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Body Mass Index as a Predictor of New-Onset Atrial Fibrillation after Coronary Artery Bypass Graft Surgery

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Abstract: ***Background: Atrial Fibrillation (AF) has been one of the most commonly found arrhythmia in daily practice. This also applies in the settings of post coronary artery bypass graft (CABG) surgeries. Post-operative Atrial Fibrillation (POAF) prevalence has been reported not less than 33% in CABG surgeries and is linked primarily to advanced age, followed by obesity and male population. As the number of obesity as Coronary Artery Disease (CAD) risk has increased, identifying body mass index (BMI) as a risk factor for POAF could be of importance, noting that obesity is a modifiable risk factor. Methods: This study was a retrospective observational investigation of 131 CAD patients undergoing CABG from August 2012 to March 2016 in Tarakan Hospital, Jakarta. BMI was stratified using WHO Asia Pacific Criteria. Baseline characteristics and peri-operative risk factors were analyzed through binary logistic regression to predict POAF. Results: The total incidence of POAF in this study population is 11% (n=15) and has the highest incidence in Obesity group (53%, n=15). In contrast, we found no POAF in other BMI groups. Using binary logistic regression, BMI stands as the only risk factor that strongly predicts POAF (OR 1.76, CI 95%; 1.50 – 1.90, p<0.001). Conclusion: Obesity, which is represented by the increasing of BMI, is a strong single independent risk factor that predicts POAF***

Keywords: atrial fibrillation, coronary artery bypass graft, coronary artery disease, obesity, body mass index

1. Introduction

Atrial fibrillation (AF) is one of the most common types of arrhythmias found in daily practice.[1] This condition is often associated with risk factors such as hypertension and structural abnormalities of the heart, specifically various risk factors that trigger enlarged atria.[1,2] Besides atrial fibrillation is also associated with excess body mass index (BMI), especially BMI> 27 kg / m^2.[2-5] Specifically in post-heart surgery patients, AF is one of the most common arrhythmias.

The incidence of postoperative AF is estimated to reach 33% in coronary bypass surgery, and 46% in valve surgery.[3] This figure is shown to increase with the patient's age, so old age is considered an important risk factor for postoperative AF.[4] One of the heart operations the most common is coronary bypass surgery. This surgery is one of the definitive therapies for coronary arterial disease (CAD). One important risk factor for CAD is obesity.[5] In one study it was found that the proportion of obese patients undergoing coronary bypass surgery is increasing.[6] This is accompanied by data that obesity is one of the important risk factors for postoperative AF besides age and sex. However, various studies on postoperative AF show that age is the single most consistent risk factor for postoperative AF.[7] Only a few studies have shown that increased body mass index (BMI), especially obesity, is a risk factor for postoperative AF.[2-5]

With the increasing prevalence of obesity in the general population and populations undergoing coronary bypass surgery, it is necessary to further investigate the possibility of BMI as a risk factor for postoperative AF in coronary bypass surgery.

2. Methods

This study used a cross sectional study design to determine the risk factor for the new onset of atrial fibrillation after coronary arterial bypass grafting during the period of June 2015 to June 2016 at the Cardio Vascular Care Unit TarakanHospital.This study used total sampling method, which was consisted of all patients who underwent coroangiography and then continued with the coronary bypass surgery in the period August 2012 to March 2016. The study was conducted by taking medical record data after obtaining permission from the research ethics committee of the TarakanHospital.

This study used measurement variables in the form of age, gender, CAD risk factors and follow-up post-coronary bypass surgery in the form of postoperative AF events. Postoperative AF in this study is defined as a new onset AF found on ECG with a minimum duration of 30 minutes, during the hospital stay after coronary bypass surgery. In this study, BMI was categorized into 4, namely underweight (BMI <18.5 kg / m^2), Normal (BMI 18.5 - 24.9 kg / m^2), Overweight (BMI 25.0 - 29.9 kg / m^2), and Obesity (BMI ≥30 kg / m^2).

3. Statistical Analysis

All data were analyzed using SPSS for Macintosh version 20.0 (SPSS, Inc. Chicago, Illnois). In univariate analysis, nominal data are presented as proportions and frequencies in descriptive tables or narratives and were tested using the Kolmogorov Smirnov test for normality test. To the data that has been presented, an analysis is carried out by means of an appropriate statistical test. BMI and various other variables that can be related as postoperative AF risk factors were

analyzed by multivariate logistic regression analysis methods. Variables with p-values <0.05 in multivariate analysis are expressed as meaningful relationships, in which Odds Ratio (OR) is determined with a 95% confidence level (CI).

