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Transcatheter Embolization of Giant Pulmonary Arteriovenous Malformation with an Amplatzer Vascular Plug II

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Pulmonary arteriovenous malformation (PAVM) is a rare anomalous direct communication between the pulmonary artery and vein with a considerable risk of serious complications such as cerebral thromboembolism or abscess and pulmonary hemorrhage. Although the past, surgical resection such as lobectomy was mostly used to treat PAVM, the recent development of endovascular treatment has made it a primary consideration to perform transcatheter embolization using coils or detachable balloons. We report a case of successful transcatheter embolization of giant PAVM with the second generation Amplatzer vascular plug II as a new self-expanding device.

Key words: 1. Pulmonary arteries
2. Veins
3. Fistula
4. Endovascular procedures
5. Stents

CASE REPORT

A 41-year-old male patient presented with a complaint of deteriorating dyspnea for two months. At room air circumstances, arterial blood gas analysis was pH 7.39, $PaCO_2$ 35.7 mmHg, PaO_2 64.2 mmHg, HCO_3 -21.2 mmol/L, and SaO_2 92.5%. Chest X-ray showed a circumscribed mass shadow in the left lower lobe area and computed tomography (CT) scan revealed a large nodular lesion suggestive of pulmonary arteriovenous malformation (PAVM) between left pulmonary artery to left pulmonary vein in the left lower lobe (Fig. 1).

Because use of coil embolic device in the existing PAVM had a high likehood of complications including device migration, we decided to perform transcatheter embolization using the Amplatzer vascular plug (AVP) II as a new self-expanding device.

Under local anesthesia after systemic heparinization (3,000 IU intravenous), a 6F introducer sheath was placed through right femoral vein puncture. The feeding artery was selected by using a 6F guiding catheter and a selective angiogram was taken showing an arteriovenous malformation as an aneurismal dilatation with no thrombus and a drainage vein to a pulmonary vein and the left atrium. The diameter of the feeding artery was about 7 mm. A 10 mm AVP II (AGA Medical, Golden Valley, MN, USA) was delivered through the catheter. The guiding catheter was pulled back a few centimeters to give the device space at the occlusion site to expand. After the proper position was reached, the plug was

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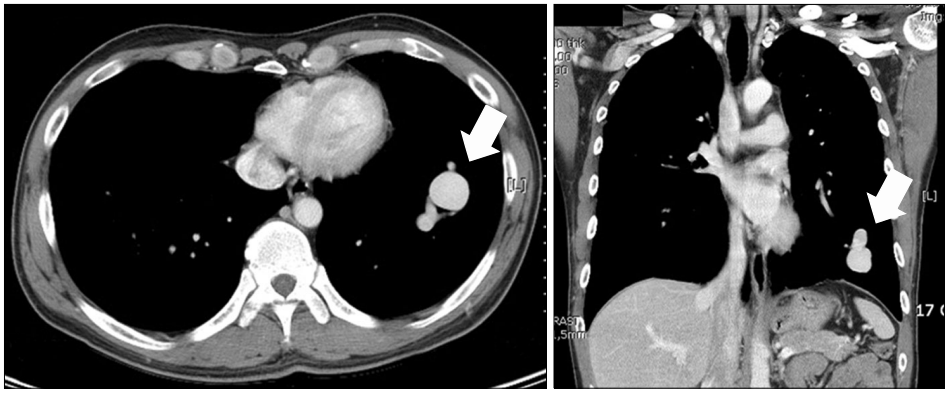

Fig. 1. Computed tomography angiogram shows a large nodular lesion (white arrow) suggestive of pulmonary arteriovenous malformation between left pulmonary artery to left pulmonary vein in the left lower lobe.

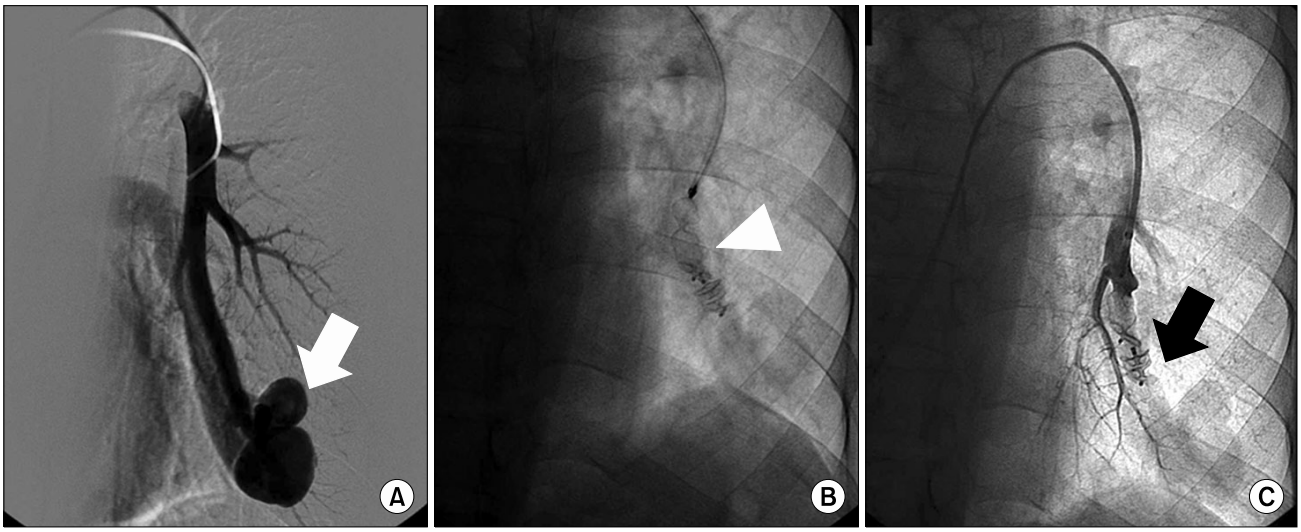

Fig. 2. (A) Subtracted angiogram shows an arteriovenous malformation (white arrow) as an aneurismal dilatation with no thrombus and a drainage vein to a pulmonary vein. (B) 10 mm and 12 mm Amplatzer vascular plug II (AGA Medical, Golden Valley, MN, USA) are delivered to a feeding artery (white arrow head). (C) Completion angiogram demonstrates complete embolization (black arrow).

