

## Effect of percutaneous transvenous mitral commissurotomy on brain natriuretic peptide in mitral stenosis in tertiary care hospitals of Peshawar

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### Abstract

The current study was planned to determine the effect of percutaneous transvenous mitral commissurotomy (PTMC) on brain natriuretic peptide (BNP) levels in mitral stenosis patients. It was conducted at the Postgraduate Medical Institute, Lady Reading Hospital, Peshawar, and Rehman Medical Institute Laboratory, Peshawar, Pakistan, from December 2013 to June 2014. Of the 100 patients, 63(63%) were females. The patients' age ranged from 14 to 58 years. Patients diagnosed with isolated mitral valve stenosis or with grade 1 or with grade 2 mitral regurgitation were randomly selected. BNP values before and after 24 hours of PTMC were calculated. The statistical analysis of the echocardiographic variables and BNP levels showed an increase in mitral valve area, drop in pulmonary artery systolic pressure, left atrium diameter and reduction in BNP levels ( $p < 0.05$  each) after PTMC that provides a concrete evidence for a successful PTMC procedure.

**Keywords:** Percutaneous transvenous mitral commissurotomy, Natriuretic peptide, Mitral stenosis, BNP.

### Introduction

Natriuretic peptides (NP) are endogenous hormones which are mostly secreted from the heart and are used clinically to diagnose heart disease.<sup>1-3</sup> Brain natriuretic peptide (BNP) plasma level is used in mitral stenosis assessment and the BNP levels and mitral stenosis are significantly correlated.<sup>4-6</sup> The long-term and commonest complications of rheumatic fever is reported to be mitral stenosis.<sup>7</sup> Echocardiography is a test used for cardiac dysfunction. BNP and echocardiographic parameters are correlated<sup>8</sup> and its levels are increased in patients with left ventricular dysfunction and heart failure.<sup>9</sup> Doppler evaluation and echocardiography are of great importance in determining the progression level of organic changes

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in the valve itself as well as in finding out the direction of further management.<sup>10</sup> Percutaneous transvenous mitral commissurotomy (PTMC) is the treatment for mitral stenosis.<sup>11-12</sup> Currently, there are two main techniques for PTMC: the balloon and the metallic commissurotomy.<sup>13</sup> PTMC is a safe procedure with optimal results and a good rate of success which may save or delay the need for the replacement of mitral valve.<sup>14-16</sup> It is also recommended for asymptomatic patients with moderate to severe mitral stenosis having pulmonary hypertension with a pulmonary systolic pressure greater than 50 mmHg at rest or 60 mmHg with exercise due to an obstruction in the mitral valve.<sup>17</sup> The present study was planned to determine the effect of PTMC on BNP levels on mitral stenosis patients. To our knowledge, no such study has ever been conducted.

### Methods and Results

This descriptive, cross-sectional study was conducted at Cath Lab, Lady Reading Hospital, Peshawar, Rehman Medical Institute Laboratory, Peshawar, Pakistan, from December 2013 to June 2014. The institutional ethics committees approved the study protocol and a written informed consent was obtained from the patients. Patients of all ages and both genders having isolated mitral stenosis or with grade 1 or with grade 2 mitral regurgitation for PTMC were included in the study. Patient history, complete routine examination, baseline investigations, including echocardiography, was ensured. Patients with chronic renal failure (serum creatinine > 1.2 mg/dl), tranoesophageal echocardiography (TOE) showing left atrial thrombus, recent thromboembolic event, pregnant woman on clinical and urine examination, and those needing simultaneous coronary angioplasty were excluded. Non-probability consecutive sampling was employed to collect the blood samples of the patients.

A fibrosed obstructed mitral valve was opened with the help of a few wires and a balloon. The balloon was inflated at different volumes according to patient height till optimal valve dilation was achieved. The procedure was performed within 30 minutes by an experienced cardiologist. Blood samples stored at 2-8°C were tested

**Table:** Descriptive statistics (n=100).

Pre & Post PTMC	Minimum	Maximum	Mean	Std. Deviation	P-value
Age	14	58	34.72	11.242	--
MVA (Pre) cm <sup>2</sup>	0.50	2.20	0.969	0.349	0.000
MVA (Post) cm <sup>2</sup>	1.00	3.00	1.841	0.450	
PASP (Pre) mmHg	25.00	120.00	61.640	21.069	0.000
PASP (Post) mmHg	30.00	75.00	47.200	10.738	
LAD (Pre) cm <sup>3</sup>	3.20	7.00	5.017	0.824	0.000
Left Atrium Diameter (Post) cm <sup>3</sup>	1.90	6.40	4.559	0.716	
BNP (Pre) pg/ml	13.20	903.00	140.863	149.656	0.000
BNP (Post) pg/ml	14.30	590.70	96.143	103.339	

MVA: Mitral valve area

PASP: Pulmonary artery systolic pressure

LAD: Left atrium diameter

BNP: Brain natriuretic peptide

PTMC: Percutaneous transvenous mitral commissurotomy.

