


# Pseudohemothorax induced by residual contrast medium mimicking aortic dissection rupture

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## Abstract

Hemothorax is an urgent condition, and its accurate diagnosis and the identification of the cause are important. Herein, we report a case of a 74-year-old man with end-stage renal disease who was presented with high-concentration pleural effusion owing to residual contrast medium. The case required differentiation from hemothorax owing to an aortic dissection and its rupture. In patients with end-stage renal disease, noncontrast-enhanced computed tomography after contrast-enhanced computed tomography may result in high-concentration pleural effusion owing to the existence of residual contrast medium. This realization is important to determine whether high-concentration pleural effusion symptoms reflect an urgent hemothorax case possibly related to an imminent rupture of an aortic aneurysm or intrathoracic penetration of aortic dissection, and whether invasive procedures, such as thoracentesis, ought to be avoided.

## Keywords

Pseudohemothorax, chronic renal failure, computed tomography, contrast medium

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## Introduction

The known causes of hemothorax include (among others) traumatic, iatrogenic, pneumothorax, tumor, vascular abnormalities (ruptured aortic aneurysm/aortic dissection), pulmonary infarction, abnormal coagulation (drugs and hemodynamics), and endometriosis.<sup>1,2</sup> The diagnosis of hemothorax is essential because exacerbation of hemothorax causes respiratory failure, hemodynamic instability, and hypoxemia.<sup>3</sup>

If hemothorax is suspected, thoracentesis or chest tube insertion procedures are performed. Furthermore, if the hematocrit value of pleural effusion is  $\geq 50\%$  of that in peripheral blood, a definitive diagnosis of hemothorax is made.<sup>4</sup> In addition, radiologists measure the attenuation values of the pleural effusion in computed tomography (CT) scans, and if these are in the range of 35–70 Hounsfield units (HU), the possibility of hemothorax is considered.<sup>5</sup>

Herein, we report a case of pseudohemothorax in CT owing to the presence of residual contrast medium that requires differentiation from a possible rupture of a thoracic aortic dissection.

## Case report

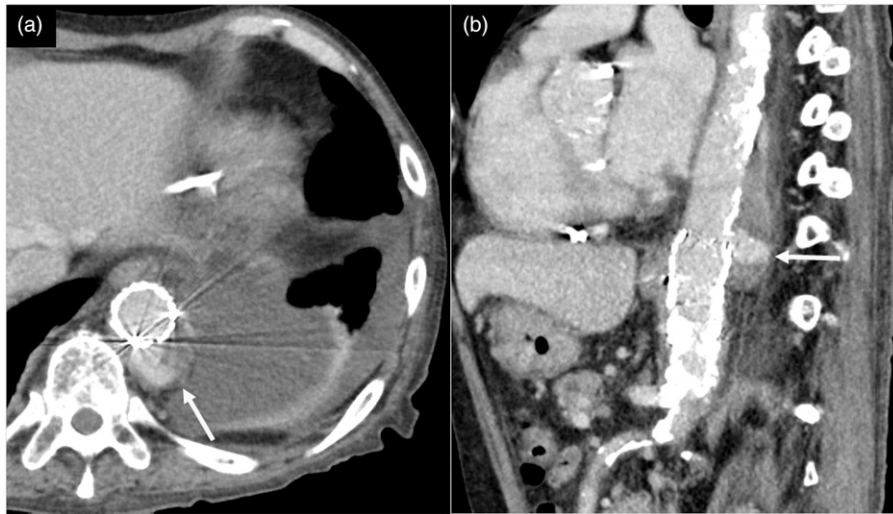
A 73-year-old man was admitted to another hospital with fever, abdominal pain, and back pain symptoms. He had a history of stent-graft interpolation for an impending rupture of the abdominal aortic dissection and received hemodialysis

