

A Prospective Clinical Audit to Strengthen the Clinical Practices Affecting the Incidence of New-onset Atrial Fibrillation after Off-pump Coronary Artery Bypass Grafting

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ABSTRACT

Introduction: New-onset Atrial Fibrillation (AF) carries significant morbidity and mortality risk for postoperative patients. Clinical practice guidelines aimed at preventing it are beneficial, with protocols in place to prevent deviations from the standard.

Aim: To improve or strengthen the clinical practices that impact the incidence of new-onset AF after off-pump Coronary Artery Bypass Grafting (CABG).

Materials and Methods: The present prospective clinical audit was conducted in the Department of Cardiac Anaesthesiology, Bhanubhai Madhuben Patel Cardiac Centre, Bhaikaka University, Anand, Gujarat, India, from January 2021 to June 2021. Study included 50 consecutive patients undergoing off-pump CABG surgery. The monitored standards included the continuation of beta-blocker therapy in the preoperative period, restarting them in the immediate postoperative period, and maintaining serum potassium (S.K⁺) within the range of 3.5-5.5 mEq/L. The incidence of AF was also noted. The data were analysed using Microsoft Excel.

Results: The audit included a total of 50 patients, with 36 males with a mean age of 58.72 years, and 14 females with a mean age of 60.07 years. Preoperative beta-blocker/Calcium Channel Blocker (CCB) therapy on the day of surgery was administered to 45 (90%) patients, while restarting beta-blockers in the immediate postoperative period was done for 49 (98%) patients. S.K⁺ levels were maintained within the range in 31 (62%) patients. The last standard was reaudited, and compliance was achieved in 39 (78%) patients. New-onset AF occurred in 4 (8%) and 5 (10%) patients in the audit and reaudit samples, respectively.

Conclusion: Clinical audit is a process that helps to identify the lacunae in clinical practices that affect patient outcomes. In the current study, clinical audits have aided in measuring compliance with different clinical practices, as per Institutional protocols. They have also assisted in increasing compliance with clinical practices where measured compliance was below the targeted goal.

Keywords: Arrhythmias, Guideline adherence, Hypokalemia, Morbidity, Standards

INTRODUCTION

Atrial fibrillation is a common arrhythmia occurring in CABG patients during the postoperative period [1-4]. The reported incidence is approximately 35%, varying from 10% to 40% in the literature [1-3]. The peak onset of AF typically occurs on the second or third postoperative day, with an average of 2.4 days after surgery [5,6]. During the perioperative period, it is crucial to avoid hypokalemia and to continue beta-blockers and calcium channel-blockers to prevent new-onset AF. With the aim of improving patient outcomes, this audit was designed to evaluate and reinforce institutional protocols. Additionally, there are very few clinical audits on these practices in the literature [7,8].

The aetiology of AF in such scenarios is multifactorial. Risk factors that increase the incidence of AF after surgery include advanced age, Chronic Obstructive Pulmonary Disease (COPD), poor left ventricular function, withdrawal of β -blocker therapy, intraoperative medications like inotropes, cardiopulmonary bypass, myocardial ischaemia, congestive cardiac failure, electrolyte imbalances especially hypokalemia and hypomagnesemia, among others [5,9].

The occurrence of AF in the postoperative period increases morbidity and mortality in these groups of patients [9,10]. It raises the risk of cerebrovascular complications, renal or respiratory failure, haemodynamic instability, and even cardiac arrest [11-13]. It also prolongs the length of stay and increases the cost of treatment [14,15]. Managing patients with new-onset or existing AF in the perioperative period remains challenging.

O'Brien B et al., published guidelines for the management of perioperative AF in patients undergoing cardiac surgery on behalf of the Society of Cardiovascular Anaesthesiologists (SCA) in collaboration with the European Association of Cardiothoracic Anaesthetists (EACTA) [16]. They recommended continuing β -blockers in the preoperative period to avoid withdrawal and using β -blockers immediately postoperatively (defined as within 24 hours) to prevent postoperative AF in patients undergoing cardiac surgery.

Implementing and adhering to practices that prevent AF in these patient groups is therefore crucial. The present study was aimed to analyse, strengthen, and sustain institutional preventive practices that affect the occurrence of AF in these patients.

