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Diagnosis of blunt thoracic aortic injury with electrocardiogram-gated computed tomography in pediatric patient: A case report

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ABSTRACT

Computed tomography (CT) is a sensitive and specific test for thoracic aortic injury, and is the choice of diagnostic test for adult patients. However, the diagnostic accuracy of conventional CT in pediatric patients has not been elucidated, and the diagnostic strategy has not been clarified. We present the case of an eight-year-old patient who had a thoracic injury, with left open pneumothorax, pulmonary contusion, and multiple left-sided rib fractures. Although the findings on conventional CT were insufficient either to diagnose or deny as having thoracic aortic injury, additional examination using electrocardiogram-gated CT angiography and three-dimensional reconstruction revealed a localized enlarged aortic diameter with an intimal flap. Electrocardiogram-gated CT may be useful for diagnosing thoracic aortic injury in pediatric patients.

Introduction

Blunt thoracic aortic injury (blunt TAI; BTAI) is a life-threatening trauma, and only 20% of patients survive to receive treatment [1]. This survival rate can increase to more than 80% in patients received appropriate diagnoses and interventions [2,3]. Computed tomography (CT) angiography is a highly sensitive and specific test for thoracic aortic injury, and is the choice of diagnostic test in adult patients [4–7]. The sensitivity of CT for BTAI was reportedly 95% [8,9]. Although the guidelines strongly recommend enhanced CT to diagnose BTAI [10], the accuracy of conventional CT in pediatric patients has not been elucidated.

We report a case of a pediatric patient with BTAI that could not be diagnosed by conventional CT, but was definitively diagnosed by electrocardiogram-gated CT angiography.

Case

An eight-year-old boy fell from the second floor outdoors and struck his chest against a fence while playing with friends. He was transported by helicopter emergency medical service and admitted to our emergency department. His Glasgow Coma Scale score was 15, and he was hemodynamically stable on admission. Left open pneumohemothorax was diagnosed on physical examination.

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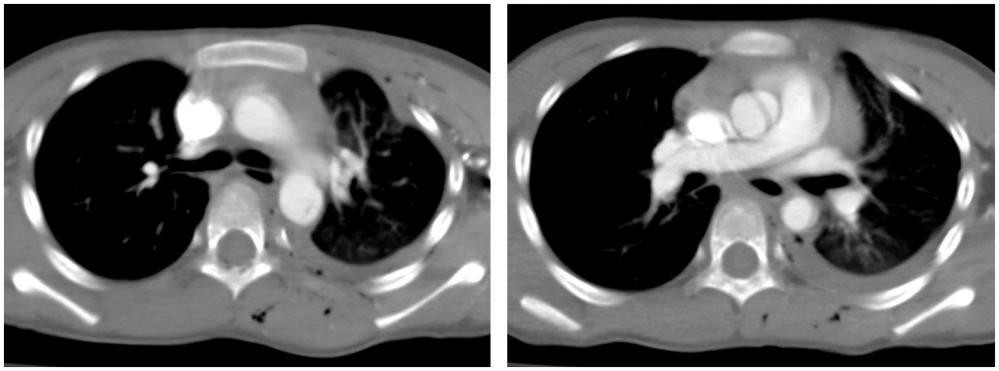

Fig. 1. Conventional enhanced-computed tomographic images in axial view.
Although a localized dilatation of descending aorta with irregular contour was suggested, no definitive diagnostic findings of thoracic aortic injury were revealed due to artifacts.

Fig. 2. Three-dimensional reconstruction of thoracic aorta by computed tomographic angiography showing a slightly dilated descending aorta.

Conventional enhanced CT (128-slice CT) showed left pneumothorax, pulmonary contusion, and multiple left-sided rib fractures. Although intimal tear-like findings were observed in the ascending and descending aorta, the findings were insufficient to diagnose or exclude TAI due to fast heartbeats and motions (Fig. 1). Three-dimensional reconstruction of the thoracic aorta showed that the descending aorta was slightly dilated (Fig. 2).

Since TAI was not excluded, further examination using electrocardiogram-gated CT angiography was performed. A localized enlarged aortic diameter with an intimal flap was noted (Fig. 3). TAI with descending aorta dilation was clearly demonstrated in a three-dimensional reconstruction using electrocardiogram-gated CT (Fig. 4). The patient was successfully treated with endovascular repair without post-intervention events.

