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Volume 1 Issue 5
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ES Journal of Case Reports

Importance of *pin-vise* of duct occluder during percutaneous closure of Patent Ductus Arteriosus (PDA)

Case Report

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Received: Nov 21, 2020; **Accepted:** Dec 29, 2020; **Published:** Dec 31, 2020

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Abstract

Patent ductus arteriosus (PDA), a persistent left to right shunt at great arterial level, accounts up to 10% of all congenital heart disease. Here, we report a case of a 6-month old baby with large PDA (5mm) whose percutaneous closure was planned. The Coccoon Duct Occluder (CDO) - 8/6 was fitted by rotating it clockwise over the delivery cable and the assembly of *loader-cable-device* was advanced into the descending aorta. The device was properly positioned across the PDA as both the aortic, and pulmonic side of the devise was properly opened. The device was then released by turning the delivery cable counter-clockwise using the pin vise, but inadvertently the delivery sheath remained attached to the pulmonic side of the device. All efforts to rescrew the delivery cable to the device failed. The delivery sheath was gently rotated counter-clockwise over the device to detach it successfully from the pulmonic end of the device, thereby securing its perfect placement. Aortogram using the pigtail catheter confirmed its perfect position with no residual shunt. Therefore, delivery sheath should be pulled fair enough proximal to the pulmonic end of the device before releasing it by rotating the pin-vise counter clockwise.

Keywords: Patent ductus arteriosus; Coccoon Duct Occluder; Delivery cable; Pin-vise

Introduction

Patent ductus arteriosus (PDA), a persistent left to right shunt at great arterial level, accounts up to 10% of all congenital heart disease [1]. It may remain asymptomatic or may complicate into pulmonary vascular disease, atrial fibrillation, dissection of the pulmonary artery, endocarditis, Eisenmenger's syndrome, congestive heart failure, and rarely sudden death [2,3]. Therefore, all PDA with left atrial and/or left ventricular enlargement, pulmonary arterial hypertension, or symptoms should undergo either percutaneous or surgical intervention as mortality rates may reach to 20% at third decade. Since the first successful attempt of percutaneous intervention by transcatheter closure (TCC) in 1967 using an Ivalon plug, it has emerged as a valuable alternative to surgery because of its simplicity, high success rates and lesser complications (e.g., device embolization, protrusion of device into the left pulmonary artery and descending aorta) [4]. Although different devices and coils have been used in the past, nitinol-based, self-expanding occluder devices or coils are considered as the gold standard in the current era. Though PDA anatomies vary in shape, the available devices are mainly suited for small and conically-shaped PDAs (i.e. Krichenko Type A morphology) [4].

Case report

A 6-month old baby presented for evaluation of a continous murmur. His vitals and routine biochemistry were normal. Echocardiography with colour Doppler in the parasternal short-axis view confirmed large PDA (5mm) with left to right shunt. The chest x-ray revealed cardiomegaly, pulmonary plethora, enlarged left atrium and left ventricle. Device closure was planned after proper consent. Femoral artery and vein was accessed using 5F introducer sheath (Cordis, USA). 500U heparin was administered. Angiogram, by placing the distal end of 5F Pigtail catheter into distal aortic arch, was done to delineate the anatomy and size of the ductus arteriosus (DA) in right anterior oblique view with little cranial angulation (**Figure 1A**). 5F multipurpose catheter (MPA) was advanced from the venous side into the descending aorta through the DA. The catheter was exchanged with long length super stiff terumo wire (260cm, 0.035"; Terumo, Japan), thus making a rail road. 6F delivery sheath (Vascular Concept, UK), appropriate according to the size of the device, was tracked over the guidewire and the dilator was removed, leaving the sheath in the descending aorta. The accessory set of cocoon duct occluder (CDO; Vascular Innovation, Thailand) consists of delivery sheath with haemostasis valve adapter, a dilator to be used to ease penetration of tissue, a loader to be used to introduce the occluder, and a delivery cable where the device is screwed onto its distal tip (**Figure 5B**), which allows the placement and retrieval of the device. The duct occluder- 8/6 was fitted by rotating it clockwise over the delivery cable and the assembly of *loader-cable-device* was advanced into the descending aorta where the sheath was little retracted until the aortic side of disc was opened. The sheath, with opened aortic end of the disc, was pulled back as one unit until aortic side of disk was snugly fitted against the aortic end of the ampulla. Sheath was further pulled to release the pulmonary end of the device (**Figure 1B**). Device position was checked after 5 minutes doing an aotogram to rule out any residual leak and to ensure proper device position (**Figure 2A**). The device was then released by turning the delivery cable counter-clockwise using the pin vise. When we tried to pull the delivery sheath, little resistance was felt and suddenly our mistake was realized as it was still attached to the pulmonic end of the device **(Figure 2B, 3A)**. We tried to rescrew the delivery cable to the device but failed. We though to forcefully pull the delivery cable but it had a potential disadvantage of malaligning the device and to push it into the aorta leading to its dislodgement. We gently rotated the delivery sheath counter-clockwise over the device to detach it successfully from the device, thereby securing its perfect placement (**Figure 3B, 4**). Aortogram using the pigtail catheter confirmed its perfect position with no residual shunt (**Figure 5A**). The trans-thoracic echo-doppler on next day ruled out any obstruction of the

