

MEDICAL SCIENCE

To Cite:

Francis AP, Bhalerao N, Modak A, Wanjari D, Dash S. Intra-arterial migration of a transcatheter patent ductus arteriosus occluder device: A case report. *Medical Science* 2023; 27: e126ms2859. doi: <https://doi.org/10.54905/disssi/v27i133/e126ms2859>

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Peer-Review History

Received: 23 January 2023
Reviewed & Revised: 27/January/2023 to 20/February/2023
Accepted: 27 February 2023
Published: 03 March 2023

Peer-review Method

External peer-review was done through double-blind method.

Medical Science
pISSN 2321-7359; eISSN 2321-7367

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Intra-arterial migration of a transcatheter patent ductus arteriosus occluder device: A case report

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ABSTRACT

Patent ductus arteriosus (PDA) is the inadequate closure of the ductus arteriosus within three days after birth. Patients with PDA may be treated pharmaceutically, surgically, or conservatively. With the introduction of PDA occlusion devices, the management of PDA with occluder devices has gained immense popularity. Complications of the procedure range from infection to life-threatening complications like device embolization. We report a case of a ten-year-old female posted for patent ductus arteriosus occluder device deployment, complicated by device embolization. Embolization of the device was identified intra-operatively with the help of 2D ECHO and subsequent attempted transcatheter retrieval of the device resulted in the rupture of the iliac artery. This resulted in a drastic change in the hemodynamics of the patient. The patient was then administered general anaesthesia and an internal jugular venous access catheter and a radial arterial cannula were placed. This was followed by surgical retrieval of the device and evacuation of the clot with iliac artery repair.

Keywords: Patent ductus arteriosus, Congenital heart disease, Occluder device, Device embolization, Device migration, iliac artery repair

1. INTRODUCTION

Patent ductus arteriosus (PDA) is characterized by inadequate closure of the ductus arteriosus within seventy-two hours after birth resulting in a left-sided to right-sided shunt. This shunting causes a portion of oxygenated blood from the aorta to be diverted and sent to the pulmonary arteries. Tachycardia, bounding pulses with widened pulse pressure, systolic murmur, respiratory distress, failure to thrive and cardiomegaly are some of the symptoms (Dice and Bhatia, 2007). Management can be conservative, pharmacological and surgical. They did the first PDA closure surgery in 1939 (Gross and Hubbard, 1939) and the first transcatheter closure of the PDA was done in 1967 by them (Portsmann et al., 1967). Ever since, transcatheter closure of the PDA by an occluder device has been the management of choice for most cases in all age

groups (Baruteau et al., 2014). The complications of the procedure include hemolysis, infective endocarditis, narrowing of vessels and vascular injury. Migration of the occlusion device is a rare complication (Jang et al., 2007). We report a case of the management of iliac artery dissection following the migration of the PDA occluder device.

2. CASE REPORT

A ten-year-old female came to the hospital with a loss of appetite and failure to thrive, as informed by the mother. Birth history revealed a full-term normal vaginal delivery with no complications. A continuous murmur was heard in the pulmonic area during auscultation. 2D ECHO showed a PDA of size 1.2mm, a left-sided to right-sided shunt and a mildly dilated left atrium. The patient was planned for PDA device closure with an occluder device. A complete blood count revealed a hemoglobin of 12.6 g/dl. Renal and hepatic function tests were within normal limits. Electrocardiogram (Figure 1) and chest X-ray (Figure 2) were normal.

