

INFLUENCE OF CELL-SAVER USE ON POSTOPERATIVE HEMATOLOGIC PARAMETERS

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The aim of this study was to reduce homologous blood transfusion during open heart operations by a cell-saver in order to get rid of the side effects of using homologous blood. Some of these side effects are viral infections, bacterial infections and transmission of diseases. Forty coronary artery patients who were operated on electively in GATA Haydarpaşa Training Hospital Cardiovascular Clinic were included in this study and divided into two groups. In Group I cell-saver (Dideco STAT Blood Recovery Cell Separator) was used for autotransfusion intraoperatively and in Group II cell-saver was not used. In both groups, drainage in 24 hours, ACT level (Hemochron 800, USA) in the postoperative 4th hour, total transfusion amount and platelet count in postoperative 4th hour were followed. In Group I, mean total drainage in 24 hours was 878.25cc, while it was 812.25 cc in Group II ($p>0.05$). In follow-up, after 24 hours, total transfusion rate was 0.95 U in Group I and it was 3.4 U in Group II ($p<0.01$). In Group I, ACT level at the 4th postoperative hour was 145 seconds, while it was 137 sec in Group II ($p<0.05$). In Group I, platelet count was $97.9 \times 10^3/\text{mm}^3$, and in Group II, it was $112.7 \times 10^3/\text{mm}^3$ ($p<0.01$). Blood transfusion requirement during open heart surgery has decreased significantly by using cell-saver. No harmful side effects was observed due to cell-saving.

Key words: Autotransfusion, open heart surgery, postoperative bleeding

Increase in number of cardiac surgery operations is accompanied by its own complications (1). Blood transfusion is one of the most important aspects of cardiac surgery. On the other hand, infections transmitted by blood and blood products (hepatitis, HIV, etc.) are also increasing every other day (2). For this reason, in recent years many different techniques have been under investigation in order to lessen blood transfusion rate (3,4). Although, these techniques help diminish transfusion rates, they also have various complications. In our study,

we investigated the effects of cell-saving comparing the results from two study groups: in one group cell-saver was used for autotransfusion, while in the other group there was no cell-saving. We searched for statistically significant difference in transfusion amount, drainage, platelet count and activated clotting time (ACT) levels comparing these two groups.

MATERIALS AND METHODS

40 patients who underwent coronary artery bypass grafting (CABG) operation between January 1998 and February 2000 in GATA Haydarpaşa Training Hospital Cardiovascular Clinic, were divided in to two groups.

In Group I, cell-saver (Dideco) was used for autotransfusion intraoperatively and in Group II there was no cell-saver use. In decision making while choosing patients for Group I, we only took the blood group of the patient (rare or not) and operation period into consideration.

In Group I (n=20), 16 were male and 4 were female. The youngest one was 57 and the oldest was 71 years old (mean age 65.4). In Group II (n=20), 15 were male and 5 were female. Mean age was 62.9.

All coagulation parameters and CBC were normal in both groups. In all patients, LIMA was anastomosed to LAD and for the other coronary arteries saphenous vein was used.

In both groups, drainage for 24 hours, ACT level (Hemochron 800, USA) in the postoperative 4th hour, total transfusion amount and platelet count in the postoperative 4th hour were followed.

RESULTS

We tried to construct two similar groups in terms of age, number of bypass, LIMA anastomosis, preoperative ACT level, platelet count. In Group I, we tried to include the patients whose blood group was rarely found when required for bleeding complications. In Group I, we used cell-saver during the operation, and in Group II, we only used aspirator and cardiotomy suction.

In Group I, about 1600cc mediastinal fluid

(topical cooling fluid and mediastinal shed blood) was aspirated during the operation and about 600 cc transfusion material was maintained. This transfusion material was transfused according to the requirement either by adding to the pump during the operation or after termination of cardiopulmonary bypass (CPB) or in ICU according to the hematocrit level. After termination of cardiopulmonary bypass heparin was neutralized by protamine according to ACT.

The parameters followed in postoperative period were evaluated by two-tailed Student's t test (p values <0.05 considered statistically significant).

In both groups, about 1600 cc mediastinal fluid was aspirated. In Group I, all aspirated fluid was centrifuged, washed and transfused back to the patients.

In Group I, mean total drainage in 24 hours was 878.25 cc (minimum 670 cc and maximum 1150). In Group II, it was 812.25 cc (minimum 630 cc and maximum 1050 cc) (p>0.05).

In follow-up after 24 hours, total transfusion rate was 0.95 U in Group I (minimum 1 U and maximum 2 U), while it was 3.4 U in Group II (minimum 2 U and maximum 5 U) (p< 0.01). In our study, we neglected 1 U fresh blood out of these transfusion amounts.

In Group I, in the 4th postoperative hour ACT level was 145 sec (minimum 135 sec and maximum 168 sec) (preoperative mean ACT level was 114 sec), and in Group II, it was 137 sec (minimum 126 sec and maximum 153 sec) (preoperative level was 116 sec) (p<0.05). protamine neutralization was performed according to ACT levels.

Simultaneously, blood samples were collected in order to detect platelet count. In Group I, platelet count was $97.9 \times 10^3 / \text{mm}^3$ (minimum $81 \times 10^3 / \text{mm}^3$ and maximum $138 \times 10^3 / \text{mm}^3$) and in Group II, $112.7 \times 10^3 / \text{mm}^3$ (minimum $85 \times 10^3 / \text{mm}^3$ and maximum $141 \times 10^3 / \text{mm}^3$) (p<0.01).

