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Research Article

Is Closed Mitral Valvotomy Obsolete? A Comparitive Study between Percutaneous Balloon Mitral Valvotomy (PBMV) and Closed Mitral Valvotomy (CMV)

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ABSTRACT

Purpose: As compared to developed nations, in developing countries especially Indian subcontinent population overload, mal-nutrition, poor socio-economic status of affected group and health care facilities affect the outcome of treatment.

A surgical intervention with comparable short and long term results along with low cost and wider group of patient population included (pregnant females, young adults and restenosis cases) is definitely need of the time. Closed Mitral Valvotomy (CMV) therefore essentially remains modality of treating the Mitral stenosis of favourable morphology as it caters to above challenges. Where percutaneous procedures are unavailable due to financial con-straints and open surgical management cannot be offered due to overburdened and limited resources CMV provides an excellent choice with convincing immediate and late outcomes in favourable mitral valve pathology.

Methods: We reviewed the literature for various valvotomy techniques done for mitral valve stenosis and restenosis. Immediate and late outcomes were compared between the patients receiving Percutaneous Balloon Mitral Valvotomy (PBMV) and Closed Mitral Valvotomy (CMV).

Results: The immediate and late term results are comparable for PBMV and CMV. Complications developing in both the techniques are also nearly similar. CMV holds important role in excellent palliation provided to child bearing age mothers and young adults suffering from mitral valve pathology of favourable morphology because its cost effectiveness and freedom from hazardous side effects of anticoagulation are promising.

Conclusion: With excellent immediate and late outcomes, CMV stands as procedure of choice for favourable mitral valve morphology where our resources are limited and overburdened. It is life saving and definitely not obsolete

Keywords: Closed mitral valvotomy (CMV), Mitral stenosis, Percutaneous Balloon Mitral Valvotomy (PBMV)

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INTRODUCTION

"To have the greatest number of patients live the longest time, in the best possible condition." 73% of global burden of RHD alone prevails in India, Pakistan, China, Indonesia and Congo democratic republic. Disability adjusted life years due to RHD is approximately >10 million. Age standardised prevalence is estimated to be maximum in females of reproductive age group (Watkins DA, *et al*., 2017). Prevalence of heart disease in pregnancy in developing nations is 0.65% (mitral stenosis due to RHD being the commonest) (Schoon, MG, *et al*., 1997).

In regions of high prevalence RHD juvenile Mitral Stenosis is also frequently encountered (age~5 years old). Treatment of valvular cardiac lesions as suggested in ACC/AHA and ESC valvular heart disease guidelines focuses on identification and grading of severity of disease and early intervention (Bonow RO, *et al*., 2006).

Even in asymptomatic patients with moderate lesions early intervention is indicated (Vahanian A, 2007). Hazards of cardiopulmonary bypass, anticoagulation and poor health care referral facilities warrants us to opt for palliative intervention with comparable short and long term results (Bernal JM and Miralles PJ, 1986). CMV completely justifies the above notion given by Ankeney as it caters to greatest number of patients without posing risk of anticoagulation.

As compared to developed nations, in developing countries especially Indian subcontinent population overload, mal-nutrition, poor socio-economic status of affected group and health care facilities affects the outcome of treatment (Kumar SA, 2020). CMV offers the advantage of tactile assessment of valve. What eyes cannot appreciate in the echocardiographic images, fingers can feel (Neelakandan B, 1996). A surgical intervention with convincing short and long term results along with low cost and less strict compliance and monitoring is the choice (Suri RK, *et al*., 1996). 25 times less cost is required as compared to the open heart procedure (Neelakandan B, 1996). With excellent immediate and late outcomes, CMV stands as procedure of choice for favourable mitral valve morphology where our resources are limited and overburdened. It is life saving and definitely not obsolete.

MATERIALS AND METHODS

Closed mitral valvotomy therefore essentially remains modality of treating the Mitral stenosis of favourable morphology as it caters to above challenges (Patel JJ, *et al*., 1991). Where percutaneous procedures are unavailable due to financial constraints and open surgical management cannot be offered due to overburdened and limited resources. Closed Mitral Valvotomy provides an excellent choice with convincing immediate and late outcomes in favourable mitral valve pathology.

Mitral valve stenosis: Pathophysiology

The term valve (Latin: Valvae) means double folding doors.

Mitral (Italian: Mitre) as it resembles bishop's mitre.

In mitral stenosis disease intervention is offered usually when (Burckhardt D, *et al*., 1991):

MVA: <1.5 cm^2

Gradient (mean diastolic gradient): >5 mm Hg

Pulmonary artery systolic pressure: >50 mm Hg

Pulmonary capillary wedge presssure: >20 mm Hg

Pulmonary arteriolar resistance: >3 units

According to Gorlin formula, twofold increase in flow across the mitral valve causes fourfold increase in the gradient across the valve.

$$MVA=\frac{MVF}{(38*\sqrt{MG})}$$

Where, MVA=Mitral valve area; MVF=Mitral valve flow; MG=Mean gradient

RESULTS AND DISCUSSION

CMV was the first intervention to be devised for Mitral stenosis. In 1923, Cutler inserted valvotome and performed CMV for the first time (Perloff JK, 2004). Soutter did digital dilatation of stenotic lesion. After three decades Bailey in 1949 popularised this technique (Bailey CP, 1949). Tubb's dilator was introduced in 1957 ,since then percentage of restenosis cases has declined , as better release of fused commissures is possible with Tubb's dilator as compared to finger fracture method (Fraser KE and Sugden BA, 1977). Brock RC, 1952 for the first time performed CMV in pregnant patient. Abortion was earlier offered to such patients. Percutaneous Balloon mitral valvotomy became available in 1990, introduced by Japanese surgeon Inoue. In a randomized controlled trial Arora R, *et al*, 1993 reported comparable short and long term outcome in 2000 patients that they studied. They equally divided the patients receiving PBMV and CMV (*Tables 1 and 2*). Increase in mitral valve area was nearly comparable in both the groups. Complications like mitral regurgitation and restenosis were also same in both the groups.

