Techniques in Cardiology : PDA Closure in Children

Lt Col JS Dugal (Retd)*, Lt Col V Jetley⁺, Lt Col JK Sharma (Retd)[#], Brig Charanjit Singh^{**},
Lt Col M Mehta⁺⁺, Lt Col JS Sabharwal^{##}, Lt Col Sunil Sofat^{***}, Lt Col P Bharadwaj⁺⁺⁺

Abstract

Background : Transcatheter closure of patent ductus arteriosus (PDA) with various devices has been evaluated worldwide and in selected cases can be performed successfully, thus avoiding the morbidity associated with surgical closure.

Methods and results : A 2 year old female child presented with PDA and aortic angiography showed large PDA (tubular). This defect can be closed nonsurgically by coils and devices. The coil used are normally 0.038" having delivery system called Flipper, but this child had a large PDA and so was closed by thicker coil 0.052" using a coil-Bioptome-sheath system, which is the first reported case from the Armed Forces.

Conclusions : We report the initial experience at our center of closure of PDA with a new coil-Bioptome-sheath system.

MJAFI 2005; 61 : 63-65

Key Words : Patent Ductus Arteriosus (PDA); Children; Coil-Bioptome-Sheath system

Introduction

Management of PDA has over the years evolved with the development of various surgical and nonsurgical techniques. Although surgical repair is a safe, widely accepted procedure with negligible mortality, it is associated with morbidity, discomfort and a thoracotomy scar. As an alternative to surgery, a variety of devices for transcatheter closure of PDA have been developed starting with the Ivalon plug used by Porstmann et al in 1967, 0.038" coil-Gianturco embolisation coils [1] and recently the Amplatzer Device duct occluder [2].

This report describe our experience with transcatheter closure of a PDA with a bizarre configuration (Krichenko Type E anatomic variant) [3]. A 2 years old female child presented with features suggestive of a large PDA. This congenital cardiac defect was closed nonsurgically using the 0.052" Gianturco embolisation coil by a new system called the coil-bioptome-sheath system. This is apparently the first reported case report using this technique from this city and also in the Armed Forces.

Material and Methods

1. Device

The peripheral embolisation coil used is a Cook Embolisation coil 0.052" in thickness with a 10 mm diameter

coil and a total length of 15 cm. The Bioptome used is a 3 F device, routinely used for carrying out endomyocardial biopsies. It has a jaw at the distal end, which can be manipulated into an open or closed position from the proximal end.

2. Procedure

The procedure was performed under general anaesthesia as described by Grifka et al [4]. Antibiotics were administered. 6F and 4F sheaths were placed in the femoral vein and artery vessels respectively. Heparin plain in a dose of 200 IU intravenous was given. A 4F pigtail was passed up the descending aorta upto the region of the duct. An aortogram was taken at this place which delineated a large and long tubular duct with a constriction at the pulmonary end (Krichenko Type E) and its length and minimum diameter were measured (Fig 1). A 6F Cournand catheter was passed through the venous side across the right heart, across the PDA and down into the descending aorta till the distal end of the Cournand crossed below the level of the diaphragm. Then a 0.035" stiff Amplatzer exchange length wire was passed through the Cournand catheter. The Cournand was then withdrawn leaving the Amplatzer wire in situ. Thereafter the Amplatzer wire was exchanged for a 6F 80cm long sheath. The distal most point of this long sheath would lie across the PDA in the descending aorta.

The 0.052" embolisation Cook's coil was then loaded into the sheath. The proximal end of the coil, which has a bulbous tip, was pulled so as to unravel a few of the initial coils, and then gripped with the Bioptome. The whole system was then

*Ex-Classified Specialist (Medicine & Cardiology), **Consultant (Medicine & Cardiology), ***Classified Specialist (Medicine), Military Hospital, Cardio Thoracic Centre, Pune-40, +Classified Specialist (Medicine & Cardiology), Base Hospital Delhi Cantt, ++Classified Specialist (Medicine & Cardiology), Military Hospital, Jalandhar Cantt, ##Classified Specialist (Medicine & Cardiology), Command Hospital (Central Command), Lucknow, ***Classified Specialist (Medicine), Command Hospital (Northern Command), C/o 56 APO

Received : 18.02.2003; Accepted : 06.05.2004

Fig. 1 : Retrograde descending aorta angiogram delineating the PDA
PDA-patent ductus arteriosus, Pa-pulmonary artery, DAo-descending aorta, Scale - A metallic scale of known dimensions pasted on the side of the patient's chest, used as reference to measure the PDA dimensions

Fig. 2 : Deployment of the coil by the release of biptome

passed into the long sheath. The coil was gradually deployed by withdrawing the sheath over the biptome. The coils were opened out so as to open $4\frac{1}{2}$ coils in the aortic ampulla and $1\frac{1}{2}$ loop in the pulmonary end (Fig 2).

