

## Effect of Preoperative Anemia on Short Term Clinical Outcomes in Diabetic Patients after Elective Off-Pump CABG Surgery

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**Abstract-** Diabetic mellitus (DM) is a major risk factor of morbidity, mortality and economic cost to society. Diabetic patients are at risk of having microvascular or macrovascular disorders of diabetes. Postoperative anemia have wide spectrum of some early complications that require more care in hospitalization stays. Therefore, this study was designed to evaluate effect of preoperative anemia on short-term clinical outcomes in diabetic patients undergoing elective off-pump CABG. This study conducted on 86 diabetic patients underwent elective off-pump CABG surgery from August to October 2011, in Afshar Cardiovascular Center, Yazd, Iran. The patients had hemoglobin concentration between 10-12 mg/dl, patients with preoperative atrial fibrillation and renal and respiratory dysfunction were excluded from this study. Participants were randomly assigned into two groups; the normal group (n=42) that had hemoglobin concentration ~ 12-15 g/dl and the anemic group (n=44) had hemoglobin concentration~7-10 g/dl. We evaluated post-CABG variables including incidence of atrial fibrillation and early morbidity such as infection, vomiting, renal and respiratory dysfunctions, ICU or hospital stay and early mortality. Data were analyzed by ANOVA, Chi-square and Fisher's exact test for quantitative and qualitative variables. The mean age of the patients was 52.51±6.9 years, from all of patients 64 cases (74.4%) were male and 22 cases (44.5.6%) were female. Postoperative atrial fibrillation was observed in 17 cases (19.8%), 7 cases (16.7%) of whom were in normal group and 10 cases (22.7%) of whom were in anemia group. anemia could significantly increase hospital stay ( $P=0.0001$ ) but no ICU stay. Preoperative anemia did not affect the incidence of atrial fibrillation and early complications and mortality in patients undergoing off-pump CABG. However, anemia could increase postoperative hospital stay and renal dysfunction significantly.

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**Keywords:** Anemia; CABG Outcomes; Diabetic mellitus; Elective off-pump

### Introduction

Diabetic mellitus (DM) is one of the most important risk factor of morbidity, mortality and economic cost to society. Diabetic patients may experience microvascular and macrovascular disorders of diabetes (1-3). Common complications of diabetes are renal failure, blindness, amputation, stroke and coronary artery disease. DM can increase induction of atherosclerotic plaques in main arteries of heart that require coronary artery bypass graft (CABG) surgery (2,3). CABG is one of the most common surgeries in diabetic patients in the world. Complications following CABG are including: atrial fibrillation, infections, organ dysfunctions, bleeding, vomiting, neurological disorders

and increased ICU and hospital stay. Postoperative bleeding can be a reason for anemia and low hemoglobin. Patients with postoperative anemia have wide spectrum of some early complications that require more care in hospitalization stays. Patients with anemia need red blood cell (RBC) transfusion in preoperation. Without RBC transfusion, patients have insufficient hemoglobin to resistance dilution of the blood during bleeding around major surgery (4-6). According to probable complications of anemia in patients undergoing CABG especially patients with diabetic mellitus, this study was designed to evaluate the effect of anemia on short term outcomes in diabetic patients after elective off-pump CABG.

