Percutaneous Occlusion of Patent Ductus Arteriosus for an Elderly Patient With Refractory Congestive Heart Failure

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A 92-year-old woman with a history of patent ductus arteriosus (PDA) was referred to our hospital because of worsening dyspnea, with New York Heart Association classification IV. She had 3 admissions because of congestive heart failure within a year. A 12-lead ECG showed atrial fibrillation, and a chest radiograph showed severe pulmonary congestion and cardiomegaly (Figure [A]). The plasma B-type natriuretic peptide level was 4527.9 pg/mL. The echocardiogram showed a reduced ejection fraction of 39% and moderate to severe aortic valve stenosis (peak velocity=3.9 m/s; mean pressure gradient=29 mm Hg; aortic valve area=0.83 cm^2). The reconstructed 3-dimensional computed tomography (CT; Ziostation2; Ziosoft Inc, Tokyo, Japan) revealed a 50-mm thoracic aortic aneurysm and a large PDA (Krichenko type A, 4.7 mm of the pulmonary artery side) with severe calcifications surrounding it (Figure B–D; Movies I and II in the Data Supplement). Because of her refractory heart failure despite treatment with intravenous furosemide and dobutamine, we decided to perform a transcatheter occlusion of PDA 8 days after her admission to the hospital. For the transcatheter occlusion procedure, we selected a 12/10-mm Amplatzer Duct Occluder (St Jude Medical, St. Paul, MN) based on the information obtained from the 3-dimensional CT scan (Figure E) because aortography had not been performed because of severe oxygen desaturation. As a result, we were able to successfully deploy the occluder onto the ductus arteriosus (Figure F). Shortly after the occlusion of the ductus arteriosus, the pulmonary to systemic blood flow ratio (Qp/Qs) was normalized, decreasing from 2.95 to 1.00, the oxygenation improved, and the mean pulmonary artery pressure decreased from 48 to 30 mm Hg. Finally, the complete occlusion of PDA was confirmed by an aortography (Figure G; Movie III in the Data Supplement). The postprocedural echocardiogram showed improvement in left ventricular function (ejection fraction of 45%) and the peak pressure gradient of the aortic valve. Her dyspnea and pulmonary edema were alleviated (Figure H), and she was discharged without complications. She has been doing well for 1 year, without requiring any rehospitalizations because of heart failure.

PDA is the third most common congenital cardiovascular anomaly.[1] With improvements in the diagnostic accuracy of echocardiography, PDA is more likely to be diagnosed early and closed during early childhood.[1] Although there are few reports on the management of elderly patients with PDA,[2] our patient had severe comorbid conditions in addition to PDA, including atrial fibrillation and aortic valve stenosis. Therefore, we needed to be cautious while determining the most appropriate medical treatment and interventional strategy. Interventions in the management of PDA first reduce the pulmonary artery pressures, resulting in increasing the systemic circulating blood volume. However, if we considered interventions to treat the aortic valve stenosis first (eg, transcatheter aortic valve implantation), blood flow through the PDA shunt would increase, resulting in a worsening of pulmonary congestion. The main cause of hypoxia was pulmonary congestion because of shunt flow via

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PDA; we determined that medication therapy alone was limited for improving pulmonary congestion. Therefore, treatment of PDA first was considered the most appropriate strategy for improving the hemodynamic status of this patient. In general, we perform aortography during the catheter procedure to evaluate PDA morphology and determine the size of device needed. However, diameters of the aorta and PDA are larger in adults than in children, which can make it difficult to describe the precise PDA morphology. In addition, in this case, because of the severe pulmonary congestion, we thought that performing routine aortography just before PDA closure could be burdensome. Thus, we ordered raw CT data from the previous hospital to reconstruct the 3-dimensional CT images. Reconstructed 3-dimensional CT images are informative for calcifications and complicated morphology, which makes it possible to determine the optimal interventional strategy and perform the least invasive procedure possible in patients with severe comorbid conditions. On the basis of these considerations, we selected CT as the imaging tool for planning an interventional strategy instead of performing aortography during the procedure. The important thing is to evaluate the 3-dimensional configuration-to-image-device compatibility.

