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Blood Loss and Intraoperative Salvage Procedure in Patients Underwent Re-operation Coronary Artery Bypass

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Introduction

- Cell saving systems are commonly used during cardiac operations to improve hemoglobin levels and to reduce blood product requirements[1].
- Preoperative patients` characteristics can predict the need for perioperative blood transfusion in cardiac surgery.
    - Use of cardiopulmonary bypass (CPB)
    - Hematocrit <30%, weight < 70 kg
    - Serum creatinin > 100 µmol/L

[1]Scrascia G *et al*. Perfusion 2012; 27(4):270-7.

Background

- Currently, a large number of patients with coronary artery diseases are on antiplatelet therapy.
- A group of these patients require reoperative surgery (redo) after coronary artery bypass grafting (CABG).

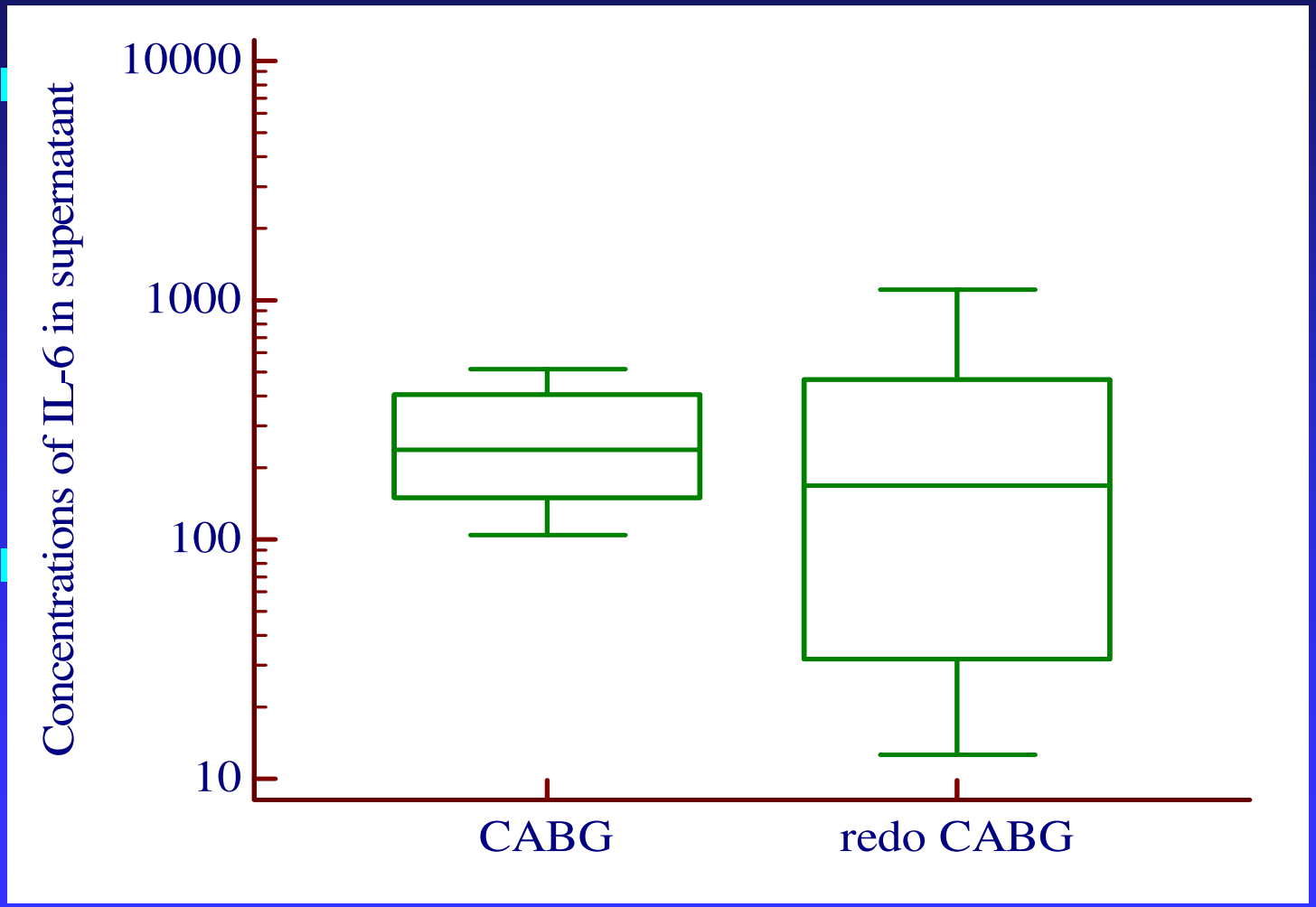
CPB induces the inflammation

- Open-heart surgery is associated with the inflammatory response, which occurs as a result of
  - the contact of blood and artificial surfaces of the circuit,
  - ischemia-reperfusion damage,
  - surgical trauma,
  - changes in body temperature, and
  - release of endotoxin[2,3].

[2] DePalma L, *et al*. J Thorac Cardiovasc Surg 199; 101:240-244.

[3] Klein DJ, *et al*. Critical Care 201; 15:R69.

Cell salvage procedure



[5] Stojkovic et al. J Clin&Experim Cardiol 2011, DOI:10.4172/2155-9880.S7-003.

Intraoperative blood management

- Cell saver procedure
  - collecting
  - washing
  - reinfusing
  - return own RBC
- Autologous blood transfusion

Aim

- We analyzed the effects of blood salvage through a cell saver on
  - **postoperative hemoglobin levels**,
  - the volume of the autologous blood transfusions reinfused after reoperative cardiac surgery

Dideco cell saver (Sorin, Italy) device was used for blood salvage procedure

Patients and Methods

- Fifty-four elective patients were included.
- In 30 patients, CABG was done for the first time in their life (Group 1). These patients have had low ejection fraction (LVEF)
- In the other 24 patients, the reoperative surgery was done several years after the first CABG (Group 2).

Patients and methods *(cont.)*

- **Fifty-four patients** (16% female, 84% male; aged 60.5 ± 6 *vs*. 66.2 ± 7 years) were divided in:
  - **Group 1** – CABG (n=30), and
  - **Group 2** – redo CABG (n=24)
- Two patients were excluded in Group 2 intraoperatively due to changed indication

Patients and Methods *(cont.)*

- Blood samples were collected
  - 24 h prior to the surgery
  - 6 h, and
  - 24 h after initiation of CPB
- Laboratory parameters and coagulation
  - RBC count, Hgb, Hct, Platelets, WBC, etc.
  - MEA (platelets function), Rotem, ACT, ATIII, fibrinogen, etc.

Patients and methods *(cont.)*

- **Time frame** (November 2010 – May 2011)
- **Outcomes** (clinical and other endpoints)
  - use of transfused blood products
  - blood loss, chest tube drainage
  - rethoracotomy and revision
  - atrial fibrillation rate (AF)
  - tracheal intubation time
  - ICU stay
  - hospital stay
  - mortality

