

# PERCUTANEOUS TRANSVENOUS MITRAL COMMISSUROTOMY IN PATIENTS WITH RHEUMATIC HEART DISEASE: A HOSPITAL-BASED RETROSPECTIVE STUDY

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## Abstract

**Background:** Percutaneous Transvenous Mitral Commissurotomy (PTMC) is a procedure of choice for the treatment of severe mitral stenosis. We aimed to describe our experiences on management of rheumatic heart disease with PTMC in Malaysia.

**Methods:** Patients who underwent PTMC were traced through the electronic medical record of University Malaya Medical Centre. The patients detailed echocardiogram parameter pre-procedure, post-procedure and outcome were documented. Statistical analysis was performed using SPSS version on 18 for windows.

**Results:** 11 patients were treated with PTMC in our centre with 90.9% (n=10) success rate. Subjects underwent PTMC were statistically significant associated with improved echocardiogram parameters as following: increase in mitral valve size (p=0.0058) from  $0.89 \pm 0.2 \text{ cm}^2$  (pre) to  $1.4 \pm 0.4 \text{ cm}^2$  (post); reduction in mean pressure gradient across mitral valve (p=0.0283) from  $11.5 \pm 4.9 \text{ mmHg}$  (pre) to  $6.9 \pm 3.5 \text{ mmHg}$  (post); and reduction (p=0.0019) in elevated pulmonary artery systolic pressure from  $65.7 \pm 21.4 \text{ mmHg}$  (pre) to  $45.6 \pm 10.0 \text{ mmHg}$  (post). More than half (62.5%, n=5) of the subjects with favourable Wilkin score 8 or less achieved good outcome defined as post-PTMC mitral valve size  $\geq 1.5 \text{ cm}^2$ . All subjects with unfavourable Wilkin score of more than 8 only achieved sub-optimal post-PTMC mitral valve size  $\leq 1.5 \text{ cm}^2$ .

**Conclusion:** Given the minimally invasive nature of PTMC with comparable excellent haemodynamic outcome to invasive vascular repair, PTMC should be the recommended first line therapy in mitral valve stenosis.

**Keywords:** Mitral stenosis, Mitral valve, Percutaneous Transvenous Mitral Commissurotomy, PTMC, Interventional cardiology

## Introduction

Mitral stenosis (MS) is characterised by the narrowing of the mitral valve (MV) opening area, which leads to obstruction of transmittal flow. The aetiology of the stenosis varies from leaflets thickening, restricted valve movement, chordal shortening or even fusion of commissural (1). Rheumatic heart diseases (RHD) remain the most common causative aetiology followed by aged-related calcific degeneration.

Retrospective literature revealed a significantly higher prevalence of RHD in our country compared to developed countries, and these figures have been transmitted into increased MS cases (2). Almost half (46.7%) of the mitral valve repair performed in Malaysia was caused by rheumatic mitral valve diseases (3). Furthermore, we observed an increasing trend of degenerative MS in developed countries contributed by the ageing population

and will positively contribute to higher prevalence of MS in the future (4).

The introduction of percutaneous transvenous mitral commissurotomy (PTMC) is an innovative procedure which offers a less invasive alternative to surgical closed mitral commissurotomy (CMC) or open mitral commissurotomy (OMC). The effectiveness of this minimally invasive procedure has been studied via prospective randomised controlled trial, which was non inferior in terms of residual post-procedural MS between PTMC and OMC (4). Hence, PTMC is recommended as the initial treatment option due to less complication; shorter hospital stays and relatively less invasive compared to thoracotomy or cardiopulmonary bypass. Indeed, PTMC will be more suitable and beneficial for the ageing population (5). We aimed to describe our experience in the management of RHD with PTMC in Malaysia, in addition to the existing published literature (6).