MATERIALS AND METHODS

The present prospective audit was conducted in the Department of Cardiac Anaesthesiology, Bhanubhai Madhuben Patel Cardiac Centre, Bhaikaka University, Anand, Gujarat, India, from January 2021 to June 2021. Study was conducted on 50 consecutive patients undergoing off-pump CABG surgery. The reaudit was planned for 50 consecutive patients undergoing off-pump CABG from February 2022 to July 2022 at the same centre. The authors obtained Institutional Ethics Committee approval with letter no. IEC/BU/2023/Ex 27/145/2023. They were granted a "waiver of informed consent" by the IEC following institutional protocols for clinical audits. The sample size was calculated using the calculator available on the National Health Service

(NHS) website for clinical audits. Considering approximately 60 cases of off-pump CABG in a six-month period and a possibility of deviation from the standard protocol of 20%, with an accuracy of 0.05 and a 95% confidence interval, the sample size was determined to be 49. Therefore, the authors decided to conduct the audit on 50 cases.

Inclusion criteria: Any adult patient undergoing off-pump CABG, aged 18-75 years, was included in the audit.

Exclusion criteria: Patients over 75 years of age, those requiring redo surgery, preoperative AF, on-pump CABG, severe left ventricular dysfunction, combined valve plus CABG surgery and patients with heart block were excluded from the study. Out of the 54 patients enrolled, four were excluded as the procedure was converted to on-pump surgery.

Study Procedure

To prevent new-onset postoperative AF, the authors' protocol included the continuation of β -blocker or CCB therapy in the preoperative period, early initiation of either β -blocker or CCB in the postoperative period (defined as within 12 hours of tapering inotropic support), and maintaining serum potassium concentration in the range of 3.5-5.5 mEq/L [16,17]. These were the standards of the authors' audit as shown in [Table/Fig-1]. The Institute's protocol is to use β -blockers for AF prevention. The authors used CCBs in the postoperative period, if a radial arterial graft was used as a conduit or if there was any contraindication for β -blocker therapy. S.K⁺ levels were monitored every four hours on '0' postoperative day and the 1st postoperative day, every six hours on the 2nd postoperative day, and then once daily until discharge. The authors also documented the incidence of AF in the postoperative period until the patient was discharged from the hospital.

S. No.	Standard/Criterion	Target	Exception
1	Continuation of β -blocker on the day of surgery	100%	1. Patients with heart block 2. Patients having bradycardia or hypotension
2	Maintaining S. Potassium in the range of 3.5-5.5 mEq/L perioperatively	80%	None
3	Reinstitution of either β -blocker or CCB in the postoperative period within 12 hours of tapering inotropic support	100%	1. Patients with heart block 2. Patients having bradycardia or hypotension

[Table/Fig-1]: Standards of audit [16,17].

STATISTICAL ANALYSIS

Data collected from 50 patients were analysed using Microsoft Excel to assess compliance with these practices.

RESULTS

Demographic data in the initial audit are observed [Table/Fig-2]. Out of the total study population, 36 (72%) were males with a mean age of 58.72 years, and 14 (28%) were females with a mean age of 60.07 years. The observed adherence to the three preventive practices is shown in [Table/Fig-3]. The results of this table are discussed below in relation to the audited standards and the outcomes obtained.

Standard 1: Continuation of β -blocker in the preoperative period has been recommended to prevent AF [2,14,16]. The patient

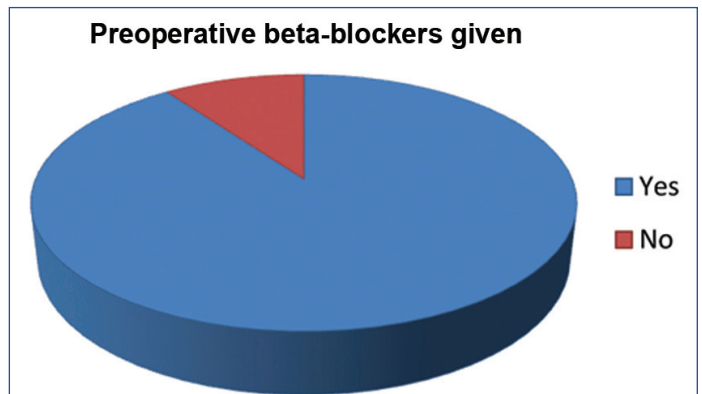
Gender	n (%)	Mean age (years)
Male	36 (72)	58.72
Female	14 (28)	60.07
Total	50	59.1

[Table/Fig-2]: Age and gender distribution of study population.

