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Case Report

# Acute pericardial diverticulum caused by pericarditis treated with drainage of pericardial effusion

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ABSTRACT

A 50-year-old woman was admitted with congestive heart failure due to cardiac tamponade, which was caused by acute pericarditis with pericardial effusion. Although images of contrast computed tomography (CT) obtained two weeks prior to admission had shown no abnormality, CT on admission showed a mediastinal tumor communicating with the pericardial cavity. It had rapidly appeared in a few weeks. We diagnosed it as acute pericardial diverticulum caused by acute pericarditis. They improved after treatment with antibiotic therapy and pericardial drainage.

<**Learning objective:** This case suggests that acquired pericardial diverticulum could be caused by herniation due to increasing pressure of the pericardial cavity resulting from pericarditis.The drainage of pericardial effusion decreased the pressure, so we could treat the acute phase of pericardial diverticulum.>



## Introduction

A pericardial diverticulum and cyst are benign mediastinal tumors and rare diseases, estimated to occur in 1 in 100,000 of the population [1]. They are usually thought of as congenital anomalies, asymptomatic, and incidentally discovered on routine chest X-ray. A pericardial diverticulum has a communication with the pericardial cavity; but a pericardial cyst does not. A pericardial diverticulum may appear radiologically 10% of the time, compared with a pericardial cyst [1].

Because it is difficult to detect the communication by X-ray, a pericardial diverticulum has often been misdiagnosed as a pericardial cyst prior to communication detection during surgery in case reports [2]. Moreover, a pericardial diverticulum and cyst have many points of similarity and are thought of as different stages of a common pathological development process, so both diseases have not been distinguished distinctly in the historic literature [1,3,4].

In contrast, acquired cases of both diseases are thought to arise from development processes differing from those of congenital cases [1,3,4]. Some cases of acquired pericardial diverticulum and cyst were thought to be associated with pericarditis [4–7]. However, the detailed clinical courses of those cases remain unclear.

In this case, computed tomography (CT) was useful to detect an enlarged communication and diagnose the rare disease. We describe a case of acquired and symptomatic pericardial diverticulum, which was caused by acute pericarditis.

## Case report

A 50-year-old woman visited her family doctor with intermittent chest discomfort for two days. At the age of 44 years, she had been diagnosed with ulcerative colitis and treated with mesalazine, and then remained asymptomatic without medication for several years. There was no history of syphilis, tuberculosis, surgery, or trauma.

The body temperature was 37.4 °C. Blood chemistry revealed an increase in the level of C-reactive protein. Chest X-ray and contrast CT showed no abnormality (Fig. 1A and D). The doctor directed her to visit another day, but she had failed to do so.

One week later, she had dyspnea on effort. It subsequently worsened to chest discomfort without effort, which aggravated in a

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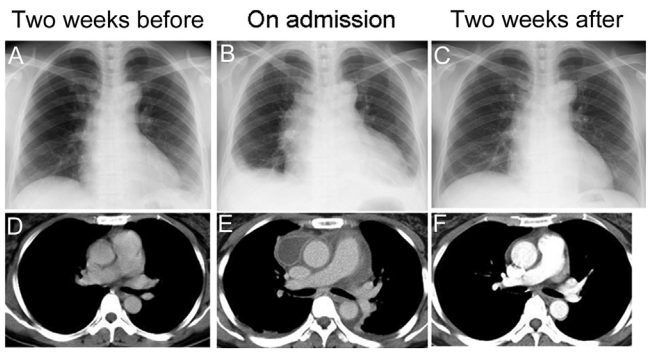


**Fig. 1.** Chest X-ray (A, B, and C) and the chest contrast computed tomography (D, E, and F) in the present case. Two weeks before admission they showed no abnormal finding (A and D). On admission they showed pericardial effusion, a small amount of bilateral pleural effusion, and a mediastinal mass (B and E). They improved after 2 weeks (C and F).

