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ORIGINAL ARTICLE

Evaluation of Pulmonary Function after Surgical Correction of Atrial Septal Defect

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Abstract:

Introduction: *An atrial septal defect represents a communication between the left and right atrium leading to left to right shunt. It is one of the commonest varieties of congenital heart disease. With gradual increase in number & improved result, surgical correction of ASD is now most frequently performed surgery in NICVD. Although in our country no such study had yet been done on evaluation of pulmonary function after surgical correction of ASD. So, prospective study on surgical correction of ASD may show significant influence of surgery on postoperative pulmonary function.*

Methods and Materials: *This prospective, consecutive cross sectional interventional study was conducted in the department of cardiac surgery National Institute of Cardiovascular Disease (NICVD), Sher-E-Bangla Nagar, Dhaka, Bangladesh from July 2006 to June 2007. Postoperative pulmonary functions, complications were seen up to 3 months after operation.*

Results: *Pulmonary function found impaired before surgery. After surgical correction of atrial septal defect pulmonary function improved subsequently in 3 months post operative period and upper NYHA class.*

Conclusions: *Pulmonary function significantly improved after ASD closure surgery.*

Key Words: *Atrial septal defect, Pulmonary function.*

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Introduction:

An atrial septal defect represents a communication between the left and right atrium leading to left to right shunt. It is one of the commonest varieties of congenital heart disease. It comprises about 10-15% of congenital heart disease, about 1 in 1500 live birth.[1]

When peripheral vascular resistance decreases beyond the neonatal period an ASD will result left to right shunting with increased pulmonary blood flow, leading to the development of pulmonary vascular congestion or recurrent respiratory infection.[2] It has been suggested that increased pulmonary blood volume induces enhanced diffusing capacity and a slight decreased in lung compliance. Moreover, patient with ASD who develop pulmonary hypertension have reduced pulmonary volume & increased airway resistance. Consequently in some patient with ASD there is evidence of pre operatively impaired respiratory function.[3]

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Management of atrial septal defect is essential, where medical treatment has got limited role and surgery plays an important role. Comparison of surgical closure with medical management, particularly when symptoms have developed, has suggested a significant survival benefit in surgically treated group.[4]

If untreated, increased pulmonary flow causes pulmonary hypertension and rise in pulmonary vascular resistance. Pulmonary hypertension (PH) is rare in childhood but 35 to 40% have raised pulmonary vascular resistance (PVR) by the age of 40 years. The development of pulmonary vascular disease is unpredictable and is not uniformly related to age or degree of shunting through ASD.[5]

Pulmonary function impairment in ASD commonly seen due to delayed presentation or late referral to the hospital. Early corrective surgery for ASD defect can prevent further progression of respiratory function impairment and pulmonary vascular change. Very rarely patient, who dies in hospital after repair of an ASD, usually has a serious coexisting condition, such as pulmonary vascular disease or old age.[6]

Spirometry is one of the earliest methods available and still it is probably one of the most valuable of all tests. It enables for measurement of all lung volumes and maximal breathing capacity or maximal voluntary ventilation. Modern pulmonary function equipment is extremely automated and computer assisted, computers perform all the necessary calculations and prepare the reports.[7]

Preoperatively, it is important to identify patient with significant restrictive or obstructive pulmonary diseases. The most common cause of preoperative pulmonary dysfunction is chronic obstructive pulmonary disease (COPD). Patients with mild COPD and few or mild symptoms generally do well through cardiac surgery. However, patients with moderate to severe obstructive pulmonary diseases who are undergoing cardiac surgery, especially those in an older age group, are at increased risk for operative mortality and postoperative complications of pulmonary dysfunction. Identification of these higher-risk patients is important because preoperative measures to improve respiratory function may diminish postoperative complications.[8]

The parameter most commonly reported by authors in estimating the degree of pulmonary dysfunction is the forced expiratory volume in 1st second (FEV_1). There is little consistency in the literature defining the level of abnormality for moderate to severe COPD. Values for FEV1 range from <70% to <50% of the normal predicted value and/or an FEV_1 of <1.5L. FEV_1 levels as low as 1.0L would not necessarily disqualify a candidate for cardiac surgery. Clinical evaluation of lung function is important as spirometric studies.[9]

With gradual increase in number & improved result, surgical correction of ASD is now most frequently performed surgery in NICVD. Although in our country no such study had yet been done on evaluation of pulmonary function after surgical correction of ASD. So, prospective study on surgical correction of ASD may show significant influence of surgery on postoperative pulmonary function.

