

The Accuracy of Computed Tomography in Blunt Abdominal Trauma in unusual times

Abstract

Background: A potential research for the evaluation of CT scan accuracy in blunt abdominal trauma was carried out by comparing operative and CT scan observation. About 60 patients undertook the blunt abdominal trauma in three years. CT scan was performed on these stabilized patients for its further comparison with operative results. Moreover, all the documented data comprised of scan results, sex, age and type of injuries.

Aim of Study: The objective of our current research was to discover the accuracy of CT scan results for blunt abdominal trauma which was evaluated by surgeons in duty compare with operative findings.

Results: From 60 patients, 40 pts (66.6 %) underwent surgery. 20 pts (33.3%) were conservatively managed. 5 pts were died. Hemoperitoneum was perceived in fifty five patients. The patients having little hemoperitoneum on CT scan along with reasonable clinical observations were conventionally managed whereas those patients having huge hemoperitoneum needed surgical investigation. Out of all the patients involved in study, 13 had splenic, 3 pancreatic, 15 hepatic, 4 vascular and 5 renal injuries, however, 12 showed retroperitoneum hematoma.

Conclusion: In comparison between clinical monitoring, CT in the evaluation of blunt abdominal trauma with accuracy 86-100% (over all accuracy 94%).

Keywords: *Computed Tomography; Blunt Abdominal Trauma.*

Introduction

The abdominal trauma is categorized in penetrating and blunt kinds. The penetrating abdominal trauma (PAT) is frequently diagnosed on the basis of clinical symptoms. Whereas, the blunt trauma get missed or postponed due to unclear clinical signs.^[1]

Thus, it can create problems for individuals of all ages. The recognition of severe intra-abdominal pathology is sometimes perplexing as it is difficult to acknowledge various injuries in initial evaluation and treatment^[2].

Diagnosis: The most significant concern in evaluating the blunt abdominal trauma is the estimation of hemodynamic stability^[3]. Moreover, a quick estimation for hemodynamically unstable patients can be achieved with FAST (Focused assessment with sonography trauma) and diagnostic peritoneal lavage (DPL) for

hemoperitoneum evaluation. The inconvincible physical examination results leads to the abdominal radiographic studies of stable patients^[4,5].

FAST: The FAST examination done in 4 windows of ultrasound: (perihepatic, pelvic, pericardiac, perisplenic) along with the supine patients to detect free fluid or bleeding in any of this 4 windows (2,3,4,5)

Computed Tomography: The outcomes of CT scans are essential for solid organ injuries' detection such as liver, kidneys, spleen, as well as for retroperitoneum involving colorectum, pancreas, bladder, diaphragm, and small bowel^[6]. Likewise CT scan can further expose other related injuries for instance, thoracic cavity injuries, vertebral and pelvic fractures as well.

Scans illustrate brilliant imaging for genitourinary system, pancreas and duodenum by revealing blood quantity in abdomen & precisely each individual organ.

But it has some limitations such as marginal sensitivity for hollow viscous, pancreatic and diaphragmatic injuries' diagnosis. These are also considered as costly, time taking and need oral or intravenous contrast which may lead to the severe reactions [7,8]

Thus, the CT scans in contrast to the FAST and DPL investigation have capacity for the haemorrhage source determination. Besides this, various retroperitoneal injuries get ignored with DPL & FAST evaluation [9].

