



Original Article

Evaluation of three phases computed tomography scan findings in blunt abdominal trauma

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Abstract

Introduction: Blunt abdominal trauma is one of the important types of trauma and causes mortality in patients. Identifying the internal organ damage is necessary to proper management of trauma patients. Computed tomography (CT) scan is a powerful non-invasive imaging technique to assess internal organ damages in blunt abdominal trauma. The aim of present study was to evaluate findings of CT scan with contrast in patient with blunt abdominal trauma.

Methods: In this descriptive study, 290 patients with blunt abdominal trauma were studied who referred to emergency department of Imam-Reza Hospital of Tabriz University of Medical Sciences in Tabriz, Iran, from June 2014 to June 2015. Abdominal and pelvic CT scan with contrast was done using 1 detector CT scan machine in three phases (arterial phase, portal-venous phase and a delayed phase). Patients' demographic information, cause of trauma, and CT scan findings were collected.

Results: Mean age of patients was 26.3 ± 8.15 years. Male to female ratio was 1 to 0.42. Most common causes of blunt abdominal trauma were traffic accidents in 65.5% of patients, fall from height in 24.1% patients, and fall of heavy objects in 10.4% patients. Among all the patients, 57.6% had a detectable damage based on CT scanning. Based on CT scan findings, most common injuries were spleen injury in 20.0% of patients, liver injury in 18.9% of patients, and kidney injury in 8.9%.

Conclusion: Traffic accidents were the most common cause of blunt abdominal trauma. Spleen, liver, and kidney injury were the most common internal organ damages based on CT scan findings.

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Introduction

Nowadays accidents and injuries have increased because of industrial societies and

increased use of vehicles and changes in people's way of living. Among all injuries, blunt abdominal trauma is one of the

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important critical injuries that is necessary to detect in a timely manner and if not, can lead to death.^{1,2} Abdomen is one of the vulnerable areas, because it contains vital organs such as large blood vessels, liver, spleen, stomach, pancreas and intestines, so blunt trauma to abdomen can cause serious and fatal complications.^{3,4}

Blunt abdominal trauma alone is responsible for 5% of deaths due to trauma, and together with other types of trauma, it accounts for 15% of deaths.^{5,6} Intra-abdominal hemorrhage is a major cause of death caused by blunt abdominal trauma.⁷ Many of these injuries are preventable with population training and fastening safety belts.¹ With regard to the importance of this issue, early detection and taking action can significantly improve the prognosis of trauma patients.^{1,2}

Computed Tomography (CT) scan is as a noninvasive and available method to accurately identify injury to internal organs of the abdomen and pelvis in patients with blunt abdominal trauma in a limited time.⁸ CT scan is a quick and accurate tool to diagnose abdominal organs injury, and is also used to detect retroperitoneal and abdominal wall injury. The use of CT scan is also a helpful method to diagnose fractures of hip, spine and chest.^{9,10} Considering the importance of blunt abdominal trauma, the aim of present study was to evaluate three phases CT scan findings in patients with blunt abdominal trauma.

Methods

In a descriptive study, all patients with blunt abdominal trauma referred to emergency department of Imam-Reza Hospital of Tabriz University of Medical Sciences in Tabriz, Iran, were studied from June 2014 to June 2015. This hospital is a referral center for trauma patients in Northwest of Iran.

Inclusion criteria were all patients with blunt abdominal trauma who were referred to our educational center. Exclusion criteria were patients who were indicated for emergency surgery, patients with penetrating

trauma, patients with intentional injury, and patients with kidney disease. CT scan was done by 1 detector CT scan machine (Siemens Computed Tomography) before and after contrast injection in 3 phases (arterial phase, portal-venous phase and a delayed phase) for all patients. All CT scan were reported by a radiology specialists and surgical out comes were reported by a general surgeon separately. The radiology specialist and general surgeon were blinded to each other. Patients' demographic information, type of trauma, and findings of three phases CT scan were collected.

Statistical analysis was performed by SPSS software (version 16, SPSS Inc., Chicago, IL, USA). Descriptive statistical methods were used for statistical analysis. To present quantitative data, mean \pm standard deviation (SD) was used, and frequency and percentage were used to demonstrate qualitative data.

Results

Two hundred ninety patients were enrolled in this study. Mean age of patients was 26.3 ± 8.15 years. In present study, 204 patients (70.3%) were male and 86 patients (29.6%) were female. Male to female ratio was 1:0.42. Traffic accidents were the most common cause of blunt abdominal trauma documented in 190 patients (65.5%). Other causes of blunt abdominal trauma were fall from height in 70 patients (24.1%), and fall of heavy objects in 30 patients (10.4%).

Among the traffic accidents, car accidents were the most common cause of injuries in documented in 130 patients (68.8%). Other common causes of injuries were motorcycle accidents in 31 patients (16.4%), pedestrian injuries in 18 patients (9.5%), and bike accidents in 6 patients (3.2%).

