

# Percutaneous Closure of the Aortopulmonary Window in an Infant Using an Amplatzer Duct Occluder II Prosthesis

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## Introduction

The Aortopulmonary Window (APW) is a rare congenital malformation, representing approximately 0.2% of all congenital heart diseases. It is typically nonrestrictive and requires early surgical intervention to prevent complications such as pulmonary congestion, respiratory infections, and obstructive pulmonary vascular disease. In cases like ours, where the surgical risk is exceedingly high, percutaneous closure may present a viable alternative.

## Case Report

A 1.5-month-old male infant, born with a weight of 2180 g, presented with multiple comorbidities, including esophageal atresia, congenital chylothorax, and Meckel's diverticulum. The patient underwent several surgeries within the first few days of life. He also experienced recurrent infections and required prolonged mechanical ventilation. During evaluation, cardiomegaly was noted alongside a continuous murmur at the upper left sternal border. The echocardiogram revealed a 5.0 mm APW (Figures 1 and 2). The echocardiogram revealed a large left-to-right shunt, resulting in left chamber enlargement. Following a multidisciplinary discussion with the cardiology team and given the high surgical risk, percutaneous closure of the APW was chosen as the best approach. The procedure was performed after informed consent was obtained.

Cardiac catheterization was performed under general anesthesia using ultrasound-guided puncture of the right carotid artery and right femoral vein, with a 4F sheath in the artery and a 5F sheath in the vein. Heparin was administered at 100 IU/kg. Mean aortic and pulmonary pressures were measured at 44 and 29 mmHg, respectively. The ascending aortogram confirmed a 5.0 mm APW located

distant from the left aortic cusp (Figure 3). The defect was crossed via the aorta using a 4F Judkins catheter with a 3.5 bend and a 0.0035 Terumo guidewire. The guidewire was captured and exteriorized through the femoral vein, forming a venoarterial loop. A long 5F sheath and a delivery system were then advanced from the femoral vein, through the APW, and into the descending aorta. Initially, an Amplatzer Duct Occluder II (ADOII 6/6) prosthesis (St. Jude Medical, St. Paul, MN, USA) was advanced; the aortic disc was delivered followed by the pulmonary disc, which did not fix properly. The device was then replaced by an ADO II 4/4. After confirming proper device positioning using transthoracic echocardiography and fluoroscopy, ensuring no interference with aortic and pulmonary flows or proximity to the coronary arteries, the device was successfully implanted (Fig. 4). Two weeks post-procedure, the patient showed no signs of heart failure, and the echocardiogram confirmed the device was well-positioned, with no significant vessel obstruction or residual shunt. The patient remained in the ICU due to other comorbidities.

## Discussion

APW is a defect resulting from incomplete separation of the aorta and pulmonary trunk walls at the conotruncal septum during early embryogenesis. APW is classified into three morphological types. Type I defects (60-70%) are located proximally, in the aorta above the sinus of Valsalva. Type II defects (20-25%) are distal, situated in the upper ascending aorta before the emergence of the aortic branches. Type III defects, which are less common, are extensive and combine features of types I and II, involving most of the ascending aorta, the pulmonary trunk, and the right pulmonary artery. The Type II defect reported in this case accounts for 20% of APW cases and is particularly amenable to percutaneous correction due to its location. Surgery is the gold standard treatment and has been performed for many years. However, when a patient's clinical condition is critical, with a prohibitively high surgical risk, as the case presented. In these cases, percutaneous closure becomes a valuable alternative when the defect allows for it. Reports in the literature on transcatheter closure of APW are limited, especially for patients weighing less than 3 kg, and they describe various vascular access methods and devices.<sup>1-13</sup> Table 1 presents a summary of the literature review. The defect's position was conducive to percutaneous intervention, while the infant's multiple comorbidities made surgery exceedingly high-risk.

## Keywords

Cardiovascular Surgical Procedures; Aortopulmonary Septal Defect; Infant.