**Material and Methods**

This study is a single centre, retrospective study conducted in University Malaya Medical Centre (UMMC) over a 6-years period between 2012 and 2018. All patients over the age of 18 years old that underwent PTMC in UMMC were identified from the procedure logbook inclusive of those with rheumatoid heart diseases affecting the mitral valve. Patient clinical data and outcomes were subsequently retrieved from electronic medical records and documented. Trans-thoracic and trans-oesophageal images, cinematic loops and records of all patients were reviewed. Pre- and post-PTMC parameters including pulmonary artery systolic pressure, left atrium (LA) size, mitral valve area and ejection fraction were collected. Incident and severity of mitral regurgitation pre- and post-PTMC were collected for all the included subjects. Wilkin echocardiographic score was calculated by taking the following aspects into consideration: mitral leaflet mobility, thickening, sub valvar thickening and valvar calcification. A final Wilkin score of less than 8 would predict favourability of PTMC procedural success. Patient with good haemodynamic outcome. All patients with incomplete data were excluded from the final analysis. Patients who aged < 18 years old, Wilkin score > 12, bilateral commissural calcification, end stage renal and liver diseases, moderate mitral valve regurgitation and presence of other pathology that require open heart surgery were excluded from the study.

Statistical analysis was performed using SPSS version 18 for windows (SPSS, Inc., Chicago, IL). The pre and post-procedural echocardiographic value were analysed using the Wilcoxon signed-rank test. The incidence of mitral regurgitation pre- and post-procedure was analysed with the McNemar’s test. All p values < 0.05 are considered significant.

**Results**

A total of 11 patients who met the inclusion criteria and underwent PTMC procedure were included in our study. There was no patient excluded from the analysis. The study

was predominantly female, with male to female ratio of 1:4.5. The mean age of the study population was 54.1 years old with the eldest who aged 78 years old and the youngest who aged 27 years old. There were 45.5% (n=5) of the subjects were elderly population who aged 60 years and above. Dyspnoea is the main presenting symptom in all patients with baseline New York Heart Association (NYHA) Class II-III (Table 1).

**Table 1:** Basic demographics of the participants (n=11)

Basic Demographic	n (%)
<b>Gender</b>	
Male	2 (18.2%)
Female	9 (81.8%)
<b>Age</b>	
Adult	6 (54.5%)
Elderly (60 years and above)	5 (45.5%)
<b>Ethnicity</b>	
Malay	7 (63.6%)
Chinese	3 (27.2%)
Indian	1 (9.1 %)
<b>Clinical Presentation</b>	
Dyspnea	11 (100%)
Reduced Effort Tolerance	9 (81.8%)
<b>NYHA on presentation</b>	
Class I	0 (0%)
Class II	8 (72.7%)
Class III	3 (27.3%)
Class IV	0 (0%)

NYHA, New York Heart Association

The average Wilkin score for our studied population was 6.9. The majority of the subjects 72.7% (n=8) had Wilkin scores of 8 or less, and 27.3% (n=3) had Wilkin scores of more than 8. The mean MV area of the study cohort was 0.89 ± 0.2 cm<sup>2</sup>, with the majority 63.6% (n=7) had severe stenotic MV. The mean pressure gradient across the mitral valve pre-PTMC was 11.5 ± 4.9 mmHg with all of them had moderate- severely (> 5 mmHg) elevated mean gradient. The LA diameter of the subject ranges between 4.7 cm to 7 cm with a mean of 5.6 cm. None of the patients of the study had a normal LA diameter of less than 4 cm prior to PTMC. All of them presented with elevated pulmonary artery systolic pressure (PASP) of more than 30 mmHg with a mean PASP of 65.7 ± 21.4 mmHg. Majority 72.7% (n=8) of the patients had severely elevated PASP (> 50 mmHg) ranging from 56 mmHg to 106 mmHg while others 27.3% (n=3) had moderately elevated PASP (> 30 mmHg). The mean baseline left ventricular ejection fraction (LVEF) based on the Simpson method was 62.9%. Prior to PTMC, there were 54.5% (n=6) of the subjects with pre-existing mild mitral regurgitation (MR), followed by 27.3% (n=3) with no MR and 18.2% (n=2) with trivial MR.

