

PROPHYLACTIC TRANEXAMIC ACID VERSUS AUTOLOGOUS BLOOD TRANSFUSION TO REDUCE BLEEDING IN ELECTIVE CORONARY BYPASS GRAFT SURGERY.

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Abstract

Many blood conservation strategies were developed in the past decades to reduce risk of bleeding and the need for blood products among patients undergoing cardiac surgeries. This study was conducted to define the benefit of reinfusion of preoperative collected autologous blood in reduction of the risk of bleeding and the need for blood and blood products in comparison with tranexamic acid.

This single centre single-blinded, randomized study was conducted in Erbil cardiac centre during the period from 1st of November 2018 to 30th of April 2019. A total of 150 patients were divided into three groups with 50 patients for each. The 1st group received nothing, the 2nd group received initially infusion of 200mg/hr of tranexamic acid until reaching 1.5gm/hr, and the 3rd group received one pint of preoperative auto-transfused whole blood. Data on risk of bleeding and the need for blood and blood products were collected using special questionnaire prepared for the reason of this study and were analyzed using appropriate statistical tests.

Patients receiving autologous blood showed lower chest tube drainage than the other study groups with a p value of <0.001. Similarly the need for blood and blood products intra or postoperatively was significantly lower among patients receiving autologous blood with p value of <0.001. Therefore, the risk of intra and postoperative bleeding was significantly lower among those receiving autologous blood when compared to other study groups.

In conclusion, reinfusion of one pint of preoperative collected autologous blood is higher than tranexamic acid in reducing the risk of postoperative bleeding and the need for blood and blood products among patients undergoing cardiac surgery.

Keywords: Autologous, tranexamic acid, bleeding, cardiac surgery, Coronary bypass.

Introduction

One of the major complications that threaten the life of patients during and after cardiac surgery is bleeding¹⁻³. Reducing the risk of bleeding and the need for blood products remains the main concern among cardiac surgeons during preoperative period⁴. To achieve this goal, many blood conservation strategies were developed in the past decades^{4,5}. Among these different strategies, antifibrinolytic drugs were used in open cardiac operations⁵, of these drugs, tranexamic acid was the more potent antifibrinolytic drug that achieve

sufficient reduction in the risk of bleeding and the need for blood products⁵. However, due to safety concerns, tranexamic acid use in cardiac surgery remains underutilized and controversial^{6,7}. On the other hand, autologous blood transfusion as another strategy provides reduction in the need for blood products and improves the coagulation process during cardiac surgery. This procedure is simply including preoperative collection of patient own blood and reusing it during or after cardiac operation⁸. The main

advantages of this procedure are elimination of infection risk (viral hepatitis, cytomegalovirus, HIV) and alloimmunization, lack of Rh incompatibility, preserving immune system, keeping the integrity of RBCs, platelets and clotting factors, and preventing transfusion related lung injuries associated with homologous blood transfusion^{9,10}. On the other hand, some disadvantages of this procedure were also reported including wastage of collected autologous blood if not used during operation, subjecting the patient to preoperative anaemia, risk of ABO incompatibility are not eliminated, and risk of bacterial contamination during post blood collection period is not reduced⁸. In the recent years, gradual attention on the use of autologous blood transfusion on patients undergoing cardiac surgery has been attracted clinicians due to increasing problem of blood safety and blood bank shortage¹¹.

This study was conducted to define the benefit of reinfusion of preoperative donated semi-autologous blood in reduction of the risk of bleeding and the need for blood and blood products in comparison with tranexamic acid.

Patients and Methods

This single centre, single-blinded, randomized prospective comparative study was conducted in Erbil cardiac centre during the period from 1st of November 2018 to 30th of April 2019.

A total of 150 patients younger than 80 years of age undergoing first time elective coronary artery bypass graft (CABG) at Erbil cardiac centre were enrolled in this study.

