ORIGINAL ARTICLE

Effect of Preoperative Pulmonary Function on Outcomes of Coronary Artery Bypass Grafting

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ABSTRACT

Aim: To evaluate the impact of FEV_1 on early outcomes of patients after CABG.

Methods: This prospective observational comparative study was conducted in department of pulmonology and intensive care unit of Ch. Pervaiz Elahi Institute of cardiology Multan. A total number of 140 patients having age > 40 years, who were planned to undergo conventional coronary artery surgery from Jan-2017 to June-2017 were recruited for analysis. Spirometry is performed in all patients. Group I patients were those in whom $FEV_1 \geq 60\%$ and in Group II there were patients in whom $FEV_1 < 60\%$. The primary endpoints of this study were duration of ventilator support, hospital stay and operative mortality.

Results: Mechanical ventilation time was significantly prolonged in $FEV_1 \geq 60\%$ group, 5.57±2.33 days versus 6.41±2.59 days in $FEV_1 < 50\%$ group (p-value 0.05). Hospital stay period was 6.48±1.09 days in $FEV_1 \geq 60\%$ and 8.78±4.29 days in FEV_1 <60% (p-value 0.002). Hospital stay was significantly prolonged in patients with $FEV_1 < 60\%$ with p-value 0.002. In-hospital mortality was high 9(12.9%) in $FEV_1 < 60\%$ versus 3(4.3%) in patients with $FEV_1 \geq 60\%$ with p-value of 0.07.

Conclusion: FEV_1 <60% is an important predictor of increased morbidity and mortality in patients after coronary artery bypass grafting.

Keywords: forced expiratory volume in one minute, in-hospital mortality, coronary artery bypass grafting.

INTRODUCTION

For more than 6 decades, coronary surgery have been performed to prevent mortality and improve quality of life of patients with coronary artery disease (CAD)[1].. Due to improvement in skills of interventional cardiologist and availability of newer drugs for prevention and management of CAD patients, there is an increasing trend of elderly patients who are now referred for coronary artery bypass grafting. These patients also have higher incidence of co-morbid conditions[2,3].

Different prognostic scores have been developed to determine the outcomes of patients after surgery, out of these score EUROSCORE is most widely used and accepted. It provides a good prediction of early and late outcomes of cardiac surgery patients[4]. Forced Expiratory Volume in one second (FEV_1) is used to measure pulmonary physiology and is considered a more reliable and accurate tool to measure pulmonary functions. It is also considered a strong predictor of mortality independent of other risk factors e.g., age, hypertension, diabetes and hyper-cholestrolemia in patients undergoing esophagiotomy[5,6]. Some studies have concluded that FEV_1 is also an independent predictor of adverse clinical outcomes after cardiac surgery[7,8]. Very little data have been documented regarding association of forced expiratory volume in one second with surgical outcomes of cardiac surgery patients. In this study, we evaluated the impact of FEV_1 on early outcomes of patients after coronary artery bypass grafting.

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MATERIALS AND METHODS

This prospective observational comparative study was conducted in department of pulmonology and intensive care unit of Ch. Pervaiz Elahi Institute of cardiology Multan. A total number of 140 patients having age > 40 years, who were planned to undergo conventional coronary artery surgery from Jan-2017 to June-2017were recruited for analysis. Patients undergoing any other cardiac surgery procedure such as valvular operations or surgical closure of atrial septal or ventricular septal defects were excluded. In our setup pre-operative spirometry is routinely performed in all patients before surgery. Spirometry is performed in all patients under the supervision of a trained physiotherapist. Spirometery was done using chest radiograph HI-105 electronic spirometer (Chest M.I., Inc., 3-6-10 Hongo Bunkyo-ku, Tokyo, Japan). The patients were divided into two groups on the basis of FEV_1. Group I patients were those in whom $FEV_1 \geq 60\%$ (patients having normal or mild

pulmonary dysfunction) and in Group II there were patients in whom FEV_1<60% (moderate to severe pulmonary dysfunction).

In all patients, coronary artery bypass grafting was done after establishing standard cardiopulmonary bypass. The details of cardiopulmonary bypass, cardioplegia delivery, hypothermia during surgery, grafting procedure andweaning from cardiopulmonary bypass have already been published in previous surgeries from our institution. Data regarding cardiopulmonary bypass variables e.g., bypass time, cross-clamp time and pre-operative patient characteristics e.g. age, gender and cardio-vascular risk factors was entered prospectively in cardiac surgery database and after completion of study patients,

Data analysis was done using software SPSS v23. Mean and standard deviation was calculated to present continuous variables, frequencies were used for qualitative ones. Fischer's exact test was used to compare operative mortality between groups. Independent sample t-test was used for the comparison of duration of ventilator support and hospital stay. P-value ≤0.05 was interpreted as significant difference.

RESULTS

In this study, a total number of 140 patients were included, there were 7 pts having FEV_1≥60% and 70 patients were having FEV_1<60%. The mean age of study patients was54.50±8.26 years in patients of FEV_1≥60% and 54.78±7.69 years in patients of FEV_1<60%. There were 54(77.1%) males in FEV_1≥60% group and 49(70%) males in FEV_1<60%. There was no difference in BMI, smoking, diabetic and hypertension history of study participants. Mean bypass time was 122.7±31.4 minutes in FEV_1>60% group and 130.4±38.89 minutes in FEV_1<60% group with p-value 0.09 (Table 1).

