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Original article

Multi-slice computed tomography for diagnosis of combined thoracoabdominal injury

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ABSTRACT

Purpose: To investigate the diagnostic value of multi-slice computed tomography (MSCT) for combined thoracoabdominal injury.

Methods: A retrospective study was conducted to analyze the clinical data and MSCT images of 68 patients who sustained a combined thoracoabdominal injury associated with diaphragm rupture, and 18 patients without diaphragm rupture. All the patients were admitted and treated in the Chongqing Emergency Medical Center (a level I trauma center) between July 2005 and February 2014. There were 71 males and 15 females with a mean age of 39.1 years (range 13–88 years). Among the 86 patients, 40 patients suffered a penetrating injury, 46 suffered a blunt injury as a result of road traffic accident in 21 cases, fall from a height in 16, and crushing injury in 9. The MSCT images were retrospectively reviewed by two radiologists. The results of CT diagnosis were compared with surgical findings and/or follow-up results.

Results: Among the 86 cases, diaphragm discontinuity was found in 29 cases, segmental nonrecognition of the diaphragm in 14, diaphragmatic hernia in 21, collar sign in 14, dependent viscera sign in 18, elevated abdominal organs in 21, bowel wall thickening and/or hematoma in 6, and pneumoperitoneum in 8. CT diagnostic accuracy for diaphragm rupture was 88.4% in the right side and 90.7% in the left side. CT diagnostic accuracy for hemopneumothorax, pulmonary contusion, mediastinal hemorrhage, kidney and adrenal gland injuries was 100%, while for liver, spleen and pancreas injuries was 96.5%, 96.5%, 94.2% respectively.

Conclusion: To reach an early diagnosis of combined thoracoabdominal injury, surgeons and radiologists should be familiar with all kinds of images which might show signs of diaphragm rupture, such as diaphragm discontinuity, segmental nonrecognition of the diaphragm, dangling diaphragm sign, diaphragm herniation, collar sign, dependent viscera sign, and elevated abdominal organs.

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1. Introduction

Combined thoracoabdominal injury refers to visceral injuries in the thoracic and abdominal cavities, accompanied by diaphragm rupture at the same time. Respiratory and circulation dysfunction often occurs as a result of acute hemorrhage in the thoracic and abdominal cavities. Shock and death rate are high. Patients' clinical manifestations are complex and lack of specific signs.¹ This study,

by analyzing the clinical data and multi-slice computed tomography (MSCT) images of 86 trauma patients admitted in the Chongqing Emergency Medical Center (a level I trauma center) between July 2005 and February 2014, attempts to investigate the diagnostic value of MSCT for combined thoracoabdominal injury.

2. Materials and methods

2.1. Patients

In this series, 68 patients sustained combined thoracoabdominal injury associated with diaphragm rupture and 18 patients without diaphragm rupture were admitted and treated in

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Fig. 1. Sagittal (A) and coronal (B) reformatted CT images show that left diaphragm rupture is revealed by the segmental diaphragmatic defect sign and dangling diaphragm sign. The omentum has herniated into the thorax through the diaphragmatic defect. Abdominal fat is located above the diaphragm and positioned against the posterior thoracic wall.

the Chongqing Emergency Medical Center (a level I trauma center) between July 2005 and February 2014. There were 71 males and 15 females with a mean age of 39.1 years (range 13–88 years). Among the 86 patients, penetrating injury was implicated in 40 patients, blunt injury in 46 consisting of road traffic accidents in 21 cases, fall from a height in 16, and crushing injury in 9. The clinical manifestations included pain in the chest and abdomen, dyspnea, chest discomfort, nausea, vomiting, coma, and hemorrhagic shock. Eighty-four patients received surgical treatments, including thoracotomy in 10 patients, laparotomy in 68, both thoracotomy and laparotomy in 4, video-assisted thoracoscope surgery in 2.

2.2. CT scanning

The chest and abdomen were detected by 16 layers spiral CT machine (GE LightSpeed 16, GE Co. Ltd). Scan parameters were: tube voltage, 100–120 kV; effective tube current, 150–300 mA; pitch, 0.938:1; scanning layer thickness and layer spacing, 7.5 mm; FOV, 35 cm × 35 cm; rebuilding layer thickness, 1.25 mm; spacing, 1.0 mm. The data were transmitted to ADW 4.4 post-processing workstation.



Fig. 3. Axial CT image shows the stomach is in a dependent position along the posterior left ribs and contacted the posterior thoracic wall (dependent viscera sign).



Fig. 2. Coronal (A) and sagittal (B) contrast-enhanced reformatted CT images show right-sided diaphragm rupture, part of the liver herniated into the thorax through a small diaphragmatic defect, which is evident from the focal constriction of herniated liver called “collar”.

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