

Original Research Article

Pulmonary function test in mitral valve disease

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	International Archives of Integrated Medicine, Vol. 2, Issue 8, August, 2015.	
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	Available online at http://iaimjournal.com/	
	ISSN: 2394-0026 (P)	ISSN: 2394-0034 (O)
	Received on: 14-07-2015	Accepted on: 29-07-2015
	Source of support: Nil	Conflict of interest: None declared.

Abstract

Background: In Rheumatic heart disease, mitral valve is most commonly affected. Approximately 25% of all patients with rheumatic heart disease have pure mitral stenosis. 10% of all rheumatic heart disease patients have pure mitral regurgitation and 40% have combined mitral stenosis and mitral regurgitation. This study is the correlation between clinical status and common pulmonary functions in patient with mitral valvular disease and improvement in pulmonary functions after surgery in mitral valvular heart diseases.

Aim and objectives: To study the pulmonary function test (PFT) in patients with mitral valvular heart diseases, to study PFT in patients with mitral valvular heart diseases with various age groups, to study clinical features and investigatory profile of mitral valvular heart disease patients, to study PFT in various stages of mitral stenosis and mitral regurgitation, to compare the pulmonary function test results before and after treatment of mitral stenosis (MS) and mitral regurgitation (MR).

Material and methods: This present study was carried out of total fifty patients of mitral valve disease to determine the changes in Spirometric pulmonary function. Out of this, forty patients were of mitral stenosis and ten patients were of mitral regurgitation. These patients were selected from indoor as well as outdoor cases of Civil Hospital, Ahmedabad and U. N. Mehta Cardiology Institute, Ahmedabad. The diagnosis was made by clinical features, X-ray, electrocardiography and echocardiography studies and all Patients, selected for study, were underwent operative procedure.

Results: Mean age of cases in this study was 30.46 years. So that present study showed that younger age groups were more affected in rheumatic mitral stenosis and regurgitation. Present study showed that mean value of FEV1/FVC% was 84.69 % in NYHA class II, 88.49% in NYHA class III and 81.51% in NYHA class. Present study showed that mean value of FEV1/FVC% of all classes were 86.06% preoperatively and after operation 89.94%. Present study showed that mean value of FEF 25-75% was 2.47 liter/sec preoperatively and after operation 2.81 liter/sec.

Conclusion: In all cases of mitral valve disease, pulmonary function tests abnormality predominantly reveals restrictive pattern of lungs.

Key words

Rheumatic heart disease, Mitral stenosis, Mitral regurgitation, Pulmonary function test.

Introduction

Human heart has four valves to regulate blood flow. They are as follows: Rheumatic heart disease is commonest disorder in childhood and young adults in our country. In Rheumatic heart disease, mitral valve is most commonly affected. Approximately 25% of all patients with rheumatic heart disease have pure mitral stenosis. 10% of all rheumatic heart disease patients have pure mitral regurgitation and 40% have combined mitral stenosis and mitral regurgitation. Once, patients who develop acute rheumatic fever have an asymptomatic period of 5-15 years. After that symptoms of mitral stenosis appear. It then takes another 5 to 10 years for most patients to progress from mild symptoms of breathlessness, chest pain (NYHA class II) to severe symptoms (NYHA class IV). It has been reported that 5-year survival rates for patients with NYHA class III are 62% and for patients with NYHA class IV are 15%. It is also postulated that 5-year survival rate in patients with symptomatic mitral stenosis who refused valvotomy is 44%. Natural history of mitral valvular disease can be altered by surgery and outcome is good with improvement in their work efficiency. Changes in pulmonary function test occur because of hemodynamic and resultant histological changes in lungs due to mitral valve disease. The purpose of pulmonary function test is to measure and pinpoint amount of disability, its nature and improvement in pulmonary function after surgery in mitral valvular disease. This study is the correlation between clinical status and common pulmonary functions in

patient with mitral valvular disease and improvement in pulmonary functions after surgery in mitral valvular heart diseases.

Aim and objectives

- To study the pulmonary function test (PFT) in patients with mitral valvular heart diseases.
- To study PFT in patients with mitral valvular heart diseases with various age groups.
- To study clinical features and investigatory profile of mitral valvular heart disease patients.
- To study PFT in various stages of mitral stenosis and mitral regurgitation.
- To compare the pulmonary function test results before and after treatment of mitral stenosis (MS) and mitral regurgitation (MR).

