]. The advent of multidetector CT imaging has revolutionised the management of blunt abdominal injury with increasing number of patients being managed conservatively [4, 6, 12, 13]. At the same time, unrecognized abdominal injury is a frequent cause of preventable death after trauma [14].

About 25% of the patients in our study showed no evidence of intra peritoneal free fluid/ visceral

injury on CT. All of these patients were managed conservatively and had uneventful hospital stay with no significant complication at 1 month follow up. Thus CT has 100% negative predictive value and highly specific in ruling out significant abdominal injuries, which was similar to studies conducted by Udekwu PO, et al. [15] and Feliciano D. V., et al. [16].

CT is highly sensitive in the detection of intra peritoneal free fluid which is associated with abdominal visceral injury in most of the cases [17]. All the patients in our study with abdominal organ injury had varying degrees of intra peritoneal free fluid. Four out of the 80 patients had isolated finding of just minimal to mild intra peritoneal free fluid with no CT evidence of visceral injury. All of these patients were kept under clinical observation and had uneventful course. The current recommendation is to admit these patients for close clinical observation and if necessary repeat CT without surgical intervention [18].

Spleen was most commonly injured visceral organ in our study (42%) which was consistent with other studies. Splenic preservation after trauma is the current standard of care. Currently success rates of non-surgical management vary from 80 - 90% [19]. In our study all the patients with grade I - III injury (75 %) were successfully managed conservatively. Rest of the patients with grade IV and V injuries underwent splenectomy.

Majority of the patients with liver injury (91.6%) in our study, including grade V injury were managed conservatively. Similar results were also reported by Poletti et al, Petrowsky et al and others [20-22]. One of the patient with active contrast extravasation and another with hepatic artery pseudo aneurysm were managed surgically.

All the 4 of the patients with bowel injury had small bowel perforation which was detected on CT as focal wall disruption with associated pneumoperitoneum. All these patients underwent laparotomy and surgical repair. It is important to recognize the often subtle CT signs of bowel trauma, as delays in diagnosis as short as 8–12 hours increases the morbidity and mortality from peritonitis and sepsis [23]. The specific signs of bowel injury include transection of the wall with focal discontinuity, pneumoperitoneum and pneumoretroperitoneum.

All the patients with renal injury except for one were successfully managed conservatively. One of the patients with subtotal infarction of the injured kidney underwent nephrectomy. Most grade I-IV renal injuries can be managed non-operatively. The absolute indications for surgery include renal pedicle injury, shattered kidney, expanding hematoma, and hemodynamic instability [1]. Out of the 5 patients with diaphragmatic injury, one patient with small defect was managed conservatively and all the other patients were managed surgically.

Conclusion

Majority of the patients with abdominal injury can be successfully managed conservatively. Only 25% of the patients in our study required surgical intervention, which was for Grade IV/V splenic injuries, hepatic injury with active contrast extravastaion, hepatic pseudoaneurysm, bowel and diaphragmatic injuries.

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