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Cardiac Surgery

"Relation between Per-Operative and Post-Operative Tranfusion of Fresh Frozen Plasma and Post-Operative Blood Loss in the Patients Undergoing Cardiac Surgery with Cardiopulmonary Bypass"

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Abstract **Original Research Article**

Introduction: Post-operative blood loss remains a major problem after cardiopulmonary bypass. The increased bleeding tendency after cardiac surgery using cardiopulmonary bypass is a complex result of multiple hemostatic defect including coagulation factor deficiency, inadequate neutralization of heparin, increased fibrinolytic activity & platelet deficiency in quantity & quality. In this study effect of Fresh Frozen plasma on post-operative blood loss was evaluated. ***Objective:*** To evaluate the relation between post-operative blood loss and transfusion of fresh frozen plasma of the patient undergoing cardiac surgery with cardiopulmonary bypass. ***Materials and Methods:*** This comparative cross sectional study was carried out at the department of cardiac surgery in BSMMU hospital. The study population was 60, with each group having 30 patients. Grouping of patients were done with respect to transfusion of fresh frozen plasma (group a patients who were received FFP and whole blood & group B: patients who were received whole blood only). Demographic, pre-operative and post-operative data were analyzed statistically to establish the hypothesis. There was significant difference in age, cross clamp time, total bypass time between two groups. ***Results:*** Total sixty (60) patients who underwent cardiac surgery with cardiopulmonary bypass were included in this study as per the inclusion and exclusion criteria. Patients were grouped into group A and B on the basis of per-operative & post-operative transfusion. Patient in group A received FFP & blood whereas patients in group B received whole blood only. Surgical procedure and ICU care were adopted on standard hospital protocol. Among the study population mean age in group A was 27.43±7.53 years and in group B was 32.37±7.54 years. The difference in age between two groups was statistically significant ($p<0.05$). There was no statistical significance of gender between the two study groups ($p>0.05$). The mean BMI in group A was 24.13±2.49 kg/m² and that in group B was 24.62±3.71 kg/m². The findings were not statistically significant ($p>0.05$). Blood loss was significantly greater in group B compared with group A within 48 hours of operation and also patients in group B had longer ventilation time, ICU stay and hospital stay. Regarding Pearson's co relation test, cross clamp time was positively and amount of FFP transfusion was negatively co relate with post-operative blood loss. Variables that have significant relationship with post-operative blood loss were not showed significance in multivariate binary regression analysis, so only transfusion of fresh frozen plasma mostly related to post-operative blood loss following cardiac surgery with cardiopulmonary bypass. ***Conclusion:*** From this study it reveals that per-operative and post-operative transfusion of Fresh Frozen plasma can effectively reduce post-operative blood loss especially in on-pump cardiac surgery as well it reduces post-operative morbidity, hospital stay.

Keywords: Per-operative & Post-operative transfusion, Cardiopulmonary bypass, Cross clamp time.

INTRODUCTION

Cardiopulmonary bypass (CPB) is a technique that temporarily takes over the function of the heart and lungs during surgery which maintains the circulation of blood and oxygen while regulating body temperature. Use of CPB allows cardiac surgical procedure to be performed in a motionless, bloodless surgical field by incorporating an extracorporeal circuit to provide physiological support. Typically, blood drained from heart to a reservoir via venous cannulation and tubing,

