

## ORIGINAL ARTICLE

## EFFECT OF GENDER ON ECHOCARDIOGRAPHIC OUTCOMES OF PATIENTS PRESENTING WITH MITRAL STENOSIS AT A TERTIARY CARE HOSPITAL

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**Background:** To assess the gender-based differences in the echocardiographic outcomes of patients with mitral stenosis presenting at a tertiary care hospital and the clinical implications of such differences. **Methods:** A total of 90 echocardiographs of both men and women (aged  $\geq 15$  years) having mitral valve area (MVA) less than  $4 \text{ cm}^2$  were assessed. In addition to MVA, pressure half time and left atrial diameter (LAD) of the patients was also recorded. Other co-existing valvular lesions were also assessed in addition to mitral stenosis. Statistical analysis was done using SPSS-17. **Results:** A higher prevalence of mitral stenosis (MS) was found in women than men (76.66% vs 24.44%). Men were having more severe mitral stenosis as compared to women (MVA= $1.19 \text{ cm}^2$  vs  $1.32 \text{ cm}^2$ ). This also resulted in significantly higher left atrial dilatation in males as compared to women (45.09 vs 41.75,  $p=0.0422$ ). Most of the patients had other coexisting valvular lesions and isolated MS was rare. However, men had a predominance of aortic stenosis along with mitral stenosis (27% vs 4%,  $p=0.0059$ ) whereas women had a higher prevalence of mitral regurgitation along with mitral stenosis than the men (65% vs 36%,  $p=0.0258$ ). **Conclusion:** There were certain significant differences in echocardiographic outcomes of patients based upon their gender. A gender-specific management approach towards the patients with mitral stenosis is essential to have better outcome.

**Keywords:** Mitral stenosis, Rheumatic heart disease, Echocardiography, Gender

## INTRODUCTION

Mitral stenosis is a very common valvular disease in the third world countries, and is considered to be a major consequence of rheumatic endocarditis.<sup>1</sup> Due to poverty and lack of health education in such countries, delay in the treatment will lead to a variety of complications. Such complications include rise in left atrial pressure, orthopnoea, paroxysmal nocturnal dyspnoea and fatigue.<sup>2</sup> Dilatation and hypertrophy of the left atrium is often associated with atrial fibrillation. Mitral stenosis is often associated with other valvular lesions like mitral regurgitation,<sup>3</sup> or any other valvular pathology. Hurst in 2001 mentioned dilated atrial chambers associated with atrial fibrillation are common in patients having mitral regurgitation.<sup>4</sup> Advances in cardiology have made us capable now to defend our patients very efficiently against the lethal outcomes of mitral stenosis. Recent studies have also shown that gender focused patient approach, investigations and interventions further improve the prognosis of patients in this case.<sup>5</sup> In our study, we also address the question whether gender has any effects on echocardiography, in patients presenting at a tertiary care hospital.

## MATERIAL AND METHODS

This study was carried out at Cardiology Department, Holy Family Hospital, Rawalpindi. Patients with suspected mitral stenosis on the basis of history and clinical examination were selected and subjected to transthoracic echocardiography (TTE). In demographic

variables only age and sex were noted. The complete Doppler and echocardiographic examinations were performed with a Hewlett Packard Sonos 1000<sup>®</sup> ultrasound system using 5 MHz transducers from transthoracic windows. The reports of TTE were analysed and only those having age equal to or above 15 years with a mitral valve area of less than  $4 \text{ cm}^2$  measured with MVA planimetry were separated for research purpose after taking an informed consent. We excluded the patients who had undergone an open heart surgery or balloon valvuloplasty. A total of 90 echocardiographs were thus included in the study that fulfilled the inclusion criteria.

The other variable that was recorded during echocardiography to check the severity of mitral stenosis apart from MVA included pressure half time. All the cases were also assessed echocardiographically for other coexisting valvular lesions including aortic stenosis, aortic regurgitation, mitral regurgitation, pulmonary regurgitation and tricuspid regurgitation. Special emphasis was given to the measurement of left atrial diameter (LAD) as in mitral stenosis considerable left atrial enlargement can result in multiple complications. Left atrial diameter was measured on the M mode echocardiogram recorded in the parasternal long axis view. All measurements were made according to the recommendations of American Society of Echocardiography.<sup>6</sup> Afterwards a comparison of all these parameters was done keeping in view the gender of patient in order to find out any significant difference.

