Case Report

A Case of Primary Pulmonary Hypertension with Pulmonary Tumor

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A 64-year-old female with a 9-year history of primary pulmonary hypertension developed a solid pulmonary tumor. Partial lung resection was planned for diagnosis. Although prostacyclin was increased to 8 ng/kg/min, she did not tolerate the decubitus position and one-lung ventilation, and her pulmonary arterial pressure rose to 110/45 mmHg. While she underwent partial resection under two-lung ventilation in the decubitus position, bleeding occurred from the suture line closed by a linear stapler and was controlled by additional sutures. She was discharged home without postoperative complications on postoperative day 15. The pathological examination revealed a bronchioloalveolar carcinoma. If pulmonary resection becomes necessary in a similar patient, we will plan a partial resection with the patient in a supine position to prevent elevation of pulmonary arterial pressure. (Ann Thorac Cardiovasc Surg 2010; 16: 270–272)

Key words: lung, primary pulmonary hypertension, pulmonary arterial pressure, perioperative hemodynamics, adult

Introduction

Recently, the introduction of new drugs such as prostacyclin (PGI_2) has improved the prognosis of primary pulmonary hypertension (PPH).[1)] The number of cases of pulmonary resection in patients with PPH is expected to increase. We herein report the case of a patient with PPH who underwent partial resection of the lung for lung cancer. We describe in detail the effects of the decubitus position, one-lung ventilation, and surgical procedure on perioperative hemodynamics.

Case

A 64-year-old female with a 9-year history of progressive breathlessness on exertion visited a clinic in 2004. Right cardiac catheterization revealed that pulmonary arterial pressure (PAP), pulmonary vascular resistance, and pulmonary capillary wedge pressure were 53/28(38) mmHg, 594 dyn·sec·cm^{-5}, and 12 mmHg, respectively. Lung perfusion scintigraphy showed no segmental defect. From these results she was diagnosed as primary pulmonary hypertension (PPH) and was prescribed bosentan, beraprost, and warfarin. A solid pulmonary tumor was found in 2007. Partial resection of the lung for suspicious primary lung cancer was planned. On admission for surgery, all tumor markers were within normal limits. Arterial blood gas analysis of room air showed that PaO_2 was 74.6 mmHg and SpO_2 95.2%. A chest X-ray showed prominent pulmonary arteries. An electrocardiogram showed an increasing R wave, a negative T wave of V1-2, and a deep S wave of V5-6, findings consistent with right ventricular hypertrophy. The preoperative right cardiac catheterization showed that mean PAP, cardiac output, and cardiac index were 40 mmHg, 3.50 l/min, and 2.41 l/min/m^2, respectively. Computed tomography showed a solid lung tumor measuring 13×12 mm under the pleura in segment 1 of the right upper lobe. Primary lung cancer was suspected, and

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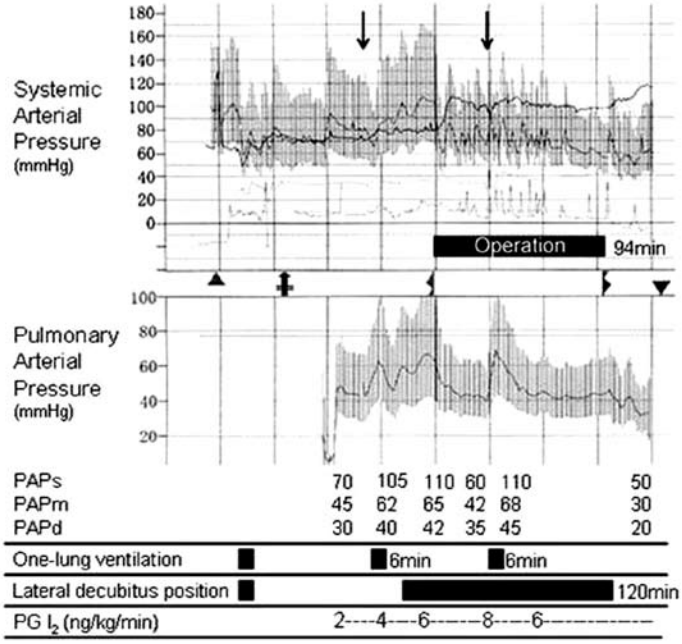

Fig. 1. Intraoperative hemodynamics. The arrows represent the onset of one-lung ventilation.
PAPs, systolic pulmonary arterial pressure; PAPm, mean pulmonary arterial pressure; PAPd, diastolic pulmonary arterial pressure; PGI_2, prostacyclin

video-assisted partial lung resection was planned.

Figure 1 represents the intraoperative hemodynamics. After intubation with a double-lumen endotracheal tube, a pulmonary arterial catheter was inserted and PAP was monitored. With intravenous prostacyclin (PGI_2) at a rate of 2 ng/kg/min, PAP was 70/30 mmHg. Before the operation, one-lung ventilation was tested with the patient in the supine position. Six minutes later, it was discontinued because PAP rose to 105/40 mmHg, and the systolic systemic arterial pressure fell to 90 mmHg, from 130. Under two-lung ventilation, the patient was then placed in the left lateral decubitus position. Her PAP rose to 110/42 mmHg, from 70/30. After the administration rate of PGI_2 was increased to 6 ng/kg/min, PAP fell to 60/35 mmHg. A minithoracotomy was begun under two-lung ventilation. One-lung ventilation was started for the purpose of lung resection after PGI_2 was increased to 8 ng/kg/min. However, it was discontinued six minutes later because her PAP rose to 110/45 mmHg and systemic arterial pressure decreased. Partial lung resection with linear staples was performed while the right lung was ventilated and held with forceps. A portion of the suture line broke, and a hemorrhage from the pulmonary artery occurred (Fig. 2). The surgery was converted to a standard thoracotomy. Sutures of absorbable monofilament were added, and the bleeding was controlled. When the operation ended, PGI_2 was administered at a rate of 6 ng/kg/min, and PAP was 50/20 mmHg.

