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What is the exact predictive role of preoperative white blood cell count for new-onset atrial fibrillation following open heart surgery?

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Abstract

Background:

Atrial fibrillation (AF) occurs in 30% patients on the second or third day post operation; therefore, it is the most prevalent and complicated arrhythmia after open heart surgery. White blood cell (WBC) count seems to be most significantly associated with cardiovascular disorders. This study was designed to evaluate the exact relationship between preoperative WBC count and post-Coronary artery bypass graft (CABG) AF in patients with severe left ventricle (LV) dysfunction who underwent elective off-pump coronary artery bypass.

Methods:

This study was conducted on 104 patients from among 400 patients with severe LV dysfunction undergoing elective off-pump CABG surgery from February 2011 to February 2012, in Afshar Cardiovascular Center, Yazd, Iran. Patients with emergency surgery, unstable angina creatinine higher than 2.0 mg/dL, malignancy, or immunosuppressive disease were excluded. Preoperative serological tests of the participants, such as WBC counts, were saved in their medical dossiers. Of the 400 patients undergoing CABG, AF was found in 54 cases; these 54 male patients formed the experimental group and 60 other patients in the intensive care unit (ICU) and hospital stay without postoperative AF were part of the control group.

Results:

The average age of the patients was 68.5±12.8 years. WBC counts in patients with and without AF three days before surgery were 12,340±155 and 8,950±170, respectively. On surgical day, WBC counts in the patients with and without AF were 13,188±140 and 9,145±255, respectively (*P* value three days before surgery: 0.04; *P* value on surgical day: 0.01). Of the 54 male patients with postoperative AF (POAF), duration of AF was more in cases with elevated WBC count (12,000-14,000) than in those with lower elevated WBC count (10,000-12,000) (]*P*=0.025), but there was no relationship between frequency of recurrence of AF and grading of elevation of WBC count (]*P*=0.81).

Conclusion:

These findings show that three days before surgery and on surgery day, there was a difference in WBC count between both groups. So, preoperative WBC count may predict the incidence and duration of AF; however, it cannot be a predictor of the frequency of recurrence of AF. Finally, WBC count is an independent marker for POAF and duration of AF.

Keywords: *Atrial fibrillation*, *elective off-pump coronary artery bypass graft*, *white blood cell count*

INTRODUCTION

Coronary artery bypass graft (CABG) surgery without cardiopulmonary bypass is among the most common operations in the world. Atrial fibrillation (AF) occurs in 30% patients on the second or third day post operation; therefore, it is the most prevalent and complicated arrhythmia after open heart surgery. Advanced age, male sex, low ejection fraction (EF), and postoperative pericarditis are the important factors leading to postoperative arrhythmia and early complications. Postoperative AF may increase morbidities after discharge from hospital including hemodynamic instability, hypertension, pulmonary edema, heart failure, as well as increase in cost of therapy.[1–3]

Inflammation may play a role in the increase in myocardial injury and organ failure. Several studies have indicated that inflammatory markers are present in different stages of cardiovascular disease, and may be predictors for coronary events. White blood cell (WBC) count seems to be most significantly associated with cardiovascular disorders. Elevation of preoperative WBC count is associated with stroke in patients undergoing cardiac surgery.[4] Early incidence, duration, and recurrence of AF after elective off-pump coronary bypass surgery, which are associated with preoperative levels of WBC count are not clearly known. This study was designed to characterize the predicting role of preoperative WBC count in occurrence, duration, and frequency of recurrence of AF after off-pump CABG in male patients with severe left ventricle (LV) dysfunction.

METHODS

This prospective cross-sectional study was approved by the regional committee of our university. After submitting written consent, patients (n=400) elected for off-pump CABG surgery in the Afshar Cardiovascular Center, Yazd, Iran between February 2011 and February 2012. All the operations were performed by a certain surgical team. Four hundred male patients with severe LF dysfunction (EF <30%) undergoing elective off-pump CABG were monitored for five days after surgery. Preoperative serological tests of the participants, such as WBC counts, were saved in their medical dossiers. Of the 400 patients undergoing CABG, AF was found in 54 cases; these 54 male patients formed the experimental group and 60 other patients without postoperative AF in ICU and hospital stay were part of the control group. Matching was based on age and confounding variables in our study in both groups. The patients with unstable angina, creatinine level higher than 2.0 mg/dL, emergency surgery, malignancy, or immunosuppressive disease were excluded from the study. The demographic variables and early postoperative complications such as occurrence, duration, and frequency of recurrence of AF and preoperative WBC counts were recorded. All patients underwent Holter monitoring during their hospital stay, after ICU discharge. Our data were analyzed by SPSS15 software. We used analysis of variance (ANOVA) and Chi-square for quantitative and qualitative variables.