Material and methods

This present study was carried out of total fifty patients of mitral valve disease to determine the changes in Spirometric pulmonary function. Out of this, forty patients were of mitral stenosis and ten patients were of mitral regurgitation. These patients were selected from indoor as well as outdoor cases of Civil Hospital, Ahmedabad and U. N. Mehta Cardiology Institute, Ahmedabad. The diagnosis was made by clinical features, X-ray, electrocardiography and echocardiography studies and all Patients, selected for study, were underwent operative procedure.

Criteria for selection of patients in present study were as below.

- Patients with primary pulmonary disease were excluded by history, physical examination and radiological investigation.
- All patients in the series were non-smokers.
- Patients with musculoskeletal involvement of the chest and thoracic spine were not taken.
- Different age groups were studied.
- Patients having only predominant mitral valve disease were included.
- Patients were on medical and surgical management.
- Detailed history and clinical examination including height and weight measurement was taken.
- Patients were classified according to 'New York Heart Association Classification' (NYHA).
- Routine laboratory investigations were done to rule out any major medical illness.
- Echocardiography was done to detect the severity of mitral stenosis and mitral regurgitation. The left atrial dimension was taken.
- Criteria taken for left atrial enlargement were:- Mild enlargement: 20-30 mm/Body surface area, Moderate enlargement: 30-40 mm/Body surface area, Severe enlargement: more than 40 mm/Body surface area.
- The operative procedures were Balloon mitral valvotomy for mitral stenosis and

Mitral valve replacement for mitral regurgitation.

- Pulmonary function tests were carried out on computerized spirometer.
- Pulmonary function tests were carried out in sitting position.
- All patients were given five minutes rest before starting tests.
- All patients were explained and demonstrated the procedure of test and their full co-operation was sought.
- In all patients, tests were done 3-6 days before operation and 3-6 months after operation.

Results

A study of total fifty patients of mitral valve disease was performed to determine the changes in spirometric pulmonary function. Out of this, forty patients were of mitral stenosis and ten patients were of mitral regurgitation. All patients evaluated in totality and consideration given for age, sex, symptoms, signs, vital capacity, FEV1 and FVC, FEF 25-75%, MVV. In all patients pulmonary function test done pre operatively and post operatively. Mean age of cases in this study was 30.46 years. So that present study showed that younger age groups were more affected in rheumatic mitral stenosis and regurgitation. (**Table – 1**) After operation all cases benefited and considerable relief in all symptoms was found. (**Table – 2**) Present study showed that mean value of FEV1/FVC% was 84.69 % in NYHA class II, 88.49% in NYHA class III and 81.51% in NYHA class. (**Table – 3**) Mean value for all classes considered together increased from 67.27% to 81.07% after surgery. (**Table – 4**)

Table – 1: Cases of mitral valve disease were distributed according to age groups.

Age (years)	Mitral stenosis		Mitral regurgitation		Total	
	No.	%	No.	%	No.	%
11-20	8	16	2	4	10	20
21-30	20	40	3	6	23	46
31-40	10	20	4	8	14	28
40-50	2	4	1	2	3	6
Total	40	80	10	20	50	100

Table – 2: Patient distribution according to symptomatology in mitral valve disease (n = 50).

Symptoms	Pre-operative				Post-operative			
	MS (n=40)		MR (n=10)		MS		MR	
	No	%	No	%	No	%	No	%
Breathlessness	34	85	8	80	7	17.5	3	30
Palpitation	33	82.5	7	70	9	22.5	2	20
Cough	19	47.5	4	40	4	10	1	10
Nocturnal dyspnea	16	40	2	20	-	-	-	-
Chest Pain	9	22.5	2	20	-	-	-	-
Edema feet	5	12.5	1	10	-	-	1	10
Fever	2	5	-	-	-	-	-	-
Hemoptysis	3	7.5	-	-	-	-	-	-
Hoarseness of voice	1	2.5	-	-	-	-	-	-

Table – 3: Pulmonary function test - mean value of FEV1/ FVC in patient with mitral valve diseases.

