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Intraoperative cell-saver autotransfusion in politrauma patients

Doina Marin*, Diana Raduta**, Ass. Prof Radu Alexandru Macovei†

Abstract

This article makes a brief review of the advantages of the using intraoperative cell saver autotransfusion in the politrauma pacient as well as the risks associated to the heterologous blood transfusion. The latest years experience definitely favours the intraoperative cell saver autotransfusion, when possible, even from the cost – efficiency point of view. (Revista de Medicină de Urgență, Vol. 3, Nr. 1: 5-7)

Key words
intraoperative autotransfusion, cell saver, heterologous blood, politrauma

Autotransfusion is defined as the reinfusion of the recovered blood during the surgical intervention to the patient.

The use of the cell saver have a tendency to become rutine for the politrauma patients and major surgical interventions (vascular, thoracic, cardiac surgery, ortopedics, gynecology, urology).

1. The cell saver autotransfusion

The blood is colected from the operative field with the cell saver, filtered, centrifugated, separated into erytrocites and plasma components. The erytrocites are then washed with cristaloid solutions and re-transfused. The salvage rate of the erytrocites is 50-60% [1].

The major, classical contraindications of the cell saver are bacterial contamination and neoplasms. The latest years studies demonstrated that devices with leukocyte depletion filters are safe for the patients, even if the autotransfused blood is highly contaminated with bacteria. However, many practitioners are reluctant in using cell-savers in such cases.

If a leukocyte reduction filter is used, E coli, S. Aureus, P. Aeruginosa and B. Fragilis were reduced by 99%, 99.6%, 100% and 97.6% respectively. A higher grade of patient safety was insured when use a leukocyte depletion filter) [2].

* M.D., senior ICU physician Emergency Clinical Hospital Bucharest
** M.D., resident ICU physician Emergency Clinical Hospital Bucharest
† M.D., senior ICU Physician Head of Department of AIC II, Emergency Hospital Bucharest
Corresponding author: Diana Raduță email: dianannmar2000@yahoo.com
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A retrospective study [3] on 11 patients with penetrating thoracic-abdominal trauma that received autotransfusion with enteric contaminated blood, processed with the cell-saver, studied the infectious pathology that followed. All patients received broad-spectrum parenteral antibiotics. Three of them developed wound infections, one of which was probably of nosocomial origin. There were no cases of intra-abdominal sepsis, nor was any deaths recorded.

Numerous studies were performed in the oncological centers. It was demonstrated that irradiation of the blood transfused with the cell-saver is a very effective method for destroying the tumor cells. [4] Similar results – no viable tumor cell in the autotransfused blood – were obtained using the leukocyte depletion filters. [5] Therefore, the use of the cell-saver is indicated in oncologic surgery (best with leukocyte depletion filter), not only in cases with unexpected major bleeding, but also in scheduled interventions with high risk of major bleeding. [6]

2. Heterologous blood transfusion

We review some of the risks associated to the heterologous blood transfusion.

• Transmission of viral infections (hepatitis viruses, HIV, CMV, HTLV-1)

A special mention must be made for CMV. Approximately 60% of donors are carriers [7]. CMV is major cause for increased morbidity and mortality in critical patients from intensive care units, because it causes immunosuppression that could have dramatic consequences in these patients [8].

• Transmission of bacterial infections

A retrospective study [9] on 9592 patients aged 60 years subjected to orthopedic surgical interventions (total hip arthroplasty) showed that heterologous blood transfusion was associated with a 35% increase of the risk of a major bacterial infection and a 52% increase of the risk of pneumonia. Patients received at least 1 heterologous blood transfusion during their hospitalization. Severe bacterial infections appeared in 4.5% of the patients and 28.8% of them died in the hospital. Pneumonia appeared in 3.8% of the patients and urinary tract infections in 12%. The authors concluded that bacterial infections could be the most lethal adverse effects of the heterologous blood transfusion.

