

ORIGINAL ARTICLE

COMPUTED TOMOGRAPHY FINDINGS IN PATIENTS WITH ACUTE BLUNT ABDOMINAL TRAUMA. OUR EXPERIENCE AT KING HUSSEIN MEDICAL CENTER

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Abstract

Purpose: The aim of this study is to evaluate the role and review the findings of computed tomography (CT scan) in determining the nature, type and associated findings of internal organ injuries due to acute blunt abdominal trauma, and then to evaluate the result of the CT scan on the decision of the surgeon. .

Methods: The surgical team evaluated the cases and wrote-down their notes before and after abdominal CT in 285 patients who presented to the emergency room due to acute abdominal trauma between January 2007 and January 2009. The study was done at King Hussein Medical Center, Amman-Jordan. The sample included 193 males (68%) and 92 females (32%), with an age range of 2-78 years (mean age, 23.5 years).

The surgeon was asked to estimate the probability of an underlying internal abdominal organ injury, which organ was suspected to be injured and if they are suspecting other associated complication like hemo or pneumo peritoneum.

Results: The CT scan results changed the surgeons' initial suspicion in 188 patients (66%). Management plans changed in 82 patients (29%). Admission into Intensive Care unit has decreased by (35%).

Conclusion: CT scans is extremely helpful in initial evaluation of patients with acute blunt abdominal injuries particularly in haemodynamically-stable patients. It is fast and widely available. The study showed strong effect on surgeons' clinical diagnoses and treatment plans.

Keywords: Blunt abdominal trauma, computed tomography.

INTRODUCTION

Accurate identification of life-threatening abdominal injuries and rapid initiation of appropriate medical or surgical decision will definitely resulting in much better chance of survival for patients. We should admit that, it is difficult to accurately evaluate patients with blunt abdominal injuries due to the mask effect of more obvious and may be more serious external abdominal

injuries or other injuries like head or chest.

CT is well established now to be the imaging modality of choice in diagnosing internal organ injuries due to blunt trauma in haemodynamically-stable patients. This method can provide a quick and accurate assessment of internal abdominal organs, free blood or air in the abdomen, retroperitoneum hematoma and diaphragmatic injuries.

In addition, CT scan can give a relative confident answer for the suspicious of coexisting injuries such as thoracic, spinal or deep pelvic injuries or fractures.

The superiority of CT scan over other radiological modalities came from its ability to produce thin-section fast-processing images, the ability to visualize the retroperitoneal structures and the use of the contrast media which can depict vascular injuries, in addition to that, CT information increases diagnostic confidence of the treating surgeon and decreases rates of unnecessary laparotomy.⁽¹⁾

This topic is highly argued and has generated a lot of discussion. Many previous researches⁽¹⁻⁵⁾ found an excellent sensitivity with variable percentage, however, others have claimed less sensitivity especially when comparing it to Diagnostic peritoneal lavage (DPL),^(6,7) in our study the sensitivity of CT is proved to be very high in evaluation of patients with acute blunt abdominal trauma.

PATIENTS AND METHODS

During the period between January 2007 and January 2009, 285 abdominal CT scans were performed to assess patients who presented to the emergency room with acute blunt abdominal trauma in a tertiary referral center (King Hussein Medical Center, Amman - Jordan) The sample included 193 males (68%) and 92 females (32%), with an age range of 2-78 years (mean age, 23.5 years).

The selected patients fall into one of two groups: (1) hemodynamically stable patients with high level of suspicion of internal abdominal organ injury, and (2) those having multisystem injuries in which abdominal examination is believed to be undependable or difficult.

The surgical team evaluated the cases and wrote-down their notes before and after abdominal CT, they were asked to estimate the probability of an underlying internal abdominal organ injury, which organ was suspected to be injured and if they are suspecting other associated complications like hemo or pneumo peritoneum.

All of the scans were done on the same multislice CT scanner (Somatom Siemens, Siemens Medical Systems, Germany) we used a slice width of 4 mm, a table feed of 10 mm and a 2 mm reconstruction interval. Pre- and post-contrast scans were routinely performed and patients received 2 mL/kg of intravenous contrast medium (Iohexol, 300 mg/mL). Oral contrast was given in special cases and non-routinely administrated.

