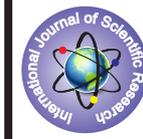


Retrospective study of Percutaneous Balloon Mitral Valvotomy in reference to mitral valve area and body surface area in a tertiary care hospital of central India



Cardiology

KEYWORDS: Optimal solution, Simulation software, steady state and random variables.

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ABSTRACT

Introduction:

Mitral valve area (MVA) is related to body surface area (BSA) of an individual and so it varies among individuals of different ethnic origin. We have calculated mitral valve area per square metre of body surface area in cohort of 50 patients who underwent percutaneous balloon mitral valvotomy (PBMV) at our centre both pre and post procedure. This data is then analyzed and compared to various studies across other parts of India and world.

Objectives:

- To calculate BSA of patients undergoing PBMV
- To assess MVA per square metre of BSA of an individual pre and post PBMV

Methodology:

This observational study was a cohort of 50 patients who satisfied ACC/AHA class I indication for PBMV over period of 1 year from Nov, 2014 to Nov, 2015. MVA was calculated a day prior and 2 days after the procedure with planimetry on 2D echocardiography. BSA was calculated using Du Bois method where $BSA = 0.007184 \times \text{height}^{0.725} \times \text{weight}^{0.425}$.

Observation:

The study population comprised of 41 female and 9 male patients, out of which 42 were in normal sinus rhythm. Mean BSA of population was 1.36 m² with standard deviation (SD) of 1.34. Pre PBMV MVA mean was 0.59 cm²/m² of BSA with SD of 0.12. Post PBMV MVA mean increased to 1.15 cm²/m² of BSA with SD of 0.19 (t=-19.7, df-49, p<0.0001). Simultaneously left atrial pressures (LAP) were recorded pre and post procedure as measure of success of procedure. Mean LAP of 23.58 mmHg with SD of 7.70 dropped down to 11.56 mmHg with SD of 4.84 (t=10.32, df-49, p<0.0001). When compared to studies in other part of country and world, pre BMV MVA varied across different region depending upon the which ethnic population was studied.

Conclusion:

MVA per BSA might standardize the cut off values across different ethnic population and provide more comparable data not only for PBMV but also other procedures dealing with mitral valve.

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Aims & Objectives:

1. To study clinical profile of patients undergoing percutaneous balloon mitral valvotomy.
2. To study rhythm characteristics of patients undergoing percutaneous balloon mitral valvotomy.
3. To study Wilkins score of patients undergoing percutaneous balloon mitral valvotomy.
4. To analyse MVA in relation with BSA of patients undergoing percutaneous balloon mitral valvotomy and to review various studies done so far on BMV in relation to MVA across the world.
5. To study change in mean Left atrial pressure pre Vs post percutaneous balloon mitral valvotomy.

Materials and Method:

This is a retrospective study done on patients who underwent BMV in a tertiary care centre Government Medical College & Super speciality Hospital, Nagpur.

Study population & Duration:

Study was conducted during period of 1 year from November 2014 to November 2015.

Inclusion criteria:

- Patients must be a diagnosed case of rheumatic heart disease with severe mitral stenosis based on clinical history and echocardiography
- Patients must be symptomatic i.e. NYHA class II or more
- Patients who underwent BMV after fulfilling criteria based on valve morphology and other subordinate parameters on assessment by echocardiography. Mitral valve area was calculated using planimetry method in 2D echocardiography. All the patients fulfilling inclusion criteria i.e. those patients with rheumatic heart disease who had isolated symptomatic MS and were apt for BMV had mitral valve area less than 1.5 cm² or less than 1cm²/m² body surface area which becomes class I indication for BMV according to ACC/AHA Task Force on practice guidelines 2014.^[3]

Exclusion criteria:

- Patients who are diagnosed case of rheumatic heart disease but are not symptomatic
- Patients who have multivalvular involvement due to rheumatic affection & who required surgical management for the same as first choice treatment.
- Patients who don't consent to undergo BMV.