The successful rate of PTMC for our cohort was 90.9% (n=10) with only one patient failed to complete the procedure,

subsequently required mitral valve replacement. Univariate analysis showed PTMC in patients with MS was associated with a statistically significant increase in valve area ( $p=0.0058$ ) post-procedure. The mean mitral valve size increase from  $0.89 \pm 0.2 \text{ cm}^2$  to  $1.4 \pm 0.4 \text{ cm}^2$  following PTMC. PTMC resulted in optimal post-PTMC mitral valve size  $\geq 1.5 \text{ cm}^2$  in 62.5% ( $n=5$ ) of patients with a Wilkin score 8 or less ( $n=8$ ). Meanwhile, all patients with Wilkin score or more than 8 ( $n=3$ ) had suboptimal post-PTMC mitral valve size ( $\leq 1.5 \text{ cm}^2$ ). PTMC correlates with a reduction in mean gradient ( $p=0.0283$ ) and reduction in PASP ( $p=0.0019$ ) as shown in Table 2 and 3. There was no association between PTMC with LVEF and LA diameter. There are 4 patients (36.4%) from our study complicated with moderate MR while one of them (9.1%) complicated with severe MR.

**Table 2:** Echocardiographic index for pre- and post-PTMC

Index	Pre-procedure	Post-procedure	p value
Ejection Fraction, %	62.9 ± 8.2	61.5 ± 11.9	0.8339
Mean gradient, mmHg	11.5 ± 4.9	6.9 ± 3.5	0.0283*
Valve area, $\text{cm}^2$	0.89 ± 0.2	1.4 ± 0.4	0.0058*
PASP, mmHg	65.7 ± 21.4	45.6 ± 10.0	0.0019*
Left atrium size, cm	5.6 ± 0.7	5.5 ± 0.6	0.8335
LVIDd, cm	4.7 ± 0.8	4.8 ± 0.7	0.4271

\* Statistically significant ( $p < 0.05$ )  
 PSAP, Pulmonary artery systolic pressure; LA, Left atrium; LVIDd, Left ventricular inter-diastolic diameter

**Table 3:** Patients' characteristics for pre- and post-PTMC

Gender/ Age	Wilkin Score	LVEF Pre/ Post (%)	MR Pre/ Post	Mean Gradient Pre/ Post (mmHg)	Valve area Pre/ Post ( $\text{cm}^2$ )	PSAP Pre/ Post (mmHg)	LA Pre/ Post (cm)	LVIDd Pre/ Post (cm)
Female/ 50	11 <sup>a</sup>	58/ Failed	Trivial/ Failed	7/ Failed	0.8/ Failed	36/ Failed	5/ Failed	4.5/ Failed
Male/72	5	53/ 50	No/ Mild	13/ 7	0.8/ 1.1	56/ 51	5.2/ 5.2	5.9/ 5.9
Female/ 27	4	77/ 77	No/ Severe	20/ 13.3	0.8/ 1.8	100/ 64	5.2/ 5	3.4/ 4.7
Female/ 78	9	66/ 73	Mild/ Moderate	7/ 6	0.6/ 0.9	72/ 61	7/ 6.2	4.3/ 4.1
Female/ 46	5	64/ 66	Trivial/ Mild	12/ 10	1.2/ 1.5	72/ 39	5.7/ 5.5	4.1/ 4.3
Female/ 70	6	66/ 61	Mild/ Moderate	6/ 3	1.2/ 2.3	48/ 38	6/ 5.6	5/ 4.5
Female/ 27	5	65/ 63	No/ Mild	16.9/ 3	0.65/ 1.5	106/ 34	6.3/ 4.6	5.5/ 4.8
Male/ 57	8	50/ 50	Mild/ Mild	11/ 7	1/ 1.6	57/ 45	5.3/ 5.9	4.3/ 4.3
Female/ 60	9 <sup>b</sup>	69/ 66	Mild/ Moderate	5/	0.7/ 1.1	48/ 44	6/ 6.3	5.8/ 5.9
Female/ 44	7	70/ 40	Mild/ Moderate	16	0.96/ 1.4	63/ 40	4.7/ 5.3	4.5/ 4.7
Female/ 64	7	54/ 62	Mild/ Trivial	12.8	1.1/ 1.2	65/ 40	4.9/ 5.2	4.6/ 4.8

