

# Delayed Pulmonary Artery Rupture after Using BioGlue in Cardiac Surgery

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A 56-year-old woman, who underwent cardiac surgery 3 months previously, presented to the emergency room with pulmonary artery rupture due to the cytotoxic effects of BioGlue (CryoLife Inc., Kennesaw, GA, USA). She was successfully treated with surgical management. Although surgical glue can be effectively used for hemostasis, it can induce delayed vascular complications. Therefore, surgical glue should be used cautiously.

**Key words:** 1. BioGlue  
2. Pulmonary artery  
3. Rupture  
4. Surgical adhesives

## Case report

A 56-year-old woman was referred to the emergency room (ER) because of an abrupt onset of chest pain, 8 hours before her presentation to the ER. Three months previously, she underwent aortic valve replacement and graft replacement of the ascending aorta at another hospital because of severe aortic regurgitation with an ascending aortic aneurysm. Her medical history showed no evidence of connective tissue disease. A 12-lead electrocardiogram showed ST elevation in leads V4–V6. During her stay in the ER, cardiopulmonary resuscitation was done for 3 minutes because of pulseless electrical activity. Coronary angiography (CAG) was performed to check for coronary artery disease; however, the findings were non-specific. She was referred to Gangnam Severance Hospital after CAG. Contrast-enhanced com-

puted tomography (CT) revealed extravasation of dye from the main pulmonary artery (MPA), suggesting rupture of the MPA, and a 77-mm hematoma around the ascending aorta (Fig. 1).

The patient underwent emergency surgery to repair the pulmonary artery and to evacuate the hematoma. In the operative field, no active bleeding was found around the prosthetic ascending aorta graft; however, there was a 1.5-cm longitudinal tear on the MPA. Around the tearing site, the tissue was soft and friable, and brownish foreign material was densely adhered to the vessel. However, the other neighboring tissue was firm and did not show inflammation or necrotic changes, so the tear was repairable without the use of other materials, such as pericardium or a Gore-Tex membrane (Fig. 2). After reviewing the medical records from the patient's previous operation, we found that the brownish material

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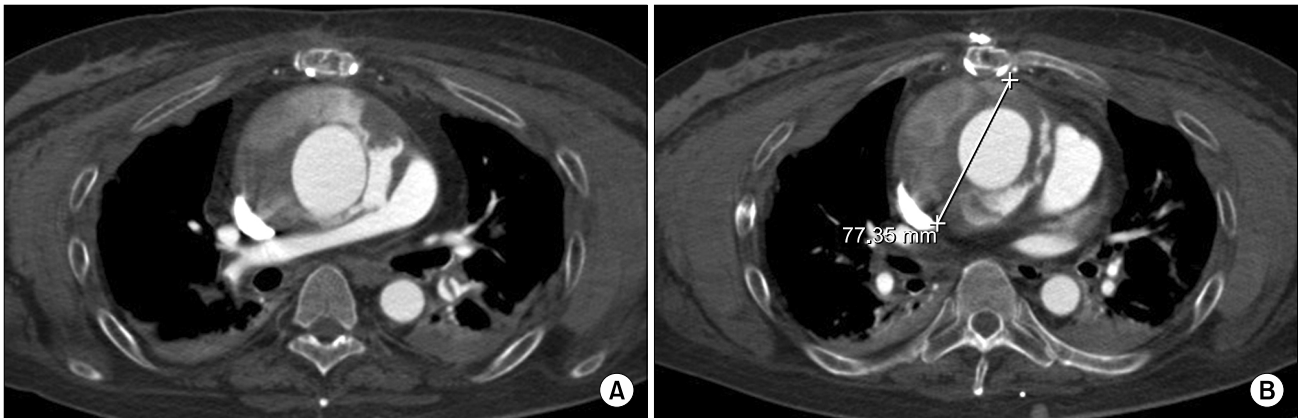


Fig. 1. (A, B) Chest computed tomography images showing a periaortic hematoma and contrast extravasation from the pulmonary artery.

