

ECHOCARDIOGRAPHICALLY-GUIDED BALLOON AORTIC VALVOPLASTY

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Abstract

We report a neonate with critical aortic valvar stenosis. He was treated by bedside balloon valvuloplasty and the only imaging technique for this intervention was echocardiography. The procedure was successful. The patient has been operated twice since then, including a metallic aortic valve replacement. He is approaching his 10 years birth anniversary and fares well.

Keywords: metallic aortic valve, mini myshak, neonatal cardiac intervention

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Introduction

Balloon aortic valvoplasty (BAV) is an angiographic method for relieve of severe aortic stenosis with appreciable early and long term results (1). Bedside balloon septostomy guided exclusively by echocardiography is now an acceptable method in critical neonates needing prompt intervention while their transport to a catheterism laboratory is dangerous. However, there may be situations when other bedside interventional procedures become necessary in neonates with the same rationale. Hereby, we report a successful experience of bedside balloon valvoplasty under the guide of transthoracic echocardiography in a newborn with extremely critical aortic stenosis, with 10 years of follow up.

Case report

A 29-day-old newborn was admitted at our neonatal intensive care unit (NICU) with the diagnosis of myocarditis. He had signs of diminished cardiac output including weak pulses, cold extremities, and grayish skin color. Infusions of dopamine and dobutamine were started from the onset. Shortly after arrival at NICU, severe bradycardia and cardiac arrest developed. Successful resuscitation was performed, after which the patient needed epinephrine infusion to keep blood pressure at a level compatible with life. An emergency echocardiography revealed severe cardiomyopathy with an ejection fraction of 10%. Despite severe depression of systolic cardiac function, a 45 mmHg pressure gradient across aortic valve was detected, as well as thickness of the aortic valve leaflets. Accordingly, a diagnosis of critical aortic stenosis was made.

Due to the critical condition of the patient, an urgent valvuloplasty was considered. At that time, our catheterism laboratory was located at a nearby hospital needing car transfer of the patients. Certainly, potential

dangers were anticipated in transfer of the patient. Unfortunately, an arterial switch operation was begun at our only cardiac operation room needing several hours to be completed. Therefore, we decided to perform bedside BAV under the guide of transthoracic echocardiography.

Procedure

We preferred to catheterize femoral artery due to our greater experience and less interference with the echocardiography in comparison with jugular artery catheterization. Left femoral artery was catheterized by a 5 Fr Radiofocus Introducer II (Terumo, Japan). A portable echocardiographic scanner (MicroMaxx Ultrasound System, Sonosite Inc., USA) was used to guide the procedure. Frequent changes from suprasternal to long axis parasternal view were made by the echocardiographer to guide the interventionist during the procedure. An 0.018 inch hydrophilic guide wire was passed over a 5 Fr right Judkins angiographic catheter (Cordis, USA). After several attempts, we could pass the guide wire through the stenotic valve. Then, a 5 Fr multipurpose A2 catheter was exchanged for the Judkins catheter and positioned in the left ventricle (LV). The guide wire was exchanged with a 0.014 inch moderate support guide wire, consequently. The aortic annulus was measured around 7 mm. We first used a Tyshak II balloon catheter with a diameter of 5 mm and length of 20 mm. Balloon valvoplasty reduced the echocardiographic pressure gradient (PG) across aortic valve to 25 mm Hg. Then, we used another Tyshak II balloon catheter with a diameter of 7 mm and length of 30 mm. PG was decreased to 21 mm Hg and trivial aortic regurgitation was developed. We considered the procedure successful and terminated it.

Follow up

The condition of the patient improved gradually after BAV. Epinephrine infusion was

tapered and discontinued after 3 days. The patient was extubated 7 days after the procedure. Dopamine and Dobutamine infusions were discontinued 15 days after the procedure. The patient transferred to the floor bed and discharged from the hospital. Ejection fraction increased gradually, as well as transaortic PG. Three weeks after the procedure during the first outpatient visit, EF was 80% and PG 48 mmHg. Six month after the procedure, the patient did well. There was no change in transaortic PG and EF. A complete neurologic examination showed normal neurologic condition of the baby despite prolonged underperfusion. Peripheral pulses including those of the left lower extremity were palpable.

The patient was operated twice. At the age of two years, aortoplasty was done due to high transaortic PG, and finally at the age of 8.5 years, the aortic valve was replaced by a St Jude 19 mm prosthetic valve after aortic root enlargement. The patient is now close to his 10 years birth anniversary. His cardiac and aortic valvar functions are acceptable. There is only a small paravalvar leak.