Discussion

This case highlighted a complementary diagnostic approach when conventional CT scans could not exclude BTAI in pediatric patients.

In the evaluation of BTAI, the 64-multidetector row CT had a sensitivity of 96.0%, specificity of 99.8%, and accuracy of 99.8% [9]. The guidelines for evaluating and managing blunt traumatic aortic injury from the Eastern Association for the Surgery of Trauma in

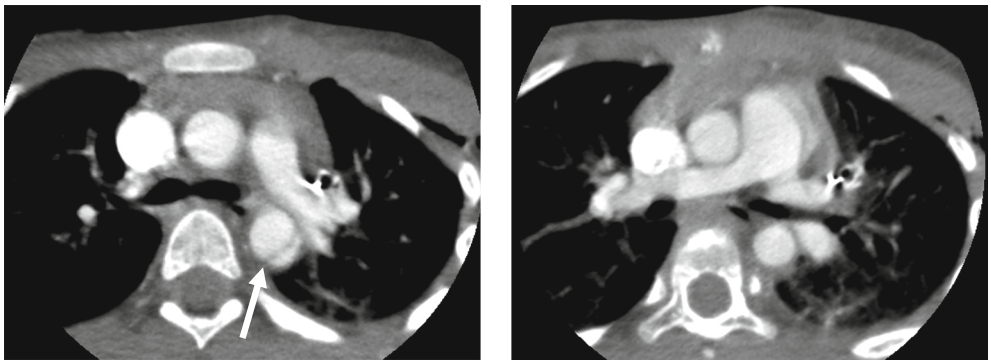

Fig. 3. Electrocardiogram-gated computed tomography angiography clearly showing localized dilatation of the aortic contour with the defect of contrast in the thoracic aorta (white arrow).

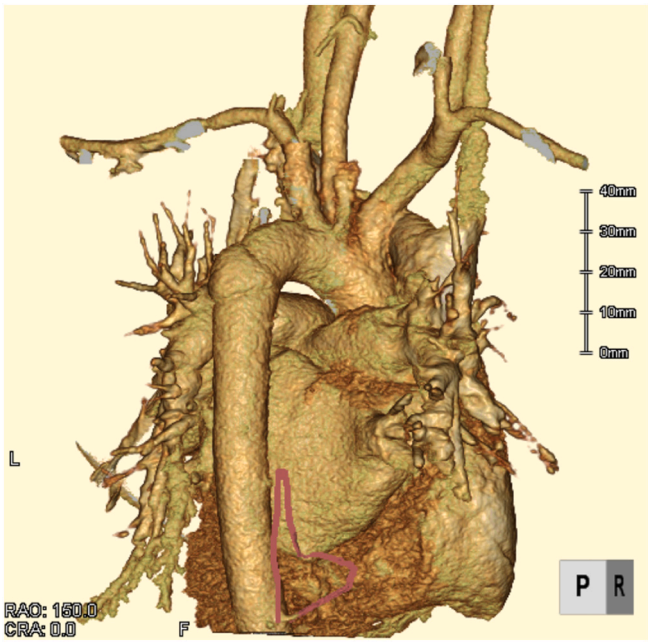

Fig. 4. Three-dimensional reconstruction of the thoracic aorta by electrocardiogram-gated computed tomography angiography showing clearly localized dilated descending aorta indicating aneurysm formation.

2014 strongly recommended chest CT with intravenous contrast to diagnose clinically significant BTAI [10]. Although the development of CT technology has improved diagnostic accuracy in adults [4–9], the accuracy of BTAI in pediatric patients has not been elucidated. Furthermore, BTAI rarely affects pediatric patients [11–14], and emergency physicians have little experience in diagnosing and treating pediatric BTAI.

Accurate diagnosis of BTAI in pediatric patients by CT angiography could be challenging due to their rapid respiratory and heartbeat motions, small body and organ size, small volume of contrast material, and small-gauge intravenous routes. Although case reports have documented the use of aortography [7,8], there were no reports on the diagnostic accuracy of electrocardiogram-gated CT in pediatric BTAI. This study showed that electrocardiogram-gated CT scans was effective and less invasive [15].

Conclusion

Diagnosing BTAI in pediatric patients is challenging and may require additional imaging modalities on top of conventional CT. Electrocardiogram-gated CT scans may be useful for diagnosing BTAI in pediatric patients.

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Declaration of competing interest

None.

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