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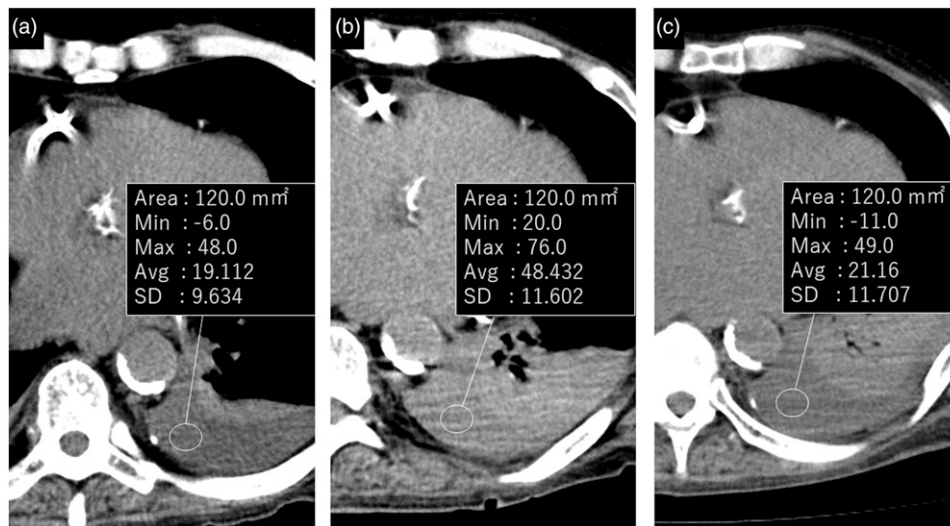
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**Figure 1.** (A) Initial contrast-enhanced computed tomography (CT) image (axial image, equilibrium phase), (B) initial contrast-enhanced CT image (sagittal image, equilibrium phase). Contrast-enhanced CT showed the aortic dilatation with the internal leakage of contrast medium (similar to ulcer-like projection or penetrating atherosclerotic ulcer) observed on the upper edge of the stent graft (Figure 1, arrow).



**Figure 2.** (A) Initial noncontrast-enhanced CT image, (B) noncontrast-enhanced CT image at the follow-up scan 13 h after the contrast-enhanced CT, (C) noncontrast-enhanced CT image 3 days later. Initial noncontrast-enhanced CT image at the level of the lower thorax showed bilateral pleural effusion, and the CT values of the pleural effusion were equal to 19 HU (Figure 2(A)). Noncontrast-enhanced CT image acquired during the follow-up scan 13 h after the contrast-enhanced CT. The image showed almost no changes in the amount of pleural effusion, but the CT value exhibited a significant increase to the value of 48 HU (Figure 2(B)). Noncontrast-enhanced CT image acquired 3 days later and showed that the CT value of the pleural effusion decreased to 21 HU (Fig. 2C).

owing to end-stage renal disease. The CT scan completed at the other hospital showed enlargement of a thoracic aortic aneurysm, and the patient was transferred to our hospital. At our hospital, noncontrast- and contrast-enhanced CT demonstrated the presence of the aortic dilatation owing to the internal leakage of contrast medium (similar to ulcer-like projection or penetrating atherosclerotic ulcer) observed on

the upper edge of the stent graft (Figure 1). In the noncontrast-enhanced CT, left-dominant, bilateral pleural effusion was confirmed, and attenuation values of bilateral pleural effusion were equal to 19 HU (Figure 2(A)).

The cardiovascular surgeon at our hospital diagnosed aortic redissection or imminent aortic rupture of an infectious aortic aneurysm and considered the option of surgery.

However, it was diagnosed that the possibility of rupture of the aortic aneurysm was low because the area around the contrast medium leaked part became a thrombus. Therefore, conservative treatments, such as the use of antibacterial agents, blood pressure control, and rest, were recommended. A noncontrast-enhanced CT for follow-up to 13 h after the contrast-enhanced CT was acquired. The images showed almost no changes in the amount of pleural effusion, but CT values exhibited a significant increase of 48 HU (Figure 2(B)). Although there was a possibility of intrathoracic penetration of aortic dissection, the patient was diagnosed with high-concentration pleural effusion. This was owing to the residual contrast medium which was present because the aortic diameter and the amount of pleural effusion did not change, and the patient was in terminal renal failure. Hemodialysis was resumed on the same day, and the CT value of pleural effusion decreased to 21 HU 3 days later (Figure 2(C)) and decreased to 13 HU 5 days later. Subsequent CT acquisitions showed no significant changes in the aortic diameter, and the clinical course of aortic disease was considered to be acceptable.