LVEF, Left ventricular ejection fraction; N/A, Not available; MR, Mitral regurgitation; PSAP, Pulmonary artery systolic pressure; LA, Left atrium; LVIDd, Left ventricular inter-diastolic diameter

a: Failed PTMC procedure and proceed with valve replacement therapy  
 b: PTMC was performed and underwent valve replacement therapy later

**Discussion**

A female predominance (81.8%) was observed in our study which is similar to previous studies, possibly explained by females (74.5%) was predominantly affected by rheumatic heart diseases in Malaysia (2, 7).

The patients that were identified and underwent hemodynamic evaluation by echocardiography pre-procedure, post-procedure ( $n=11$ ) and were followed-up for at least 1 year. PTMC was shown to improved haemodynamic post-procedure, as evidenced by satisfactory increases in mean valve size from  $0.89 \pm 0.2 \text{ cm}^2$  to  $1.4 \pm 0.4 \text{ cm}^2$ . The increase in mean valve size were reflected by a significant reduction in PASP and mitral valve gradient, in agreement with various previously published studies (8, 9). The majority of the subjects (62.5%) with

Wilkin score of 8 or less achieved optimal post-PTMC mitral valve size  $\geq 1.5 \text{ cm}^2$ , in contrast, all of the subjects with Wilkin score of more than 8 only achieved sub-optimal post-PTMC mitral valve size  $\leq 1.5 \text{ cm}^2$ . One subject with a Wilkin score of more than 8 required mitral valve replacement later. Our study demonstrated that Wilkin score of 8 or less associated with the best outcome post-PTMC, consistent with the previous study that predicted the favourable immediate and long-term outcome of PTMC (10, 11). Favourable Wilkin score independently predicts a lower risk of restenosis in long term follow-up (7, 10). A study of 10 years follow-up showed only 28% of subjects with Wilkin score 8 or less had restenosis compared to 50% of the subjects with a score of more than 8 (7). In the event of restenosis occurring, PTMC remained as the mainstay of treatment that offered excellent immediate and long-term

outcome, half of the subjects remained intervention free of 10 years follow-up (4, 12). Ninety percent of the subjects who underwent PTMC do not require reintervention, which is comparable to OMC (93%), an invasive approach (5).

### Conclusion

Given the minimally invasive nature of PTMC with comparable excellent haemodynamic outcome to invasive vascular repair, PTMC should be the recommended first line therapy in mitral valve stenosis. Patients with suitable valve morphological characteristic and Wilkin score of less than 8 would be the best candidate to be treated with PTMC.

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### Competing interests

The authors declare that there is no conflict of interest.

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### Ethical approval

Ethical approval was not sought for the present study because the study is retrospective in nature, all the relevant data analyzed were sufficiently anonymized with no indefinable personal information. This study was completed in accordance with the Helsinki Declaration.

### Informed consent

Verbal informed consent was obtained from all subjects before the study. Written consent was not obtained because the data was collected retrospectively, the subjects were not physically present at the healthcare facility.

### Authors' contributions

MAMF, KSWs, MFH, MIAH, MDI, RSAS and WAWA conceptualize the design of the study. MAMF, KSWs, MAZA and MRMS drafted, analysed the data and revised the intellectual content of the manuscript. All authors reviewed and revised the initial manuscript. All authors read and approved the final manuscript.

### Availability of data and materials

The data used in the analysis are available from the corresponding author on reasonable request.

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