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Case Report

Detection of arteriography-negative anterior spinal artery branching via intercostobronchial trunk confirmed by CT during intercostobronchial trunk arteriography: A case report

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ABSTRACT

Spinal cord ischemia is an important complication of bronchial artery embolization for hemoptysis. It has been reported even though a spinal artery was not visualized on arteriography. We could show a 67-year-old man with repeated hemoptysis. His hemoptysis gradually worsened and diagnosed with severe hemoptysis, and transarterial embolization was planned to stop the hemoptysis. An anterior spinal artery arising from intercostobronchial trunk confirmed by computed tomography during arteriography even though it was not visualized on arteriography. Great care should be taken with transarterial embolization via intercostobronchial trunk, potentially branching the spinal artery, even though it was not visualized on arteriography alone.

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Introduction

Transarterial embolization (TAE) is an effective treatment for hemoptysis [1–6]. TAE is a relatively safe procedure except for its neurologic complications due to spinal cord ischemia leading to transient or permanent paraparesis or paraplegia. The frequency of spinal cord ischemia is relatively high at 0%–6.5% [1–6].

However, several reports have shown that spinal cord ischemia occurred when a spinal artery was not visualized, even on a retrospective review of arteriography images [7–11]. Thus, these reports show the possibility of having an arteriography-negative spinal artery. Consequently, inadvertent TAE without being aware of having an arteriography-negative spinal artery leads to the development of spinal cord ischemia.

Herein, we report a patient in whom computed tomography (CT) during intercostobronchial trunk (ICBT)

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Fig. 1 – Chest CT shows multiple ground glass opacities in the entire lung lobes.

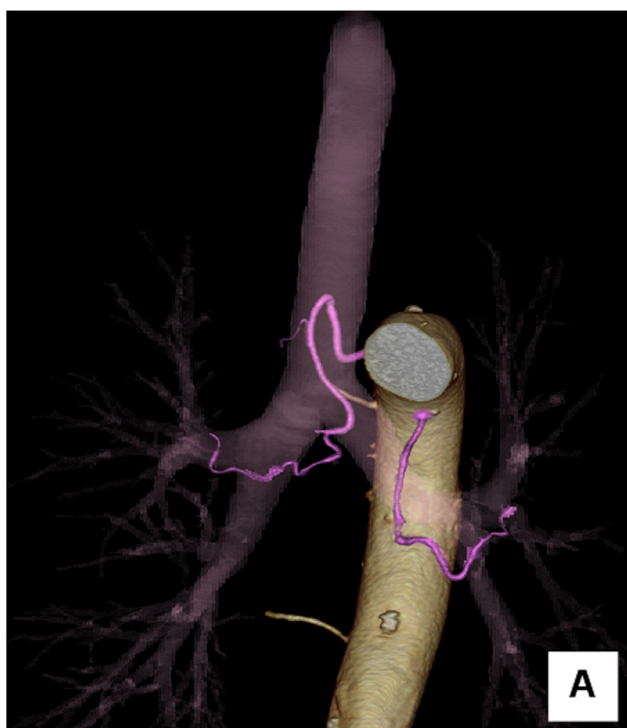


Fig. 2 – 3D-reconstructed image of contrast-enhanced CT shows an enlarged intercostobronchial trunk and left bronchial artery at an ordinary location.

arteriography could detect the arteriography-negative anterior spinal artery arising via the ICBT.

Case report

A 67-year-old man with a history of hemoptysis and bronchiectasis visited our hospital complaining of repeated



Fig. 3 – Arteriography of the intercostobronchial trunk shows an enlarged right bronchial artery and intercostal artery. The intercostal artery has several branches including dorsal branches and a radicular artery which curve towards the midline. However, a typical hair-pin curve leading to a spinal artery is not shown on careful review.

hemoptysis. The frequency of hemoptysis gradually worsened to 10 times a day, and the maximum amount of blood was about 100 ml. He was diagnosed with severe hemoptysis. Contrast-enhanced CT was performed, and 3D-reconstructed images were created. CT showed multiple ground glass opacities in the entire lung lobes (Fig. 1). The 3D-reconstructed images showed an enlarged ICBT and left bronchial artery at an ordinary location (Fig. 2). TAE was planned to stop the hemoptysis. The targeted vessels were the right bronchial artery via the ICBT and the left bronchial artery.

