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WILKIN'S SCORE;

PREDICTIVE VALUE OF WILKIN'S SCORE IN DETERMINING THE PROCEDURAL SUCCESS OF PERCUTANEOUS TRANSVENOUS MITRAL COMMISSUROTOMY

Sobia Mughal[1], Muhammad Imran Hanif[2], Areeba Riaz[3], Asif Hanif[4]

1. BSc Hons (Cardiac Perfusion Technology)
   Demonstrator
   Department of Cardiac Perfusion
   Gulab Devi Educational Complex, Lahore.
2. MBBS, FCPS (Cardiology)
   Associate Professor
   Department of Interventional Cardiology
   Gulab Devi Chest Hospital, Lahore.
3. M.Phil (Public Health),
   BSc Hons (Cardiac Perfusion Technology)
   Demonstrator
   Department of Cardiac Perfusion
   Gulab Devi Educational Complex, Lahore.
4. PhD (Biostatistics), M.S. (Applied Statistics), MSc (Biostatistics)
   Assistant Professor Biostatistics
   Gulab Devi Educational Complex, Lahore.

Correspondence Address:
Dr. Sobia Mughal
Department of Cardiac Perfusion
Gulab Devi Educational Complex, Lahore.
sobiyamughal@gmail.com

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ABSTRACT… Objectives: To assess the predictive value of Wilkin's score in determining the procedural success of Percutaneous Transvenous Mitral Commissurotomy. **Study Design:** Cross sectional study. **Setting:** Catheterization Laboratory of Gulab Devi Chest Hospital, Lahore. **Period:** April 2016 to March 2017. **Methods:** All patients with valve area <1.5cm², pliable or border line pliable valve were included in study. Patients who had LA thrombus, severe mitral regurgitation, severe valvular calcification were excluded from study. Patients were evaluated clinically and echocardiographically 24 hours before and after procedure. Valve morphology was assessed using 2D echocardiography. Wilkins' score's sensitivity and specificity and predictive accuracy at score >8 was also assessed**.** Mean was used to express quantitative data while qualitative data was presented using frequency tables. One-sample kolomogorov smirnov test was applied to see normality of data. Paired sample t-test was applied for normally distributed while Wilcoxon test for non-normally distributed data. **Results:** There were 26(23.6%) male and 84(76.4%) female with mean age 32.30±11.40 years. Successful results of PTMC with MVA ≥1.5 were obtained in 97 (88.2%) while it remained unsuccessful in 13 (11.8%) patients. Successful results with Wilkins score <8 were obtained in 22(95.6%) and unsuccessful in 1(4.3%) patient. While with Wilkin score ≥8, it remained successful in 75(86.2%) and unsuccessful in 12(13.7%) patients. Sensitivity and specificity of Wilkins score for the success of PTMC was 22.68% and 92.31% respectively. **Conclusion:** The success of PTMC depends upon valve morphology. Wilkins score is the best determinant to predict the likelihood of success or failure of procedure and therefore should be used to select suitable patients prior to PTMC.

Key words: Mitral Valve Area, Percutaneous Transvenous Mitral Commissurotomy, Predictive Accuracy, Sensitivity, Specificity.

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INTRODUCTION

Despite the decrease in the prevalence of rheumatic fever in the developed world, mitral stenosis is still a major cause of valvular heart disease in the developing countries.[1] Mitral stenosis (MS) is the most common disease, accounting for approximately 54 % of all rheumatic heart diseases.[2,3] Severe symptomatic mitral stenosis requires surgical correction of the valvular lesion and is done by prosthetic mitral valve replacement or in selected cases by mitral commissurotomy. Since it has less operative morbidity and mortality and very few postoperative complications and good prognosis, Mitral commissurotomy is considered as a better substitute of valve replacement in severe Mitral Stenosis.[4] PTMC is a class 1 indication in patients with pliable mitral valve, fused commissures without severe calcification and moderate subvalvular disease. Patients with highly calcified valve, moderate to severe mitral regurgitation, left atrial clot and associated moderate to severe aortic valve disease are contraindicated for PTMC.[5] Echocardiography is a gold standard diagnostic test used to see the structure of mitral valve apparatus, severity of stenosis and the chamber size, all giving valuable information that would surmise the success of procedure. Echocardiographic or Wilkin's score is measured by calculating the individual subcomponent scores including leaflet thickening, valve calcification, pliability and subvalvular disease. Best immediate post procedural outcomes can be found in patients with Wilkins Score<8. Patients