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## Materials and Methods

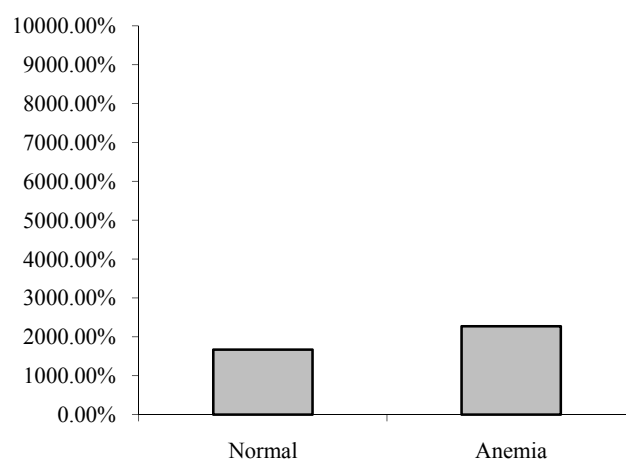
Our study was approved by regional committee in our university. After receiving the written consent from patients (n=86), they participated voluntarily for off-pump CABG surgery in Afshar Cardiovascular Center of Yazd from August to October 2011. All of the operations were performed by a certain surgical team. The patients that suffered from diabetic mellitus and were candidate for elective off-pump CABG were enrolled to the study. The patients had hemoglobin concentration between 10-12 mg/dl, patients with preoperative atrial fibrillation and renal and respiratory dysfunction were excluded from the study. 86 diabetic patients were enrolled and were randomly assigned into two groups; the normal group (n=42) that had hemoglobin concentration ~ 12-15 g/dl and the anemic group (n=44) had hemoglobin concentration~7-10 g/dl. Elective off-pump CABG; After adequate exposure and stabilization, the target vessel was exposed and snared above the anastomosed site with a 4-0 prolene suture and a soft plastic snigger to prevent coronary injury. The coronary artery was then opened and anastomosis was performed. Visualization was enhanced by utilizing, surgical blower humidifier. As premedication all the patients received morphine (10-15 mg) and oral diazepam (10mg) 30-60 minutes before introduction into the theatre. Induction of anesthesia was performed through diazepam (20 mg), fentanyl (10-15 µg/kg) and pavlon (0.1mg/kg). In order to keep on anesthetic state, fentanyl (4-5 µg/kg/h) and pavlon (0.3-0.4 mg/kg/h) were used. The demographic variables and preoperative hemoglobin concentration were recorded. Our data were analyzed by SPSS15 software. We used ANOVA, Chi-square and Fisher's exact test for quantitative and qualitative variables.

## Results

86 patients with diabetic mellitus were enrolled in this study as possible candidates for CABG surgery. Of those, 64 cases (74.4%) were male and 22 cases (44.5.6%) were female. The demographic characteristics for our patients have been presented in Table 1. Of all the participants, postoperative atrial fibrillation was observed in 17 cases (19.8%), 7 cases (16.7%) of whom were in normal group and 10 cases (22.7%) of whom were in anemia group. (Figure 2) There was no significant difference between both groups about incidence of atrial fibrillation after surgery. (0.48) there

was not a significant relationship between sex and atrial fibrillation after CABG. The participants were divided into two age groups; less than 55 years old and above 55 years old. Postoperative atrial fibrillation occurred in 10 cases (21.3%) out of 44 with less than 50 years of age while this occurred in 7 cases (17.9%) out of 39 equal or over 50 years. In our patients, the significant stenosis of one, two, three and left main coronary disease were observed in 2 (2.3%), 16 (18.6%), 47 (54.7%) and 21 (24.4%) cases respectively. There were 0 cases (0%) with atrial fibrillation with single vessel, 2 cases (12.5%) with two vessels and 8 cases (17%) of atrial fibrillation with three vessels disease and 7 cases (33.3%) in those participants suffering from left main coronary artery disease.

Early post-operative complications are compared between both groups has been saved in Table 2. Postoperative renal dysfunction observed in 15 cases (17.4%) of all patients, 12 cases of whom (27.2%) were in anemia group and 3 cases (7.1%) were in normal group (0.04). There was significant difference between both groups. Hospital stay in anemic patients was 6.04±0.96 days while this number for the other group was 7.3±1.5 days. Additionally, ICU stay duration was 2.1±0.32 days for the anemia group compared to the other group: 2.1±0.35 days. Therefore, anemia could significantly increase hospital stay ( $P=0.0001$ ) but not ICU stay ( $P=0.689$ ). Early mortality after the operation occurred in 2 cases (2.3%) in hospital; one case (2.27%) in the anemia group and one cases (2.23%) in the normal group (Table 2).



