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3 **Successful transcatheter PDA device closure in an adult with**
4 **retrograde wiring and antegrade snaring approach**

5 **Abstract:**

6 Patent ductus arteriosus accounts for 5 – 10 % of all congenital heart disease in children.
7 Currently, transcatheter closure is standard of care. Device closure in PDA is usually done by
8 antegrade technique where PDA is crossed from PA side. In some patients this universal
9 procedure may not be successful due to anatomical differences. In such patients, retrograde
10 technique with retrograde wiring and antegrade snaring approach followed by PDA device
11 closure may be used successfully to close PDA. We report such a case of difficult PDA device
12 closure where antegrade technique was not successful and PDA device closure was
13 successfully completed by retrograde approach.

14 **Keyword:** Congenital heart disease; Patent ductus Arteriosus; Device closure

15 **Abbreviations:** PDA: Patent ductus Arteriosus; PA: Pulmonary Artery; RA – Right Atrium; RV:
16 Right ventricle; IVC: Inferior vena cava

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18 **Introduction:**

19 Patent ductus arteriosus (PDA) is a congenital heart defect in which the ductus arteriosus, a
20 vascular structure between the pulmonary artery and the aorta that normally closes shortly
21 after birth, remains open. The incidence of PDA is approximately 1 in 2000 in full-term
22 infants and consists 5 to 10% of all congenital heart disease in children.^{1,2} Females are more
23 commonly affected by PDA than males.³ PDA is usually encountered and treated in
24 childhood. But sometimes it can go undetected and present in adulthood. Transcatheter
25 device closure of PDA has been the standard of care for such patients. However, sometimes
26 transcatheter closure in adults can pose unique challenges due to anatomical differences. In
27 such cases, using different views for defining the defect and use of different catheters can
28 be helpful. In addition, sometimes it may not be possible to cross the PDA by the routine
29 antegrade approach. Here we present a rare case of difficult PDA device closure where it
30 was closed using a different retrograde approach.

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34 **Case:**

35 28 year old female, third para with day 6 Post natal care, presented antenatally with
36 breathlessness and on examination was found to have a continuous murmur in left 2nd
37 intercostal space. She was referred to tertiary care centre for evaluation of murmur and
38 echocardiography. Echocardiography revealed 7 mm PDA with left to right shunt. So patient
39 was planned for hemodynamic study followed by PDA device closure. Right femoral arterial
40 and venous access obtained. Hemodynamic study revealed Qp/Qs-2:1 with PA pressure of
41 36/18 (mean-24) mmHg and PVR of 3.6 WU. So it was decided to go for PDA device closure.
42 Pigtail shoot revealed 12 mm PDA at the aortic end with a relatively poor ampulla. The PDA
43 was tried to cross from pulmonary end to Aorta with Terumo wire but despite multiple
44 attempts it could not be crossed, using MPA and JR 3.5 catheters. It was observed that the
45 Terumo wire was getting buckled at the entry point of the PDA repeatedly (Figure 1). So we
46 decided to cross the PDA from aortic Side and snare it out from pulmonary side akin to VSD
47 device closure. So we tried to cross PDA from aortic side and were able to cross it easily with
48 Terumo wire 0.035 inch. This suggested some valve like mechanism which was preventing
49 passage of the wire and catheter from pulmonary end, since angiography done in multiple
50 angulation ruled out any tortuosity of the PDA.

51 Terumo wire was used to cross the PDA retrogradely from aortic side with the help of JR 3.5
52 6 F catheter. The wire was advanced retrogradely through MPA, right ventricle, RA into the
53 IVC and was snared out from right femoral vein to complete AV loop (Figure 3, 4). This was
54 followed by antegrade placement of 10F delivery system from the right femoral vein
55 through the IVC, RA, RV, PA, through the PDA into the Aorta. A Cocoon PDA device 16/18
56 was passed through the delivery system and successfully deployed. Angiographic check
57 shoot and echocardiographic evaluation confirmed precise deployment of the device with
58 no residual flow across PDA (Figure 5). Finally the device was delivered which retained its
59 position across the PDA, rechecked in Xray 24 hours later. Patient was started on
60 antiplatelets and observed for 24 hours. Echo showed device in situ across PDA with no flow
61 across PDA (Figure 6, 7). Patient was discharged after 48 hours. Patient is asymptomatic on
62 subsequent follow-ups.

