

DOI: 10.5152/etd.2018.0116

Manuscript Type: Case Report

Title: Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication

Running Head: Intimal Flap after Aortic Balloon Valvuloplasty

Authors: Onur Taşçı, Ali Baykan, Süleyman Sunkak, Özge Pamukçu

Institutions: Department of Pediatric Cardiology, Erciyes University Faculty of Medicine, Kayseri, Turkey

Address for Correspondence: Onur Taşçı

Department of Pediatric Cardiology, Erciyes University School of Medicine, Kayseri, Turkey

e-mail: medonur@gmail.com, dr_onurtasci@hotmail.com

Phone: 0352 207 66 66

Submitted: 10.10.2017

Accepted: 19.01.2018

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as: Taşçı O, Baykan A, Sunkak S, Pamukçu Ö. Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication. Erciyes Med J DOI: 10.5152/etd.2018.0116

©Copyright 2018 by Erciyes University Faculty of Medicine - Available online at www.erciyesmedj.com

ABSTRACT

Injury to the aortic wall occurs in about 15% of patients after balloon aortic valvuloplasty. Formation of an intimal flap is a rare type of vessel wall injury, which is not well recognized yet. We report a case of a newborn with critical aortic stenosis who had an aortic wall injury after balloon aortic valvuloplasty.

Keywords: Newborn, critical aortic stenosis, balloon aortic valvuloplasty, intimal flap

INTRODUCTION

Critical aortic stenosis (CAS) is a rare and important disease in newborns. If diagnosis and treatment are delayed, decreased systemic perfusion and left ventricular dysfunction can cause fatal outcomes. Prostaglandin E1 infusion is necessary to maintain tissue perfusion via the ductus arteriosus until percutaneous intervention or surgery is performed. Diagnosis is possible using in utero fetal echocardiography. Clinical manifestations because of the effect of decreased ductal flow may be observed immediately at birth or after discharge. Severe valve stenosis results in left ventricular dysfunction and hypoperfusion in most cases (1, 2).

Aortic valve anomalies account for approximately 3.5%–5% of congenital heart diseases (3). Including the cases with asymptomatic bicuspid aortic valve, the incidence may increase by 2% in the general population (4).

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as: Taşçı O, Baykan A, Sunkak S, Pamukçu Ö. Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication. *Erciyes Med J* DOI: 10.5152/etd.2018.0116

©Copyright 2018 by Erciyes University Faculty of Medicine - Available online at www.erciyesmedj.com

In many institutes, transcatheter balloon aortic valvuloplasty (TBAV) is the first line therapy for neonatal CAS (5). In the acute period, after TBAV, aortic regurgitation, mitral valve injury, and vascular damage of the great vessels may be seen (6, 7).

Recently, the incidence of aortic wall injury is reported to be approximately 15%. Specifically, the creation of an intimal flap in the aortic wall is a rarely defined complication after neonatal TBAV. As this complication is frequently overlooked, the aorta should be carefully examined in terms of wall injury after TBAV (5).

In this report, we present an aortic wall injury complication after TBAV.

CASE REPORT

A newborn male weighing 2380 g, diagnosed with intrauterine aortic stenosis, was hospitalized for postnatal follow-up.

Electrocardiogram revealed left ventricular hypertrophy (Figure 1). The left ventricle was hypertrophic, and the cavity was partially hypoplastic. The aortic valve was bicuspid and stenotic like atretic. A 35-mmHg gradient was measured by Doppler examination of the aortic valve. There was third-degree mitral and first-degree tricuspid regurgitation. Left ventricle ejection fraction was decreased (45%), and prostaglandin E1 infusion was initiated.

In the catheterization laboratory, the aortic annulus diameter was 5.2 mm and a 28-mmHg pressure gradient was measured at the valve level. Balloon valvuloplasty was performed using a 5 mm x 2 cm Tyshak II balloon. Following the balloon valvuloplasty, first-degree aortic insufficiency and significant residual gradient was detected using a transthoracic echocardiography.

The second TBAV was performed for the residual gradient on the aortic valve level. The gradient was decreased to 13 mmHg, and first-degree aortic regurgitation was detected after the second TBAV.