Results & Analysis:

Table 1: Age wise distribution

Age group (in years)	Number of patients (n=50)
10-19	5
20 - 29	22
30 - 39	12
40 - 49	10
50 & above	1

Patients in age group 20-29 yrs constituted 44% (22/50), 30-39 yrs constituted 24% (12/50), 40-49 yrs constituted 20% (10/50) while 10-19 yrs constituted 10% (05/50). There was only 1 patient in age group 50 yrs & above in study population.

Table 2: Gender wise distribution

Gender	Number of patients (n=50)
Female	41
Male	09
Total	50

Females constituted 82% (41/50) while males constituted 18% (09/50) of the study population.

Table 3: Body surface area wise distribution

Body surface area (in Kg/m ²)	Number of patients (n=50)
< 1.2	04
1.2 - 1.3	13
1.3 - 1.4	13
1.4 - 1.5	11
1.5 - 1.6	08
> 1.6	02

26% (13/50) patients had BSA of 1.2-1.3 & 1.3-1.4 (Kg/m²) each respectively. 22% (11/50) patients had BSA of 1.4-1.5 (Kg/m²). 8 out of 50 patients were having atrial fibrillation (16%).

Table 4: Mitral valve area wise distribution

Mitral valve area (in cm ²)	Number of patients (n=50)	Mitral valve area per m ² BSA (in cm ² /m ²)	Number of patients (n=50)
<0.50	00	≤ 0.40	00
0.50-0.59	01	0.41 - 0.49	13
0.60-0.69	09	0.50 - 0.59	16
0.70-0.79	10	0.60 - 0.69	13
0.80-0.89	15	0.70 - 0.79	06
0.9-0.99	08	0.80-0.89	02
1.0	07		

30% (15/50) patients had Mitral valve area of 0.80-0.89(in cm²). 32% (16/50) patients had Mitral valve area per m² BSA (in cm²/m²) of 0.50-0.59.

Table 5: Wilkins Score of patients undergoing BMV

Wilkins Score	Number of patients(n=50)
<08	02
08-10	35
>10	13
Total	50

70% (35/50) Patients undergoing BMV had Wilkins score between 08-10.26% (13/50) patients had Wilkins score >10.

Table 6: Post BMV mitral valve area wise distribution

Mitral valve area (in cm ²)	Number of patients (n=50)	Mitral valve area per m ² BSA (in cm ² /m ²)	Number of patients (n=50)
1.20-1.29	03	≤ 0.95	05
1.30-1.39	08	0.96 - 1.00	07
1.40-1.49	08	1.01 - 1.05	07
1.50-1.59	08	1.06 - 1.10	07
1.60-1.69	07	1.11 - 1.15	05
1.70-1.79	08	> 1.16	19
>1.80	09		
Total	50		

Post BMV 18% (09/50) patient had MVA >1.80 cm².16% (08/50) had post BMV MVA 1.30-1.39 cm² 1.40-1.49 cm², 1.50-1.59 cm² & 1.70-1.79 cm². Post BMV 38% patient had MVA per m²BSA (in cm²/m²) of >1.16.

Table 7: Comparison of mean LA pressure Pre Vs Post BMV

	Pre BMV (mm Hg)	Post BMV (mm Hg)
Mean LA Pressure(mm Hg)	24	11.78

In our study mean preBMV mean LA pressure was 24 mmHg while mean postBMV mean LA pressure was 11.78mmHg.

Table 8: Results of BMV in various study across the world (sorted by the year of publication in descending order)

Sr No.	Pre BMV mitral valve area (in cm ²)	Post BMV mitral valve area (in cm ²)	Sample size	Region	Reference
1	1.03 ± 0.19	1.95 ± 0.40	432	Italy	10
2	0.89 ± 0.04	1.75 ± 0.07	10	United Kingdom	11
3	1.0±0.3	1.8 ± 0.4	1156	Germany	13
4	0.6 ± 0.19	1.9 ± 0.19	45	Kenya	14
5	0.8 ± 0.3	1.9 ± 0.6	61	Saudi Arabia	15
6	1.03 ± 0.30	1.94 ± 0.38	60	United States	18
7	1.0 ± 0.3	1.7 ± 0.6	290	United States & Canada	19
8	0.78 ± 0.23	1.61 ± 0.64	235	South Africa	20
9	0.82 ± 0.17	1.53 ± 0.48	28	Singapore	21
10	1.1 ± 0.1	1.8 ± 0.1	41	United States	22
11	0.8 ± 0.04	1.6 ± 0.11	60	United States	23