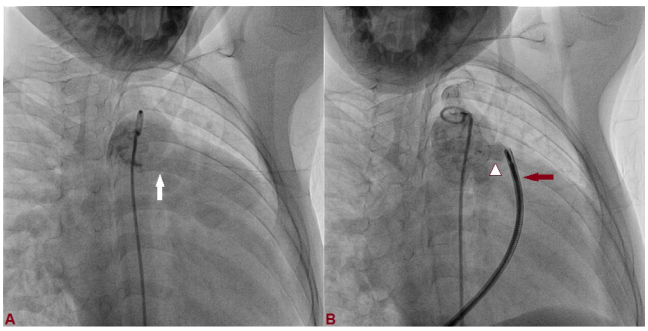

Figure 1: Aortogram in right anterior oblique (RAO) view showing large tubular PDA (white arrow- A); properly positioned device (white arrowhead) across the ductus with delivery cable still attached to pulmonic end of device (red arrow).

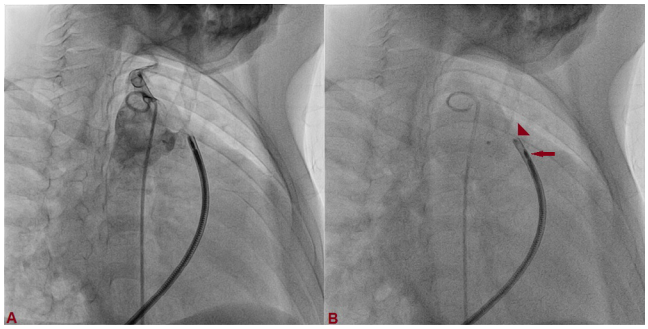

Figure 2: RAO view showing well positioned device with no shunt after 5 minutes across the device, and ductus (A); The device was released by turning the delivery cable (red arrow) counter-clockwise using the pin vise with delivery sheath still (red arrowhead) attached to its pulmonic end (B).

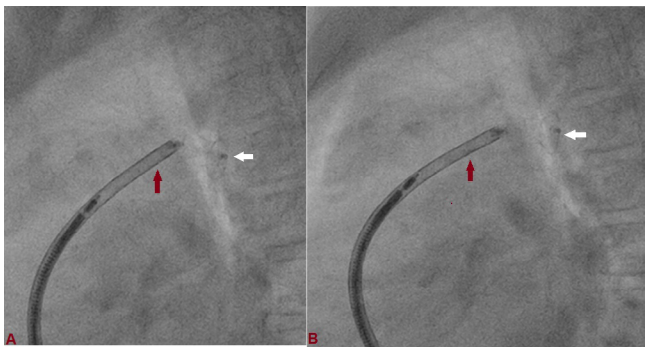

Figure 3: The delivery sheath was gently rotated counter-clockwise over the device to detach it from the device (A; B).

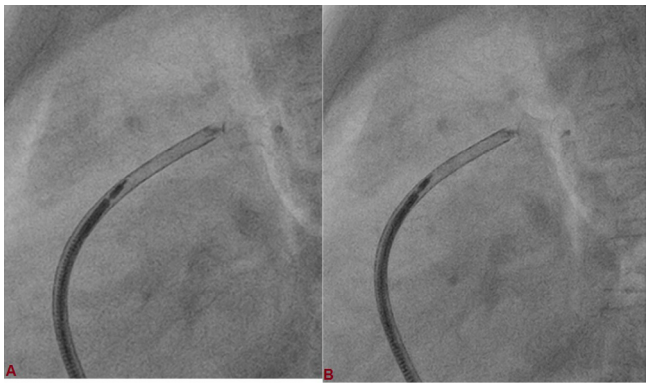

Figure 4: The delivery sheath was gently rotated counter-clockwise over the device to detach it successfully from the device (A; B).

