Letter to the Editor

eISSN 2005-8330
https://doi.org/10.3348/kjr.2024.0311
Korean J Radiol 2024;25(7):684-686

Korean Journal of Radiology
KJR

Interventional Treatment for Iatrogenic Central Pulmonary Artery Injury Using a Vascular Plug and N-Butyl-2-Cyanoacrylate

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Keywords: Pulmonary artery injury; Vascular plug; N-butyl-2-cyanoaclylate

Pulmonary artery injury resulting from chest tube placement is rare and not commonly addressed in typical discussions on thoracic trauma, as summarized by Wong et al. [1]. Herein, we present a case of pulmonary artery injury caused by chest tube insertion that was successfully treated with a vascular plug and N-butyl-2-cyanoacrylate (NBCA). The Institutional Review Board of the National Cancer Center (IRB No. NCC2023-0324) approved this report and waived the requirement for written informed consent for publication.

A 65-year-old female with multi-metastatic ovarian cancer, previously treated with surgery and chemotherapy, presented to the emergency department with septic shock due to bowel perforation. She underwent exploratory laparotomy and primary repair of the small bowel, followed by treatment in the intensive care unit. A chest tube was inserted at bedside to drain the left pleural effusion. Immediately after the procedure, approximately one liter of blood leaked through the chest tube. CT revealed that the inserted chest tube had penetrated the lung parenchyma and reached the proximal part of the inferior lobar branch of the left pulmonary artery (Fig. 1A).

Pulmonary arteriography confirmed the presence of the tube in the pulmonary artery (Fig. 1A). As embolization of the pulmonary artery at this point would block blood flow to the entire left lower lobe, we decided to first attempt embolizing only the tract centered on the damaged area while preserving blood flow to the left lower lobe, if possible. Given the 10-F diameter of the inserted chest tube, it was replaced with a 9-F sheath (Flexor® Ansel Guiding Sheath, Cook Medical, Bloomington, IN, USA). During this exchange, considerable bleeding occurred through the tract, leading to a temporary drop in blood pressure that normalized after the sheath was placed. An 8-mm Amplatzer Vascular Plug (AVP) type II (Abbott Vascular, Santa Clara, CA, USA) was inserted through the sheath, allowing only the first disc to be released inside the vessel. The AVP was then slowly withdrawn to anchor the first disc portion of the AVP inside the damaged area of the vessel (Fig. 1B). Subsequently, the sheath was withdrawn to deploy the remaining two discs in the chest tube tract (Fig. 1C). The AVP was detached once pulmonary arteriography confirmed that the blood flow through the tract had ceased. Upon injection of the contrast agent through the sheath, multiple fistulae connected to the chest tube tract in the lung parenchyma were observed. A 5-F angiographic catheter was coaxially inserted into the sheath, a 1:2 mixture of NBCA and lipiodol was injected through the catheter to embolize the tract, and the sheath was slowly pulled out and removed (Fig. 1D). A subsequent left pulmonary arteriogram revealed no further bleeding and mostly preserved blood flow in the left lower lobe (Fig. 1E). A follow-up CT performed 2 days later confirmed successful embolization with preserved blood flow in the left lower lobe (Fig. 1F). Unfortunately, she died 10 days later from septic shock, unrelated to bleeding from the chest tube.

Although iatrogenic pulmonary artery injury due to chest tube placement is rare, it can have life-threatening consequences necessitating surgical intervention. With

Received: March 31, 2024 **Revised:** April 4, 2024
Accepted: April 5, 2024
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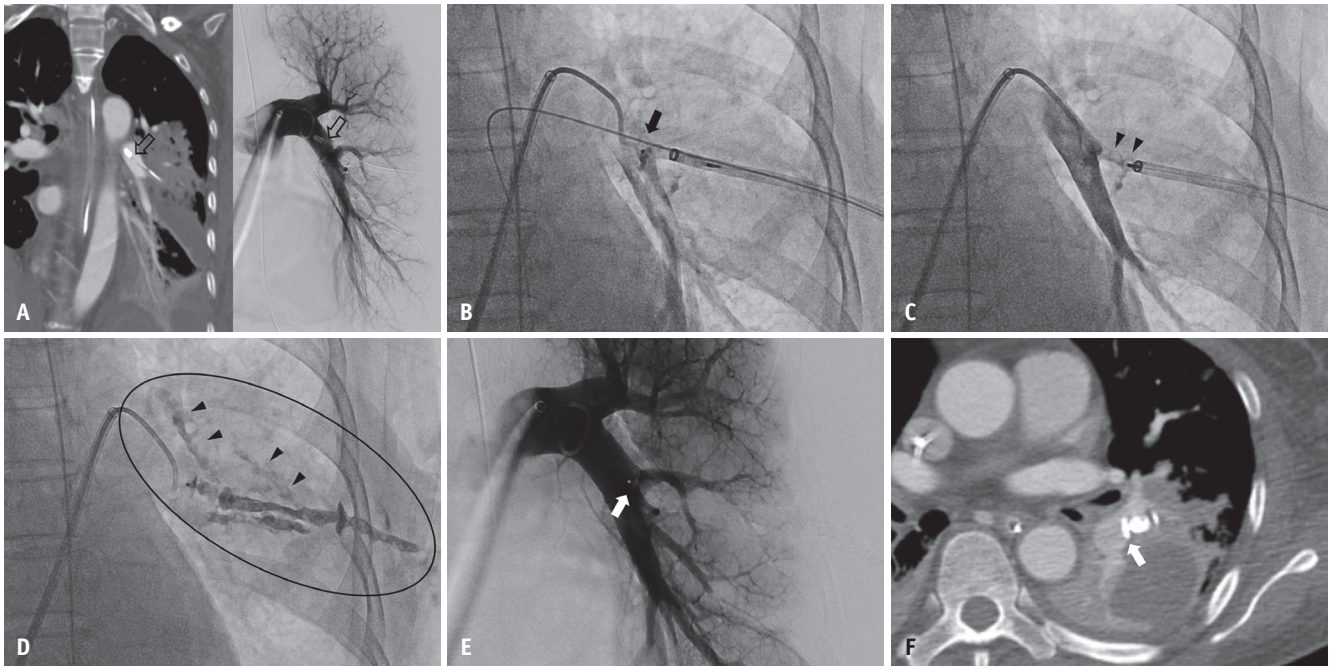

