Right or Left Traumatic Pericardial Rupture: Report of a Thought-Provoking Case

Mitsuhiro Kamiyoshihara, MD, PhD, Hitoshi Igai, MD, PhD, Natsuko Kawatani, MD, and Takashi Ibe, MD, PhD

A 62-yr-old man was transferred to our institution with blunt chest trauma after being pinched between a car and a wall. Chest computed tomography revealed left-sided rib fractures, bilateral pneumothorax, and pneumopericardium, but no displacement of the heart. The pneumopericardium caused us to suspect a tear in the pericardium. Since the left pneumothorax was slightly more marked than the right, we planned a left-sided thoracoscopic exploration. As a result, a right-sided pericardial rupture was found and repaired under thoracotomy. It was difficult to judge the injured side of the pericardial tear. We learned a valuable lesson from this case: The extent of pleural air may be, but is not always, reliable for identification of the injured side of a pericardial rupture. Direct observation of the pleural space using a thoracoscope is necessary for definitive diagnosis.

Keywords: chest trauma, pericardial rupture, surgery

Introduction

Blunt traumatic pericardial rupture is a rare but typical trauma. Undoubtedly, surgical repair should be performed, because pericardial rupture leads to cardiac herniation, fatal arrhythmias, and cardiac arrest.\(^1,2\) Fulda et al.\(^1\) reported their 10-yr experience with blunt traumatic rupture of the heart and pericardium. Of 22 patients, six (27%) experienced cardiac herniation, and only two of the six (33%) survived. Therefore, a prompt diagnosis and surgical repair is associated with survival in a patient with this type of injury. The key to diagnosing a pericardial rupture is finding the pericardial air.\(^1,3-6\) However, no recommendation as to whether the approach should be through the right or left side is available.

We experienced a case in which we had to determine the side of approach, and learned a technique for differentiating whether the injured site was on the right or the left. Here, we present that case. The management and decision-making for a pericardial rupture, particularly the surgical approach side (right or left), are discussed here.

Case

A previously healthy 62-yr-old man sustained blunt chest trauma after accidentally being pinched between a car and a wall. Approximately 30 min later, the patient was transferred to our institution. On arrival, he was conscious, hemodynamically stable, and had a normal Glasgow coma score. His heart rate was 93 beats per min, and blood pressure was 115/78 mm Hg. His oxygen saturation was 100% under 10 L/min oxygen delivered via a face mask. The other vital signs were stable. The laboratory data were unremarkable. Electrocardiography revealed no ST-T changes and demonstrated no sign of cardiac injury or tamponade. Chest computed tomography (CT) showed fractures of the left fourth to seventh ribs, bilateral pneumothorax, and pneumopericardium, but no displacement of the heart (Fig. 1a and 1b).
The pneumopericardium caused us to suspect a pericardial tear. Thoracoscopic exploration under general anesthesia using conventional double-lumen endotracheal intubation was planned; however, we were unsure which side of the pericardium was ruptured. The only key to inferring the injured side was the slightly more marked pneumothorax on the left compared to the right.

First, we used a bronchoscope after intubation to confirm the absence of injury from the trachea to the bronchus. Next, we explored the left pleural space thoracoscopically with the patient in the semi-lateral position; the left-sided pericardium was intact. We recognized only a minor tear a few millimeters long on the surface of the lateral side of the left upper lobe abutting on the rib fractures. The lung injury could have been the result of the rib fractures, which were fixated.

Next, the patient was moved to the left semi-lateral position, the pericardium tear was recognized via thoracoscopy, and the heart was exposed. We immediately converted to a thoracotomy, and the right thorax was entered via a lateral thoracotomy at the sixth intercostal space via a 12-cm skin incision. A 12-× 5-cm Y-shaped pericardial tear was detected (Fig. 2a). The longitudinal tear was located near its junction with the pulmonary hilum, and the phrenic nerve was bridging the pericardial defect, which was considered a traumatic rupture. No injury to the pulmonary parenchyma was seen. Other organs, such as the heart, superior vena cava, and diaphragm, were intact.

The pericardial tear was sutured with interrupted 3-0 polypropylene pledgeted suture material. The central parts of the pericardial edges did not come into contact during repair because the injured tissue was shriveled (Fig. 2b), so we completed the repair using surgical fabric (Bard Sauvage Filamentous Fabric; Bard Peripheral Vascular, Tempe, AZ, USA) (Fig. 2c). The total operating time, including performance of operations on both sides, was 240 min, with little blood loss. No cardiopulmonary complications occurred during or after the operation. Minor pericardial effusion was observed a few days later, but did not require drainage. The patient was transferred to the orthopedic department on postoperative day 3.

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**Fig. 1** (a–c) Chest computed tomography on arrival demonstrates bilateral pleural air (arrows) and pneumopericardium (arrowheads). (a) The left-sided pleural air is predominant, (b) whereas the right side has only a small amount of air. (c) Other slices also demonstrate pneumopericardium, but no sign of a right-sided pericardial rupture is seen.

**Fig. 2** (a–c) Photographs of the steps used to repair the ruptured pericardium. (a) The heart was exposed through a “Y”-shaped tear (asterisk). The longitudinal part of the tear was located near the pulmonary hilum (arrowheads). (b) The pericardial tear was sutured with interrupted sutures and pledgets (arrows). The injured pericardium was shriveled, so the edges did not touch (asterisk). (c) The pericardial tear was repaired completely using surgical fabric (asterisk).
Discussion

Fulda et al.\(^1\) studied pericardial tears in 22 patients and reported that left pericardial tears were the most common, but that tears also occurred in 8 (36\%) other sites, including 4 (18\%) diaphragmatic pericardial tears, 2 (9\%) right pericardial tears, and 2 (9\%) superior mediastinal tears. Unless complicated by cardiac herniation, we empirically depend on the severity of pleural air and pleural effusion\(^3\) to identify the side of a pericardial tear.\(^3,6\) This case also had predominantly left pleural air (Fig. 1a), but the right side had some air (Fig. 1b). At this point in the diagnosis, we had no other choice but to diagnose a left-sided pericardial rupture.

We analyzed the preoperative CT images to determine on which side the pericardial tear was located. We found minimal amounts of pleural air, with lung injuries in both pleural spaces, on initial CT, showing that the left pneumothorax seemed to be more severe than the right pneumothorax (Fig. 1a and 1b). This finding led us to believe that the left side was the more damaged and to diagnose left-sided pericardial rupture. However, this diagnosis was incorrect. After analyzing the CT retrospectively, there was no sign of a right-sided pericardial rupture (Fig. 1c). We believe that pleural air initially developed secondary to lung injury, leaked air entered the pericardial space, and pneumopericardium then occurred; this caused us to diagnose pericardial rupture.

How can a pericardial tear be identified as right- or left-sided? It is easy to judge the ruptured side when cardiac herniation and a mediastinal shift are seen on CT. However, when one encounters a case such as the one presented here in the future, we suggest some guidelines and ideas to avoid making the wrong choice. To infer the side of the cardiac tear, we suggest that a chest tube be inserted in advance. If the drain is in the ruptured side, the pneumomediastinum or pneumopericardium will disappear; if not, they will remain. Last but not least, the severity of the pneumothorax is not always related to the side injured in a pericardial rupture.

Conclusion

We learned a valuable lesson from this case: The severity of pleural air is not always reliable when used to determine the injured side with a pericardial rupture. Direct observation of the pleural space using a thoracoscope is required for definitive diagnosis.

Conflict of Interest

We declare that we have received no financial support and have no relationships that might pose a conflict of interest.

References