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The optimal device choice remains unclear. Device selection depends on the hemodynamicist's experience with different types of devices designed for closing cardiac and extracardiac shunts. Given the patient's low weight, arterial access via the internal carotid artery was selected, which is our preferred approach for infants under 3.0 kg. In this specific case, we anticipated that crossing the window would be relatively straightforward, as it ultimately proved to be.

### Conclusion

Although cardiac surgery is the gold standard for APW closure, high-risk patients with anatomy favorable to percutaneous closure should be considered for this approach, as a viable and effective alternative in the management of such cases.

### Author Contributions

Conception and design of the research: Oliveira EC, Castro MF; acquisition of data: Moura MAG; writing of the

manuscript: Barbosa JAA; critical revision of the manuscript for intellectual content: Nunes MCP; translation: Mendoza RF.

### Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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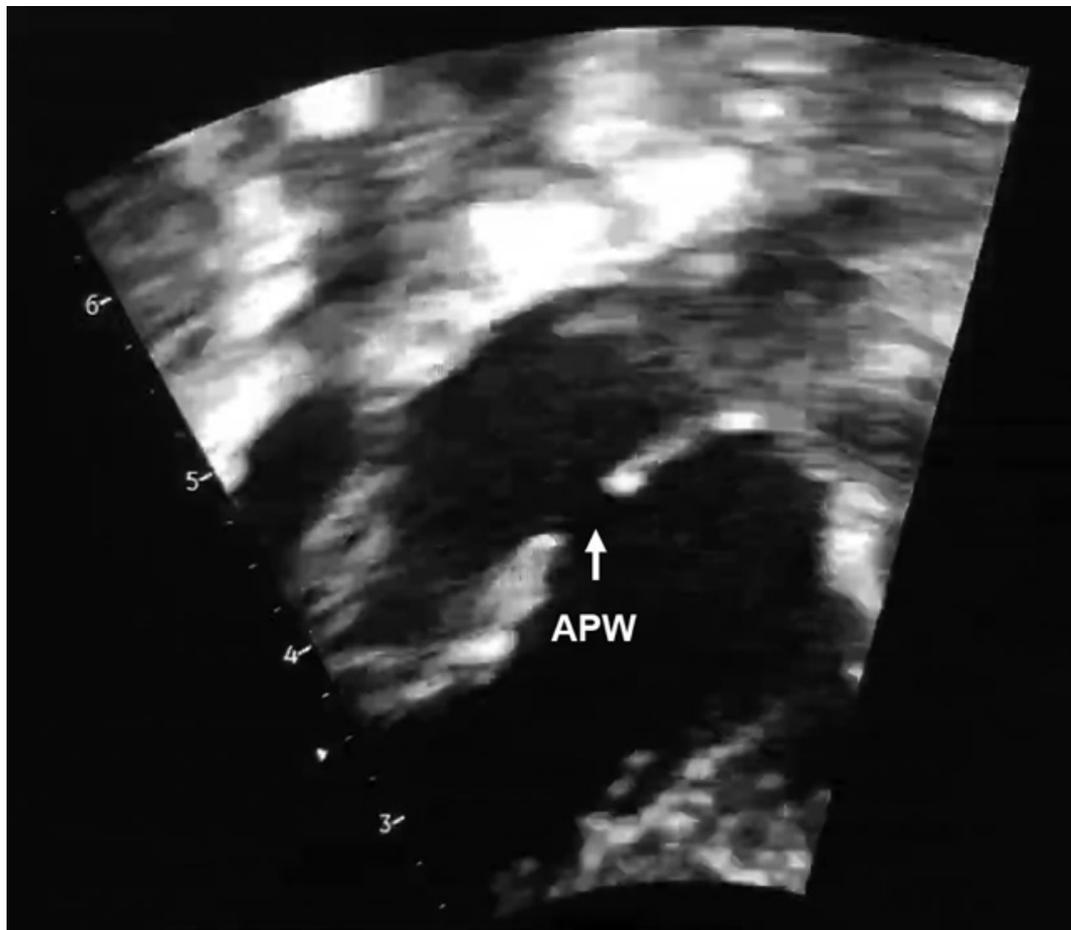
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### Study Association

This study is not associated with any thesis or dissertation work.