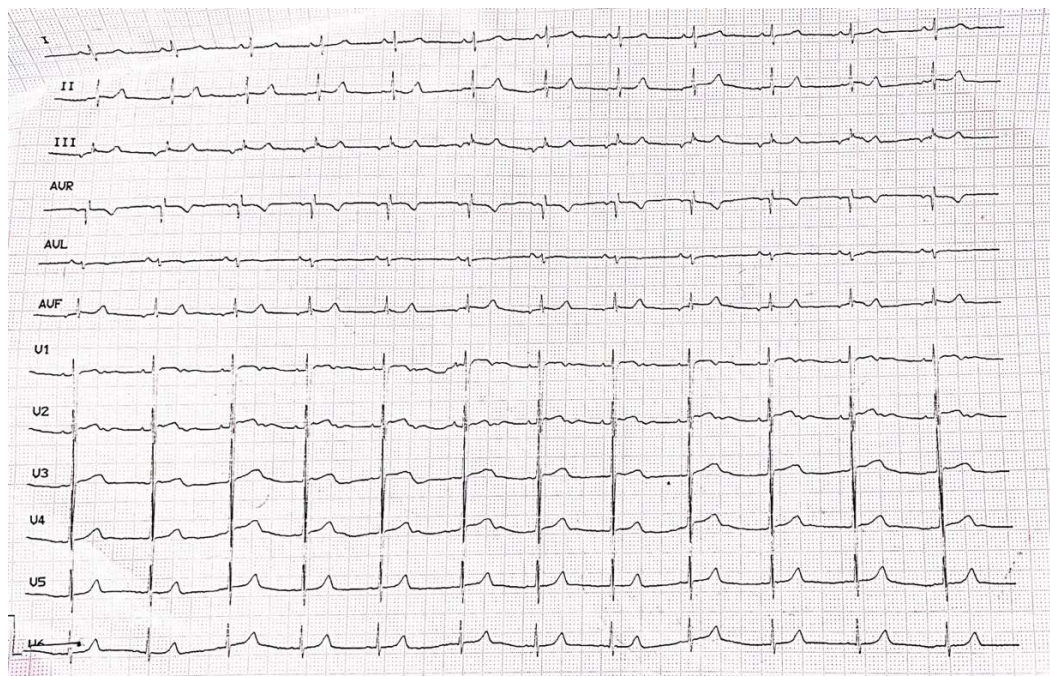


Figure 1 Electrocardiogram

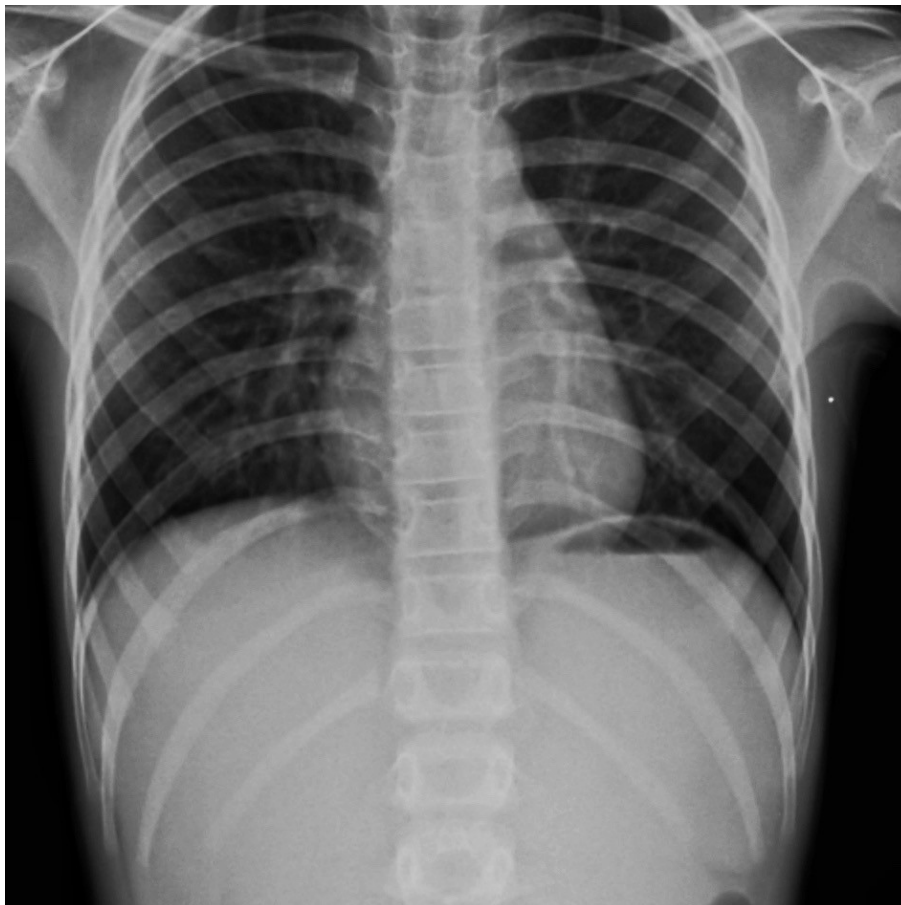


Figure 2 Pre-operative Chest X-ray

On the day of the procedure, the patient was kept nil per os for 6 hours before the scheduled time of the procedure. She was shifted to the Cath lab, standard ASA monitors were attached and baseline vital parameters (Pulse rate - 98/min, Blood pressure- 100/60 mmHg, Peripheral oxygen saturation - 100% in room air) were noted. A 22G intravenous catheter was secured in the right hand and intravenous fluid was administered. The patient was given Inj. Glycopyrrolate 0.06mg, Inj. Midazolam 0.3mg and Inj. Ketamine 30mg intravenously. Face mask ventilation was initiated and the procedure commenced. Transcutaneous femoral venous access was attained and the PDA occluder device was placed under fluoroscopic guidance (Figure 3).

