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Atypical presentation of isolated traumatic ascending aortic dissection with cardiac tamponade

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Abstract

Blunt traumatic aortic injury is a rare but life-threatening condition, usually following high-energy trauma. We present the case of a 79-year-old man who was transferred to a hospital complaining of nausea after being struck on the chest. Computed tomography led to diagnosis of ascending aortic dissection with cardiac tamponade. Emergent ascending aortic replacement was performed successfully and he was discharged home on postoperative day 24 without any complications. The key to early diagnosis of blunt traumatic aortic injury is careful and detailed history-taking. If trauma patients complain of unexplained symptoms, the threshold for conducting computed tomography should be lowered to avoid misdiagnosis or therapeutic delay.

Keywords

Traumatic aortic injury, aortic dissection, low-energy trauma

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Introduction

Blunt traumatic aortic injury (BTAI) is a rare condition seen in 0.1%–0.6% of trauma patients, but is fatal with a high mortality rate of 55% within 2 days after BTAI.[1,2] Major causative agents for BTAI are high-energy traumas like motor vehicle accidents, comprising approximately 80% of all cases, whereas low-energy traumas rarely trigger BTAI.[3] With high-energy traumas, most patients with BTAI also show multiorgan injuries[4] and may present with chest or back pain, signs of external chest wounds, or hemodynamic instability. Without these typical clinical manifestations, prompt and accurate diagnosis of BTAI is challenging for physicians.[5] According to previous report, the most common reason for delayed surgical intervention was missed diagnosis which accounts for 47%, all of whom were transferred from outside institutions.[6] We report a rare case of isolated traumatic ascending aortic dissection with an atypical presentation.

Case presentation

A 79-year-old man with a history of controlled hypertension had been in a restaurant, where he had got into an altercation with another customer. He had then been hit in the chest and fell to the ground. Although he could not recall details of the situation probably due to mild alcohol intoxication, according to an eyewitness in a restaurant, the hit was a single strong one in the center of his chest. He started feeling nausea 30 min later and requested emergency services. He was brought to the emergency department of another hospital complaining of nausea. On arrival, he was alert and oriented with almost-normal vital signs except for a relatively low blood pressure (92/68 mmHg). He denied chest or back pain, or any other accompanying symptoms. No obvious wounds were evident on physical examination. Laboratory data showed mild elevation of D-dimer (2.7 μg/mL), but other parameters were almost within normal limits. Despite stable vital signs and no signs of chest injury, the physician decided to conduct computed tomography (CT) of the head and chest without contrast, based on the history of chest trauma and the

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unexplained symptom of nausea. No abnormalities were seen on head CT, but massive pericardial effusion was demonstrated on CT of the chest and dissection was suspected in the ascending aorta (Figure 1). Aortic dissection was considered as a cause of pericardial effusion. The patient was transferred to our institute for further evaluation. Contrast-enhanced CT revealed an aortic dissection localized at the ascending aorta with massive pericardial effusion (Figure 2(a)). A three-dimensional (3D) reconstruction of preoperative CT demonstrated dissected and dilated ascending aorta with a maximal diameter of 44 mm (Figure 2(b)). Given these findings, an emergent operation was performed. After opening the pericardium, massive hemorrhagic pericardial effusion was evacuated and hematoma was revealed on the pulmonary artery side of the ascending aorta (Figure 3(a)). There was no obvious laceration on the adventitia; however, it can be contained rupture into aortopulmonary window in view of massive hemorrhagic pericardial effusion. Cardiopulmonary bypass (CPB) was initiated with an arterial cannula inserted into the undamaged right side of the ascending aorta under transesophageal echocardiography guidance according to CT finding of intact arch vessels and a venous cannula via the right atrium. In addition to an arterial cannula in the ascending aorta, one more arterial cannula was inserted into the left common femoral artery for flushing out of debris. Moderate hypothermia (bladder temperature, 28°C) was induced and the ascending aorta was opened without applying an aortic clamp. Retrograde cardioplegia was used for myocardial protection throughout the operation. For cerebral protection during circulatory arrest, antegrade cerebral perfusion was selected. Intimal tears were present on the noncoronary sinus of Valsalva and the distal part of ascending aorta located at the lesser curvature, and the ostia of the coronary arteries were intact (Figure 3(b)). All dissection sites were excluded and ascending aortic replacement with a single-branched Dacron® graft (J Graft 28/9 mm; Japan Lifeline, Tokyo, Japan) was performed. At first, distal anastomosis was performed under lower body circulatory arrest, followed by proximal anastomosis with lower body circulation using the side branch of graft connected to an arterial circuit. Weaning off CPB was uneventful and the chest was closed without difficulties.