Audit	Standard 1 (Continuation of β -blocker in preoperative period), n (%)	Standard 2 (Maintaining S. potassium in the range of 3.5-5.5 mEq/L perioperatively), n (%)	Standard 3 (Reinstitution of either β -blocker or CCB in the postoperative period), n (%)	Incidence of new onset AF after surgery
Target	50 (100)	40 (80)	50 (100)	5 (10)
Yes	45 (90)	31 (62)	49 (98)	4 (8)
No	5 (10)	19 (38)	1 (2)	46 (92)

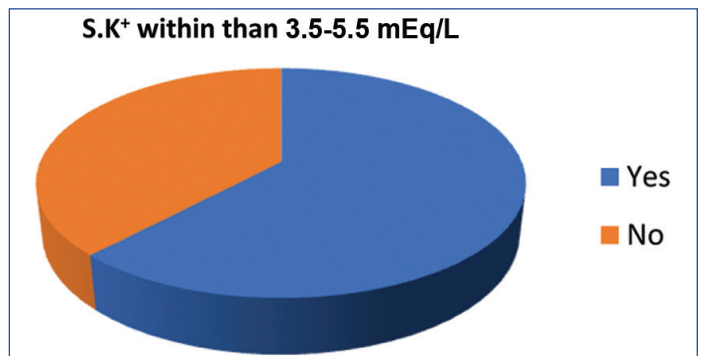
[Table/Fig-3]: Results of audit.

should receive the dose of β -blocker that he or she is on in the immediate preoperative period on the day of surgery. As mentioned in [Table/Fig-3,4], 90% of the patients received it on the day of surgery, while only 10% of patients did not receive it due to either very low heart rate {<60 beats per minute (bpm)} or systolic blood pressure <100 mmHg.



[Table/Fig-4]: Continuation of preoperative beta-blockers.

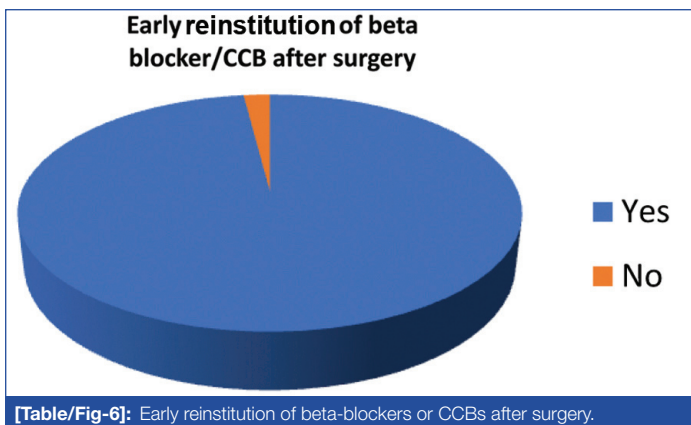
Standard 2: Hypokalaemia increases myocardial irritability and the incidence of arrhythmias. The authors' protocol is to maintain serum potassium levels in the range of 3.5-5.5 mEq/L. According to the audit findings, this level was maintained in 62% of cases, as shown in [Table/Fig-5]. In the remaining cases where it was outside of the range, corrections were made according to the protocol.



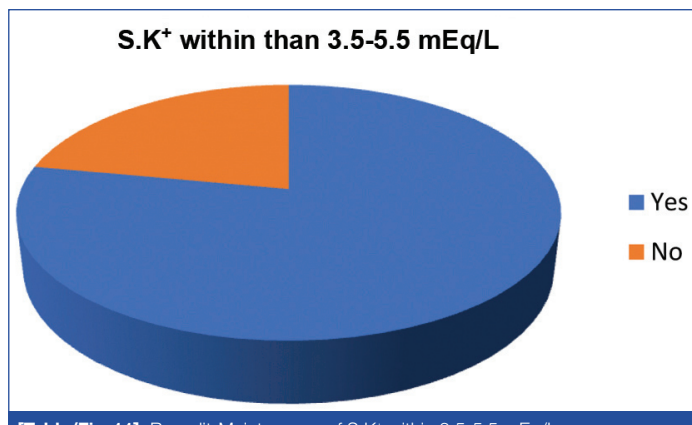
[Table/Fig-5]: Maintenance of S. K⁺ within 3.5-5.5 mEq/L.

Standard 3: Institute has been recommended to restart β -blockers early in the postoperative period in cardiac surgical patients. The authors' Institute has a protocol for restarting either β -blockers or CCB within 12 hours of tapering off inotropic support. This practice was followed in 98% of cases, and it was delayed in 2% of cases, as shown in [Table/Fig-6]. Outcome of Audit (Incidence of Postoperative AF): The incidence of AF in this group of patients was 8%, as shown in [Table/Fig-7].