4. Results

Baseline Characteristics of the Patients

The total number of patients who underwent coroangiography procedures in that period was 1142 patients. Of these, there were 131 patients who underwent coronary bypass surgical procedures, while the rest underwent percutaneous coronary intervention procedures or did not undergo any procedures. Therefore, the total number of patients included in this study was 131 patients.

Baseline characteristics of 113 patients who underwent CABG procoedure are described in Table 1.From table 1 it can be seen that the number of coronary bypass surgery patients from August 2012 to March 2016 totaled 131 patients including 98 male patients (74.8%) and 33 female patients (25.2%).There is a variation in the age of patients in the group of coronary angioplasty patients where the lowest age at the limit of 43 years is 1 patient (0.935%), the highest age at the 77-year limit is 1 patient (0.935%), and as many as 116 patients (88.5%) have age in the range age 45 to 76 years where the average age is 56 years (SD = 10).

The majority of patients in this study had a BMI above normal; 45 patients in the overweight category (34.4%) and 28 patients in the obesity category (21.4%). All patients in this study had undergone a coronary diagnostic procedure in the form of a coroangiography, and from these measures, data were obtained on the type of stenotic lesions in patients in this study. From the data in this study, it was found that the majority of patients had lesions with type 3 coronary arteries / 3 Vessel Disease (3 VD) of 70 people (53.4%) which generally consisted of LAD, LCX and RCA arteries. This is consistent with the findings of general prevalence stenotic lesions which often cover all three arteries.The average length of stay is 10 days. At post-surgery follow-up, it was found that there were 15 patients with atrial fibrillation after coronary bypass surgery. Of these 15 patients 1 died in less than 30 days, due to multiorgan complications.

Table 1 Characteristics of subjects

Variables	Frequency (n=131)	Percentage (%)
Age		
< 45 year	15	11.5
> 45 year	116	88.5
Sex		
Male	98	75%
Female	33	25%
BMI		
Underweight	37	28.20%
Normal	21	16.00%
Overweight	45	34.40%
Obesity	28	21.40%
Coronaryangiography		
1 VD	4	3.1
2 VD	21	16
3 VD	70	53.4
Main Vessel	35	26.7
3VD+LM	1	0.8
Length of stay		
< 10 days	81	61.8
> 10 days	50	38.1

Abbreviation: BMI: *Body Mass Index*,VD: *vessel disease*; LM: *Left Main*

Characteristics of Patients Who Have Atrial Fibrillation After Coronary Bypass Surgery

Of the 131 patients who underwent coronary bypass surgery, there were 15 patients who had a new onset fibrillation with a type of rapid ventricular response atrial fibrillation. The majority of patients are in the age group above 45 years (86.7%). The sex of the patient is generally male (73.3%). Patients with postoperative AF had a higher mean BMI compared to the non AF group (p <0.001) where the group with AF had a higher BMI (30.27 vs 24.90).

In terms of risk factors, there were no significant differences between the AF and Non-AF groups, with the risk factors (table 2) sequentially highest being Hypertension, Diabetes Mellitus, Smoking and Menopause. From this study's data it was found that more than half (53.6%) patients in the obese group experienced postoperative AF (table 3). This is different from other BMI groups which did not experience postoperative AF at all. This indicates the probability of a strong relationship between the obesity variable and the frequency of postoperative AF events.

Table 2: Distribution of Basic Characteristics of Coronary Bypass Surgery Patients With and Without Atrial Fibrillation Postoperatively

Variables	*Without AF (n = 116)*	*With AF (n = 15)*	*p-Value*
Age			
< 45 tahun	11.20%	13.30%	0.808
> 45 tahun	88.80%	86.70%	0.808
Sex			
Male	75.00%	73.30%	0.889
Female	25.00%	26.70%	0.889
BMI	24.90 ± 3.6	30.27 ± 0.72	<0.001
Hypertension	86.20%	86.70%	0.961
Diabetes Mellitus	57.80%	80.00%	0.99
Smoking	56.90%	40.00%	0.219
Menopause	20.70%	13.30%	0.22
EF < 50%	33.60%	40.00%	0.628
LVH	59.50%	73.30%	0.304

Abbreviation: AF: *Atrial Fibrillation,* BMI: *Body Mass Index*, EF: *Ejection Fraction*, LVH: Left Ventricular Hypertrophy.