During postoperative follow-up, all hemodynamic parameters and body temperatures were normal (Group I, mean blood pressure (BP): 103/65 mmHg, heart rate (HR): 98/min, body temperature (BT): 37.8°C, in Group II; mean BP: 109/66 mmHg, HR: 101/min, BT: 37.4°C).

In early postoperative period, a mean amount

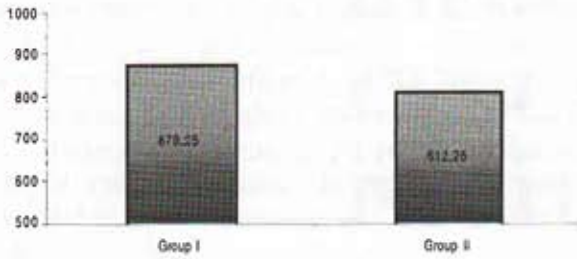


Table 1. Mean amount of drainage ($P < 0.05$)

of $6 \mu\text{g/kg/min}$ dobutamine was infused in Group I, while a mean amount of $8 \mu\text{g/kg/min}$ was infused in Group II.

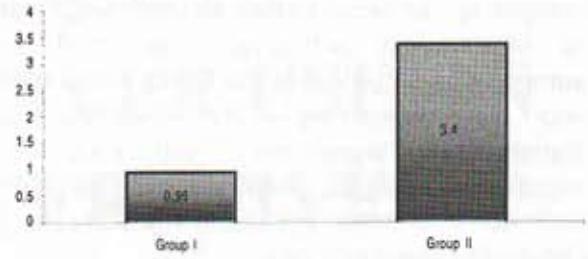


Table 2. Mean amount of homologous blood used

(5,6). For investigating these different techniques, all authors have followed hematological parameters, drainage and blood requirements and some of them also followed renal, hepatic, neurologic parameters and blood culture results (7). It is very difficult to say that autotransfusion is the only factor which effects hematologic parameters, since CPB alone has many effects on hematological and other systemic parameters (2). But Johnson and colleagues (8) concluded that over use of cell-saver alone has injurious effect on hematologic parameters. In normal usage, they found no significant difference compared to the other groups (8). Elami and colleagues (9) stated that cell-saver use does not cause overt hematological defects but lessens the amount of transfusion, transfusion reactions and long-term complications are decreased as well. Saggau and colleagues (10) mentioned cell-saving as a very effective method for lessening blood transfusion. All studies state that cell-saver has a mild injurious effect on hematologic parameters which can be considered normal in early postoperative period. According to these studies, ACT and aPTT were the parameters that were affected the most (11,12). On the

DISCUSSION

In recent 30 years of cardiac surgery, the use of blood and blood products have changed from many aspects (1). Hemodilution is the most important issue in cardiac surgery, and increasing transmission of infections by blood and blood products also requires developments in this field. Even if there were no clinical bleeding requiring transfusion, hemodilution by itself would effect plasma proteins, platelets and fibrinolytic cascade causing coagulation abnormalities.

All transfused blood and blood products have risk for allergic reactions, viral infections and hemolysis (2). For this reason, in order to diminish the amount of transfusion advanced surgical techniques, mild hemodilution, aprotinin, hemostatic techniques, blood salvage and autotransfusion techniques have been used (3,4).

In various studies, many different techniques were tried while performing autotransfusion

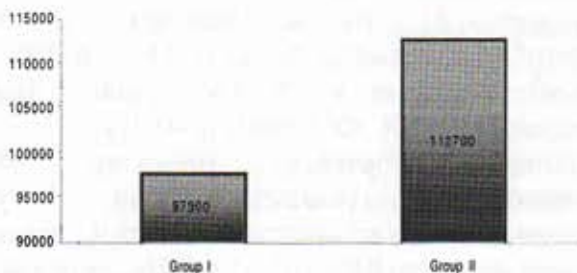


Table 3. Mean platelet count.

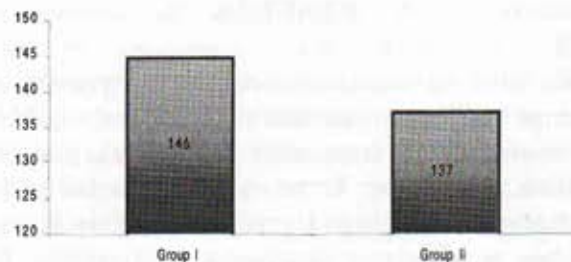


Table 4. Mean ACT levels.

other hand, all these abnormalities are immediately normalized by diet, rest and optimal prevention (13,14). In a study, it was shown that cell-saver had less injurious effect on chemotactic factors compared to usual cardiotomy suction (15). In the same study, it was shown that contamination was more often with cell-saver but with no clinical infection.

The main purpose of cell-saver is not to effect hematologic parameters but to lessen the amount of blood and blood products transfusion (16-18). However, in some of the studies it was concluded that cell-saver was a safe but not a beneficial method (19). On the other hand, some authors suggested that cell-saver had more injurious effect on hematologic parameters compared to the other methods (20,21). One of the most striking results of cell-saver studies was stated by Winton and colleagues (4), they reported that cell-saver is not cost-effective.

In our study, we concluded that cell-saver was very safe in emergency cases, having very mild injurious effect on hematologic parameters. Merely, the increase of heparin amount in the circulation requires neutralization with protamine. In our opinion, decrease in platelet count is associated with heparin. But, the most striking result was the decrease in the amount of donor blood transfusion. In our opinion, cell-saver is not very cost-effective, but in the long term in case of an infection transmitted by blood, its complications and resultant economic destruction would make cell-saver cost-effective.

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