Method and Materials:

This prospective, consecutive cross sectional interventional study was conducted in the department of cardiac surgery National Institute of Cardiovascular Disease (NICVD), Sher-E-Bangla Nagar, Dhaka, Bangladesh from July 2006 to June 2007. Total number of patients was sixty. Inclusion criteria includes all patients of Atrial septal defect and FEV_1, FVC & FEV_1/FVC > 50% of the predicted value. Exclusion criteria are age below 10 yrs& above 40 yrs, associated valve disease, associated other congenital anomaly, ASD with coronary heart disease, ASD with reversed shunt, associated hepatic & renal dysfunction, associated cerebro-vascular disease, LVEF < 40% and patient with preexisting lung diseases like pulmonary tuberculosis & history of pulmonary lobectomy.Detailed history of each patient under study was recorded, Important and relevant findings on thorough physical examinations and investigations (Chest X- ray, Lung function test: Spiro metric variables - FEV_1, FVC and FEV_1/ FVC ratio and Echocardiography) were collected. Postoperative variables wereChest X- ray (At 3rd POD to see postoperative complications) and 3 months after operation and Lung function test: Spiro metric

variables - FEV_1, FVC and FEV_1/ FVC ratio- 3 months after operation. Postoperative complications like atelectasis, collapse and pneumonia were recorded.Patients were followed up after 3 months of surgery where FEV_1, FVC and FEV1/ FVC ratio were studied & these values were compared with preoperative values and also Chest X-ray, compared with preoperative X-ray.Statistical analysis of the results was done by computer software devised as the statistical packages for social solution (SPSS). The results were presented in Tables, Figures and Diagrams etc.

Results:

At first 60 patients were included in the study out of which 2 patients were excluded due to drop out from the follow up visit. Ultimately 58 cases were enrolled in this study. All the subjects were underwent Atrial Septal Defect surgery in NICVD, Dhaka, Bangladesh during the period July 2006 to June 2007.

Among 58 patients 21 patients were male, 37 were female and male female ratio was 1:1.8 Z-test was done between the two proportions. Z=3.13, p<0.001 which was highly significant. The mean age of the study subject was 20.7 ± 7.3. The mean age of the male patients was 19.3 ± 6.6 years and that of female patients was 21.9 ± 7.8 years. It was evident that among the male patients, highest percentage 47.6% was in the age range of 10-19 years followed by 42.4 % in age range 20-29 years and 9.5% in age range ³30 years. Whereas among the female patients highest percentage 45.9% was in the age range of 20-29 years followed by 35.1 % in age range 10-19 years and 18.9% in age range 30 years. Analysis revealed no statistically significant mean age difference between male and female patients (p>0.05) in unpaired t-test (Table I).

Table II depict the preoperative and postoperative NYHA Functional Class in the study groups. The figure shows that the preoperative NYHA functional Class I, II, III and IV occupied 11(19.0%), 20(34.5.6%), 21(36.2%) and 6(10.3%) respectively. The post operative NYHA Functional Class I, II and III occupied 21(36.3%), 31 (53.4%) and 6(10.3%) respectively and none was found in class IV and the difference was statistically significant (p<0.05) between preoperative and postoperative period in chi square test.

Out of 58 study patients the preoperative and after 3 months operation the mean values of FVC were 2.56±0.39L and 3.15±0.17L in NYHA functional class I, 2.47±0.28L and 3.01±0.52L in NYHA functional class II, 2.37±0.49L and 2.86±0.65L in NYHA functional class III and 2.16±0.65L and 2.42±0.76L in NYHA functional class IV respectively. The differences were statistically significant (p<0.05) between preoperative and 3 months after operation in all NYHA functional class in paired t-test. (Table III)

Out of 58 study patients the preoperative and after 3 months operation the mean values of %FVC were 73.14±12.12% and 89.30±4.57% in NYHA functional class I, 72.02±6.31% and 86.65±3.53% in NYHA functional class II, 66.68±10.68% and 80.18±11.92% in NYHA functional class III and 58.82±7.67% and 66.70±10.56% in NYHA functional class IV respectively. The differences were statistically significant (p<0.05) between preoperative and 3

Table-I

Age and sex distribution of the study patients

Age inYears	Male		Female		Total		PValue
	n	%	n	%	n	%	
10 – 19 yrs	10	47.6	13	35.1	23	41.4	0.350^{ns}
20 – 29 yrs	9	42.9	17	45.9	26	46.6	0.820^{ns}
≥30 yrs	2	9.5	7	18.9	9	12.1	0.342^{ns}
Total	21	100	37	100	58	100	
Mean ± SD)	19.3 ± 6.6		21.9 ± 7.8		20.7 ± 7.3		0.162