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Figure 1: LAO 70 showing coiling of wire while passing through pulmonary end

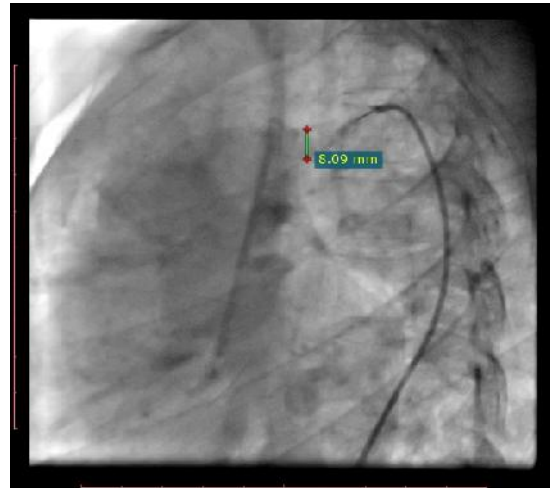
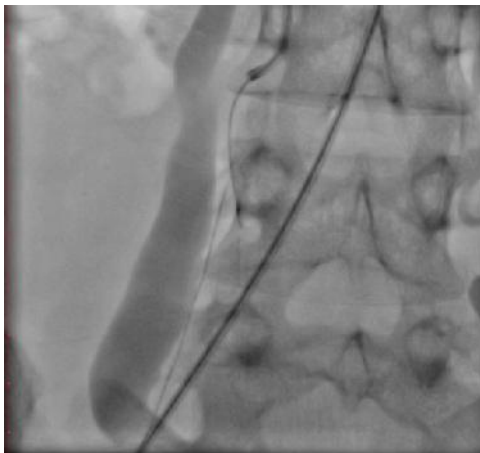


Figure 2: LAO 70 view showing size of PDA



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Figure 3: AP view showing snaring of terumo wire in IVC

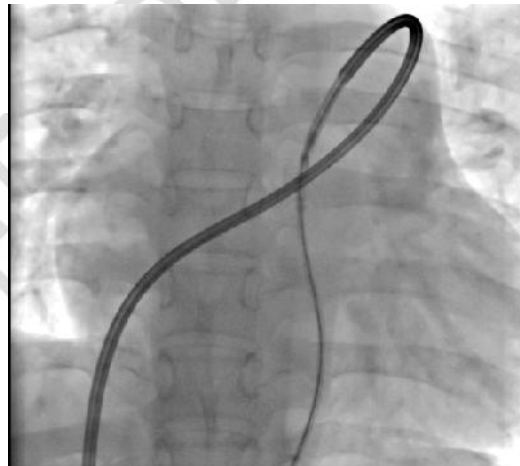
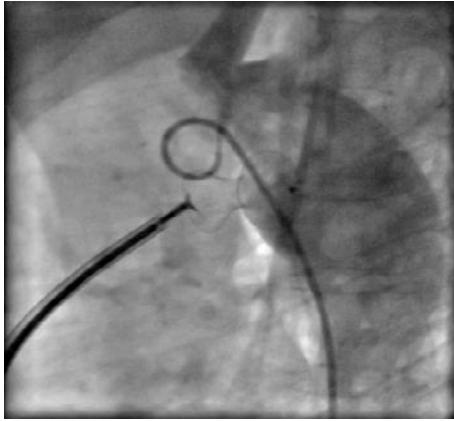


Figure 4: AP cranial view showing crossing of PDA with cocoon PDA sheath



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Figure 5: LAO 70 view showing device across PDA with no residual shunt.