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as: Taşçı O, Baykan A, Sunkak S, Pamukçu Ö. Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication. *Erciyes Med J* DOI: 10.5152/etd.2018.0116

After the procedure, we observed a flap-like mobile structure in the ascending aorta, above the aortic valve, which had an appearance similar to a second valve proximal to the brachiocephalic artery (Figure 2, Left). Doppler echocardiography revealed a gradual filling defect with color in this area compatible with the intimal flap in the ascending aorta (Figure 2, Right), and the gradient at the flap level was measured to be 15 mmHg in the cath lab.

After the procedure, the patient was extubated, and a control echocardiography revealed increased the left ventricle ejection fraction (82%) and decreased mitral and tricuspid regurgitations. Upon echocardiography, no clinically significant changes or gradient were detected. He was discharged with limited clinical symptoms.

DISCUSSION

TBAV is an efficient and safe intervention for CAS in the pediatric population. Compared with aortic valve surgery, it is believed to be a more feasible palliative approach (8).

In a multicenter study, Torres et al (9) reported favorable outcomes in over 70% of patients who underwent TBAV for congenital aortic stenosis under 1 month. In that study, the safety and efficacy results of the TBAV were shown. The procedural adverse events are relatively rare; however, minor complications can be seen. In patients aged <1 month, the reported minor complications are transient hemodynamic compromise, difficulties in vascular access, and adverse events related to sedation or airway. Patients were evaluated for the severity of adverse events because of major complications, and there was no significant difference between <1 month-old and older patients. Vascular trauma was reported more frequently in patients younger than 1 month in that study (15% vs. 5%; $p=0.03$) (9).

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as: Taşçı O, Baykan A, Sunkak S, Pamukçu Ö. Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication. *Erciyes Med J* DOI: 10.5152/etd.2018.0116

Brown et al. (5) published the results of a single-centered study in Boston in 2008. The objective of this research was to determine the incidence of aortic wall injury and other complications during TBAV. They reported that injury to the aorta wall was in 15% of the interventions among 173 infants who underwent neonatal TBAV over a 20-year time in this center. Most injuries were reported to have occurred in the transverse aortic arch (58% in the distal ascending aorta). They supposed the outcomes of significant dysfunction of left ventricle, recurrence of balloon dilations, and an inexperienced team were related to the injury.

The movement of stiff dilation catheters were accused for flap formation (10). Furthermore, the intimal flap may also occur during balloon movement in the aortic arch when the lumen of the stiff balloon catheter is incompatible with the guide wire. Similarly, intimal flaps can also be seen in the descending aorta during aortic balloon angioplasty performed for aortic coarctation. These therapeutic interventions can to be identified as risk factors for adverse events (10).

CONCLUSION

TBAV is an efficient and safe treatment method for aortic stenosis. Infants under 1 month of age who underwent balloon valvuloplasty, particularly CAS patients, are at a higher risk for complications. Complications associated with aortic balloon valvuloplasty have rarely been reported in literature. However, studies have reported that these complications are about 15%. Thus, intimal flap creation as a complication of aortic wall damage during aortic balloon valvuloplasty is a rare and important complication and should not be ruled out.

Informed Consent: Written informed consent was obtained from patients' parents who participated in this study.

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as: Taşçı O, Baykan A, Sunkak S, Pamukçu Ö. Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication. *Erciyes Med J* DOI: 10.5152/etd.2018.0116

Peer-review: Externally peer-reviewed.