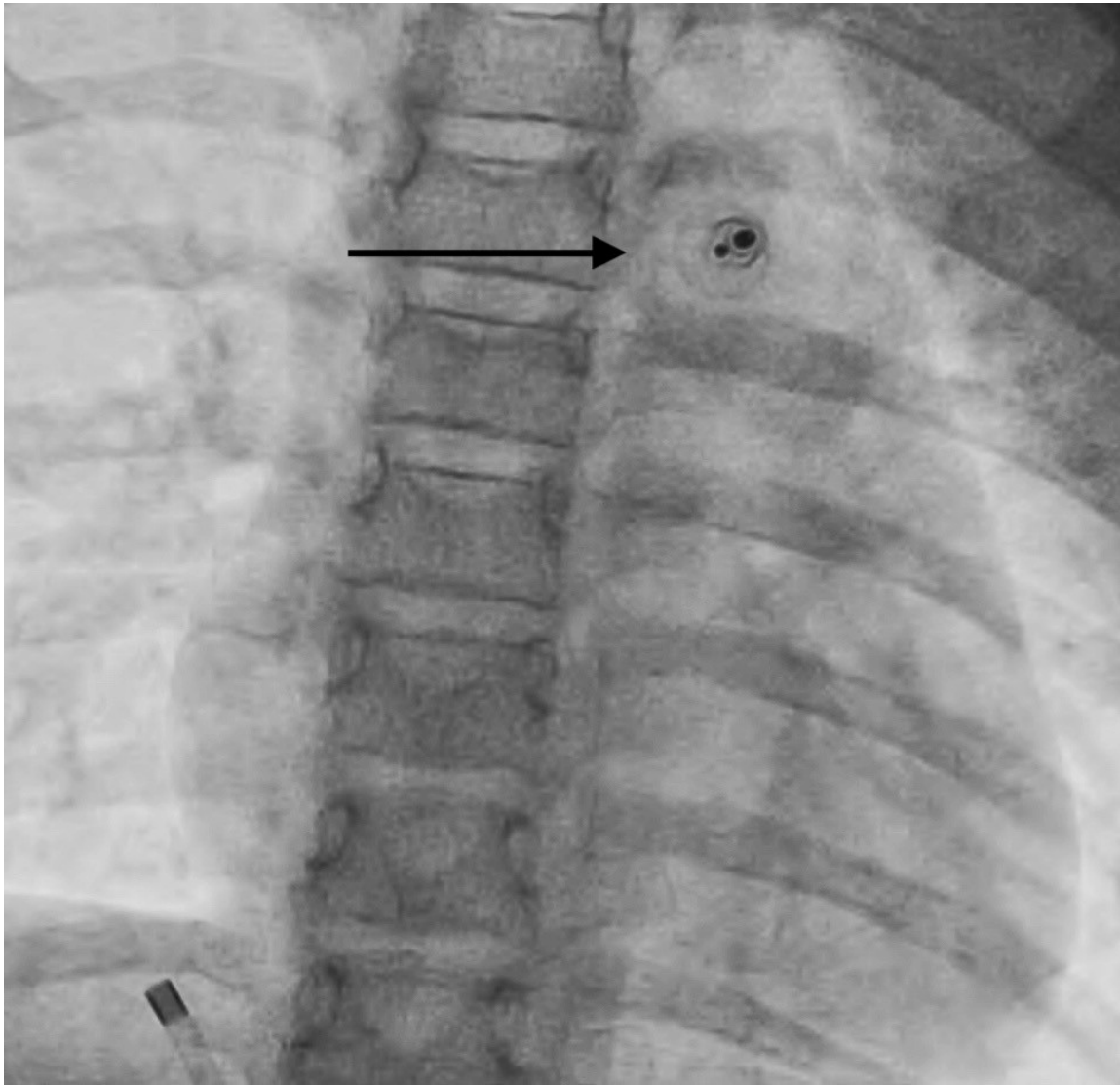


Figure 3 Fluoroscopy image showing PDA occluder device in place

Post-device placement, 2D ECHO was done intra-operatively to check for the size of the PDA. 2D ECHO revealed a PDA of size 1.2mm. Hence, fluoroscopy was done