Case Report

First Ever Hybrid Procedure of Balloon Co-arctoplasty & Patent Ductus Arteriosus (PDA) Ligation in a Neonate in Bangladesh

Nurun Nahar Fatema[1], Md. Shaukat[2], Ashik Md. Raihan Chowdhury[3]

Abstract :

Coarctation of the aorta is a rare form of congenital heart disease, though preductal co-arctation is not very uncommon. This is a report on a 28-day-old girl who was referred to our center for evaluation. Doppler echocardiography showed severe preductal coarctation of aorta and a small-sized Patent Ductus Arteriosus (PDA). Later, it was confirmed by aortogram which showed critical coarctation of aorta (COA) with a very large Patent Ductus Arteosus (PDA). This full-term infant with symptomatic COA and a large PDA was treated successfully with a hybrid procedure of Balloon angioplasty and PDA ligation.

(Bangladesh Heart Journal 2023; 38(1): 88-91)

Introduction:

A combination of Coarctation of aorta (COA) and Patent Ductus Arteriosus (PDA) can lead to heart failure and severe symptoms, which can be manifested by shock, and subsequently other organ failure.

Aortic coarctation indicates a narrowing at some point along the course of the aorta. Preductal coarctation is one of the common type of Coarctation and circulation below the level of coarctation is maintained by patent ductus arteriosus (PDA) . A neonate or infant with severe coarctation of the aorta may present with symptoms of congestive heart failure, having been well days before when the ductus was still open[1,2]**.** Subsequently, they may develop renal failure and the feature of hypoperfusion to other organs once the ductus is closed. So, the infant becomes acutely, seriously, and even critically ill**[3].** Any neonate or infant with such critical symptoms needs urgent intervention which includes medical management like injection prostaglandin to keep the ductus open, surgical intervention, or balloon angioplasty(1). Here we are reporting a case of pre-ductal coarctation of aorta who needed balloon angioplasty and PDA ligation at 28 days of age and was cured completely.

Case Report:

A 28-day-old girl weighing 2.4 kg presented with severe respiratory distress and difficulty feeding and was referred to our center at Bangladesh Specialized Hospital (BSH), Dhaka, for evaluation. Clinical examination showed that the child was ill-looking, pale, dehydrated, dyspneic, and tachypneic, with visible bilateral chest indrawing, a clearly audible systolic murmur, and pulse of the lower limbs was reduced in comparison to the upper extremity.

Chest x-ray showed –cardiomegaly, with the plethoric lung fields and electrocardiography (ECG) showed right axis deviation with Right ventricular hypertrophy (RVH).

Echocardiography showed, severe Coarctation of aorta (COA), associated with a small sized Patent Ductus

1. Pediatric Interventional Cardiologist
2. Cardiovascular and Thoracic Surgeon
3. Registrar, Pediatric Cardiology

Address of Correspondence: Prof. Nurun Nahar Fatema. Dr. Pediatric Interventional Cardiologist, E-mail: colfatema@hotmail.com

DOI: https://doi.org/10.3329/bhj.v38i1.67223

Arteriosus (PDA), Small Atrial Septal Defect (ASD) and severe pulmonary hypertension (PAH). So patient was planned for urgent Balloon coarctoplasty. Considering the small PDA size, PDA device closure was not planned.

After admission, the patient was stabilized over one week, her hydration was maintained by Intravenous fluid and relevant investigations were sent. Injectable antibiotics were added to cover infection. After proper premedication and aseptic precautions, patient was taken into the cath lab on 21st march 2023 for balloon coarctoplasty .

