

Case Report

Heart compression caused by gastric herniation following traumatic diaphragmatic rupture: a case report

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Abstract: Traumatic diaphragmatic rupture (TDR) with traumatic diaphragmatic hernia (TDH) and heart compression is a combination of injuries occurring due to a motor vehicle accident. In this report, we present a case of heart compression caused by gastric herniation following TDR. Diaphragmatic rupture was diagnosed from radiograph and CT photographs and cardiac compress was suspected based on elevation of cardiac enzymes. The patient received cholecystectomy plus enterolysis and recovered after 30 days. This case reminds us that if a patient suspected of suffering from TDR/TDH caused by blunt trauma and with low voltage and multiple T-wave inversions in ECG as well as abnormal cardiac enzyme test results, heart compression from TDH should be considered. Immediate surgery for TDH reduction and TDR repair should be used as the first choice of treatment.

Keywords: Traumatic diaphragmatic rupture, traumatic diaphragmatic hernia, heart compression

Background

The incidence rate of traumatic diaphragmatic ruptures (TDRs) is observed in 1%-7% and 10%-15% of major blunt and penetrating injuries, respectively [1, 2]. Recently, blunt TDR accumulates with the increasing incidence rate of motor vehicle crashes [3]. Blunt TDR accumulates are also associated with high mortality, which is attributed to its concomitant occurrence with other severe injuries [4]. There is a sudden increase pressure in intra-abdominal because of blunt trauma, which tears a weak point in the diaphragm [5]. The ruptured diaphragm gives a chance to form herniation of abdominal organs into the chest cavity, since the pressure in the abdominal cavity is higher than that in the chest cavity [6, 7]. As a complication of traumatic diaphragmatic ruptures (TDRs), traumatic diaphragmatic hernia (TDH) is a not common but potentially lethal, since it is one of the most frequently missed injuries following TDR [8]. TDH could cause various pathological changes and poses both diagnostic and therapeutic challenges for surgeons for the lack of available effective diagnostic tests

[2]. Here we present a case of heart compression caused by gastric herniation following TDR, and summarize diagnostic and therapeutic skills of this case.

Case presentation

A previously healthy 45-year-old male was brought to our Emergency Department for being unconscious for two hours for being involved in a traffic accident. From physical examination, the patient's vital signs were as followed: body temperature 36.6°C, heart rate 110 beats per minute, respirations 20 per minute, blood pressure 116/79 mmHg, and oxygen saturation 86%. Lung auscultation revealed no breath sounds in the lower left hemithorax and lowered breath sounds in the right hemithorax, with dry and moist rales on both sides. Cardiac auscultation revealed normal cardiac rhythm and lowered heart sound. His abdomen was soft and non-tender to palpation, with normo-active bowel sounds. Laboratory blood tests showed leukocyte count $9.81 \times 10^9/L$, red blood cell count $4.25 \times 10^{12}/L$, hemoglobin 125 g/L, platelet count $156 \times 10^9/L$. Liver function tests

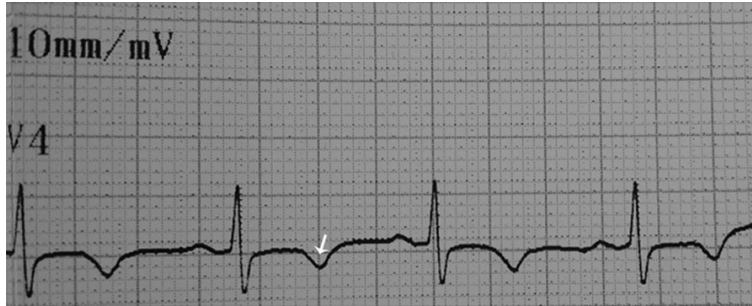


Figure 1. ECG showing low voltage and multiple T-wave inversions.