Comparison was done using the 2 sample *t*-test (unpaired) for variables that were continuous and Fisher's exact test for the categorical variables. The difference was regarded significant when *p*-value was less than 0.05. For data analysis, SPSS-17 was used.

## RESULTS

A total of 90 patients were included in the study. Among them 68 (75.56%) were females and 22 (24.44%) were males giving a F:M ratio of 3:1. The various echocardiographic outcomes observed in women are displayed in Table-1 whereas Table-2 shows co-existing valvular lesions in women in addition to mitral stenosis. Echocardiographic patterns of the men suffering from mitral stenosis are shown in Table-3 and Table-4 displays the co-existing valvular lesions in addition to mitral stenosis in men. In Table-5, a comparison between the echocardiographic outcomes of women and men is shown. Men presented at a slightly early age with mitral stenosis as compared to women (36.64 year vs 40.88 year), although it was not statistically significant. MVA was smaller in men compared to women (1.19 cm<sup>2</sup> vs 1.32 cm<sup>2</sup>), although statistically insignificant. LAD showed considerable enlargement in men (45.09 mm vs 41.75 mm) and it was statistically significant (*p*=0.0422). The pressure half time was higher in men compared to women (216.73 msec vs 196.17 msec) but without any statistical significance. Table-6 shows a similar comparison of men and women but with regard to co-existing valvular lesions along with mitral stenosis. Co-existing aortic regurgitation was almost equally and highly prevalent in both men and women (64% vs 60%) but in cases of aortic stenosis and mitral regurgitation, significant difference was seen. Aortic stenosis was more prevalent in men than women (27% vs 4%, *p*=0.0059) whereas mitral regurgitation was more prevalent in women (65% vs 36% with *p*=0.0258). Pulmonary stenosis was seen in none of the patients and similarly tricuspid stenosis was not present in any of the men but it was seen in 4% women. Co-existing pulmonary regurgitation and tricuspid regurgitation were also highly prevalent in both men and women but there were no significant differences in these findings.

**Table-1: Echocardiographic outcomes in women (n=68)**

Parameters	Range	Mean±SD
Age (Year)	22-80	40.88±16.65
MVA (cm <sup>2</sup> )	0.73-1.92	1.32±0.35
LAD (mm)	30-68	41.75±6.90
Pressure Half time (msec)	105-275	196.17±51.59

**Table-2: Co-existing valvular lesions in women in addition to mitral stenosis**

Valvular Lesions	%	n
Aortic regurgitation	60	41
Aortic Stenosis	4	3
Mitral Regurgitation	65	44
Pulmonary Regurgitation	52	35
Pulmonary Stenosis	0	0
Tricuspid Regurgitation	68	46
Tricuspid Stenosis	4	3

**Table-3: Echocardiographic outcomes in men (n=22)**

Parameters	Range	Mean±SD
Age (years)	15-60	36.64±12.15
MVA (cm <sup>2</sup> )	0.76-1.74	1.19±0.25
LAD (mm)	38-53	45.09±5.57
Pressure Half time (msec)	147-314	216.73±52.97

**Table-4: Co-existing valvular lesions in men in addition to mitral stenosis**

Valvular Lesions	%age	n
Aortic regurgitation (AR)	64	14
Aortic Stenosis (AS)	27	6
Mitral Regurgitation (MR)	36	8
Pulmonary Regurgitation (PR)	54	12
Pulmonary Stenosis (PS)	0	0
Tricuspid Regurgitation (TR)	82	18
Tricuspid Stenosis (TS)	0	0

**Table-5: Comparison of echocardiographic outcomes in men and women**

Parameters	Women (n=68) Mean±SD	Men (n=22) Mean±SD	<i>p</i>
Age (years)	40.88±16.65	36.64±12.15	0.2737
MVA (cm <sup>2</sup> )	1.32±0.35	1.19±0.25	0.1107
LAD (mm)	41.75±6.90	45.09±5.57	0.0422
Pressure half time (msec)	196.17±51.59	216.73±52.97	0.110

