CASE REPORT

Balloon Valvoplasty of Severe Aortic Valve Stenosis Following Badly Planed Midline Thoracotomy

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ABSTRACT

Aortic valve replacement (AVR) is the gold standard method for management of severe aortic stenosis (AS), with transcatheter balloon valvoplasty (BAV) increasingly used as palliative option for calcified valve in experienced hand. In the AVR era, BAV was not considered a long-term definitive treatment for severe calcific AS due to a high restenosis rate and short durability of gradient improvement. However, it continues to have an important role as a bridge-to-decision or bridge-to-intervention in cases where definitive therapy must be delayed due to clinical instability, imaging uncertainty or failed trial of surgical valve replacement. We report a case of heavily calcified AS in an adolescent female, in which the calcification involves the ascending aorta extending to the aortic arch with failure of surgical management trail and she finally managed by transcatheter balloon valvoplasty.
Keywords: Aortic valve, Classification, Stenosis.

INTRODUCTION

Aortic stenosis (AS) is a relatively uncommon but clinically significant congenital heart disease in children and adolescents [1]. It is characterized by obstruction of left ventricular outflow due to malformation or progressive calcification of the aortic valve, leading to pressure overload, left ventricular hypertrophy, and, if untreated, heart failure or sudden cardiac death [2, 3]. Management of pediatric AS requires careful assessment of valve morphology, hemodynamic severity, and patient growth potential, as therapeutic strategies differ significantly from adults [4]. While surgical aortic valve replacement (AVR) is the definitive treatment for severe AS, transcatheter balloon aortic valvuloplasty (BAV) is often preferred in younger patients with small aortic annuli, providing temporary relief while delaying the need for prosthetic valve implantation [1]. The presence of extensive valvular calcification complicates both percutaneous and surgical approaches, increasing procedural risk and influencing treatment planning.

We report a case of an adolescent female with severe calcific aortic stenosis, characterized by extensive calcification of the aortic valve extending into the ascending aorta and reaching the aortic arch. Surgical aortic valve replacement was attempted; however, intraoperative finding of diffuse and heavy calcification precluded safe valve replacement. The patient was subsequently managed with percutaneous balloon aortic valvoplasty in the cardiac catheterization laboratory.

This case highlights the critical importance of comprehensive preoperative assessment of aortic valve and aortic root calcification prior to AVR surgery. Failure to identify extensive calcific involvement may significantly limit surgical intervention, alter intraoperative decision making and expose the patient to unnecessary thoracotomy and its associated risks.

Case presentation: A 15 -year- old female with severe aortic stenosis and a history of transcatheter closure of a patent ductus arteriosus performed at three years of age. Recently (10 days ago), she underwent open thoracotomy in India for planned surgical aortic valve replacement. Intraoperatively, severe calcification of aortic valve that extended to involve the ascending aorta was demonstrated and the procedure was cancelled.

On presentation to our center, examination revealed a thin female with body weight 30 kg (below 5th centile), height 150 cm (below 5th centile). She had dyspnea, tachypnea, orthopnea, pulse rate 110 beats per minute weak and thready in nature, Blood pressure 65/40 mmHg. The cardiac examination revealed suprasternal thrill, with grade 4 ejection systolic murmur at the 2nd left intercostal space. Although aortic outflow murmurs classically auscultated at the right upper sternal border, in this patient the murmur was elicited in the left side. This finding may be explained by dilated aortic root as part of post stenotic dilatation, in addition the

Gallavardine phenomenon may attribute to abnormal sound propagation, whereby components of aortic systolic murmur are perceived in the mitral area. Echocardiography (Fig. 1) reviled left sided dilatation, severe calcified bicuspid AS with systolic pressure gradient about 75mmhg which is underestimated due to Left ventricular failure with EF 32% and moderate functional mitral valve incompetence. She was admitted to the cardiac department in the hospital for 5 days on aggressive anti failure medication. All necessary investigations were done, including lipid profile that was normal, ECG shows left axis deviation. (Fig. 2). Preparing her for session of Transcatheter balloon valvoplasty.

In the planned day of Cath, under general anesthesia, and endotracheal intubation. The right femoral artery is accessed by 6f sheath. Aortogram at lateral projection & left anterior oblique 30 degree show the significant calcification at the ascending aorta that almost reach to the arch and PDA device of previous catheterization session was In Site, with aortic valve anulus measure from angiography was 16 mm. Heparin in a dose of 5000 IU infused. Initially attempting to cross the stenotic AV by 0.21mm straight guide wire (Fig. 3A) that replaced by 0.35mm guide wire to support 14mm,3cm Ty shake balloon that inflated three times then replaced by 15mm,3cm Zemid balloon that inflated twice (Fig. 3 B). The Peak-to-peak Pressure gradient droop from 110 mmhg pre balloon dilatation to 35mmhg post balloon dilatation. The extubating was not an easy job due to frothy lung secretion from the pulmonary edema that needs frequent suction. The patient kept in hospital for the next 24hours post Cath & discharge well to home with anti-failure medications including Frusemide tab, Carvedilol tab, Ramipril tab, Digoxin tab.

