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ORIGINAL ARTICLE

Effect of preemptive bronchodilator therapy in reducing postoperative pulmonary complications in smokers undergoing CABG.

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ABSTRACT… Objective: To study the effect of preemptive bronchodilator therapy in reducing postoperative pulmonary complications in smokers undergoing coronary artery bypass grafting. **Study Design:** Randomized Control Trial. **Setting:** Army Cardiac Centre CMH Lahore. **Period:** January to June 2021. **Material & Methods:** A total of 200 patients undergoing CABG in Army cardiac Centre CMH Lahore were included in this study. Patients were divided in to two groups i.e. case and interventional groups. All the procedures were performed by the consultant cardiac surgeon of experience of more than 5 years. In interventional group patients were administered with bronchodilator therapy i.e. salmicort inhaler preoperatively along with other necessary preoperative measures while in case group no bronchodilator therapy was introduced. Preoperatively, ASA status, FEV1, BMI, oxygen saturation, Ejection fraction (EF), and smoking status, COPD diagnosis, and $PaCO_2$, FVC-L, PEFR, Hb and CRP levels was assessed. Postoperatively, different pulmonary function tests were performed in both groups i.e. need for prolonged oxygen therapy, prolonged ICU stay, re-intubation and antibiotic use. **Results:** The frequencies of prolonged oxygen therapy and ICU stay, re-intubation, antibiotics use, COPD diagnosis were same in both the groups. Therefore, the differences were statistically insignificant. But, $PaCO_2$, in intervention group was higher than the control group with significant difference, ($p=0.004$). **Conclusion:** It can be concluded from the results of this study that administration of bronchodilator therapy preoperatively in patients with known history of smoking undergoing coronary artery bypass graft surgery has no significant effect in terms of outcome variables.

Key words: Bronchodilator Therapy, Coronary Artery Bypass Graft Surgery, Preemptive, Postoperative Pulmonary Complications, Smokers.

INTRODUCTION

In the United States, cigarette smoking is the main cause of chronic obstructive pulmonary disease (COPD).[1] In-hospital morbidity is linked to smoking status, however mortality is not related to smoking.[1] It is well acknowledged that smoking has a negative influence on long-term survival after coronary artery bypass surgery (CABG).[2] Cardiovascular and pulmonary compromises occur due to smoking, which are linked to a higher risk of mortality during surgery and a worse chance of long-term survival. In surgical patients, smoking-related pulmonary dysfunction can contribute to the increase of postoperative pulmonary problems.[1,7] Hence, individuals who smoke cigarettes are frequently advised to quit before to surgery.[2] In surgical patients, post-operative pulmonary complications (PPCs) are a considerable source of disease. The documented prevalence for general surgical patients is 5%, but it can be as high as 20% in some populations having high-risk operations.[3] In general surgical patients, PPCs are as prevalent as cardiac problems.[4] PPCs are a leading cause of death, with mortality rates as high as 25% depending on the complications and surgery.[3] Patients who have abdominal surgery and acquire postoperative pneumonia have a 10-fold higher death rate and a lengthier hospital stay than those who do not.[5] The rate of readmission may also enhance to 30 days due to PPCs and may be a sign of poor long-term survival in older hospitalized patients. PPCs are more expensive than cardiovascular or infectious problems following surgery, costing

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the US $3.4 billion per year.[5]

PPCs are still the primary cause of morbidity and mortality after adult heart surgery, despite numerous advancements in perioperative treatment.[6] PPCs are linked to a longer stay at hospital, which has a significant impact on health-care costs in cardiac surgery patients. The development of pulmonary complications after cardiopulmonary bypass is multifactorial including, changes in chest muscle and wall function caused by median sternotomy, cardiopulmonary bypass triggering systemic inflammatory response syndrome, administration of cold saline during cardiac arrest in the pericardial cavity leading to phrenic nerve damage, and alveolar edema by the use of left ventricular assist device and increased pressure in the pulmonary vasculature are all included as the primary contributing causes for this fatal consequence.[7] Depending on the parameters used to identify pulmonary problems, the reported incidence of pulmonary complications following heart surgery ranges from 6% to 70%.[8]

