



## Original Article

# PRE-OPERATIVE BRONCHODILATOR TREATED PATIENTS PRESERVE BETTER PULMONARY FUNCTION IN CABG CASES

Md. Mostafizur Rahman<sup>1</sup>, Mohammad Samir Azam Sunny<sup>2</sup>, Abdul Quiyum Chowdhury<sup>3</sup>, Sanjoy Kumar Saha<sup>4</sup>, Md. Rezwanul Hoque<sup>1</sup>, Asit Baran Adhikary<sup>5</sup>

### Abstract

**Background:** Bronchodilator ( $\beta_2$  selective adrenergic drug-salbutamol) causes bronchodilation and increases the vital capacity, tidal volume and total lung capacity and reduces gas trapping. Use of bronchodilator in patients undergoing Off-pump coronary artery bypass graft (OPCABG) may lead to better preservation of pulmonary function.

**Objective:** To evaluate the role of bronchodilator on preservation of post-operative pulmonary function in patients who underwent OPCABG.

**Methods:** This study was conducted on 50 patients randomized into two groups to assess the pulmonary function after off-pump CABG. Among them, 25 patients (group-I) were treated by preoperatively bronchodilator and compared them with other 25 patients (group-II) who were not treated by preoperative bronchodilator. We compared arterial blood gas analysis, duration of total mechanical ventilation, days spent in the surgical ICU and spirometric indices.

**Results:** Mean $\pm$ SE value of mechanical ventilation time after operation in group-I was 14.25 $\pm$ 0.85 hours and in group-II was 16.88 $\pm$ 0.85 hours. Mean $\pm$ SE value of ICU stay after surgery was 98.64 $\pm$ 2.07 hours in group I and 110.56 $\pm$ 2.36 hours in group-II. Both results were statistically significant (P=0.042 and P=0.001 respectively). The FVC and FEV1 after admission were not statistically significant (P>0.05). On the day before surgery the values of FVC and FEV1 were increased (more in group-1 who were treated with bronchodilator) and 7th postoperative day the value were decreased (more in group -II who were not treated with bronchodilator). The results were found statistically significant in between two groups (P<0.05). Significant difference were found in PaO<sub>2</sub> and PaCO<sub>2</sub> on arterial blood gas analysis at half an hour after extubation and on 1st POD (P<0.05). Mean $\pm$ SE value of postoperative hospital day in group-1 was 8.88 $\pm$ 0.24 days and in group II was 10.14 $\pm$ 0.43 days which was found statistically significant (p=0.014). Among post-operative pulmonary complications, in group 1, one (4%) patient was found with pleural effusion and one (4%) patient with atelectasis. but in group-II, one (4%) patient was found with pleural effusion and five (20%) patients were found with atelectasis.

**Conclusion:** Use of bronchodilator preoperatively in patients who underwent OPCABG with impaired pulmonary function leads to reduced mechanical ventilation time, less ICU stay after surgery, better preservation of pulmonary function, reduced post-operative pulmonary complications and reduced hospital stay.

**Key words:** Bronchodilator, Off-pump coronary artery bypass graft (OPCABG), Pulmonary function.

1. Associate Professor, Department of Cardiac Surgery, Bangabandhu Sheikh Mujib Medical University.
  2. Medical Officer, Department of Cardiac Surgery, Bangabandhu Sheikh Mujib Medical University.
  3. Resident, Department of Cardiac Surgery, Bangabandhu Sheikh Mujib Medical University.
  4. Consultant, Cardiac Anesthesia, Bangabandhu Sheikh Mujib Medical University.
  5. Professor, Chief, special unit, Department of Cardiac Surgery, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka.
- Correspondence to:** Dr. Md. Mostafizur Rahman, Associate Professor, Department of Cardiac Surgery, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka. Tel.: +88 0171 3032504, e-mail: ratan\_cts@yahoo.com

