Surgical Retrieval of Embolized Patent Ductus Arteriosus Occluder Device in an Adult after 12 Years of Initial Deployment: A Case Report with Perioperative Considerations and Decision-Making in Resource-Limited Settings

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Abstract

Transcatheter closure of patent ductus arteriosus (PDA) is a well-established technique worldwide, with minimal incidence of associated major and minor complications. Surgical closure of PDA is equally effective with negligible mortality risk. We describe a case of an adult with unexpected diagnosis of PDA occluder device embolization in main pulmonary artery, presenting after 12 years of initial device deployment during childhood. Due to persistent duct flow, patient developed severe pulmonary hypertension and congestive heart failure. In this report, we are focusing on perioperative management of surgical retrieval of the embolized device along with the need of intermediate and sometimes long term follow up of patients planned for percutaneous closure, in order to avoid procedure-related complications and associated morbidity and mortality risk. At the same time, the socio-economic aspects of the patient should also be considered in decision-making in terms of choice of transcatheter versus surgical closure of the shunt.

Keywords: Embolization, follow-up, late complications, patent ductus arteriosus occluder device, socio-economic aspects

Introduction

Transcatheter closure of patent ductus arteriosus (PDA) is a well-established technique, with reasonable safety and high success rate. Major complication associated with the procedure is embolization and protrusion of occluder disc into either pulmonary artery (PA) or descending aorta causing obstruction. In most cases, device embolization is detected either immediately or within 48 hours and can be retrieved either by transcatheter or, in rare cases, surgical route. We report a rare case of an 18-year-old male who presented after 12 years of initial device deployment, with persistent ductal flow due to late detection of device embolization and embedment in the PA, leading to complications, such as severe pulmonary hypertension and congestive heart failure.

Case Report

An 18-year-old male, with a body mass index of 18, belonging to lower socioeconomic status, residing in rural area, presented to the cardiology outpatient department with symptoms of easy fatigability, palpitation, and shortness of breath. The patient had a history of recurrent chest infections and inability to gain weight. The patient was on antiplatelet therapy prior to his admission. Chest X-ray and transthoracic echocardiogram showed a grade 3/4 systolic murmur at the left sternal border, with right ventricular hypertrophy. Chest CT angiography revealed an embolized occluder device in the right pulmonary artery, which was not retrievable with a transvenous approach.

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weight since childhood. The patient also gave a history of transcatheter device closure of PDA at 6 years of age in another hospital but was lost to his follow-up evaluation.

Physical examination revealed continuous murmur in his infraclavicular area and bilateral basal chest crepitations. Electrocardiography (ECG) indicated left-axis deviation. Chest X-ray showed cardiomegaly and increased pulmonary vascular markings with a device shadow [Figure 1]. Echocardiography confirmed large ductal shunt with dilated left atrium and ventricle along with a PDA occluder, which was found to be stuck at the main PA (MPA). During cardiac catheterization, Qp:Qs ratio was 2.2:1 with a mean PA pressure of 55 mmHg. The systolic gradient between PA and aorta over PDA was 92 mmHg. The patient was admitted, and the medical management of congestive heart failure with injection (inj.) furosemide 20 mg intravenous and table (Tab.) enalapril 2.5 mg twice daily was started. Inj. digoxin 200 µg was given as half the loading dose, and the remaining 200 µg was given eight hourly in divided doses. Tab. digoxin 0.25 mg was started as maintenance dose. Serum potassium level was regularly monitored and maintained above 3.5 mEq.dl$^{-1}$. After 5 days of therapy and symptomatic improvement, percutaneous transcatheter retrieval of the embolized device was planned. However, unfortunately, the device could not be retrieved percutaneously as it was well embedded into the wall of the PA. Owing to the presence of large symptomatic ductal shunt, the patient was sent for surgical retrieval of the device on cardiopulmonary bypass (CPB) and duct ligation.

The patient was premedicated with Tab. ranitidine 150 mg and Tab. alprazolam 0.25 mg in the morning of the surgery with a sip of water. All standard and invasive monitors such as ECG, oxygen saturation, capnography, intra-arterial blood pressure, and temperature monitoring were attached. After preoxygenation, the patient was induced with inj. midazolam 0.02 mg.kg$^{-1}$, inj. fentanyl 5 µg.kg$^{-1}$, and inj. etomidate 0.4 mg.kg$^{-1}$. Muscle relaxation was achieved with inj. vecuronium 0.1 mg.kg$^{-1}$. The surgery was performed with median sternotomy. Inj. heparin 4 mg.kg$^{-1}$ was given to achieve the activated clotting time of 480 seconds. After securing aortic and venous cannulation, PDA was ligated before initiation of CPB. The embolized device was palpated over the PA. During initiation of CPB, pulmonary arteriotomy was performed to expose the device [Figure 2]. The device was completely endothelized and had become deeply embedded into the intimal layer of the PA [Video 1]. After removal of the device, PA was primarily closed as medial layer was uninvolved, and the patient was weaned off from CPB on mild inotropic support. The patient was extubated the next day and discharged from the hospital on the 7th postoperative day [Table 1]. The patient was thoroughly instructed about the monthly follow-up visits for minimum of 3 months. Surgical ligation of PDA led to significant improvement in the symptoms of the patient. Endocarditis prophylaxis was given until 6 months of the treatment.