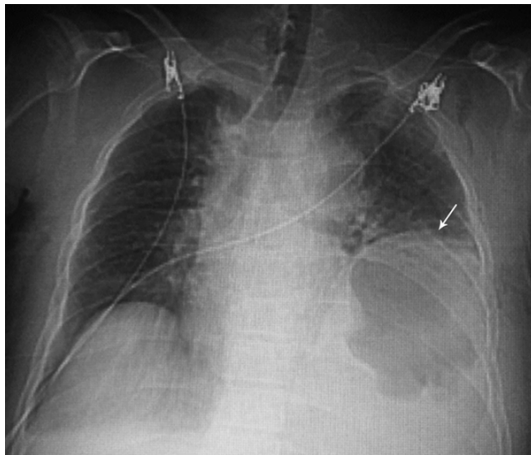


Figure 2. Chest x-ray showing a raised left hemidiaphragm with the presence of stomach shadow in the lower half of the left hemithorax.

showed alanine transaminase 84 U/L and aspartate aminotransferase 122 U/L. Cardiac enzyme tests showed lactic acid dehydrogenase 520 U/L, creatine kinase 1788 U/L, and creatine kinase-MB 76 U/L. Blood gas tests showed PH 7.35, PCO₂ 53 mmHg, and PO₂ 56 mmHg. Electrocardiography (ECG) showed low voltage and multiple T-wave inversions (**Figure 1**). Chest radiography revealed a raised left hemidiaphragm with the presence of stomach shadow in the lower half of the left hemithorax (**Figure 2**). Computed tomography (CT) showed rupture of the left hemidiaphragm and herniation of the stomach into the left thoracic cavity (**Figure 3**). No evidence of head trauma was found.

The patient was suspected to traumatic diaphragmatic ruptures complicated herniation of the stomach into the chest cavity from the chest radiography and CT photographs. Also cardiac compress was diagnosed based on elevation of cardiac enzymes (lactic acid dehydrogenase 520 U/L, creatine kinase 1788 U/L, and creatine kinase-MB 76 U/L) and multiple T-wave inversions in ECG.

The patient was subjected to laparotomy immediately. And a 10-cm left diaphragm rupture was identified during the operation. We also found that the stomach and part of the transverse colon had herniated into the left thoracic cavity up to the fifth intercostal space and

the heart was compressed to the upper right; the pericardium was intact, with no effusion in the pericardial cavity; the left lung was compressed to the fifth intercostal space, without active bleeding in the chest. Firstly we reduced the abdominal contents into the abdomen. And then the diaphragm closed with silk sutures and a running reinforcement suture. The patient received supportive treatment for about half a month after surgery. However, he suffered from upper abdominal pain and MRCP exhibited gallbladder volume increase and exudation around the gallbladder. Blood routine showed WBC at $19.56 \times 10^9/L$ and neutrophil rate at 0.898. Thus, it was considered as continuous edematous cholecystitis and the patient received gallbladder drainage and anti-infection treatment. Four days later, the abdominal pain aggravated and CT scan demonstrated pneumo-gallbladder, surrounding fiber strips, and bilateral pleural effusion and ascites. Procalcitonin was 1.37 ng/ml, total bilirubin was 25.3 $\mu\text{mol/L}$, and direct bilirubin was 13.9 $\mu\text{mol/L}$. Therefore, he received cholecystectomy plus enterolysis. Pathology demonstrated gangrenous cholecystitis. Postoperative cardiac enzyme tests showed lactic acid dehydrogenase 233 U/L, creatine kinase 22 U/L, and creatine kinase-MB 11 U/L. The ECG was normal. From the postoperative CT photographs in **Figure 4**, the diaphragm of this patient maintains normal anatomical structure. The patient's recovery was uneventful thereafter, and he was discharged 30 days after first surgery.

Conclusions

In part to the lack of awareness amongst healthcare providers in addition to the low sensitivity and specificity of commonly available diagnostic tests.



Figure 3. Computed tomography showing rupture of the left hemidiaphragm and herniation of the stomach into the left thoracic cavity compressing the heart.