to check for the position of the device. It was found that the device had dislodged and migrated into the left iliac artery (Figure 4).

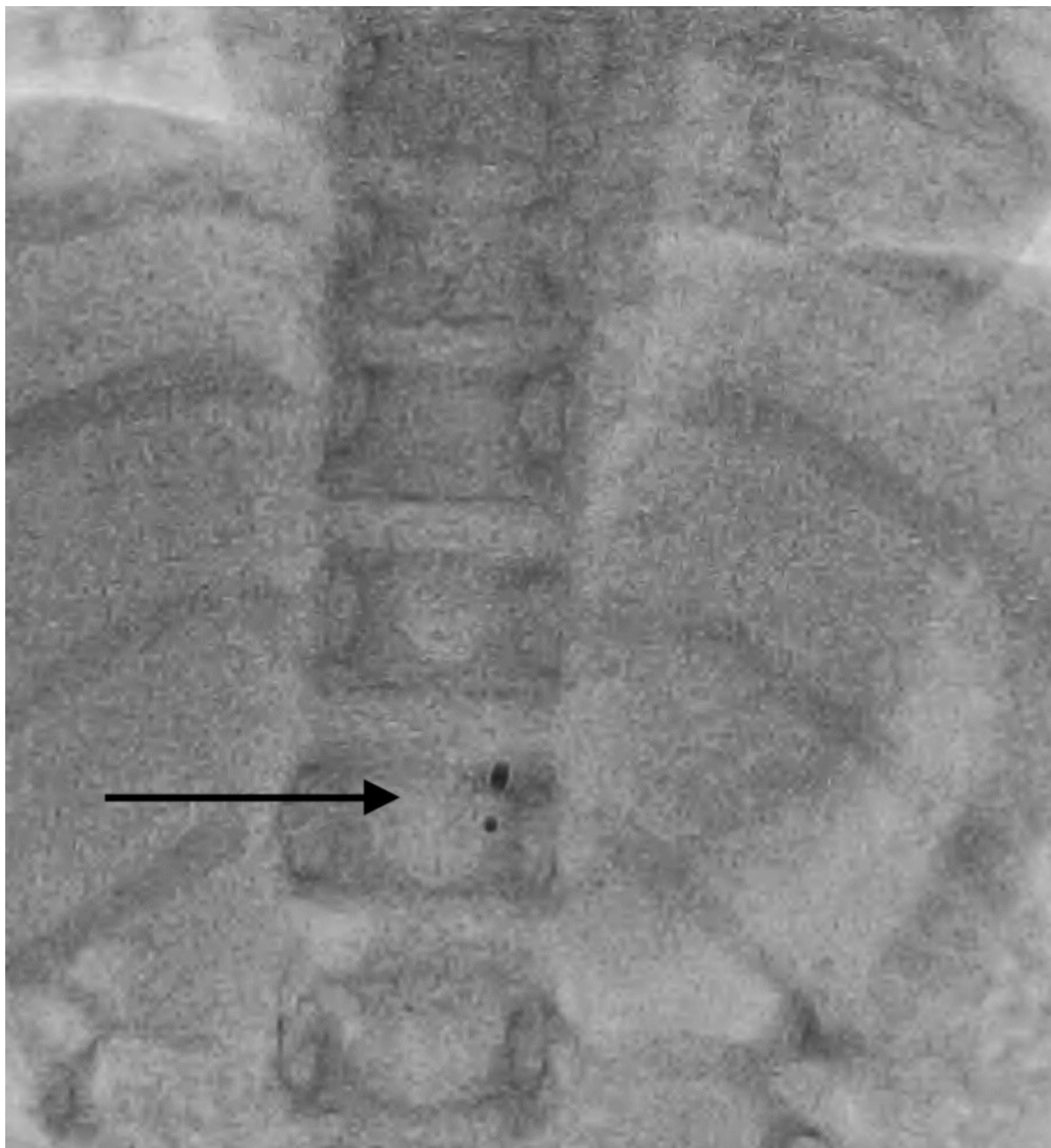


Figure 4 Fluoroscopy image showing the occluder device in the left iliac artery.