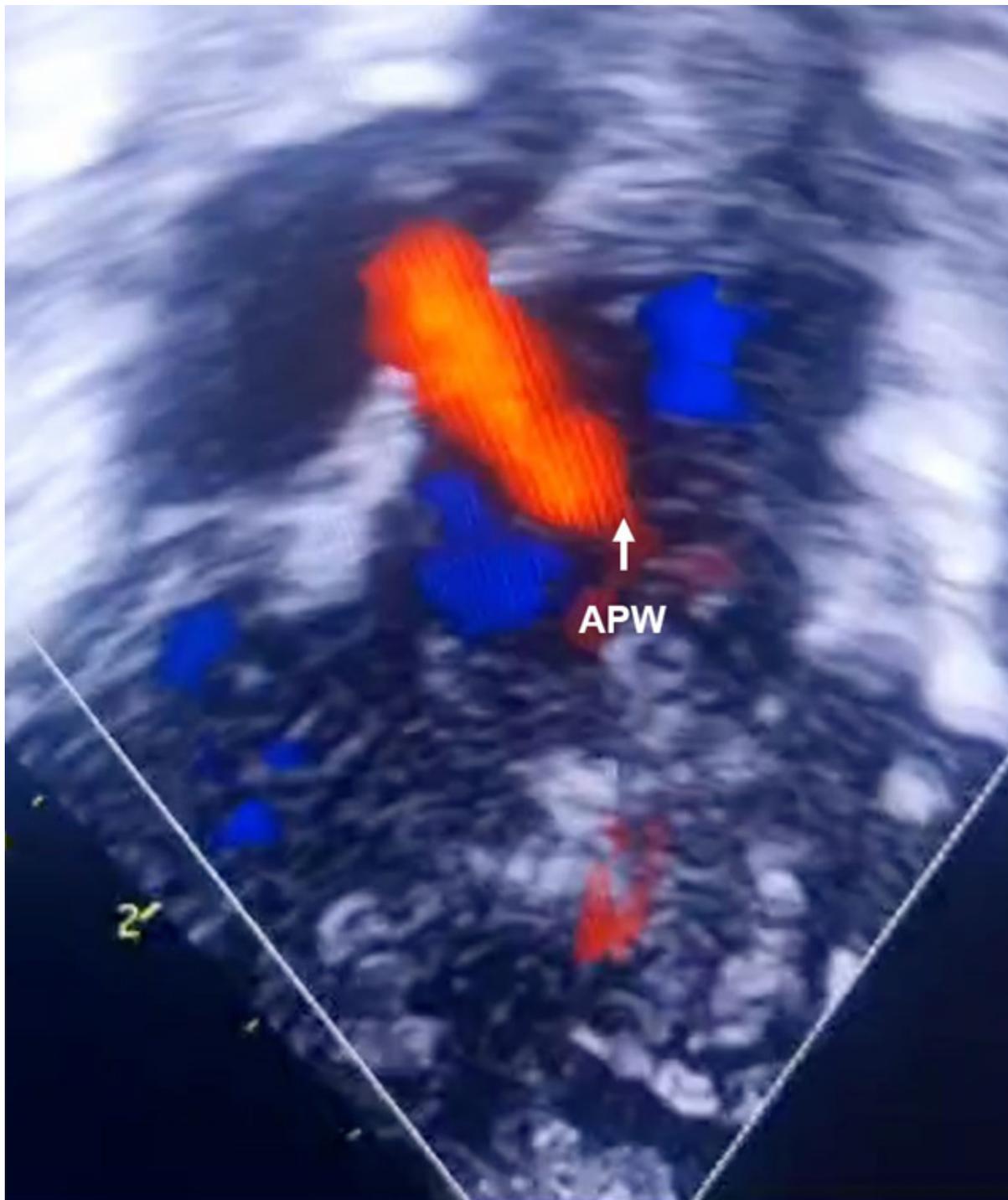
### Ethics Approval and Consent to Participate

This article does not contain any studies with human participants or animals performed by any of the authors.

