Three-Dimensional Structure of Pulmonary Capillary Vessels in Patients With Pulmonary Hypertension

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Pulmonary arterial hypertension, pulmonary veno-occlusive disease, and pulmonary capillary hemangiomatosis are included in the same group (group 1) of clinical classification of pulmonary hypertension.1 Histological changes in the small pulmonary arteries (ie, intimal fibrosis and medial hypertrophy) are similar in these 3 diseases, and clinical presentations of the 3 diseases are often indistinguishable.1 However, it is estimated that the hemodynamics of capillary vessels are quite different in each disease. The hemodynamics of capillary vessels (ie, capillary occlusion) play an important role in cardiovascular diseases.2 Thus, clarification of the differences in the hemodynamics is essential to understand the pathophysiology of these 3 diseases.

We obtained lung segments from patients with pulmonary hypertension who underwent living-donor lung transplantation and from patients with bronchogenic carcinoma who underwent lobectomy as described previously.3 All experiments were performed after approval was obtained from the Human Ethics Committee of Okayama University, and written informed consent was obtained from all patients before the procedure. We succeeded in visualization of the 3-dimensional structure of the pulmonary capillary in patients with pulmonary arterial hypertension, pulmonary veno-occlusive disease, and pulmonary capillary hemangiomatosis using scanning electron microscopy of blood vascular casts.4

A 20-year-old man who underwent lobectomy for bronchogenic carcinoma. Figure 1A shows hematoxylin-eosin staining of a normal pulmonary artery. Blood vascular architecture in the most distal area from the carcinoma in the resected lobe shows a normal capillary network around the alveolus of the lung (Figure 1B).

A 20-year-old man underwent lung transplantation for idiopathic pulmonary arterial hypertension. The blood vascular architecture resembled dead branches. The small vessels were severely stenosed and were often occluded (Figure 2A), and the capillary was deficient (Figure 2B).

A 27-year-old man underwent lung transplantation for pulmonary veno-occlusive disease. The small pulmonary veins were stenosed (Figure 3A), and capillary vessels were swollen compared with a normal capillary (Figure 3B).

A 14-year-old boy underwent lung transplantation for pulmonary capillary hemangiomatosis. A proliferation of capillaries was seen (Figure 4A), and the capillary vessels resembled a tumorous cluster (Figure 4B).

Scanning electron microscopic study of blood vascular casts revealed the differences in the 3 diseases. Pulmonary arterial hypertension was characterized by a deficient capillary network, pulmonary veno-occlusive disease by swollen capillary vessels, and pulmonary capillary hemangiomatosis by a tumorlike outgrowth of capillaries. To the best of our knowledge, this is the first report on differences in the 3-dimensional structure of capillary vessels in normal controls, pulmonary arterial hypertension, pulmonary veno-occlusive disease, and pulmonary capillary hemangiomatosis using scanning electron microscopy of blood vascular casts. These findings provide an insight into the basic mechanism responsible for pulmonary hypertension.

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Disclosures
None.

References

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Figure 1. Images of normal control microvessels. A, Hematoxylin-eosin staining of a small pulmonary artery (*). Bar=200 μm. B, Scanning electron micrograph of blood vascular casts. Bar=200 μm.

Figure 2. Images of microvessels from a patient with pulmonary arterial hypertension. A, Hematoxylin-eosin staining of small pulmonary arteries (*). Bar=200 μm. B, Scanning electron micrograph of blood vascular casts. A deficient capillary network is seen. Bar=1 mm.
Figure 3. Images of microvessels from a patient with pulmonary veno-occlusive disease. A, Masson’s trichrome staining of a small pulmonary vein (*). Bar=200 µm. B, Scanning electron micrograph of blood vascular casts. Swollen capillary vessels are seen. Bar=200 µm.

Figure 4. Images of microvessels from pulmonary capillary hemangiomatosis. A, Hematoxylin-eosin staining of small pulmonary vessels. Bar=200 µm. B, Scanning electron micrograph of blood vascular casts. Tumorlike outgrowth of capillary vessels is seen. Bar=1 mm.
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