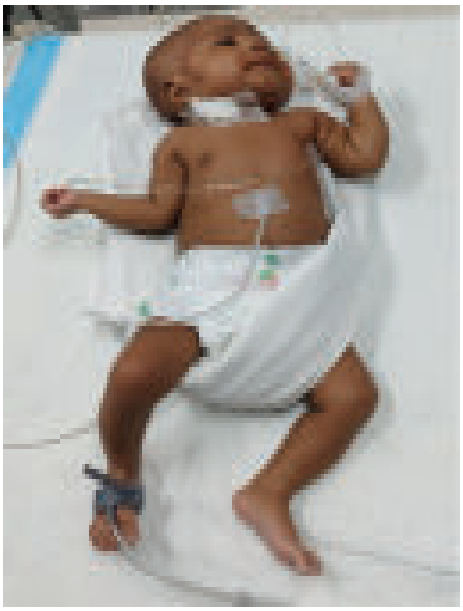

Fig.--1: *Patient A after PDA ligation*

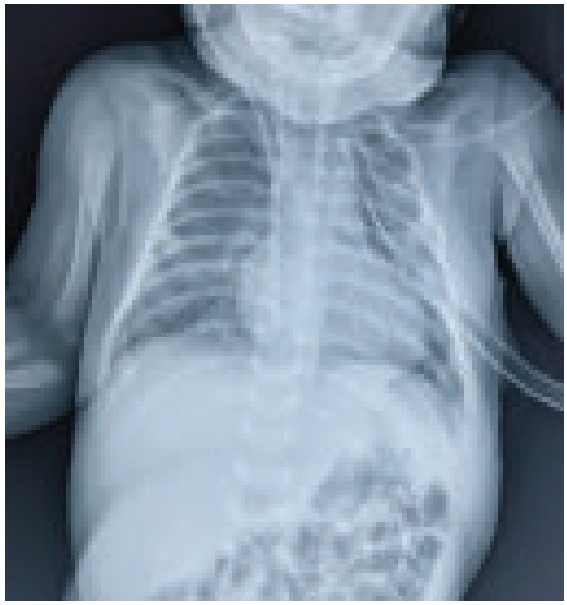

Fig.-2: *Chest X-ray showing cardiomegally*

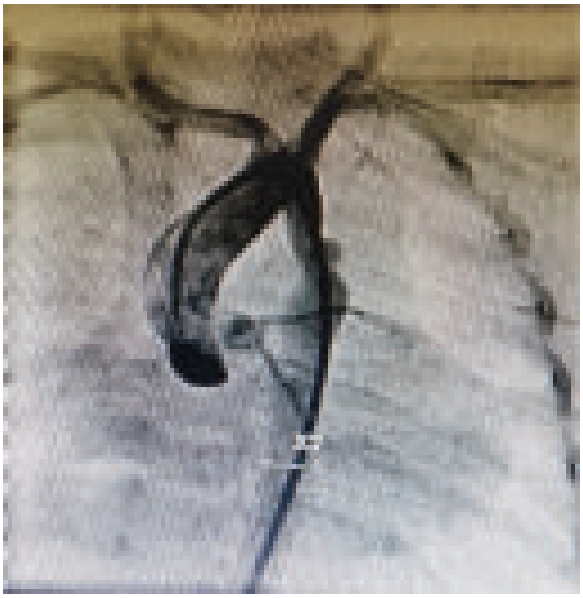

Fig.-3 *Aortogram Showing Critical COA of Aorta*

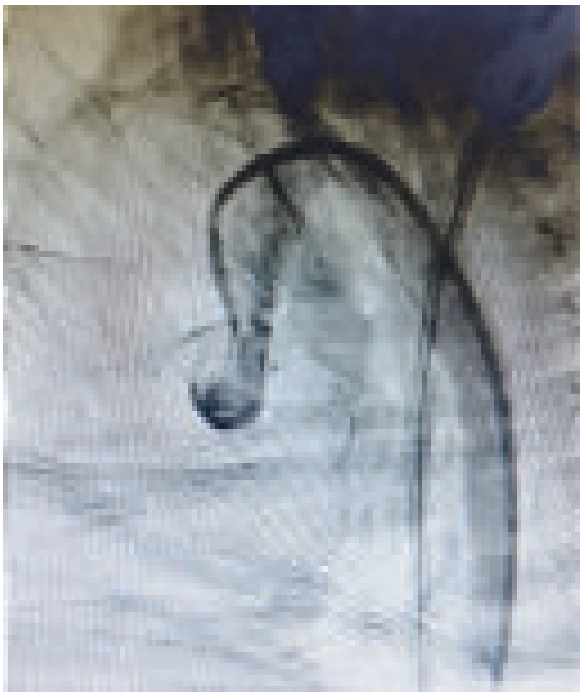

Fig.-4: *Aortogram after Balloon angioplasty showing no Coarctation.*

Procedure:

Hardwires : Standard pediatric drape, Jewsini catheter, Pigtail catheter, Bherman balloon catheter, Tyshak-mini balloon , Piccolo occluder, 4F long delivery system, exchange wire , PTCA all star wire etc.