and returned after oxygenation to the cannulated arterial system by utilizing a pump and artificial lung [1]. The use of cardiopulmonary bypass (CPB) during cardiac surgical procedures causes a significant disruption of the coagulation system that may contribute to coagulopathy of varying degrees. The pathophysiology of CPB relates to the unique responses that occur when blood contacts a biomaterial surface (biomaterial related processes), non-contact related processes such as blood collection by cardiotomy sucker and the effect of non-pulsatile flow. Within milliseconds of the blood is contacting the synthetic surface of the CPB circuit, plasma protein become adsorbed to the biomaterial. Although the amount, composition, and conformation of protein adsorption may differ surfaces, there is no surface on which the process is completely inhibited, and each surface has a characteristic blood adsorption pattern. Further exposure of the surface to blood results in activation of proteins of the contact activation system. This system comprises four primary plasma proteins: factor XII, factor XI, prekallikrein, and high molecular weight kininogen (HMWK). In presence of negatively charged biomaterial, a conformational change occurs in factor XII that permits its activation in the presence of prekallikrein and HMWK. Factor XIIa activates factor XI and initiates the intrinsic coagulation pathway, with the subsequentgeneration of thrombin and the cleavage of fibrinogen to produce fibrin, which is cross-linked by activated factor XIII. Factor XIIa also activates prekallikrein to form kallikrein within second of start of bypass. Kallikrein catalyzes the conversion of HMWK to bradykinin and plays a role in the activation of fibrinolytic system. Bradykinin has a very short half-life in the plasma because of its rapid metabolism by angiotensin converting enzyme in the pulmonary circulation and by the vascular endothelium [2]. The addition of haemodilution in the form of crystalloid prime, there is the reduction of the level of clotting factors and platelets. Besides, cell-saving devices that are routinely used for red cell salvage, there is elimination of platelets and coagulation factors from the blood by CPB [3]. There are surgery related factors that increases the risk of coagulopathy. These include the use of heparin to limit clotting during extracorporeal circulation, the dilution, activation and consumption of coagulation factors and factors associated with the use of cardiopulmonary machines, such as acquired platelet dysfunction, hypothermia, hyperfibrinolysis. In addition to surgery-related factors, the use of preoperative anticoagulation may also increase the likelihood of perioperative coagulopathy [4]. In addition to coagulopathy other independent risk factors that have an impact on post-operative morbidity and mortality include excessive blood loss, the use of allogenic blood products and reoperation for bleeding. Fresh Frozen Plasma (FFP) is the plasma that is separated from red blood cells which needs to be frozen within eight hours of collection to -18 ˚C. FFP contains maximum level of both stable and labile clotting factors about one international unit (IU) per ml, has normal level of factor V and slightly reduced level of factor VIII [5], and 400 mg of fibrinogen per unit. One unit of FFP contains about 250 ml of volume. So, it contains necessary coagulation factors needed to stop post-operative bleeding [6]. Fresh whole blood, collected 48 hours before surgery, has an adequate concentration of coagulation factors, including fibrinogen, can provide adequate volume replacement but fresh collected blood products are not readily available at most institutions. Given that the most convenient alternative source of fibrinogen is fresh frozen plasma [7]. These study aims to compare the outcomes of transfusion of FFP between whole blood following On Pump Cardiac Surgery as there is gross disruption of a coagulation factor, platelets, RBC due to extracorporeal circulation.

OBJECTIVES OF THE STUDY

General Objective

To evaluate the relation between post-operative blood loss and transfusion of fresh frozen plasma of the patient undergoing cardiac surgery with cardiopulmonary bypass

Specific Objectives

To measure post-operative bleeding of patients from chest tube drainage hourly for 48 hours following cardiac surgery using CPB

To compare the duration of mechanical ventilation
To compare the duration of ICU stay
To compare the duration of hospital stay
To compare the complication associated with blood transfusion

LITERATURE REVIEW

Extracorporeal circulation has evolved into a remarkably safe means of providing systemic perfusion during open-heart surgery. Modifications of the extracorporeal circuit have enabled surgeons to use a variety of surgical approaches for open-heart procedures while minimizing some of the adverse effects of cardiopulmonary bypass (CPB), so it is important to review the technology and physiologic concepts of CPB in cardiac surgery [3]. Patient undergoing cardiac surgery are at particular risk for development of peri-operative coagulopathy. There are surgery related factors during cardiac surgery procedures that increased the risk of coagulopathy. This include the use of heparin to limit clotting during extracorporeal circulation, the dilution, activation and consumption of coagulation factors and factors associated with the use of cardiopulmonary machines, such as acquired platelet dysfunction, hypothermia, hyper fibrinolysis. In addition to surgery related factors, the use of pre-operative anticoagulation medication may also increase the likelihood of peri-operative coagulopathy [4]. The use of cardiopulmonary bypass (CPB) during cardiac surgical procedures causes a significant disruption of the coagulation system that

