Quantitative Comparison of Blood and Blood Products Requirement between Two Groups with and without Auto-transfusion following Coronary Artery Bypass Grafting Surgery

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Abstract: The objective of this study was to assess the effectiveness of auto-transfusion in reducing need to blood products transfusion after open-heart surgery. **Design:** A randomized, controlled, double-blind, prospective study. **Setting:** An academic, tertiary and referral hospital. **Participants:** One hundred male patients scheduled for coronary artery bypass grafting surgery. **Interventions:** Patients divided in two equal groups. In group (A) Donated 500ml of patient`s blood after induction of general anesthesia and saved at room temperature and transfused it to patient at the end of surgery. The control group (Group C) received the same anesthesia method and surgery without any transfusion. **Measurements and Main Results:** In the group (A) need to transfusion of packed cell, FFP and platelet significantly decreased in compare with group (C). **Conclusions:** Saving the patient's blood and auto-transfusion will improve hemostasis after CABG surgery.
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Key words: Transfusion, CABG, Platelet, FF

1. Introduction

Despite improvement of surgery and cardiopulmonary methods in open-heart surgery, nonsurgical bleeding is still of serious complications after this kind of operation. Coagulation abnormalities that are created during cardiopulmonary bypass surgery is often multifactorial and because of a set of factors such as Fibrinolysis, Platelet dysfunction, inadequate reversal of heparin and Coagulopathy induced by blood exposure to artificial surfaces of bypass machine.(1,2)

In some studies the incidence of life threatening bleeding after open-heart surgeries are between 5-25%.(3) Moreover after adult open-heart surgery reopening for bleeding is required in 2-7 % of patients, being associated with increased rates of morbidity and mortality(~10%) (4,5); Although in about 50-80% reopening causes there were no specific source of bleeding would be found(6).

The increasing in bleeding tendency during open-heart surgery will cause augment in blood and its products usage after surgery and subsequently increase side effects of transfusion such as transmission of infectious diseases, suppression of immune system and hemolytic or non-hemolytic reactions (7, 8).

In order to decrease in blood transfusion after open-heart surgery a great number of techniques such as auto-transfusion, hem dilution and anti-fibrinolytic drugs has been used. Auto-transfusion means taking patient's blood before surgery; replace

it by isotonic fluids and finally take it back to the patient at the end of operation (9, 10, 11, and 12). In order to clarifying auto-transfusion benefits and ambiguities, this study has been designed.

2. Methods

After approval by the institutional ethics committee of our university, the male patients candidate for coronary artery bypass grafting by cardiopulmonary bypass method (open-heart), enrolled in a period of six months for our study. Inclusion criteria were male gender, being elective surgery, being first open-heart surgery, age <70 years old, ejection fraction (E.F.) > 35% and body mass index (B.M.I.) <24.

In this study exclusion criteria were involving left main coronary artery stenosis, Hb (hemoglobin) <12 g/dL, Platelet<100,000 µl, taking antiplatelet drugs like clopidogrel in last 9 days and pervious hemostatic disorders.

Patients randomly divided into two groups; Auto-transfusion group (Group A) underwent general anesthesia and before taking heparin, in sterile situation donated 500ml blood from central line by standard routine blood bag containing CPD(Citrate, Phosphate, Dextrose) and at the same time replaced it with ringer lactate solutions in proportion 3:1(ringer / blood) . The blood would save in the room temperature for preservation of platelet in the saved blood and take back to the patient after administrating Protamine sulfate at the end of operation. Control group (Group C) underwent the same induction of general anesthesia and the same surgery without donating blood and transfusion during surgery.

The surgeon and surgery team were the same and core body temperature during surgery was 30-32 centigrade.

The study data were expressed as mean ± standard deviation for the quantitative variables percentages for the categorical variables. The parametric data of the patients were compared using the student t-test for the continuous variables and the chi-square test for the categorical variables. A P-value < 0.05 was considered significant.

3. Results

Each of the both groups contained 50 male patients. Mean volume of used packed cells in the group C (control group) was 1.48±1.07 liter and at group A (auto-transfusion group) 0.4±0.67 liter (table 1). Mean volume of used FFP at group C was 2.02±2.34 liter and at the group A 0.82±1.67 liter (table 2). Mean volume of used platelet at group C was 0.76±2.046 liter and at group A zero (table 3). Group A significantly taking less packed cell, FFP and platelet in compare with group C. (P-Value < 0.05)

4. Discussion

In our study transfusion of packed cell, FFP and platelet to the patients decreased significantly in auto-transfusion group.

In Marberg and colleagues study, bleeding rate during 12 hours after open-heart surgery and need to blood products had no significant differences between two groups; which is different with our study. In Schmidtz and colleagues study, auto-transfusion decreased blood transfusion approximately 50%; which is significant and justifiable with our results.

Although in our study transfusion of all blood products reduced in the group (A) but the main point is reduction in platelet transfusion in this group; That it shows platelets may be more prone to damage during cardiopulmonary bypass. Each unit of fresh saved blood is equivalent about ten units of platelets; which it can effectively help to hemostasis. This research determined that auto-transfusion improves hemostatic performance and suggest that this method may be better for control of hemostasis during cardiopulmonary bypass surgery.

Table1. Descriptive statistics for received packed cells between two groups

Group	N	Mean	SD	T	df	P-value
Control	50	1.48	1.07	6.034	82.144	**<0.001**
Auto-transfusion	50	0.4	0.67			

Note: N=number, SD=standard deviation, T=t-test value, df =degrees of freedom, L=liter

Table2. Descriptive statistics for received fresh frozen plasma between two groups

Group	N	Mean	SD	T	df	P-value
Control	50	2.02	2.34	2.947	88.69	**0.004**
Auto-transfusion	50	0.82	1.67			

Table3. Descriptive statistics for received platelets between two groups

Group	N	Mean	SD	T	df	P-value
Control	50	0.76	2.046	2.627	49	0.011
Auto-transfusion	50	0.000	0.000			

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