Patient with Multiple Rib Fractures Developed into Phrenic Hernia after Cardiopulmonary Resuscitation

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Case report

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Abstract

Background: Phrenic hernia is a rare condition in patients with multiple rib fractures after cardiopulmonary resuscitation. We report a 28-year-old case of multiple injuries with multiple rib fractures who developed Phrenic hernia after cardiopulmonary resuscitation.

Case presentation: We report a case of a young woman who developed sudden respiratory and cardiac arrest during treatment in the intensive care unit with severe multiple injuries with multiple fractures of the left rib. The patient developed a left diaphragmatic hernia after cardiopulmonary resuscitation, causing the stomach and part of the liver to enter the left chest. After emergency operation, the patient was in stable condition and finally recovered and discharged from hospital.

Conclusion: It is easy to cause diaphragmatic hernia in the process of cardiopulmonary resuscitation for patients with rib fracture, but sometimes it is necessary to carry out cardiopulmonary resuscitation before saving the patient's life. Once diagnosed with diaphragmatic hernia, surgical treatment should be done as soon as possible to avoid organ necrosis.

Background

Cardiorespiratory arrest caused by a variety of critical diseases and accidents is a common emergency in the emergency department. Improper rescue and treatment will lead to new complications or death. Common complications of cardiopulmonary resuscitation include rib fracture, sternal fracture, hemothorax, pneumothorax, lung injury and bleeding, costal cartilage injury, rupture of liver, spleen and kidney, reflux of gastric contents, heart rupture and so on. However, there are few literatures about Phrenic hernia after cardiopulmonary resuscitation. We report a case of Phrenic hernia during cardiopulmonary resuscitation in a young woman with severe multiple injuries with multiple fractures of ribs.

Case Presentation

A 28-year-old lady with severe multiple trauma injuries and multiple left rib fractures (Figure 1) and sudden cardiac and respiratory arrest in ICU after external fixation of pelvic fractures and interventional angiography and embolization. External cardiac compression and electrical defibrillation were implemented, she was rescued successfully and recovered finally. However, the broken ends of fractured ribs punctured the stomach and diaphragm during CPR, the whole stomach herniated into the left pleural cavity forming diaphragm hernia(Figure2, 3).

This patient had multiple fractures of the left ribs, and sudden cardiac and respiratory arrest in ICU after surgery. Cardiopulmonary resuscitation must be given immediately. The doctor on duty had no ability to open the chest for cardiac compression, and no abdominal pressure cardiopulmonary resuscitation (CPR) device in this ICU, so only chest compressions were chosen. Fortunately, the patient recovered heart rate and breathing successfully after chest compressions. Unfortunately, the fractured ribs pierced the stomach and the diaphragm, the whole stomach and part of the liver got into the left thoracic cavity after

chest compressions. The emergency surgery was done again and the patient discharged without any related complications finally.

Discussion And Review Of The Literature

Phrenic hernia can be divided into traumatic Phrenic hernia and non-traumatic Phrenic hernia, and the latter can be divided into congenital and acquired types. The most common non-traumatic Phrenic hernia are esophageal hiatal hernia, thoracoabdominal hiatal hernia, parasternal hernia and Phrenic absence. Esophageal hiatal hernia is the most common cause of esophageal hiatal hernia in more than 90% of Phrenic hernia. it is controversial that a few patients with congenital developmental disorders occur in infancy, but in recent years, it is believed that acquired factors are mainly related to obesity and chronic increase of intra-abdominal pressure.

Due to the existence of physiological negative pressure in the thoracic cavity, there is a 0.588-1.98Kpa (6-20cmH₂O) pressure gradient between the chest and abdominal cavity when breathing calmly, and the pressure difference between the chest and abdomen can exceed 9.8Kpa (100cmH₂O) if the maximum inspiratory force is applied(2). The blunt crush injury directly acting on the lower chest and upper abdomen can suddenly increase the intra-abdominal pressure, increase the chest-abdominal pressure difference, and the diaphragm is subjected to a huge pressure shock, resulting in diaphragm rupture. The rupture of the diaphragm can be located anywhere in the diaphragm, or it can be completely avulsed from the attachment of the costal arch, either horizontally or longitudinally, but the left posterolateral radial rupture of the diaphragm is the most common. This is because this site has no liver buffer protection in the area of weak embryonic development and left diaphragm trauma.

Phrenic hernia is generally difficult to heal itself, once diagnosed, surgical treatment should be taken as soon as possible. For patients with multiple organ injuries, we should follow the principle of severe injury first and then treat diaphragmatic hernia; for patients with shock, we should actively fight shock and prepare for operation; for those with massive hemorrhage or progressive hemorrhage, we should immediately stop the bleeding. Because Phrenic hernia is very easy to cause respiratory and circulatory disorders and organ strangulation, obstruction or rupture, in this case, the patient's life was successfully saved by timely operation. But it also reminds us that in the cardiopulmonary resuscitation of multiple rib fractures, we should pay attention to standard compressions, avoid rough movements and reduce the complications of cardiopulmonary resuscitation. After the cardiopulmonary resuscitation is effective, the relevant examination should be reexamined in time to avoid missing the treatment time window.

Conclusion

Generally, chest compressions are not appropriate in patients with rib fractures(1). However, in special cases, when there is no condition or ability to guarantee thoracotomy, in order to save the patient's life, it is necessary to perform CPR in the presence of rib fractures, even if it may cause other injuries to the patient. While these often occur in pre-hospital, small hospitals or community hospitals. Therefore, it is

necessary to find out a method or device that can be used for these special cases to conduct a safe and effective resuscitation for patients with cardiac arrest.

Abbreviations

ICU: intensive care unit

CPR: cardiopulmonary resuscitation

Declarations

Acknowledgements

The patient kindly gave full written permission for this report to be made including the use of computed tomography images.

Ethics Approval and Consent to participate

The treatment and operation have been signed and agreed by the patients and their families, and the collection of relevant medical history materials has been agreed by the patients and their families.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors were responsible for the treatment. Shaowen Cheng was responsible for the ongoing care of the patient in hospital. Zhihua Hu, Shaowen Cheng, Lei Peng, Yangping Chen and Jian Yang conceived of the case report. Shaowen Cheng and Jian Yang researched and drafted the manuscript. All authors read and approved the final manuscript.

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Figures

Figure 1

multiple left rib fractures

Figure 2

In the chest CT, the stomach protrudes into the left chest.

Figure 3

The stomach enters the left thoracic cavity and forms a Phrenic hernia.