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# Patent Ductus Arteriosus Device Embolization

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## Abstract

Nonsurgical closure of patent ductus arteriosus (PDA) using a duct occluder placed percutaneously is currently the first line of therapy and the success rate is quite high. Several devices are currently available. An eight year child underwent device closure of the ductus. However after deployment of the device it, became dislodged into the left pulmonary artery. Several attempts at catheter retrieval failed. The child underwent successful surgical removal of the device without cardiopulmonary bypass.

**MeSH:** Heart defects, congenital, patent ductus

## Introduction

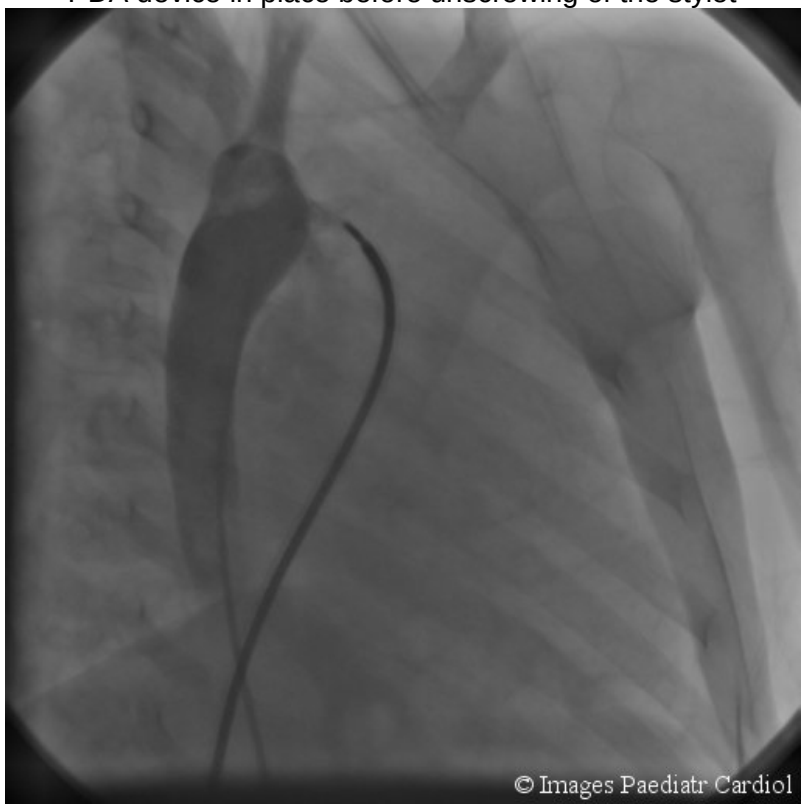
The sizing of PDA for device implantation is based on the automatic calculations of dimension by the inbuilt sizing software in the cardiac catheterisation laboratory and many experienced interventionists believe their eyeball measurements more. The estimations can be erroneous if the calibrations are not proper, leading to catastrophic embolisation of the device, needing emergency surgical removal as was needed in our patient. Calibration by comparing with the fluoroscopic images of measured metallic sizing devices placed outside body can be misleading because of magnification errors.[1] In order to circumvent these problems we suggest some novel ways which take care of magnification errors and avoid the need for aortic root angiography.

## Technique

An eight year child with echocardiographically documented 6mm patent ductus arteriosus (PDA) was planned for device closure. The child was put under general anaesthesia. Femoral venous access was obtained using 8F sidearm sheath and the artery cannulated with a 6F sidearm sheath. A 6F pigtail catheter was advanced

through the femoral arterial sheath into the descending aorta at the mouth of the PDA and an angiogram obtained in a lateral projection delineating the ductus (figure 1). The minimum diameter at the aortic end was 6mm and a 8-10 mm PDA device was selected for deployment. A 7F Swan-Ganz catheter was advanced into the the pulmonary artery through venous route and a 0.35" Terumo wire advanced through the PDA into the descending aorta .The Terumo wire was exchanged with an 0.35" extra stiff Amplatzer wire and the Swan-Ganz catheter with the PDA delivery system. An 8-10mm size PDA device was released across the ductus and after confirming the proper position by repeat angiogram which showed a small residual shunt flow which may be expected. The delivery cable was disconnected.