may contribute to a coagulopathy of varying degrees. In addition to hemodilution from a crystalloid prime, which reduces levels of clotting factors and platelets, contact of blood with the extracorporeal circuit activates platelets and the extrinsic and intrinsic coagulation systems, and triggers fibrinolysis. In fact, systemic heparinization alone causes platelet dysfunction and induces fibrinolysis. In addition, cell-saving devices that are routinely used for red cell salvage eliminate platelets and coagulation factors from the blood [3]. The use of cardiopulmonary bypass (CPB) during cardiac surgical procedures causes a significant disruption of the coagulation system that may contribute to a coagulopathy of varying degrees. In addition to hemodilution from a crystalloid prime, which reduces levels of clotting factors and platelets, contact of blood with the extracorporeal circuit activates platelets and the extrinsic and intrinsic coagulation systems, and triggers fibrinolysis. In fact, systemic heparinization alone causes platelet dysfunction and induces fibrinolysis. In addition, cell-saving devices that are routinely used for red cell salvage eliminate platelets and coagulation factors from the blood [3]. Fresh frozen plasma (FFP) contains necessary coagulation factors needed to stop post-operational bleeding [6]. According to Patricia [5], Wright, and Hughes indication of FFP transfusion is, routine surgical bleeding, massive trauma, DIC and when no particular cause of bleeding can be identified. It is contraindicated in patients with specific known coagulation disorder that can be treated with specific factor concentrate [5]. In department of Transfusion Medicine, BSMMU, preparation of FFP done by using Rotixa 50 RS machine made by Hettich Zentrifugen, Germany, by centrifuging whole blood. At first blood centrifuge at 1400 rpm to separate PCV and plasma then again centrifuge at 3400 rpm to separate Platelet from plasma. After separation freezing the plasma at -18º C, up to 1 year it can preserve at that temperature and 7 years at -65º C. There was a meta-analysis included 15 trials, with a total of 755 participants for analysis in the review. Fourteen trials compared prophylactic use of FFP against no FFP. One study compared therapeutic use of two types of plasma. The timing of intervention varied, including FFP transfusion at the time of heparin neutralization and stopping cardiopulmonary bypass (CPB) (seven trials), with CPB priming (four trials), and after anesthesia induction (one trial) and post-operatively (two trials). Twelve trials excluded patients having emergency surgery and nine excluded patients with coagulopathies. There was no difference in the number of deaths between the intervention arms in the six trials (with 287 patients) reporting mortality (very low quality evidence). There was also no difference in blood loss in the first 24 hours for neonatal/pediatric patients (four trials with 138 patients; low quality evidence): mean difference (MD) -1.46 ml/kg (95% confidence interval (CI) -4.7 to 1.78 ml/kg); or adult patients (one trial with 120 patients): MD -12.00 ml (95% CI -101.16 to 77.16 ml). There was a difference in prothrombin time within two hours of FFP transfusion in eight trials (with 210 patients; moderate quality evidence) favoring the FFP arm: MD -0.71 seconds (95% CI -1.28 to -0.13 seconds). There was no difference in the risk of returning to theatre for reoperation (eight trials with 398 patients; moderate quality evidence): Peto OR 0.81 (95% CI 0.26 to 2.57). Only one included study reported adverse events as an outcome and reported no significant adverse events following FFP transfusion [8]. A recent study revealed, FFP contains the coagulation factors necessary to establish hemostasis, and thus, administering FFP to the patient during the cardiac surgery could attenuate the effects of coagulant factors hoping to prevent post-operative bleeding. PCH agreed to study 175 cases retrospectively to evaluate the effects of FFP to post-operational bleeding. The study was expected to be random since there was no protocol as to when to use the FFP and its administration during the case was solely based on the decision of the cardiac team in a case-by-case scenario. Initially, the study showed negative correlation of FFP to post-operative bleeding but not on length of stay. However, further investigation of the data shows that the study lacks true randomization. Although FFP administration on CPB did correlate significantly with decreased bleeding post-operatively, other variables such as age, type of surgery, XC time and CPB time could not accurately and reliably be used to determine their effects on post-operative bleeding and LOS [6]. The study of Desborough *et al*. [8], found no evidence for the efficacy of FFP for the prevention of bleeding in heart surgery and it found some evidence of an increased overall need for red cell transfusion in those treated with FFP. There were no reported adverse events due to FFP transfusion. Overall the evidence for the safety and efficacy of prophylactic FFP for cardiac surgery is insufficient. The trials focused on prevention of bleeding and did not address prevention of bleeding for patients with abnormal blood clotting or for the treatment of bleeding patients. Another study revealed inclusion of FFP in pump priming for congenital heart surgery in infants and children was shown to improve hemodilution-related coagulation dysfunction immediately after weaning from CPB and heparin reversal. However, beneficial effects were not shown to be continued until 24 h in the ICU and clinical benefits were not clearly evident [7]. One other study Gökalp *et al*. [9], stated that using blood products increases the risk for re-operation due to bleeding, gastrointestinal complications, prolonged ventilator support, acute renal failure, pneumonia, and sepsis. Consistent with the literature, both the off-pump and on-pump groups along with the blood and blood plus FFP subgroups had mean extubation times which were significantly longer compared with the control subgroups.