supine position and improved in a decubitus position. Two weeks later she was admitted to our hospital with appetite loss and high fever. Her blood pressure was 106/70 mmHg, body temperature was 37.7 °C, and heart rate was 120 bpm. Chest X-ray showed a round shadow at the right border of the mediastinal part with cardiomegaly and bilateral pleural effusion (Fig. 1B). Twelve-lead electrocardiogram showed sinus tachycardia and T inversion in leads , , and aVF. Trans-thoracic echocardiography showed a normal systolic function of the left ventricle (ejection fraction was 72%) and moderate pericardial effusion with cardiac tamponade. On the second hospital day, we started empirical antibiotic therapy to treat her acute pericarditis, using sulbactam/ampicillin because we speculated that acute pericarditis might have been secondary to respiratory infection. Chest contrast CT showed pericardial effusion with collapse of the right atrium and a pericardium enhanced by pericarditis (Figs. 1E and 2). The enhanced wall continued to a fluid-filled cystic mass (Fig. 2) measuring $5 \times 3 \times 2$ cm beside the right side of the ascending aorta. Multi-planar reconstruction(MPR) images of CT showed a communication, 6 mm in diameter, between the mass and pericardial cavity (Fig. 2A and D). On the fourth hospital day, we performed pericardial fenestration and pericardial drainage. The pericardial fluid was a clear pinkish exudate with a small amount of blood. The glucose level of 96 mg/dL, adenosine deaminase was normal, bacteria and tuberculosis were negative, and cytological examination was negative for malignancy. We diagnosed the patient with acute pericarditis and acquired pericardial diverticulum. After pericardial drainage, the symptoms and inflammatory reaction were improved. At 17 days, X-ray showed improvements of cardiomegaly and pleural effusion (Fig. 1C). Contrast CT showed that the pericardial effusion had decreased, and the pericardial diverticulum had disappeared (Fig. 1F). The patient's clinical course was uneventful. She remained without symptoms for 6 months following treatment.

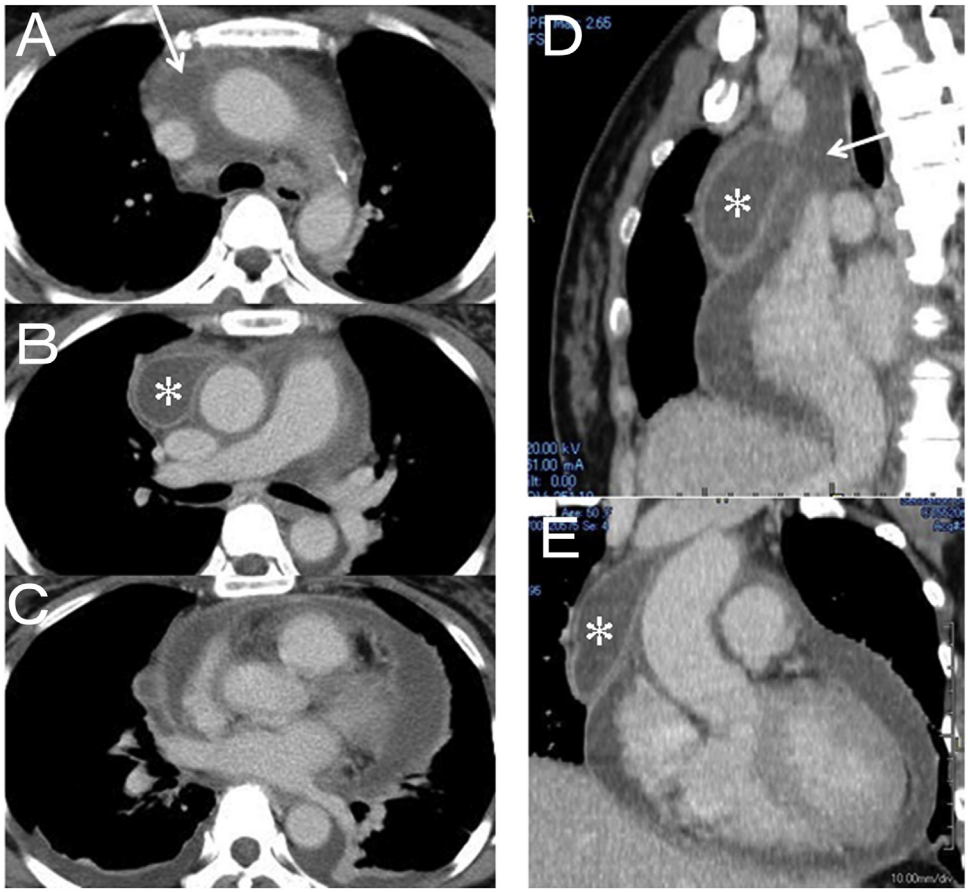


**Fig. 2.** Multi-planar reconstruction images of chest contrast computed tomography in the present case obtained on admission the axial plane (A, B, and C), left anterior oblique plane (D), and coronal plane (E). They showed the mediastinal mass (asterisk) and pericardial effusion, which had the communication (arrow). So, we made a diagnosis of pericardial diverticulum.