with Wilkin's score >8 have a 56% chances of suboptimal immediate outcomes. PTMC will not produce a good immediate or long term result in patients with Wilkin's score >12.[6] Successful PTMC is considered as post valvuloplasty valve area > 1.5 cm^2 or >50% increase in the mitral valve area without any documented significant complications.[7] In the majority of mitral stenosis patients, PTMC produces optimal immediate betterment in both cardiac pressure and functions and clinical symptoms.

Since Wilkins score provides noninvasive information about the valve morphology, it can predict the likelihood of success of the procedure. As most of the patients suffering from mitral stenosis are non-affording and PTMC is a very expensive procedure so we aimed this study in order to see the predictive accuracy of the Wilkins score so that we can assess the valve prior to PTMC in selected suitable patients to obtain the excellent outcomes.

MATERIAL AND METHODS

Cross sectional study of patients during April 2016 to March 2017 with severe mitral stenosis was conducted at catheterization laboratory of Gulab Devi Chest Hospital Lahore. Sample size of 110 cases is calculated using 95% confidence level, sensitivity 91.6% at 7% margin of error and specificity 25% of Wilkin's score < 8 at 10% margin of error in the prediction of successful procedure with an expected prevalence of mitral stenosis i.e. 40%.[8,9] Purposive sampling technique was used to collect the data of patients of either gender with age 10-60 years. Informed verbal consent was taken from the patients prior to data collection. Patients with valve area <1.5cm^2, pliable or borderline pliable valve with no LA or LAA clot were included in the study. Patients who had LA or LAA thrombus, severe mitral regurgitation and severe valvular calcification were excluded from this study.

To compute the results of balloon dilatation, we analyzed clinical, echocardiographic, and hemodynamic variables before and after PTMC. The clinical variables included cardiac rhythm, dyspnea according to NYHA classification, X-ray findings (Cardiothoracic ratio, mitralization, double atrial shadow and pulmonary opacities). On echocardiography mitral valve area was measured by planimetry in parasternal short axis view it is calculated by Gorlin formula i.e. cardiac output/SEP×HR×44.3$\sqrt{G}$. Successful procedure was defined if mitral valve area (MVA) was increased to > 1.5 cm^2 or > 50 percent increase in MVA after procedure. Valve area, Transmitral, mean and peak pressure gradients were also observed to see the difference before and after the procedure. PTMC was done by using Inoue balloon technique. Balloon size was calculated by patient height according to formula height/10+10. The right side of heart was approached via right femoral vein and septum was punctured using Brocken rough needle with Mullin's sheath under fluoroscopy (AP projection). Thereafter a curly wire is passed into the LA and then the puncture site is dilated with 14F dilator. Inoue balloon was then passed over this wire into the LA. Thereafter, the balloon is passed across the mitral valve in RAO 30◦ projection. Balloon was inflated gradually as per standard Inoue technique. With complete inflation, the waist of the balloon tears the fused commissures of the valve to a pre-planned diameter as required for each patient to achieve a good result.

Predictive Scores

Wilkins score was determine as described by Wilkin's et al and Abascal et al. This score is the sum of semi quantitative grading of mitral valve leaflet thickening, mobility, calcification and subvalvular thickening, each on a scale of 1 to 4 with 1 being the least involvement and 4 being the most severe involvement. The total Wilkins score is the sum of these four individual numbers.[10-12] In patients with severe mitral stenosis, a low total score (< 8) suggests valvuloplasty. A total score > 10 and the presence of more than mild mitral regurgitation or of calcification of both commissures suggest valvular replacement.

PREDICTIVE ACCURACY

True positive (a)

It was labeled when we got good score (was assessed separately for each score) and

procedure was successful.

True negative (d)
It was labeled when we did not get good score (was assessed separately for each score) and procedure was not successful.

False positive (b)
It was labeled when we got good score (was assessed separately for each score) and procedure was not successful.

False negative (c)
It was labeled when we did not get good score (was assessed separately for each score) and procedure was successful.