A check aortography done at this stage showed only a trivial leak across the PDA. The biptome jaws were then opened to release the coils (Fig 3). The system consisting of the Biotome and the long sheath from the venous side and the pigtail from the arterial side were then removed.

Post procedure patient was continued on parenteral antibiotics (Cefotaxime 100 mg/kg and gentamycin 5 mg/kg) for five days. Clinical evaluation the next day showed

Fig. 3 : Check aortogram showing the deployed coils with the closed PDA

complete abolition of the continuous murmur. A predischarge echocardiography confirmed absence of any PDA flow.

Discussion

The 0.038" Gianturco embolization coils have been effective in closing small sized PDA's however there is limited control of the coil during implantation. Larger PDA's require multiple coils and this procedure is still complicated by episodes of coil embolisation.

This coil-biotome-sheath system has been tried by a few workers [5] and the same procedure has been utilized successfully in our patient. This report additionally demonstrates the usefulness of this system in closure of complex ducts. It would not have been possible to use the 0.038" Gianturco embolisation coils because of the bizarre anatomy of our patient. The Amplatzer PDA Closure device would have been a more expensive proposition.

The advantages of this method thus are ability to use these coils to handle complex shaped PDA's, ease in deployment as well as the ability to reposition and redeploy it. The coils can be held by the biptome during angiography so as to confirm complete occlusion and proper deployment of the coil before releasing it. Lastly these coils because their larger size and their increased thrombogenicity, as compared to the 0.038" coils, have increased successful closure rates and also fewer chances of dislodgement.

Conclusion

The coil-biotome-sheath system is an efficient and relatively cheaper nonsurgical technique that can be safely used for closure of PDA's with complex or bizarre anatomical shapes in PDA sizes less than 6 mm. It is

simple in construction, easy to deploy and can be withdrawn and repositioned, if required.

Long term follow up of these patients and an increase in the number of such procedures by various workers from different centers in a larger number of children would confirm these conclusions and thus establish utility of this technique.

References

1. Moore JW, George L, Kirkpatrick SE, et al. Percutaneous closure of the small patent ductus arteriosus using occluding spring coils. J Am Coll Cardiol 1994;23:759-65.
2. Fisher G, Stieh J, Uebing A, Grabitz R, Kramer HH. Transcatheter closure of persistent patent ductus arteriosus in infants using the Amplatzer duct occluder. Heart 2001;86:444-7.
3. Krichenko A, Benson LN, Burrows P, Moes CAF, McLaughlin P and Freedom RM. Angiographic classification of the isolated, persistently patent ductus arteriosus and implications for percutaneous catheter occlusion. Am J Cardiol 1989;67:877-80.
4. Ronald G Grifka, Thomas K Jones. Transcatheter closure of large PDA using 0.052 Gianturco Coils : Controlled Delivery using a Biopptome catheter through a 4 French Sheath. Cathet Cardiovasc Intervent 2000;49:301.
5. Lanjewar CP, Aithal JK, Singhal AR, Toal SC, Nyayadish PY, Nathani PJ, Mahajan AU, Kerkar PG. The Biopptome-Assisted Technique for Transcatheter Coil Occlusion of Moderate Patent Ductus Arteriosus : Immediate and Intermediate Results. IHJ Sept-Oct 2002;54(5) Article No. K246:571-2.

ANNOUNCEMENT

BEST ARTICLE AWARD - MJAFI

With effect from 1994 all Original Articles published in MJAFI are being screened for selection of the best two articles. These articles receive the 'Best Article Award' and the 'Second Best Article Award'. They carry a cash prize of Rs. 2000/- and Rs. 1000/- respectively to be shared by all authors. Articles are judged for their originality and research content.

So all those who believe that they have original work, not yet published, please send it in fast.

The following articles received the award for 2003 :

Best Article Award

Col Prakash Singh, Brig GS Misra, VSM, Col Amarjit Singh, Lt Col MGK Murthy (Retd) "*Missile Injuries of Brain - an Experience in Northern Sector*". MJAFI;2003;59(4):290-297.

Second Best Article Award

Lt Col JS Duggal, Lt Col V Jetley, Col Charanjit Singh, Lt Col SK Datta, Lt Col JS Sabharwal, Lt Col Sunil Sofat "*Amplatzer Device Closure of Atrial Septal Defects and Patent Ductus Arteriosus : Initial Experience*". MJAFI;2003; 59(3): 218-222.