The patient was transferred to the intensive care unit under stable condition. He was extubated on the day of operation and was transferred to the general ward on postoperative day (POD) 5. Postoperative contrast-enhanced CT revealed no abnormalities at sites of anastomosis, with no residual dissection. Pathological findings of the mid-part of ascending aortic wall showed hemorrhage and fibrosis in the adventitia, whereas no abnormality was seen in the media (Figure 4). The postoperative course showed no complications, and the

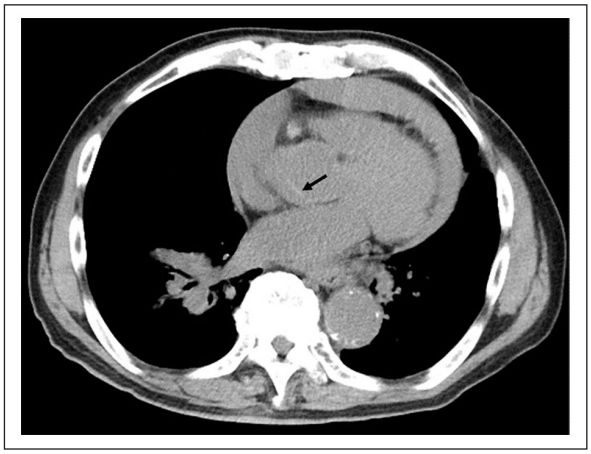

Figure 1. Axial-view preoperative CT without contrast. Massive pericardial effusion is seen. Dissection is suspected in the ascending aorta (black arrow).

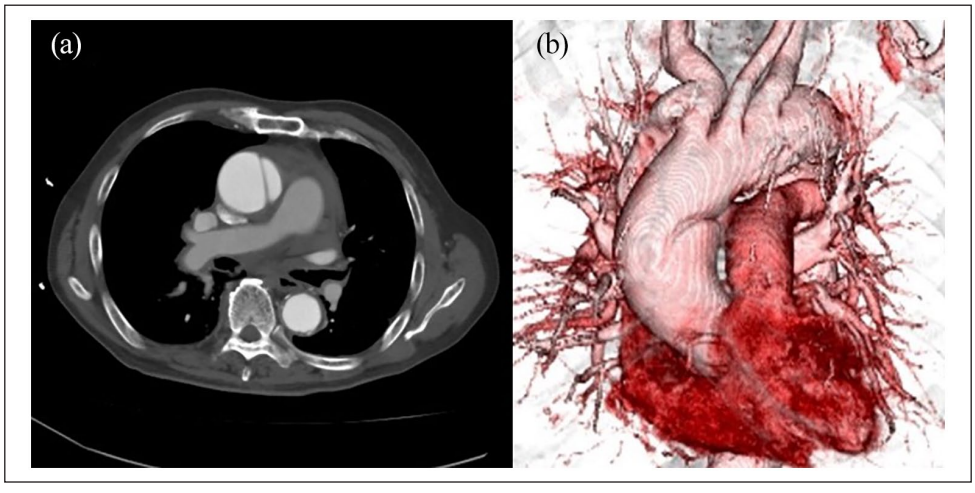

Figure 2. (a) Axial-view preoperative contrast-enhanced CT. Dissection is seen in the ascending aorta. (b) A 3D reconstruction of preoperative CT. Dissected and dilated ascending aorta with maximal diameter of 44 mm is demonstrated.

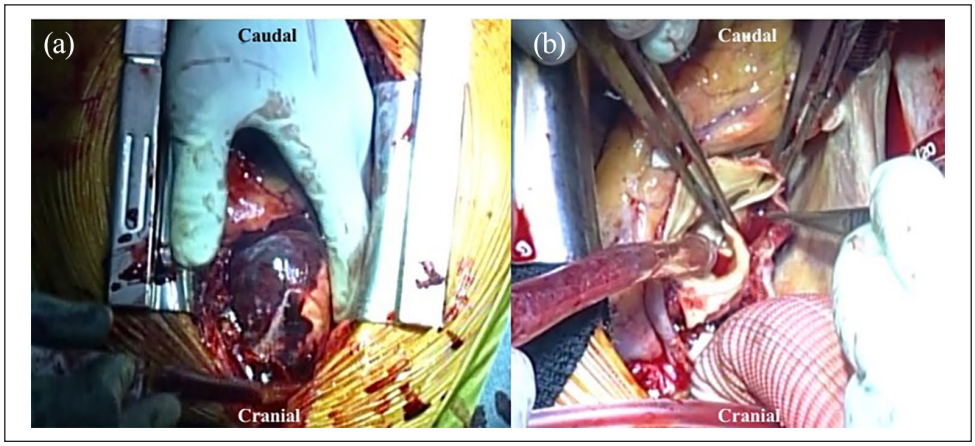

Figure 3. Intraoperative findings. (a) Hematoma is detected on the pulmonary artery side of the ascending aorta. (b) Intimal tears were present on the noncoronary sinus of Valsalva and the distal part of ascending aorta located at the lesser curvature.

