A 64-year-old man came to the emergency department complaining of dyspnea. He had a history of ascending aortic pseudoaneurysm treated by ascending aortic and total arch replacement 2 months before. Because he had had deep vein thrombosis of the femoral vein, pulmonary thromboembolism was suspected, and contrast-enhanced computed tomography (CT) of the chest was performed. The dose-length product was 223 mGy cm; the effective dose (3.12 mSv) was determined using the European Guidelines for Multislice Computed Tomography estimate for thorax effective dose per DLP of 0.014 mSv/(mGy*cm). On CT, a pseudoaneurysm was noticed at the anterosuperior mediastinum. The definite leak point was not identifiable, but the anastomotic site between the left common carotid artery and the aortic arch was suspected to be the leakage point (Figure 1). Because no leakage point was detected on conventional angiography, treatment with conservative management was chosen for the best of the patient.

After 1 month, however, anterior chest pain, hoarseness, and dysphagia developed. Continued arterial leakage causing enlargement of the pseudoaneurysm was highly suggested. To accurately identify the leakage point, a contrast-enhanced ECG-gated CT of the thoracic aorta was performed. The dose-length product was 1130 mGy cm, and the effective dose was 15.82 mSv. The size of the pseudoaneurysm had increased considerably, causing tracheal deviation to the right side and esophagus compression to the posterior side. On the oblique coronal reconstructed image at the mid-diastolic phase, regurgitant flow from the pseudoaneurysm to the lumen of the left common carotid artery was seen. On the oblique coronal reconstructed image at the early systolic phase, forward flow to the lumen of the pseudoaneurysm was visible. The leak point was at the anastomotic site between the left common carotid artery and the aortic arch (Figure 2). On the axial and oblique coronal motion images, a pulsatile to-and-fro flow into and out of the pseudoaneurysm was readily seen (Movie I in the online-only Data Supplement).

Five days later, transthoracic echocardiography and transesophageal echocardiography were performed. The cardiologist who performed the examination could not identify the leak point. It was only after an intense 1-to-1 matching of the sonographic and CT images that a possible leak point was discernible on transthoracic echocardiography (Figure 3). The patient subsequently underwent thoracic aortography, which demonstrated a connection between the pseudoaneurysm and the left common carotid artery. An Amplatzer plug (AGA Medical Corp, Plymouth, Minn) was inserted at the leak point. Follow-up CT revealed no to-and-fro flow but only a small amount of leakage around the device (Figure 4). The dose-length product was 829 mGy cm, and the effective dose was 11.61 mSv.

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Traditionally, identification of the leak point after an aortic surgery has been heavily dependent on transesophageal echocardiography or magnetic resonance imaging. By demonstrating flow signals with either color Doppler on transesophageal echocardiography or cine images on magnetic resonance imaging, we can point out the leakage site. On the contrary, the roles of CT in this field have been relatively limited. Although it can provide some clues as to the whereabouts of the leak point by showing contrast leakage, the quality of the information is influenced heavily by the scan time and the amount of flow.

However, our case clearly shows that CT can be a powerful imaging tool for detecting a leak point with ECG-gated technique. With the advent of an ECG-gated CT, showing to-and-fro flow according to the cardiac cycle was possible. Moreover, creating full cine images by putting together the images acquired at different cycles is also feasible.

To the best of our knowledge, this is the first report of the novel use of an ECG-gated CT to detect a leak point. We expect that this novel role of an ECG-gated CT can be applied to detecting the leak point of the whole arterial system where the leak flow is vulnerable to the blood pressure (ie, the cardiac cycle).

Disclosures

None.

References

Figure 4. Images acquired 1 day after Amplatzer plug insertion. Oblique coronal images reconstructed at the mid-diastolic phase (A) and early systolic phase (B) of the RR interval. No to-and-fro flow but only a small amount of leakage to the mostly thrombosed pseudoaneurysm is seen. White arrow shows the Amplatzer plug. P indicates pseudoaneurysm; AA, ascending aorta.
Pulsatile To-and-Fro Flow Detected by Contrast-Enhanced Electrocardiogram-Gated Computed Tomography: A Novel Method for Detecting the Leakage Point of a Pseudoaneurysm
Bohyun Kim, Joon-Won Kang, Choong Wook Lee, Dae Chul Suh, Jae Won Lee and Tae-Hwan Lim

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