



Surgical ligation of a large patent ductus arteriosus with severe pat in a low birth weight baby: A case report

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Abstract

A 1month 8 days old female child was admitted in the Pediatric cardiology department of Dhaka Shishu (Children) hospital with the complaints of severe respiratory distress and cyanosis. Since the baby was delivered at home in a rural area of the country by normal vaginal delivery, they could not seek help immediately from a tertiary level hospital. Subsequently they were referred to Dhaka Shishu (Children) Hospital Pediatric Cardiology department. As the baby was cyanosed and gradually desaturating the cardiology arranged a quick evaluation which revealed Spo₂ 65%, chest X ray shows ground glass opacity on both lung field, specially right lung field was not totally visible, and Trans-thoracic Echocardiography revealed a large almost 6 mm diameter Patent Ductus Arteriosus with predominant left to right shunt, severe pulmonary hypertension (PA pressure 65 mm Hg) and with severe heart failure. The initial management was done in ICU with proper inotropic support, anti-failure medication and broad spectrum antibiotic as the patient had temperature at that time.

Keywords: ligation, Arteriosus, severe, birth

1. Introduction

Patent Ductus Arteriosus (PDA) with severe pulmonary hypertension is a significant detrimental condition very often seen in cardiac ICU and the neonatal intensive care units especially in low-birth weight infants ^[1]. Significant left-to-right shunt through the PDA can cause respiratory distress, cardiac failure, hypotension and decreased end-organ perfusion ^[2]. Prostaglandin inhibitors, such as indomethacin or ibuprofen, are used to close the PDA, but if pharmacological closure is contraindicated or unsuccessful, surgical ligation is usually performed in most neonatal intensive care units (NICU) according to present clinical practice ^[3]. Surgery is well tolerated in most infants, but 30% develop severe systemic hypotension and respiratory decline requiring maximum levels of cardiopulmonary support in the postoperative period ^[4]. Treatment of the large patent ductus arteriosus (PDA) in the setting of pulmonary hypertension (PH) is challenging. Large Left patent PDA can result in irreversible pulmonary vascular disease. Occlusion, however, may lead to right ventricular failure for certain patients with severe PH (Pulmonary Hypertension) ^[5].

However, our center still took the challenge to ligate the PDA of these babies who otherwise will succumb without any treatment. Furthermore, with limited facilities and considering being a citizen of a developing country, most of them cannot afford expensive treatment. Considering this situation our center preferred to do surgical ligation with this large PDA with severe PH instead of trans-catheter closure. Patent ductus arteriosus, which leads to significant hemodynamic, pulmonary, gastrointestinal, cerebrovascular, and retinal problems, can be medically or surgically treated; although, there has been an ongoing debate on which method should be preferred ^[6]. However, studies show that PDA closure rates with medical treatment are still low in very low birth weight premature newborns (VLBWP). Failure of medical intervention occurs in 40% to 50% of VLBWP (Very Low Birth Weight Preterm Neonate) necessitating surgical intervention ^[7, 8]. In patients with a bleeding diathesis, necrotizing enterocolitis (NEC) or where nonsteroidal antiinflammatory drugs (NSADs) are contraindicated surgical intervention is the only available option ^[7].

2. Case Report

A 1month 8 days old female child was admitted in the Pediatric cardiology department of Dhaka Shishu (Children) hospital with the complaints of severe respiratory distress and cyanosis. Since the baby was delivered at home in a rural area of the country by normal vaginal delivery, they could not seek help immediately from a tertiary level hospital. Subsequently they were referred to Dhaka Shishu (Children) Hospital Pediatric Cardiology department. As the baby was cyanosed and gradually desaturating the cardiology arranged a quick evaluation which revealed Spo₂ 65%, chest X ray shows ground glass opacity on both lung field, specially right lung field was not totally visible, and Trans-thoracic Echocardiography revealed a large almost 6 mm diameter Patent Ductus Arteriosus with predominant left to right shunt, severe pulmonary hypertension (PA pressure 65 mm Hg) and with severe heart failure. The initial management was done in ICU with proper inotropic support, anti-failure medication and broad spectrum antibiotic as the patient had temperature at that time.



Fig 1

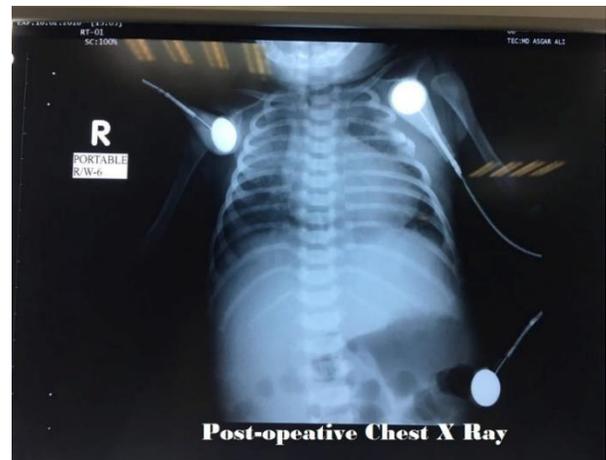


Fig 2

Although initially ABG also done and showed Metabolic acidosis and PO₂ 85 mm Hg, the patient did not required ventilator support at that time because after initial prompt treatment the respiratory distress was improving, SPO₂ became 94% and temperature subsided, but after couple of days again Spo₂ was started to decrease. The cardiology department upon discussion with Pediatric cardiac surgery department had decided to go for surgical ligation because the desaturation was due to severe heart failure and extremely large PDA in terms of this baby's weight and age. The patient was shifted to cardiac surgery unit and prepared for open surgical ligation.