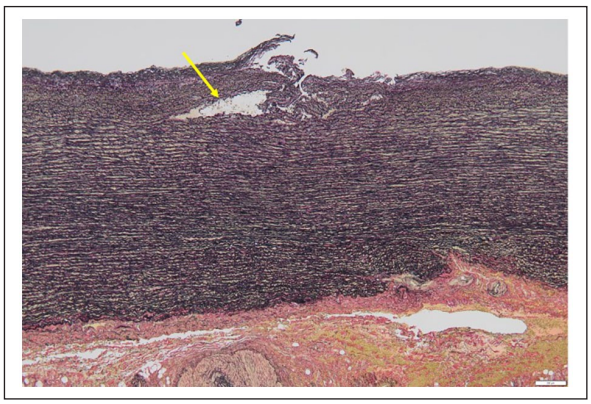

Figure 4. Pathological findings of the aortic wall (elastica van Gieson stain). The yellow arrow points to hemorrhage in the adventitia.

patient was discharged home on POD 24 after setting up in-home nursing care services.

Discussion

BTAI is a rare but life-threatening condition present in 0.1%–0.6% of all trauma patients, and 1.5%–2% of blunt chest trauma.[1,7] A previous report revealed a high mortality rate, at approximately 55% within the first 2 days after BTAI.[2]

Regarding the etiology of an aortic dissection in this case, it is difficult to assert that a dissection was triggered by chest trauma, because the exact circumstances of the injury remain unclear due to the poor recall of the patient and limited eye witness accounts. However, the fact that pathological findings revealed hemorrhage and fibrosis in the adventitia with no abnormality in the media, which were quite different from typical pathological findings of aortic dissection, suggests a traumatic cause rather than a blood pressure surge.

The most common site of BTAI is the aortic isthmus, accounting for 90% of all cases, owing to the anatomical characteristics of immobility in the thorax due to the attachment to the ligamentum arteriosum. In contrast, traumatic injuries to the ascending aorta are seen in only 5%–8% of BTAI and sometimes manifest as hemorrhagic pericardial effusion, as seen in the present case.[8] This patient's advanced age of 79 years might affect the outcome of having aortic injury in the ascending aorta. Etiologies of age-related decreases in aortic wall compliance are due to increased fragmentation and decreased density of elastin, increased concentration of collagen, hypertrophy of vascular smooth muscle, and decreased nitric oxide production.[9] Tsamis et al.[10] revealed that the concentration of elastin significantly decreased, especially in the ascending aorta; in depth, the elastin concentration in the ascending aortic wall was reported to gradually decrease by 36% in subjects aged from newborn to 81 years old. Furthermore, Tobey et al.[11] analyzed aortic compliance in patients with aortic diseases using intravascular ultrasound and they concluded that ascending and arch aortic compliance decreased significantly with age. In view of thoracic aortic geometry, Redheuil et al.[12] reported that the ascending aortic length increased significantly with age, leading to aortic arch widening and decreased curvature, which resulted in proximal aortic stiffness. Although traumatic injuries to the ascending aorta are rare, based on this knowledge, we can assume that older patients tend to have dissection in the ascending aorta rather than younger patients.

BTAI usually occurs as a result of high-energy trauma. Based on the research regarding mechanisms of BTAI, motor vehicle accidents account for approximately 80% of all cases. Other causes include motorcycle and aircraft crashes, auto-pedestrian collisions, falls from height, and crush injuries.[13] BTAI caused by low-energy trauma, as in the present report, does not appear to have been described previously. Although a hit in the patient's chest was strong enough to

force him fall, as we never know how strong it was owing to mild alcohol intoxication, it was quite difficult to presume he might have aortic injury.

In this case, the patient sustained only aortic injury, but in high-energy traumas, a majority of patients show concomitant injuries in addition to aortic injuries. Fabian et al.[14] analyzed injuries associated with BTAI and described closed head injury, multiple rib fractures, pulmonary contusion, and pelvic injury as the most common.

If patients have no concomitant injuries or characteristic symptoms such as chest or back pain, signs of external chest wounds, or hemodynamic instability, early diagnosis is even more challenging for physicians. Yu et al.[15] described the sensitivities of diagnostic criteria for BTAI, including widened mediastinum on chest X-ray, high-energy mechanism, tenderness to palpation, distracting injury, and chest CT. They concluded that the sensitivity of chest CT was 100%. Another report said that clinical examination contributes little because of the lack of both specificity and sensitivity, and CT angiography is the standard examination for BTAI with 98% sensitivity and 100% specificity.[8]

Because of minimal clinical or laboratory abnormalities, the diagnosis of BTAI was considered quite difficult in our case. However, early diagnosis of BTAI was established based on CT, which was conducted to clarify the cause of nausea. We thus consider the decision to perform CT as key to early diagnosis of BTAI. Even with no typical signs of BTAI, CT should be considered as a modality for accurate diagnosis in trauma patients complaining of unexplained symptoms.

Conclusion

The key to early diagnosis of BTAI is careful and detailed history-taking. If a trauma patient complains of unexplained symptoms, the threshold for conducting CT should be lowered to avoid misdiagnosis or therapeutic delay.

Declaration of conflicting interests

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Data availability

Data are available from the corresponding author on request.

Ethics approval

Our institution does not require ethics approval for reporting individual cases or case series.

Consent

Written informed consent was obtained from the patient for the publication of his anonymized information in this article.

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