Gram-negative bacteria are responsible for the majority of pneumonias following heart surgery. However, a more recent prospective research discovered that pneumonia developing within three days following CABG is most frequently caused by Gram-positive bacteria detected in the sputum of the patient before surgery. Preoperative smoking, poor cardiac output, preoperative positive tracheal aspirate, and the transfusion of more than 4 units of packed RBCs were all risk factors for the development of severe pneumonia.[9] Bronchodilator treatment is frequently continued during the preoperative and perioperative periods in COPD patients with a history of smoking, since daily usage helps to preserve respiratory function after surgery.[10] Other strategies for lowering PPCs in COPD patients are similar to those used in asthmatic patients: minimize airway stress and medicines that cause bronchospasm. Multiple studies have been conducted in the past about PPCs in patients with COPD and asthma undergoing cardiac and non-cardiac surgery, but none have ever evaluated the role of preemptive bronchodilator therapy in decreasing PPCs in patients undergoing CABG, which is the study's main objective.

MATERIAL & METHODS

This is a randomized control trial conducted in Army cardiac Centre from 1st January 2021 to 30th June, 2021. A total of 200 patients undergoing CABG were included in this study. Patients were divided in to two groups i.e. case and interventional groups. Inclusion in the study was based upon the following criteria: patients undergoing CABG, patients aged 18 or above, belonging to either gender and with positive history of smoking at least 10 pack years but not diagnosed of having COPD or on any bronchodilator therapy. Patients aged less than 18, patients with interstitial pulmonary disease, lung cancer; systemic diseases such as chronic liver disease, chronic kidney disease etc were excluded from the study 25/Estb/ACC/Feb2021. A nonprobability consecutive type of sampling technique was used to collect the sample size. Ethical approval for the study was obtained from the ethical committee of the hospital. All the procedures were performed by the consultant cardiac surgeon of experience of more than 5 years. In interventional group patients were administered with bronchodilator therapy i.e. salmicort inhaler preoperatively along with other necessary preoperative measures while in case group no bronchodilator therapy was introduced. Preoperatively, ASA status, FEV1, BMI, oxygen saturation, Ejection fraction (EF), smoking status, COPD diagnosis, $PaCO_2$, FVC-L, PEFR, Hb and CRP levels was assessed. Postoperatively, different pulmonary function tests were performed in both groups i.e. need for prolonged oxygen therapy, prolonged ICU stay, re-intubation and antibiotic use. All the data was collected by the researcher himself with the help of a predesigned proforma.

The data thus collected was subjected to statistical analysis using the computer software SPSS version 16. Qualitative data was analyzed in the form of frequencies and percentages while quantitative data was analyzed in the form of mean and standard deviation. Chi square test was applied to assess the significance of the outcome variables in the two groups. A P value of less than or equal to 0.05 was considered as

statistically significant.

RESULTS

Two hundred patients were included in this study. The patients were randomized into two groups, controls n=100 (50.0%) and intervention n=100 (50.0%). The differences were statistically significant for age, BMI, FEV_1/FVC, level of oxygen standard free, EF (%), ASA, FVC-L, VC (%) predicted, FEV_1 and Hb in both the study groups. (Table-I).

The frequency of prolonged oxygen therapy and ICU stay, re-intubation, antibiotics use, COPD diagnosis were same in both the groups. Therefore, the differences were statistically insignificant. But, $PaCO_2$, in intervention group was higher than the control group with significant difference, (p=0.004). (Table-II).