Patients profile

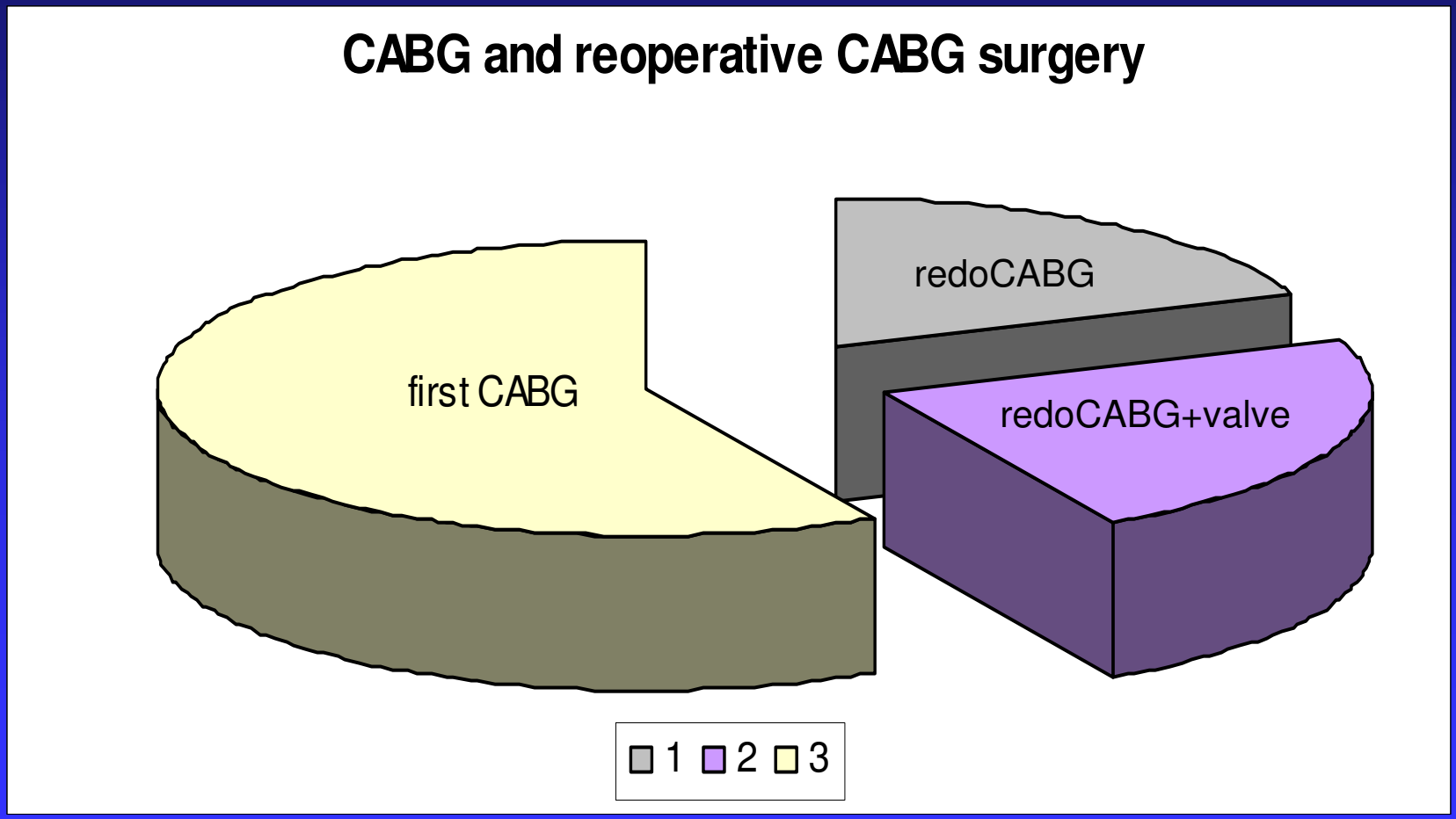