Table 1: Mitral Valve Area (MVA) pre and post PBMV and CMV in various studies

Study	References				
	Patel JJ, *et al*., 1991	Arora R, *et al*., 1993	Ben-Farhat M, *et al*., 2001	Rifaie O, *et al*., 2009	Aggarwal N, *et al*., 2005
PBMV (pre-operative MVA)	0.8 ± 0.3	0.85 ± 0.26	0.9 ± 0.2	-	-
PBMV (post-operative MVA)	2.1 ± 0.7	2.3 ± 0.94	2.1 ± 0.5	2 ± 0.05	-
CMV (pre-operative MVA)	0.7 ± 0.2	0.79 ± 0.21	0.9 ± 0.2	-	0.8 ± 0.2
CMV (post-operative MVA)	1.3 ± 0.3	2.2 ± 0.85	1.6 ± 0.3	2.1 ± 0.05	2.1 ± 0.01
p	<0.001	NS	-	NS	-
Mitral regurgitation (MR)	1 in each	12 (PBMV) 14 (CMV)	-	-	-

Table 2: Comparison of operative mortality

Study	Number of patients	Operative mortality	Duration of follow up
Fraser KE and Sugden BA, 1977	359	4.20%	17 years
Suri RK, *et al*., 1996	113	2.80%	10 years
John ST, *et al*., 1983	3724	1.50%	5 years
Commerford PJ, *et al*., 1982	654	2.97%	12 years
Arora R, *et al*., 1993	2000	1%	22 ± 6 months

Rifaie O, *et al*., 2009 in a prospective randomised study in which they followed 40 patients for 15 years; reported similar immediate and long term benefits in PBMV and CMV patients.

In a 7 years study by Ben-Farhat M, *et al*., 2001 a lower success rate was documented which reflected lower immediate success rate and hence increased residual stenosis rate. This study also highlighted the importance of subvalvular disease on impact on final outcome.

In a study carried on 654 patients by Commerford PJ, *et al*., 1982 low operative mortality (2.97%) and survival rate (90%) was reported. Patients were followed for a period of 12 years. John ST, *et al*., 1983 studied immediate and long term outcome on 3724 patients: Long term survivors were 86%. Late deaths occurred in 4.3%. CMV for restenosis was also carried out in their study which involved 6.7% mortality. It highlighted the cost-effectiveness and excellent immediate and late outcomes of CMV.

CMV for restenosis was elaborately studied by Fraser KE and Sugden BA, 1977 giving excellent outcome in 70.5% cases. Operative mortality in 10.4% and late mortality in 23.8% patients after second CMV (Arora R, *et al*., 1993). In Ellis and Harken (1964) study of 139 patients in which second CMV for restenosis was performed; late results were comparable to results after first CMV (Arora R, *et al*., 1993).

Suri RK, *et al*., 1996 reported no role of PBMV in restenosis cases where they opted for second CMV (Kumar SA, 2020). Interval between first and second CMV was around 9.4 years. Moderate to excellent improvement was documented in 89.4% cases.

In a retrospective cohort study by Radhakrishnan BK, *et al*., 2019 they reported results of Mitral Valve Replacement after CMV. Hospital stay, Intensive Care Unit (ICU) stay and need of ventilation was found comparable in post CMV and non CMV MVR.

Aggarwal N, *et al*., 2005 found excellent results of CMV in pregnancy and labor and also emphasised its cost effectiveness. Acute pulmonary edema resulting in maternal death and when medical therapy fails CMV offers great breakthrough in refractory patients. In a study by Otto CM, 2007 with focus on women with valvular heart disease, early intervention even in asymptomatic young females expecting pregnancy in near future was recommended .This would result in prevention of symptoms and decompression during the pregnancy.

In research by Naidoo DP, *et al*, 1991 they reported how open heart surgery in pregnancy increases risk of CNS damage, bleeding and teratogenic effects due to anticoagulation. Thus, indicating role of PBMV/CMV in such patients (Perloff JK, 2004).

CONCLUSION

The overall results of the present study indicated that the nanofilled glass ionomer cement ketac N and glass carbomer cement with surface coat had better retention rate and proper marginal seal than conventional glass ionomer with surface coat. Moreover, the effect of the restorations on the periodontal health assessed by modified papillary index and modified gingival index showed better results.

The limitation of this clinical study is related to the short-term of the study (1-year follow-up) for the retention and sealing ability assessments. However, longer follow up periods would be interrupted by the physiological exfoliation of the teeth unless a younger age group would be used. Nevertheless, further trials with longer observation periods are still necessary to evaluate the esthetic, functional, and biological properties to document whether secondary caries which is regarded as the main reason for failure would develops in these restorations.

Based on the study's results, the following conclusions can be made-

- Nano filled GICs were more effective than conventional GIC (Equia fill) in restoring class II cavities in primary molars when followed up for 12 months.
- Ketac N GIC showed better durability than glass carbomer cement

after 12 months follow up in restoring class II cavities in primary molars.

- Nano filled GICs showed better effect on periodontal health than conventional GIC at baseline and 6 months follow up.

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