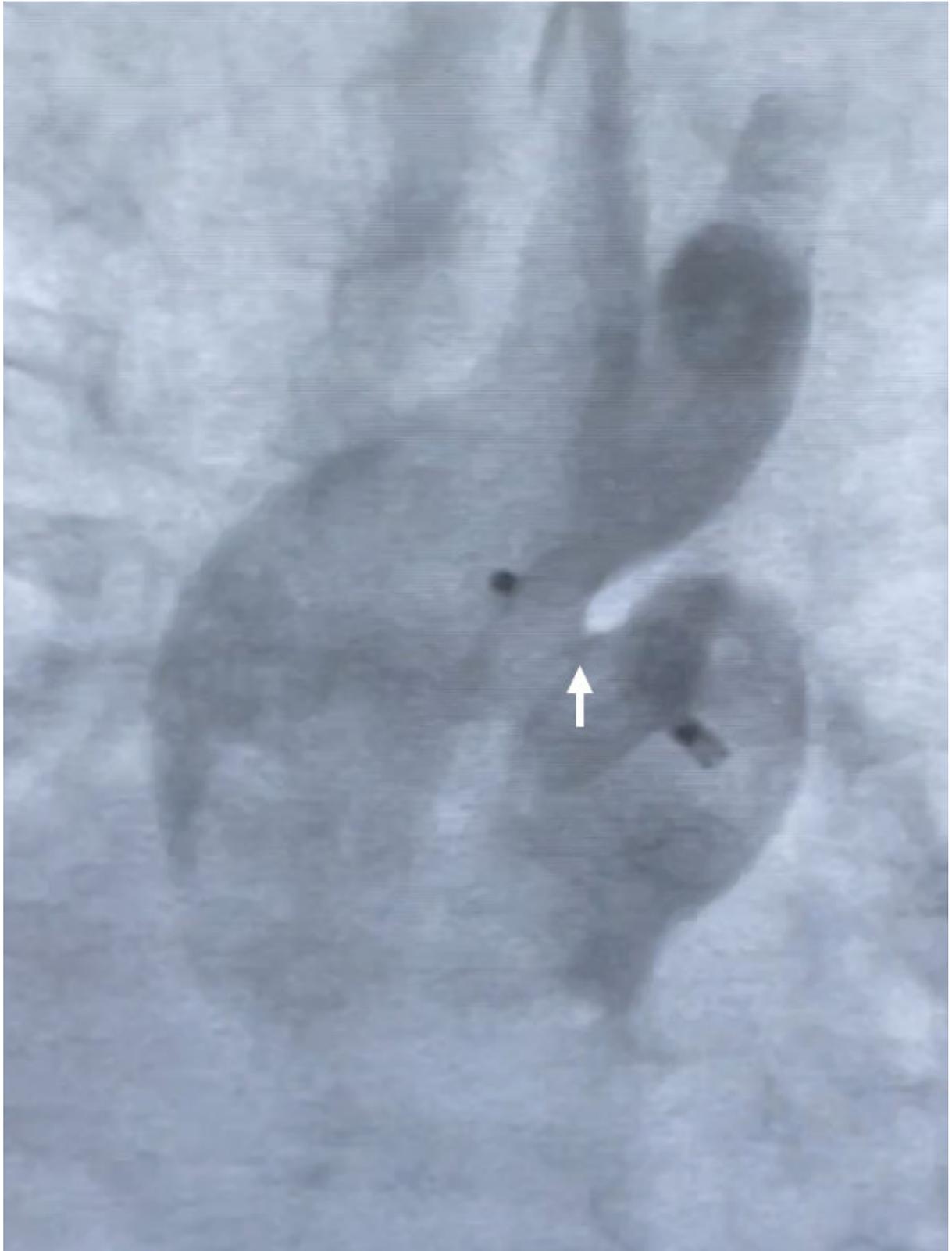


**Figure 1** – Echocardiogram showed a large 5.0 mm APW (white arrow). APW: Aortopulmonary Window.

## Case Report



**Figure 2** – Echocardiogram with Color Doppler revealed a significant left-to-right shunt. APW: Aortopulmonary Window



**Figure 3** – Ascending aortogram confirmed an APW.

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**Figure 4** – Confirmation of the position by fluoroscopy, without interfering in the aorta and pulmonary flow (white arrow).

**Table 1** – Overview of percutaneous closure of the APW as described in the literature.

Reference	Year	Country	Age	Weight (kg)	Sex	Prosthesis	Prosthesis size (mm)
Stamato et al. <sup>1</sup>	1995	Canada	3 y	11	NI	Modified Double Umbrella Occluder System	12
Sivakumar et al. <sup>2</sup>	2006	Sri Lanka	8 m	6.5	M	Amplatzer Duct Occluder 12/10	8.7
			5 y	6.5	F	Amplatzer Duct Occluder 10/8	6
Trehan et al. <sup>3</sup>	2008	India	5 m	5	F	Blockaid PDA occluder (12/10mm)	10
			9 m	6.5	F	Amplatzer muscular VSD occluder (12mm)	10
			5.5 y	5.5	M	Blockaid VSD occluder perimembrane (9mm)	8
Zhao-feng et al. <sup>5</sup>	2011	China	11 m	8	M	A 6-8 mm Amplatzer duct occluder	3
			2 y	NI	F	An 18 mm HeartR muscular ventricular septal defect occluder (Lifetech Scientific Co, China)	10.4
			14 y	NI	M	An 18-20 mm HeartR Duct Occluder (Lifetech Scientific Co, China)	14