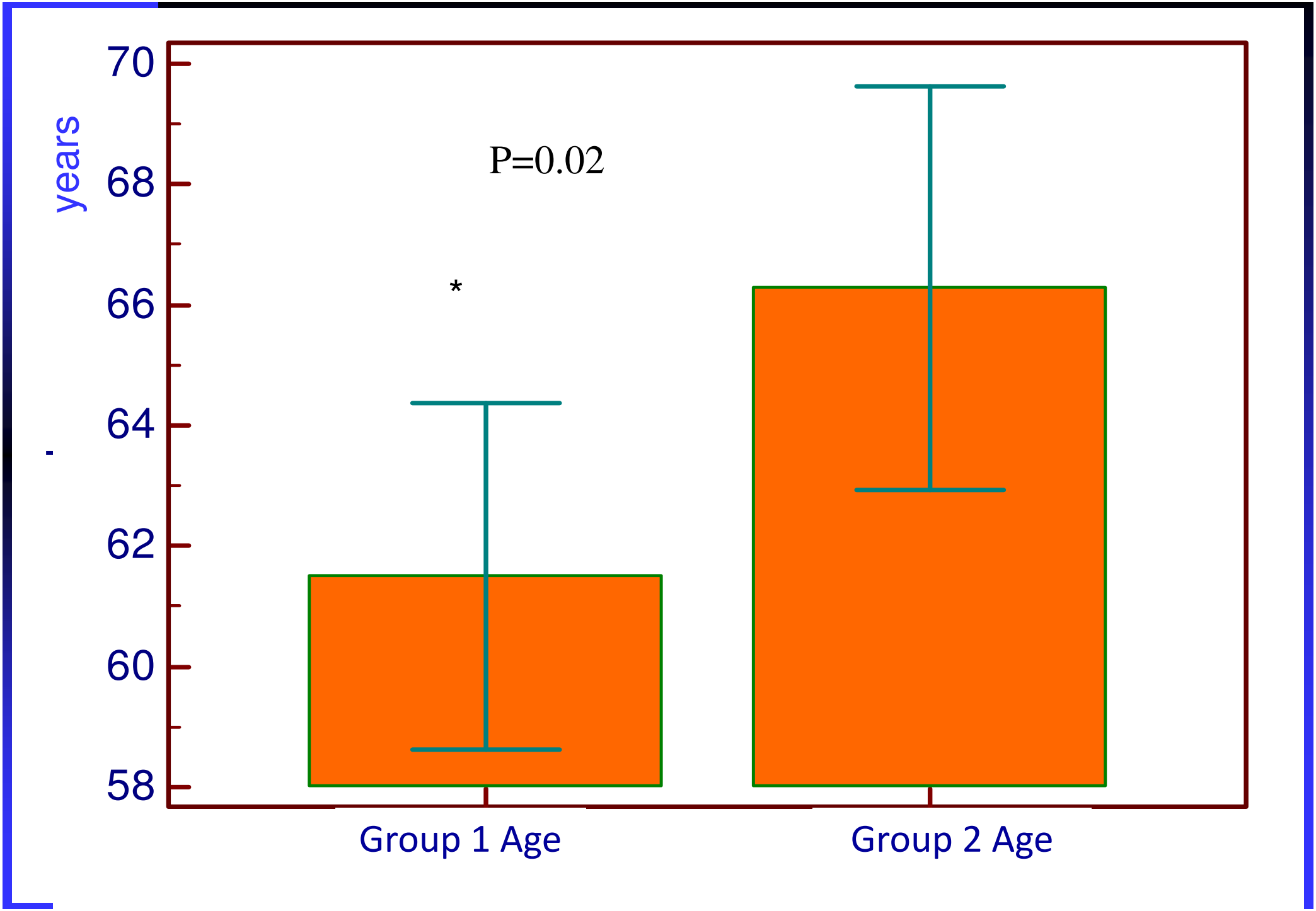