RESULTS

Fifty-four male patients with severe LF dysfunction suffering from AF after off-pump CABG were the AF group and 60 male patients with severe LV dysfunction without postoperative AF five days after surgery in the control group were monitored during hospital stay. The average age of the patients was 68.5±12.8 years. The prevalence of risk factors was hypertension (47%), HLP (26%), and cigarette smoking (23%). In the AF group, overall duration and frequency of recurrence of AF were 1,720±1,008 and 3.3±1.4 minutes, respectively. In patients with postoperative AF, there were 0 cases (0%) with one-vessel, seven cases (12.9%) with two-vessel, and 37 cases (68.5%) with three-vessel disease, and 10 cases (18.5%) suffering from left main artery disease. In the control group, there were three case (5%) with one-vessel, 14 cases (23.3%) with two-vessel, and 39 cases (65%) with three-vessel, and four cases (6.6%) suffering from left main artery disease. WBC counts in patients with and without AF three days before surgery were 12340±155 and 8950±170, respectively. On surgical day, WBC counts in patients with and without AF were 13188±140 and 9145±255, respectively (P value three days before surgery: 0.04, P value on surgical day: 0.01) Of the 54 male patients with postoperative AF (POAF), duration of AF was more in cases with a higher elevated WBC count (12,000-14,000) rather than lower elevated WBC count (10,000-12,000)

(*P*=0.025) but there was no relationship between frequency of recurrence of AF and grading of elevation (more: 12,000-14,000; lower: 10,000-12,000) of WBC count (*P*=0.81) [Table 1]. These findings show that three days before surgery and on the surgical day, there was a difference in the WBC count between the two groups. So, preoperative WBC count may predict incidence and duration of AF; however, it cannot be a predictor of frequency of recurrence of AF.

DISCUSSION

AF is one of the most common arrhythmias after cardiac surgery. AF following CABG is an important cause of morbidity and mortality among patients.[2,3] Occurrence of postoperative AF is related to the type of surgical operation as well as the procedure and duration of postoperative management and monitoring. The prevalence, duration, and frequency of recurrence of AF in our study was lower compared with similar studies which was most likely due to appropriate care before the operation and good protection of the myocardium during the operation. Inflammatory reactions may have an association with coronary artery disease. Several studies have indicated that WBC count may be a predictor for poor prognosis in patients undergoing cardiac or noncardiac surgery. This study was designed to evaluate the association of WBC count before surgery with the occurrence, duration, and frequency of recurrence of AF during hospital stay in male patients with severe LV dysfunction undergoing elective off-pump CABG. Our findings show that three days before surgery and on the surgical day, there were differences in WBC count between the two groups. So, preoperative WBC count may predict incidence and duration of AF; however, it cannot be a predictor of the frequency of recurrence of AF. Rienstra *et al*., in a study resulting from the Framingham Heart Study reported that the median WBC count was 6.4 × 10 (9)/L (25^{th} to 75^{th} percentile: 5.6 × 10 (9)/L to 7.8 × 10 (9)/L). At a follow-up after five years, 82 participants (9%) suffered from new AF. Elevated WBC count was related to incident AF significantly. They opined that in the community-based sample, increase in WBC count was associated with incidences of AF during five years of follow-up.[5] This study was in line with our findings; however, our results indicate that WBC count was not associated with frequency of reccurrence of AF. A study carried out by Fontes ML *et al*. reported that in 60 patients more than 60 years of age undergoing elective on-pump coronary artery bypass surgery, a twofold higher WBC count before surgery was associated with a sevenfold higher incidence of AF; therefore, preoperative leukocytosis may be a strong predictor of AF following myocardial revascularization surgery without cardiopulmonary bypass.[6] These findings also were in line with our study in some aspects such as incidence and duration of AF but not frequency of reccurrence of AF. Another study conducted by Lamm *et al*. indicated that there is a significant relationship between WBC count and AF after surgery.[7] These findings provide evidence to support the association between postoperative AF and inflammatory response. A study by Amar *et al*. has shown that patients with preoperative leukocytosis undergoing elective lobectomy, pneumonectomy, or esophagectomy suffered from AF more than patients without leukocytosis before surgery.[8] A study carried out by Letsas *et al*. about the recurrence of AF following pulmonary vein isolation indicated that inflammatory markers such as WBC count and high-sensitivity C-reactive protein were significantly associated with the recurrence of AF.[9] This result was contradictory to our findings. Our findings about the relationship between preoperative leukocytosis and frequency of recurrence of AF were contrary to other studies; perhaps this is the result of the selection of one gender or type of surgical procedure. WBC count is an independent marker for POAF and duration of AF. Finally, we conclude that preoperative elevated WBC count can predict the incidence and duration of postoperative AF, but it may not be a predictor for the frequency of recurrence of AF in male patients with severe LV dysfunction undergoing elective off-pump CABG.

Footnotes

Source of Support: Nil

Conflict of Interest: None declared

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Figures and Tables

Table 1

Variables	AF group	Control group	*P* value
WBC count (3 days before surgery)	12340±155	8950±170	0.04
WBC count (surgical day)	13188±140	9145±255	0.01

WBC - White blood cell; AF - Atrial fibrillation

Preoperative WBC count in both groups