Author Contributions: Conceived and designed the experiments or case: AB, OT. Performed the experiments or case: AB. Analyzed the data: SS, OP. Wrote the paper: OT. All authors have read and approved the final manuscript.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Siddiqui J, Brizard CP, Galati JC, Iyengar AJ, Hutchinson D, Konstantinov IE, et al. Surgical valvotomy and repair for neonatal and infant congenital aortic stenosis achieves better results than interventional catheterization. *J Am Coll Cardiol* 2013; 62: 2134–40.
2. Brown JW, Rodefeld MD, Ruzmetov M, Eltayeb O, Yurdakok O, Turrentine MW. Surgical valvuloplasty versus balloon aortic dilation for congenital aortic stenosis: Are evidence-based outcomes relevant? *Ann Thorac Surg* 2012; 94: 146–53.
3. Kitchiner DJ, Jackson M, Walsh K, Peart I, Arnold R. Incidence and prognosis of congenital aortic valve stenosis in Liverpool (1960–1990). *Br Heart J* 1993; 69: 71–9.
4. Carabello BA. Clinical practice. Aortic stenosis. *N Engl J Med* 2002; 346: 677–82.
5. Brown DW, Chong EC, Gauvreau K, Keane JF, Lock JE, Marshall AC. Aortic Wall Injury as a Complication of Neonatal Aortic Valvuloplasty: Incidence and Risk Factors. *Circ Cardiovasc Interv* 2008; 1(1): 53-9.

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as: Taşçı O, Baykan A, Sunkak S, Pamukçu Ö. Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication. *Erciyes Med J* DOI: 10.5152/etd.2018.0116

6. McElhinney DB, Lock JE, Keane JF, Moran AM, Colan SD. Left heart growth, function, and reintervention after balloon aortic valvuloplasty for neonatal aortic stenosis. *Circulation* 2005; 111: 451–8.
7. Zeevi B, Berant M, Fogelman R, Galit BM, Blieden LC. Acute complications in the current era of therapeutic cardiac catheterization for congenital heart disease. *Cardiol Young* 1999; 9: 266 –72.
8. Wu L, Qi C, He L, Liu F, Lu Y, Huang G. Balloon valvuloplasty for congenital aortic valve stenosis in children. *Zhonghua Er Ke Za Zhi* 2014; 52(9): 699-702.
9. Torres A, Vincent JA, Everett A. Et al. Balloon valvuloplasty for congenital aortic stenosis: Multi-center safety and efficacy outcome assessment. *Catheterization and Cardiovascular Interventions* 2015; 86: 808–20.
10. Egito ES, Moore P, O’Sullivan J, Colan S, Perry SB, Lock JE, et al. Transvascular balloon dilation for neonatal critical aortic stenosis: early and midterm results. *J Am Coll Cardiol* 1997; 29: 442–7.

