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Systemic air-angiogram appearance caused by aortobronchial fistula in a cardiac arrest patient with ruptured aortic arch aneurysm

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ABSTRACT

Introduction: We report a very rare finding of air replacement of systemic arteries appeared as air-angiogram on radiographs and multi-detector computed tomography (MDCT). Case Report: A 70-year-old male suffered cardiac arrest after a massive hemoptysis and received endotracheal intubation and positive pressure ventilation. Chest and abdominal radiographs showed massive air in the heart, the aorta and the systemic arteries appeared as "air-angiogram". Postmortem multi-detector computed tomography images obtained shortly after death confirmed a ruptured aortic arch aneurysm and air replacement of the left heart chambers, the aorta and systematic arteries. Conclusion: Positive pressure ventilation causes massive air embolism in the patient with aortobronchial fistula secondary to the aneurysmal rupture.

Keywords: Aortic aneurysm, Aortobronchial fistula, Cardiac arrest, Cardiopulmonary resuscitation, Ruptured aortic arch aneurysm

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INTRODUCTION

Aortobronchial fistula is a fatal and rare condition characterized by the development of a communication between the aorta and the bronchial tree.

Massive hemoptysis occurs in more than 50% of patients with the fistula secondary to a ruptured thoracic aortic aneurysm [1]. We report a very rare finding of air replacement of systemic arteries appeared as air-angiogram on radiographs and multi-detector computed tomography (MDCT) in a cardiac arrest patient with massive hemoptysis

CASE REPORT

A 70-year-old male suddenly suffered massive hemoptysis at his home. On an arrival of our emergency department, the physicians who confirmed his asystole status without lacking clear post-mortem changes started the advanced cardiopulmonary resuscitation (CPR) procedures which included endotracheal intubation and positive pressure ventilation. The chest radiograph showed extensive consolidations in the lungs and massive air collection in the aortic arch, the left heart chambers (Figure 1).

The abdominal radiograph demonstrated air replacements of both the visceral arteries and the abdominal aorta overlying air-distended stomach (Figure 2). The physicians decided to cease the CPR in the patient because spontaneous circulation was not expected to be returned due to massive air embolism.

Post-mortem MDCT of the head and trunk shortly after death was performed to investigate the cause of death without intravenous contrast enhancement using the MDCT system (Aquilion 16; Toshiba Medical Systems, Ohtawara, Japan). The trunk from the neck to the pelvis was scanned with 16×1 mm collimation (16 detectors with 1-mm section thickness), a beam pitch of 0.9375, a rotation speed of 0.5 second, a table speed of 15.0 mm per rotation and a tube current determined by automated tube modulation (120 kVp). Images were reconstructed at the MDCT console to a section thickness of 5 mm. Referring previous MDCT images of the chest which had been obtained using the same system (Figure 3A), coronal reconstructed images from the post-mortem MDCT data confirmed a ruptured aortic arch aneurysm and air replacement of the left heart chambers, the aorta and systematic arteries (Figure 3B). Moderate amount of hematoma was observed near the aorta between the aortic arch and the descending thoracic aorta. But there was no hematoma in other portions. Most of blood in the artery and the left heart chambers were suggested to be drained into the bronchus as massive hemoptysis via a considerable large fistula between the distal aortic arch and the left main bronchus. Volume rendering image for isolating air structures (Figure 3C) was also generated to evaluate systemic air distribution by the post-processing software (Synapse 3D, Fuji-Film Medical Co., Tokyo, Japan).