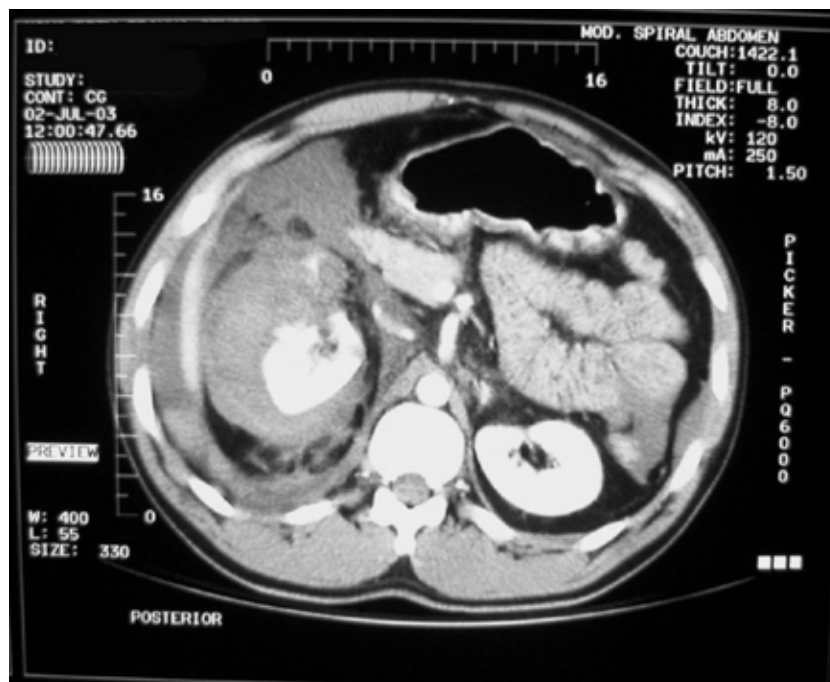


Figure 1. Blunt abdominal trauma. Right kidney injury with blood in perirenal space. Injury resulted from high-speed motor vehicle collision.

Method

This prospective study, done in Al Hussain Teaching Hospital in Nassyriah \IRAQ during 3 years (from January 2012 to December 2014), used abdomen CT scan to assess abdominal blunt trauma to most stable patients arrived emergency room in holidays and daily after 10 pm till morning by surgeon in duty and technician (because unavailable radiologist at hospital at this time)

About sixty stabilized blunt abdominal trauma patients went through this examination. The patients included 36 males (60%) and 24 females (40%). The age range was 7 – 68 years.

Clinical examination and diagnostic peritoneal tapping was done for most of them. The patients who weren't admitted or the ones who got discharged after short examination were devoid of any more investigation were omitted from our research.

We are usually looking for any hemoperitonium and solid organ injuries. Hence, the CT of hemoperitoneum was categorised as defined by Federle and Jeffrey et al.^[10]

- Fluid in one space = Small (100-200 cc)
- Fluid in tow spaces or more = Moderate (250-500cc)
- Fluid in all spaces or pelvic fluid anterior\superior tourinary bladder = Large (> 500 cc)

The Organ Injury Scale (OIS system) was used to grade the solid organ injuries. from simple organic contusion grade I to avascularisation of one organ grade V., then these CT observations were related to the operative discoveries of forty patients who underwent explorative laprotomy .

Results

Most of patients involved in this study whom

suffering from abdominal trauma are male, the Male :female ratio is 1.5 :1 look table 2 they extend from different age groups ranging from 7 years to 64 years.

Table 1. Explain the Gender ratio, mode of injury, operative and conservative management, and organs injuries.

Gender	No of patients	%
Male	36	60%
Female	24	40%
Mode of injury		
Cause of abdominal trauma	No of patients	%
RTA	48	80%
fall from height	4	6,7%
Fighting	3	5%
Animal trauma	2	3.3%
Others	3	5%
Operative and conservative management		
Management	No of patients	Deaths
Underwent surgery	40 patients, (66.6%)	4
Conservatively managed	20 (33.3%) patients	1
Organs injuries		
Organs injuries	No of patients	%
Liver	15	37.5 %
Spleen	13	32.5 %
Kidney	5	12.5 %
Bowel & mesentry	5	12.5 %
Pancrease	3	7.5 %
Vascular injuries	4	10 %
Urinary Bladder	4	10 %
Stomach	2	5 %
Diaphragmatic rupture	1	2.5 %
Retroperitoniumheamatoma	12	30 %

The commonest mode of injury in blunt abdominal trauma, is RTA (road traffic accident) in 48 from 60 patients (80%). look table1.