within 24 hours of collection. Pre- and post-PTMC blood samples were centrifuged to obtain the plasma of the sample and the blood plasma stored at 2-8°C was tested for BNP levels within 24 hours. The architect BNP assay is a chemiluminescent microparticle immunoassay (CMIA) used for the quantitative determination of human brain natriuretic peptide in human ethylenediaminetetraacetic acid (EDTA) plasma on ARCHITECT I system. The 8K28 ARCHITECT BNP Reagent Kit (Abbott Laboratories, Peshawar) was run on the ARCHITECT I system; it comprised microparticles, conjugate and specimen diluent. The reagents within ARCHITECT I system that were used for the BNP test were ARCHITECT wash buffer containing phosphate buffered saline solution, pre-trigger solution containing 1.32% (w/v) hydrogen peroxide and trigger solution containing 0.35N sodium hydroxide. Other materials used to run the test were septum, reaction vessels and sample cups. Each BNP control single sample was tested and it was ensured that the assay control values lie within the concentration ranges given in the control package insert and the calibrators should be priority loaded. The ARCHITECT BNP kit was loaded on the ARCHITECT I system. Calibrators and controls were prepared and were mixed gently before use. The blood samples were loaded and run on the ARCHITECT I system. The biological principles of the procedure included the combining of sample and anti-BNP coated paramagnetic microparticles in the first step. BNP present in the sample was bound to the anti-BNP coated microparticles. To make a reaction mixture anti-BNP acridinium labelled conjugate was added after washing in the second step. Pre-trigger and trigger solutions were added to the reaction mixture following another wash cycle. The resultant chemiluminescent reaction was measured in relative light units (RLUs). A

direct relationship was found between the amount of BNP present in the sample and the relative light units detected by the ARCHITECT I system optics. The patients' pre-and post-echocardiographic variables and BNP levels were analysed using SPSS 20, and a paired t-test was applied to the datasheet to calculate mean and standard deviation (SD).  $P < 0.05$  was considered statistically significant.

There were 100 patients in the study. Echocardiographic assessment of the patients after PTMC showed mean mitral valve area (MVA) increased from  $0.969 \pm 0.349$  cm<sup>2</sup> to  $1.841 \pm 0.450$  cm<sup>2</sup> ( $p < 0.001$ ), mean pulmonary artery systolic pressure dropped from  $61.640 \pm 21.069$  mmHg to  $47.200 \pm 10.738$  mmHg ( $p < 0.001$ ), left atrium diameter dropped from  $5.017 \pm 0.824$  cm<sup>3</sup> to  $4.559 \pm 0.716$  cm<sup>3</sup> and BNP levels fell from  $140.863 \pm 149.656$  pg/ml to  $96.143 \pm 103.339$  pg/ml (Table).

Moreover, 62(62%) patients were found with post-PTMC mild mitral regurgitation, 16(16%) with post-procedural moderate mitral regurgitation, and 6(6%) having increased post-procedural mitral regurgitation with elevated BNP levels. Global studies showed females had double the rate of mitral stenosis. Our results showed similarity with the findings of some other studies. The echocardiographic assessment in one study showed an increase in MVA and significant drop in pulmonary artery systolic pressure.<sup>16</sup> In the current study, there was no mitral regurgitation in 22(22%) patients but there were 58(58%) patients with grade 1, 16(16%) patients with grade 2, no patients with grade 3 and grade 4 compared to another study in which there was no mitral regurgitation after the PTMC in 318 patients, 441 patients were recorded with grade 1, 222 patients with grade 2, 22 patients with grade 3 and 3 patients with grade 4.<sup>18</sup>

The results show a significant increase in MVA which provides the evidence for successful PTMC procedure and by echocardiography the success of the procedure is more evident if MVA becomes greater than double the original area or it is increased by 1cm<sup>2</sup>.<sup>15</sup> In the present study, post-procedural MVA was greater than double the original area in 44(44%) patients while the area increased by 1 cm<sup>2</sup> after the PTMC in 37(%) patients. In our current PTMC set-up, 90(90%) patients achieved post-procedural MVA  $\geq$ 1.5 cm<sup>2</sup>. In a study, PTMC procedure gave a high rate of success, with 93.6% of the patients achieving MVA  $\geq$ 1.5 cm<sup>2</sup>.<sup>19</sup> The insignificant increase in the size of left atrium in a few cases can only be explained on the ground that echo is a subjective tool and even minimal changes in probe placement from different window sites in the same person some time can result into different size readings. In one study, the plasma BNP levels decreased after a successful PTMC.<sup>20</sup> In the current study, the small group of patients having increased post-procedural mitral regurgitation with increased BNP levels can be readily explained because of acute volume overload secondary to mitral regurgitation.

### Conclusion

BNP values can be used as a significant tool to comment on the success of PTMC procedure along with other parameters like mitral valve area, pulmonary artery systolic pressure and left atrium size. The success of the PTMC procedure can easily be inferred from the decrease in the levels of BNP.

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**Conflict of Interest:** None.

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