

Blood Component Transfusion in Primary Coronary Artery Bypass Surgery in Kuwait

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Key Words

Primary coronary artery bypass surgery · Blood products · Cost of transfusion

Abstract

Objective: The aims of this study were to determine the rate of blood product transfusion, associated perioperative factors and cost of such blood product transfusion in primary coronary artery bypass surgery (CABG). **Subjects and Methods:** The medical records of 159 consecutive primary CABG patients (142 male, 17 female) from January 1, 2003 to June 30, 2003 at Chest Diseases Hospital, Kuwait, were reviewed. Urgent and emergency cases were included. **Results:** The mean age of the patients was 57.2 (range 36–77 years). Overall, 128 (80.5%) patients received blood product transfusion during primary CABG: 113 (70.5%) packed red blood cells (RBC), 54 (33.9%) fresh frozen plasma, and 13 (8%) platelets. Overall, 23 patients (12.6%) received more than two RBC transfusions intraoperatively. Significant factors for intraoperative RBC transfusion were: age >60 years, female gender, preoperative hemoglobin <12 g/dl, and 3 or more coronary bypass grafts constructed. One hundred and fifty-nine patients consumed 342 units of RBC at an average of 2.1 RBC units per patient. The cost per

patient was 80 Kuwaiti dinar (KD; USD 240). **Conclusion:** The findings indicate a high rate of blood component transfusion in primary CABG patients in Kuwait that could expose the patients to the possible adverse effects, and such transfusions have high economic impact.

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Introduction

Cardiac surgery remains one of the major consumers of allogeneic blood products.

The rate of blood product transfusion during coronary artery bypass surgery (CABG) differs widely among cardiac centers [1, 2]. This in turn may reflect differences in blood transfusion guidelines in such centers or the relative risk for transfusion of the studied population. Unnecessary blood transfusion is considered to be harmful because of the possibility of transmission of infections (viral, bacterial, and emerging infectious agents) [3–5], allergic reactions to the transfused blood and the possible association of acute lung injury and red cell transfusions [6]. The scarcity of blood resources and increasing economic impact of the large amount of blood product consumed is becoming a very important issue. The aims of this study were to determine the frequency of blood prod-

Table 1. Demographic data and frequency of the studied factors

Predictive factors	Patients	%
Age >60 years	52/159	32.7
Female gender	17/159	10.6
Preoperative Hb <12 g/dl	21/159	13.2
Preoperative creatinine >160	3/159	1.8
Preoperative EF <40%	24/159	15
Urgent/emergency cases	54/159	33.9
Perfusion time >120 min	61/146 ^a	41.7
Number of grafts >3	58/159	36.4

Hb = Hemoglobin; EF = ejection fraction.

^a13 patients were not included because they were operated on using the OPCAB technique.

uct transfusion in primary CABG patients, as well as perioperative predictors and cost of blood product transfusion in Kuwait.

Subjects and Methods

This study was conducted at the Chest Diseases Hospital, Kuwait, which is the only center for the surgical treatment of coronary artery disease in Kuwait. The medical records of 159 patients (142 male, 17 female) who underwent primary CABG from January 1 to June 30, 2003 were reviewed. All urgent and emergency cases were included. The data obtained included age, gender, preoperative serum creatinine, ejection fraction (EF), status of the procedure, perfusion time, aortic cross clamp time, number of grafts, total chest tube drainage, the use of intraoperative coagulation medications, and the number of patients who required re sternotomy for increased postoperative bleeding. The primary endpoints of interest as dependent variables were in-hospital transfusion of packed red blood cells (RBC), fresh frozen plasma (FFP), and platelets. The in-hospital transfusion was defined as blood product transfusion either intraoperatively or during the stay in the postoperative intensive care unit and surgical ward for up to a period not exceeding 2 weeks. Although there was no unified departmental policy on the level of hematocrit as trigger for blood transfusion, patients were usually transfused on bypass if the hematocrit was below 25 or postoperatively below 30 in hemodynamically stable patients. The economic cost of transfusion was calculated using figures issued by the Kuwait Blood Bank as follows: cost of one unit of RBC = 40 Kuwaiti dinar (KD; USD 120), platelet apheresis = 72 KD (USD 210), and FFP = 15 KD (USD 45).

Statistical Analysis

Data analysis was made using SPSS software windows version and packages (SPSS, Chicago, Ill., USA). Data were expressed as mean, number, or percentages. The cutoff level for statistical significance was a p value <0.05. The Pearson chi-square test was used

to ascertain the significance of association between two categorical variables. Fisher's exact test replaced the chi-square test if the cell frequencies of any of 2 × 2 contingency table were below 5. Logistic regression method was used to determine the factors affecting the use of blood components.

Results

Of the 159 patients who underwent primary CABG, 106 (66%) were elective operations. All the patients were on aspirin preoperatively; however, the time of aspirin stoppage was not documented. Seventy-four patients (46.5%) received preoperative coagulative medications, 39 (24.5%) aprotinin, 34 (21.4%) tranexamic acid, and 1 patient received both. The mean perfusion time was 114 min (range 33–216 min) and the mean aortic cross clamp time was 71.28 min (range 20–135 min). The mean amount of drainage from the chest tubes was 808.57 ml (range, 185–2,140 ml). Four patients (2.5%) required re sternotomy due to bleeding.