Aortogram showed Critical coarctation of aorta . So, Balloon dilatation was performed with Tyshak mini 5x2 & followed by 8x2 balloon. Post Balloon Aortogram showed a very Large PDA out of our surprise. We tried to close the PDA subsequently with 8/6 Piccolo occluder. But PDA was larger than the device, Considering 2.4kg baby weight , passing a delivery sheath of 6F size through RFV/RFA was avoided.

As the Patient developed tachypnea and respiratory distress on the procedure table, we decided to refer the case to the cardiac surgeon. Doing PDA ligation on a 2.4kg baby was difficult but the case was accepted by our surgical team. PDA ligation was performed on next day; PDA size was equal to aorta as mentioned in surgical note.

During the postoperative period, the patient tolerated the procedure well and was on ventilator support till the next morning. Patient developed left lung collapse but recovered with Chest Physiotherapy (CPT) and gradually stepped down to CPAP then to headbox O2 supply to Room air . After Surgery improvements were also noted in the heart rate (from 150–170 beats/min to 120 beats/min), as well as in the respiratory rate (from 70 to 40 breaths/min) . There was no chest indrawing so breastfeeding was started. The patient was discharged on the 5th postoperative day.

Discussion:

The management of patients presenting with coarctation in neonates is revolutionized by the invention of prostaglandin E and its use to maintain and restore the patency of the ductus[1,2,3]. Neonates presenting with preductal coarctation have heart failure, shock, and deteriorating renal function, which could be reversed by maintaining the lower body circulation through the ductus[1,2,3,4,5]. Any neonate or infant presented with shock within the first few weeks of life and in whom lower limb pulses are absent, it should be consider to start prostaglandin along with other resuscitative maneuvers until expert assistance is available[1,2].

Coarctation of aorta can occur as an isolated defect or in association with a patent ductus arteriosus (PDA), It can be a discrete or long segment defect associated with a variable degree of hypoplasia of the isthmus or transverse arch[1]. In the present case, coarctation was discrete and preductal in location . The indications for balloon angioplasty of the coarctation of aorta are 1. Native or recurrent obstruction with a gradient of >20 mmHg. 2. Coarctation where there is left ventricular hypertrophy or systemic hypertension. But in neonate pre ductal significant coarctation is a medical emergency and should be treated immediately[1-5].

In neonates and infants < 1 year of age with native coarctation surgical resection and repair is recommended(1-5). Transcatheter therapy is the treatment of choice in >1 year age with a well-developed isthmus. Balloon angioplasty is one of the modalities of transcatheter treatment[6-7]. A balloon, 2-3 times the diameter of the coarctation segment but not exceeding the diameter of the adjacent arch proximal to the narrowed segment is selected and inflated across the coarctation site [8-11].

In this case, coarctation had a pinhole opening only and the diameter was 3 mm. So, gradual dilatation of the coarctation area was performed with 5x2 & followed by up to 8x2 Tyshak mini balloon. Stent implantation in the coarctation area is another modality of treatment for older children, adolescents, and adults. Published reports of balloon angioplasty demonstrate that this procedure results in short-term effective relief of gradient in 75-90% of patients and low mortality of 0.7-02.5%[12-14]. Long-term follow-up revealed re-stenosis in 25-36% cases[15-18]. VACA (Valvuloplasty and Angioplasty for Congenital Anomalies) registry data reported suboptimal outcomes in 19% of native and 25% of recurrent lesions[18]. The study was conducted among 970 patients from 25 centers. The major drawback of angioplasty alone is the recoil of the vessel wall with recurrence of stenosis [(19)]. Balloon angioplasty may cause aortic wall dissection in 1-4% of patients and aneurysm formation in 4-11.5% of patients [(19-20)] . Another study reports that the immediate gradient reduction was similar in both surgery and angioplasty case [(21)] . But in our country, since 1998 most of the surgeons refused to do a surgical repair of coarctation on neonates and infants. So balloon angioplasty was performed as a life-saving intervention and the excellent outcome encouraged us to take it as first-choice therapy.

