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# THE DIFFERENCE OF SPIROMETRY RESULT BEFORE AND ONE YEAR AFTER CORONARY ARTERY BYPASS GRAFT PROCEDURE

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**ABSTRACT** To evaluate the differences of pulmonary function test before and one year after CABG procedure. A descriptive analytic cohort study was performed in Division of Cardiothoracic Surgery, Department of Surgery, H. Adam Malik General Hospital, Medan, Indonesia from January 2018 to January 2019. All patients was underwent coronary artery bypass graft procedure in our center from October 2017 to April 2018. A preoperative pulmonary function test was compared with postoperative CABG results. A total of 35 patients were included in the study, averaging 57.6 (± 4.6) years old. The FEV1/FVC before and after CABG procedure were recorded with the mean value of 75.97 ± 6.22 and 89.35 ± 5.59 respectively. A statistically significant difference was noted ($p<0.001$). An improvement of pulmonary function test after CABG was found compared to preoperative pulmonary function test.

**KEYWORDS :** Coronary Artery Bypass Graft, Spirometry, Pulmonary Function

## INTRODUCTION

Coronary Artery Bypass Graft (CABG) is one of the most common surgical procedure done, account for approximately 400.000 operation each year in the United States. In the last decade, there was a trend towards less CABG procedures due to percutaneous coronary intervention (Alexander, 2016).

A CABG procedure was introduced in the 1960 by creating two parallel way to bypass the coronary artery obstruction, using either internal mammary artery (IMA) or saphenous vein graft (SVG). Cardiac surgeon mostly prefer SVG in performing CABG procedure in 1970. However, during the present days, most patients were underwent the surgery using a left IMA (LIMA) (S-hikhman, 2011).

One of the drawbacks of CABG procedures is the negative effect on pulmonary function. Pulmonary function test such as VC, FVC, FEV1, FEV1/FVC, and MVV have lower results after the surgery compared to before surgery (El-Sobkey, 2011). The decreased of the pulmonary function could remained for 4-6 months, moreover as long as 1 year, after surgery (Westerdahl, 2016).

From these findings, pulmonary complications after cardiac surgery are multifactor phenomenon and statistical explanation to describe these problems is mandatory (El-Sobkey, 2011). In this study, we aimed to evaluate if there were any differences of pulmonary function test before and after CABG procedure.

## METHODS

A descriptive analytic cohort study was performed to all patients who underwent CABG procedures in Division of Cardiothoracic Surgery, Department of Surgery, H. Adam Malik General Hospital, Medan, Indonesia from January 2018 to January 2019. All CABG patients from October 2017 to April 2018 was our first inclusion criteria. In this study all patients were between 20 to 60 years old, and having a valid spirometry test results. A history of unstable cardiovascular condition; cerebral, abdomen, or pulmonal aneurism; pneumothorax or hemoptysis for the last month; recent pulmonary or abdominal surgery; pulmonary infection; and congenital pulmonary condition were the exclusion criteria in this study.

Demographic data of all patients who underwent the CABG procedure in our center, such as age, gender, and job were recorded, including pulmonary test result before surgery. After that, the patients were called back to the hospital and underwent history taking and physical examination. All eligible patients were included into the study and underwent a spirometry test in the integrated diagnostic center H. Adam Malik General Hospital, Medan, Indonesia. A calibrated spirometry tool was used, and a maneuver to perform spirometry test was demonstrated before the test.

Statistical analysis using paired T-test was done to evaluate the pulmonary function before and after CABG procedure.

## RESULTS

A total of 51 patients were underwent spirometry examination before CABG procedures, 10 patients did not come for the spirometry test after CABG procedures. Six patients were diagnosed with chronic obstructive pulmonary disease (COPD) and excluded from the study. Finally, 35 patients were included in the study. The mean of age of all participants was 57.6 ± 4.6 years old, men were noted in 22 patients (62.9%) compared to 13 (37.1%) women.

