

Percutaneous Transluminal Mitral Commissurotomy in Nepalese children with Rheumatic Mitral Stenosis

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ABSTRACT

Background: Rheumatic heart disease is one of the most common heart diseases in developing country; however rheumatic mitral stenosis in children is relatively rare. Percutaneous transluminal mitral commissurotomy is a well established therapeutic intervention for mitral stenosis in adults. The study is conducted to determine the efficacy and safety of PTMC in children with severe mitral stenosis.

Methods: A single centre retrospective study is conducted over a 3 and half years period (from 16th November, 2009 to 15th May, 2013) in Shahid Gangalal National Heart Centre, Kathmandu, Nepal. All consecutive patients aged less than 15 years who underwent Percutaneous transluminal mitral commissurotomy for severe mitral stenosis were included. Mitral valve area, left atrial pressure and mitral regurgitation were compared pre and post procedure.

Results: During the study period, 2237 patients underwent Percutaneous transluminal mitral commissurotomy. Among them 100 children less than 15 years of age were included. Successful results were obtained in 94 (94%) patients. Mitral valve area increased from $0.7 \pm 0.15 \text{ cm}^2$ to $1.5 \pm 0.32 \text{ cm}^2$ ($p < 0.001$). A significant decrease in left atrial pressure was observed from $29 \pm 7.9 \text{ mmHg}$ to $13.9 \pm 6.2 \text{ mmHg}$ ($p < 0.001$). There was no significant change in grade of post procedural mitral regurgitation.

Conclusions: Percutaneous transluminal mitral commissurotomy in children with severe mitral stenosis is safe, effective and should be considered as procedure of choice for childrens.

Citation

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Keywords

Children, Mitral stenosis, Percutaneous transluminal mitral commissurotomy, Rheumatic Heart Disease

BACKGROUND

Rheumatic Heart Disease (RHD) is endemic in developing countries. Limbu and Maskey in 2002 reported that RHD is the commonest heart disease in Nepal.¹ In school aged children, the incidence

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of RHD is reported as 1.35 per thousand in rural community of hill region and 1.2 per thousand in Kathmandu city.^{2,3} Mitral Stenosis (MS) of rheumatic origin is usually diagnosed late in older patients. However in developing countries, MS progresses rapidly resulting in symptoms in early to mid teens and early twenties.^{4,5} MS under 21 years carries poorer prognosis. Patient may present with severe pulmonary edema, early severe pulmonary hypertension or severe right ventricular failure.^{4,5} Surgical closed or open mitral commissurotomy is the traditional mode of treatment for MS. Mitral valve replacement in children in addition to its acute risk of surgical intervention, need of re-intervention later after 10-15 years carries another disadvantage. Percutaneous Transluminal Mitral Commissurotomy (PTMC) in adults has similar result to open commissurotomy and has better result than that of closed commissurotomy.⁶⁻⁸ Hence, PTMC is an attractive alternative in children with MS with suitable mitral valve. The objective of this study is to determine the efficacy and safety of PTMC in children with severe rheumatic MS

METHODS AND MATERIALS

It is a single centre, retrospective study performed in Shahid Gangalal National Heart Centre, Kathmandu, Nepal over a period of 3 and half years from 16th November, 2009 to 15th May, 2013. All consecutive patients aged less than 15 years who underwent PTMC procedure for severe MS at the cardiac catheterization laboratory (Cath Lab) were included. Proforma was designed to record patient's demographic profile, Left Atrial (LA) size, outcome of procedure including any complications. The main outcomes taken for the study were post procedural change in Mitral Valve area (MVA), mean LA pressure and Mitral Regurgitation (MR) status.

Procedure: Before the procedure, all patients underwent trans-thoracic echocardiography (TTE) and trans-esophageal echocardiography (TEE), electrocardiography, chest X-ray and pre-catheterization laboratory tests. Suitability of PTMC was determined by echocardiography (both TTE and TEE). MVA was calculated with planimetry. Patients with grade 2+ MR or more, LA or LA appendage thrombus, commissural calcification or significant aortic valve (AV) disease were unsuitable for the procedure.

PTMC was done with the standard Inoue technique for all patients. The procedure involves passing a balloon catheter from the right atrium through the interatrial septum into the left atrium and then across the stenotic mitral valve into the left ventricle.

Inflation of the balloon mechanically splits the fused commissures.

A simple balloon sizing method, based on the patient's height, was applied for the selection of appropriate sized balloon catheter. Following formula was applied:

$$\text{Balloon size (mm)} = \text{Height (cm)} / 10 + 10$$

Pre and Post procedural mean LA pressures were recorded in Cath Lab. Post procedural changes in MVA and MR status were evaluated by TTE next day. Further, procedure related complications like cardiac tamponade, acute pulmonary edema, stroke etc. were recorded.

Successful PTMC means increase in MVA by 50% or more, or MVA more than 1.5 cm² and decrease in mean LA pressure to 18 mmHg or less without causing significant mitral regurgitation (i.e., MR > 2+ grade) or any other complications.⁹⁻¹¹

The retrieved data were entered into and analyzed using Statistical Package for Social Sciences Software, version 16 (SPSS Inc). Descriptive statistics (mean and proportion) were obtained and comparative analysis was done by Paired T-test. A p-value <0.05 was considered significant.

RESULTS

During the study period, total of 2237 patients underwent PTMC which included 100 children less than 15 years of age. The mean age of children was 13±1.6 (7 -15) years and 48% were male. The mean left atrial size was 4.4±0.6 cms.

