Pulmonary Capillary Bleeding in a Patient with Severe Left Ventricular Failure after Acute Myocardial Infarction under Anti-thrombotic Therapy

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Abstract

A 52-year-old man who was admitted for cardiogenic shock after acute myocardial infarction developed severe left ventricular dysfunction despite reperfusion therapy with coronary stents. After the 40th hospital day, he started to have cough and pulmonary infiltrates. Antimicrobial therapies and subsequent prednisolone for bronchiolitis obliterans organizing pneumonia were ineffective. Bronchoscopic examination revealed diffuse pulmonary bleeding and exudation of hemosiderin-containing macrophages in bronchial lavage fluid. Pulmonary capillary bleeding has been reported in the terminal stage of patients with mitral stenosis in the pre-cardiac surgery era. This complication reemerges in patients with severe heart failure receiving intensive anti-coagulation therapy after implanting a sirolimus-eluting coronary stent.

Key words: pulmonary bleeding, heart failure, pulmonary capillary stress failure, sirolimus-eluting coronary stent, anti-thrombotic therapy

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Introduction

Pulmonary capillary stress failure, in which detachments of pulmonary capillary endothelium and alveolar epithelium and matrix thickening in basement membrane occur, is caused by elevations of pulmonary venous and capillary pressures in persistent left heart failure (1-3). Typical clinical pictures of pulmonary capillary stress failure had been observed in the patients with terminal-stage mitral stenosis (MS) in the pre-cardiac surgery era (4, 5). We describe a case with pulmonary bleeding in persistent severe left ventricular (LV) dysfunction after anti-thrombotic therapy following broad anterior myocardial infarction (AMI). This complication seems to be attributable to increased alveolar capillary stress after the development of mitral regurgitation from papillary muscle dysfunction. Intensive anti-thrombotic therapies (consisting of aspirin, ticlopidine and warfarin) given to prevent coronary thrombus formation after the implantation of sirolimus-eluting stent (6) and LV thrombus formation also seem to be involved in this complication.

Case Report

A 52-year-old man was transferred to our department for the treatment of cardiogenic shock, severe pulmonary edema and acute renal failure 3 days after the onset of acute coronary syndrome. He had been medicated for hypertension, diabetes and hyperlipidemia for 4 years. He had a history of smoking for 30 years. He started to have epigastralgia for 4 days and visited emergency room in his neighboring hospital. Since he developed orthopnea and his systolic blood pressure gradually fell to around 70 mmHg on the 3rd hospital day, he was transferred to our hospital. In our emergency room, his electrocardiogram showed sinus tachycardia (126/min), low voltage in limb leads, Q-wave and ST-
Figure 1. 12-lead electrocardiogram recorded in the emergency room shows sinus tachycardia (126/min), Q-wave and ST-segment elevation in precordial leads (V1-6). Low voltages in limb leads are also observed. 1 mV=10 mm.
Figure 2. Cardiac angiography findings; (A) Emergent coronary arteriogram on admission shows occlusion of proximal LAD artery and diffuse stenosis in LCX artery (indicated by arrowheads). Emergent percutaneous catheter angioplasty was performed to LAD and LCX. (B) Coronary angiogram at 1 month after the onset of AMI. Sirolimus-eluting stents were implanted to LCX. (C, D) Left ventriculography at 1 month after admission shows severely impaired and aneurysmal motion of anterior wall of LV. LV ejection fraction; 34 %, LV end-diastolic volume index; 160 ml/m², LV end-systolic volume index; 106 ml/m². Diastolic (C) and systolic (D) phase.

Discussion

Pulmonary capillary bleeding in patients with heart failure typically had been observed in end-stage MS in pre-cardiac surgery era (4, 5). Elevation of left atrial pressure generates backward hemodynamic effects resulting in the increases of pulmonary venous and capillary pressures (2). These hemodynamic effects are responsible for the injuries of vascular endothelium in lung capillaries and alveolar epithelium (1-4). This is currently termed as ‘pulmonary capillary stress failure’ (1-4). The patient in this report was afflicted with this complication around 40 days after the onset of AMI although he did not have MS. In spite of intensive treatment, this patient continued to show poor cardiac performance. Follow-up cardiac catheterization study revealed the development of severe mitral regurgitation as judged from the emergence of highly elevated PCWP (Fig. 3).

Cardiac chamber remodeling, adaptive responses to elevated pressure and volume overload after AMI, are considered to affect the prognosis (7). Recent studies have revealed that remodeling processes also occur in the blood gas barrier, which consists of endothelium of pulmonary capillaries, alveolar epithelium and the basement membrane (1-4). Chronic elevation of pulmonary capillary pressure from hemodynamic backward effects of LV dysfunction exposes the alveolar membrane to a stress-failure process. This process consists of increased collagen IV synthesis leading to thickening of basement membrane, loss of capillary endothelium and detachment of alveolar epithelium (1-4). Severe in-
Figure 3. Changes in PCWP and chest x-ray on emergent admission (A) and 1 month after treatment (B). (A) Marked pulmonary congestion and elevation of PCWP were observed on admission. (B) Persistent elevation of PCWP and the development of new v-wave, suggesting the development of mitral regurgitation due to insufficient papillary muscle function, whereas pulmonary congestion had been compensated.

Figure 4. Changes of pulmonary infiltrates in the middle and lower lung fields. Abnormal shadows appeared around 40 days after the onset of AMI (A). These infiltrates were resistant to antibiotics and steroid treatments (B). After the discontinuation of anti-thrombotic medication, improvement of pulmonary infiltrates was observed (C).
juries of capillary endothelium and alveolar epithelium were observed over 32.5 cmH2O in an experimental pulmonary capillary hydrostatic pressure animal model (8). Although the critical pulmonary capillary pressure in humans is unclear, in the present patient continuous elevation of PCWP around 45-50 mmHg seemed to injure pulmonary capillary
structures. This persistent hemodynamic deterioration may be involved in the occurrence of pulmonary bleeding (Fig. 3).

Another inducing factor for pulmonary bleeding in this patient may include anti-thrombotic therapy. Since the patient underwent percutaneous coronary angioplasty using sirolimus-eluting stents, continuation of aspirin and ticlopidine administration was required (6). Furthermore, since he developed LV aneurysm with severely impaired systolic function, we also administered warfarin. Although the intensity of warfarin control was within the therapeutic range, this patient experienced bleeding only in the lung (9) after more than 1 month from the onset of AMI. However, this patient did not show any other systemic bleeding complication. In addition, levels of vitamin K-dependent coagulation factors such as II, VII, IX and X were normal.

Currently, we may have more opportunities to execute intensive anti-thrombotic therapy since we have increasing chances to implant sirolimus-eluting coronary stent. Antiplatelet therapy such as the administration of ticlopidine for several months is mandatory to prevent coronary thrombus formation until re-endothelialization. Although it is not known whether these anti-thrombotic agents worsen pulmonary capillary stress and increase the incidence of pulmonary bleeding, it will be necessary to consider the possibilities of this complication especially in patients with a marked PCWP elevation. This case may suggest the substantial need of further experimental study to investigate the safety of anti-coagulation and anti-platelet agents under highly increased PCWP in patients with heart failure.

References


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