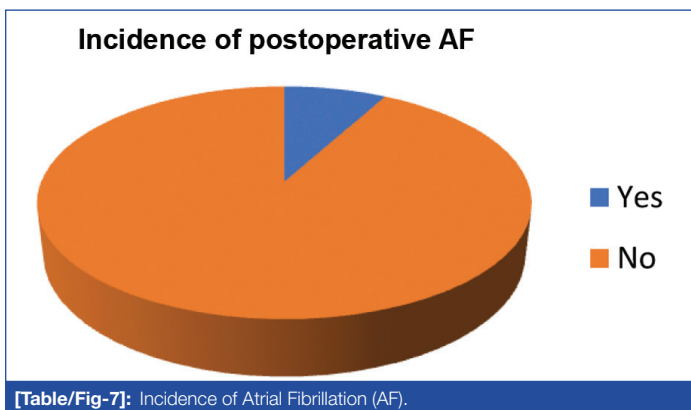
Reaudit: This audit found the compliance of maintaining serum potassium levels in the range of 3.5-5.5 mEq/L (Standard 2) to be 62%, indicating a definite scope for improvement in this standard. The outcomes of the audit were discussed with the healthcare team members, and the importance of avoiding hypokalemia was reinforced. Subsequently, the authors conducted a reaudit to assess adherence to this practice.



[Table/Fig-6]: Early reinstatement of beta-blockers or CCBs after surgery.

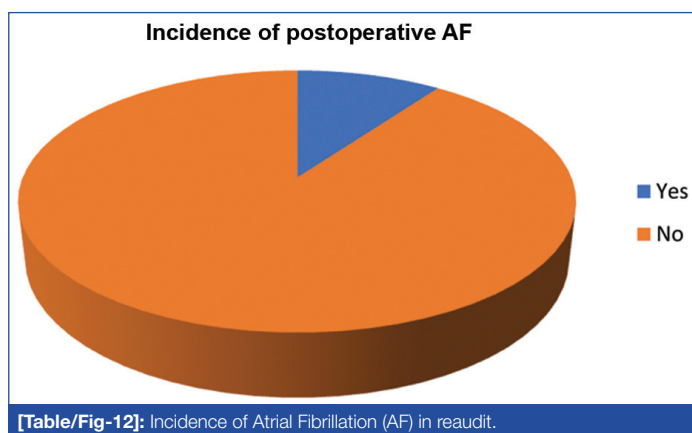


[Table/Fig-11]: Reaudit-Maintenance of S.K+ within 3.5-5.5 mEq/L.



[Table/Fig-7]: Incidence of Atrial Fibrillation (AF).

Outcome: (Incidence of postoperative AF): The incidence of AF in the reaudit was found to be 10%, as shown in [Table/Fig-12].



[Table/Fig-12]: Incidence of Atrial Fibrillation (AF) in reaudit.

The reaudit was a prospective audit of 50 adult patients undergoing CABG surgery at the authors' Institute. As shown in [Table/Fig-8], 66% were males, while the remaining 34% were females. The male patient group had a mean age of 56.9 years, and the female group had a mean age of 59.4 years.

Gender	n (%)	Mean age (years)
Male	33 (66)	56.9
Female	17 (34)	59.4
Total	50 (100)	58.15

[Table/Fig-8]: Age and gender distribution of study population in reaudit.

In the perioperative period, the aim was to maintain S.K+ in the range of 3.5-5.5 mEq/L at all times according to Institutional protocols, as shown in [Table/Fig-9]. Any potassium readings outside of this range were noted as non compliance. Postoperatively, patients were also monitored for the development of AF until discharge from the hospital.

S. No.	Criterion	Target	Exception
1	S. Potassium (S.K+) is maintained in the range of 3.5 to 5.5 mEq/l	80%	None

[Table/Fig-9]: Standards of reaudit.

Results of Reaudit: The compliance with maintaining S.K+ from 3.5 to 5.5 mEq/L was found to be 78%, as shown in [Table/Fig-10,11]. Eleven out of 50 patients (22%) had S.K+ levels outside of the range at some point during the perioperative period. Compared to the previous audit, compliance improved from 62% to 78%, which is close to the set target of 80%.

Reaudit	Standard 2 (S.K+ maintained from 3.5-5.5 mEq/L), n (%)	Outcome (Incidence of postoperative AF), n (%)
Target	40 (80)	2.5 (5)
Yes	39 (78)	5 (10)
No	11 (22)	45 (90)

[Table/Fig-10]: Results of reaudit.

