CASE REPORT

Postoperative Lung Perfusion with Anomalous Origin of One Pulmonary Artery from the Aorta

Yasunobu Miki,1 MD, Kenji Waki,1 MD and Yoshio Arakaki,1 MD

Summary
Pulmonary artery damage is difficult to estimate in a patient with one pulmonary artery from the aorta, and the pulmonary artery of anomalous origin is usually damaged. We describe a newborn patient with anomalous origin of the right pulmonary artery from the aorta who presented with significant lung perfusion at the anastomotic site 6 months postoperatively; the left/right perfusion ratio was 10:90 on a scintigram. The unbalanced left/right lung perfusion gradually improved over a number of years. In a newborn patient with anomalous origin of one pulmonary artery from the aorta, unbalanced lung perfusion may improve.

(Int Heart J 2018; 59: 1166-1168)

Key words: Pulmonary artery damage, Unbalanced lung perfusion, Newborn, Scintigram

Anomalous origin of one pulmonary artery from the aorta is a rare congenital cardiac anomaly, and it is frequently associated with other cardiac malformations.1–3 A pulmonary artery originating from the aorta is usually more damaged by systemic pressure than a normally connected pulmonary artery. Sequential change in postoperative lung perfusion remains unclear. We describe a newborn patient with anomalous origin of one pulmonary artery from the aorta, who presented with significant lung perfusion of the anastomotic artery 6 months postoperatively, and exhibited an improvement in unbalanced lung perfusion over a number of years.

Case Report
A female newborn was delivered at 40 weeks of gestation. Her birth weight was 3098 g and her 1-minute Apgar score was 8. She was admitted to our hospital because the oxygen saturation of her legs was 90%. She had slight tachypnea. Chest radiography showed the left lung perfusion was larger than the right (Figure 1A). Echocardiography revealed anomalous origin of the right pulmonary artery from the aorta, aortic coarctation, and patent ductus arteriosus. Preoperative catheterization confirmed supra-systemic right ventricular pressure; the pulmonary to systemic pressure ratio was 1.22. A left ventriculogram showed a stenosed right pulmonary artery from the aorta (Figure 1B) while the right ventriculogram showed only the left pulmonary artery, patent ductus arteriosus, and descending aorta (Figure 1C).

When the patient was 21 days old, we performed a right pulmonary artery anastomosis to the main pulmonary trunk, coarctation repair, and patent ductus arteriosus ligation. Cardiac catheterization 6 months postoperatively showed improvement of the right ventricular pressure; the left and right pulmonary artery pressures were 46/11 mmHg and 35/10 mmHg, respectively, and the pulmonary to systemic pressure ratio was 0.61 (Table). The right ventriculogram showed no stenosis in the right pulmonary artery and poor circulation in the left pulmonary artery. Scintigraphy indicated that the left/right lung perfusion ratio was 10:90 (Figure 2A). Chest radiography showed a significant increase in right lung perfusion (Figure 2C).

At 1, 4, and 10 years postoperatively, the left/right lung perfusion ratios, based on scintigrams, were 39:61 (Figure 2B), 49:51, and 54:46, respectively. The unbalanced left/right lung perfusion gradually improved.

Cardiac catheterization 10 years postoperatively showed further improvement in the hemodynamic data; the left and right pulmonary artery pressures were 38/8 mmHg and 28/7 mmHg, respectively, and the ratio of the pulmonary to systemic pressure was 0.36 (Table). Angiography showed marked improvement in left pulmonary perfusion. Chest radiography revealed improvement of the laterality (Figure 2D).

Discussion
In patients with anomalous origin of one pulmonary artery from the aorta, the normally connected pulmonary artery receives the entire cardiac output from the right ventricle, whereas the anomalous pulmonary artery is exposed to systemic pressure and volume overload. The pressure and volume load leads to the development of pulmonary vascular obstructive disease.4–7 The pulmonary ar-
Figure 1. A: Preoperative chest radiograph shows lung perfusion (left > right). B: Preoperative left ventriculogram shows anomalous origin of the right pulmonary artery, and right pulmonary stenosis. C: The right ventriculogram shows only the left pulmonary artery, patent ductus arteriosus, and descending aorta. LV indicates left ventricle; RV, right ventricle; Ao, ascending aorta; dAo, descending aorta; PDA, patent ductus arteriosus; LPA, left pulmonary artery; and RPA, right pulmonary artery.

<table>
<thead>
<tr>
<th></th>
<th>Before surgery</th>
<th>6 months after surgery</th>
<th>10 years after surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV (mmHg)</td>
<td>54/8</td>
<td>77/17</td>
<td>108/8</td>
</tr>
<tr>
<td>RV (mmHg)</td>
<td>66/5</td>
<td>47/7</td>
<td>39/4</td>
</tr>
<tr>
<td>Ao (mmHg)</td>
<td>62/30 (46)</td>
<td>76/39 (55)</td>
<td>112/72 (88)</td>
</tr>
<tr>
<td>LPA (mmHg)</td>
<td>-</td>
<td>46/11 (24)</td>
<td>38/8 (15)</td>
</tr>
<tr>
<td>RPA (mmHg)</td>
<td>-</td>
<td>35/10 (19)</td>
<td>28/7 (14)</td>
</tr>
<tr>
<td>Pp/Ps</td>
<td>1.22</td>
<td>0.61</td>
<td>0.36</td>
</tr>
</tbody>
</table>

LV indicates left ventricle; RV, right ventricle; Ao, ascending aorta; LPA, left pulmonary artery; RPA, right pulmonary artery; and Pp/Ps, pulmonary to systemic pressure ratio.

The patient course provided two important clinical suggestions. The anastomotic pulmonary artery does not necessarily have poor perfusion postoperatively and the unbalanced lung perfusion may recover in a newborn patient.

First, the anastomotic pulmonary artery does not necessarily have poor perfusion postoperatively. It is difficult to estimate pulmonary artery damage. The difference between left and right lung perfusion is associated with vascular diameter and resistance. In the present case, lateral-
logical difference in vessels was one of the factors of vascular resistance.

Second, unbalanced lung perfusion may recover in a newborn patient. The laterality recovered almost completely in this case. Recovery of severely unbalanced lung perfusion in an older child is less likely. Early surgical repair improves the outcome of a patient. Although other cardiac malformations affect pulmonary vasculatures, early repair is most important to avoid the development of pulmonary vascular obstructive disease.

In conclusion, postoperative lung perfusion is variable in a patient with anomalous origin of one pulmonary artery from the aorta, and unbalanced lung perfusion may recover in a newborn patient.

**Disclosures**

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

**References**