Table 1. Demographic variables.

Variable	FEV_1≥60% (n=70)	FEV_1<60% (n=70)	P-value
Age (Y)	54.50±8.26	54.78±7.69	0.83
Male (%)	54 (77.1%)	49 (70%)	
Female (%)	16 (22.9%)	21 (30%)	0.34
BMI (Kg/m^2)	26.24±4.51	26.29±4.50	0.95
LVEF	53.50±2.33	52.50±9.69	0.53
Hypertension(%)	27 (38.6%)	31(44.3%)	0.49
Smoking (%)	21 (30.0%)	30(42.9%)	0.72
Diabetes (%)	27 (38.6%)	24 (34.3%)	0.60
Bypass Time (mins)	122.7±31.4	130.4±38.89	0.09
Cross-clamp Time (mins)	75.07±20.10	71.92±16.46	0.31

Mean mechanical ventilation time was significantly prolonged in FEV_1≥60% group, 5.57±2.33 days versus 6.41±2.59 days in FEV_1<50% group (p-value 0.05). Hospital stay period was 6.48±1.09 days in FEV_1≥60% and 8.78±4.29 days in FEV_1 <60%. Hospital stay was significantly prolonged in patients with FEV_1<60% with p-value 0.002. In-hospital mortality was high 9(12.9%) in FEV_1<60% versus 3(4.3%) in patients with FEV_1≥60% with p-value of 0.07 (Table 2).

Table 2. Study outcomes.

Variable	FEV_1≥60% (n=70)	FEV_1<60% (n=70)	P-value
Duration of Mechanical Ventilation (days)	5.57±2.33	6.41±2.59	0.05
Hospital Stay (days)	6.48±1.09	8.78±4.29	0.002
In-hospital Mortality (%)	3 (4.3%)	9 (12.9%)	0.07

DISCUSSION

Tobacco abuse is an important contributor to the development of chronic obstructive pulmonary disease (COPD) and also increases the risk of coronary artery disease[9]. The prevalence of COPD varies depending upon the definitions and criteria's used to define the disease[10,11]. Studies have estimated that estimation of airflow limitation is more sensitive and specific as compared to symptoms, self-reporting and clinical diagnosis of COPD[12]. COPD has been proven to be the major risk factor of morbidity and mortality after cardiac surgery[13,14]. In this study, we evaluated the effect of pre-op FEV_1 on operative outcomes of patients who underwent CABG surgery in our institute.For this we divided patients into groups one those having FEV_1<60% and the other having FEV_1≥60%. Patients of both of these groups were comparable regarding baseline demographic and CAD risk factors. However, smoking history was more common in patients having FEV_1<60%. There were 30.0% smokers in FEV_1>60% group and 42.9% in FEV_1<60% group. Smoking history was also more common in study by Osuka et al[15] who found smoking history 58.6% patients in non-COPD group and 85.5% patients in COPD patients.

In our study, mechanical ventilation time, hospital stay time was significantly high in patients having FEV_1<60%. Abadag et al[16] also found significantly increased length of stay and hospital mortality in patients having reduced pre-op FEV_1. However, they did spirometry in only 45% of their total patients and in remaining patient's the diagnosis was purely based on the clinical history of the patients. Andthey did not compare COPD patients

with normal patients having no COPD. McAllister et al[17].concluded that pre-op FEV_1 is a best predictor of post-op hospital stay and in-hospital mortality in patients after cardiac surgery. However, they made four group of patients and in their study operative mortality and hospital stay was significantly prolonged in patients having FEV_1<60% and they concluded that FEV1 <60% is a significantly predictor of mortality after cardiac surgery. Girardi et al. also concluded that $FEV_1$is a significant predictor of mortality after major aortic root replacement procedures[18].

COPD is often not diagnosed in many primary care settings especially when mild or sometimes even in moderate to severe cases[19]. This is also common in patients who are planned to undergo cardiac surgery. In cardiac surgery patients, in about 5.0% of the patients diagnosis of COPD is made on the basis of age and sex of the patients even in Scotland. Not only in cases of COPD, even in non-smokers and in patients having no breathing problems reduced FEV_1 is a predictor of worse outcomes after surgery. FEV_1/FVC ratio also has similar predictive outcomes as FEV_1 alone. Exposure to pro-inflammatory substances, smoking habit and environmental pollution was common risk factors of reduction in FEV_1. Pulmonary congestion due to any cause such as valvular heart disease may also have negative effects on forced expiratory volume in one second[20].

FEV_1 is highly correlated with post-operative outcomes after CABG surgery, so recommendations should be made to measure FEV_1 in every patient before surgery to evaluate risk assessment regarding post-op outcomes in patients after CABG or other cardiac surgeries.

CONCLUSION

FEV_1 <60% is an important predictor of increased morbidity and mortality in patients after coronary artery bypass grafting.

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