The CT scans were acquired during the portal venous phase, arterial and delayed phases were taken if indicated. Reformatting sagittal and coronal images were taken in cases where spine injury is suspected.

RESULTS

Of these 285 patients, CT scan showed no intra-abdominal injury in 211 patients (74%), solid organ injury in 29 patients (10%), free fluid in 34 patients (12%), and suspected bowel or mesenteric injury in 11 patients (4%). In the solid organ injuries, the organ involved was spleen (48%), liver (21%), kidney (10%), and multiple injuries (21%). Of those with normal abdominal CT scan, 84 (40%) were admitted to the hospital and 127 (60%) were sent home. Of the 84 hospitalized patients, 1 patient had exploring laparotomy for his severe abdominal tenderness and guarding, the surgery result was unremarkable for any abnormality, thus, the negative predictive value of a normal abdominal CT scan for acute blunt abdominal trauma in our study was 100%

The CT scan results changed the surgeons' initial suspicion in 188 patients (66%). Management plans changed in 82 patients (29%). Admission into Intensive Care unit has decreased by (35%).

DISCUSSION AND CT SCAN FINDINGS OF MAJOR ABDOMINAL ORGAN INJURIES

The role of CT in evaluating patients with acute blunt abdominal trauma has been described in many previous papers.⁽¹⁻⁵⁾ The superiority of CT over other imaging modalities (plain X-Ray, Ultrasound, and angiogram) has been well counted. CT is characterized by its ability to rapidly scan the whole abdomen and other hidden areas like retroperitoneum in a noninvasive situation even if multi-organ injury is suspected. Abdominal CT can take a vital role in detecting other coexisting extra abdominal injuries.⁽⁶⁻⁸⁾

There has been a significant reduction in the number of exploratory laparotomies for cases with acute blunt abdominal trauma since we started using emergency abdominal CT scanning at our hospital. This decrease in laparotomies is due to many causes which include a trend toward more conservative management of abdominal trauma, decreasing use of diagnostic peritoneal lavage, and more trust that a negative CT scan can exclude significant abdominal injury.

Splenic Injuries:

The spleen is the most frequently injured organ in acute blunt abdominal trauma and may account for up to 50% of all visceral injuries.⁽⁹⁾ CT is very sensitive and specific in splenic injury. CT appearance of splenic trauma would include subcapsular hematomas which appear as crescent shape collections that indent or flatten the splenic surface. Other findings of intrasplenic hematomas are seen as low-density areas within the spleen.^(5,10) Lacerations appear as linear low-density areas

. Unenhancing portions of the spleen should suggest injury or thrombosis of the feeding artery of that portion of the spleen, shattered spleen is an easy diagnosis. Both hemoperitoneum and clot around the spleen may be seen with no obvious splenic injury,⁽⁵⁾ therefore, presence of either should prompt a thorough search for splenic injury. (Figs. 1,2).

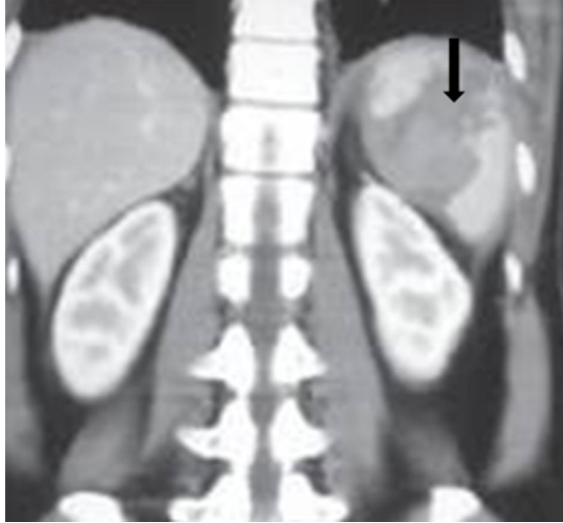


Fig 1. Coronal CT scan in a 31 year male patient after a motor bike accident showing a big wedge shape splenic laceration (arrow), no total splenic rupture. The patient was treated conservatively without surgery.