Most of patients underwent surgery about 40 from 60 patients, (66.6%), while 20 patients (33.3%) were conventionally managed without any difficulties. Five deaths occurred and two of them were because of the complications after operations while other two deceased patients were accompanied with sever extra abdominal injuries within first 24 hours . there was one patient not operated because severely injured head and chest, and

autopsy reveal no significant intra abdominal injuries look table 1.

Another group with normal CT scan no collection no solid organ injury with stable general condition they discharge home this group not involve in this study

All the 9 patients with large Hemoperitoneum required surgical exploration., while All 10 patients with small fluid on CT scan started with conservative management in spite of one severely injury in head and chest, 3 of them (30%) deteriorated with in 24 hours of follow up

The moderate fluid group indicated that thirteen (13) were conservatively managed who were stable general condition and the other 28 patients underwent surgical exploration that were either unstable haemodynamically and/or had deterioration of their conditions like unexplained abdominal rigidity, therefore, the explorative laparotomy’s rate in moderate hemoperitoneum patients was observed to be as 68% on CT scan as presented in table (2).

Table 2 (Hemoperitoneum was detected on CT)

	Total	Conservative	Op	Op\total
Small	10	7	3 out of 10	30%
Moderate	41	13	28 out of 41	68%
Large	9	0	9	100%

Most of patient who operated 25 patients from 40 was explored 62.5% have multiorgans injuries, and 12 patents 30% have single organ injured, another 3 patents only free fluid no solid organ injured . anyhow the commonest organ involved was the liver 15 out of 40 patients 37.5% and spleen 13 out of 40 patients 32.5% look table 1.



Figure 2. (23 years old man injured by RTA low speed vehicle injury of stomach)



Figure 3. (18 years old woman with splenic injury grade III after fall from height)

About grading of solid organ injury is its difficult to assess by CT scan by non provisional person and without contrast, but during surgery we found different grading among patient, look table 1.

About accuracy of fluid collection the accuracy is 100 % all cases we positive in CT scan were positive in surgery, but some cases in CT looked mild collection while in surgery looked moderate or severe, but no false positive or negative

Table 3. Show (Grade of solid organ, solid organ and other injuries CT scan findings vs operative findings, fluid collection CT scan findings vs operative findings)

Grade solid organ	Liver	Splenic	Kidney	Pancreatic	Total
I	7	7	1	0	15
II	2	1	2	2	7
III	3	3	2	1	9
IV	3	1	0	0	4
V	0	1	0	0	1
Total	15	13	5	3	36
Solid organ and other injuries CT scan findings vs operative findings					
Findings	CT finding	Operative finding	False - ve	False + ve	Accuracy
Liver injuries	13	15	2	0	86%
Spleen injuries	11	13	2	0	84%
Kidney injuries	5	5	0	0	100%
Pancreas injuries	3	3	1	1	67%
Diaphragmatic rupture	1	1	0	0	100%
Retroperitonium haematoma	12	12	0	0	100%
Fluid collection CT scan findings vs operative findings					
Findings	CT finding	Operative finding	False - ve	False + ve	Accuracy
Mild fluid collection	3	3	0	0	100%
Moderate fluid collection	28	28	0	0	100%
Large fluid collection	9	9	0	0	100%

Discussion

The primary inspection of abdomen can distinguish the major intra-abdominal haemorrhage symptoms. Whereas, the secondary investigation is important to spot a continuous bleeding or haemorrhage subsequent to the normal blood pressure restoration [11].

The blunt abdominal trauma patients lack the substantial physical symptoms of organ participation. In case of instability of patients having numerous injuries, there is an ambiguity about abdomen being a shock source, thus a FAST investigation might be helpful. In case of stabilized patient and easy approach to CT scan,

abdomen and head scan should be performed. The stable patients having several injuries including occult organ injuries which are not threat of life then CT estimation is essential.^[12] in this study we start with clinical assessment of all patients had abdominal blunt trauma who arrived emergency room, the stable patients sent to CT scan assessment ., if negative or minimal collection they treated conservatively and most of them go home so not involved in this study, but patents whom admit hospital for follow up 60 patients 40 from 60 patients, (66.6%) underwent surgery about, while 20 patients (33.3%) continue on conservative managed without any complications.