MATERIALS AND METHODS

Study Design: This was a comparative cross sectional study.

Study Population: The study populations were the patients who underwent cardiac surgery with cardiopulmonary bypass.

Place of Study: Department of cardiac surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka-1000, Bangladesh was my study area.

Study Period: The period of study were from September 2017 to August, 2019.

Sampling Unit: Each patient with valvular or congenital heart disease admitted under the department of cardiac surgery for elective heart surgery.

Sample Size: Patients who underwent cardiac surgery with cardiopulmonary bypass was included in my study. A total number of 60 patients were evaluated.

Grouping

- Group A: Thirty (30) patients who received FFP and whole blood in per-operative and post-operative period.
- Group B: Thirty (30) patients who received only whole blood in per-operative and post-operative period.

SELECTION CRITERIA

Inclusion Criteria

a) Patients underwent cardiac surgery with cardiopulmonary bypass.

Exclusion Criteria

a) Re-do surgery
b) Re-exploration surgery
c) Abnormal coagulation profile
d) Patient with hepatic or renal failure

Sampling Technique: Convenient sampling technique was adopted. Patients admitted for elective cardiac surgery during data collection period who fulfilled the study selection criteria were included in the study.

Data collection tools: A semi structured questionnaire was developed in English. The questionnaire was developed using the selected variables according to the specific objectives. The questionnaire contained questions related to sociodemographic characteristics, pre-operative, per-operative and post-operative parameters (Appendix D). A checklist was also developed to record desired variables from admission record, history sheet and related investigation reports.

Study Procedure

1. Patients admitted in cardiac surgery department with congenital and valvular heart disease scheduled for surgery were considered for study population.
2. Patient who fulfilled the inclusion criteria and willing to enroll in study was included in the study after receiving the proper consent
3. Detailed history, clinical examination and relevant investigation reports of all patients were recorded in the data collection sheet pre-operatively.
4. Patients were taken to the operating room. Peripheral venous cannula, central venous catheter and arterial line were established aseptically.
5. Standard anesthetic techniques of induction, maintenance were followed for all procedures.
6. All patients were operated through a median sternotomy approach. After pericardiotomy patients were heparinize. Cardiopulmonary Bypass was established with Aortic and venous cannulation. Heart was arrested with cold blood Cardioplegia. After completing the surgical procedure patients were wined from cardiopulmonary bypass. Wound was closed in layers maintaining proper hemostasis.
7. After completion of surgery all patients were transferred to intensive care unit (ICU).
8. All patients received inotrope support and other medication as per hospital protocol.
9. Blood loss through drain tubes were carefully calculated and replaced the volume by crystalloid solution, whole blood & FFP as recommended.
10. The patients who has got FFP per-operative and post-operative period were selected randomly with a collaborative decision of surgeon, anesthesiologist and perfusionist. Patients who received FFP with whole blood were in group A and those who received only whole blood were included in group B.
11. Patients were extubated as soon as they met the standard extubation criteria. After meeting the discharge criteria, the patients were discharged from the hospital.