Insignificant (p > 0.05) with unpaired t-test,
Z=3.13, significant (p<0.001)

Table-II

NYHA class of the study patients

NYHA Class	Pre operative (n=58)		Post operative (n=58)		P value
	n	%	n	%	
Class I	11	19.0	21	36.2	0.038[S]
Class II	20	34.5	31	53.4	0.039[S]
Class III	21	36.2	6	10.3	0.001[S]
Class IV	6	10.3	0	0.0	0.013[S]

Significant ($p < 0.05$) with chi square test
s: Significant

Table-III

FVC before and after surgery according to preoperative NYHA functional class

FVC	Preoperative mean±SD	3 month after operation mean±SD	P value
Class I	2.56±0.39	3.15±0.17	0.001[s]
Class II	2.47±0.28	3.01±0.52	0.001[s]
Class III	2.37±0.49	2.86±0.65	0.001[s]
Class IV	2.16±0.65	2.42±0.76	0.012[s]

Significant ($p < 0.05$) with paired t-test
s: Significant

months after operation in all NYHA functional class in paired t-test. (Table IV)

Out of 58 study patients the preoperative and after 3 months operation the mean values of FEV_1 were 2.32±0.28L and 2.67±0.16L in NYHA functional class I, 2.13±0.34L and 2.56±0.44L in NYHA functional class II, 2.01±0.62L and 2.41±0.61L in NYHA functional class III and 1.67±0.82L and 2.10±0.80L in NYHA functional class IV respectively. The differences were statistically significant ($p<0.05$) between preoperative and 3 months after operation in all NYHA functional class in paired t-test. (Table V)

Out of 58 study patients the preoperative and after 3 months operation the mean values of $\%FEV_1$ were 75.30±8.89% and 86.51±3.01% in NYHA functional class I, 70.01±9.52% and 83.89±8.22% in NYHA functional class II, 65.45±16.00% and 77.21±13.51% in NYHA functional class III and 54.72±16.45% and 65.63±16.03% in NYHA functional class IV respectively. The differences were statistically significant ($p<0.05$) between preoperative and 3 months after operation in all NYHA functional class in paired t-test. (Table VI)

Out of 58 study patients the preoperative and 3 months after operation the mean values of FEV_1/

Table-IV

%FVC before and after surgery according to preoperative NYHA functional class

%FVC	Preoperative Mean±SD	3 month after operation mean±SD	P valu
Class I	73.14±12.12	89.30±4.57	0.001[s]
Class II	72.02±6.31	86.65±3.53	0.001[s]
Class III	66.68±10.68	80.18±11.92	0.001[s]
Class IV	58.82±7.67	66.70±10.56	0.006[s]

Significant ($p < 0.05$) with paired t-test
s: Significant

Table-V

FEV_1 before and after surgery according to preoperative NYHA functional class

FEV_1	Preoperative mean±SD	3 month after operation mean±SD	P value
Class I	2.32±0.28	2.67±0.16	0.001[s]
Class II	2.13±0.34	2.56±0.44	0.001[s]
Class III	2.01±0.62	2.41±0.61	0.001[s]
Class IV	1.67±0.82	2.10±0.80	0.001[s]

Significant ($p < 0.05$) with paired t-test
s: Significant

Table-VI

%FEV_1 before and after surgery according to preoperative NYHA functional class

%FEV_1	Preoperative mean±SD	3 month after operation mean±SD	P value
Class I	75.30±8.89	86.51±3.01	0.001[s]
Class II	70.01±9.52	83.89±8.22	0.001[s]
Class III	65.45±16.00	77.21±13.51	0.001[s]
Class IV	54.72±16.45	65.63±16.03	0.001[s]

Significant ($p < 0.05$) with paired t-test
s: Significant

FVC were 88.0±7.0 and 90.1±8.5 in NYHA functional class I, 85.8±14.4% and 86.7±10.5 in NYHA functional class II, 82.5±17.70 and 85.3±10.9 in NYHA functional class III and 79.6±18.8 and 84.7±17.8 in NYHA functional class IV respectively. The differences were not statistically significant ($p>0.05$) between preoperative and 3 months after operation in all NYHA functional class in paired t-test. (Table VII).

