

# All CABG Patients Who Have No Contraindications: Do They Get Perioperative Beta Blockers?

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## Abstract

New-onset postoperative atrial fibrillation (POAF) following Coronary artery bypass graft (CABG) surgery has been described in up to 15% to 40% of patients in the initial postoperative period. POAF is related with higher mortality, increased hospital resource utilization, postoperative extra ITU hours and hospital days, consequently increasing hospital-related budgets. Beta blocker administration decreases the rate of POAF from 30% - 40% to 12% - 16% after CABG. According to the EACTS (European Association of Cardiothoracic Surgery) guideline December 2006,  $\beta$ -Blockers should routinely be used as the first choice for the prophylaxis of atrial fibrillation (AF) in all patients undergoing cardiac surgery, if not contraindicated (IB). To compare the contemporary practice with the recommended standard retrospective data of consecutive 400 patients treated with isolated CABG between July 2015 and June 2017 were collected. Those patients who received  $\beta$ -blockers on the day of surgery or the following morning (Continued and Restarted on 1st POD) met the standard guidelines. Thus, according to the data (12% + 20%) 32% of the patients met the standard. To compare the rate of Postoperative Atrial fibrillation, we divided the patients into two groups. Group A, who followed the guideline (128 patients) and Group B, who resumed  $\beta$ -Blockers 48 hours onwards (272 Patients). In group A, only 8 patients developed postoperative AF whereas in group B 88 patients developed postoperative AF which is also statistically significant ( $P < 0.003$ ).  $\beta$ -blockers significantly decrease the incidence of AF after CABG. Attention must also be paid on understanding and improving  $\beta$ -blockers use at perioperative period.

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## Keywords

CABG-Coronary Artery Bypass Graft,  $\beta$ -Blockers, AF-Atrial Fibrillation, POAF-Postoperative Atrial Fibrillation

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## 1. Introduction

Atrial Fibrillation (AF) is the most common arrhythmia happening after cardiac surgery and its occurrence peaks between second or third postoperative day. Postoperative AF varies depending on types of surgery. Particularly, AF occurs in nearly 30% of patients undergoing CABG, and in 40% and 50% of patients after valve surgery alone or combined valve and CABG surgery correspondingly. AF has been stated in up to 15% to 40% of patients in the initial postoperative period after Coronary artery bypass graft surgery (CABG) [1]. New-onset POAF following CABG is often self-limiting; nevertheless, it may necessitate anticoagulation therapy and either a rate or rhythm control approach. Postoperative atrial fibrillation (POAF) is related with higher mortality, increased hospital resource utilization, postoperative extra ITU hours and hospital days, consequently increasing hospital-related budgets [2]. In patients undergoing CABG, the constant use of  $\beta$ -blockers was related with a lower risk of long-term mortality and complex cardiac and cerebrovascular events. Beta blocker administration lowers the incidence of POAF from 30% - 40% to 12% - 16% following CABG [3].

## 2. Purpose

In the European Society of Cardiothoracic Surgery 2006 guidelines, the perioperative use of  $\beta$ -Blockers is suggested as the first choice in all patients undergoing CABG, unless otherwise contraindicated. The 2004 ACC/AHA guidelines update on CABG gave a class I recommendation to preoperative or initial postoperative beta blocker therapy in patients without a contraindication [4]. If the patient is on  $\beta$ -Blockers, this must be continued up to the morning of surgery and restarted on the first postoperative day [5]. Our audit objective was to find out any perioperative period in which patient was not on  $\beta$ -Blockers, if there was any, to compare with the standard.