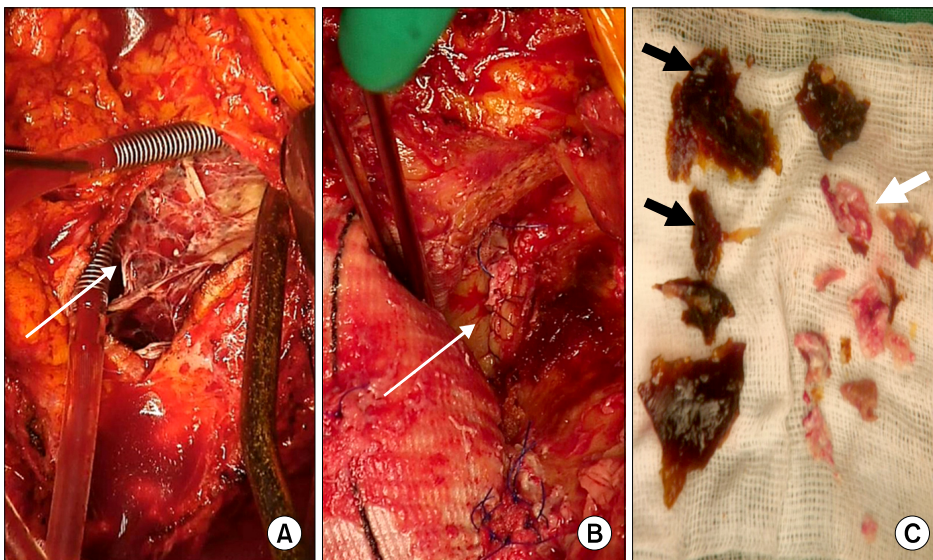


Fig. 2. Intraoperative findings. (A) Perivascular necrosis around the main pulmonary artery (arrow). (B) Pulmonary artery after primary repair (arrow). (C) Tissue debridement (white arrow) with BioGlue (black arrow).

around the tearing site was BioGlue (CryoLife Inc., Kennesaw, GA, USA). After blocking back-flow with a Foley catheter in the MPA, the necrotic MPA tissue was resected and repaired with continuous 3-0 Prolene sutures.

The patient was extubated on postoperative day 14 and moved to the general ward on postoperative day 21. Her follow-up chest CT showed a patent and firm pulmonary artery, and she was discharged without any other complications.

## Discussion

BioGlue (CryoLife Inc.) is an adhesive solution approved in 1998 by the Food and Drug Administration

for use in the United States for treating acute thoracic aortic dissections. It is composed of purified bovine serum albumin (45%) and glutaraldehyde (10%). Glutaraldehyde serves as a bridge between albumin molecules and binds albumin to tissue proteins. Thus, this reaction forms a permanent covalent bond between the tissues and adhesive. Linkage starts within 20-30 seconds, and the maximum bonding capability is reached in 3 minutes [1].

The use of biological glue has been reported to improve outcomes and reduce mortality from acute type A aortic dissections. Coselli et al. [2] reported that using BioGlue as an adjunct to repair aortic tissue showed superior results in terms of anastomotic bleeding compared with the control group. No major

differences were observed in adverse events such as stroke, death, and transfusion.

However, recent reviews have raised concerns about the rate of reoperations because of aortic wall necrosis and redissection. In 2001, Kazui et al. [3] reported 4 cases (7%) of redissection after acute aortic dissection repair; these cases were retrogradely extended to the aortic annulus and required root reconstruction. Tissue necrosis was noted at the application site of the glue, and a histopathological evaluation revealed the disappearance of medial smooth muscle, suggesting tissue necrosis. In addition, Luk et al. [4] reported 2 cases of pseudoaneurysm formation after BioGlue application. These cases also showed inflammatory reactions due to BioGlue itself on histopathology.

Polymerized BioGlue can still release glutaraldehyde, which is known to cause cytotoxic effects in the neighboring tissue, including aortic tissue, by inducing inflammation, edema formation, and necrosis at the site of application [5].

Complications of BioGlue embolization include coronary embolism, acute limb ischemia, cerebral embolism, and pulmonary embolism [6,7]. Moreover, the spillage of BioGlue can lead to complications due to the creation of masses, reactive fluid collections, and compression of adjacent structures [7,8].

In this case, pulmonary artery rupture occurred as a result of a chemical reaction with BioGlue. Some amount of the BioGlue that had been applied to the aortic root spread to the neighboring pulmonary artery and seemingly induced an inflammatory reaction. Although there are also other possibilities for explaining the MPA injury, such as mechanical laceration by dense BioGlue material or necrosis due to peri-aortic graft inflammation, the inflammatory changes were focal around the site where BioGlue was applied, and systemic inflammatory changes were not definitively present around the perigraft vessels. Therefore, a focal chemical reaction triggered by BioGlue is thought to have been the main reason for the necrotic changes in the MPA.

Furthermore, the adhered material (hematoma with BioGlue) between the aortic conduit and MPA was thought to have caused direct pressure on the ne-

crotic portion of the MPA. Consequently, repetitive pressure on the necrotic MPA seemed to induce MPA tearing. Because the pulmonary artery is exposed to less pressure than the aorta, the patient was able to survive for 9 hours from symptom onset despite the rupture.

Thus, surgical glue should be carefully used, because it can induce delayed complications, such as native vessel necrosis, dissection, and embolization.

### Conflict of interest

No potential conflict of interest relevant to this article was reported.

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