DATA ANALYSIS

Statistical analysis was conducted using Statistical Package for Social Science (SPSS) version 23.0 for windows software. Comparisons between groups were made with unpaired Student's *t*-test, Chi-Square test Fisher's exact test, Pearson's co-efficient correlation test and Multivariate binary logistic regression test. Observations were recorded as statistically significant if a p-value ≤ 0.05.

RESULTS

Total sixty (60) patients who underwent cardiac surgery with cardiopulmonary bypass were included in this study as per the inclusion and exclusion criteria. Patients were grouped into group A and B on

the basis of per-operative & post-operative transfusion. Patient in group A received FFP & blood whereas patients in group B received whole blood only. Surgical procedure and ICU care were adopted on standard hospital protocol. The findings of the study obtained from data analysis are presented below.

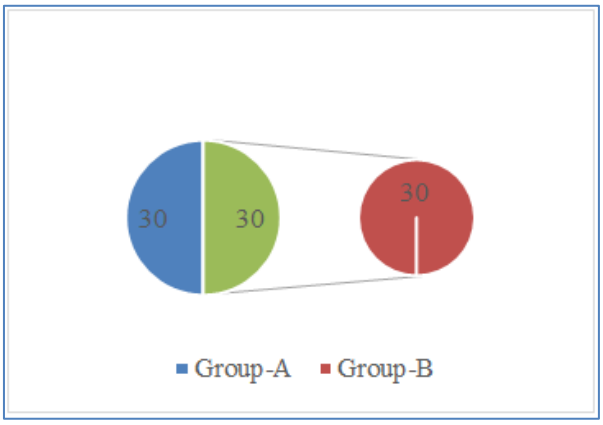

Fig-1: Distribution of patients groups

Comparison of demographic and anthropometric variables

Among the study population mean age in group A was 27.43±7.53 years and in group B was 32.37±7.54 years. The difference in age between two groups was statistically significant (p<0.05). There was no statistical significance of gender between the two study groups (p>0.05). The mean BMI in group A was 24.13±2.49 kg/m² and that in group B was 24.62±3.71 kg/m². The findings were not statistically significant (p>0.05) [Table 1].

Table-1: Comparison of demographic variables between two groups (N=60)

Variables			p value*
	Group A(n=30)	Group B(n=30)	
[a]Age (In years) Mean ± SD	27.43±7.53	32.37±7.54	0.014[s]
[b] Sex			0.797[ns]
Male	16 (53.3%)	14 (46.7%)	
Female	14 (46.7%))	16 (53.3%)	
[a] BMI (kg/m^2) Mean ± SD	24.13±2.49	24.62±3.71	0.548[ns]

Figure in the parentheses indicate percentage. Data were analyzed using [a]Student's t-test and was presented as mean ± SD. [b]Chi-square test (χ^2) was used to measure the level of significance. *p>0.05 was considered not to be significant. n= number of subjects s=significant ns= not significant BMI = Body Mass Index.

Comparison of history and clinical findings

[Table 2] shows the distribution of data obtained by evaluating history and major risk factors. The comparison of the presence of shortness of breath and palpitation in group A and B patients were statistically not significant (p>0.05).

Table-2: Comparison of the patients according to history and clinical findings by groups (N=60)

Variables	Group		p value*
	Group A(n=30)	Group B(n=30)	
[b]Shortness of Breath	07 (23.33%)	05 (16.7%)	0.748[ns]
[b]Palpitation	17 (56.7%)	17 (56.7%)	0.792[ns]

[b]Data was analyzed using Chi square test and was done to measure the level of significance. Figure within parenthesis indicate percentage. n= number of subjects s=significant ns= not significant *p>0.05 was considered not to be significant

Comparison of pre-operative variables

[Table 3] shows that there were no statistically significant differences in findings between two groups in terms of Platelet count, Hb level, Bleeding time, Clotting time, Prothrombin time, Activated partial thromboplastin time.