Fig 2. Axial CT scan in an 18 years male patients who sustained a motor bike accident showing a sub capsular splenic hematoma (arrow), this patients also managed conservatively and discharged home after 2 days admission to hospital.

Liver injuries:

The liver is second most commonly injured organ from blunt abdominal trauma. As with splenic trauma, CT is proved to be highly sensitive, specific, and accurate in characterizing liver injury.^(4,11) It is well known that the right lobe of the liver is injured more frequently than other areas likely due its larger size and close relation to the lower ribs.⁽³⁾ The CT findings in hepatic injury are generally similar to those seen with splenic injuries; they include simple contusions, subcapsular crescent shape hematomas, intraparenchymal hematomas, lacerations and fractures through the liver. The liver has a notable capability to heal even after severe injury.⁽¹²⁾ Therefore, conservative management of such injuries in hemodynamically stable patients is now an acceptable practice, moreover, the liver does not exhibit delayed rupture as with spleen injuries (Figs. 3,4).

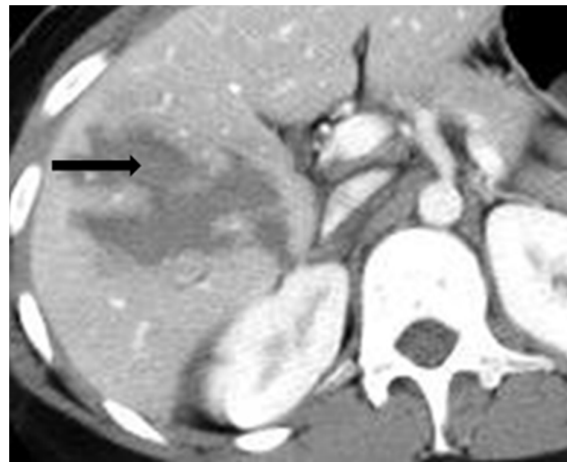


Fig 3. Axial CT scan for a 44 year female patient after a car accident showing a liver laceration (arrow) that is typically need conservative management.

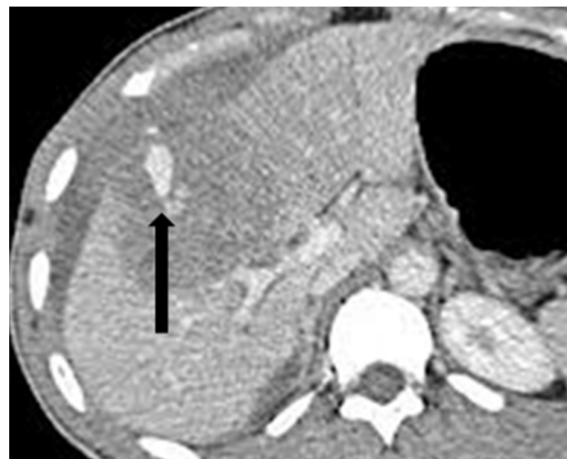


Fig 4. (a)



Fig 4. (B)

Fig 4. (a) Axial and (b) Coronal CT scan for a 29 year male patient after a blunt abdominal trauma due to car accident showing an extensive liver injury with hemoperitonium, there is also an active source of bleeding (arrow), this patient had an urgent laparotomy to stop the bleeding.

Renal Injuries:

Renal injury occurs in about 10% of cases of acute blunt abdominal injury and more than 80% of renal injuries result from blunt trauma.⁽¹³⁾ Most renal injuries are minor and include simple contusions, small subcapsular crescent shape collection of blood that may flatten the renal border, small lacerations which is not communicating with the collecting system, and small segmental infarcts. Patients under category of mild injury are having microscopic hematuria but usually hemodynamically stable, so they are treated conservatively. More severe injuries include deep lacerations that communicate with the collecting system and result in urine extravasation. Treatment of such injuries is controversial; some prefer conservative management unless severe bleeding ; others like to go for early surgery to avoid further complications.^(9,14,15) Very severe renal injuries include shattered kidneys and renal pedicle injuries. These injuries require immediate surgery. (Figs. 5,6).



