Percutaneous closure of a prenatally diagnosed large coronary artery fistula with an Amplatzer vascular plug immediately after delivery

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We describe successful percutaneous closure of a prenatally diagnosed large coronary artery fistula originating from the right coronary sinus and draining into the right ventricle in a one-day-old neonate using an Amplatzer vascular plug. Early intervention may be a useful tool in such cases with large fistulas to avoid complications such as severe congestive heart failure, myocardial ischaemia, need for assisted ventilation and longer hospital stay.

Keywords: abnormal coronary arteriovenous connection – transcatheter closure – newborn.

Introduction

Isolated coronary artery fistulas (CAF's) are rare congenital anomalies. Large or giant CAF's can be rarely diagnosed prenatally.\(^1\) Transcatheter embolization has become the treatment of choice in most cases with CAF. Particularly in large fistulas, use of multiple coils, detachable balloons, the Rashkind umbrella, Amplatzer duct occluder, Amplatzer muscular ventricular septal defect (VSD) occluder device, and Amplatzer vascular plug (AVP) or a combination of such devices has been reported.\(^2\) Experience with AVP usage in closing CAF's in children are scarce.\(^3\) We report a newborn with a prenatally diagnosed large CAF who underwent successful percutaneous embolization by using an AVP in the first day of life.

Case report

A 32-year-old pregnant woman had been referred by another centre for further evaluation of a suspected foetal cardiac abnormality in the 33\(^{rd}\) week of gestation. Foetal echocardiographic examination revealed a large tortuous CAF originating from the right coronary cusp (RCC) and draining into the right ventricle (RV), near the tricuspid valve annulus (figure 1). The baby was born at full term with a birth weight of 3 kg. On admission to the neonatal care unit, clinical and laboratory reevaluation of the patient revealed tachypnoea, a slight cardiomegaly and significantly increased natriuretic peptide. Echocardiography confirmed the prenatal diagnosis. Right and left heart catheterization, haemodynamic study and selective coronary angiography demonstrated a large tortuous, “S”-shaped CAF originating from the RCC and draining into the RV without additional abnormalities in the right or left coronary vessels. It was about 6 mm in diameter with a slight tapering just before draining into the RV (figure 2). The normal right coronary artery leaving from the proximal part of the fistula was poorly visualized due to significant runoff. The Qp/Qs ratio was 3.2 even in the first day of life. It was a high flow, large fistula, consequently, AVP (AGA Medical, Golden Valley, MN) closure of the fistula was planned. A 5Fr guiding catheter with 0.056” inner diameter (Envoy Guiding Catheter MPC, Cordis Co., Johnson & Johnson Co., FL, USA) was advanced with the help of a hydrophilic Glide-wire to the terminal part of the fistula in a retrograde manner (figure 2). A test injection contrast was performed to gauge the placement of the catheter. After removing the Glide-wire and ensuring the tip of the catheter was sufficiently distant from the right coronary artery origin, an 8-mm AVP was advanced through the guiding catheter into the fistula and deployed near the drainage point in the fistula. Injection contrast through the guiding catheter showed that the native right coronary artery and branch filling had improved and were intact and that the device was
angiography confirmed a slight residual shunt after 10 minutes. The patient's postprocedural recovery was uneventful. The patient was discharged from the hospital 3 days later with no significant shunt observed echocardiographically.

Discussion

The preferred method of approach for any patient depends on the anatomy of the fistula, the presence or absence of associated defects and the experience of the interventional cardiologists and surgeons. Since its introduction in 1983, transcatheter closure of coronary fistulas has been utilized as an alternative to surgical closure. To date, particularly in large fistulas, multiple coils, detachable balloons, the Rashkind umbrella, Amplatzer duct occluder, Amplatzer muscular VSD occluder device, and AVP or a combination of such devices have been used.

In the present case, an AVP was chosen for transcatheter closure due to its particular advantages over the other devices, such as lower risk of embolization than coils, a smaller guiding catheter, a more flexible delivery cable and lower cost than duct or muscular VSD occluder. It is a recently FDA-approved self-expandable cylindrical device made of 144 nitinol wire mesh without occlusive fabrics and was originally designed for abnormal vascular connections. The device was recently evaluated in the embolization of vascular lesions associated with congenital heart diseases in a multicentre study by Hill et al. A total of 84 various vascular connections in 52 patients with congenital heart disease from 11 centres were occluded with 89 devices. AVP was found to be effective and safe in closing various abnormal vascular communications. In the literature, the use of AVP in closing CAFs has been reported only in older patients; to our knowledge, it has never been used in neonates.

There is no doubt that the risk of developing congestive heart failure and myocardial ischaemia in the first days or weeks is very high in such cases. For instance, Khan et al. reported that a neonate with 4-mm coronary fistula (Qp/Qs = 3:1) had developed congestive heart failure within the first week of life requiring assisted ventilation. A successful transcatheter occlusion with an 8/6 mm Amplatzer duct occluder was performed at 3 weeks of age and the patient could be discharged 38 days after the procedure. In another case with giant CAF reported by Holzer et al., tachypnoea and progressive worsening were seen immediately after birth. At 12 days of age, percutaneous closure using multiple devices was performed. The patient was discharged from the hospital after 12 days. In the present case, we thought that postponing the intervention to a later period and followed by medical therapy to control congestive heart failure, as reported in

Fig. 1. - Long-axis (A) and short-axis (B) views of the foetal heart showing a large coronary fistula originating from the right coronary cusp (dense arrows); C: colour-Doppler view of the foetal heart demonstrating turbulence in the right ventricle. AO: aorta, LA: left atrium, LV: left ventricle, PA: pulmonary artery, RV: right ventricle.

well positioned (figure 2). The device was released by unscrewing the cable in a counterclockwise fashion. No rhythm abnormalities or ischaemic ST-segment changes were observed during the procedure. Repeat
the above-mentioned cases, may lengthen the hospitalization and complicate the process.

Conclusion

This is a unique case with a large CAF diagnosed prenatally and closed immediately after delivery by using AVP, with discharge from the hospital possible in a short period. Experiences with embolization of CAFs with AVP are scarce. We think it can be used safely even in the first day of life in selected neonates. Prenatal diagnosis and early intervention may be very important in such cases to avoid complications such as severe congestive heart failure, myocardial ischemia, need for assisted ventilation and longer hospitalization.

Conflict of interest: none declared.

References


