EXPERIENCE OF BALLOON PULMONARY VALVULOPLASTY IN ADULTS AT AFIC

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ABSTRACT

Objective: Pulmonary balloon valvuloplasty is considered as first line of treatment for isolated pulmonary valve stenosis in all age groups. This study aimed at determining immediate results and complications associated with transcatheter pulmonary valvuloplasty in adult (defined as age 18 years or more) patients.

Study Design: Retrospective quasi experimental study.

Place and Duration of Study: Armed Forces Institute of Cardiology/National institute of heart diseases (AFIC/NIHD) Rawalpindi, from Jan 2017 to Jun 2019.

Methodology: This Retrospective Quasi experimental study was done at Paediatric cardiology department of Armed Forces Institute of Cardiology/National institute of heart diseases (AFIC/NIHD) Rawalpindi and comprised of 24 patients with severe pulmonary valve stenosis in whom balloon dilatation was attempted from January 2017 to June 2019. As per guidelines, the intervention was considered as successful if right ventricle to pulmonary artery invasive pressure gradient was reduced to less than 50% of initial value, suboptimal if PG reduced by 25% and failure if PG reduced by less than 25% of pre-procedural value.

Results: Total 24 adults patients (with no history of previous cardiac surgery or pulmonary valve ballooning) underwent balloon pulmonary valvuloplasty for pulmonary valve stenosis with mean age of 30.5 ± 10.1 years, including 11 males & 13 females with 100% success. Balloon to annulus ratio was 1.25:1. The pressure gradient between Right Ventricle to pulmonary artery reduced from 111 mmHg to 39 mmHg after the intervention. The mean procedural time and fluoroscopy time were 40 & 10 minutes respectively and there were no complications. In three patients, ASD device closure was also done in same procedure.

Conclusion: Percutaneous balloon valvuloplasty is an effective and safe option for the treatment of pulmonary valve stenosis in adult patients with excellent results.

Keywords: Intervention, Pulmonary valvuloplasty, Pulmonary valve stenosis.

INTRODUCTION

Among adults with congenital heart disease, isolated pulmonic valvular stenosis is one of the common lesions and percutaneous balloon valvuloplasty is widely used as a procedure of choice to relieve pulmonic valve obstruction both in children as well as in adults[1]. The scale of severity of pulmonary stenosis varies from mild to critical and pulmonary valve morphology ranges from simple doming valve to severely dysplastic & hypoplastic valve[2]. Percutaneous balloon valvuloplasty is a technique in which large balloon is inserted percutaneously in ante-grade manner and then inflated across the stenotic pulmonary valve to reduce the degree of stenosis and obstruction[3,4]. The first procedure of Percutaneous balloon valvuloplasty performed by Semb in a neonate in 1979 followed in 1982 by Kan and colleagues in an 8-year-old patient[5,6]. The recommendations to perform this procedure are for peak to peak gradients in excess of 50 mm Hg across right ventricle to pulmonary artery. Because of very low incidence of complications and good results, pulmonic balloon valvuloplasty is considered the treatment of choice for severe, isolated pulmonic stenosis for all age groups and is widely practiced at many different Hospitals[7-14]. Though there are number of studies from developed countries regarding efficacy and follow up of balloon pulmonary valvuloplasty[1], the data from developing countries like Pakistan

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is scanty and especially in grown up patients. The aim of this study was to observe results and complications of pulmonary valve balloon valvuloplasty in adult patients with age 18 years or more at AFIC-NIHD in last two and half years.

METHODOLOGY

This retrospective study was carried out at Armed forces institute of cardiology/National institute of heart diseases Pakistan (AFIC-NIHD), and included 24 consecutive adult patients underwent attempted balloon pulmonary valvuloplasty from Jan 2017 to Jun 2019. Data collected after reviewing clinical records, catheterization and echocardiography reports and follow up records. Before procedure detailed history, physical examination, complete blood counts, chest X-ray and detailed transthoracic echocardiography were performed. Echocardiography focused on determining severity & morphology of the pulmonary valve, pulmonary valve annulus and any associated cardiac defects. After written consent, patients were subjected to balloon pulmonary valvuloplasty under general or local anaesthesia with or without sedation, depending upon the patient's age and clinical status. After establishing vascular access (usually right femoral vein), right ventricle entered with NIH catheter (pressure also recorded) and right ventricle angiogram done in AP and LAO 90 views to visualize the pulmonary valve. In majority of the cases, pulmonary valve was crossed with 0.35 terumo wire over Judkin right catheter and exchanged to 0.35 super stiff exchange length wire followed by pulmonary valve ballooning with appropriate size balloon (fig-1).