Most of patients involved in this study whom suffering from abdominal trauma are male, the Male :female ratio is 1.5 :1 look table 2 they extend from different age groups ranging from 7 years to 64 years

The severe wound caused because of blunt force trauma are reliant on transferred kinetic energy amount and tissue whom energy is transmitted. Thus the kinetic energy is related to the object movement which is equivalent to the one half of the object mass while multiplying with the square of object velocity such as $\frac{1}{2} mv^2$. Therefore, generally, the lighter objects moving with a high speed are more dangerous as compared to the heavy object roving at lower speed. ^[1- 4] However, unluckily 5 patients expired and out of them two deaths were caused due to postoperative complications. But the other two deceased patients were associated with sever extra abdominal injuries within first 24 hours . there was one patient not operated because severely injured head and chest, and autopsy reveal no significant intra abdominal injuries so all deaths due to severity of trauma look table 1.

Haemodynamically, the CT accurateness in stabilized blunt trauma patients is well recognised. Moreover, among the patients of emergency CT, the specificity of about 98.7% while sensitivity of about 97% & 92% have been testified^[13,14] which is near the range of this study table 9 accuracy for solid organs between 84 – 100 % median range may be because reading by surgeon in duty himself who is not provisional in radiology, and also not use contrast at this time of day but any haw if compare its nearby, Various researchers endorse being admitted and observed subsequent to a negative CT^[15,16] to repeat CT scan with or without contrast and reassessed by radiologist to exclude farther injuries as CT is particularly insufficient to diagnose the

mesenteric wounds while it might skip some hollow visceral wounds. Thus, for the hollow visceral or mesenteric prone patients, the most suitable test is DPL ^[17]. And negative results of CT scan for these patients do not consistently eliminate the intra-abdominal wounds. So we depend on hemoperitoneum or fluid collection we found the accuracy of CT scan was 100%, the overall nine patients having great hemoperitoneum need surgical examination. Whereas, the group of moderate fluid have conservatively managed thirteen patients who were stable general condition and the other 28 patients underwent surgical exploration. More than 68% patients of moderate fluid were investigated. Taylor et al. presented a report of an experience of 50%^[18] we think this relatively higher percentage because exclude most of stable patient with negative CT and stable those discharge on their responsibility and not involved in this study, and of course less experience of surgeon in CT scan assessment without contrast at night or holidays.

CT was executed in forty four haemodynamically stabilized patients of blunt trauma succeeding DPL by Kane. The scan of sixteen patients exposed an essential retroperitoneal or intra-abdominal wounds which DPL could not identify. Finally, the results of scans helped 58% patients in modifying the original plan of treatment.^[19]

About grading of solid organ injury in this study we cannot assess by CT scan because lack of experience, but during surgery show a lot of patients have multi-organ injuries 25 from 40 patient was explored 62.5%, and 12 patents 30% have single organ injured, another 3 patents only free fluid no solid organ injured, the injured organs in different grades II, III, IV or V injuries they required surgery. While the rest of the injuries were managed conservatively, and according to follow up clinical finding if deteriorated go to surgery

The high grade injury of solid organs upsurge the surgical management. While the low grade wounds were insufficient for management protocol prediction because some time hypo or hyper assessment of CT scan by surgeon

Conclusion

We conclude that the CT scan is accurate test for diagnosis of intra-abdominal hemoperitoneum or fluid collections, and solid organ injury after blunt trauma and has all the attributes to make it an initial investigation of choice in haemodynamically stable patients even

done by surgeon in duty (but it's better to be done with contrast and assessed by provisional radiologist) Thus, the negative laparotomy's rate is decreased by abstaining from unnecessary surgical interference, also reduce missed injury by early discover of internal bleeding or organ injury in cases of conservative management.

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Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the College of Medicine and all experiments were carried out in accordance with approved guidelines.

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