Out of 58 patients the preoperative and 3 months after operation mean values of FVC were 2.41±0.45L and 2.91±0.59L respectively and the percentage of change was 20.6±12.2. The mean values of %FVC were 68.56±10.41% in preoperative period and 82.23±11.04% in after 3 months operation and the percentage of change was 20.7±12.3. The mean values of FEV_1 2.07±0.54L and 2.47±0.54L in FEV_1 in preoperative and after 3 months operation respectively and the percentage of change was 23.4±12.4. The mean values of %FEV_1 67.47±14.21% in preoperative period and 79.55±12.54% after 3 months operation and the percentage of change were 20.0±12.5%. The mean values of % FEV_1/FVC were 84.72±15.94% in preoperative period and 85.20±10.36% after 3 months operation and the percentage of change was 3.8±21.1. Analysis revealed statistically significant ($p<0.05$) of all parameters between preoperative and 3 month after operation except FEV_1/FVC in paired t-test. (Table VIII)

Out of 27 male patients the preoperative and 3 month after operation mean values were 2.55±0.55L and 3.00±0.72L in FVC, 69.79±13.15% and 81.01±11.59% in %FVC, 2.17±0.69L and 2.60±0.65L in FEV_1, 66.87±16.06% and 78.78±12.72% in % FEV_1, 82.69±16.02% and 87.05±7.68% in % FEV_1/FVC respectively and the difference was statistically significant ($p<0.05$) of pulmonary function between preoperative and 3 month after operation except FEV_1/FVC in paired t-test. (Table IX)

In 31 female patients the preoperative and 3 month after operation mean values were 2.30±0.30L and 2.84±0.44L in FVC, 67.50±7.30% and 83.29±10.60% in %FVC, 1.98±0.37L and 2.34±0.40L in FEV_1, 67.98±12.63% and 80.21±12.54% in % FEV_1, 86.45±15.93% and 83.59±12.14% in % FEV_1/FVC respectively the difference was statistically significant ($p<0.05$) of pulmonary function between preoperative and 3 month after operation except FEV_1/FVC in paired t-test. (Table X)

The change of pulmonary function after operation in male and female were 3.00±0.72 and 2.84±0.44 in FVC, 81.01±11.59% and 83.29±10.60% in %FVC, 2.60±0.65 and 2.34±0.40 in FEV_1, 78.78±12.72% and 80.21±12.54% in %FEVI, 87.05±7.68% and 83.59±12.14% in % FEV_1/FVC respectively. Analysis revealed no statistically significant (p>0.05) rate of change between male and female patients in unpaired t-test. (Table XI)

Among 58 patients, 3(5.2%) had developed Atelactasis, collapse of lung 1(1.7%), 1(1.7%) had postoperative pneumonia, and all of them were recovered after treatment. (Table XII)

Table-VII

FEV_1/FVC before and after surgery according to preoperative NYHA functional class

FEV_1/FVC	Preoperative mean±SD	3 month after operation mean±SD	P value
Class I	88.0±7.0	90.1±8.5	0.162^{ns}
Class II	85.8±14.4	86.7±10.5	0.960^{ns}
Class III	82.5±17.7	85.3±10.9	0.509^{ns}
Class IV	79.6±18.8	84.7±17.8	0.155^{ns}

Insignificant (p > 0.05) with paired t-test
ns: nonsignificant

Table-VIII

Pulmonary function before and after surgery for atrial septal defect

	Preoperative mean±SD	3 month after operation mean±SD	%of change Mean±SD	P value
FVC	2.41±0.45	2.91±0.59	20.6±12.2	0.001^{s}
%FVC	68.56±10.41	82.23±11.04	20.7±12.3	0.001^{s}
FEV_1	2.07±0.54	2.47±0.54	23.4±12.4	0.001^{s}
%FEV_1	67.47±14.21	79.55±12.54	20.0±12.5	0.001^{s}
FEV_1/FVC	84.72±15.94	85.20±10.36	3.8±21.1	0.725^{ns}

Significant (p < 0.05) with paired t-test
Insignificant (p > 0.05) with paired t-test
s: Significant; ns: nonsignificant

Table-IX

Pulmonary function before and after surgery for atrial septal defect in male patient

	Before (n=27) mean±SD	After (n=27) mean±SD	P value
FVC	2.55±0.55	3.00±0.72	0.001^{s}
%FVC	69.79±13.15	81.01±11.59	0.001^{s}
FEV_1	2.17±0.69	2.60±0.65	0.001^{s}
%FEV_1	66.87±16.06	78.78±12.72	0.001^{s}
FEV_1/FVC	82.69±16.02	87.05±7.68	0.236^{ns}