Transcutaneous retrieval of the device was attempted to no avail. During the attempted retrieval, the left iliac artery ruptured, and the patient developed tachycardia and hypotension. Given the unstable hemodynamics, it was decided to administer general anaesthesia to the patient. The patient was given Inj. Fentanyl 30mcg, Inj. Ketamine 20mg and Inj. Vecuronium 3mg intravenously and was intubated with a 6mm I.D. Portex cuffed endotracheal tube (Figure 5). Her pulse was 128 per minute, with a systolic pressure of 70 mmHg and a diastolic pressure of 40 mmHg. The left lower extremity started becoming cold and the left femoral pulse was not palpable.

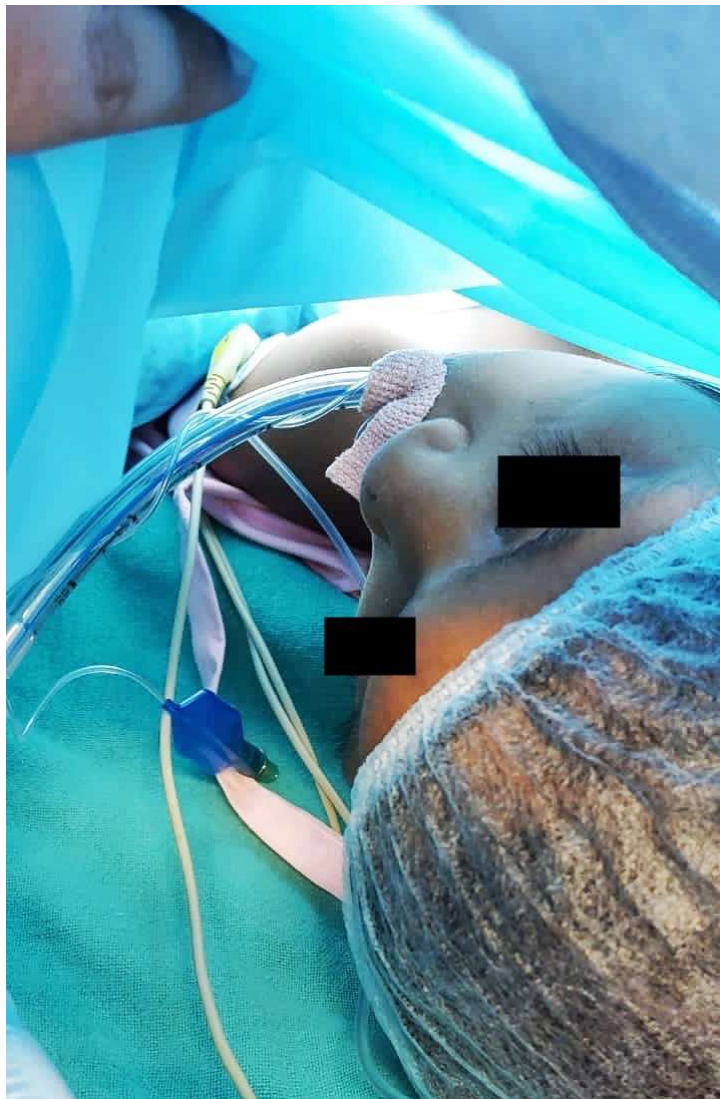


Figure 5 The patient after intubation

She was immediately shifted to the cardiac operating room for PDA device retrieval with iliac artery embolectomy and repair. Under ultrasound guidance, a 5.5 French central venous line with a triple lumen was inserted in the internal jugular vein on the right side and a 22G arterial catheter was placed in the radial artery of the right hand. Packed cell transfusion and Inj. Noradrenaline infusion at 1.5mcg/min was initiated. With the patient positioned supine, a J-shaped incision was given in the left iliac fossa and was extended. Retroperitoneal clots were evacuated. The iliac vessels were identified and looped. The PDA device was found impacted in the left iliac artery (Figure 6). The iliac artery was found ruptured near the bifurcation.



