Pulmonary Restenosis 2 Years After Pulmonary Balloon Dilation and Surgical Approach

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Abstract

Pulmonary balloon dilation has almost replaced surgical therapy. After this intervention the restenosis rate might seen as 6-6.7%.

In this study, we report a case with pulmonary restenosis. He had been performed a pulmonary balloon dilatation 2 years ago at another health facility with a diagnosis of supravalvular pulmonary stenosis. His complaints recurred after this intervention. He was investigated and a pulmonary restenosis with a peak pressure gradient of 133 mm Hg was found out. He underwent a successful surgical repair and we report this surgical intervention under the light of literature.

Surgical treatment of isolated pulmonary restenosis is a safe and effective procedure.

INTRODUCTION

Since the first description of balloon pulmonary valvuloplasty in 1982 by Kan, the procedure has been extensively utilized by several groups of workers for relief of pulmonary stenosis. It is generally recommended that the procedure be performed for peak-to-peak gradients in excess of 50 mmHg. Immediate reduction of gradient, increase in jet width and free motion of the pulmonary valve leaflets with less doming have been observed following balloon dilatation. Complication can occur, but are rare and minimal. The results of balloon valvuloplasty are either comparable to or better than those reported with surgical valvuloplasty. The causes of restenosis have been identified, and appropriate modifications in the technique, particularly the recommended use of a balloon/annulus ratio of 1.2 to 1.5. Long-term follow-up results are scanty, but the limited data reveal minimal additional restenosis, event-free rates in mid-80s and mid-70s at 10 and 15 years respectively.

CASE PRESENTATION

Our patient was a 48 years old man. He admitted to our center with chief complaints of angina, fatigue and dyspnea. He had a past medical history of pulmonary balloon dilatation at another health facility due to a severe supravalvular pulmonary stenosis performed 2 years ago.

Before that intervention, a pulmonary stenosis with a peak pressure gradient of 110 mm Hg and a mean pressure gradient of 70 mm Hg were diagnosed. Two months before the application to our institution, his transthoracic echocardiography had revealed a severe supravalvular pulmonary stenosis. He then underwent a cardiac catheterization. In this investigation, a severe supravalvular pulmonary stenosis not extending beyond bifurcation with a peak pressure gradient of 133 mm Hg was diagnosed (Figure 1 and 2). His ejection fraction was 66%. During the same investigation, coronary angiography was discovered as normal.
A decision of surgical intervention was made during the common council of Departments of Cardiology and Cardiovascular Surgery. He was operated under endotracheal general anesthesia and in supine position. We carefully performed median sternotomy and after heparinization, extra-corporeal circulation is established between the venae cavae and the ascending aorta. A cross clamp was placed on aorta and by antegrade intermittent isothermic blood cardioplegy from aortic root and cardiac arrest was established. Hypothermia was moderate (28°C). A vent was placed via the right superior pulmonary vein.

A ring-shaped supravalvular constriction with a distance of 4 to 5 centimeters away from the annulus was demonstrated. Pulmonary arteriotomy was performed. Although the pulmonary annulus was a bit narrow, it allowed a dilator of 13 millimeters of diameter to be inserted through (Figure 3).

To remove the constriction thoroughly, pulmonary arteriotomy was extended distally to bifurcation and a patch plasty was carried out over the pulmonary arteriotomy with a Dacron patch (Figure 4). Following patent foramen ovale was closed primarily.
He required inotropic support during weaning from cardiopulmonary bypass and early postoperative period. The volume of blood transfused was one unit. The quantity of mediastinal drainage was 600 cc. He was extubated after an intubation duration of 11 hours and stayed in the intensive care for 2 days. The hospital stay was 8 days. Postoperatively an echocardiographic investigation was revealed no restenosis for the supravalvular pulmonary artery and no significant pressure gradient. He is still symptom-free and he was followed at our outpatient clinic without additional problem.

DISCUSSION

Pulmonary balloon valvuloplasty replaced surgical valvotomy, with the exception of patients with truly dysplastic valve\(^1\). Limited information is available on the value of balloon valvuloplasty in adult patients, particularly with regard to its long-term outcome\(^1\).

The indications for balloon valvuloplasty have not been clearly defined but should probably be similar to those used for surgical valvotomy; only patients with moderate to severe valvar pulmonary stenosis are candidates for balloon valvuloplasty\(^2\). The procedure is also applicable to pulmonary stenosis associated with other complex cardiac defects and stenosis of bioprosthetic valves in pulmonary position.

Complications of the procedure have been minimal. Further refinement of the catheters and technique may reduce the complication rate even further. Miniaturatization of balloon/catheter systems to further reduce the complication rate and documentation of favorable result at 5- to 10-year follow-up are necessary\(^3\). The study of Fawzy et al. was performed in 90 consecutive patients and it confirms that PBV is as effective in adults as it has been shown in children\(^3\). Furthermore, follow-up evaluation up to 17 years after the procedure demonstrated that the beneficial effect is maintained. The peak pulmonary gradient at long-term follow-up showed no significant changes when compared with the gradient obtained at 1 year after PBV, indicating the absence of restenosis. Five (6%) patients in the present series who had immediate suboptimal results developed restenosis and underwent a second valvuloplasty using a larger balloon, with a satisfactory short and long-term outcome. This is in contrast to the situation in children and newborns, where the restenosis rate might be as high as 19%\(^4\). Rao determined in his last study; restenosis, defined as gradient \( \geq 50 \) mmHg, has been observed in nearly 10% of children. Predictors of restenosis include balloon/annulus ratio of <1.2 and immediate post-valvuloplasty gradient of \( \geq 30 \) mmHg. Small pulmonary valve annulus, earlier study year and post-surgical complex pulmonary stenosis have also been identified as factors predictive of restenosis\(^4\). In study of Castillo et al, pulmonary valve balloon dilation was performed in 109 patients and at follow-up restenosis developed in 6.7%\(^5\). Restenosis is also reported after surgical valvotomy, and follow-up studies have shown a residual gradient of \( \geq 30 \) mm Hg in 10% of operated patients, with 3% to 4% requiring reoperation for restenosis\(^6, 7\).

In an experimental study, performed with the dogs, it was demonstrated that there is general agreement with resting pressure gradients between right ventricle and pulmonary artery in the severe category\((>80\text{ mmHg})\) are at increased risk for syncope, congestive heart failure or sudden death, therefore surgical intervention is usually recommended\(^8\). Pulmonary patch plasty operation is a safe and effective procedure for the treatment of pulmonary restenosis after unsuccessful balloon dilation. Overall survival after surgical treatment of isolated pulmonary stenosis remains excellent, many patients undergo late reintervention after 30 years of follow-up, emphasizing the need for lifelong cardiac follow-up\(^9\).

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