Transcatheter closure of patent ductus arteriosus in children weighing 10 kg or less: Initial experience at Sohag University Hospital

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Aim: **To assess the challenges, feasibility, and efficacy of device closure of patent ductus arteriosus (PDA) in small children weighing ⩽10 kg for different types of devices used in an initial experience at Sohag University hospital.**

Methods: **Between March 2011 and September 2014, 91 patients with PDA underwent transcatheter closure in our institute, among whom 54 weighed ⩽10 kg. All of these patients underwent transcatheter closure of PDA using either a Cook Detachable Coil, PFM Nit-Occlud, or Amplatzer duct occluder. A retrospective review of the treatment results and adverse events was performed.**

Results: **Successful device placement was achieved in 53/54 small children (98.1%). The median minimum PDA diameter was 2.4 mm [interquartile range (IQR, 1.8–3.5 mm), median weight 8 kg (IQR, 7–10 kg), and median age 10 months (IQR, 8–17 months)]. Mild aortic obstruction occurred in one case (1.9%), as the device became displaced towards the aorta after release. The device embolized in one case (1.9%) and no retrieval attempt was made. Five cases (9.3%) had minor vascular complications.**

Conclusion: **With the current availability of devices for PDA closure, transcatheter closure of PDA is considered safe and efficacious in small children weighing ⩽10 kg with good mid-term outcome. The procedure had a low rate of high-severity adverse events even with the initial experience of the catheterization laboratory.**

Keywords: Adverse events, Closure, Device, Patent ductus arteriosus

Introduction

Transcatheter occlusion of the patent ductus arteriosus (PDA) using either coils or device transcatheter therapy is considered to be a well-established procedure both in adults and older children. Since the first experience of the transcatheter occlusion of PDA by Porstmann et al. in 1967 [1], technical improvements over the years have increased the proportion of patients who undergo successful transcatheter closure [2,3].

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Despite the advancement in the procedure, there are many problems during performance of transcatheter PDA closure in infants: relatively large sheath size for small vessels, stiffness of the delivery system with resultant hemodynamic instability during device deployment, risk of protrusion of the device into the aorta or pulmonary artery, poor anchoring or stability within the PDA, and difficult retrievability [4,19]. The purpose of this study was to determine efficacy and safety of transcatheter closure of PDA in infants weighing <10 kg and mid-term follow-up of our institution in its initial experience.

Materials and methods

A total of 91 patients underwent transcatheter occlusion of PDA at Sohag University Hospital from April 2011 to September 2013. Among them, 54 (58%) patients (13 male, 38 female), weighing <10 kg, were included in this retrospective study. We retrospectively analyzed medical records, echocardiographic findings, angiographic findings, hemodynamic data, adverse events, and follow-up results of these patients.

Written consent from parents of patients included in the study and the approval of ethical scientific committee of Sohag University Hospital were obtained.

The patients who were selected for this device occlusion were those with clinical and echocardiographic features of PDA who weighed 5 kg. These patients had one or more of the following: symptoms and signs of cardiac failure requiring medications, failure to thrive, bounding pulses, cardiomegaly on chest radiography and at least moderate dilation of the left atrium and ventricle on two-dimensional echocardiography. Two patients had a small restrictive perimemberanous ventricular septal defect (VSD); one patient had mitral valve prolapse with moderate mitral regurgitation; and two patients had small ostium secundum atrial septal defect. Three patients had genetic syndrome: two patients had Down syndrome and the third patient had Turner syndrome.

The patients' clinical characteristics (age, sex, and weight) were recorded. Aortic angiogram in lateral and right anterior oblique views was performed to evaluate the size, position, and shape of the duct for appropriately choosing the occluder device type and size. Hemodynamic data including pulmonary artery pressure and the pulmonary-to-systemic flow ratio were recorded. The technique of device deployment was similar to that reported in the literature [5,6]. Detachable

Abbreviations

ADO	Amplatzer duct occluder
AE	Adverse events
PDA	Patent ductus arteriosus
VSD	Ventricular septal defect

or PFM coils were used for patients with small PDAs of ⩽1.5 mm at the narrowest diameter. Amplatzer duct occluders (ADOs) were used for PDAs that were >1.5 mm. ADO size selected was usually 2–3 mm larger than the duct diameter in children [7]. However, some exceptions to this rule had to be made due to unavailability of the devices at the time of procedure. Amplatzer muscular VSD devices (AGA Medical Corporation, Golden Valley, Minnesota) were used in the one type C PDA that had long length. After device deployment in PDA, a second aortic angiogram was performed 10 min after device deployment (Figs. 1 and 2). In four patients, the PDA occluders (ADO I; AGA Medical Corporation, Golden Valley, Minnesota) were implanted using venous access only as the arterial line was not accessible. The angiography for determination of PDA measurements was done by pigtail catheter introduced through PDA from pulmonary artery (Fig. 3). The position of the occluder was determined by angiography through the delivery sheath and by echocardiography.

The fluoroscopy time during the procedure were identified. The transcatheter occlusion was performed under general anesthesia in our 1st year of experience, after which the procedure was performed under deep sedation and local anesthesia.

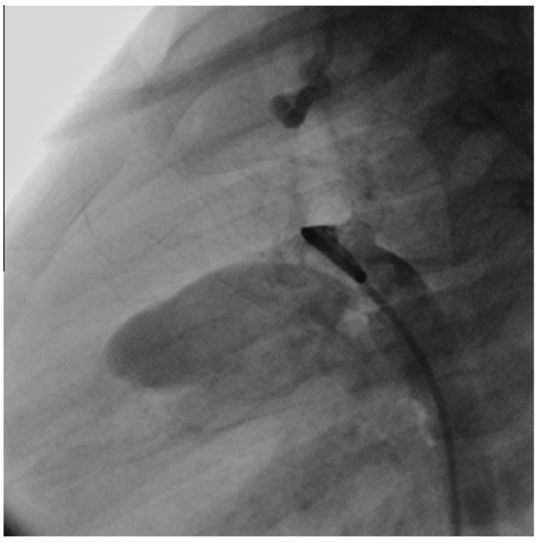

Figure 1. Descending aortogram showing large tubular type C patent ductus arteriosus in lateral view.