Post procedural right ventricle angiogram routinely performed and pressure recorded in both pulmonary artery & right ventricle to document the peak to peak pressure gradient (PG) across right ventricle outflow (RVOT). In three patients ASD device closure was also done in same catheter procedure, Post procedural care included monitoring of access site, pulse and blood pressure along with review echocardiography after 4 & 24 hrs. Data collected regarding age, hemodynamic status, gender, valve annulus, PG across pulmonary valve, balloon size, no of inflations, immediate results, pre and post procedural right ventricle & left ventricle pressures and any complication encountered during the procedure. Procedure considered successful if peak to peak angiographic PG reduced to less than 50% of its initial value, suboptimal if PG reduced by 25-49% and unsatisfactory if PG reduced by less than 25%. The records of early follow up were also recorded and data was entered in SPSS 23 and descriptive analysis was done.

RESULTS

This retrospective quasi experimental study included total consecutive 24 adult patients (with no history of previous cardiac surgery or pulmonary valve ballooning) who underwent balloon pulmonary valvuloplasty for severe pulmonary valve stenosis at our institution from January 2017 to June 2019. Age ranged from 18 to 52 years with mean age of 30.5 ± 10.1 years. There were 13 (54%) female and 11 (46%) male patients. Pre-procedural assessment revealed all had severe (Peak instantaneous PG >64 mmHg across pulmonary valve) pulmonary valve stenosis and three patients also had significant shunt at ASD level. Mean pulmonary valve annulus size on echocardiography was 18 mm and the mean balloon size used for balloon pulmonary valvuloplasty was 22.7± 3.9mm (range 16-28). Only one balloon used for balloon pulmonary valvuloplastyin 23 cases, second larger sized balloons used in 01 case. Ninty percent cases were done under general anaesthesia. The mean procedural time and fluoroscopy time were 40.2 ± 11 & 10.2 ± 6.5 minutes respectively.

The procedure was considered successful in 100% of the total cases. The pressure gradient between Right ventricle to pulmonary artery reduced from 111 ± 42.7 mmHg to 39 ± 16.7 mmHg after pulmonary valve ballooning. There were no complications encountered in study population like death, non-fatal cardiac arrest, life threatening arrhythmias, heart perforation

or cardiac tamponade, bleeding /hematoma or vascular complications.

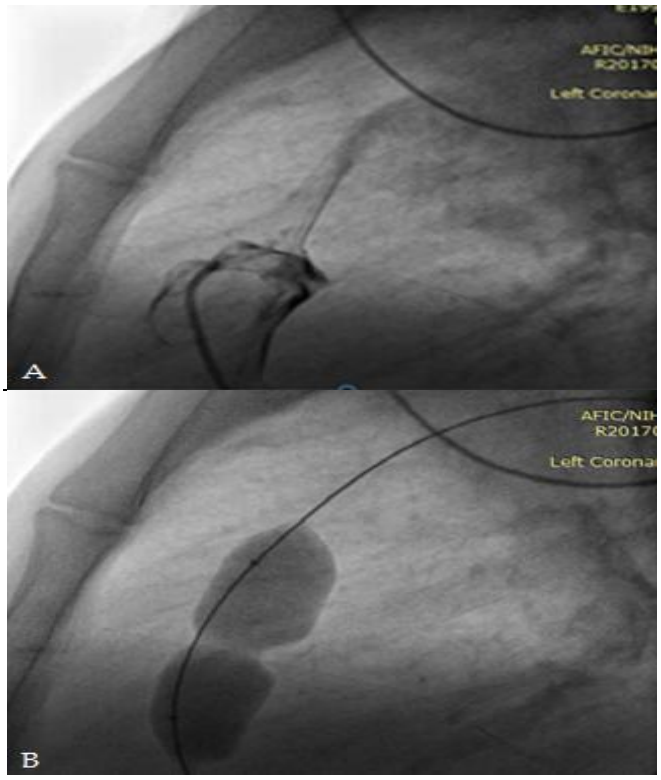

Figure: A: Severe pulmonary valve stenosis in 52 year old male. B: Pulmonary valve being dilated with 22 mm valvuloplasty balloon showing waist.

DISCUSSION

Congenital isolated pulmonary valve stenosis is a common heart defect and in majority of the cases, severity of pulmonary valve stenosis increases with age and it carries significant morbidity especially exercise intolerance, if left untreated. Congenitally malformed valve has been recognized as the most common cause of isolated pulmonic stenosis. In congenital pulmonary valve stenosis, the pulmonary valve has a dome shape with central small opening and the commissures are usually fused. Other rare causes of pulmonic stenosis especially in adults have been reported such as carcinoid heart disease and rheumatic heart disease. When the pulmonic valvular stenosis is severe and long-standing, secondary infundibular hypertrophy may occur due to long standing severe pulmonic valvular stenosis and dynamic right ventricular outflow obstruction can occur as a consequences. If remains unrecognized, severe pulmonic valve stenosis can leads to right sided heart failure in the fifth or sixth decade of life and even earlier. After diagnosis and treatment of the underlying problem, there is significant improvement in symptoms as well as prolongation of life.