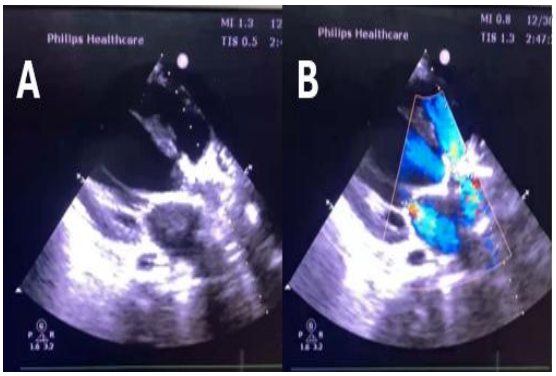

Fig. 1. Transthoracic echocardiography demonstrating severe calcific aortic stenosis. A: two-dimensional parasternal long axis view showing markedly thickened and heavily calcified valve leaflets with extension of calcification to ascending aorta. B: color doppler imaging revealing turbulent high velocity flow across the aortic valve.

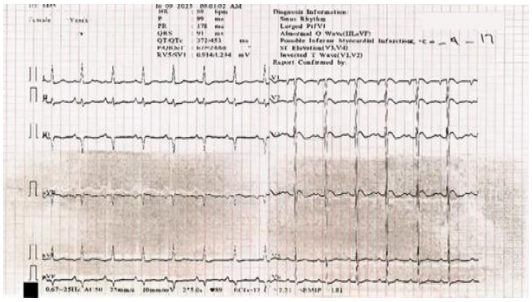

Fig. 2. ECG of the patient that shows left axis deviation.

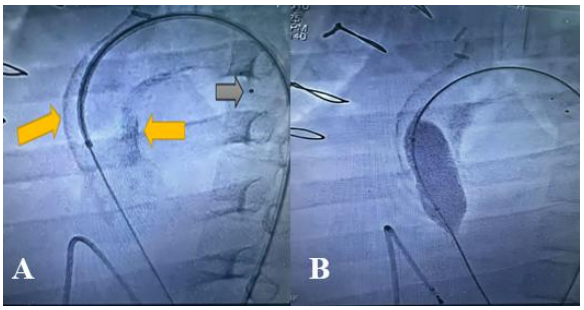

Fig. 3. Fluoroscopic images (A) Straight Guide wire cage 0.21mm cross the valve demonstrating the calcification at the Ascending aorta (the yellow arrows) & the dote of the PDA occluder (the grey arrow). (B) The inflated balloon in the Aortic valve.

DISCUSSION

Severe calcific AS is predominantly a disease of older adults, most commonly resulting from progressive degenerative leaflet calcification or congenital bicuspid aortic valve pathology [5]. The presence of extensive valvular and supravalvular calcification in an adolescent patient is uncommon and rises the importance of therapeutic and diagnostic considerations. The present case highlights the clinical implications of diffuse aortic calcification on procedural planning and feasibility.

The current international guidelines, including the 2020 and 2025 American College of cardiology/American heart association (ACC/AHA) guidelines emphasize surgical AVR as preferred intervention for severe symptomatic AS in technically operable young patients because of long term durability compared with transcatheter approach [6, 7]. However, extensive calcification involving ascending aorta and aortic arch may substantially increase operative risks and may preclude surgical intervention. Transcatheter valve implantation has been indicated in some high-risk patients but limited by anatomic complexity and financial reasons. Transcatheter balloon valvoplasty in an experienced hand appear as salvage intervention for severe calcified aortic valve with high success rates.

In the current case, transcatheter balloon valvuloplasty represents the most appropriate therapeutic option as palliative and salvage therapy given the patient's age, extended calcification, clinical presentation, and

relatively small aortic valve annulus [8]. Although restenosis risk is substantial and long-term durability is limited it may provide meaningful symptomatic and hemodynamic improvement [9]. The unusual severity and distribution of aortic calcification warrant evaluation of underlying etiologies, including congenital valve malformation metabolic disorders, rare systemic conditions associated with accelerated vascular calcifications. Careful evaluation is essential to inform long-term follow up and potential future interventions [10]. Preoperative evaluation by echocardiography is widely used for aortic root pathologies with transesophageal echocardiograph considered most convenient as it provides a real-time observation of valve pathophysiology [11]. The main limitation is underscoring the extracardiac calcification. Multidetector computed tomography (MDCT) provides excellent anatomical delineation of both valvular and supravalvular aortic calcification and is now routinely recommended for preoperative planning [12]. Although aortic valve calcification scoring system by CT is considered the gold standard for detection of aortic calcification, the cost and ionizing radiation exposure are the main limitations for its use. Recently, a new scoring system by echocardiography has demonstrated to be better cost effective, faster, with elimination of radiation exposure [13, 14].

This case highlights the need for heightened awareness of supravalvular calcific extension in young patients with severe AS and reinforces the importance of individualized management strategies in anatomically complex diseases. Unfortunately, as result of missed degree of calcification of aorta preoperatively, the patient subjected to unnecessary surgical intervention involving opening the thoracic cavity. Instead, careful and thorough assessment prior to surgery should be done, especially such a significant aortic calcification might be discovered preoperatively [15]. As a result, this inappropriate surgical step making the next AVR like a redo surgery with higher surgical risk due to excessive soft tissue adhesion.

This case highlights the critical need for thorough evaluation of patients with severe aortic stenosis and strict adherence to guideline-based patient selection for valve replacement, to avoid unnecessary or high-risk surgical procedure.

CONCLUSIONS

Transcatheter balloon valvoplasty is a safe first choice in treatment of severe calcific stenosed aortic valve in teenage age groups as palliative and salvage intervention. This case emphasizes the paramount importance of careful preoperative assessment to avoid unnecessary surgical interventions

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Conflict of interests

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Ethical consideration

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Author contribution

Authors contributed evenly.

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