Frequency of Transfusion

Of the 159 patients, 128 (80.5%) received blood component transfusion during primary CABG; 54 patients (33.9%) FFP; 113 patients (70.4%) RBC, and 13 patients (8%) platelet transfusions. Twenty-three patients (12.6%) received more than 2 units of RBC intraoperatively, while 12 received more than 5 units of RBC and the maximum units 1 patient received was 13.

Predictors for Use of Blood Component Use

The possible predictors for blood product transfusion are shown in table 1.

Factors associated with overall blood component transfusion during hospitalization are shown in table 2. The two independent factors were the status of operation and more than 3 grafts constructed during CABG. Overall, 77 of the 159 patients (48.4%) received intraoperative RBC transfusion. Factors associated with intraoperative RBC transfusions are shown in table 3. The following independent factors are statistically significant: age >60 years, female gender, hemoglobin <12 g/dl and more than 3 grafts constructed during CABG.

Cost of Blood Product Transfusion

The total amount of RBC transfused to the 159 patients was 342 units with a mean of 2.1 units per patient with a calculated cost of 80 KD (USD 240)/patient. The total amount of FFP transfused for the 159 patients was 244 units at 1.53 unit/patient at a cost of 23 KD

Table 2. Overall blood component transfusion during hospitalization

Predictive factors	Transfused patients (n = 128)	Nontransfused patients (n = 31)	p value
Age >60 years	43	9	0.3
Female gender	15	2	0.3
Preoperative Hb <12 g/dl	19	2	0.1
Preoperative EF <40%	20	4	0.4
Urgent/emergency cases	38	15	0.04
Perfusion time >120 min	52	9	0.5
Number of grafts >3	53	5	0.006

Hb = Hemoglobin; EF = ejection fraction.

Table 3. Intraoperative RBC transfusion and predictive factors

Predictive factors	Transfused patients (n = 77)	Nontransfused patients (n = 82)	p value
Age >60 years	31	21	0.03
Female gender	12	5	0.04
Preoperative Hb <12 g/dl	16	5	0.006
Preoperative EF <40%	12	12	0.5
Urgent/emergency cases	22	31	0.1
Perfusion time >120 min	36	25	0.6
Number of grafts >3	35	23	0.01

Hb = Hemoglobin; EF = ejection fraction.

(USD 70)/patient. The total number of platelets transfused was 77 units at 0.48 unit/patient at a cost of 35 KD (USD 105)/patient. Therefore, the total cost of blood product transfusion per patient was 138 KD (USD 414) and the total cost for the whole sample of 159 was 22,000 KD (USD 66,000).

Discussion

In this study most primary CABG patients (80%) received blood products during the procedure, similar to the results obtained by Kytola et al. [7] and McGill et al. [8], where in Finland and England the CABG patients received 53–93% and 92% blood products, respectively. On the other hand in the studies by Litmathe et al. [9], in 400 consecutive CABG patients, and Karkouti et al. [10]

in 1,007 consecutive patients, the transfusion rates were 33 and 29.4%, respectively.

Similar to results obtained by other investigators [9, 11], in our study the factors associated with an increased risk of intraoperative RBC transfusion were: age >60 years, female gender, hemoglobin <12 mg/dl and more than 3 grafts.

The high blood transfusion rate in this study could be due to several factors: (a) The lack of strict transfusion guidelines and the rather high level of hematocrit for intraoperative and postoperative patients. Investigators [12, 13] have shown that such practices could lead to high transfusion rates. Paone and Silverman [12] achieved a low transfusion rate (13%) by accepting low hematocrit level as a trigger for transfusion while Bracey et al. [13] confirmed the above finding and suggested that a low hemoglobin threshold does not adversely affect patient outcome and therefore safeguards the patient from unnecessary transfusions. (b) Lack of a standardized multidisciplinary blood conservation approach to cardiac patients. Although surgeons attempt to reduce blood product consumption through pharmacological and mechanical means of blood conservation, such methods should be part of a more comprehensive program as evidenced by the fact that some centers are implementing such programs whereby they are achieving a marked reduction in the blood transfusion rates [8, 14–19].

In order to reduce the high transfusion rate, certain aspects of multidisciplinary blood conservation approach that could be implemented in Kuwait include: (a) a departmental policy to stop the use of aspirin before surgery, as there are conflicting reports in the literature on the role of aspirin in causing increased perioperative bleeding [15]; (b) the consistent use of pharmacological means of improving coagulation and urgent and emergency cases [16]; (c) the consistent use of mechanical cell salvage devices to reduce homologous blood transfusion; (d) minimal dilution caused by the high priming volume (2 liters) of the perfusion circuits could be reduced to 1.2 liters, and (e) the possible use of erythropoietin for patients with low hemoglobin [18].

In our service, the high transfusion rate has a significant economic impact. Based on a projected 400 primary CABG procedures per year, the annual cost of such transfusion practices will be in excess of 55,000 KD (USD 165,000) per year. As Goodnough et al. [20] have shown that at least 24% of the cost of transfusions is due to the inappropriate practice, applying some of the above multidisciplinary blood conservation approaches could reduce this high cost.

Conclusion

This study confirmed the high rate of blood product use in CABG patients in Kuwait, which has a high economic impact on healthcare delivery. Reducing the high rate of transfusion can be achieved in part by adopting strict guidelines for blood transfusion as well as applying a comprehensive blood conservation strategy.

Acknowledgment

We thank Dr. A.K. Ayed for reviewing the manuscript and Dr. M. Ashoor of Kuwait Blood Bank for his assistance.

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