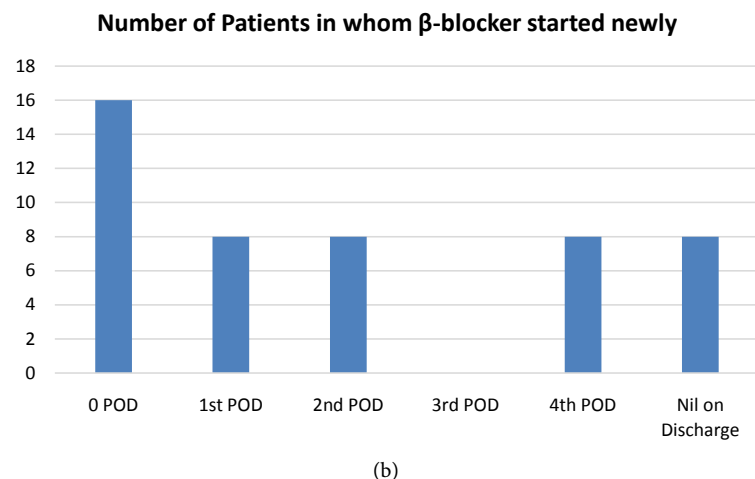
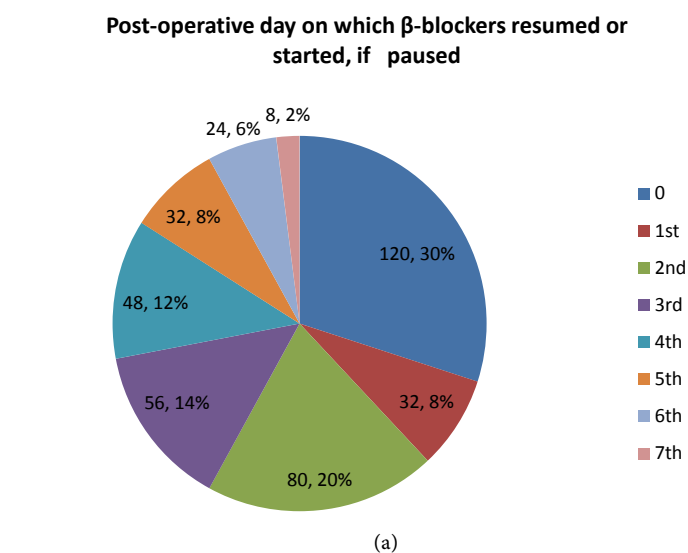
## 3. Patients and Methods

We conducted a retrospective Cohort study. Retrospective data were collected for consecutive 400 patients over 2 years via PICs system (Hospital's internal computer soft wear system for keeping the record of the patients). Patients who underwent isolated CABG were included. Patients who had contraindications to  $\beta$ -blocker therapy like Asthma, Bradycardia (Heart rate < 60 beats/minute), 2nd or 3rd degree heart block or who underwent CABG combined with other cardiac procedure (like valve surgery) were excluded. Consecutive 400 patients treated

with isolated CABG between July 2015 and June 2017 were included and 66 patients were excluded as they had physician-documented contraindications to  $\beta$ -blocker therapy, or underwent CABG combined with valvular or other cardiac surgery [6].

#### 4. Results

According to the standard guidelines all patient undergoing CABG should receive  $\beta$ -blockers on immediate postoperative period, which is within 24 hours.  $\beta$ -Blockers were continued peri-operatively only in 12% patients. However, in 20% patients it was resumed in 1st postoperative day. In 48% patients,  $\beta$ -Blockers were resumed on 2nd postoperative day (Table 1). According to the data (12% + 20%) 32% of the patients met the standard guideline (Figure 1(a)).



**Figure 1.** (a) Pie chart and bar chart showing post-operative day on which  $\beta$ -blockers resumed or started, if paused (NB: 8 patients were excluded from the above chart as they were not treated with beta blocker in the pre-, peri- or post-operative periods). (b) Day beta-blocker commenced post-operatively on those not admitted on a  $\beta$ -blocker (8 patients were discharged without commencing  $\beta$ -blocker).