In conclusion, we treated an elderly woman who had refractory congestive heart failure with severe pulmonary hypertension and aortic valve stenosis, and we were able to achieve a successful clinical outcome by performing a percutaneous occlusion of PDA. To the best of our knowledge, this report describes the case of the oldest patient with PDA reported to date.[2] For elderly people with concomitant diseases that who cannot be expected to experience improvements in their hemodynamic state and symptom profile with optimal drug therapy alone, it is possible that a less invasive catheter intervention may improve their quality of life. Importantly, it is necessary to assess the effects and risks of treatment for each individual cases, especially for elderly patients.

DISCLOSURES

None.

AFFILIATION

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FOOTNOTES

The Data Supplement is available at http://circheartfailure.ahajournals.org/lookup/suppl/doi:10.1161/CIRCHEARTFAILURE.117.004764/-/DC1.

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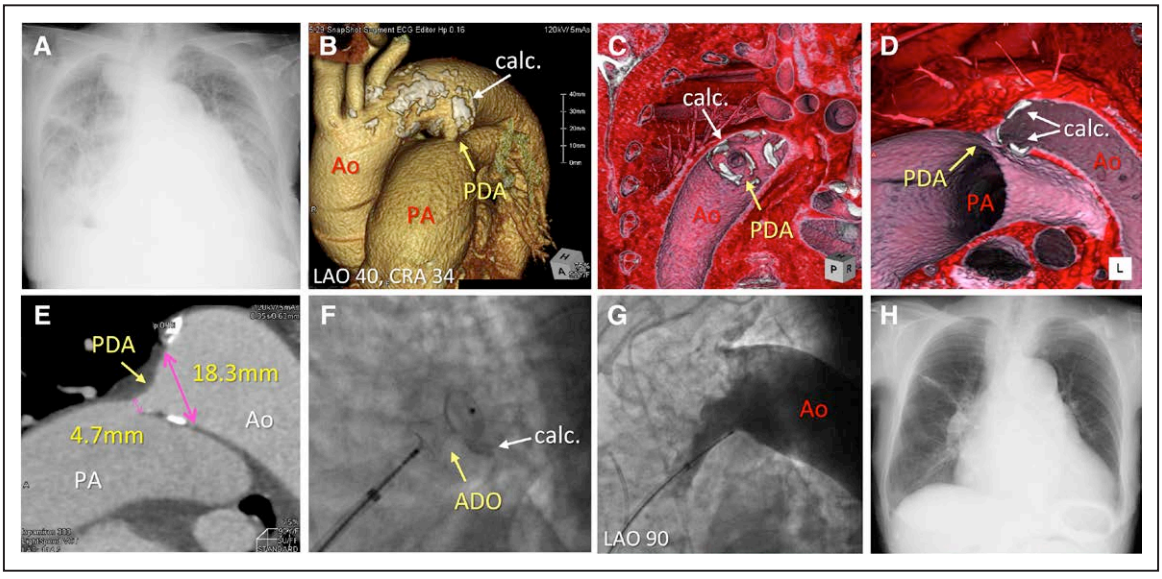

Figure. **A**, Chest radiograph shows severe pulmonary congestion and cardiomegaly. **B**–**D**, Reconstructed 3-dimensional computed tomography (CT) shows patent ductus arteriosus (PDA; yellow arrow) with severe calcifications (white arrow). **E**, PDA size measured by CT. **F**, Deployment of the Amplatzer Duct Occluder (ADO). **G**, Confirmation of complete occlusion of PDA on an aortography. **H**, Improvement shown on a chest radiograph (3 wk post-occlusion). Ao indicates aorta; calc, calcification; LAO, left anterior oblique; and PA, pulmonary artery.

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SUPPLEMENTAL MATERIAL

Movie legends

Movie 1. Rotational evaluation of the patent ductus arteriosus using reconstructed 3-dimensional computed tomography.

Movie 2. Anatomical evaluation of the inside of the patent ductus arteriosus using reconstructed 3-dimensional computed tomography.

Movie 3. Aortography post-Amplatzer duct occluder deployment for the patent ductus arteriosus.