**Table 1. Demographic characteristics**

| Characteristics (n=35) | Normal BMI | Overweight |
|---|---|---|
| **Age (years) (Mean + SD)** | 57.71 + 4.69 | 56.72 + 4.57 |
| **Sex n (%)** | | |
| Men | 20 (57.1) | 2 (5.7) |
| Women | 11 (31.4) | 2 (5.7) |
| **BMI (Mean + SD)** | 21.05 + 2.11 | 26.02 + 0.34 |
| **Smoking** | | |
| Yes | 13 (37.1) | 2 (5.7) |
| No | 18 (51.4) | 2 (5.7) |

The ratio of FEV1 to FVC before and after CABG procedure were averaging 75.97 ± 6.22 and 89.35 ± 5.59 respectively. These indicate no obstructive symptoms in all of our patients. Subsequently, a paired T-test was done and showed a statistically significant result, $p<0.001$.

**Table 2. Comparisson of Spirometry Result between Pre- and Post-CABG**

| Spirometry | (Mean+SD) | p-value |
|---|---|---|
| **Pre- CABG** | | <0.001* |
| FEV1/FVC | 75,97+6,22 | |
| **Post- CABG** | | |
| FEV1/FVC | 89,35+5,59 | |

*Paired t-test

## DISCUSSION

The range of age for patients underwent CABG procedure was between 55 to 75 years old (Asimakopoulos et al, 2005). While other study has reported the mean of age was 57.6 years old (Reents, 2014). The mean of age of all participants was 57.6 ± 4.6 years old.

In this study, men were noted in 22 patients (62.9%) compared to 13 (37.1%) women. Majority of patients underwent CABG is men with comparison of 80% to 20% between men and women (Urell, 2012). Other study showed women underwent CABG as high as 31.1% (Reents, 2014).

For smoking, in our study, we found 15 patients as active smokers (42.9%), while the other 20 patients were non-smokers (57.1%). Similar results were found in other studies. Urell (2012), reported a 49% of their sample was smokers, while in non-smoker group, they showed a 51% result. Data from Soman in 2017 found that 51% of their patient was normal BMI and smoking, and 40% overweight BMI and smoking.

A significant change was noted in the vital capacity after miocardiac revascularization. In the first day postoperative, an approximately 70% decrease was found in comparison of preoperative result. After that, a rise will be found gradually, mostly after the patients out from the hospital. Cardiac surgery was also proved to have a negative effect on the pulmonary function. All of the test results, including VC; FVC; FEV1; FEV1/FVC were lower postoperatively compared to preoperative setting. Several studies have supported these findings (Shenkman et al., 1997; Saxena et al., 2007; Weissman, 1999; Stenseth et al., 1996; Vaidya et al., 1996).

Spirometry test was used because it was an objective, valid, and capable to evaluate pulmonary function test. Moreover, it was a non-invasive method especially for postoperative patients. Pulmonary hypertension could be caused by combination of increase left atrial pressure, pulmonary arteriole narrowing, and organic change in the pulmonary vessels. Pulmonary dysfunction was related to interstitial and alveolar edema, reactive fibrosis, previous pulmonary infarct, pleural effusion, and decrease of pulmonary volume postoperatively Shenkman et al., 1997; Saxena et al., 2007; Weissman, 1999; Stenseth et al., 1996; Vaidya et al., 1996).

Women were tend to have a lower pulmonary function test score compared to men as they may have a worse reaction to pain. This may explain the reason of lower pulmonary function test was noted in valve replacement surgery compared to CABG. But further question is whether there could be another factors explaining the findings. A proposed mechanism is inflammatory respons that secreted in the pulmonary system and resulted in pulmonary dysfunction or edema (Mahmoud et al, 2005; Barnas et al, 1994). Beside the worse gas exchange, a decrease in FVC, FEV1, PEF was more common in a longer cardiopulmonary bypass procedure (more than 80 minutes) (Kochamba et al, 2000; Chandra et al, 1998).

Compared to alternative study, we have a similar result. A difference in pulmonary function test with spirometry before and after CABG procedure could be a threshold in assessing respiratory quality in post CABG patients. An increasing pulmonary function test after CABG was found compared to preoperative pulmonary function test.

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