Kosmač B. <sup>4</sup>	2013	German	25 m	3.9	F	Amplatzer perimembranous VSD occluder (5mm)	4/6
Fiszler et al. <sup>6</sup>	2017	Poland	4.5 y	6	NI	Amplatzer Duct Occluder 4/2	2.3
Sabnis et al. <sup>7</sup>	2018	India	27 d	2.6	M	ADOI (St. Jude Medical, USA)	5
Campos-Quinteiro et al. <sup>8</sup>	2019	Mexico	9 m	6.3	NI	Amplatzer Duct Occluder 5/4	25
			15 y	45	NI	Amplatzer Duct Occluder 10/8	30
			1 y 7 m	8.4	NI	Amplatzer Duct Occluder 8/6	30
			22 d	3.1	NI	Amplatzer Duct Occluder II 6/4	80
			4 y 7 m	15	NI	Amplatzer Duct Occluder 14/12	80
			1 y 5 m	14.2	NI	Cera 16/18	60
Uçar et al. <sup>9</sup>	2020	Türkiye	9 m	NI	F	Amplatzer Duct Occluder AS 5/2	3.7
Giordano et al. <sup>10</sup>	2020	Italy	25 y	51	F	Amplatzer Muscular Septal occluder device 16mm (Abbot)	9/12
Guzeltas A. <sup>11</sup>	2021	Türkiye	1 m	3.5	M	8/6 Amplatzer Muscular Septal occluder (Abbot)	4/7
			6 m	5.3	F	10/8 Amplatzer Muscular Septal occluder (Abbot)	4.7
Yıldırım et al. <sup>12</sup>	2021	Türkiye	3 m	4	M	A 7-mm symmetric membranous VSD occlude (Lifetech Scientific Co, China)	5.1
Abdelrazek Ali et al. <sup>13</sup>	2022	Egipt	12 m	7	M	A multifunctional occluder device 12 x 10 mm (Lifetech Scientific Co, China)	7/8

Note: NI = no information available; y = years; m = months; d = days. PDA: patent ductus arteriosus; VSD: ventricular septal defect.

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