

Does Perioperative Autologous-blood-component Therapy Demonstrate Clinical Benefits In Patients Undergoing Orthopedic Surgery

H Jutzi, H Herren, R Rehle, J Steiner, P Ueltschi

Citation

H Jutzi, H Herren, R Rehle, J Steiner, P Ueltschi. *Does Perioperative Autologous-blood-component Therapy Demonstrate Clinical Benefits In Patients Undergoing Orthopedic Surgery*. The Internet Journal of Anesthesiology. 1997 Volume 2 Number 2.

Abstract

INTRODUCTION

In the past different techniques were used in order to restore erythrocytes perioperatively: Predonation, isovolemic hemodilution (IHD), cell-saving (CS), and patient-positioning. Repeated cell-saving results often in loss of platelets and coagulation factors necessitating transfusion of homologous blood products (1,2). This loss will play even a bigger role in the future when artificial oxygen-carriers will be available.

With a new procedure 'Autologous-Blood-Component Therapy' (ABC) autologous red blood cells (aRBC), autologous fresh plasma (aFP) and autologous platelet rich plasma (aPRP) are produced perioperatively by means of IHD and sequestration. AFP and aPRP are thought to compensate for the plasma- and platelet loss resulting from the wash-out. This procedure was shown to be effective in Redo-CABG (3).

Components gained using this technique are fresh and fully active. They suffer no activity-loss as it is found in stored predonations. aPRP contains active platelets.

The aim of our study was to investigate whether ABC demonstrates clinical benefits in orthopedic surgery.

METHODS

1996 we performed ABC in 22 patients undergoing total hip-arthroplasty (THA) and 22 patients with total knee-arthroplasty (TKA) and compared the perioperative blood-loss with 38 THA and 19 TKA patients without ABC. All patients had normal preoperative homeostatic laboratory findings. Low molecular Heparin was used routinely as thrombosis prophylaxis.

In group +ABC during induction of anesthesia (single shot spinal anesthesia with bupivacaine 0.5% supplemented with 80-100 mcg morphine intrathecal) 20-25% of the circulating blood volume per patient was withdrawn and replaced by Hemacel (3.5% colloid solution). The withdrawn blood was sequestered (Sequestra 1000 by Medtronic; fill rate 100 cc/min, wash volume 200 cc, 5600 rpm) aPRP was reinfused rapidly before wound closure when oozing was under control. aRBC and aFP were retransfused according to the rules of the conventional blood component therapy, as a rule in the late intraoperatively or early postoperative period. Patients with marginal preoperative Hb-levels were transfused with their aEc during IHD.

In the group -ABC no blood was withdrawn.

In both groups wound blood was collected and mixed with ACDA-Solution (15cc/100cc blood) from the beginning of the surgery until 6 hours later. The collected blood was then washed and concentrated (fill rate 400 cc/min, rate of washing 400cc/min, wash volume 1500 cc, at 5600 rpm) The resulting volume of aEc served as a measure for the perioperative blood loss in both groups. It was retransfused immediately.

Data from 9 -ABC and 3 +ABC THA patients and 12 -ABC and 8 +ABC TKA resp. were excluded. In these patients an unknown volume of collected blood was rejected in the beginning of the study for technical reasons.

To compare the results the amount of the washed blood was related to 80 kg body weight. To ensure that a possible saving of blood was not biased by dilution of the patient's blood, the difference of pre-/postop (1st postoperative day)

Does Perioperative Autologous-blood-component Therapy Demonstrate Clinical Benefits In Patients Undergoing Orthopedic Surgery

Hb-content was related to 80 kg and preoperative Hb. Up to that time point no patient was transfused with other components than his collected and washed blood.

RESULTS

Figure 1

THA		Overall Blood Products in 133 orthopedic Patients in 1996	TKA	
-ABC	+ABC		-ABC	+ABC
47	25	Total Patients	31	30
11	0	Total used RBC units	4	4
5	0	in (numbers of patients)	2	3
12	9	Total Units of Predonations	0	2
6	5	in (numbers of patients)	0	1

THA		Preoperative Characteristics for evaluated Patients	TKA	
-ABC	+ABC		-ABC	+ABC
76.7	73.3	Mean Body weight (kg)	78.3	79.2
3.0	3.5	S.E.M. mean body weight (kg)	3.3	2.8
2.0	1.9	Mean ASA-Class	2.3	2.1
0.1	0.1	S.E.M. ASA-Class	0.1	0.2

Figure 2

THA		Clinical Effect of ABC in 101 evaluated Patients	TKA	
-ABC	+ABC		-ABC	+ABC
38	22	Number of Patients	19	22
445	366	Volume (cc) of Washed Red Blood Cells as a Measure for Blood Loss	471	353
36	25	S.E.M. Blood loss (cc)	42	30
26 %	21 %	Relative Hb-Decease (pre- / 1 st postop day)	26 %	23 %
5 %	2 %	S.E.M. relative Hb-Decease	5 %	2 %
100 %	82%	Relative Volume of Washed Red Blood Cells as a Measure for Blood Loss	100 %	75 %

There were no differences in patient population between the -ABC and the +ABC group, when preoperative patient characteristics were compared.

In THA-patients blood loss was 18% and in TKA-patients 25 % smaller in the +ABC Group.

The Hct in the collected and washed blood was 50-54%. Platelet count in the aPRP was about 3-5 times the patient's blood count.

After retransfusion of the last components patients were transferred from the PACU to the ward.

We encountered neither side-effects nor complications.