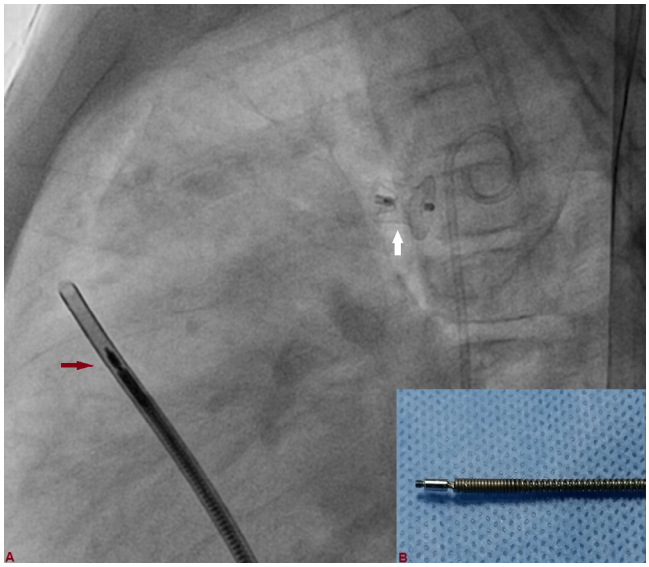

Figure 5: Well detached delivery cable, and perfectly placed device (A); the tip of the delivery cable where device is attached (B).

left pulmonary artery, descending aorta and residual leak. Patient was discharged on next day in stable condition and is in regular follow up since then.

Discussion

In the present era, TCC has replaced surgical intervention as the first-choice management option. Though it is remarkable safe, there is always a concern regarding complications such as embolization and mild obstruction of left pulmonary artery and descending aorta, particularly in infants with large PDA who require a relatively larger device [5,6]. Nevertheless, the Cocoon duct occluder, because of its design, has made a cut through in the field of TCC and can be used for larger defects (up to 22 mm) with outcomes comparable to Amplatzer duct occluder device [7]. In addition, retention disc on its distal aortic end which is 4 mm bigger than its size prevent its embolization to the pulmonary artery.

The accessory set of CDO have 4 components- a *delivery sheath* with haemostasis valve adapter which facilitates to deliver the device, *dilator* to ease the penetration of tissue, *loader* which introduces the duct occluder, and *delivery cable* on the top of which the device is fitted, which allows for placement and retrieval of the device. The delivery cable contains a *pin-vise* at its proximal end which, when torque counter-clockwise, release the devise. The delivery of the device is very smooth provided certain caution needs to be exercised.

First, sheath should be pulled to open the aortic side of the device. Secondly, sheath with partially opened disc should be pulled enough to ensure the proper sitting of the device at the aortic end of the ductus. If it is undersized, it may slip in into the pulmonary artery where one needs to oversize the device. If it is fitting well, one should wait for 5-10 minutes to rule out any para-device leak which speaks of either undersize, or malposition of the device. In such case, either it should be repositioned by slightly pushing the delivery cable as very taut cable may sometimes malaligned it creating persistent shunt across the ductus. In large series of patients with large PDA (>8mm), Sinha et al had waited for 10 minutes to access the shunt either across, or through the device [8]. Another important point which always needs to be exercised is that one should pull the delivery sheath fair enough before releasing the device by *pin-vise*. In our case, the delivery cable was still attached while device was deployed. One released, it further strengthen its contact with the device. In such situation, one should try to rescrew the cable to the device with sheath still there, which at times may be successful. Otherwise, one should gently torque the sheath counter-clockwise to facilitate its detachment from the device. As sheath is bigger, torque transmission may take some time, therefore it should be done gently, and slowly as in our case.

References

1. Mitchell SC, Korones SB, Berendes HW. Congenital heart disease in 56,109 births: incidence and natural history. Circulation. 1971; 43: 323-332.
2. Campbell M. Natural history of persistent ductus arteriosus. Br Heart J. 1968; 30: 4-13.
3. Gaia DF, Palma JH, Kim HC, de Souza JA, Alves CR, Buffolo E. Patent ductus arteriosus: endovascular treatment in adult patient. Arq Bras Cardiol. 2008; 91: 25-27.

4. Abdelbasit MA, Alwi M, Kandavello G, Che Mood M, Samion H, Hizari ZM. The new Occlutech® PDA occluder: Initial human experience. Catheter Cardiovasc Interv. 2015; 86: 94-99.

5. Schneider DJ, Moore JW. Patent ductus arteriosus. Circulation. 2006; 114: 1873-1882.

6. Atiq M, Aslam N, Kazmi KA. Transcatheter closure of small-to large patent ductus arteriosus with different devices: queries and challenges. J Invasive Cardiol. 2007; 19: 295-298.

7. Hakim FA, Hiari A, Tsaousis GS, Paphitis C, Hijazi ZM. Patent ductus arteriosus equipment and technique, Amplatzer duct occluder: intermediate-term follow-up and technical considerations. J Interv Cardiol. 2001; 14: 247-254.

8. Sinha SK, Razi M, Pandey RN, Kumar P, Krishna V, et al. Prospective evaluation of the feasibility, safety, and efficacy of Cocoon Duct Occluder for transcatheter closure of large patent ductus arteriosus: A single-center study with short- and medium-term follow-up results. Anatol J Cardiol. 2017; 18: 321-327.