Variable	Control n=100 (50.0%)	Intervention n=100 (50.0%)	P-Value
Age (years)	61.26±4.72	59.59±4.48	0.014
BMI (kg/m^2)	24.04±2.72	24.93±1.75	0.007
FEV_1/FVC	63.01±8.27	59.22±8.37	0.001
Level of oxygen standard free	89.19±5.51	84.07±4.13	0.000
EF%	43.17±5.52	47.32±3.73	0.000
Smoking status	n=62 (62.0%)	n=63 (63.0%)	0.884
Pack years	48.74±15.94	48.92±8.81	0.908
COPD Diagnosis	n=12 (12.0%)	n=15 (15.0%)	0.192
PaCo2	38.16±3.61	39.97±4.99	0.004
ASA			
I	n=20 (20.0%)	n=40 (40.0%)	0.006
II	n=51 (51.0%)	n=34 (34.0%)	
III	n=29 (29.0%)	n=26 (26.0%)	
IV	n=0 (0.0%)	n=0 (0.0%)	
FVC-L	2.95±0.73	3.43±0.68	0.000
VC (%) Predicted	87.83±11.97	95.02±12.18	0.000
FEV_1	1.72±0.46	2.14±0.61	0.000
PEFR	6.29±1.76	6.59±1.96	0.264
Hb	12.70±1.79	13.63±1.75	0.000
CRP Normal	n=17 (17.0%)	n=20 (20.0%)	0.585

Table-I. Demographic and baseline characteristics of the study groups.

Variable	Control n=100 (50.0%)	Intervention n=100 (50.0%)	P-Value
Prolonged oxygen therapy	n=34 (34.0%)	n=31 (31.0%)	0.651
Prolonged ICU stay	n=18 (18.0%)	n=12 (12.0%)	0.235
Re-intubation	n=1 (1.0%)	n=2 (2.0%)	0.888
Antibiotics use	n=11 (11.0%)	n=13 (13.0%)	0.663

Table-II. Outcome variables of the study groups.

DISCUSSION

The first step in preventing PPCs is to get a complete medical history. Complaints including underlying pulmonary illness and a history of smoking should be given special consideration. Exercise tolerance has been linked to a higher rate of survival following critical abdominal surgeries.[11] PPCs are increased by respiratory illness within 4 weeks and high sputum output, as well as alcohol usage.[12-15] The bodily habitus as well as cardiorespiratory symptoms should be carefully examined throughout the physical examination. Obesity that is severe i.e. BMI >40 kg/m2, enhances the risk of complications.[16,17] A positive cough test outcome, in which a patient tries to breathe deeply yet coughs involuntarily, is a forecaster of PPCs.[15]

Routine laboratory testing prior to surgery may aid in the identification of individuals who are at a higher risk. The ARISCAT research confirmed preoperative anemia as an independent cause for PPCs, and high blood urea nitrogen levels i.e. >30 mg/dL, may further increase risk.[15]

Although routine arterial blood gas (ABG) measurements are not recommended, they may be beneficial for screening at-risk patients and initiating preoperative positive airway pressure treatment, which can decrease morbidity and death.[18-20]

COPD patients are at definitely higher risk of perioperative complications, and COPD is arguably the most commonly mentioned risk factor for PPCs.[14,15,21] PPCs can be as high as 18 percent in COPD patients having general surgical procedure, and the risk rises with severity of disease.[14,21] If feasible, surgery should be postponed in patients who are experiencing an acute exacerbation prior to surgery. Although empiric antibiotics are not recommended for COPD, all patients should be monitored for acute exacerbations, and those with increased secretions should be treated with oral antibiotics for short period.[14,22] Corticosteroids should be recommended in situations with chronic symptoms.[23] Muscle fiber remodeling and total perioperative pulmonary function are both improved by preoperative pulmonary rehabilitation with muscle training.[24] Bronchodilator treatments should be continued in patients with COPD during the perioperative period, since it helps to preserve postoperative respiratory function.[25] Other strategies for lowering PPCs in COPD patients are similar to those used in asthma patients: minimize airway stress and medicines that cause bronchospasm. In our study we observed that the preemptive bronchodilator therapy in smokers not diagnosed of having COPD undergoing coronary artery bypass grafting had no added benefit in preventing the postoperative pulmonary complications and decreasing the length of ICU stay of patients after surgery.

CONCLUSION

It can be concluded from the results of this study that administration of bronchodilator therapy preemptively in patients with known history of smoking undergoing cardiovascular bypass graft surgery has no significant effect in terms of outcome variables.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Rehana Feroz	Statistical analysis, Critical revision.	