Out of 100 children, 94 (94%) had successful outcome. There was statistically significant increase in MVA and decrease in mean LA pressure. MVA (mean±SD) increased from 0.7±0.15 to 1.5±0.32 cm² (p<0.001) and mean LA pressure (mean±SD) decreased from 29±7.9 to 13.9±6.2 mmHg (p<0.001) (Fig.1). There was no significant mitral regurgitation. 45 patients (47.9%) had grade 0 MR, 39 patients (41.5%) had grade 1+ MR and 10 patients (10.6%) had grade 2+ MR.

Out of six unsuccessful cases, 2 were referred for mitral valve replacement. Remaining four were under follow up out of which 2 cases were planned for redo PTMC and 2 were under medical management as they had significant mitral regurgitation but didn't have indication for mitral valve replacement.

DISCUSSION

MS in children is not an uncommon in RHD endemic country like Nepal. Over the last two decades, PTMC has become the treatment of choice for symptomatic isolated MS.⁴ The present study with sample size of 100 children has seen the successful PTMC in 94%. This is similar to the previous studies by Nobuyoshi et al. (92%) in Japan,¹² Alkhalifa et al. (94.5%) in

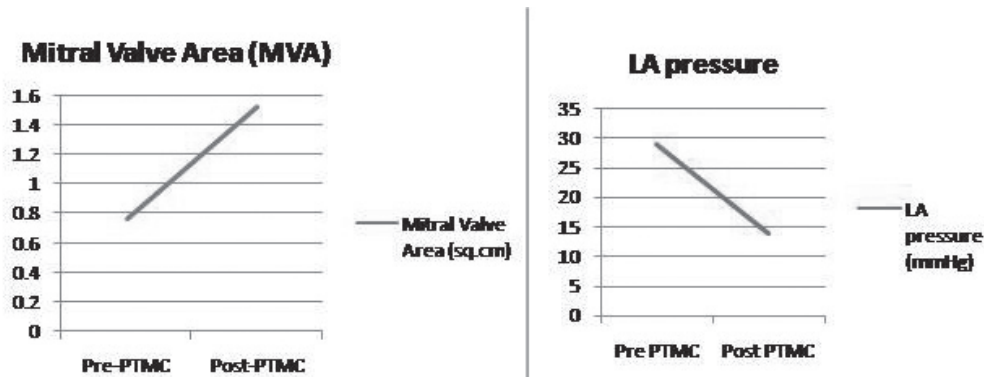


Figure 1: Changes in Mean mitral valve area and mean left atrial pressure pre and post PTMC procedure

Sudan,¹³ Arora et al. (99.8%) in New Delhi, India¹⁴ and Yonga et al. (100%) in Kenya.⁴ The first three studies used the standard Inoue technique for PTMC similar to our study however the study population was different in all those studies. Their study population included all age group (both children and adults). In the contrary, Yonga et al. studied juvenile age group (<21 years of age) however the PTMC technique was different. The latter used Multi-track ballooning technique.

Successful candidates in the present study had 100% increase in mean MVA and 52% decrease in mean LA pressure with no significant MR or any other complications. Table 1 compares the procedural changes in mean MVA and mean LA pressure in the present study with respect to similar other studies.

It is seen that PTMC is as effective in children as in adults with standard techniques including the Inoue technique. Inoue and Feldmen in 1993 published that PTMC with Inoue balloon catheter is technically successful in over 90% of patients, and the long-term durability of commissurotomy is excellent in those with pliable mitral valve leaflets and minimally deformed submitral apparatus.⁸ At a mean 20 month follow up of Post PTMC status patient by Lau et al., symptomatic benefit was maintained in 97% of patients and an echocardiographic evidence of restenosis (loss of more than 50% initial gain in valve area, a valve area of less than 1.5 cm², or both) was noted in 9.8%.¹⁰ In long term follow-up by Hamasaki et al., the event-free (death, mitral valve replacement, and repeat PTMC) survival

Table 1: Comparison of changes in MVA and LA pressure pre and post procedure of the present study with the other similar studies

Study	MVA (Mean ± SD) cm ²		LA pressure (Mean ± SD) mmHg		p-value
	Pre -PTMC	Post-PTMC	Pre-PTMC	Post-PTMC	
Present Study	0.7±0.15	1.5±0.32	29.0±7.9	13.9±6.2	p<0.001
Yonga et al. ⁴ study	0.6±0.19	1.9±0.19	30.5±3.9	11.5±3.8	p<0.001
Gamra et al. ⁵ study	0.95±0.20	2.13±0.3	29.0±8.0	13.0±6.0	p<0.001
Lau et al. ¹⁰ study	0.8±0.2	1.7±0.4	20.0±6.0	13.0 ±5.0	p<0.001

There was statistically significant increase in MVA and decrease in mean LA pressure post procedure in all the comparable studies including the present study. Yonga et al. studied 45 patients younger than 21 years old however they use multi-track ballooning technique for mitral commissurotomy. In the same age group category, Gamra et al. studied 110 patients however PTMC was carried out with two different techniques (Double ballooning and Inoue techniques). In the study by Lau et al. Inoue technique was used in all 105 patients similar to our study, however the study population was age-range 21 to 69 years.

rate was 90%, 85%, and 66% at 1, 5, and 10 years, respectively.⁹

The present study has certain limitations. Being a retrospective study, the study is largely based on hospital database, so we could not exactly comment regarding pre and post procedural status of the patient (clinical as well as echocardiographical). Further, change in pulmonary artery pressure and trans-mitral gradient could not be included in the study. Follow up study could not be included in the study. Hence, further studies regarding prospective study and follow up are recommended.

CONCLUSION

PTMC safe and effective intervention in children with severe MS of Rheumatic origin and should be considered the procedure of choice for those children.

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