Fig 5. Axial CT scan for an 18 year female patient who sustained an acute blunt abdominal trauma due to falling from her bicycle showing a crescent shape subcapsular haematoma of the left kidney (arrows) that is mildly compresses the adjacent renal parenchyma. She was managed conservatively with complete recovery.

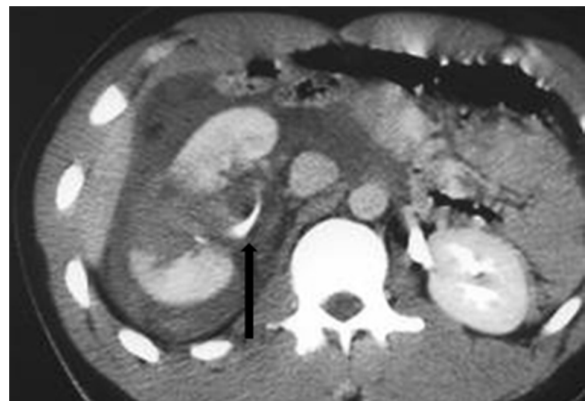


Fig 6. Axial CT scan for a 29 year male patient who sustained an acute blunt abdominal trauma due to RTA showing major renal laceration involving the collecting system of the right kidney with large, distracted renal fracture through the mid portion with extravasation of contrast material from the laceration (arrow). This patient was managed surgically due to rapid deterioration of his hemodynamic state and ended up with right sided total nephrectomy.

Pancreatic injuries:

Pancreatic injury may be encountered in about 5-10 % of all blunt abdominal injuries. It is more common in children mostly due to less retroperitoneal fat as a protective buffering mechanism.⁽¹⁶⁾ Pancreatic injuries include pancreatic duct disruption, fractures, contusions, and traumatic pancreatitis. Pancreatic injuries are important due to high mortality and morbidity if not diagnosed and treated early, complications may include

pseudocyst, abscess, hemorrhage, acute pancreatitis, and fistulae.^(4,10,17) Pancreatic injury may be difficult to diagnose on CT especially in minor trauma or in pancreatic duct disruption so repeating the scan at 24 to 48 hours can help disclose evolving injuries. (Fig. 7)



Fig 7. Axial CT scan of a 19 year male patient with bicycle-handle injury. He was admitted to the hospital, CT scan done after 36 hours of his injury and showing nearly total transection of the body of pancreas (arrow). He was managed conservatively but complicated later by a small pseudocyst that resolved spontaneously and did not require any drainage.



Fig 8. Axial CT scan of a 24 year male patient with motor cycle accident showing areas of small bowel thickening (arrows), no free intraperitoneal air could be identified. Small bowel perforation was noted intraoperatively.

Bowel and Mesenteric injuries:

Bowel and mesenteric injuries are reported in less than 6% of blunt abdominal trauma cases. The incidence increases due to more usage of seat belt (deceleration injuries).^(1,8) Unfortunately, clinical signs may be subtle or even absent in early phase. Early diagnosis is crucial as patients with duodenal perforation (the common part of the bowel to be injured) will have less than 5% mortality rate if surgery performed within 24 hours of injury, whereas delayed diagnosis and surgery may result in up to 50% mortality.

CT findings can include extra luminal free air, focal areas of bowel wall thickening, mesenteric haziness and infiltration, free fluid within the abdomen and extravasation of oral contrast material. Free air either in intra or retro peritoneal areas is a relatively specific sign of bowel perforation but is seen in only 50% of cases.^(2,4,17) The most common location to detect free intraperitoneal air is the sub diaphragmatic space and anterior to the liver. (Fig. 8).

Conclusion:

The use of CT scans in evaluation of acute blunt abdominal injuries in hemodynamically-stable patients is extremely helpful with a shift towards conservative management of these patients. CT scans can disclose a wide diversity of major internal organ injuries. It is fast and widely available these days in emergency departments. With appropriate scanning protocol, CT scans precisely show various patterns of organ injuries and other associated surgically important findings. Knowledge of CT scan findings of major organ injury is important for both radiologists and surgeons for optimal patient care.

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