Arteriography was performed via the right femoral artery with a 4F sheath. ICBT arteriography showed an enlarged right bronchial artery and intercostal artery. The intercostal artery had several branches including dorsal branches and a radicular artery which curved towards the midline. However, a typical hair-pin curve leading to a spinal artery was not found by careful observation (Fig. 3). CT during ICBT arteriography showed a small vessel that ran into the intervertebral foramen which was considered a radicular artery (Fig. 4a). This vessel continued to the vertebral canal and ran cranially on

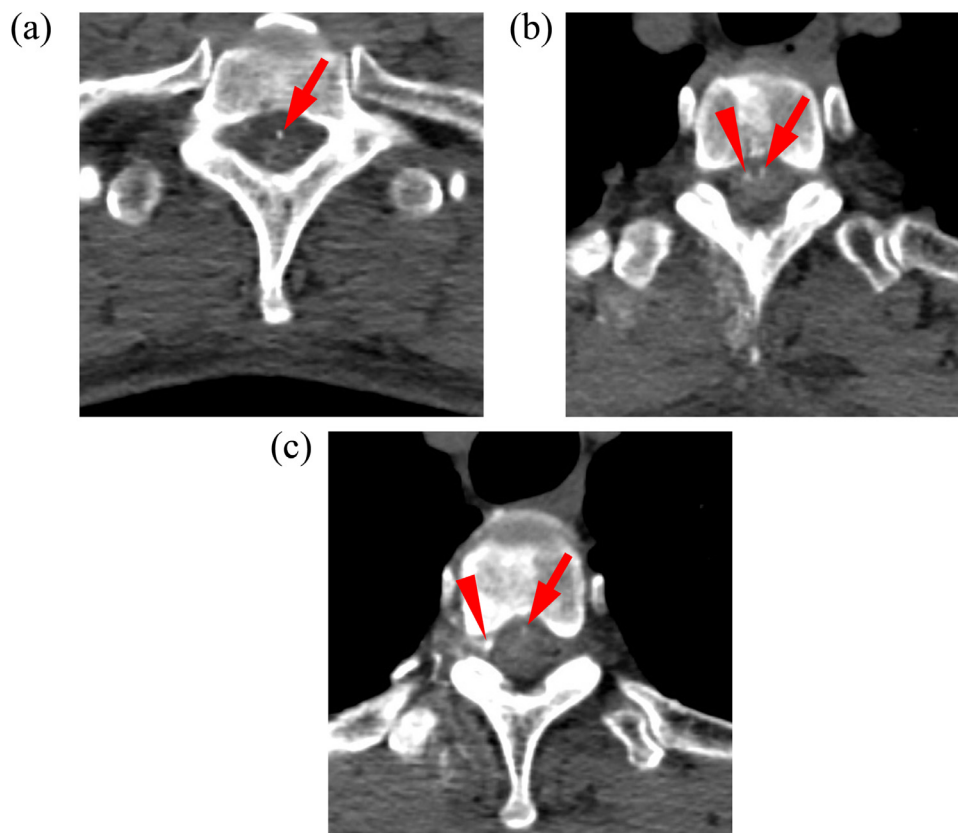


Fig. 4 – CT during intercostobronchial trunk arteriography. (A) A dot (arrow) enhancement continues craniocaudally on the anterior midline surface of the spinal cord considered to be an anterior spinal artery. (B) Another dot enhancement (arrowhead) concurs to the anterior spinal artery on the right anterior oblique surface of the spinal cord considered to be an anterior radiculomedullary artery. (C) The anterior radiculomedullary artery continues to the intervertebral foramen and concurs to an intercostal artery.

the right anterior oblique surface of the spinal cord which was considered a right anterior radiculomedullary artery (Fig. 4b). Then, the vessel concurred to the vessel that runs craniocaudally on the anterior midline surface of the spinal cord which was considered the anterior spinal artery (Fig. 4c). The 3D-reconstructed images based on the CT during the ICBT arteriography helped us to understand more clearly the vessel connections (Fig. 5).

To eliminate the risk of nontarget embolization of the anterior spinal artery, a detachable micro coil was selected as an embolic agent. During selective cannulation to the right bronchial artery via the ICBT, coil embolization was performed. Regarding the left bronchial artery, arteriography and CT during left bronchial arteriography confirmed the absence of a spinal artery, and TAE was performed using gelatin sponge particles. After the TAE, complications and spinal cord ischemia were not observed, and the hemoptysis was stopped.