NYHA Class	Pre-operative FEV1/ FVC%	Post-operative FEV1/ FVC%
II	84.69	89.26
III	88.49	89.50
IV	81.51	93.97

Table – 4: Pulmonary function test - maximum voluntary ventilation in patients with mitral valve diseases.

	Pre-operative				Post-operative			
	Class	Class	Class	Total	Class	Class	Class	Total
Mean	68.29	66.92	65.07	67.27	79.09	81.67	85.73	81.07
Range	47.19-92.14	21.78-90.56	20.16-78.02	20.16-92.14	65.65-92.86	40.57-94.9	58.87-95.12	40.57-95.12
SD	12.14	17.96	21.26	17.36	8.93	13.22	16.46	11.92
SE	2.72	3.6	9.53	2.45	1.99	2.64	7.38	1.68

Discussion

Present study showed mean age was 30.46 years, which was comparable with studies done by R.S. Chatterji [1], Saxena, et al. [2], West, et al. [3] and Douglass, et al. [4] with mean age of 30, 29.7, 32.8 and 34.48 years respectively. Present study showed that male to female ratio was 1:1.39; which was comparable to studies done by Shepherd, et al. [5], Kadam, et al. [6], Chatterji, et al. [1] and Saxena, et al. [2] which showed male to female ratio of 1:1.75, 1:1.5, 1:1.61 and 1:1.5 respectively.

Present study showed breathlessness, palpitation, chest pain, hemoptysis in 34 (85%), 33 (82.5%), 9 (22.5%), 3 (7.5%) cases respectively in MS and 8 (80%), 7 (70%), 2 (20%), 1 (10%) cases respectively in MR which is comparable to studies done by R.S. Chatterji, et al. [1]; Roy, et al. [7]; and Saxena, et al. [2], which showed breathlessness, palpitation and chest pain in 54 (86.67%), 44 (83.33%), 12 (20%); 46 (92%), 37 (74%); 25 (100%), 20 (80%) and 6 (24%) cases respectively. Present study showed that 30 (75%) cases of MS and 6 (60%) cases of MR had excellent results and 10 (25%) cases of MS and 4

(40%) cases of MR had significant improvement after surgery which is comparable to studies done by Ellis, et al. [8] noted 59 (62.8%) cases and 23 (24.4%) cases achieved excellent and significant results respectively. He also found that 12 (12.8%) cases met with failure. Goodwin, et al. [9] noted 26 (63.4%) cases and 10 (24.4%) cases with excellent and significant results. In his study failure was obtained in 5 (12.2%) cases. Lyons, et al. [10] reported 7 (58.3%) cases as excellent result and 5 (41.7%) cases had significant result.

Present study showed that preoperatively parasternal heave, loud S1, opening snap and mid diastolic murmur were found in MS in 31 (77.5%), 40 (100%), 35 (87.5%) and 40 (100%) cases respectively and 1 (10%), 1 (10%) and 3 (30%) cases respectively in MR which is comparable to studies done by Goodwin, et al. [9] observed that 60 (80%) cases had parasternal heave, 74 (98%) cases had loud Si and 63 (84%) cases had opening snap while all cases had mid diastolic murmur. Wood, et al. [10] found parasternal heave in 118 (78.66%) cases, 99 (66%) cases had loud S1, 132 (88%) cases had opening snap and 144 (96%) cases had mid diastolic murmur. Present study showed that mean value of vital capacity is 74.38% preoperatively and 81.23% after operation which is comparable to studies done by Rhodes, et al. [11, 12] study, Yoshioka, et al. [13] study, Cosby, et al [14], T. Singh, et al. [15] study, they all were observed mean value of Vital Capacity 83.4%, 84.7%, 80% and 83% respectively. Present study showed that mean value of FEV1/FVC% of all classes were 86.06%