Oral intake of bosentan and beraprost was resumed on the first postoperative day, and PGI_2 dosage was gradually tapered. The mean PAP was within 35-40 mmHg until the pulmonary arterial catheter was removed on postoperative day 4. Oxygen administration via nasal cannula was discontinued on postoperative day 10 when the room air SpO_2 was 95%. The patient was discharged home without postoperative complications on postoperative day 15. The pathological examination revealed a bronchioloalveolar carcinoma, Noguchi classification type B. The surgical margin was free, and the background lung tissue showed no significant pathological changes, such as proliferation of capillary vessels involving the alveolar septa.

Discussion

The median survival time for PPH from the time of confirmed diagnosis is reportedly less than 3 years, and the 5-year survival rate is about 40%; the prognosis is progressive and poor.[2] However, this prognosis has been improving

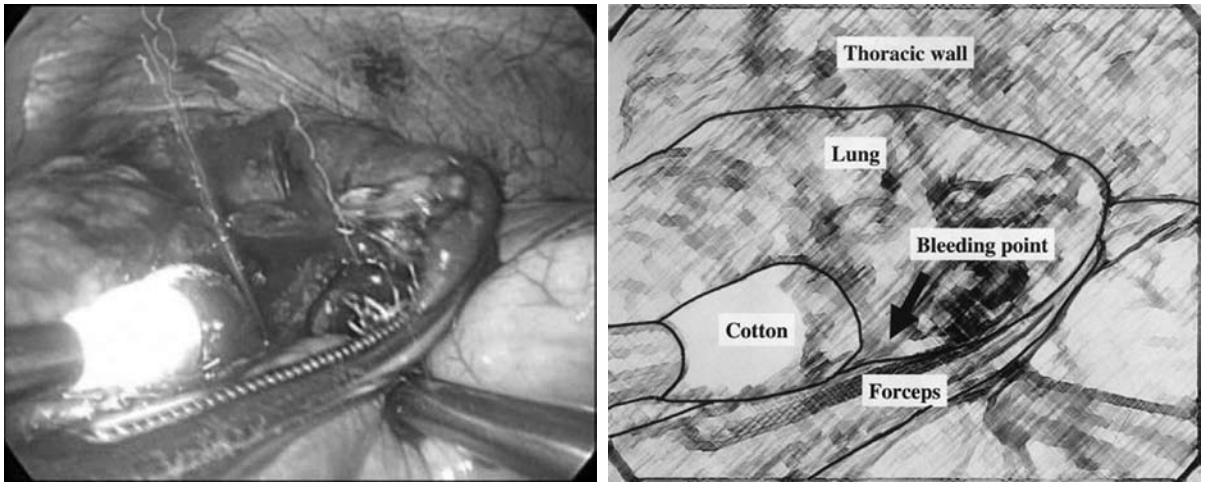

Fig. 2
a: A portion of the suture line broke, and blood spouted from the pulmonary artery.
b: The schema of Fig. 2a.

since the recent development of treatments such as PGI_2.[1] Therefore the number of cases of pulmonary resection in patients with PPH is expected to increase.

Pulmonary resection for patients with PPH is assumed to carry high morbidity and mortality[3]; pulmonary resection for patients with secondary pulmonary hypertension, such as severe emphysema and surgically reduced lung volume, has been performed safely.[4] We know of no report describing the perioperative hemodynamics in patients with PPH who underwent partial lung resection. Intraoperative management should include the prevention of exacerbating factors, such as hypoxemia, hypercapnia, acidosis, hypothermia, hypervolemia, and increased intrathoracic pressure.[5] In our case, one-lung ventilation and the lateral decubitus position individually raised PAP, presumably because each of these factors could cause a decrease in the pulmonary vessel bed and a disproportion in pulmonary circulation. When we disregarded the administration rate of PGI_2, one-lung ventilation in the supine position for 6 minutes raised systolic PAP by 35 mmHg; meanwhile, one-lung ventilation in the lateral decubitus position for 6 minutes raised it by 50 mmHg. The patient tolerated one-lung ventilation for no more than 6 minutes, when she developed right heart failure. From this experience, a patient with PPH is not very likely to tolerate one-lung ventilation and the lateral decubitus position simultaneously. In future surgeries, we will place a patient with PPH in the supine position and perform pulmonary resection with a small thoracotomy to minimize PAP elevation and the risk of bleeding from pulmonary arteries.

Pulmonary resection in the case of a patient with primary pulmonary hypertension is a high-risk procedure, so it is important to adequately consider the surgical procedure, perioperative management, and body position to optimize patient's safety.

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