## Discussion

We diagnosed the patient with cardiac tamponade due to acute pericarditis that had developed two weeks before admission, based on the positive findings of fever, an increase in the level of C-reactive protein, echocardiographic findings, and the test results of pericardial fluid. Moreover, previous CT images showed no abnormal finding, so we could diagnose her with acute-phase pericardial diverticulum, based on the radiographically abnormal mediastinal cystic mass on admission, which connected with the pericardial cavity through the communication.

It is difficult to detect a communication of the pericardial diverticulum not only with X-ray but also with CT [1]. In this case, we could detect the communication with CT because the communication was enlarged by increased pressure in the acute phase of pericarditis.

Our patient was admitted with congestive heart failure at a relatively long time after developing the initial symptoms of acute pericarditis, probably because the escape route provided by the pericardial diverticulum allowed the intrapericardial pressure to increase relatively slowly over two weeks.

Acquired and congenital types of pericardial diverticulum are thought to be caused by different pathological development processes [1]. One of the hypothetical mechanisms of acquired pericardial diverticulum and cyst involves herniation, and the histological background has been reported previously. The parietal pericardium consists of an outer "strong" fibrous layer and an inner serous layer [5]. There is the potentially weak area between groups of fibers of the pericardiaum, especially near the roots of the great vessels, allowing herniation of the thin serous layer because of increased intrapericardial pressure due to pericardial disease and effusion [3–5]. In our case, acute pericarditis could have made the pericardium vulnerable, as well as increasing the intrapericardial pressure. Thus, acquired pericardial diverticulum could occur as a result of herniation secondary to acute pericarditis, while acquired pericardial cyst may be a remnant of the diverticulum whose communication has closed [6,7].

Acute pericarditis with pericardial effusion may cause acquired pericardial diverticulum, but cases of pericardial diseases, in which a definite previous inflammatory pericarditis was documented, are rare. Money et al. reviewed several dozen reports of pericardial diverticulum with a search of PubMed entries from 1946 to 2015 [2]. Maier reported a case of pericardial diverticulum revealed several years after acute pericarditis with sequential X-rays that showed the appearance of a pericardial cystic mass compared with a prior image [5]. Some similar cases of pericardial cysts were also reported [6,7]. In these cases, pericardial diverticula and cysts were found several years after acute pericarditis.

Our case is the first report of acute pericardial diverticulum with acute pericarditis showing both their appearance and disappearance with changes of CT images. This case provides supporting evidence that an acquired diverticulum could develop in a shorter period of several weeks because of acute pericarditis, compared with previous reports. The time course of CT images suggests that the pressure of the pericardial cavity is an important factor for the formation of a pericardial diverticulum. In other words, the increasing pressure of the pericardial cavity caused herniation through a weak point of the parietal layer of the pericardium, and then it formed the diverticulum [4,5]. Its decreasing pressure caused the disappearance in this case.

It is unclear why the rare herniation occurred in this patient, while acute pericarditis is not so rare. It might be an important factor that high pressure of the pericardial cavity was sustained during a relatively long period of several weeks, affecting the impaired inflammatory pericardium. Another possibility is that a congenital atrophied pericardial diverticulum or a local weakness of the pericardium had been hidden before this episode, which could not be detected by CT, and the pericarditis exposed it.

Symptomatic pericardial diverticulum is usually treated by surgical resection or direct percutaneous aspiration to the diverticulum [1], but these are invasive and associated with various kinds of complications. Instead, we perform pericardial drainage for pericardial effusion, with the procedure being reasonable and popular for cardiologists with aims of investigation and treatment. However a hidden atrophied pericardial diverticulum may cause recurrence of the pericardial diverticulum, so careful observation is needed.

In this case, the time course of the images enabled us to understand the cause, decide on treatment, and evaluate the results. This case strongly supports the theory that a pericardial diverticulum could develop as a herniation because of increasing pressure of the pericardial cavity.

## Conflict of interest

No authors have a conflict of interest.

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