Graph 1: Pre BMV mitral valve area in various studies across the world

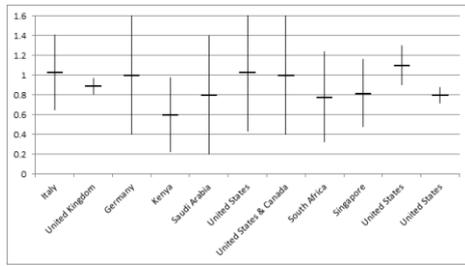
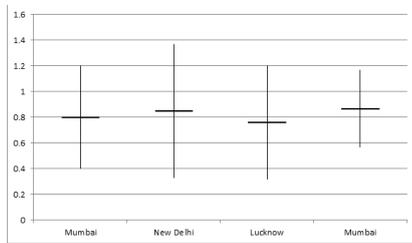


Table 9: Results of BMV in various study across the nation (sorted by the year of publication in descending order)

Sr No.	Pre BMV mitral valve area (in cm ²)	Post BMV mitral valve area (in cm ²)	Sample size	Region	Reference
1	0.8 ± 0.2	1.7 ± 0.2	40	Mumbai	9
2	0.85 ± 0.26	2.39 ± 0.94	200	New Delhi	12
3	0.76 ± 0.22	-	193	Lucknow	16
4	0.87 ± 0.15	1.69 ± 0.29	530	Mumbai	17

Graph 2: Pre BMV mitral valve area in various studies across the country



Conclusion:

In our study most common presenting age group among patients with symptomatic rheumatic mitral stenosis was 20-29 yrs constituted 44% (22/50) majority of patient. It complies with natural history & Indian epidemiology of rheumatic heart disease.^[1]

Females constituted 82% (41/50) majority of patient in study population. This is in accordance with world statistics were by almost two third of all patients with rheumatic mitral stenosis are female.^[2]

Majority of patient had Body surface area of 1.20 -1.40 kg/m². 8 out of 50 patients were having atrial fibrillation (16%)

Patients considered ideal for BMV based on symptoms and echocardiographic findings had mean mitral valve area of 0.82 cm² or 0.59 cm²/m² body surface area.

There was 1.90 times increase in mitral valve area post BMV, nearly doubling in mitral valve area post BMV which is in exact terms with guidelines and references sort for formulating guidelines.^[4,5,6,7,8]

There was 203.7% fall in mean LA pressure among patients who underwent BMV at the study institute.

It is quite evident that mean mitral valve area in all the 11 studies carried out in different countries across the world, published in various journals indexed in pubmed database was never beyond 1.1 cm² as shown in table 6 and graph⁶.

As far as studies done in India are concerned, none had mean mitral valve area of even 1.0 cm² as shown in table 7 and graph⁷.

According to Rajendran et al²⁴, mitral valve area has strong correlation with body surface area and people of different ethnic origin will have varying body surface area and so forth their mitral valve area. This clarifies that any single cut-off valve of mitral valve area across various geographic distribution is not sound. Mitral valve

area per square metre of body surface area would be the ideal scalar to set for the cut-off valve for BMV.

Our study takes into account MVA per m² of BSA in patients undergoing BMV. Studies done so far haven't taken into account BSA including those sort as a reference for cut off value in ACC/AHA Force on practice guidelines 2014 on valvular heart disease though the guidelines themselves mention about BSA as an important parameter in deciding cut off valve of MVA for BMV.

Limitation of the study:

This was single center study. Complication's & long term follow up of the patients was not done in our study.

It can be concluded from the study that there is need for more studies across different ethnic groups to get the appropriate cut-off value of mitral valve area for BMV and body surface area is an important confounding factor which needs to be matched.

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