The general protocol for the treatment of pulmonary valve stenosis is to offer them ballooning of stenosed pulmonary valve all age groups with moderate or more valvular stenosis or in symptomatic cases[1,8,15,16]. After first reported by Semb and kan *et al* in 1882,[5,6] with passage of time, the technique has improved and proved very safe and effective. The most difficult cases are of neonates with critical pulmonary valve stenosis and carries risk of major complications. There are numerous articles proving efficacy & safety of balloon pulmonary valvuloplastyin children, but such data in adults/grown up patients is scanty and especially in Pakistan. We aimed at studying immediate results of balloon pulmonary valvuloplastyin patients with age 18 years or more.

The mean age in our study population was 30.5 years and female patients outnumbered the opposite gender. In our study, the ratio of valvuloplasty balloon diameter to pulmonary annulus was kept around 1.25:1 as recommended by most of the literature[5]. Pre-procedural echocardiographic assessment is of paramount importance and it should include determination of severity of pulmonary valve stenosis, valve morphology, valve annulus size and exclusion of other defects. It is essential to specifically look & determine the infundibular contribution in the degree of right ventricular outflow obstruction, as it is important contributing factor in valvuloplasty failure or suboptimal results. Pulmonary valve annulus size was not significantly different when measured by transthoracic echocardiography or angiographically. Similarly, the comparison of echo derived peak instantaneous PG with angiographic derived peak to peak PG was in accordance to reported, almost >10-20% in favour of echo derived peak instantaneous pressure gradient.

The efficacy of balloon pulmonary valvuloplastyis time tested and is safe in experienced hands[1]. Our experience of pulmonary valve stenosis in 24 adult patients also proved efficacious with 100% success without anymajor complications. There are reports of use of double balloon for various reasons in literature but in our study only one patient was managed with simultaneous two balloons technique (because bigger balloon was not available) otherwise only single balloon was used in all remaining cases. Newer versions or double or even triple balloon techniques are generally reserved if the valve annulus is larger than available balloon or if single balloon is repeatedly melon seeds[7,17]. We defined procedural success, if peak to peak PG across RVOT reduced to less than 50% of initial value, considered as suboptimal if PG reduced by 25-49% and labelled as unsatisfactory/procedural failure if PG reduced by less than 25%. Our overall success rate was 100% that is quite similar to other studies. One large study reported reduction in PG from 71 mmHg to 33 mmHg in 784 pressures recorded Pulmonary valve stenosis[1] and is very similar to our results of 71 mmHg reduction after ballooning. Another way to consider efficacy is to compare the right ventricle pressure with aortic pressure. The best outcome of balloon pulmonary valvuloplasty is cases with moderate to severe pulmonary valve stenosis with doming pulmonary valve. It's worth mentioning that operator needs to be very careful while dealing with critical PS especially with element of RC dysfunctions, as these patients may collapses quickly when right ventricle or RVOT is manipulated by catheter and in worst cases can go into cardiac arrest which is very resistant to CPR until successful balloon pulmonary valvuloplasty is achieved. The principle is to be brisk with ballooning, once pulmonary valve is crossed. Our limited follow-up was also encouraging, as almost all patients maintained post procedural PG across PV without significant pulmonary regurgitation. In general, pulmonic balloon valvuloplasty is quite safe procedure and only few complications have been reported. Pulmonary regurgitation is one of common complication which does not occur to an extent which may result in hemodynamic problems. In dysplastic pulmonary valve stenosis, results may not be optimal as these valves are quite difficult to pulmonary valve ballooning[8]. Residual infundibular stenosis may be effectively treated with adrenergic blockade. According to some reports, patient may have complete heart block, vascular complications and disruption of the annulus. Pulmonary regurgitation progression over the period of time is debatable and there is a need to understand its potential consequences on patients. In one registry, residual moderate pulmonary regurgitation was detected in 7% of their patient[18]. In our study no case of moderate or severe pulmonary insufficiency was detected. It may be due to our slightly conservative approach as balloon annulus ratio was kept around 1.2-1.25:1 and success was defined as 50% reduction in PG across pulmonary valve.

CONCLUSION

Our study, though small, confirms the safety and efficacy of balloon pulmonary valvulo-plastyin severe pulmonary valve stenos is in adult patients.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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