Table 3: Comparison of patients according to pre-operative variables by groups (N=60)

Variables	Group		P-value*
	Group A(n=30)	Group B(n=30)	
[a]Platelet (x10^3/dl) Mean ± SD	291.50±45.25	289.0±42.53	0.826^{ns}
[a]Hb (gm/dl) Mean ± SD	13.01±1.65	13.65±.77	0.896^{ns}
[a]BT (min) Mean ± SD	3.88±0.34	3.89±0.35	0.824^{ns}
[a]CT (min) Mean ± SD	7.24±0.52	7.25±0.52	0.948^{ns}
[a]PT (min) Mean ± SD	12.28±0.68	12.34±0.65	0.060^{ns}
[a]APTT (min) Mean ± SD	33.83±3.01	33.16±2.70	0.371^{ns}

[a]Data was analyzed using Student's t test. Data was expressed as Mean ± SD BT=bleeding Time, CT= Clotting Time, PT= prothombin Time, APTT= Activated Partial Thromboplastin Time, n= number of subjects s=significant ns= not significant *p>0.05 was considered not to be significant.

Comparison of per-operative variables

[Table 4] shows that difference in ACT after heparinization and ACT after heparin neutralization between the two groups were statistically not significant (p>0.05). Among the study population, the cross clamp time of surgery in group A was 41.33±22.21 hours and that in group B was 55.93±20.42 hours. Which was statistically significant (p<0.05).

Table 4: Comparison of per-operative variables (N=60)

Variables	Group		p value*
	Group A(n=30)	Group B(n=30)	
[a]ACT after Heparinization(sec) Mean ± SD	545.13±28.37	549.36±28.0	0.563^{ns}
[a]ACT after Heparin neutralization(sec) Mean ± SD	113.46±6.00	113.80±6.80	0.842^{ns}
[a]Cross Clamp time (mins) Mean ± SD	41.33±22.21	55.93±20.42	0.010^{s}
[a]Total Bypass time (mins) Mean ± SD	85.13±47.57	108.43±38.65	0.042^{s}
[a]Per-operative Blood transfusion(ml) Mean ± SD	445.5±234	495±135	0.137^{ns}

[a]Data were analyzed using Student's t-test and was presented as mean ± SD.
*p>0.05 was considered not to be significant.
n= number of subjects, ns= not significant
ACT = Activated Clotting T

Comparison of post-operative variables

[Table 5] shows the comparison of post-operative variables between group A and B patients. Amount blood loss in 1st 48 hours immediate after surgery in group A and B were statistically significant (p<0.05). Significant number of patients had transfusion reaction in group B. Post-operative blood transfusion in group A and B were 900±135 ml and 1138.5±346.5 ml respectively, which was statistically significant (p<0.05). Duration of ventilation time and ICU stay following surgery was longer in group B patients, which was statistically significant (p<0.05), difference between the duration of hospital stay of the two groups was also statistically significant (p<0.05).

Table-5: **Comparison of post-operative variables (N=60)**

Variables	Group		p value*
	Group A(n=30)	Group B(n=30)	
[a]Blood loss in 1st 48 hours (ml) Mean ± SD	521.6±95.3	592.5±83.1	0.003^{s}
[a]Postoperative blood transfusion (ml) Mean ± SD	900±135	1138.5±346.5	0.003^{s}
[b]Transfusion reaction f (%)	03(10%)	11(36.7)	.015^{s}
[a]Postoperative ventilation time(hours) Mean ± SD	6.97±1.56	8.08±1.73	0.012^{s}
[a]Duration of ICU stay(hours) Mean ± SD	58.50±9.06	64.36±11.97	0.037^{s}
[a]Duration of hospital stay(days) Mean ± SD	10.10±1.15	11.13±1.45	0.033^{s}

[a]Data were analyzed using Student's t-test and was presented as mean ± SD
[b]Data was analyzed using Chi square test and was done to measure the level of Significance
*p>0.05 was considered not to be significant. n= number of subjects, s=significant

Pearson co-efficient correlation test for Cross clamp time, Total bypass time, FFP transfusion and post-operative blood loss in 48 hours. The Pearson co-efficient correlation test showed a significant positive relationship of cross clamp time and total bypass time with post-operative blood loss and a significant negative relationship of FFP transfusion with post-operative blood loss and no significant relationship between age and post-operative blood loss [Table 6].