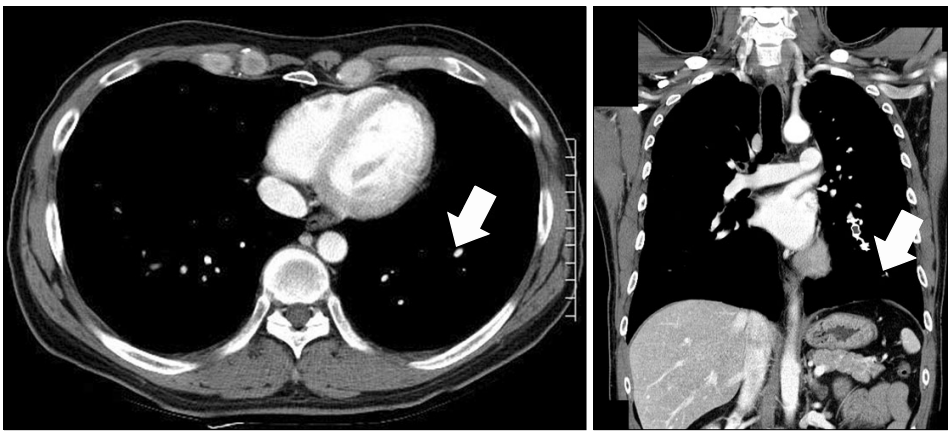

Fig. 3. Computed tomography angiogram at three years-follow-up shows nearly complete regression of pulmonary arteriovenous malformation (white arrow) and complete occlusion of the fistula.

released by turning the release cable counterclockwise. An angiogram five minutes later confirmed incomplete occlusion of the fistula, we then added an additional 12 mm AVP II (Fig. 2). There were no procedure related complications and there was marked improvement of patient's symptoms. Chest CT scan at three years-follow-up showed nearly complete regression of pulmonary arteriovenous malformation and complete occlusion of the fistula (Fig. 3).

DISCUSSION

About 80% of PAVM are congenital. Acquired PAVM is related to injury, mitral stenosis, or actinomycosis caused by chest trauma or chest surgery [1-3]. Among congenital cases, about 50% to 80% are associated with Osler-Weber-Render syndrome or hereditary hemorrhagic telangiectasia. Our case was assumed to be congenital PAVM without any apparent acquired origin, although there were no abnormalities in skin, oral, and nasal mucosa. About 13% to 15% of PAVM show symptoms such as dyspnea, hemoptysis, or hemothorax related to the intrapulmonary arteriovenous shunt [4,5]. In cases with severe symptomatologies, hemorrhage from a ruptured PAVM and various neurological complications such as cerebrovascular accidents from brain abscess and paradoxical embolism may occur [2,6].

In the past, surgical removal through ligation, segmentectomy, lobectomy, and pneumonectomy, among others, was the first approach used. However, because of high surgery-related morbidity and mortality, endovascular embolization with coil or balloon is currently preferred [7,8]. In this case study, the diameter of the feeding artery was about 7 mm and sac diameter was 30 mm which would be associated with high risk of incomplete occlusion, recanalization and embolization of coil. Although coil embolization has the advantage of precise placement and detachment, on occasions unstable positioning and anchoring might occur, causing distal coil migration; also, use of multiple coils can be time-consuming and expensive. On the other hand, detachable balloon embolization is a single step device and has the merit of sealing the vessel lumen, but its lack of anchoring can lead to flow-induced migration. Therefore AVP II was used for embolization in this case.

Vascular plugs are some of advantages with coil and detachable balloon. The second generation AVP II utilizes the shape memory of nitinol, providing the practitioner the ability to deploy, recapture and redeploy thereby ensuring precise placement. Once expanded, the 360° of vessel wall apposition creates a secure fit in the target vessel. The AVP II's unique multi-segmented, multi-layered design significantly reduces time-to-occlusion for transcatheter embolization procedures while maintaining complete control during positioning and delivery of the occluder. Currently, AVP II has been adapted for the treatment of high-flow lesions and parent artery occlusions. The mean reported time to flow cessation of AVP II in the treatment of PAVM has been 4.8 minutes (range, 3.0 to 11.2 minutes) [9]. Therefore, delayed occlusion time during parent artery occlusion has potential risk of thromboembolic complications, making it important to perform complete occlusion of the primary artery in single step. Minimum size of the guiding catheter is 5F and detachment can be done with a counterclockwise rotation of the pusher wire after deployment. In oversizing of the device, the company recommends a 20% larger diameter than that of the target vessel, but as seen in this case study, that also depends on the patient's target vessel and anatomy vessel such as a pulmonary feeding artery.

From our case, we suggest that transcatheter embolization with AVP II might be a reasonable alternative in the treatment of PAVM because of its effectiveness and ease of device management.

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