DISCUSSION

Clinical audit is a quality improvement process that assesses ongoing patient care against established standards or criteria. This audit aimed to monitor and evaluate adherence to clinical practices for the prevention of new-onset AF at the authors' centre and identify opportunities for improvement.

Continuation of β -blockers in the preoperative period is a Class I recommendation for preventing AF [14,16]. Omission of preoperative β -blockers has been shown to be associated with an increased risk of postoperative AF by Mathew JP et al., in their study [14]. According to SCA/EACTA guidelines by O'Brien B et al., the continuation of β -blockers in the preoperative period varied from 10-90% of the time [16]. At the authors' centre, 90% of patients undergoing CABG received β -blockers or CCBs in the immediate preoperative period.

The SCA/EACTA guidelines also recommend the immediate postoperative use of β -blockers (within 24 hours), which is a Class I recommendation supported by Level of Evidence A. The rationale behind this recommendation is that AF can be triggered by sympathetic activation or an altered response to adrenergic stimulation. O'Brien B et al., reported that adherence to this recommendation varied from 10% to 90% among different responders [16]. Additionally, Buerge M et al., found a significant correlation between the incidence of new-onset AF and the early initiation/ reinitiation of beta-blockers following cardiac surgery [8]. In their study, 82.7% of patients had postoperative beta-blockers initiated or reintroduced before the use of the care bundle, which increased to 91.3% following the adoption of the care bundle. The authors' Institute has a protocol that mandates starting CCBs or β -blockers within 12 hours of tapering inotropic support, a process followed in 98% of cases in the initial audit.

Hypokalaemia commonly occurs in the perioperative period, with potassium homeostasis playing a crucial role in membrane excitability

[13,17]. Hypokalaemia is believed to contribute to ventricular and supraventricular arrhythmias. However, an analytical study by Lancaster TS et al., found that potassium supplementation did not protect against the occurrence of AF, suggesting weak evidence to support the association [18]. Despite this, the Institutional protocol mandates maintain S.K⁺ in the range of 3.5-5.5 mEq/L in the perioperative period. In 62% of audited instances, serum potassium levels were within the designated range, with corrections made to normalise levels when deviations occurred. Emphasis on the importance of maintaining normal serum potassium levels was reinforced among healthcare team members, with specific attention to potassium correction, especially in cases involving diuretic use.

A planned reaudit indicated that in 78% of cases, serum potassium levels were maintained within the target range, showing increased adherence to the protocol. However, despite this improvement, the incidence of AF in the reaudit remained relatively unchanged. This could be due to the complex aetiology of postoperative AF and the already low incidence of AF in the primary audit.

In both the initial audit and reaudit, the incidence of AF in off-pump CABG cases was 8% and 10%, respectively, significantly lower than the reported incidence of 10-40% [1-3]. This reduced incidence may be due to the off-pump nature of the surgery, as indicated in the study by Ascione R et al., where cardiopulmonary bypass, including cardioplegic arrest, was identified as an independent predictor of postoperative AF [19]. However, randomised trials by Lewicki L et al., and Enc Y et al., refuted the association between on-pump surgery and an increased incidence of AF [20,21]. Administration of β -blockers in the perioperative period has been shown to significantly reduce the rate of new-onset postoperative AF after CABG [22]. The authors' high compliance with perioperative β -blockers administration, exceeding 90%, may have contributed to the lower incidence of AF observed in the authors' audit.

Limitation(s)

There were many other factors that can affect the incidence of AF after off-pump CABG, like advanced age, COPD, congestive heart failure, poor left ventricular function, myocardial ischaemia, and others. Since this was a clinical audit, the causal association of these factors with postoperative AF was not analysed here. Large case-control trials are needed to establish such relationships.

CONCLUSION(S)

This clinical audit conducted in off-pump CABG patients demonstrated that the clinical practice of continuing perioperative beta-blockers or CCBs was satisfactory. The audit and reaudit showed an improvement in the compliance of maintaining serum potassium within the normal range in this patient group. Although the incidence of new-onset postoperative AF after cardiac surgery did not decrease in the reaudit, it remained well below the reported incidence in the literature. The present study highlighted the value of clinical audit as a tool for quality improvement and its role in enhancing clinical practices and outcomes in healthcare. The authors would like to emphasise the routine and repetitive use of clinical audit for sustained improvement in clinical practices.

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- iThenticate Software: Apr 26, 2024 (13%)

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