Figure 6 PDA device impacted in the left iliac artery

Intimal tear and dissection were extended proximally till the impacted device. Iliac arteriotomy was done at the impaction site, and the device was retrieved (Figure 7, Figure 8). Proximal and distal embolectomy was done with a 3Fr Fogarty catheter.

Prolene 7-0 was used to close the arteriotomy. The ruptured segment was mobilized, ends refashioned and anastomosis was done from end-to-end with 7-0 prolene. Good flow was noted in the distal vessels. Hemostasis was confirmed and the incision was subsequently closed in layers. The nor-adrenaline infusion was slowly tapered off and discontinued through the course of the surgery as the hemodynamics started stabilizing. The patient was shifted to PICU on ventilatory support. Peripheral pulsations were feeble on the left lower limb. Investigations were done, which revealed a hemoglobin of 11.1g/dl. Coagulation profile was done and INR was 1.17. Ultrasonographic colour doppler was suggestive of dampened flow with monophasic waveforms in the left superficial femoral artery and popliteal artery, possibly secondary to the occlusion of the common iliac artery. The opinion of a cardiologist was sought and Inj. Heparin was started. The patient was on ventilatory support for two days post-procedure and was extubated on postoperative day three (Figure 9).

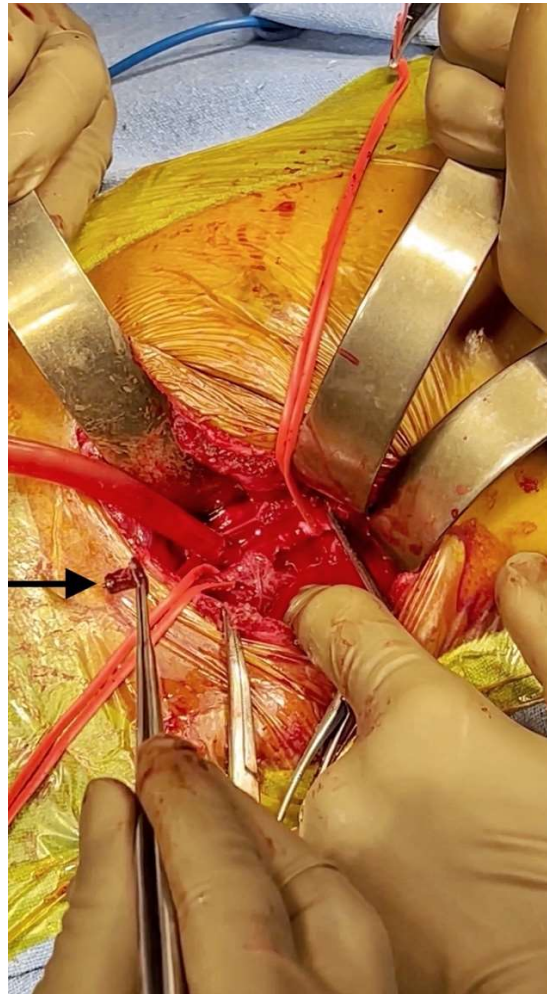


Figure 7 Arrow denoting the retrieved device

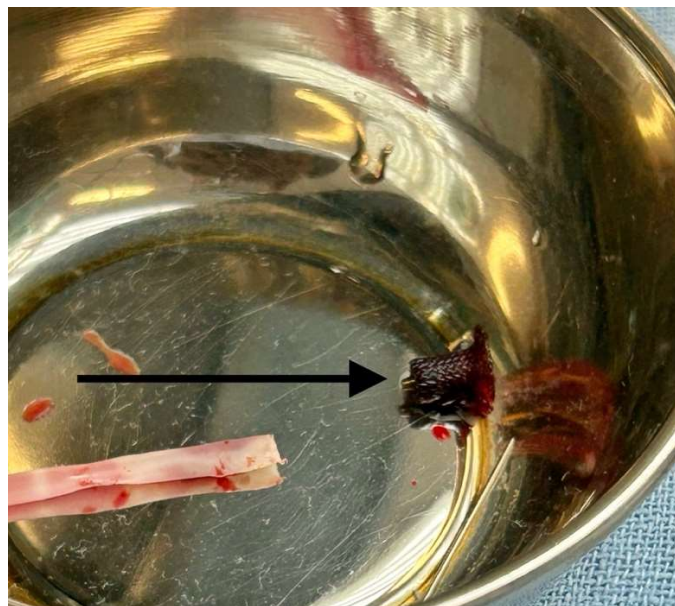


Figure 8 Retrieved device



Figure 9 Chest Xray post extubation

The central venous line and the arterial catheter were removed. Ultrasonographic colour doppler was repeated and was suggestive of good flow till the popliteal artery and dampened flow below (Figure 10, Figure 11, Figure 12). Inj. Heparin was continued and serial coagulation profile monitoring was done.



Figure 10 Doppler ultrasonography - Good flow seen in the superficial femoral artery