Table 1. Demographic and baseline characteristics

Variable	Group 1	Group 2	*p*
Gender male (%)	25 (83)	19 (86)	0.9370
Age (years)	60.5±6.5	66.2±7.36*	0.0216
Body mass (kg)	82±15.3	81.4±6.24	0.7064
LVEF (%)	26.08±4.8	35.68±10.72*	0.0004
EuroSCORE	4.66±1.37	8.1±2.34*	0.0001
Aspirin (yes/no)	93/7	76/24	0.1163
Hemoglobin (g/L)	133.37±16.1	137.0±17.2	0.4487
Leukocytes x10^9/L	7.83±1.86	7.39±3.23	0.5735
Thrombocytes x10^9/L	244.13±62.9	186.86±45.32*	0.0004

* $p<0.05$


70
68
66
64
62
60
58
years
P=0.02
*
Group 1 Age
Group 2 Age

Control group in reoperative surgery

- For complicated cardiac surgery, such as re-operation with repeated use of CPB, as a control group in this study we choose the patients with poor LVEF (26% *vs*. 35%)
- p = 0.0004

Table 2. Perioperative and lab data

Variable	Group 1	Group 2	*p*
CPB (minutes)	82.83±21.43	127±57.93*	0.00
Hemoglobin (g/L)	104.31±10.12	114.0±13.3 *	0.00
Leukocytes x10^9/L	13.63±10.42	16.25±4.79 *	0.03
Thrombocytes x10^9/L	187.78±196.0	137.4±42.66	0.19
Autologous RBC (mL)	566.0±146.66	733.4±297.8*	0.05
Blood loss (mL)	868.5±587.5	1040±823.4	0.42
Allogenic RBC (mL)	505.5±169.4	556.66±332.04	0.61