Patients with weight more than 100kg, having uncontrolled hyper or hypotension, congestive cardiac failure, atrioventricular or left bundle branch

block, or a pacemaker in-situ, patients with valvular heart disease, previous CABG surgery, misuse of alcohol or drugs, severe hepatic or renal insufficiency were excluded from this study.

The included patients were divided into three groups with 50 patients for each. Patients in the 1st group received nothing, patients in the 2nd group received initially an infusion of 200mg/hr of tranexamic acid until reaching 1.5gm/hr, and patients in the 3rd group received one pint of preoperative collected auto-transfused whole blood. This blood was collected from the same patient just before starting surgery.

Patients data were selected using special questionnaire prepared for the reason of this study. Variables including demographic (name, age, gender), history of chronic diseases (hypertension, diabetes mellitus, chronic obstructive pulmonary diseases), lipid profile, chest tube drain at operation room and intensive care unit during 1st and 2nd 24 hrs post operatively.

Data were analyzed by using the Statistical Package for Social Sciences (SPSS) version 23. Descriptive statistics are presented as mean±standard deviation, frequencies and percentages. Multiple contingency tables were conducted and appropriate statistical tests were performed, Chi-square was used for categorical variables, analysis of variance (ANOVA) was used to compare between means of the different study groups.

Results

Significant differences (P Value=0.009, <0.05) was found among the three study groups in term of hypertension which was significantly lower among group B & C than group A. No significant differences in remaining patients characteristics were reported, as shown in Table I.

Table I: Patients characteristics among the three study groups.

		Placebo Group	Tranexamic Group	Autologous Group	P value
Age (Mean \pm SD)		65.54 \pm 7.87	63.30 \pm 8.58	66.30 \pm 7.88	0.152*
Gender	Male	25 (50%)	20 (40%)	21 (42%)	0.566**
	Female	25 (50%)	30 (60%)	29 (58%)	
HPT	yes	48 (96.0%)	37 (74%)	40 (80%)	0.009**
	No	2 (4.0%)	13 (26%)	10 (20%)	
DM	yes	30 (60%)	36 (72%)	31 (62%)	0.404**
	No	20 (40%)	14 (28%)	19 (38%)	
Hyperlipidemia	yes	29 (58%)	35 (70%)	32 (64%)	0.457**
	No	21 (42%)	15 (30%)	18 (36%)	
COPD	yes	12 (24%)	20 (40%)	13 (26%)	0.163**
	No	38 (76%)	30 (60%)	37 (74%)	

*ANOVA, **ChiSquare

Postoperative chest tube drain during the 1st and 2nd 24hours was significantly lower among group receiving autologous

blood than those groups receiving nothing or receiving tranexamic acid with P value of <0.0001 as shown in Table II.

Table II: Chest tube drainage during 1st and 2nd 24 hours postoperatively

	Placebo Group	Tranexamic Group	Autologous Group	P value
Drainage during 1st 24 Hr	719 \pm 123.09	732 \pm 80.5	279.7 \pm 43.3	<0.0001*
Drainage during 2nd 24 Hr	62.5 \pm 19.92	62.9 \pm 19.4	23.2 \pm 8.3	<0.0001*

*ANOVA

Significant differences among the three study groups in terms of packed red blood cells (PRBC), plasma, and platelets needs, being lower in group receiving

autologous blood than those groups receiving nothing or receiving tranexamic acid with P value of <0.0001 for each, as shown in Table III.

Table III: Intra and post-operative data

	Placebo Group	Tranexamic Group	Autologous Group	P value*
PRBC - OT	78 (34.2%)	80 (38.6%)	0 (0.0%)	<0.0001
PRBC- ICU	150 (65.8%)	127 (61.4%)	82 (100.0%)	
PRBC -Total	228	207	82	
Plasma - OT	150(60.0%)	150(60.0%)	0 (0.0%)	<0.0001
Plasma - ICU	100 (40.0%)	100 (40.0%)	50 (100.0%)	
Plasma -Total	250	250	50	
Platelets - OT	150(60.0%)	150(60.0%)	0 (0.0%)	<0.0001
Platelets - ICU	100 (40.0%)	100 (40.0%)	50 (100.0%)	
Platelets - Total	250	250	50	

*Chi Square.