**Figure 1.** Incidence of atrial fibrillation after off-pump CABG in two groups.

**Table 1.** Demographic characteristics of both groups.

Variables	Normal (n=42)	Anemia (n=44)	P-value
Age (year)	52.6±7.02	52.3±7.04	0.86
Sex (M/F)(n)	30/12	34/10	0.53
HB	13.3 ±0.57	8.5±0.73	0.0001
HTN [n (%)]	17 (40.5)	18 (40.9)	0.96
HLP [ n(%)]	19 (45.2)	21 (47.7)	0.81
Cigarette smoking [n(%)]	11 (26.2)	10 (22.7)	0.70
Addiction [n(%)]	6 (14.3)	6 (13.6)	0.93
COPD [n(%)]	13 (32)	10 (22.7)	0.38

**Table 2.** POAF and early complications after operation in both groups.

Variables	Normal	Anemia	P-value
POAF [n (%)]	7 (16.7)	10 (22.7)	0.48
Infection [n (%)]	11 (26.2)	13 (29.5)	0.72
GI dysfunction [n (%)]	9 (21.4)	6 (13.6)	0.34
Vomiting [n (%)]	11 (26.2)	13 (29.5)	0.72
Loss appetite [n (%)]	15 (35.7)	13 (29.5)	0.54
Renal dysfunction [n (%)]	3 (7.1)	12 (27.2)	0.04
Respiratory dysfunction [n (%)]	8 (19)	13 (29.5)	0.25
Mortality [n (%)]	1 (2.23)	1 (2.27)	1.000
ICU stay (days)	2.14 ± 0.35	2.1 ± 0.32	0.68
Hospital stay (days)	6.04 ± 0.96	7.31 ± 1.5	0.0001

## Discussion

Coronary artery bypass graft (CABG) is the most common cardiac surgery compare to other surgical procedures that has postoperative early and late complications. Of all them atrial fibrillation is one of the most prevalent arrhythmia after cardiac surgery (7). Early complications following CABG are important reason of morbidity among patients. Postoperative complications are related to the patients' characteristics and history of previous disease such as diabetic mellitus. Several studies indicated that preoperative anemia may correlate to long term mortality after vascular surgery (2,7). In this study we wondered if preoperative anemia in diabetic patients can aggravate morbidity and mortality after coronary bypass surgery.

In a study conducted by Lazar *et al.* about effect of forceful (90-120 mg/dl) versus moderate (12-180 mg/dl) glycemic control on postoperative morbidity and mortality in diabetic patients undergoing CABG, indicated that forceful glycemic control does not result in significant improvement in overall early complication following CABG (8). In a study done by Székely *et al.* indicated hyperglycemic before surgery was associated

with increased mortality during hospitalization stay in patients without diabetic mellitus after CABG. In diabetic patients, hyperglycemic was not associated with mortality (9). A study carried out by Lingman *et al.* reported that addition of diabetes with hypertension had negative effects on outcomes after percutaneous coronary intervention (PCI) (10).

Diabetic patients undergoing non-cardiac surgery may experience postoperative incidence of organ dysfunction. In a study conducted by Jackson *et al.* on the relationship between hyperglycemic with morbidity and mortality after colectomy for cancer, indicated that even mild hyperglycemic was associated with significant adverse outcomes following surgery (11). Regarding that diabetic patients are high risk category of patient's candidate for cardiac surgery, we selected diabetic patients that were enrolled in our study.

Boening *et al.* performed a study about relationship between preoperative anemia with outcomes after CABG (12). They found that there was a significant relationship between anemia and adverse outcomes. The early mortality of anemic patients (12.9%) was statistically more ( $P<0.001$ ) than the mortality of normal patients (2.2%) (12). In another study Kurek *et al.*

## Clinical outcome of diabetic patients after CABG

indicated that anemia in high risk patients with acute myocardial infarction undergoing percutaneous coronary intervention was associated with elevated early and late mortality. However, high incidences of complications were observed in patients with multivessel disease and incomplete revascularization. In our study, mortality in ICU or hospital stay after off-pump CABG was similar between anemia and non-anemia groups (13). Dunkelgrun *et al.* reported that the presence and severity of preoperative anemia in vascular patients are significant predictors of 30-day and 5-year cardiac events, regardless of underlying heart failure or renal disease. (14). Spence *et al.* reported that bleeding and anemia could enhance some morbidities and some procedure that can stop bleeding or improve anemia, can reduce morbidity after surgery (15). In our study, renal dysfunction and hospital stay in diabetic patients with anemia were higher than diabetic patients without anemia. Finally, we conclude that preoperative anemia in combination with diabetic mellitus could increase renal dysfunction and hospital stay following coronary bypass surgery; however, postoperative atrial fibrillation, early complications, ICU stay and mortality were similar in anemic and non-anemic patients.

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