Statistical package for social sciences (SPSS) version 16 was used for data entry and its analysis. Mean ± Standard Deviation was used to express quantitative data while qualitative data like gender and distribution of baseline clinical characteristics were presented using frequency and percentage. One-sample kolomogorov smirnov test was used to see the normality of data. Paired sample t-test was applied to normally distributed data while the non normally distributed data was analyzed using Wilcoxon test. Predictive accuracy of Wilkin's score was assessed using the sensitivity, specificity, positive and negative predictive values.

RESULTS
A total of 110 patients were included in the study. There were 26(23.6%) male and 84(76.4%) female with mean age 32.30±11.40 years. Body mass index was calculated and there were 45(40.9%) underweight, 51(46.4%) normal weight, 8(7.3%) overweight and 6(5.5%) obese patients. Pre procedural echocardiographic findings shows that there were 74(67.3%) patients with palpitation, 12(10.9%) with hemoptysis and 3(2.7%) with cerebrovascular accidents and 17(15.5%) with transient ischemic attacks. According to WHO classification of dyspnea there were 50(45.5%) patients with class II, 51(46.4%) with class III, 9(8.2%) with class IV. Echocardiographic findings shows that the mean mitral valve area (MVA) increased from 0.8±0.18 cm^2 to 1.67±0.24 cm^2 with p-value <0.0001. Mitral valve mean pressure gradient decreased from 14.7±5.44 to 6.1±2.2 with p-Value <0.0001. Mitral valve peak pressure gradient decreased significantly from 25.65 ±8.76 to 11.81±3.83 with p values of <0.001.

Successful results of PTMC with MVA ≥1.5 were obtained in 97 (88.2%) while it remained unsuccessful in 13 (11.8%) patients. Successful results with Wilkins score <8 were obtained in 22(95.6%) and unsuccessful in 1(4.3%) patient. While with Wilkin score ≥8, it remained successful in 75(86.2%) and unsuccessful in 12(13.7%) patients. Sensitivity of the procedure was 22.68% and specificity was 92.31%. Positive and negative predictive values of the procedure was 95.65%, 13.79% respectively with diagnostic accuracy of 30.91%.

Gender n (%) Males Females		 26 (23.6%) 84 (76.4%)
Age (Mean±S.D.)		32.30±11.40
BMI (kg/m2) n (%) Underweight Normal weight Overweight Obese	 17-18.5 18.5-25 25-30 30-35	 45(40.9%) 51(46.4%) 8(7.3%) 6(5.5%)

Table-I. Baseline characteristics

Mitral valve area Before PTMC After PTMC p-value *paired sample t- test	 0.88±0.18 1.67± 0.24 <0.0001*
Mean pressure gradient Before PTMC After PTMC p-value *paired sample t-test	 14.72±5.44 6.14±2.22 <0.0001*
Peak pressure gradient Before PTMC After PTMC p-value *Wilcoxon test	 25.65±8.67 11.81±3.83 <0.0001*

Table-II. Echocardiographic findings

	Success of PTMC	
	Successful PTMC (mitral valve area >1.5 cm)	Unsuccessful PTMC (mitral valve area <1.5cm)
Wilkin's score < 8 ≥8	 22 75	 1 12
Predictive accuracy	Parameters	Estimate
	Sensitivity	22.68%
	Specificity	92.31%
	Positive predictive value	95.65%
	Negative predictive value	13.79%
	Diagnostic accuracy	30.91%

Table-III. Predictive accuracy of Wilkin's Score

DISCUSSION

PTMC is considered as a best non surgical alternative treatment for mitral stenosis.[13] Although majority of patients benefit immediately from this procedure, results in individual patients are variable.[14] Therefore it is very important to assess the clinical factors which are likely to affect the success of this procedure. Morphology of mitral valve and subvalvular apparatus, assessed by 2D echocardiography, greatly influences the immediate outcomes of PTMC and it was supported by previous literature.[15] These findings correspond with the surgical data which show pliability of the valve and no or less calcification have better immediate and long term results of the procedure.[10] Low Echo score (≤8) is submissive of a pliable, non calcified valve with small subvalvular disease and express as best indicator of immediate successful results. Comparative to this higher scores have been shown to be associated with a higher complication rate, a lower immediate success rate and a higher rate of restenosis as demonstrated by a study.[12] Another study of Babu DS et al. shows that increasing valve area tend to have lower Wilkin's score and it surmise the better outcomes after PTMC with positive and negative predictive value of 76 and 54% respectively p<0.04.[9]