Figure 1 Angiogram in lateral plane showing a small residual left to right shunt with PDA device in place before unscrewing of the stylet




After a short while, the device suddenly embolised into the left pulmonary artery (figure 2). The patient had a brief episode of mild hypotension which improved spontaneously and his oxygen saturations remained static . An attempt was made to retrieve the device percutaneously by a snare and later by a bioptome but the trial was given up as the device tended to go more distally, in which case even surgical removal would be difficult. The patient was discussed with the cardiac surgeon who shifted the patient for emergency surgery. After considerable debate surgeon decided for a left thoracotomy hoping to avoid cardiopulmonary bypass and closed the ductus. Later the left pulmonary artery was separated from the surrounding tissues and umbilical tape passed around it proximally for control of bleeding. A 1.5 cm longitudinal incision was made distal to the umbilical tape which was kept under traction and a long curved forceps passed toward the pulmonary hilum and the device retrieved. The incision was closed by 6-0 prolene and hemostasis achieved. The umbilical tape was removed and the thoracotomy closed (figure 3).

Figure 2 Cine image in lateral plane showing device embolized into left pulmonary artery soon after its release from stylet.

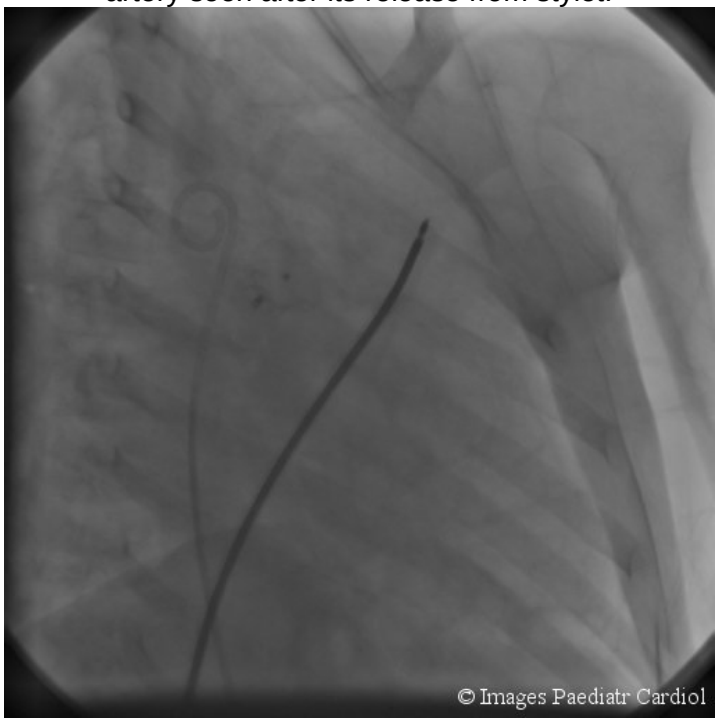
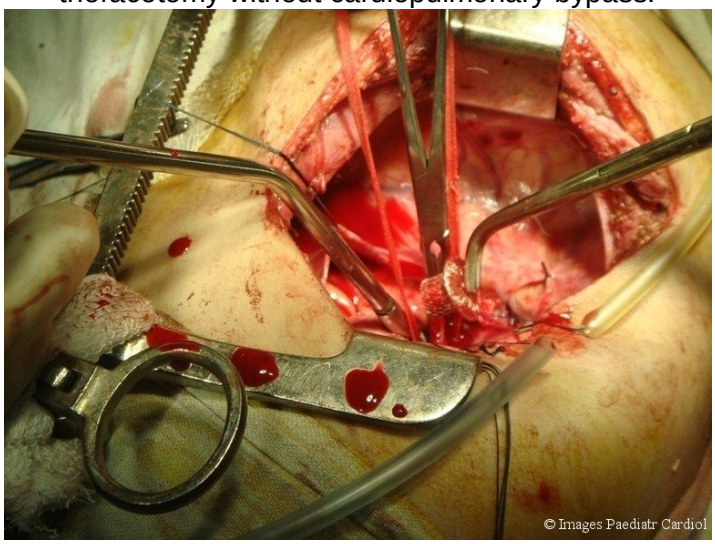



Figure 3 Showing the PDA device being retrieved from left pulmonary artery via left thoracotomy without cardiopulmonary bypass.




In order to prevent such eventualities we tried to devise some alternative ways of sizing a PDA .The first involves measuring a fully inflated Tyshak pulmonary balloon outside the human body with a caliper and then inflating the balloon to the same pressure in the right ventricular outflow tract passed over a 0.35" extra-stiff wire, and repeating the measurements, and using the same calibration factor for sizing of PDA visualized by aortic arch angiogram. Previously, some radio opaque sizing devices have been used placing them outside human body which can have magnification errors if not placed exactly at the level of heart.[2]

The second method involves advancing a Tyshak balloon 2-4mm bigger than the echocardiographic dimension across the PDA and inflating the balloon with dilute dye under low pressure without dilating the ductus so that it forms an impression of the ductus which is recorded in a cine mode in multiple planes, and the plane delineating

the exact anatomy of the ductus is used for measurements after proper calibrations as mentioned above without the need for aortic arch angiogram (figures 4,5).