Significant (p < 0.05) with paired t-test
Insignificant (p > 0.05) with paired t-test

Table-X

Pulmonary function before and after surgery for atrial septal defect in female patients

	Before (n=31) mean±SD	After (n=31) mean±SD	P value
FVC	2.30±0.30	2.84±0.44	0.001[s]
%FVC	67.50±7.30	83.29±10.60	0.001 [s]
FEV_1	1.98±0.37	2.34±0.40	0.001 [s]
$\%FEV_1$	67.98±12.63	80.21±12.54	0.001 [s]
FEV_1/FVC	86.45±15.93	83.59±12.14	0.345[ns]

Significant ($p < 0.05$) with paired t-test
Insignificant ($p > 0.05$) with paired t-test

Table-XI

Change of pulmonary function after surgery for atrial septal defect between male and female

	Male (n=27) Mean±SD	Female (n=31) Mean±SD	P value
FVC	3.00±0.72	2.84±0.44	0.085[ns]
% FVC	81.01±11.59	83.29±10.60	0.065[ns]
FEV_1	2.60±0.65	2.34±0.40	0.179[ns]
% FEV_1	78.78±12.72	80.21±12.54	0.506[ns]
FEV_1/FVC	87.05±7.68	83.59±12.14	0.390[ns]

Insignificant ($p > 0.05$) with unpaired t-test,
ns: nonsignificant

Table-XII

Postoperative complications

Name of complications	No. of patients	Percentage
Atelactasis	3	5.2
Collapse of lung	1	1.7
Post operative pneumonia	1	1.7

Discussion:

This prospective, consecutive cross sectional interventional study was carried out with an objective to define the spectrum of pulmonary function test abnormalities with ASD before surgery & 3 months after correction and to make a baseline for further in depth research work on various aspect on ASD surgery and also to evaluate pulmonary function after surgical correction of atrial septal defect.

In this study out of 58 patients, 21 patients were male, 37 were female and male female ratio was 1:1.8 and the proportion was statistically significant. The mean age of the study subjects was 20.7 ± 7.3 years. The mean age of the male patients was 19.3 ± 6.6 years and that of female patients was 21.9 ± 7.8 years and the mean age difference was not statistically significant ($p>0.05$) between male and female patients. It is nearly closer to the mean age of Saxenaet al.[9] and Kabir[10].

In the present study the preoperative NYHA functional Class I, II, III and IV occupied 19.0%, 34.5%, 36.2% and 10.3% respectively. The postoperative NYHA Functional Class I, II and III improved 36.3%, 53.4% and 10.3% respectively and none was found in class IV. The difference was statistically significant ($p<0.05$). It is similar with the study of Hamano K et al.[3] and Ghosh et al[4].

In this series the preoperative and 3 months after operation the mean values of FVC were 2.560.39L

and 3.15±0.17L in NYHA functional class I, 2.47±0.28L and 3.01±0.52L in NYHA functional class II, 2.37±0.49L and 2.86±0.65L in NYHA functional class III and 2.16±0.65L and 2.42±0.76L in NYHA functional class IV respectively. The differences were statistically significant ($p<0.05$) between preoperative and 3 months after operation in all NYHA functional class. This finding consistent with the study of Brochu MC et al.[12]

The preoperative and 3 months after operation the mean values of %FVC were 73.14±12.12% and 89.30±4.57% in NYHA functional class I, 72.02±6.31% and 86.65±3.53% in NYHA functional class II, 66.68±10.68% and 80.18±11.92% in NYHA functional class III and 58.82±7.67% and 66.70±10.56% in NYHA functional class IV respectively. The differences were statistically significant ($p<0.05$) between preoperative and 3 months after operation in all NYHA functional class. This result approximating to other study by Helber U et al.[13]

The mean values of FEV_1 in this study the preoperative and 3 months after operation were 2.32±0.28L and 2.67±0.16L in NYHA functional class I, 2.13±0.34L and 2.56±0.44L in NYHA functional class II, 2.010.62L and 2.41±0.61L in NYHA functional class III and 1.67±0.82L and 2.10±0.80L in NYHA functional class IV respectively. The differences were statistically significant ($p<0.05$) between preoperative and 3 months after operation in all NYHA functional class. This finding closely correlated with study of Giardini A et al.[14]