Tabl- 6: Correlation test for Cross clamp time, Total bypass time, FFP transfusion and post-operative blood loss in 48 hours (N=60)

		bloodLoss48hr	FFP	XCT	ECCT	Age
bloodLoss48hr	Pearson Correlation	1	-.154	.566**	.526**	.105
	Sig. (2-tailed)		.240	.000	.000	.423
	N	60	60	60	60	60
FFP	Pearson Correlation	-.154	1	-.155	-.095	-.534**
	Sig. (2-tailed)	.240		.239	.471	.000
	N	60	60	60	60	60
XCT	Pearson Correlation	.566**	-.155	1	.970**	.240
	Sig. (2-tailed)	.000	.239		.000	.065
	N	60	60	60	60	60
ECCT	Pearson Correlation	.526**	-.095	.970**	1	.184
	Sig. (2-tailed)	.000	.471	.000		.160
	N	60	60	60	60	60
Age	Pearson Correlation	.105	-.534**	.240	.184	1
	Sig. (2-tailed)	.423	.000	.065	.160	
	N	60	60	60	60	60

**. Correlation is significant at the 0.01 level (2-tailed).

Multivariate binary logistic regression analysis among variables had significant relationship with post-operative blood loss

Multivariate binary logistic regression analysis shows cross clamp time, total bypass time and age, none of these has significant relationship with post-operative blood loss ($p > 0.05$).

Table-7: Multivariate binary logistic regression analysis among significant variables (N=60)

Variables	B	p value*	Odds ratio	95% C.I for odds ratio	
				Lower	Upper
Cross clamp time	0.604	0.452ns	1.829	0.379	8.825
Bypass time	0.654	0.410ns	1.923	0.405	9.123
Age	-1.011	.075ns	0.364	0.120	1.106

p>0.05 was considered not to be significant
s= significant, ns= not significant

DISCUSSION

The aim of the study was to find relation between per-operative and post-operative transfusion of fresh frozen plasma and post-operative blood loss in patients undergoing cardiac surgery with cardiopulmonary bypass. The study was conducted in the department of Cardiac Surgery, BSMMU, Dhaka, included a total number of 60 patients undergoing cardiac surgery as per the inclusion and exclusion criteria. The patients were divided into two groups on the basis of per-operative and post-operative transfusion. Patient who received FFP along with whole blood were included in group A and those who received only whole blood were included in group B. The demographic variable of the participating patients were recorded and analyzed. The mean age for group A was 27.43±7.53 years and B was 32.37±7.54 years respectively, which was statistically significant (p=0.014). The observation of the study was that the incidence of post-operative blood loss were more common in older age. This finding was similar to the finding of the study carried [6]. Regarding sex distribution, in group A, approximately half of the population were male 16 (53.3%) and half 14 (46.7%) were female. In group B, distribution were approximately same, male were 14 (46.7%) and 16 (53.3%) respectively. The sex distribution between the groups were not statistically significant (p=0.797), which corresponded to the findings of Gokalp & colleagues [9]. Mean BMI in group A was 24.13±2.49 kg/m^2 and that in group B was 24.62±3.71 kg/m^2, which was statistically not significant (p=0.548). Which corresponded to the findings of Ortmann and his colleagues [10]. The presence of shortness of breath between patients in group A and B were 07 (23.33%)