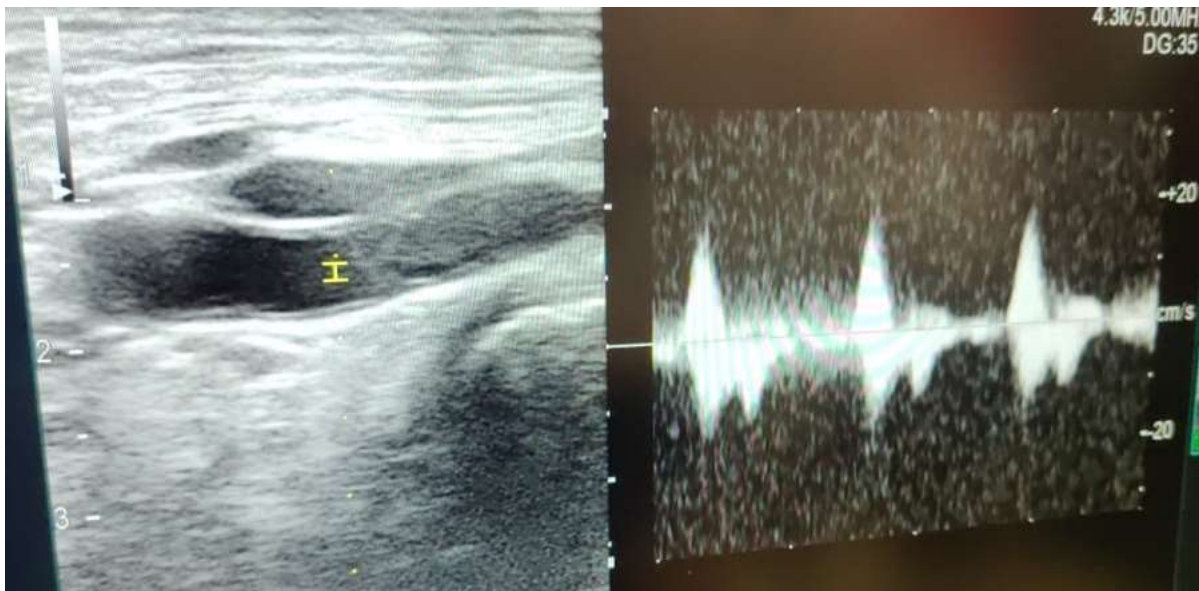


Figure 11 Doppler ultrasonography - Good flow seen in the popliteal artery

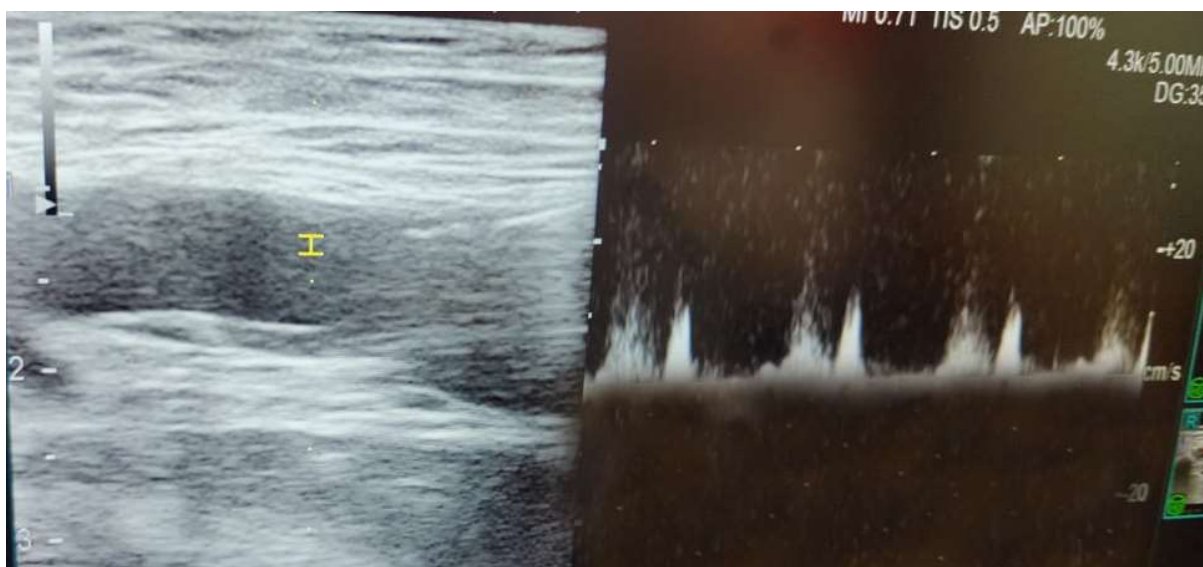


Figure 12 Doppler image showing monophasic flow in the peroneal artery

On postoperative day six, the patient was shifted to the ward. A cardiologist call was made and the patient was advised to undergo PDA device closure after three months. The patient was switched from intravenous anticoagulants to Tab. Aspirin and Tab. Clopidogrel. On postoperative day nine, an ultrasonographic colour doppler was done, which showed triphasic flow in the left iliac artery and good flow and biphasic waveform in the superficial femoral artery and popliteal arteries. The patient was transferred out of the hospital on postoperative day ten.

3. DISCUSSION

With recent advances in medicine and improvements in the design of occluder devices, transcatheter device closure has become popular in the last few decades since its introduction. Associated with high success rates, low risk-benefit ratio and lesser complications, it has decreased the requirement for surgical correction of patent ductus arteriosus. Migration of the occluder device is a rare complication associated with the transcatheter device closure (Raju et al., 2019). Usually occurring in the first twenty-four hours after deployment, migration of the device can have catastrophic consequences. Occlusion of blood vessels by the device can cause reduced blood flow to the target areas or even ischemia (Garg et al., 2021).

Early detection is of utmost importance in the management as there may be a dramatic change in the patient's hemodynamics. Once recognized, transcatheter retrieval of the device or surgical removal should be done. As reported in our case, intra-operative