The preoperative and 3 months after operation the mean values of $\%FEV_1$ were 75.30±8.89% and 86.51±3.01% in NYHA functional class I, 70.01±9.52% and 83.89±8.22% in NYHA functional class II, 65.45±16.00% and 77.21±13.51% in NYHA functional class III and 54.72±16.45% and 65.63±16.03% in NYHA functional class IV respectively. The differences were statistically significant ($p<0.05$) between preoperative and 3 months after operation in all NYHA functional class. A similar finding was observed by Giardini A et al. [14]

The preoperative and 3 months after operation the mean values of FEV_1/FVC were 88.0±7.0 and 90.1±8.5 in NYHA functional class I, 85.8±14.4% and 86.7±10.5 in NYHA functional class II, 82.5±17.70 and 85.3±10.9 in NYHA functional class III and 79.6±18.8 and 84.7±17.8 in NYHA functional class IV respectively. The differences were not statistically significant ($p>0.05$) between preoperative and 3 months after operation in all NYHA functional class. This finding closely correlated with study of Giardini A et al.[14]

In this study the preoperative and 3 months after operation mean values of FVC were 2.41±0.45L and 2.91±0.59L respectively and the percentage of change was 20.6±12.2. The mean values of %FVC were 68.56±10.41% in preoperative period and 82.23±11.04% in after 3 months operation and the percentage of change was 20.7±12.3. The mean values of FEV_1 2.07±0.54L and 2.47±0.54L in FEV_1 in preoperative and after 3 months operation respectively and the percentage of change was 23.4±12.4. The mean values of $\%FEV_1$ 67.47±14.21% in preoperative period and 79.55±12.54% after 3 months operation and the percentage of change was 20.0±12.5. The mean values of $\%FEV_1$/FVC were 84.72±15.94% in preoperative period and 85.20±10.36% after 3 months operation and the percentage of change was 3.8±21.1. The mean difference of FVC, % FVC, FEV_1 and $\%FEV_1$ were statistically significant ($p<0.05$) between preoperative and 3 month after operation and FEV_1/FVC was not statistically significant ($p>0.05$). This finding is similar with the study by Hamano K et al.[3]

Among the 27 male patients in this study the preoperative and 3 month after operation mean values were 2.55±0.55L and 3.00±0.72L in FVC, 69.79±13.15% and 81.01±11.59% in %FVC, 2.17±0.69L and 2.60±0.65L in FEV_1, 66.87±16.06% and 78.78±12.72% in % FEV_1, 82.69±16.02% and 87.05±7.68% in % FEV_1/FVC respectively. The difference was statistically significant ($p<0.05$) of pulmonary function between preoperative and 3 month after operation except FEV_1/FVC, which was not statistically significant ($p>0.05$). On the other hand in 31 female patients in this study the preoperative and 3 month after operation mean values were 2.30±0.30L and 2.84±0.44L in FVC, 67.50±7.30% and 83.29±10.60% in %FVC, 1.98±0.37L and 2.34±0.40L in FEV_1, 67.98±12.63% and 80.21±12.54% in % FEV_1, 86.45±15.93% and 83.59±12.14% in % FEV_1/FVC respectively the difference was statistically significant ($p<0.05$) of

pulmonary function between preoperative and 3 month after operation except FEV_1/FVC.The result of this series is approximating to another study by Hamano K et al.[3]

The change of pulmonary function after operation in male and female were 3.00±0.72 and 2.84±0.44 in FVC, 81.01±11.59% and 83.29±10.60% in %FVC, 2.60±0.65 and 2.34±0.40 in FEV_1, 78.78±12.72% and 80.21±12.54% in %FEVI, 87.05±7.68% and 83.59±12.14% in % FEV_1/FVC respectively. Analysis revealed no statistically significant ($p>0.05$) in rate of change between male and female patients in unpaired t-test. This finding is consistent with the study of Hamano K et al.[3]

In the present study out of 58 patients, 3(5.2%) had developed Atelactasis, collapse of lung 1(1.7%), post operative pneumonia 1(1.7%) all of them were recovered after treatment. These complications correlated with the study of Kabir.[11]

Conclusion:

Pulmonary function found impaired before surgery. After surgical correction of atrial septal defect pulmonary function improved subsequently in 3 months post operative period and upper NYHA class.

- Pulmonary function significantly improved after surgery.
- The pulmonary functions' improvement of NYHA functional class IV was statistically significant but not up to the mark compared to others functional class.
- The rate of change in male and female were comparatively parallel.
- Postoperative complications should be prevented as possible.

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