preoperatively and after operation 89.94% which was comparable to studies done by Kadam, et al. [6] found that preoperatively, mean value of FEV1/FVC% was 81.72% and post-operatively it was 88.2%. Yoshioka, et al, [13] found that mean value of FEV1/FVC% was 82.1% and post-operatively it was 82.7% without significant change. They found increase in FEV1, after surgery, which revealed an improvement in airway obstruction. The reason why FEV1/FVC% did not improve was that the increase in FEV1 was similar to the increase in the FVC. Dogliotti, et al. [16] found that pre operatively mean value of FEV1/FVC% was 80.8% and post-operatively it was 87.2%. Present study shows that mean value of FEF 25-75% was 2.47 liter/sec preoperatively and after operation 2.81 liter/sec which is comparable to studies done by Yoshioka, et al. [13] showed that pre operatively mean value of FEF25-75% was 2.47 liter/sec, which increases post-operatively to 2.71 liter/Sec; Chatterji, et al. [1] showed that mean value of FEF 25-75% was 2.38 liter/sec. Present study showed that mean value of classes of MVV% were 67.27% before surgery and 81.07% postoperatively which is comparable with studies done by Curti, et al. [17] found mean value of MVV was 66.25% pre operatively, Post-operatively the mean value of MVV was increased up to 76.25%; Yoshioka, et al. [13] found that mean value of MVV was 66.6% which increased post-operatively up to 82.1%; Dogliotti, et al. [16] found that mean value of MVV was 59% which increased post-operatively up to 79%. (Table – 5)

Table – 5: Comparison of pulmonary function tests in patients of mitral valve disease.

Parameter	Kadam, et al. study		Yoshioka, et al.		Dogliotti, et al.		Present study	
	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op
VC (%PRED.)	52.8	60.8	72.6	84.7	75	82.4	74.38	81.23
FEV1/FVC%	81.72	88.2	82.1	82.7	80.8	87.2	86.06	89.94
FEF 25-75% (%PRED.)	58.28	77.28	-	-	-	-	64.56	81.77
MVV (%PRED.)	-	-	66.6	77.1	59	79	67.27	81.07

Conclusion

In all cases of mitral valve disease, pulmonary function tests abnormality predominantly reveals restrictive pattern of lungs.

References

1. Chatterji RS, et al. Lung function in mitral stenosis. JAPI, 2000; 48: 976-80.
2. Saxena P, et al. Early changes in pulmonary functions after mitral valve replacement. Journal of Thoracic medicine, 2000; 2: 111-117.
3. West JR, et al. Pulmonary functions in rheumatic heart disease and its relation to exertional dyspnea in ambulatory patients. Circulation, 1953; 8: 178-87.
4. Braunwald E, Libby P, Bonow R, Douglasmann, Zipes. "Heart Disease" A Textbook of Cardiovascular Medicine, 9th edition, Elsevier, 2011; p. 1625-1711.
5. Shepherd RJ, et al. The pattern of respiration in rheumatic heart disease. British Heart Journal, 1956; 10: 241-7.
6. Kadam, et al. Effect of closed mitral valvotomy on spirometric pulmonary function tests in mitral stenosis. J Postgrad Med., 1997; 43: 38-40.
7. Roy, Gopinath, et al. Mitral Stenosis. Circulation, 1968; 68: 37-38.
8. Ellis H, et al. Mitral commissurotomy. Archives of Internal Medicine, 1954; 94: 774.
9. Goodwin, et al. Mitral valve disease and mitral valvotomy. BMJ, 1955; 3: 573.
10. Wood, et al. An appreciation of mitral stenosis. BMJ, 1954; 25: 1051.
11. Rhodes, et al. Relation between severity of mitral valve disease and results of routine lung function tests in nonsmokers. Thorax, 1982; 37: 751-5.
12. Rhodes KM, et al. Effects of mitral valve surgery on static lung function and exercise performance. Thorax, 1985; 40: 107-12.
13. Yoshioka, et al. Improvement in pulmonary function in mitral stenosis after percutaneous mitral commissurotomy. Chest, 1990; 98: 290-294.
14. Cosby RS, et al. Pulmonary function in left ventricular failure including cardiac asthma. Circulation, 1957; 15: 492-501.
15. Singh T, et al. Pulmonary function study before and after closed mitral valvotomy. American review of respiratory disease, 1970; 101: 62-6.
16. G.C. Dogliotti, et al. Pulmonary function in mitral valve disease. The American Journal of cardiology, 1959; 1: 28-39.
17. Curti PC, et al. Respiratory and circulatory changes of patients with mitral stenosis. Circulation, 1953; 15: 893-903.