Among the findings of CT scan of abdomen and pelvis with and without contrast in 290 patients, 123 patients (42.4%) had normal scan and 167 patients (57.6%) had detectable damage. According to the report of CT scan, intra-peritoneal free fluid was seen in 56 patients (19.3%). Spleen injury in 58 patients (20.0%) and liver injury in

55 patients (18.9%) were the most common injuries based on CT scan findings. Other common injuries based on CT scan findings were kidney injury in 26 patients (8.9%), intra-abdominal bleeding in 14 patients (4.8%), bladder injury in 3 patients (1.0%), mesenteric injury in 3 patients (1.0%), small intestine injury in 2 patients (0.6%), stomach injury in 1 patient (0.3%), pancreatic injury in 1 patient (0.3%), large intestine injury in 1 patient (0.3%), and peritoneal free air in 1 patient (0.3%).

Vital signs of the patients on arrival at the emergency department are demonstrated in table 1.

Table 1. Mean values of vital signs of the patients

Variable	Value
SBP (mmHg) (mean ± SD)	112 ± 19.5
DBP (mmHg) (mean ± SD)	70.8 ± 11.8
Heart rate (per min)	91.1
Blood oxygen saturation (%) (mean ± SD)	91.5 ± 7.6
GCS (mean ± SD)	14.7 ± 0.41

SBP: Systolic blood pressure; DBP: Diastolic blood pressure; GCS: Glasgow Coma Scale

Regarding final outcome of the patients, 285 (98.3%) were discharged healthy and 5 (1.7%) expired (Figure 1).

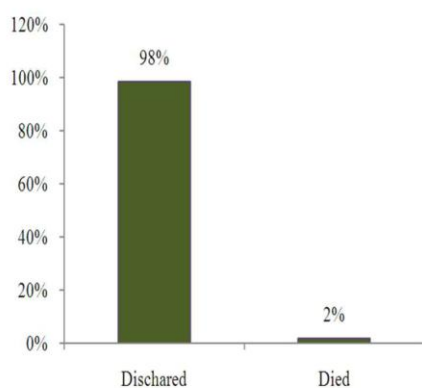


Figure 1. Patients' outcome

Discussion

Imaging methods are always important for evaluating injured patients. Also ultrasonography is the safest and easiest modality for evaluation of trauma patients and can be done by emergency physicians and even it can be used to find pneumothorax and hemothorax.^{11,12} CT scan is one of the

best methods for evaluating patients with blunt abdominal trauma.¹³ In present study we evaluated three phases CT scan report of 290 patients with blunt abdominal trauma. Overall, 70.3% of patients were male and 29.6% of patients were female and traffic accidents were the most common cause of injuries with car accidents as the leading cause among them.

In a similar study, 327 patients with blunt abdominal trauma were evaluated of which 15.9% had a detectable intra-abdominal lesion.¹⁴ Car accidents in 79.0% of patients was the most common cause of injury, and spleen and kidney were the most common damaged organs. This study proposed that, CT with contrast was one the best option for evaluating blunt abdominal trauma.¹⁴ Also in present study, traffic accidents were the most common cause of injury. Based on CT scan findings, spleen, liver, and kidney injury were the most common injuries. Also in a prospective study of 45 pediatric patients, traffic accidents accounted for 60.0% of injuries and spleen injury was the most common injury in 33.3% of patients based on CT findings.¹⁵

In a retrospective study, 669 male patients with blunt abdominal trauma were studied. From all patients, 7.2% had free intra-peritoneal fluid.¹⁶ In our study, 19.3% of patients had intra-peritoneal fluid. This could indicate the severity of trauma in our region in comparison with other regions.

This study had also some limitations. This research was done in one center, it will be better to involve multiple centers to increase the study power, and also it will be better to include abdominal physical exam and its relation with CT findings.

Finally based on result of multiple different studies, spleen is the most common damaged organ in blunt abdominal trauma, and included about 45% of intra-abdominal injuries. CT scan can show spleen injuries such as lacerations and hematomas with accuracy of 98%, so CT scan is a useful imaging technique for assessing blunt abdominal trauma.^{17,18} Liver is the second

most common damaged organ in blunt abdominal trauma, often associated with concomitant spleen injury. The method of choice for assessment of liver damage is CT scan and it shows different types of liver injury such as hematoma, laceration and bleeding.^{19,20}

Conclusion

Based on present study, road traffic injury was the most common cause of blunt abdominal trauma. CT scan with contrast is a useful imaging technique for assessment of internal organ damage in blunt abdominal trauma. Spleen, liver, and kidney injury were the most common organ damage in blunt abdominal trauma respectively.

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Authors' Contribution

MP designed the study. MT collected the data and CT reports. FK collected data and surgical reports. SSV performed the analysis and critically revised the article. YR drafted the first copy of article.

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Conflict of Interest

Authors have no conflict of interest.

Ethic approval

The protocol of the present study was approved by the Ethics Committee of Tabriz University of Medical Sciences which declares Declaration of Helsinki (ethic no: 5/4/11497).

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