Effectiveness of Nitroglycerin in Managing Subacute Lung Bleeding Induced by Balloon Pulmonary Angioplasty

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Summary
Lung bleeding (LB) and hemoptysis is a common but life-threatening complication of balloon pulmonary angioplasty (BPA) for chronic thromboembolic pulmonary hypertension. LBs related to BPA mostly occur acutely during BPA session. Therefore, it can usually be managed with occlusion balloon or other catheter-based approaches. While LB also develops subacutely after BPA session, the pharmacological option to subacute LB is currently limited. Here, we present a case of subacute LB which can be managed with intravenous administration of nitroglycerin. Nitrate mediated venous dilation can be an effective therapeutic option in managing LB and hemoptysis after BPA session.

Key words: Chronic thromboembolic pulmonary hypertension, Catheter treatment, Hemostasis

Hemoptysis due to lung bleeding (LB) is a major, life-threatening complication of balloon pulmonary angioplasty (BPA) for chronic thromboembolic pulmonary hypertension (CTEPH). There are two types of LB related to BPA. One is acute LB which occurs during BPA session. Most LBs related BPA develop acutely, and are chiefly induced by wire perforation. The other is subacute LB, which is usually induced by oozing rupture of the pulmonary artery (PA). To achieve hemostasis in the management of acute LB, we most commonly use a wedging catheter, balloon inflation, and/or infiltration of gelatin sponge within the culprit vessel. While several catheter-based approaches are available to acute LB, pharmacological options to subacute LB are limited except for the infusion of protamine infusion. Thus far, an effective method of achieving hemostasis or reducing the amount of bleeding for subacute LB is not established. Here, we present a case in which intravenous administration of nitroglycerin was effective in the management of subacute LB after BPA session.

Case Report
A 70-year-old woman with dyspnea lasting for four years was referred to our hospital four months ago. Based on the examinations in our hospital, she was diagnosed with CTEPH. Her mean pulmonary artery pressure was 33 mmHg. Riociguat was administered, whereas she discontinued due to the pyrosis. At her desire, we planned to perform BPA procedure. Because her lung perfusion scintigram chiefly defected in the left lung, we treated her left lung in initial BPA session. We performed BPA to a web type lesion of segment A4 using a 3.0 mm diameter balloon (Figure 1). We subsequently performed BPA to the other 12 vessels in left lung, following which, her vital signs remained stable with inhaled oxygen, and she returned to her ward. One hour after BPA procedure, hemoptysis developed and her oxygen saturation rapidly worsened to around 80% despite high concentration oxygen inhalation, while carbon dioxide concentration in arterial blood did not retain. The chest X-ray and CT images revealed consolidation in her left lung (A4) consistent with subacute LB (Figure 2A). We applied noninvasive positive pressure ventilation (NPPV) and administered high concentration oxygen, which prevented further deterioration of her arterial saturation. However, it was not helpful in the management of hemoptysis. We then injected nitroglycerin intravenously. Notably, hemoptysis improved, and her oxygen saturation normalized after administering nitroglycerin. We further injected nitroglycerin continuously, and lung bleeding did not develop afterward. Her general status significantly improved, and we could perform another BPA procedure in the following week.

Discussion
Since BPA was technically refined in 2012, its procedure is currently becoming one of the therapeutic options in the management of CTEPH. Thus far, BPA can treat...
severe cases.\(^5,6\) LB is one of the serious complications in BPA procedures. Most LBs are induced by guidewire perforation which elicits acute LB and hemoptysis (1). In managing acute LB, we have several catheter-based approaches to achieve hemostasis including a wedged catheter, balloon inflation, embolization with gelatin sponge, and/or insertion of a covered stent within the culprit vessel.\(^2,7\) All these methods have to be performed in a catheter laboratory. While subacute LB, which results from overdilatation of pulmonary artery,\(^1\) usually occurs outside a catheter laboratory, protamine infusion is available for LB,\(^2\) yet the efficacy is limited. In our case, 3.0 mm balloon might be oversize to PA of A4, and protamine was not used because heparin was injected about 4-5 hours before.

During hemoptysis, patient’s mPAP can usually be elevated, it makes LB worse. The efficacy of venous dilatation of nitroglycerin resulted in reducing mPAP and ameliorated subacute LB. While systolic blood pressure has to be carefully observed during nitroglycerin administration, the case presented in this manuscript showed that nitroglycerin has a potential to be one of the pharmacological options in the management of subacute LB. Part of the effects of nitroglycerin administration in our patient may be a decrease in the intravascular pressure in PA A4 branch. A4 branch of PAs perfuses superior and anterior portion of the left lingular segment of the left lung. Therefore, the therapeutic effects of nitroglycerin may be mediated through a reduced venous return or the redistribution of the intravascular fluid to the A4 branch of PAs.

**Conclusion:** Intravenous administration of nitroglycerin has a potential to be an effective pharmacological approach in the management of subacute LB after BPA procedures.

**Disclosures**

**Conflicts of interest:** none.
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