## Introduction

Coronary artery bypass grafting is one of the procedures with the highest impact in the history of medicine<sup>1</sup>. Among the post cardiac surgical complications, respiratory complication is one of the leading causes of postoperative morbidity and can prolong hospital stay and increases costs.<sup>2</sup> Pulmonary impairment after cardiac surgery is believed to be multifactorial and reflects the combined effects of general anesthesia, surgical factor (median sternotomy, plurotomy and harvesting of internal mammary artery (IMA) and cardiopulmonary bypass (CPB). Coronary artery bypass grafting performed without CPB results in less inflammatory response and hence pulmonary function is better preserved postoperatively<sup>3</sup>. To reduce postoperative pulmonary complications respiratory physiotherapy and bronchodilators are used preoperatively which improve patients pulmonary status. Bronchodilator ( $\beta_2$  selective adrenergic drug-salbutamol) act on  $\beta_2$  receptor on bronchial smooth muscle. By dilatation of bronchial smooth muscle it increases the vital capacity, tidal volume, total lung capacity and reduces gas trapping<sup>4</sup>. Bronchodilator also inhibit histamine release by stabilizing of mast cell membrane, inhibit microvascular leakage and increase mucociliary transport by increasing ciliary activity or by affecting the composition of mucous secretion.<sup>5</sup> In this study, we have tried to evaluate the role of bronchodilator in relation to pulmonary function and respiratory outcome after Off-pump coronary artery bypass graft (OPCABG).

## Methods

This prospective cohort study was carried out in the department of cardiac surgery, BSMMU, Dhaka, Bangladesh, from July 2009 to Jun 2011. This study included 50 patients of multi-vessels coronary artery disease with impaired pulmonary function who underwent Off-pump CABG, randomized into two groups, 25 patients in each group. Group-I patients were treated by bronchodilator (syrup Salbutamol) 0.05mg/kg body weight for 2 weeks preoperatively. Group-II patients underwent off-pump CABG without bronchodilator preoperatively having mild to moderate impaired pulmonary function. Ethical approval was taken from institutional review board of BSMMU and informed written consent was taken from each individual patient after briefing the merits and demerits of using bronchodilator preoperatively. Those with severe impaired pulmonary function and those who

did not give consent for study were excluded. Statistical analysis were performed using independent student's 't' test and chi square test. P value <0.05 was considered as statistically significant.

## Results

Mean $\pm$ SE value of mechanical ventilation time after operation in group -I was 14.25 $\pm$ 0.85 hours and in group -II was 16.88 $\pm$ 0.85 hours. Mean  $\pm$ SE value of ICU stay after surgery was 98.64 $\pm$ 2.07 hours in group I and 110.56 $\pm$ 2.36 hours in group II. Both results were statistically significant (P=0.042 and P=0.001 respectively). Spirometry was done in both groups of patients after admission, day before operation and on the 7th postoperative day. The FVC and FEV<sub>1</sub> after admission were not statistically significant (P>0.05). On the day before surgery the values of FVC and FEV<sub>1</sub> were increased (more in group 1 who were treated with bronchodilator) and on the 7th postoperative day the value were decreased (more in group -II who were not treated with bronchodilator). The results were found statistically significant in between two groups (P<0.05). FVC to FEV<sub>1</sub> ratio was not statistically significant all over the study period in between groups. Arterial blood gas analysis was done pre and post-operatively in both groups of patients. Significant difference were found in PaO<sub>2</sub> and PaCO<sub>2</sub> at half an hour after extubation and on 1st POD (P<0.05). Mean  $\pm$ SE value of postoperative hospital day in group 1 was 8.88 $\pm$ 0.24 days and in group-II was 10.14 $\pm$ 0.43 days. It was found statistically significant difference in respect to hospital stay in days between two groups (p=0.014). Post-operative pulmonary complications were found in both groups of patients. In group-1, one (4%) patient was found with pleural effusion and one (4%) patient with atelectasis. but in group-II, one (4%) patient was found with pleural effusion and five (20%) patients were found with atelectasis.

**Table I**

*Comparison of age in study groups (n=50)*

Age (in years)	Group I (n =25)	Group II (n = 25)
	51.88 $\pm$ 1.70	54.60 $\pm$ 1.65

**Table II**

*Comparison of sex in study groups (n=50)*

Sex	Group I (n =25)	Group II (n = 25)
Male	80%	84%
Female	20%	16%

**Table III***Comparison of mechanical ventilation time after operation in study groups (n=50)*

Ventilation time (hours)	Group I (n=25) Time (hours)	Group I (n=25) Time (hours)	P value
Mean ±SE	14.25±0.85	16.88±0.03	0.0425