Post-operative bleeding is significantly lower in group receiving autologous blood than those groups receiving nothing

or receiving tranexamic acid with a P value of 0.018, as shown in Table IV.

Table IV: Post-operative bleeding data among the three study groups.

		Placebo Group	Tranexamic Group	Autologous Group	P value*
Post-operative bleeding	yes	11 (22.0%)	5 (10.0%)	2 (4.0%)	0.0187
	No	39 (78.0%)	45 (90.0%)	48 (96.0%)	

*Chi square test

Discussion

Patients undergoing cardiac surgery suffers from severe damage to blood components (RBCs, WBCs, platelets, and clotting factors) thus exposing these patients to increased risk of bleeding post-operatively and increased the needs to blood and blood products^{8,10}, this encourage the cardiac surgeons to search for procedures that help in reduction of risk of bleeding and the need for blood and blood products¹⁰.

Oz et al¹⁰ reported no significant differences among patients undergoing cardiac surgery and using autologous blood compared to patients using homologous blood in terms of hypertension with p value of 0.06. However, in the current study, there were significant differences between the study groups in terms of hypertension with p value of 0.009. On other hand, Oz et al reported significant differences among patients undergoing cardiac surgery and using autologous blood compared to patients using homologous blood in terms of diabetes mellitus and hyperlipidaemia with p value of 0.002 and 0.03 respectively. While, Huseyin et al⁹ reported non-significant differences among patients undergoing cardiac surgery and using autologous blood compared to patients using homologous blood alone or combination of autologous and homologous in terms of diabetes mellitus with p value more than 0.05. However in the current study, non-significant differences were reported

between the study groups in terms of diabetes mellitus and hyperlipidaemia with p value of 0.40 and 0.45 respectively.

Oz et al¹⁰ reported that chest tube drainage was significantly (<0.0001) lower among patients receiving autologous blood than those receiving homologous blood with p value of <0.0001. Similarly, blood transfusion intra-operatively and post-operatively was significantly lower among those patients receiving autologous blood than those receiving homologous blood with p value of 0.025 and 0.018 respectively¹⁰. On the other hand, Huseyin et al⁹ reported that blood transfusion was significantly lower among those patients using autologous blood compared to patients using homologous blood alone or combination of autologous and homologous with p value of <0.05. In the current study, chest tube drainage during 1st and 2nd 24 hr was significantly lower among patients receiving autologous blood than those receiving nothing or receiving tranexamic acid with p value of <0.0001. similarly, PRBCs needs was significantly lower among patients receiving autologous blood than those receiving nothing or receiving tranexamic acid with p value of <0.0001.

Huseyin et al⁹ reported no significant differences in plasma need between patients receiving autologous blood compared to those receiving homologous blood alone or combination of autologous

and homologous with p value of >0.05 , while in the current study, plasma need intraoperatively and postoperatively was significantly lower among patients receiving autologous blood than those receiving nothing or receiving tranexamic acid with p value of <0.0001 .

Luque-Oliveros et al¹¹ reported that reinfusion of \leq one pint (≤ 580 ml) of autologous blood is statistically significant (<0.01) in reducing the risk of postoperative bleeding in patients undergoing cardiac surgery. Huseyin et al⁹ reported that risk of bleeding is significantly lower among those patients using autologous blood compared to patients using homologous blood alone or combination of autologous and

homologous with p value of <0.05 . Oz et al¹⁰ reported significant differences in risk of postoperative bleeding in those receiving autologous blood compared to those receiving homologous blood with p value of <0.01 . In the current study, risk of postoperative bleeding was significantly lower (p value= 0.018) in those patients receiving autologous blood when compared to those receiving nothing or those receiving tranexamic acid.

In conclusion, reinfusion of one pint of preoperative collected autologous blood is higher than tranexamic acid in reducing the risk of postoperative bleeding and the need for blood and blood products among patients undergoing cardiac surgery.

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