* $p<0.05$

Table 3. Clinical outcomes after primo- and reoperative CABG surgery

Variable	Group 1	Group 2	*p*
Tracheal intubation time (h)	16.07 (13.9-18.45)	19.20 (12.13-30.18)	0.30
Revision (%)	3 (10.0%)	2 (9.1%)	0.91
Arrhythmia (%)	5 (16.7%)	3 (13.6%)	0.76
ICU stay (days)	3.03 (2.32-3.95)	4.55 2.76-7.53)	0.14
Hospital stay (days)	9.86 (7.9-10.4)	14.6* (10.2-20.8)	0.01
Survival (yes/no)	30/30	21/1	ns

* $p<0.05$

Transfused products (ml)	Mean ±SD		
	CABG	redo CABG	*p*-Value
Packed red blood cells transfused intraoperatively	505.5±169.4	556.6±332.0	0.61
Autologous erythrocytes reinfusad intraoperatively	566.0±146.6	733.4±297.7	0.05
Fresh frozen plasma transfused	906.5±452.8	829.1±289.0	0.68
Crioprecipitate substitution	400.0±142.2	440.0±242.2	0.89
Packed red blood cells transfused postoperatively	771.1±809.5	1143.0±958.7	0.32
Platelets transfused	466.6±378.6	502.0±292.2	0.88

Results

- The two groups of patients had no significantly different hemoglobin levels before open heart surgery

  (133.37±16.1 g/L *vs.* 137.0±17.2 g/L; 0.44).
- The Group 2 of patients had a significant improvement in hemoglobin levels after operation

  (104.31±10.12 g/L *vs.* 114.0±13.3 g/L; 0.00).

Results *(cont.)*

- No differences were found for allogenic red blood cell transfusions intraoperatively (505.5± 169.4 *vs.* 556 ± 332.04; *p*: NS).
- The Group 2 of patients had higher amount of the blood loss (868.5± 587.5 *vs.* 1040 ± 823.4) but *p*: NS
- The Group 2 of patients had increased amount of the autologous RBC transfusions (566.0±146.6 *vs.* 733.4±297.8; *p*:0.05).