Conclusion

We treated a full-term infant with symptomatic COA and a Large PDA successfully with a Hybrid procedure, Balloon angioplasty and Surgical PDA ligation . Thus, this hybrid approach might be a useful treatment option for Critical COA and Large PDA in country where surgical treatment is not available in most of the centers. °

References:

1. Fatema NN, BANGLADESH J CHILD HEALTH 2009; VOL 33 (2): 70-72
2. Anderson R. S. Paediatric Cardiology. Newyork: Churchil Livingstone; 2002. P.1323-57.
3. Nadas AS, Fyler DC. Nadas Paediatric Cardiology. Philadelphia: Hanley and Belfas; 1992. P. 683.

4. Adams FT, Emmanoulides GC, Rimenschneider TA. Heart disease in Infant, Children and Adolescents, 5th ed. Baltimore: Williams and Wilkins; 1995. P. 1111-32.

5. Jeffery J Pomerane, Joan Richardson. A Neonatology for the clinical Practice. Norwalk (Cunnecticut): Appleton and Lange; 1993. P. 633.

6. Fatema NN, Rahman SMM. Balloon angioplasty of coarctation of abdominal aorta – A case report. Bangladesh Armed Forces Medical College Journal 2003; 32: 95-98.

7. Beckman RH, Roccini AP, Dick M. Percutaneous balloon angioplasty for native coarctation of aorta. J Am Col Cardiol 1987; 10: 1078-84.

8. Rudloph AM, Heyman MA. Haemodynamic consideration in the development of narrowing of the aorta. Am J Cardiol 1972; 30: 514-25.

9. Cobanoglu A, Teply TF, Grunkemeier GL. Coarctation of the aorta in patients younger than 3 months. J Thorac Cardiovasc Surg 1985; 89: 128-35.

10. Yetman AT, Nykanen D, McCrindle B, Balloon angioplasty of recurrent coarctation. A 12 year review. J Am Coll Cardiol 1997; 30: 811-16.

11. McCrindle BW, Jones TK, Moaow WE. Acute follow up results of balloon angioplasty of native coarctation versus recurrent aortic obstruction are equivalent. Valvoplasty and Angioplasty for Congenital anomalies (VACA) registry investigations. J Am Coll Cardiol 1996; 28: 1810-17.

12. Rui A, Qureshi S, Rosenthal E. Determinants of Haemodynamic results of balloon dilatation of aortic recoarctation. Am J Cardiol 1992; 69: 665-71.

13. Fletcher SE, Nihil MR, Grifko RJ. Balloon angioplasty of native coarctation of the aorta: Midterm follow up and prognostic factors. J Am Coll Cardiol 1995; 25: 730-34.

14. Mendel Sohn AM, Lioyd TR, Crowley DC. Late follow up of balloon angioplasty in children with a native coarctation of the aorta. Am J Cardiol 1994; 74: 696-700.

15. Hijazi ZM, Fahey JT, Kleinman CS, Hellenbrand WE. Balloon angioplasty for recurrent coarctation of aorta. Immediate and long term results. Circulation 1991; 84: 1150-56.

16. Rao PS, Thaper MK, Galal O, Wilson AD. Follow up result of balloon angioplasty of native coarctation in neonates and infant. J Invasive Cardiol 1990; 120: 1310-14.

17. Ray DG, Subramanyam R, Titus T. Balloon Angioplasty of native coarctation in neonates and infants 1990; 120: 1310-14. 19. Overt C, Benson LN, Nykanen D, Freedom RM. Transcatheter treatment of coarctation of aorta: A review. Pediatr Cardiol 1998;

18. Hellenbrand WE, Allen HD, Golinki RJ. Balloon angioplasty for aortic coarctation: Results of valvuloplasty and Angioplasty of congenital anomaly registry. Am J Cardiol 1990; 65: 793-97.

19. Horvath R, Towgood A, Sandhu SK. Role of transcatheter therapy in the treatment of coarctation of aorta. J Invasive Cardiol 2008; 20: 660-63.

20. Overt C, Benson LN, Nykanen D, Freedom RM. Transcatheter treatment of coarctation of aorta: A review. Pediatr Cardiol 1998; 19: 27-44.

21. Shaddy RE, Moucek MM, Sturtevent JE. Comparison of angioplasty and surgery for unoperated coarctation of aorta. Circulation 1993; 87: 743-49.