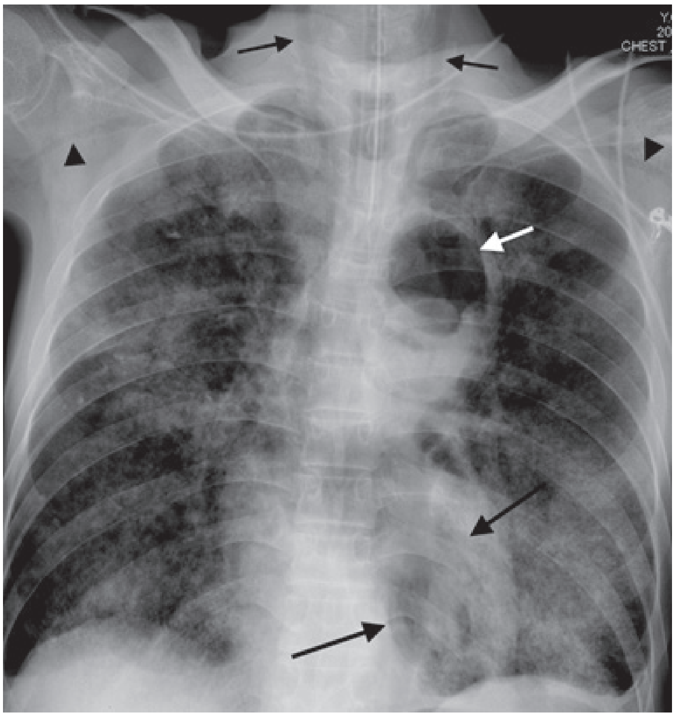

Figure 1: Chest radiograph showing systemic air angiogram appeared as air replacement of the aortic arch (white arrow), the left ventricle (black arrows), common carotid arteries (small black arrows), and axillary arteries (black arrowheads).

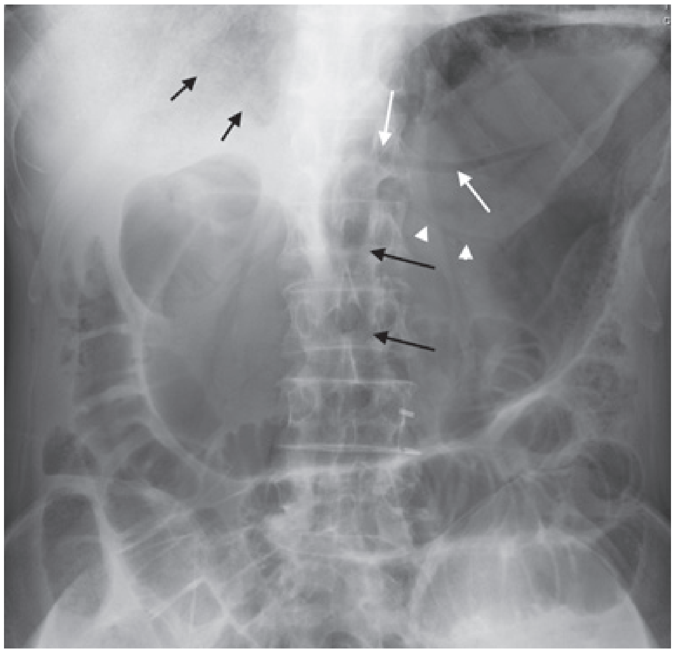

Figure 2: Abdominal radiograph showing air replacement of the splenic artery (white arrows), a branch of superior mesenteric artery (arrowheads), and abdominal aorta (black arrows) overlying the air-distended stomach and the common hepatic artery (small black arrows).

DISCUSSION

Aortobronchial fistula which is defined as a fistulous communication between the thoracic aorta and tracheobronchial tree occurs rarely. But it is required for emergent surgery when it is once detected [2]. Most commonly cause of the fistula is thoracic aortic aneurysm or dissection when expansion of the aneurysm causes tracheobronchial compression, chronic inflammation and adhesion [1]. In patients with aortobronchial fistula, hemoptysis can initially present in small amounts and intermittently but can become massive in more than half of the reported cases [1].