**DISCUSSION**

The incidence of PDA is 1 in 2000 in full-term infants and contributes to 5%–10% of all the congenital heart disease.$^{[5]}$ Mortality of untreated PDA in 2–19 years of age is about 0.49% per year.$^{[6]}$ Transcatheter device closure of PDA was first described by Porstmann in 1971. Although it is a recommended and safe technique for PDA closure in both children and adults, the procedure is associated with few complications, such as residual shunt, left PA narrowing, peripheral arterial complication, and hemolysis.$^{[2]}$

Device embolization is a significant complication of transcatheter closure of PDA, with an incidence rate ranging from 3% to 20%, and occurs mostly in acute stages.$^{[3,7]}$ In reported case, the patient presented with symptoms after 12 years of initial device deployment, which is a rarity. Embolization of PDA occluder is more common in pulmonary circulation than the systemic circulation and largely depends on pressure gradient between PA and aorta over PDA.$^{[8]}$ In our case, it was hypothesized that the device was embolized...
Table 1: Timeline - Course of the patient from presentation to outpatient department till the discharge from the hospital after surgery

| Timeline       | Course of events                                                                 |
|---------------|----------------------------------------------------------------------------------|
| 12 years ago  | Transcatheter PDA device closure was done                                         |
| Day 1, presentation | Presented in OPD with symptoms of congestive heart failure                    |
| Day 2         | Admitted into the hospital and medical management for congestive heart failure was started |
| Day 3         | Echocardiography showed embolized PDA device embedded into main pulmonary artery with persistent shunt |
| Day 5         | Symptomatic improvement in clinical condition                                    |
| Day 7         | Percutaneous transcatheter retrieval of embolized device was tried but failed. Procedure abandoned and surgical retrieval was planned |
| Day 8         | Embedded PDA device was surgically removed on CPB and shunt was closed            |
| Day 11        | Discharge from ICU                                                                |
| Day 15        | Discharge from hospital in good clinical condition                               |

PDA=Patent ductus arteriosus, OPD=Outpatient department, CPB=Cardiopulmonary bypass, ICU=Intensive care unit.

Conlong-term follow-up is usually not required,[11] certain patients may require interval echocardiography testing depending upon the postprocedure physiology of the lesion.[12] A study done by Narayan et al. recommended a follow-up until 3 months of transcatheter procedure to detect embolization of device.[11] Further studies should be conducted to compare the long-term outcome of PDA closure through surgical versus transcatheter route, especially in developing countries where regular follow-up is usually not feasible due to poor patient compliance, economic constraints, and nonaccessibility of medical facilities for evaluation.

CONCLUSION

PDA closure is indicated in all patients irrespective of the severity of symptoms and ductus size to prevent the development of endocarditis. Endocarditis prophylaxis is usually given in patients with long-standing left-to-right shunt in view of the risk of right-sided IE, although routine administration is not recommended.[10] The decision-making in terms of transcatheter versus surgical closure of PDA should also consider socio-economic aspect, availability of medical resources, and compliance of the patient, especially in resource-limited settings, as intermediate-term and sometimes long-term follow-up of the patients may be required to avoid sequelae of pathology as well as procedure-related complications.

Consent

The author/s confirm that written consent for submission and publication of this case report including image (s) and associated text has been obtained from the patient in line with COPE guidance.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Masura J, Tittel P, Gavora P, Podnar T. Long-term outcome of transcatheter patent ductus arteriosus closure using Amplatzer duct occluders. Am Heart J 2006;151:75567-10.
2. Jang GY, Son CS, Lee JW, Lee JY, Kim SJ. Complications after transcatheter closure of patent ductus arteriosus. J Korean Med Sci 2007;22:484-90.
3. Tripathi RR, Agarwal R, Premsekhar R. Late surgical removal of an embolized patent ductus arteriosus device causing erosion of the aortic wall. Pediatr Cardiol 2012;33:1453-5.
4. Shahabuddin S, Atiq M, Hamid M, Amanullah M. Surgical removal of
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an embolised patent ductus arteriosus amplatzer occluding device in a 4-year-old girl. Interact Cardiovasc Thorac Surg 2007;6:572-3.

5. Schneider DJ, Moore JW. Patent ductus arteriosus. Circulation 2006;114:1873-82.

6. Campbell M. Natural history of persistent ductus arteriosus. Br Heart J 1968;30:4-13.

7. Thanopoulos BD, Hakim FA, Hiari A, Goussous Y, Basta E, Zarayelyan AA, et al. Further experience with transcatheter closure of the patent ductus arteriosus using the Amplatzer duct occluder. J Am Coll Cardiol 2000;35:1016-21.

8. Atik FA, Jatene FB, Costa PH, Atik E, Barbero-Marcial M, Oliveira SA. Surgical treatment of coil embolization to the pulmonary artery after an attempt at percutaneous closure of patent ductus arteriosus. Arq Bras Cardiol 2004;83:80-2.

9. Gokaslan G, Ustunsoy H, Deniz H, Ozcaliskan O, Yasin A, Baspinar O, et al. Urgent surgical management for embolized occluder devices in childhood: Single center experience. J Cardiothorac Surg 2012;7:127.

10. Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, Levison M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association: A guideline from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. Circulation 2007;116:1736-54.

11. Narayan SA, Elmahdi E, Rosenthal E, Qureshi SA, Krasemann T. Long-term follow-up is not indicated after routine interventional closure of persistent arterial ducts. Cathet Cardiovasc Intervent 2015;86:100-4.

12. Stout KK, Daniels CJ, Aboulhosn JA, Bozkurt B, Broberg CS, Colman JM, et al. 2018 AHA/ACC Guideline for the management of adults with congenital heart disease: Executive summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines J Am Coll Cardiol 2019;73:1494-563.