Figure 4 Showing measurement of diameter of inflated Tyshak Balloon by a caliper after inflating it with fixed quantity of contrast.

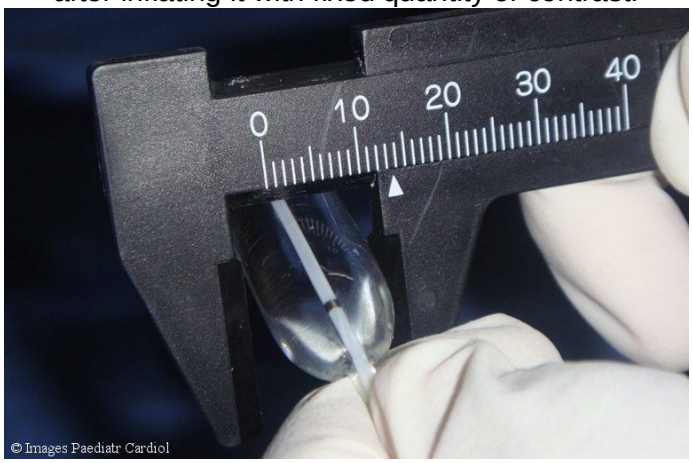
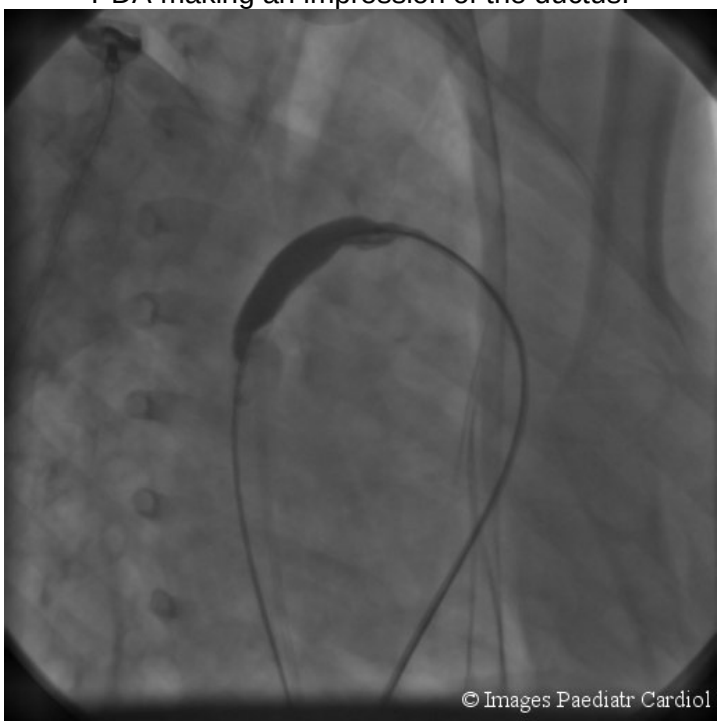



Figure 5 Angiogram in lateral plane showing an inflated Tyshak balloon across the PDA making an impression of the ductus.




## Discussion

Technological advances have made nonsurgical closure of the PDA a simple and a routine percutaneous intervention. The use of the Amplatzer device occluder (ADO) has further simplified the method and improved the results with minimal complications. However there are situations where complications are encountered and surgical help is required to ameliorate them. Faella and colleagues reported 15 procedure related complications in 316 patients which included hemolysis, left pulmonary artery artery stenosis, device protrusion into aorta causing coarctation, device misplacement and one death following device embolisation.[2] Late embolisation of the device to the left pulmonary artery has been reported with impaired left pulmonary perfusion six months after implantation requiring surgical

removal. Similarly, embolised coils have required surgical removal on cardiopulmonary bypass. Most of the complications occur because of improper sizing of the ductus. M Vavuranakis et al reported severe hemolysis with jaundice, anemia and hemogloginura on the second day following deployment of smaller sized coil due to improper sizing which needed removal and replacement by an ADO after repeat sizing using balloon tipped catheter.[3] The complications can be reduced by proper expertise and optimal sizing of the ductus. Sizing of atrial septal defect (ASD) by inflating a balloon across the ASD till a circumferential waist is created and measuring the waist (stretched balloon diameter) and also inflating the balloon outside by same amount of dye across sized rings, is a standard method.[4,5] Using a similar method for the PDA is not routine since angiographic visualization is usually adequate. However making an impression of the ductus by inflating a balloon across it can give a detailed anatomy about the length and breadth of the ductus in multiple planes without the need for multiple dye injection and may help in the selection of proper sized device.

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