**Table IV***Comparison of total ICU stay after operation in study groups (n=50)*

ICU stay (hours)	Group I (n=25) Time (hours)	Group I (n=25) Time (hours)	P value
Mean ±SE	98.64±2.07	110.56±2.36	0.0015

**Table V***Comparison of spirometric indices in study groups with measured/raw values (n=50)*

Spirometric indices	Group I (n=25) Mean±SE	Group I (n=25) Mean±SE	P value
<b>FVC (liters):</b>			
After admission	1.43±0.04	1.39±0.03	0.428
Day before operation	1.76±0.07	1.43±0.03	0.001
7th postoperative day	1.25±0.03	0.90±0.04	0.001
<b>FEV1 (liters):</b>			
After admission	1.25±0.02	1.23±0.03	0.582
Day before operation	1.58±0.06	1.27±0.01	0.001
7th postoperative day	1.08±0.03	0.76±0.04	0.001
<b>FEV1/FVC (%):</b>			
After admission	87.57±1.99	88.39±1.56	0.747
Day before operation	89.81±2.33	88.96±1.12	0.744
7th postoperative day	86.44±1.19	84.54±1.64	0.353

**Table VI***Comparison of spirometric indices in study groups with percent of predicted values (n=50)*

Spirometric indices	Group I (n=25) Mean±SE	Group I (n=25) Mean±SE	P value
<b>FVC (liters):</b>			
After admission	63.88±1.16	66.12±0.96	0.142
Day before operation	73.00±0.96	67.48±1.11	0.001
7th postoperative day	57.58±1.09	48.56±1.31	0.001
<b>FEV1 (liters):</b>			
After admission	68.28±1.73	70.40±1.59	0.371
Day before operation	79.28±2.03	72.92±1.86	0.03
7th postoperative day	58.78±1.02	49.02±2.19	0.001
<b>FEV1/FVC (%):</b>			
After admission	106.18±1.69	106.67±2.06	0.854
Day before operation	108.42±3.24	107.76±2.02	0.864
7th postoperative day	101.65±1.49	100.90±2.95	0.821

**Table VII**  
Comparison of Arterial blood gas (ABG) results in study groups (n=50)

Arterial blood gas	Group I (n=25)	Group II (n=25)	P Value
	Mean±SE	Mean±SE	
PaO <sub>2</sub> (mm of Hg)			
Prior to induction	128.44±2.18	122.43±2.36	0.067
After arrival of ICU	321.86±7.35	304.11±7.98	0.108
Half an hour before extubation	139.23±4.63	134.15±3.31	0.376
Half an hour after extubation	149.21±4.16	137.52±3.92	0.046
1st post-operative day	125.80±3.70	114.16±3.10	0.025
3rd post-operative day	115.77±2.88	111.48±3.13	0.318
PaCO <sub>2</sub> (mm of Hg)			
Prior to induction	34.48±0.65	35.68±0.72	0.391
After arrival of ICU	35.40±0.69	36.92±0.62	0.108
Half an hour before extubation	36.05±0.68	37.44±0.75	0.176
Half an hour after extubation	36.26±0.93	38.90±0.86	0.043
1st post-operative day	37.11±0.89	40.24±0.96	0.21
3rd post-operative day	36.04±0.81	37.09±0.89	0.387
SpO <sub>2</sub> (%)			
Prior to induction	99.01±0.06	98.89±0.07	0.199
After arrival of ICU	99.12±0.09	98.95±0.07	0.142
Half an hour before extubation	99.05±0.03	98.96±0.06	0.186
Half an hour after extubation	99.09±0.08	98.44±0.05	0.144
1st post-operative day	98.62±0.08	98.48±0.06	0.140
3rd post-operative day	98.95±0.09	98.76±0.07	0.102

**Table VIII**

Comparison of post-operative hospital stay in study groups (n=50)

Post-operative hospital stay (days)	Group I (n=25) Time (days)	Group I (n=25) Time (days)	P value
Mean ± SE	8.88±0.24	10.14±0.43	0.0145

**Table IX**

Comparison of post-operative complications in study groups (n=50)

post-operative complications	Group I (n=25)	Group I (n=25)
Pleural effusion	1 (4%)	1 (4%)
Atelectasis	1 (4%)	5 (20%)

### Discussion

This study included 50 patients of multi-vessels coronary artery disease with impaired pulmonary function who underwent off-pump CABG. They were

randomized into two groups, 25 patients in each group; group-I patients underwent off-pump CABG who were given bronchodilator (salbutamol) preoperatively having mild to moderate impaired pulmonary function and group-II patients underwent off-pump CABG who were not given bronchodilator preoperatively having mild to moderate impaired pulmonary function.