Table 3: Percentage of postoperative AF in each BMI category

Postoperative AF	*BMI*			
	Underweight	*Normal*	*Overweight*	*Obesity*
% postoperative AF	0	0	0	53.6

Abbreviation: AF: *Atrial Fibrillation,* BMI: *Body Mass Index.*

Variables That Increase Risk of Occurrence of Atrial Fibrillation Post-Coronary Artery Bypass Surgery

Various variables in this study were processed in multivariate regression to then look at the possibility of these variables in terms of increasing the frequency of postoperative AF. From the data analysis process in Table 4, it was found that only BMI showed positive results as a predictor of the frequency of postoperative AF (OR 1.76, 95% CI, 1.50 - 1.90, p <0.001). Other variables which are the basic risk factors for AF in the general population such as hypertension, LVH and age did not show significant results.

Table 4: Results of Multivariate Regression Analysis of Variables on the Frequency of postoperative AF Occurrence

Variables	*OR (95%CI)*			*p-value*
Age	0.82	(0.72)	(– 0.90)	0.808
Sex	1.46	(1.00)	(– 1.52)	0.631
BMI	1.76	(1.5)	(– 1.90)	< 0.001*
Hypertension	0.87	(0.5)	(– 1.0)	0.869
Diabetes Mellitus	2.71	(2.0)	(– 2.90)	0.141
Smoking	0.55	(0.40)	(– 0.50)	0.306
EF<50	0.82	(0.50)	(– 0.95)	0.737
LVH	1.82	(1.1)	(– 2.0)	0.333
Creatinine	0.92	(0.5)	(– 1.2)	0.878
Menopause	0.17	(0.09)	(– 0.2)	0.083
CTR > 50%	0.3	(0.10)	(– 0.50)	0.223

*Significant with 95% CI

Abbreviation: OR: Odd Ratio, BMI: *Body Mass Index*, EF: *ejection fraction*, LVH: Left ventricular hypertrophy, CTR: Cardiothoracic ratio.

5. Discussion

Various other studies show that BMI includes several independent risk factors for the frequency of postoperative AF. Other risk factors in the study were age, male sex, and presence of valve disease comorbidity. In this study no significant relationship was found for risk factors other than BMI. Patients who had valve disease and had valve surgery not included in the study were different from previous studies that included valve surgery in their study sample.[2-4, 13-16]

In this study it was found that the risk of postoperative AF increased with the increase in BMI, which is especially in the obese group. postoperative AF was found in more than half the patient population in the obese group in this study, inversely proportional to other BMI groups which did not occur at all postoperative AF. Considering that in this study the incidence of postoperative AF was not large enough (11% of the total study sample), an increase in the number of samples might indicate the involvement of other variables such as age and male sex as risk factors for postoperative AF. In other studies examining risk factors for postoperative AF, age is one of the most consistent risk factors for postoperative AF, beyond obesity. However, this itself is recognized as requiring further study because generally in their sample group, patients who are obese in the BMI category are in a younger age group. However, in one of the largest studies on postoperative AF risk factors conducted by Sun et al on 12,367 patients it was found that high BMI, especially obesity, was an independent predictor of postoperative AF. This is consistent with the results of this study which show similar findings.[8, 15-18]

As with various observational studies, there is a possibility of immeasurable variables in this study that can be deficient. In this study, postoperative AF was only observed during the stay, which in this study averaged 10 days. This study did not include AF rates above that time, for example within a period of 30 days. However, this basically may not be too meaningful, given that according to the results of the study, postoperative AF mostly occurs within the first 4 - 6 days post surgery.

6. Conclusion

We found that BMI was an independent predictor of the frequency of occurrence of postoperative AF in this study. Specifically, it was found that obesity increases the risk of postoperative AF. In this study other risk factors such as old age and male sex did not show significant results as risk factors for the occurrence of postoperative AF. The importance of identification of risk factors for postoperative AF to prevent comorbidity and reduce the mortality rate of patients after coronary bypass surgery. Further follow-up is needed to assess the incidence of postoperative AF in patients after coronary bypass surgery. In subsequent studies, patients who underwent valve surgery can also be included to expand the study in the field of postoperative AF.

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