• Duration of transfused blood conservation

The valability period for whole blood is 35 days and 45 days for erythrocytes mass. The erythrocyte mass also con-

tains platelets, leukocytes and plasma and the life span of the leukocytes is less than 42 days. At their death potentially toxic enzymes and mediators are released. These mediators are significant after approximately 14 days of storage. [10]. A study on 63 politrauma patients [11] that received between 6 and 20 erythrocyte mass units in the first 12 hours after the trauma recorded multiple system organ failure (MSOF) in 23 of them. The period of blood conservation for the MSOF patients was significantly higher than the blood received by the other patients: 30.5±1.6 days versus 24±0.5 days. The number of bags older than 14-21 days was also higher n MSOF patients. The period of blood storage, the number of bags older than 14 days and 21 days are independent risk factors for MSOF.

Moreover, older erythrocytes have a lower capability of oxygen carriage. In a study on respiratory assisted sepsis patients[12] not only it was demonstrated the improvement of oxygenation after the transfusion of 3 erythrocyte mass units, but patients who received erythrocyte mass older than 15 days showed evident signs of splanhnic ischemia.

• Risk of immunosuppression

The immunosuppressive effect of the heterologous blood transfusion is known from the late 70s, yet not fully understood [13-15]. Has been studied 109 patients of whom 60 received autotransfusion and at least one heterologous blood transfusion and 25 received no transfusions at all. [15] The patients who received heterologous blood had a longer hospitalization, a higher rate of nosocomial infections, more days of fever, longer antibiotic therapy and a dramatic decrease in postoperative NK cells.

Other studies [16] reached similar conclusions. 15 patients with autotransfusion were compared to 50 patients with heterologous blood transfusion in terms of postoperative infections, postoperative leukocytosis and fever episodes. The patients in both groups had low Hb on admission. The patients who received heterologous blood transfusions had bigger blood losses and required a greater number of blood units. Positive cultures were obtained from 16% of those who received heterologous blood transfusion, compared to 4% in the autotransfusion group ($p<0.05$). 17 patients from the heterologous blood transfusion had leukocytosis compared to 12 from the autotransfusion group.

All these disadvantages of the heterologous blood transfusion are consistently lowered in autotransfusion. The use of the cell-saver brings an undisputed benefit in the management of the critical, politrauma patient.

3. The recent experience of the Emergency Clinical Hospital Bucharest

The use of the cell-saver increased in the past 5 years in the Emergency Clinical Hospital Bucharest. The benefits of this system are obvious in abdominal trauma (ruptured liver, spleen, great vessel lesions, associated or not) as well as in multiple fracture patients (pelvic fractures, bilateral femoral fractures, femoral and tibia fractures etc).

Over the year 2005 there were approximately 30 cases of major abdominal injury (ruptured liver, spleen, associated or not with great vessels injuries). Two cell-savers kits were used in the management of these patients because the volume of the aspired blood per time unit was greater than the capacity of a single kit. In 97% of the cases (29 patients), the evolution was favorable. For 1 patient (ruptured liver and great vessels injuries), the bleeding couldn't be surgical stopped. Some of the patients required postoperative heterologous blood transfusion.

The cell-saver was also used in abdominal laparoscopy in politauma patients, intervention meant to assess the need for the open laparotomy and intra-abdominal injuries. The autotransfusion of the intraperitoneal blood significantly decrease the need of heterologous blood transfusion, similar data being reported in the literature. The indication for the use of cell-saver in the general surgery is the loss of blood > 500 ml, and >900 ml in orthopedic surgery.

For the politrauma with multiple fractures (pelvis – femoral, bilateral femoral, femoral – tibial, pelvis – femoral – tibial), all 50 cases where the cell-saver was used had a favorable evolution.

4. Conclusions

As from the cost-effectiveness perspective, actual data neatly favors the intraoperative cell-saver autotransfusion, when possible.

Smith et al [17] studied the effectiveness of the cell-saver autotransfusion in trauma patients, over a period of 3 years, comparing the cost of the autotransfusion to that of the estimated necessary heterologous blood for the patients. 126 abdominal trauma patients had blood losses of 4864 - 6070 cc. The median volume of the intraoperative autotransfused blood per patient was 1547 - 2359 cc, equivalent of 6.9 units of erythrocyte mass. The total cost of the autotransfusion in these patients was $63.252. If all that blood was heterologous, the total cost reached $114.523; the difference is significant.

In today's conditions, when transfusion centers record a dramatic decrease in the number of donors and the lack of the blood derivatives is a daily reality we all face, the use of the cell-saver is an alternative that should be considered and exploited to the limits.

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