Fig. 1. Images from the case of a 65-year-old female with iatrogenic central pulmonary artery injury. **A:** The chest tube (arrows) penetrating the left lung parenchyma is visualized on the CT image (left image), a finding confirmed on pulmonary arteriography (right image). **B:** An 8-mm AVP type II is inserted through the sheath. The first disc (arrow) is released inside the vessel and is slowly withdrawn to anchor the first disc portion of the AVP inside the vessel. **C:** The sheath is withdrawn, and the remaining two discs (arrowheads) are deployed at the chest tube tract. Subsequently, the AVP is detached. **D:** The chest tube tract, along with multiple fistulae (arrowheads) connected to it, is embolized by injecting a 1:2 mixture of N-butyl-2-cyanoacrylate and lipiodol (ellipse). **E:** A subsequent left pulmonary arteriogram showed no further bleeding, with blood flow mostly preserved to the left lower lobe. The arrow depicts the first disc of AVP in the vessel. **F:** CT scan image taken 2 days later shows the AVP at the chest tube tract. Only the first AVP disc (arrow) is positioned in the pulmonary artery with preserved blood flow. AVP = Amplatzer Vascular Plug

technical advancements, many conditions that require surgery can be resolved through interventional treatment. Shigefuku et al. [2] reported a case of coil embolization for pulmonary artery injury caused by a chest tube. However, in the present case, the chest tube was not inserted into a branch vessel but into a large central pulmonary artery, and coil embolization could have led to extensive atelectasis and lung infarction. Therefore, our initial approach involved the embolization of the iatrogenic tract using AVP and NBCA. AVP has a dense mesh structure made of nitinol, which induces thrombus formation by altering the blood flow. This plug can only block blood flow proximally without directly embolizing the distal part of the vessel, making it easy to embolize short fistula tracts. The use of AVP in the present case was adapted from previous reports wherein an entry tear in aortic dissection was embolized with AVP [3,4]. AVP type II consists of three discs, allowing precise positioning at the injury site in the pulmonary artery. One disc was placed inside the vessel for anchoring and the other two were positioned appropriately in the outer tract of the vessel. NBCA is a liquid embolic agent that can be used for embolization of the transhepatic tract after portal venous access [5]. The combined use of AVP type II and NBCA allowed us to successfully embolize only the lung parenchymal tract while maintaining blood flow to the left lower lobe of the damaged pulmonary artery.

We described the interventional treatment of an iatrogenic central pulmonary artery injury that was successfully managed through the appropriate use of AVP type II and NBCA while maintaining blood flow in the pulmonary artery. This demonstrates a viable option for treating pulmonary artery injuries resulting from chest tube placement.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: In Joon Lee. Data curation: Lynda Nadine Gui-Bile, Raïssa Michelle Kabas, Beomsik Kang. Formal analysis: Lynda Nadine Gui-Bile, Raïssa Michelle Kabas, Beomsik Kang. Investigation: Lynda Nadine Gui-

 https://doi.org/10.3348/kjr.2024.0311

Bile, Raïssa Michelle Kabas, Beomsik Kang. Methodology: In Joon Lee. Project administration: Beomsik Kang, In Joon Lee. Resources: In Joon Lee. Supervision: In Joon Lee. Validation: In Joon Lee. Visualization: Lynda Nadine Gui-Bile. Writing—original draft: Lynda Nadine Gui-Bile. Writing—review & editing: Raïssa Michelle Kabas, Beomsik Kang, In Joon Lee.

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Funding Statement
None

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https://doi.org/10.3348/kjr.2024.0311