and 05 (16.7%) respectively, which were not significant statistically. Comparison of pre-operative palpitation between the two groups were also statistically not significant (p=0.792). Pre-operative biochemical parameters like Platelet count, Hb, Bleeding Time, Clotting Time, Prothrombin Time & APTT were evaluated in two groups. Mean platelet count in group A were 291.50±45.25 $x10^3$/dL and in group B were 289.0±42.53 $x10^3$/dL. Mean Hb in group A was 13.61±1.65 gm/dL and B was 13.65±.77 gm/dL. Mean Bleeding Time in group A were 3.88±0.34 minutes and in group B were 3.89±0.35 minutes. Mean Clotting Time in group A were 7.24±0.52 minutes and in group B were 7.25±0.52 minutes. Mean Prothrombin Time in group A were 12.28±0.68 seconds and in group B were 12.34±0.65 seconds. Mean APTT in group A were 33.83±3.01 seconds and in group B were 33.16±2.70 seconds. Difference of all pre- operative parameters between two groups are statistically not significant. These findings corresponded to the study conducted by Ortmann and colleagues [10]. Time taken for operating procedure of patients in group A and B were also compared statistically. The mean Cross clamp time & Total Bypass time in group A were 41.33±22.21 minutes, 85.13±47.57 minutes and in group B were 55.93±20.42 minutes, 108.43±38.65 minutes respectively. Differences of those two parameters between two groups were statistically significant (p=.010 & p=.042 respectively). These findings corresponded to the study conducted [6]. Activated Clotting Time (ACT) was measured just before establishing cardiopulmonary Bypass and after winning from bypass in both group carefully. Differences of both ACT values between two groups were statistically insignificant (p values were 0.563 & 0.842 respectively). Per-operative transfusion of whole blood in group A were 445.5±234 ml and in group B were 495±135 ml, Difference between two groups were statistically non-significant. These findings corresponded to the study conducted by Tettey and colleagues [11]. The postoperative blood loss through chest drain in 1st 48 hours were calculated. There were statistically significant difference in blood loss between two groups. Blood loss in group A was 521.6±95.3 ml and in group B was 592.5±83.1 ml, p value was 0.003. Post-operative blood transfusion in group A and B were 900±135 ml and 1138.5±346.5 ml respectively, which was statistically significant (p=.003). This finding corresponded to the study conducted by Ortmann and colleagues [6, 10]. The mean of total ventilation time of the patients of group A was 6.97±1.56 hours and in group B was 8.08±1.73 hours. The mean ICU stay of the patients of group A was 58.50±9.06 hours and that of group B was 64.36±11.97 hours. The mean hospital stay in group A was 10.10±1.15 days and B 11.13±1.45 days. Longer duration of Ventilation, ICU and Hospital stay of the group B patients were statistically significant. (p=0.012, p=0.037 and p=0.033 respectively). Post transfusion reaction was occurred in 03 and 11 patients in group A and group B respectively which was statistically significant. Casbard and colleagues (Casbard *et al.* [12], and Ortmann and his colleagues reported the same findings [10]. The Pearson co-efficient correlation test showed a significant positive relationship of cross clamp time and total bypass time with post-operative blood loss and a significant negative relationship of FFP transfusion with post-operative blood loss and no significant relationship between age and post-operative blood loss. Variables that were statistically significant between two groups are further analyzed by multivariate binary logistic regression analysis. Among the variables none had significant relationship to post-operative blood loss. This is similar to the information provided [6].

CONCLUSION

From this study it was revealed that per-operative and post-operative transfusion of Fresh Frozen plasma effectively reduced post-operative blood loss in on-pump cardiac surgery as well as it reduced post-operative ICU stay and hospital stay.

Limitations of the Study

a) This study evaluated a small population of patients for a limited period of time.
b) This analysis was done in a single center of Bangladesh and the sample only represents a small fraction of patients undergoing cardiac surgery.
c) No follow-up was conducted after the discharge of the patient.

RECOMMENDATIONS

i. Transfusion of FFP at per-operative and Post-operative state of cardiac surgery can effectively reduce blood transfusion as well as transfusion related cost & hazard.
ii. Multi center based, larger prospective studies are needed to validate our findings.

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