Blood transfusions

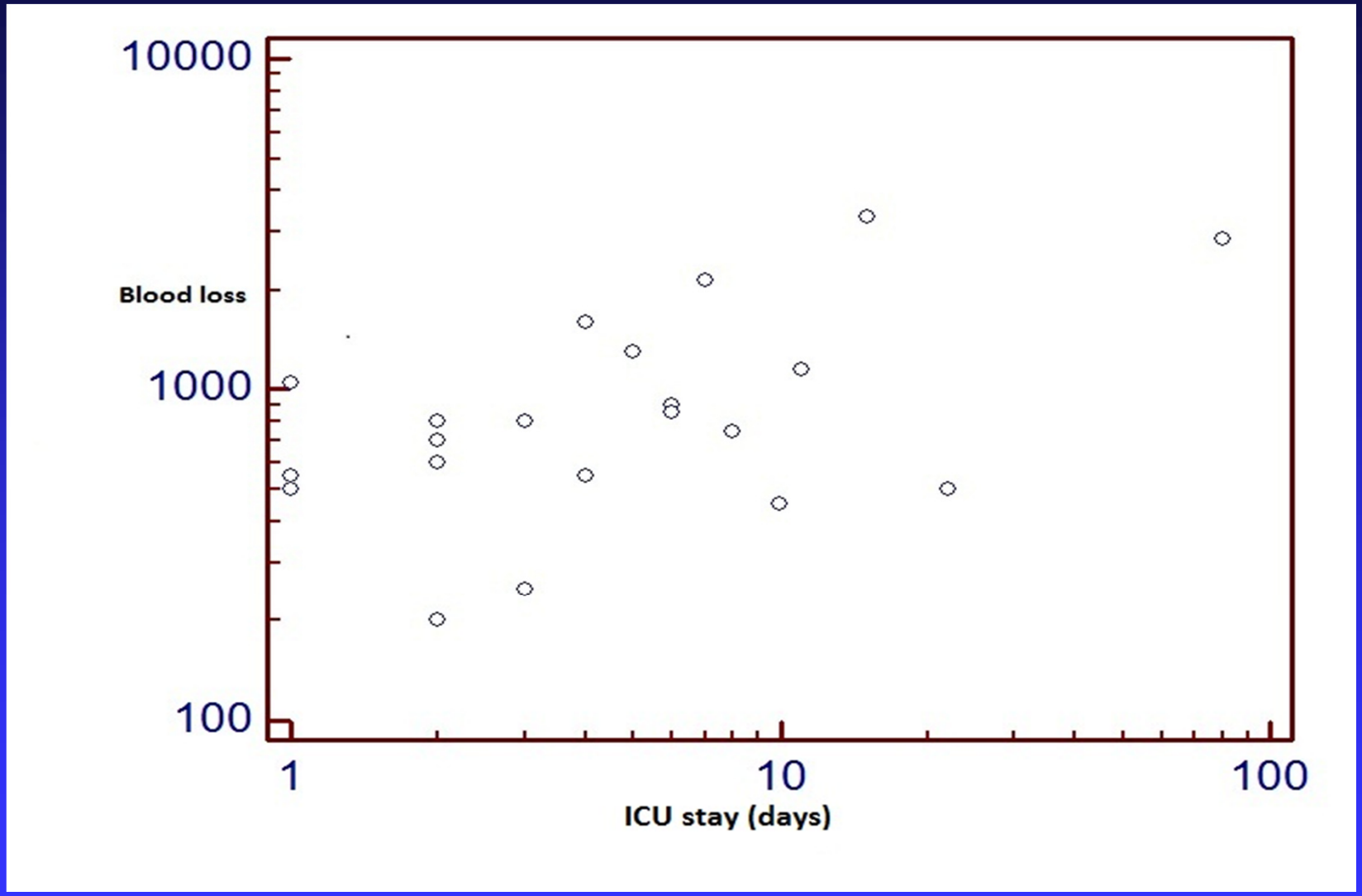
- Of 52 patients observed, 27 patients (51.92%) received a blood transfusion.
- In the Group 1, 19 (63%) patients received alloproducts:
  - 18 (60%) intraoperatively,
  - 13 (43%) postoperatively, and
  - 12 (40%) patients received alloproducts during and after surgery
- In the Group 2, 13 (59%) patients received alloproducts:
  - 9 (40%) intraoperatively,
  - 4 (18%) postoperatively, and
  - 13 (59%) patients during and after surgery.

Blood component substitution postoperatively

- Platelets transfused ($p = 0.88$),
- fresh frozen plasma ($p = 0.68$), and
- packed red blood cells transfused ($p = 0.32$)

  have not reached statistical significance.
- ICU stay was not influenced by used blood components transfusion, either allogenic or autologous.

Figure 2. Blood loss (mL) and ICU stay



The positive correlation between blood loss and ICU stay r = 0.49 (p = 0.021)

Discussion

- Blood salvage with a cell saving system improved postoperative hemoglobin levels, but affects coagulative and fibrinolytic systems[1].
- These conditions could generate a consumption coagulopathy.

Bleeding in reoperative surgery

- Due to the re-exploration of chest these patients are at higher risk of perioperative bleeding, and requires consequential substitution of blood products[6].

[6] Moulton MJ, *et al*. J Thorac Cardiovasc Surg 1996; 111:1037-1046.

Discussion *(cont.)*

- Microvascular bleeding remains a major problem following cardiac surgery with CPB.[6-7]
- Approximately 4% of patients require reoperation for hemorrhage,[7-8] which is associated with increased mortality and morbidity[9]
- with up to 5% of patients receiving more than a 10 unit perioperative blood transfusion.[8]

[6] Nuttall et al, Anesthesiology 2001; 94:773-781
[7] Hall et al, Cardiovasc. Surg. 2002; 10:146-153
[8] Woodman and Harker, Blood 1990; 76:1680-1697
[9] Unsworth-White et al, An of Thoracic Surgery 1995 59:664-667

Conclusions

- We have found that cell salvage procedure is safe and can significantly improve hemoglobin levels in reoperative CABG surgery
- The use of cell sever could help to reduce the amount of allogenic blood transfusion, and thus,
- to prevent postponing the surgical procedure in patients scheduled for complicated open heart surgery.

Thanks' for your kind attention!!!!!!

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