Discussion

Percutaneous balloon and surgical valvuloplasty are two treatment modalities for the neonates with critical aortic stenosis. BAV was replaced surgery due to better results and lower mortality (1). Normally balloon valvuloplasty is performed in the catheterism laboratory under angiographic

guiding. Simultaneous use of echocardiography yielded better results, lower risk of insufficiency, and lower X-ray exposure (2, 3). Exclusive use of echocardiography during this procedure has been reported (4). However, long term follow up of these patients is unknown.

Echocardiography is used in many centers to perform bedside balloon septostomy in critically ill neonates needing this procedure (mostly transposition of the great arteries). Although the two procedures have many similarities, BAV needs more extensive wire maneuvers in the arteries and heart, and has a greater potential risk of injury when done under echocardiography. The risk of aortic wall injury after standard BAV is around 15 % (5). However, there are no data regarding this risk when echocardiography was used as the only guiding method. In the particular situation we confronted, the potential hazards of guide wire manipulation were negligible in view of the need to do a procedure without delay. To limit the potential risk of injuries, we carefully followed the tip of guide wires by changing the echocardiographic windows whenever needed. Echocardiography showed the tip of wires precisely.

Conclusion

Especially in developing countries where angiography and cardiac surgery facilities are not widely available, echocardiography guided BAV can save lives in emergency situations.

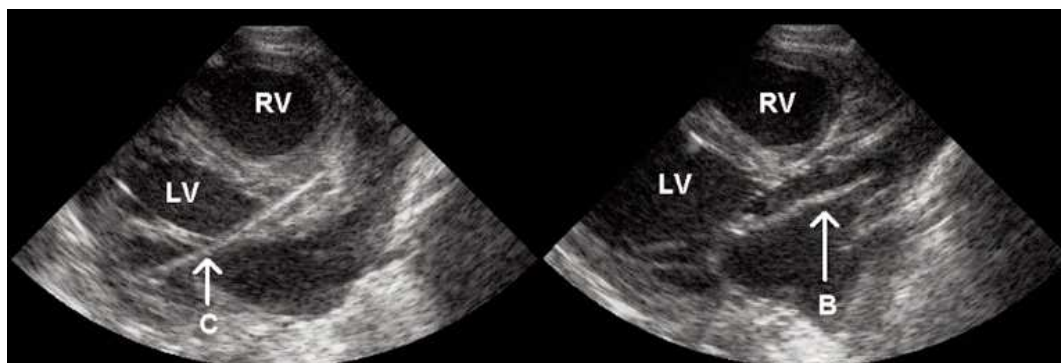


Fig. 1. Echocardiographic images when endhole catheter and Tyshak balloon were passed through the aortic valve. The balloon was inflated. LV, left ventricle; RV, right ventricle; c, catheter; b, balloon.

Resumo

Ni raportas novnaskiton kun tre serioza stenozo de aorta valvo. Li kuraciĝis per balona valvoplastio sun ununura bild-gvido de ekokardiografio. La proceduro estis sukcesa. Poste oni faris du operaciojn por li, inkluzive de la valvostataŭigo per metala valvo. Li nun proksimiĝas al sia 10-jara naskiĝ-tageveno kaj fartas bone.

References

1. Maskatia SA, Ing FF, Justino H, Crystal MA, Mullinc CE, Mattamal RJ, Smith EO, Petit CJ. Twenti-five year experience with balloon aortic valvuloplasty for congenital aortic stenosis. *Am J Cardiol* 2011;108:1024-1028.
2. Bourgault C, Rodes-Cabau J, Cote JM, et al. Usefulness of Doppler echocardiography guidance during balloon aortic valvuloplasty for the treatment of congenital aortic stenosis. *Int J Cardiol* 2008;128:30-37.
3. Weber HS, Mart CR, Kupferschmid J, Myers JL, Cyran SE. Transcarotid balloon valvuloplasty with continuous transesophageal echocardiographic guidance for neonatal critical aortic valve stenosis: An alternative to surgical palliation. *Pediatr Cardiol* 1998;19:212-217.
4. Weber HS, Mart CR, Myers JL. Transcarotid balloon valvuloplasty for critical aortic valve stenosis at the bedside via continuous transesophageal echocardiographic guidance. *Cathet Cardiovasc Intervent* 2000;50:326-329.
5. Brown DW, Chong EC, Gauvreau K, Keane JF, Lock JE, Marshal AC. Aortic wall injury as a complication of neonatal aortic valvuloplasty : Incidence and risk factors. *Circ Cardiovasc Interven* 2008;1:53-59.