Massive arterial air embolism was reported to occur from the venous system via intrapulmonary shunts after intravenous infusion of massive air at a high flow [3]. Regarding massive arterial air embolism in this case, we assumed that positive pressure ventilation for 20 minutes forced to push massive air into the aorta and systemic arteries via aortobronchial fistula. Air replacement of the ascending thoracic aorta caused air embolism in the coronary arteries and reflux of air into

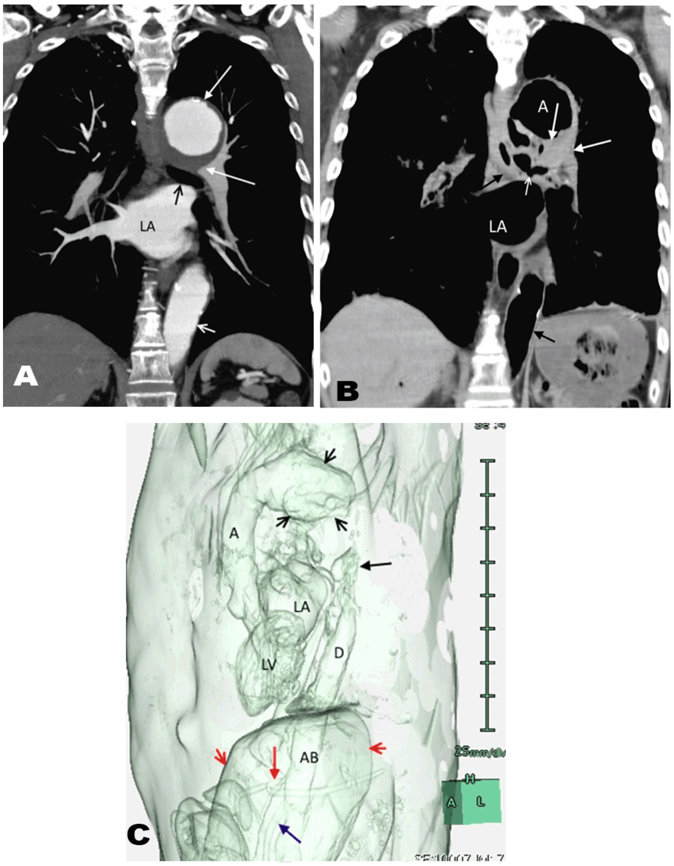

Figure 3: (A) Coronal MDCT image of the chest obtained one year before the onset of massive hemoptysis showing a 5-cm aortic arch aneurysm (white arrows) with a caudal thrombus adjacent to the left main bronchus (black arrows). LA; the left atrium, small white arrow; the descending thoracic aorta, (B) Coronal MDCT image of the chest obtained shortly after death showing air replacement of ruptured aortic arch aneurysm (A) with a suggestive fistula appeared as a small air projection (small white arrow) into the left bronchus filled with hemorrhage (large black arrow). Large white arrows; hematoma, small black arrow; the descending thoracic aorta, LA; the left atrium, (C) Left anterior oblique view of volume rendering image for isolating air structures after removal of the lungs. A; the ascending thoracic aorta, LA: the left atrium, LV; the left ventricle, DA; the descending thoracic aorta, AB; the abdominal aorta, small black arrows; aortic arch aneurysm, large black arrow; narrowed lumen of the descending thoracic aorta by hematoma, small red arrows; stomach, large red arrow; the celiac artery, large blue arrow; the superior mesenteric artery.

the left ventricle, the left atrium and the pulmonary veins in order. To avoid massive air embolism in patients with aortobronchial fistula, positive pressure ventilation in the resuscitation should be performed after selective intubation of the normal bronchus by a single- or double-lumen endotracheal tube [4].

The MDCT can be used for post-mortem imaging and has become a field of intensive study including quantitative evaluations. Jackowski et al. reported that post-processing algorithm using postmortem MDCT data is useful in generating a volume rendering images for isolating air structures and allows quantification of venous air embolism [5]. In this case, volume rendering images obtained using the algorithm provided excellent 3D visualization of the air within the vascular system.

CONCLUSION

In this report, we present a very rare finding of air collections in the aorta, systemic arteries and left cardiac chambers on radiographs and post-mortem MDCT in a patient who underwent positive pressure ventilation due to cardiac arrest by a rupture of an aortic arch aneurysm with aortobronchial fistula.

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Author Contributions
Izumi Torimoto – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Shigeo Takebayashi – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Hiroshi Manaka – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Kyota Nakamura – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Naoto Morimura – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor
The corresponding author is the guarantor of submission.

Conflict of Interest
Authors declare no conflict of interest.

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