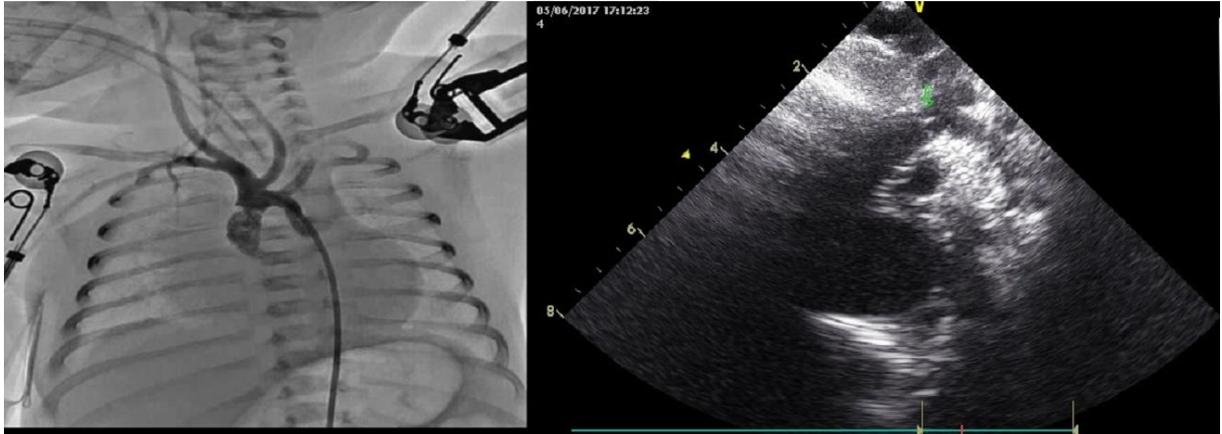
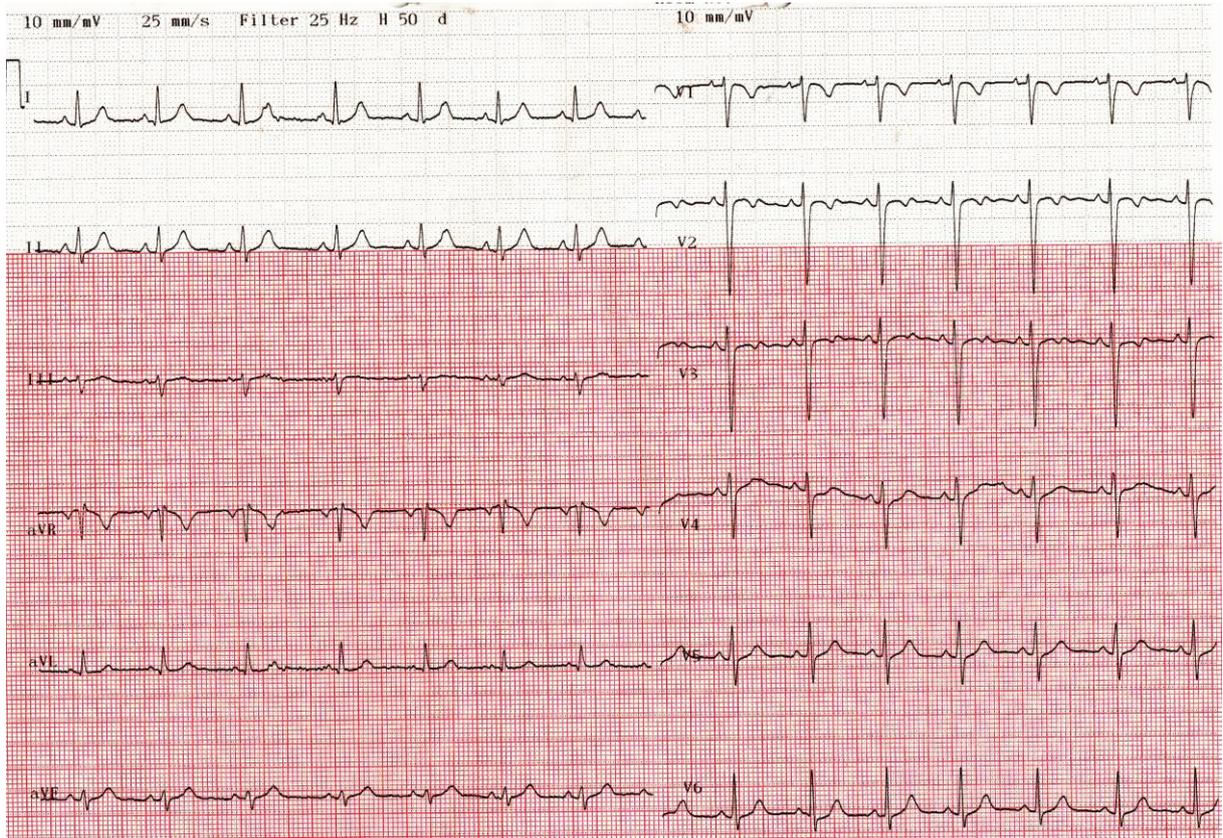
Figure 1. Electrocardiography of the patient showing left ventricular hypertrophy

Figure 2.

Left: Cineangiography showing intimal flap with radiopaque material

Right: Intimal flap diagnosed by the suprasternal echocardiographic view in the ascending aorta after balloon valvuloplasty

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as: Taşçı O, Baykan A, Sunkak S, Pamukçu Ö. Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication. *Erciyes Med J* DOI: 10.5152/etd.2018.0116



This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as: Taşçı O, Baykan A, Sunkak S, Pamukçu Ö. Aortic Wall Injury: Intimal Flap Formation after Aortic Balloon Valvuloplasty, a Rare Complication. *Erciyes Med J* DOI: 10.5152/etd.2018.0116

©Copyright 2018 by Erciyes University Faculty of Medicine - Available online at www.erciyesmedj.com