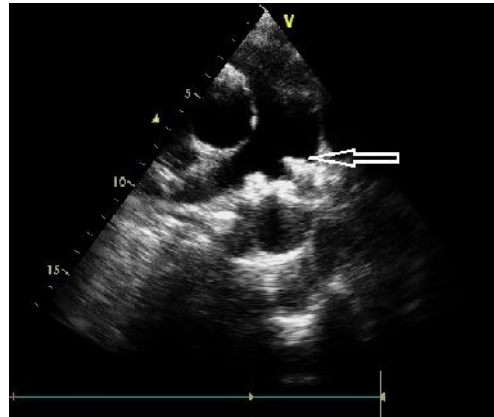
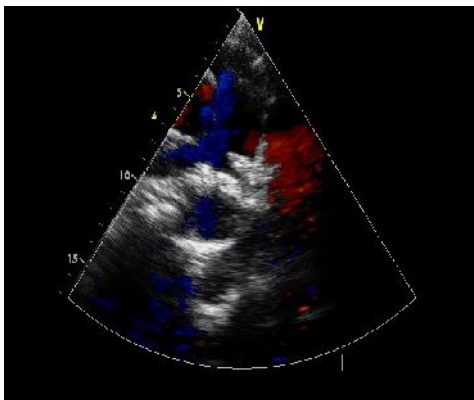


Figure 6: 2D echo showing PDA device in situ



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Figure 7: Color Doppler showing no shunt across PDA device

83 Discussion:

84 Transcatheter PDA closure options have expanded significantly since the first report of this
85 approach in 1979⁴. Since that time several devices have been used for PDA closures
86 including coils, vascular plugs and devices specifically designed for PDA closure. Currently,
87 transcatheter closure is standard of care beyond the neonatal period. With appropriate
88 patient and device selection, transcatheter PDA closure is a very safe and effective
89 procedure.^{5, 6} Mortality is rare in this procedure. PDA device closure is a well established
90 procedure, in which after crossing the PDA from pulmonary end, device is deployed. The

91 procedure is relatively simple and an excellent alternative to surgical PDA closure with a
92 success rate of about 92 %⁷. In adults, the orientation of the patent ductus arteriosus may
93 not be the same as in patients presenting in the **pediatric** age group. Anatomical differences
94 may contribute to unique difficulties in these patients taken up for device closure. In the
95 present case we were not able to cross from pulmonary end despite multiple attempts. This
96 led us to hypothesize that there must be a physical structure or valve like mechanism
97 preventing the passage of wire. This is a unusual situation which led us to rethink our
98 strategy and reattempt crossing via aortic end and snaring it out from pulmonary end. Such
99 retrograde wiring and antegrade snaring was also reported by Feyza Aysenur Pac **et al.** in
100 2011, where PDA ostium could be engaged in 17 of 18 adult patients by retrograde wire –
101 guided assisted approach.⁸ One such case of Retrograde wiring and antegrade snaring
102 approach to close the PDA was reported in 6 month infant by SK Sinha **et al** in 2018.⁹ Thus in
103 patients with difficult PDA device closure, retrograde approach should be tried instead of
104 opting for surgical closure.

105 **Conclusion:**

106 Percutaneous device closure of PDA is now the treatment of choice in isolated PDAs. Device
107 closure in PDA is usually done by antegrade technique where PDA is crossed from PA side. In
108 some selected patients this universal procedure may not be successful. In such patients,
109 retrograde technique with retrograde wiring and antegrade snaring approach followed by
110 PDA device closure may be used successfully to close PDA.

111 **Informed Consent**

112 Written informed consent was obtained from the patient for publication of this report and
113 any accompanying images

114 **Conflict of interest:** None

115 **References:**

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