The patient weight was 2.2 kg, 45cm in lengths, OFC 38cm, no other abnormalities detected at the time of operation but baby was unable to suck breast milk from her mother's breast. Physical findings shows no other abnormalities except a pan-systolic murmur at the 2nd left intercostal space and respiratory crackles on both lung fields. Spo₂ was again 65%. After taking consent from her parents we put the baby under anesthesia. All invasive monitoring line was given. After all aseptic precautions a postero-lateral thoracotomy was done at left 4th intercostal space, following dissecting the overlying pleura and serous layer of the aorta, we have found a huge PDA about 6.5 mm diameter almost exceeding the diameter of the baby's aorta. As the pulmonary

pressure was utterly high we initially put a vascular clamp over the PDA and carefully watched for any desaturation or pressure fall to occur or not, subsequently we put triple ligations around the PDA and again waited for couple of minutes for monitoring hemodynamic changes. After half an hour monitoring when we were quite sure about the no change of hemodynamic parameters, decided to close the wound putting a chest tube in situ. Then the bay was shifted to post-operative recovery ICU. The patient needed ventilatory support till 1st post-operative day, then gradually weaned from the ventilator. In the post perative period the baby never desaturated and his PO₂ was 96-97 % all the time without any O₂ support. The Chest x ray chows dramatic improvement of heart failure. The baby was discharged home at 8th POD without any significant adverse event during the recovery period. After 2 week later the bay came for follow-up and a trans-thoracic echocardiography revealed there was no residual PDA and the pulmonary arterial pressure deceased up to 28 mm Hg.

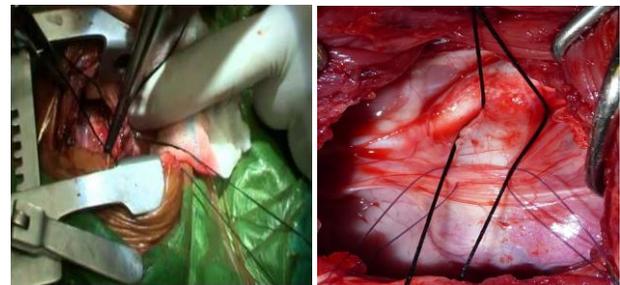


Fig 3: Postero-lateral Thoracotomy and PDA Ligation.

3. Discussion

Surgical PDA ligation is generally utilized after medical therapy with indomethacin or ibuprofen has been unsuccessful at closure. Thoracotomy (eventually done bedside in the neonatal unit to avoid transport) has been the standard of care for treating large, symptomatic, or persistent PDAs since its inception in 1938 [9]. In a study by Trust *et al*, they found for infants under 800 g, the failure rate for PDA closure with indomethacin was found to be as high as 40%-50% [10]. The prevalence of PDA is inversely related to maturity. While the PDA affects 60% of extremely preterm infants born weighing less than 1000 g [11], the incidence

of PDA among VLBWIs (Very Low Birth Weight Infant) in the some study was 35.6%, which was a similar finding to the previously reported 30% incidence of PDA among VLBWI (Very Low Birth Weight Infant) [12]. Prolonged exposure to PDA results in hemodynamic and respiratory instability due to the diastolic steal phenomenon by large ductal shunting, which leads to an increased duration of mechanical ventilation, subsequent BPD (Bronchopulmonary dysplasia), and other adverse outcomes. In addition to BPD, NEC (Necrotizing enterocolitis) is also a frequently reported postnatal morbidity of pulmonary overcirculation [13, 15]. Prone to these morbidities, 70% of those born before 28 weeks gestation reported to receive either medical or surgical therapy to close the PDA [16]. Further, early surgical ligation was advocated as the optimal therapy for PDA due to definitive ductal closure with minimal morbidity and mortality [17]. Surgical ligation of PDA is a safe and effective treatment and should be performed in selected PDA infants to reduce BPD (Bronchopulmonary Syaplasia) severity [9]. Furthermore, other studies have clearly shown that the incidence of NEC and the duration of TPN were significantly decreased in premature infants with early surgical ligation of symptomatic PDA that was refractory to medical treatment [18]. In conclusion, as the results from previous studies by Grosfeld *et al.* and Cassady *et al.* support an opinion, that VLBWPN (Very Low Birth Weight Preterm Neonate) should undergo early surgery as the treatment of choice [19, 20]. Therefore, the type of patient we operated should undergo early surgical ligation in order to save his live and reduce the comorbidity.

4. Conclusion

The aim of our study is to prove the efficacy of bedside surgical intervention in the ICU, which is preferable for premature neonates. We have concluded that the risk of transportation in those cases could be overcome with this technique without jeopardizing the safety of the patient.

5. References

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