2D ECHO helped us identify the complication immediately and management was started immediately. After the rupture of the iliac artery, our patient's hemodynamics deteriorated rapidly and general anaesthesia was administered. The speedy establishment of a central venous line and an arterial catheter helped us manage this patient effectively. Inotropic support and blood transfusion were required. The patient was transferred to the cardiac operation theatre instantly, where the device was retrieved surgically, thereby preventing potential limb loss in this patient. When occluder device placement is planned, it is of utmost importance to have a cardiovascular surgeon on standby. Also, the presence of sonographers in the Cath lab helps confirm the device's successful placement and detect device migration, if any.

4. CONCLUSION

Any surgical or interventional procedure is associated with a certain chance of related complications. A severe but rare complication associated with PDA occluder device placement is the migration of the device into the systemic circulation. As anesthesiologists, it is crucial to understand that timely management of this complication can save patients from deterioration. All centres providing transcatheter occluder device deployment must be well equipped for transcatheter device retrieval and surgical removal of the device if the complication of device embolization arises.

Acknowledgements

I, Amreesh Paul Francis, would like to thank the patient and the family for granting permission to publish this case report. I would also like to thank my family, friends, professors, seniors and colleagues for motivating me each day.

Author Contributions

Dr Amreesh Paul Francis – Involved in anaesthesia care, image selection and manuscript preparation.

Dr Nikhil Bhalerao – Involved in anaesthesia care and manuscript review.

Dr Anjali Modak - Involved in anaesthesia care and manuscript review.

Dr Dnyanshree Wanjari - Involved in anaesthesia care and manuscript preparation.

Dr Sambit Dash – Involved in anaesthesia care.

Informed consent

Informed written and oral consent was obtained from the patient's parents in the study.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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