As a potentially lethal complication following TDR, TDH is lacking high sensitivity and specificity of commonly available diagnostic tests and awareness amongst healthcare providers [2, 8]. A high level of clinical vigilance and suspicion is needed so that TDR complicated with TDH do not go undiagnosed, as TDR with TDH and heart compression is an uncommon combination of injuries occurring due to a motor vehicle accident. To the best of our knowledge, there has been no report about such a case in the literature. TDR could not only cause a series of respiratory dysfunction but also give rise to herniation of abdominal viscera into the chest which brings about organ obstruction or twisting and secondary septic shock in turn [9, 10]. Furthermore, the herniation of abdominal viscera into the chest will compress the lung and heart, and have a strong impact on the respiratory function and cardiac pump function. Since

it is vigilant for patients with blunt trauma, healthcare providers should pay a close eye on the condition of patients and carry out related inspection.

In this case, the results of radiograph and CT scan reveal the signs of TDR and TDH. The **Figure 2** shows a raised left hemidiaphragm with the presence of stomach shadow in the lower half of the left hemithorax. CT photographs could clearly display the herniation of the stomach into the left thoracic cavity. The signs of low voltage and multiple T-wave inversions and abnormal cardiac enzyme test results indicted cardiac dysfunction. This patient need to an emergency operation to prevent the deterioration of diseases. The patient was operated at once. Heart compression was identified during laparotomy and relieved by reducing the abdominal contents into the abdomen and suturing the diaphragmatic. The patient's cardiac functions recovered soon after the surgery as indicated by the postoperative ECG and cardiac enzyme test results. The overall treatment outcome was excellent. Thus, based on our experiences with this case, if a previous healthy person suffering from TDR/TDH caused by blunt trauma and simultaneously with low voltage, multiple T-wave inversions as well as with abnormal cardiac enzyme test results, heart compression by TDH should be considered. Immediate surgery for TDH reduction and TDR repair should be used as the first choice of treatment. All in all, it is recommend vigilance and a degree of suspicion along with repeated examinations and imaging when a patient with a blunt trauma and chest injury. The conditions of patient exhibit exhibits cardiorespiratory symptoms along with abnormal ECG results and cardiac enzyme test results, heart compression by TDH should be checked and relived promptly.

Acknowledgements

Written informed consent was obtained from the patient for publication of this Case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

Disclosure of conflict of interest

None.

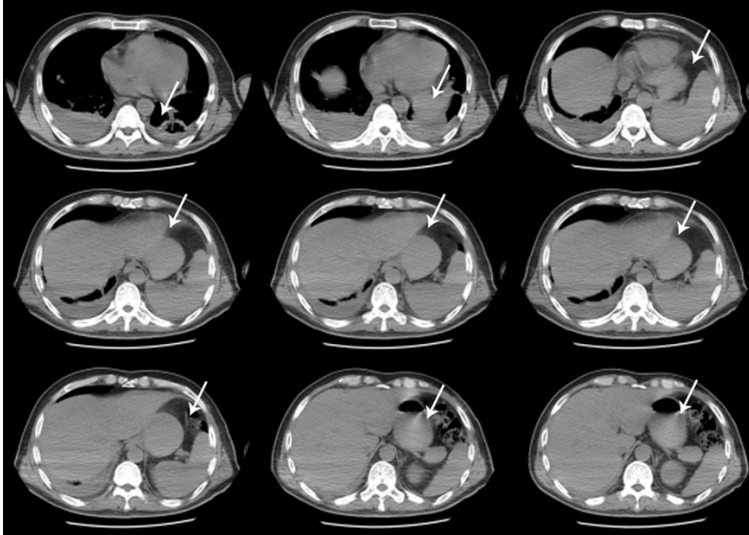


Figure 4. Postoperative computed tomography showing the diaphragm closed with silk sutures and a running reinforcement suture.

Abbreviations

CT, computed tomography; ECG, eletrocardiography; TDH, traumatic diaphragmatic hernia; TDR, traumatic diaphragmatic rupture.

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