\*Significant

**Table-6: Comparison of men (n=22) and women (n=68) for coexisting valvular lesions**

Parameters	Women	Men	<i>p</i> -value
AR (%)	41 (60)	14 (64)	1.000
AS (%)	3 (4)	6 (27)	0.0059*
MR (%)	44 (65)	8 (36)	0.0258*
PR (%)	35 (52)	12 (54)	1.000
PS (%)	0 (0)	0 (0)	1.000
TR (%)	46 (68)	18 (82)	0.2816
TS (%)	3 (4)	0 (0)	1.000

\*Significant

## DISCUSSION

The most important cause of mitral stenosis is rheumatic heart disease that occurs because of an autoimmune reaction to the M protein present in the Group A Streptococci.<sup>7</sup> Rheumatic heart disease has almost become extinct in western countries however in developing countries it is still at large particularly because of low socioeconomic status of the people.<sup>8</sup> Therefore almost always mitral stenosis in developing countries occurs because of rheumatic heart disease. Women are generally more predisposed to autoimmune reactions and therefore diseases resulting from this.<sup>9</sup> This seems to hold significantly true for the rheumatic heart disease leading to mitral stenosis in our setup. Although the mitral valve area in both men and women is not quite different but still men with mitral stenosis tend to have slightly tighter mitral stenosis. In the present study, there were thrice as many women as men. In China, women to men ratio is 0.93:1,<sup>10</sup> whereas a similar study in Bangladesh shows a women to men ratio of mitral stenosis to be about 1:1.<sup>11</sup> Considering the fact that men have a larger heart with high cardiac output as compared to women, we can well appreciate that this difference in fact is also highly significant and in men although mitral

stenosis is rare but if present, it is more severe.<sup>12</sup> This fact is further appreciated when we take a look at the left atrial diameter. Whenever there is mitral stenosis, left atrium fails to empty into the left ventricle properly during atrial contraction as there is narrowing of the channel. With time span, this results into gradual left atrial dilatation leading to atrial fibrillation. In the present study, men having a tighter mitral stenosis compared to women result into significantly larger left atrial diameter as compared to that of women, is a significant finding ( $p=0.0422$ ). As mentioned earlier, left atrial dilatation can lead to many dreadful complications, therefore, this study indicates that men with mitral stenosis should be approached and treated as soon as possible so that their high risk of complications can be minimised.

According to American Society of Echocardiography, another variable that can be used to assess the severity of mitral stenosis apart from MVA is pressure half time that should be below 100 msec in normal individuals and if higher than 200 it indicates a severe mitral stenosis and also this pressure half time can be used to measure MVA indirectly using the formula  $MVA=220/\text{pressure half time}$ .<sup>6</sup> Therefore higher the pressure half time, narrower will be the mitral valve area and thus more severe mitral stenosis. However if we use the formula and calculate MVA by pressure half time we come to know that it gives a different readings of MVA for both men and women compared to MVA calculated by planimetry. This is because of high prevalence of co-existing valvular lesions in both men and women as pressure half time gives a reliable value of MVA only in cases of isolated mitral stenosis.<sup>13</sup> Therefore MVA planimetry should be used more often to assess the severity of disease. A worth-noting observation in the study is that in our setup there is a high prevalence of co-existing valvular lesions in patients with mitral stenosis. All other valvular lesions show almost an equal distribution among men and women except aortic stenosis (AS) and mitral regurgitation (MR). Aortic stenosis is more prevalent among men with mitral stenosis, whereas, mitral regurgitation tends to be significantly common in women having mitral stenosis ( $p=0.0059$  and  $0.0258$  respectively). The main reason for this difference may be the gender-based immune response of the host in case of rheumatic heart disease however further studies may be required to reveal the real facts. Apart from these two valvular abnormalities, there is also high prevalence of co-existing other valvular lesions especially aortic regurgitation, pulmonary regurgitation etc. mainly because of secondary pulmonary hypertension and tricuspid regurgitation as

well. Isolated mitral stenosis is however found rarely. This study shows a clear-cut difference among the outcomes of patients having mitral stenosis based on their gender. This study also has some significant differences from the similar studies conducted in other parts of the world.<sup>5,10,11</sup> Therefore keeping in view these facts, ethnic and gender focused approach, investigations and interventions of the patients with mitral stenosis are necessary in order to have a better outcome.

## CONCLUSION

Mitral stenosis affects the males more severely, although it is more common in females. Because of this fact left atrial dilatation also occurs more drastically in men and therefore higher risk of complications. A gender-based approach of a physician in case of mitral stenosis can improve the prognosis of the patients.

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