Mean±SE value age in group-I was 51.88±1.70 years and in group-II was 54.60± 1.65 years. The age difference between the two groups were not statistically significant (P=0.258) and the mean age of people with coronary artery disease in this study is 53.24 years which is consistent with the study done by Lizak et al and Manganas et al<sup>6,7</sup>.

In this study male were dominant in both groups. In group-I, 80 % and group-II, 84% were male. This finding suggest that atherosclerotic coronary artery disease is more prevalent in male as is supported by Lizak et al<sup>6</sup>.

Extent of coronary artery disease between the groups demonstrates that triple vessels disease (TVD), double vessels disease (DVD), and left main (LM) were

in 64%, 32% and 4% patients respectively in group-I and 72%, 24% and 4% respectively in group-II which is consistent with study done by Hulzebos and colleagues<sup>8</sup>. The mean±SE value of total operation time in group-I was 316.20±5.96 minutes and in group-II was 308.80±6.45 minutes. There was no statistically significant difference between the two groups (P=0.404). Comparison could not be done due to scarcity of literature.

The mean±SE value of FVC after admission was 1.43±0.04 liters (63.88±1.16 % of predicted values) in group I and 1.39±0.03 liters (66.12±0.96% of predicted values) in group-II. The mean value of FVC in between groups after admission were not statistically significant (P>0.05). The mean±SE value of FVC on the day before operation was 1.76±0.07 liters (73.00±0.96% of predicted value) in group-I and 1.43±0.03 liters (67.48±1.11% of predicted values) in group-II. The mean values of FVC were more increased in group-I (after treated with bronchodilator) on the day before operation and the values between two groups were statistically significant (P<0.05). The mean±SE value of FVC on the 7<sup>th</sup> postoperative day was 1.25±0.03 liters (57.64±1.09 % of predicted value) in group-I and 0.90±0.04 liters (48.56±1.31 % of predicted values) in group-II. The mean values of FVC were more decreased in group-II (not treated with bronchodilator) on 7<sup>th</sup> postoperative day and the values between two groups were statistically significant (P<0.05). The mean±SE value of FEV1 after admission was 1.25±0.02 liters (68.28±1.73% of predicted value) in group-I and 1.23±0.03 liters (70.40±1.59% of predicted values) in group-II. The mean values of FFV1 in between two groups were not statistically significant (P>0.05). The mean value of FEV1 were more decreased in group-II on 7<sup>th</sup> postoperative day. The values between two groups were statistically significant. The FEV1/FVC was not statistically significant all over the study period in between two groups. The results were consistent with the study done by Mehrparvar et al and Omata et al<sup>9, 10</sup>. Blood gas analysis, on half an hour after extubation and on 1<sup>st</sup> post-operative day the measures of PaO<sub>2</sub> and PaCO<sub>2</sub> were found statistically significant in between two groups (P<0.05). SpO<sub>2</sub> was found statistically not significant all over the study period. We could not compare the results due to scarcity of literature.

Post-operative hospital stay in days in both groups of patients was observed. The Mean ± SE value was

8.88±0.24 days in group-I and 10.14±0.43 days in group-II. Statistically significant difference were seen in respect to hospital stay in between two groups (P<0.014). We could not compare the results due to scarcity of literature. Early post-operative pulmonary complications were found in both groups of patients. In group-I, one patient was found with pleural effusion and one patient with atelectasis. But in group-II, one patient with pleural effusion and five patients with atelectasis were found (table IX). The result is consistent with the study done by Lizak and colleagues<sup>6</sup>.

### Conclusion

Our results suggest that use of bronchodilator pre-operatively in patient's undergoing off-pump CABG with impaired pulmonary function leads to reduced mechanical ventilation time, less ICU stay after surgery as well as better preservation of post-operative pulmonary function, reduction of post-operative pulmonary complications and reduced total post-operative hospital stay after surgery.

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