## Discussion

There are various causes of hemothorax, such as traumatic, iatrogenic, tumor, vascular abnormalities, and pulmonary infarction,<sup>1,2</sup> but this is often an emergency condition which requires immediate treatment. Intrathoracic penetration of aortic aneurysm or aortic dissection is urgent, and its diagnosis is important. Early diagnosis is still important because of the possible malignant pleural effusion in hemothorax associated with tumors and the risk of hemodynamic instability and respiratory failure owing to the exacerbation of pleural effusion in traumatic and iatrogenic cases.<sup>3</sup>

Pleural effusion is usually associated with the CT attenuation values, which are less than 30 HU. However, if the attenuation values are in the range of 35–70 HU, the possibility of hemothorax is considered.<sup>5,6</sup> However, in patients with end-stage renal disease, when a contrast medium is used multiple times in a short period of time, high-concentration pleural effusion owing to residual contrast medium may be mistaken for hemothorax.<sup>7</sup> It is considered difficult to distinguish hemothorax from high-concentration pleural effusion secondary to aortic disease, as in our case. Extrarenal routes such as saliva, sweat, bile, and gastrointestinal tract are known as possible elimination routes of contrast medium in patients with renal failure, but it is necessary to be aware that pleural effusion may also be an alternative elimination route.<sup>8,9</sup> After confirming that there was a history of end-stage renal disease, we were able to diagnose high-concentration pleural effusion associated with residual contrast medium because there was no exacerbation of pleural effusion and no changes in the aortic diameter. It is reported that the CT values of the aorta in

noncontrast-enhanced CT images provide useful information for the presence of residual contrast medium<sup>7</sup>. In this case, the CT value of the descending thoracic aorta was 36 HU in the noncontrast-enhanced CT before the contrast-enhanced CT, but CT values on the day after the contrast-enhanced CT were increased considerably to 59 HU. CT values of the liver parenchyma also increased from 57 to 73 HU, which was considered to be owing to the residual contrast medium.

The half-life of hypotonic contrast agent excretion from the body is approximately 2 h in patients with normal renal function, but it has a half-life of 16–84 h in patients with severe renal dysfunction.<sup>7,10</sup> Given that this was a noncontrast-enhanced CT scan conducted 13.5 h after the contrast-enhanced CT at our hospital, we can suspect high-concentration pleural effusion due to the residual contrast medium. It is reported that hemodialysis reduces the level of contrast medium in plasma by approximately 80%, and the contrast medium remains in the blood even after hemodialysis.<sup>11</sup> In this case as well, a noncontrast-enhanced CT scan conducted 2 days after hemodialysis showed a mildly high CT value of 21 HU, suggesting the presence of residual contrast medium.

Thoracentesis is essential for a definitive diagnosis, and if the hematocrit value of pleural effusion is  $\geq 50\%$  compared with the corresponding value in peripheral blood, a definitive diagnosis of hemothorax is made.<sup>4</sup> However, considering the burden on the patient, unnecessary invasive treatments should be avoided. Accordingly, thoracentesis may not be necessary if attenuation values are evaluated based on the above considerations to determine whether the patient has hemothorax. In this case, the possibility of hemothorax was dismissed, and thoracentesis was not performed. Ultrasonography has also been reported to help distinguish between pleural effusion and hemothorax and may be useful for noninvasive diagnosis.<sup>12</sup>

In patients with end-stage renal disease, high-concentration pleural effusion after contrast-enhanced CT may be a problem because it is necessary to distinguish it from hemothorax. Specifically, when accompanied by aortic disease, there is a possibility that there is an urgent condition, such as intrathoracic puncture, and differentiation is very important.

In conclusion, in this case, misdiagnosis of hemothorax could have led to the employment of invasive treatments, such as thoracentesis. These treatments could be avoided by confirming the history of end-stage renal disease, and by conclusively diagnosing pseudohemothorax owing to the existence of residual contrast medium.

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### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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### Informed Consent

This case report has obtained Institutional Review Board approval and the formal informed consent from this patient was waived. We had obtained informed patient consent about all procedures.

### Ethical Approval

All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional and national research committees and the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards where appropriate.

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