In a study done by Abascal et al. total echocardiographic score and outcomes of PTMC shows a clear relation which is expressed as either a "good" or a suboptimal result. Wilkins' score of 8 predict optimal combination of sensitivity and specificity, below this level sensitivity decreased and specificity increased, as were found in our study. In his study, most patients benefited even with high Wilkins score. This means that high echocardiographic score does not preclude the possibility of good results. His study shows that 84% patients with echocardiographic score of 8 or less have good outcomes where as 58% patients with echocardiographic score of 8 or more have suboptimal results. Sensitivity, specificity, positive and negative predictive value were 72%, 73%, 58% and 84% respectively.[16] In our study sensitivity of the Wilkins score for the success of PTMC was calculated and it turned out to be 22.68%, that means the success of the procedure doesn't purely depends on the Wilkins score while the 92.31% specificity shows that the failure of the procedure was due to high Wilkin's score so we should choose the alternative strategies in such patients in order to achieve good immediate and long term results. Positive and negative predictive values of our procedure were 95.65% and 13.79% respectively. Study of Wilkins G et al. demonstrate the outcomes of PTMC his study shows that outcomes of PTMC depends upon valve leaflet deformity, the greater the degree of leaflet deformity, the likelihood of suboptimal results will be greater, conversely valves with more normal structure is associated with optimal results.[10] Another important determinant responsible for good outcomes of PTMC is the Mitral valve apparatus which is consistent with previous study of Sellors et al. which shows that anatomy of the valve apparatus was the major determinant of success of valve commissurotomy.[17]

Palacios I et al. Reported that PTMC is associated with significant increase in mitral valve area,

cardiac output, immediate reduction in cardiac hemodynamic and decrease in the Transmitral gradient, these changes are in consistent with the data of previous studies and believe that mitral valve commissurotomy is an effective method in relieving clinical symptoms of mitral stenosis,[18] as confirmed by our study. Our study shows that PTMC provides a significant increase in the valve area (p-value <0.0001), and a significant reduction in the Transmitral (p-value<0.0001), peak (p-value<0.0001) and mean pressure gradients (P-value<0.0001).

In the studies done by Palacios et al., Sadeghian et al., and Herrmann et al. good results of PTMC were obtained in 80%, 71% and 89% while suboptimal results were achieved in 17%, 29% and 11% respectively[18-20], as strengthened by our results in which PTMC remained successful in 88.18% and unsuccessful in 11.1%.

In the study of Sadeghian et al unsuccessful results were obtained in 25.5% these unsuccessful results were due to suboptimal secondary MVA < 1.5 cm2 and post-procedure MR grade >2 in 3.6%. They demonstrated the causes of successful results as young age, lower size of the left atrium (LA), and smaller degree of mitral valve thickness.[19] Unsuccessful results in our study were due to high Wilkins score including decreased pliability, severe valve calcification, leaflet thickening and subvalvular disease.

LIMITATIONS OF THE STUDY

The main limitations of the study were: Small sample size as compared to the disease burden in Pakistan. If the sample size is increased, the results would be better and more reliable.

Secondly we used the 2D echocardiography to assess the valve, which does not give us complete information regarding the valve morphology. If we use 3D echocardiography, the results would be improved and sensitivity of the echocardiographic score to determine the procedural success would be more.

CONCLUSION

PTMC is a minimally invasive procedure used to treat tight mitral stenosis with excellent immediate and long term outcomes. The study shows that the outcome of the PTMC is related to the structure of the mitral valve and the subvalvular apparatus. Wilkins score obtained non invasively can predict the likelihood of the success or failure of the procedure and therefore should be used to select suitable patients. Since the suboptimal results were obtained in the advanced valve deformity and scarring, this study implies that the procedure should be performed before the advanced scarring and immobility have occurred.

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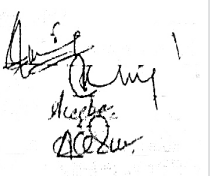
AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Sobia Mughal	Data collection	
2	Muhammad Imran Hanif	Study design & concept	
3	Areeba Riaz	Manuscript writing	
4	Asif Hanif	Statistical Analysis	