control chest CT scan was taken on the second postoperative day (Figure 2). It was recognized that the bullet had migrated to the left posteroinferior pulmonary artery. Nevertheless, throughout the patient's hospital stay, no signs of pulmonary embolism or infection could be observed. Pulmonary and laboratory test results were almost normal (aspartate aminotransferase, 33 IU/L; alanine aminotransferase, 20 IU/L; lactate dehydrogenase, 247 IU/L) on the second day. He was discharged 8 days after the emergency operation.

DISCUSSION

Pulmonary embolism after a gunshot wound is a very rare occurrence.¹⁻⁵ Most patients with gunshot wounds to the pulmonary artery do not reach the hospital, making these cases even rarer and more interesting. The number and size of bullets at the impact site might make migration easier, as in our patient. Most cases resulting in pulmonary artery embolization are results of gunshot wounds to the peripheral veins, and there is not a concomitant cardiac injury.² We thought that the bullet might have escaped into the pulmonary artery because of our finger pressure acting like a bottle opener on a wine cork. Embolism can be vague or insignificantly symptomatic, as in our patient. Pulmonary artery bullet emboli might cause pulmonary infarction, arterial wall erosion, and hemorrhage.¹ In such cases emergency or second-look surgical intervention is indicated, as in cases with massive bleeding and stubborn blood loss, bronchial injury with massive air leak, esophageal injury, pericardial tamponade, diaphragmatic injury, great vessel injury, and acute deterioration of the patient.²

Indications of bullet extraction from the branch of the pulmonary artery was not defined in the literature clearly.¹⁻⁵ The location of the bullet is important in deciding the type of management. Some authors suggest conservative treatment for asymptomatic patients.² At the same time, the stress of a secondary urgent surgical intervention was avoided in our patient. After the operation, no sign of embolism or late infection was observed. Because of these reasons, bullet removal in a second intervention was not attempted.

Bullet extraction indications from the pulmonary artery should be clearly defined individually, according to the location and size of the bullet, in each firearms victim. In patients with no exit wound from the body, bullet embolism must be considered.

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Mitral-aortic intervalvular fibrosa pseudoaneurysm resulting in the displacement of the left main coronary artery after aortic valve replacement

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Mitral-aortic intervalvular fibrosa (MAIVF) pseudoaneurysms are usually secondary to infection and common in patients with aortic valve replacement for infective endocarditis.¹ Because MAIVF pseudoaneurysms may lead to potentially perilous outcomes, such as rupture to the adjacent cardiac chamber or pericardium, alteration of the 3-dimensional structure of the mitral valve, or disturbance of coronary artery blood flow, the early detection of these pseudoaneurysms using periodic echocardiography or radiologic imaging is important. We describe a case of a MAIVF pseudoaneurysm 6 months after aortic valve replacement that resulted in displacement and compression of the left main coronary artery, causing symptoms of angina.

CLINICAL SUMMARY

A 35-year-old man was admitted with severe chest pain that developed abruptly while taking a shower. He had

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FIGURE 1. Preoperative TEE shows a large opening of the echo-free pouch (pseudoaneurysm) on the left ventricular outflow tract and a mosaic coloration into the pouch, caused by the turbulent flow (A, systolic phase; B, diastolic phase). The boundary of the pseudoaneurysm during the cardiac cycle (yellow arrow). LA, Left atrium; LV, left ventricle; pA, pseudoaneurysm.

FIGURE 2. Magnetic resonance and 3-dimensional reconstruction imaging show the spatial and anatomic relationship of the pseudoaneurysm and adjacent cardiac chamber. The left main coronary artery (asterisk) and left descending and circumflex coronary arteries (arrow) are displaced upward and compressed by the pseudoaneurysm. Ao, Aorta; LV, left ventricle; MPA, main pulmonary artery; pA, pseudoaneurysm.

a medical history of syphilis and infectious arthritis 3 years ago. Six months earlier, he had an aortic valve replacement with a mechanical prosthesis because of severe aortic regurgitation with multiple vegetations, namely, infective endocarditis. Postoperative transesophageal echocardiography (TEE) at that time showed a well-functioning prosthetic valve and intact normal cardiac chamber.

On the patient's admission, TEE showed a large MAIVF pseudoaneurysm between the main pulmonary artery and the anterior portion of the mitral annulus accompanied by mild to moderate mitral regurgitation (Figure 1). This pseudoaneurysm tended to expand in volume during systole (Figure 1, A-I), followed by a partial collapse during diastole (Figure 1, B-I). Color Doppler echocardiography demonstrated bidirectional flow during the cardiac cycle (Figure 1, A-2 and B-2). The left main coronary artery and the left descending and circumflex arteries were upward-displaced and compressed by this structure. Magnetic resonance and 3-dimensional reconstruction imaging provided a more precise spatial relationship of the intercardiac chamber (Figure 2). The workup results for coronary artery disease and infection were negative.

At operation, the region of the MAIVF was inspected after transverse aortotomy and explantation of the prosthetic aortic valve. The oval internal opening of approximately 3 cm was detected on the area between the mitral annulus and the interventricular septum, but the external shape of pseudoaneurysm could not be checked because of severe adhesion and was blocked by main pulmonary artery. A Dacron patch was used to repair the internal opening of the pseudoaneurysm, sutured to the aortic annulus and fibrotic rim. The patient was weaned from cardiopulmonary bypass uneventfully after reimplantation of the prosthetic aortic valve. An intraoperative TEE revealed complete closure of the opening of the pseudoaneurysm.

DISCUSSION

Because the area of the MAIVF (bounded by the anterior mitral annulus, posterolateral aortic root, and base of the left atrium) is susceptible to infection because of poor vascularization,² pseudoaneurysms in this portion are one of the catastrophic complications of infective endocarditis. Because of the expanding and pulsating cavity caused by exposure

to left ventricle pressure, pseudoaneurysms may cause distortion of the mitral valve, resulting in mitral regurgitation.³ The left coronary artery is stretched, leading to myocardial ischemic symptoms,⁴ and thrombus formation in the cavity may result in an embolic episode and subsequent rupture into the adjacent cardiac chamber or pericardium.

Although MAIVF pseudoaneurysms are usually detected using TEE, magnetic resonance imaging could provide the surgeon with more information on the spatial relationship to adjacent structures. Left ventriculography could also give the exact location and anatomic information of the pseudoaneurysm.

To avoid a possible injury to the coronary artery, we used the "patch ligation" technique, or closure of the aneurysm's neck by patch while the aneurysm itself remains intact, instead of resecting the aneurysm followed by closure of the defect.⁵ However, the aneurysmal sac was not resected, and the Dacron patch could be exposed to left ventricle systolic pressure with no adjacent structure dampening its pressure; thus, there is the possibility of delayed healing of the sutured area and rupture of the patch.

CONCLUSIONS

We report a case of coronary compression caused by a MAIVF pseudoaneurysm after aortic valve replacement for infective endocarditis. Scrupulous follow-up is important to detect this unusual complication of aortic valve replacement for infective endocarditis

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