**Table 1.** Number of patients and the time of their  $\beta$ -blockers commencement.

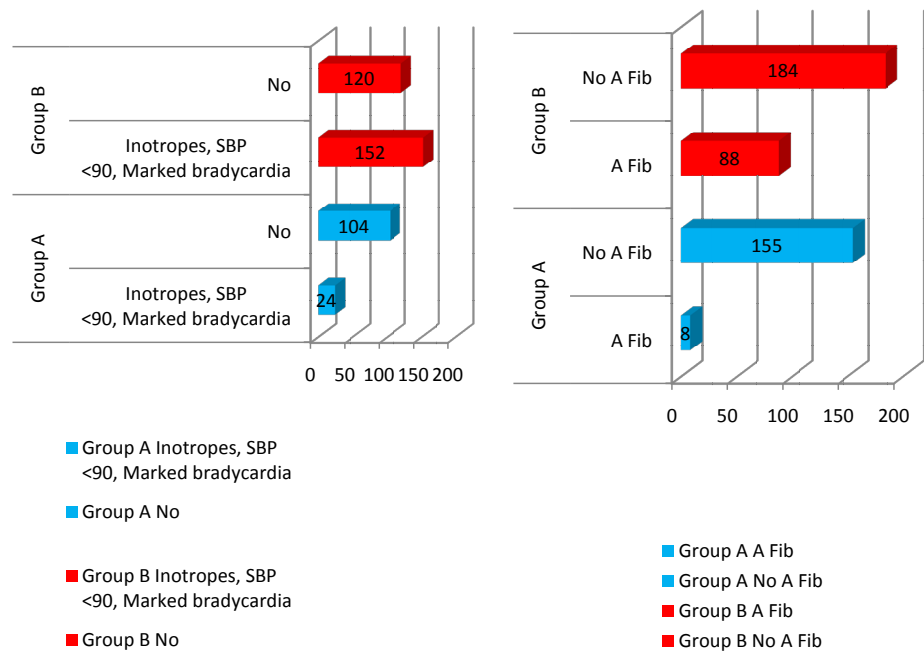
Day on which $\beta$ -blockers (resumed/started, if paused)	Number of patients	Percentage
Continued	48	12%
Restarted 1st POD	80	20%
Restarted 2nd POD	192	48%
Restarted 3rd POD	32	8%
Restarted 4th POD	16	4%
Restarted 5th POD	8	2%
Restarted 6th POD	0	0%
Restarted 7th POD	8	2%
Restarted 8th POD	8	2%
Nil on discharge	8	2%
Total	400	100%

To compare the rate of Atrial fibrillation, we divided the patients into two groups. Group A, who followed the guideline (128 patients) and Group B, who resumed  $\beta$ -Blockers 48 hours onwards (272 patients) (**Figure 2**). In group A, only 8 patients developed postoperative AF whereas in group B 88 patients developed postoperative AF which is also statistically significant ( $P < 0.003$ ).

## 5. Discussion

Pathophysiologic parameters such as the atypical electrophysiological state of the atria, the unequal shortening of the atrial myocytes refractory period and variable conduction speed over the atrial tissue predispose the development of AF. Risk factors of postsurgical AF could be divided into: preoperative, intra-operative and postoperative. Preoperative factors primarily consist of 1) atrial tissue damages due to age, prior rheumatic fever, raised left ventricular diastolic pressure, hypertension and coronary syndromes; 2) heart diseases like left ventricular hypertrophy, left atrium enlargement or history of congestive heart failure; 3) electrolytic imbalance explicitly hypokalemia, hypomagnesemia; 4) hypothyroidism and 5) preoperative usage of digoxin or milrinone. Lastly, obesity, male gender, chronic obstructive pulmonary disease (COPD), tachycardia, prolonged P-wave deviation might also influence AF. While, intra-operative risk factors could be due to increased sympathetic activation from stimulation of catecholamines, reflex sympathetic stimulation after volume loss, anemia, pain, use of adrenergic drug, aortic cross clamping time, early reversal of atrial electrical activity after cardioplegia, bi-caval venous cannulation, left ventricular venting through pulmonary vein and extracorporeal circulation.