DISCUSSION

During ABC it is important to withdraw and retransfuse 20 to 25 % of circulating platelets (4,5,6,7,8) in order to be effective. Authors reporting unsatisfying results did not respect this fact (9,10,11,12,13,14).

The two groups differed only concerning ABC. The relative Hb-decrease was even slightly smaller in the +ABC Group, which means that the 20-25% blood saving is real and not due to a dilution. In general our results are consistent with the ones from other authors (4-8).

This procedure demonstrated clinical benefits in our orthopedic patients and it has all the advantages of autologous-blood-avoiding method. Furthermore, compared to predonations it is simpler. The review of the admission Hb-concentrations suggests lower Hb-concentrations in patients who predonated blood. The components of ABC are not maltreated by cooling and storage. ABC may also probably be practiced without CS in malignancies.

We lowered the expenses for autologous blood products in our orthopedic patients from 60'000 SFr to 10'000 SFr per year. The costs per sequestration set are 450 SFr. The decrease in expenses for homologous blood products is due as well to ABC, to intraoperative patient positioning, and last but not least reflects higher transfusion triggers.

APRP, by adding thrombin, is a source for autologous platelet gel. This platelet gel may be used as a fibrin glue for local homeostasis. Combined with ABC we also perform redo THA and TKA without homologous blood products.

Further studies concerning clinical effects, laboratory findings and economics facts should be performed with ABC.

References

1. Horst, H.M., Dlugos, S., Fath, J.J., Sorensen, V.J., Obeid, F.N., Bivins, B.A.: Coagulopathy and intraoperative blood salvage (IBS). J.Trauma. 32, 646-652, 1992
2. Jacobi, K., Walther, A., Kuhn, R., Dworak, O., Neidhardt, B., Rugheimer, E.: [Advantages and limitations of intraoperative mechanical autotransfusion in al prostatectomies]
3. Moglichkeiten und Grenzen der intraoperativen maschinellen Autotransfusion (MAT) bei radikalen Prostatektomien Anaesthesist. 46, 101-107, 1997
4. Christenson, J.T., Reuse, J., Badel, P., Simonet, F., Schmuziger, M.: Plateletpheresis before redo CABG diminishes excessive blood transfusion. Ann.Thorac.Surg. 62, 1373-1378, 1996

5. Boldt, J., Kling, D., Zickmann, B., Jacobi, M., von Bormann, B., Dapper, F., Hempelmann, G.: Acute plasmapheresis during cardiac surgery: volume replacement by crystalloids versus colloids. *J.Cardiothorac.Anesth.* 4, 564-570, 1990
6. Boldt, J., Zickmann, B., Ballesteros, M., Oehmke, S., Stertmann, F., Hempelmann, G.: Influence of acute preoperative plasmapheresis on platelet function in cardiac surgery [see comments]. *J.Cardiothorac.Vasc.Anesth.* 7, 4-9, 1993
7. Davies, G.G., Wells, D.G., Mabee, T.M., Sadler, R., Melling, N.J.: Platelet-leukocyte plasmapheresis attenuates the deleterious effects of cardiopulmonary bypass [see comments]. *Ann.Thorac.Surg.* 53, 274-277, 1992
8. Jones, J.W., McCoy, T.A., Rawitscher, R.E., Lindsley, D.A.: Effects of intraoperative plasmapheresis on blood loss in cardiac surgery. *Ann.Thorac.Surg.* 49, 585-589, 1990
9. Wells, D.G., Davies, G.G.: Platelet salvage in cardiac surgery. *J.Cardiothorac.Vasc.Anesth.* 7, 448-451, 1993
10. Babka, R.M., Petress, J.W., Mack, J.W.: The effect of intraoperative autologous plasma sequestration on patients undergoing coronary bypass surgery: A retrospective study. *Proceed.Am.Acad.Cardiovasc.Perfusion.* 12, 80-84, 1991
11. Boey, S.K., Ong, B.C., Dhara, S.S.: Preoperative plateletpheresis does not reduce blood loss during cardiac surgery. *Can.J.Anaesth.* 40, 844-850, 1993
12. Ereth, M.H., Oliver, W.C., Jr., Beynen, F.M., Mullany, C.J., Orszulak, T.A., Santrach, P.J., Ilstrup, D.M., Weaver, A.L., Williamson, K.R.: Autologous platelet-rich plasma does not reduce transfusion of homologous blood products in patients undergoing repeat valvular surgery [see comments]. *Anesthesiology.* 79, 540-547, 1993
13. Shore Lesserson, L., Reich, D.L., DePerio, M., Silvey, G.: Autologous platelet-rich plasmapheresis: risk versus benefit in repeat cardiac operations. *Anesth.Analg.* 81, 229-235, 1995
14. Tobe, C.E., Vocolka, C., Sepulvada, R., Gillis, B., Nessly, M., Verrier, E.D., Hofer, B.O.: Infusion of autologous platelet rich plasma does not reduce blood loss and product use after coronary artery bypass. A prospective, randomized, blinded study [see comments]. *J.Thorac.Cardiovasc.Surg.* 105, 1007-1013, 1993
15. Wong, C.A., Franklin, M.L., Wade, L.D.: Coagulation tests, blood loss, and transfusion requirements in platelet-rich plasmapheresed versus nonpheresed cardiac surgery patients. *Anesth.Analg.* 78, 29-36, 1994

Author Information

H. Jutzi

Salem-Spital

H. Herren

Salem-Spital

R. Rehle

Salem-Spital

J. Steiner

Salem-Spital

P. Ueltschi