Discussion

Traditionally, TAE is considered to be the optimal treatment for massive life-threatening hemoptysis [12,13]. Re-

cently, there has been a gradual increase in the number of TAE candidates as TAE is indicated not only for patients with massive hemoptysis but also for patients with mild to severe hemoptysis including repeated hemoptysis [14]. Although repeated hemoptysis is not life-threatening, it compromises the quality of life. TAE is also effective for repeated hemoptysis. However, the most important aspect in the treatment of repeated hemoptysis is to reduce the risk of spinal cord ischemia caused by TAE rather than to achieve complete hemostasis, as the goal of this treatment is to improve the quality of life.

Spinal ischemia is the most significant complication of bronchial embolization. Spinal cord ischemia is caused by the inadvertent embolization of a spinal artery. It is rather confusing that a spinal artery at the thoracic level does not arise from the peripheral part of the bronchial artery, but that it arises from the ICBT which is the proximal part of the bronchial artery or intercostal artery.

Regrettably, several authors have reported that the spinal artery was not visible on arteriography in patients who developed spinal ischemia [7–11]. These patients were presumed to have arteriography-negative spinal artery. Notably, the ICBT and intercostal artery are cumbersome vessels potentially branching as the anterior spinal artery [15]. The typical

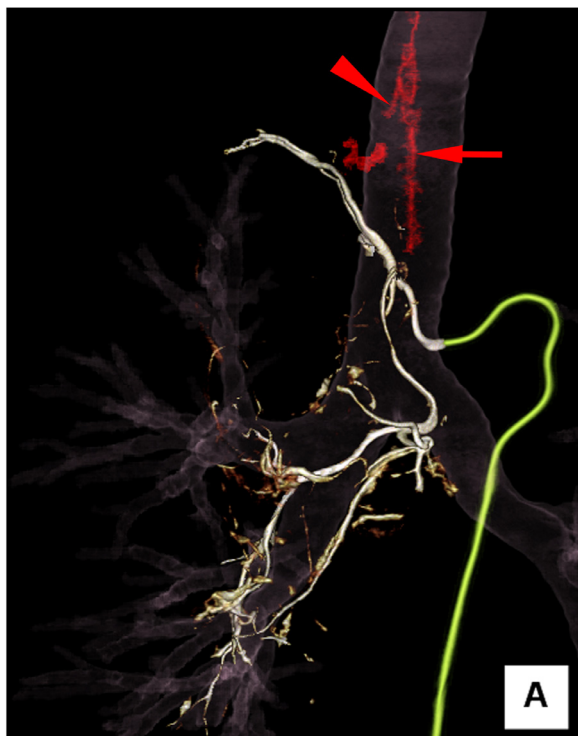


Fig. 5 – 3D-reconstructed image based on CT during intercostobronchial trunk (ICBT) arteriography shows a connection between the ICBT and the anterior spinal artery. The vessels are connected in the following order: ICBT, intercostal artery, radicular artery, anterior radiculomedullary artery (arrowhead), and anterior spinal artery (arrow).

arteriographical finding of the anterior spinal artery is a hair-pin curve consisting of an anterior radiculomedullary artery and the anterior spinal artery. Moteki et al. reported that intradural enhancement by CT during bronchial arteriography was detected in 38% of patients whose spinal artery was not visible on digital subtraction arteriography [16]. All the bronchial arteries with intradural enhancement were arising from ICBT. However, their report did not mention about the spinal artery and whether it was anterior or posterior. Maki et al. reported that CT during intercostal arteriography successfully detected the posterior spinal artery which was not visualized by arteriography [17]. In the present study, we found that CT during ICBT arteriography successfully detected the anterior spinal artery which was not visualized initially by arteriography.

These undetected spinal arteries were referred to as arteriography-negative spinal arteries. In these particular cases, embolization should be performed more carefully. Selective deep cannulation over the point of the branching spinal artery is mandatory. Embolization using a coil is more preferable than embolization using granular embolic agents including gelatin sponge, polyvinyl alcohol, and microspheres. During embolization using a granular embolic agent, the blood flow is gradually decreased. In certain occasions, the blood

flow changes dramatically. This results in a reflux of the granular embolic agent to the proximal branch and causes nontarget embolization [10]. In the present case, the anterior spinal artery was found by CT during ICBT arteriography, then embolization was carried out using micro coils to avoid spinal cord ischemia.

Conclusion

CT during ICBT arteriography is effective for the detection of an arteriography-negative anterior spinal artery.

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