Shortening of atrial refractoriness increases AF and prolonging refractoriness reduces AF. Shorter atrial refractory periods seemingly shorten the wavelength (defined by [conduction velocity]  $\times$  [refractory period]) and therefore stabilize the multiple re-entrant wavelets that spread AF. Class IA and class III agents are



**Figure 2.** Bar charts showing different groups and postoperative onset of AF among them. Group A:  $\beta$ -blockers Continued or Started/Restarted on 1st POD (16 Patients). Group B:  $\beta$ -blockers Started/Restarted 2nd POD onwards (34 Patients).

thought to protect against AF by prolonging atrial refractoriness. Even though beta-blockers are not usually observed as membrane stabilizing agents, they may defend against AF by delaying atrial repolarization. Kühlkamp *et al.* mentioned that beta-blockers protect against adrenergically facilitated shortening of the action potential duration which is believed to precipitate and maintain AF.

Several pharmacologic approaches attempt to diminish the incidence of postoperative AF. Overall, most reported studies determine a positive effect with various pharmacologic agents such as  $\beta$ -blocker, amiodarone, calcium blocker, magnesium. Nevertheless, no single agent or combination of particular agents has completely eliminated post cardiac surgery AF. Beta blockers have been an option in the control of ventricular response in AF for several years. Randomized studies have established the superiority of beta-blockers in controlling the ventricular response. Beta-blockers usually have not been considered to be atrial stabilizing agents apart from two distinct situations. First, a small number of patients experience recurrent AF in association with stress or anxiety; these patients might respond well to beta-blockade. Second, and more commonly, the use of beta-blockers for prevention of AF in patients after cardiothoracic surgery, in which AF occurs in approximately 30% of patients. The advantages of the use of beta-blockers are highest in patients who formerly have received beta-blockers, even though a drop in AF is seen also in patients not formerly receiving beta-blockers. The efficacy of beta-blockers in this context likely relates to the raised sympathetic tone present postoperatively.

All known meta-analyses demonstrated that b-blockers significantly reduced

the incidence of POAF. Mainly, Andrews *et al.*, presented that the incidence of post-CABG AF reduced from 34% to 8% in patients received b-blockers. In another meta-analysis of Kowey *et al.*, the reduction in incidence of AF was from 20% to 8%. However, Crystal *et al.* completed the largest meta-analysis based on 27 randomised controlled trials that involved 3,840 patients. Particularly, the control group presented an incidence of AF almost 33%, while markedly patients receiving b-blockers had an incidence of 19%.

According to the ESC guideline August 2009,  $\beta$ -Blockers recommended in patients with recognized ischaemic heart disease or myocardial ischaemia on preoperative testing (IB). According to the EACTS guideline December 2006,  $\beta$ -Blockers should routinely be used as the first option for the prophylaxis of AF in all patients undergoing cardiac surgery, unless otherwise contraindicated (IB). So, those patients who received  $\beta$ -blockers on the day of surgery or the following morning (Continued + Restarted immediately on 1st POD) met the standard guidelines. Thus, according to the data (12% + 20%) 32% of the patients met the standard guideline (**Figure 1(a)**). It can be said that Standards were met partially. To compare the rate of Atrial fibrillation, we divided the patients into two groups. Group A, who followed the guideline (128 patients) and Group B, who resumed  $\beta$ -Blockers 48 hours onwards (272 Patients) (**Figure 2**). In group A, only 8 patients developed postoperative AF whereas in group B 88 patients developed postoperative AF which is also statistically significant ( $P < 0.003$ ).

## 6. Study Limitations

The limitation of this study was that the comorbidities (like COPD) and electrolyte imbalance were not considered as a probable cause of AF because the initial aim was to find the number of the patients who did not receive  $\beta$ -Blockers perioperatively rather than the number of the patients who developed POAF.

## 7. Conclusion

In patients undergoing CABG, the constant usage of  $\beta$ -blockers is associated with a lesser risk of long-term mortality. From the result of our review it can be said that standards were met partially. The number of POAF was significantly higher in the group who did not receive perioperative  $\beta$ -blockes. Attention must also be paid on understanding and improving  $\beta$ -blocker use at perioperative period.

## Recommendation

All patients undergoing CABG should continue  $\beta$ -blockers in the perioperative period to reduce the chance of postoperative atrial fibrillation. Future studies in a larger scale considering other cofounders including COPD and electrolytes imbalance are recommended.

## Conflicts of Interest

The authors report no conflicts of interest in this work.

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