

THE USE OF INTRAOPERATIVE AUTOTRANSFUSION IN ORTHOPAEDIC PATIENTS

Mahmut KILIÇ*
Mahmut GİDER*

Erbil AYDIN*
Şükrü SOLAK*

Mert TÜZÜNER*
Tibet ALTUĞ*

The use of homologous blood transfusion should be minimized to reduce the risks of transfusion including transfer of HBV and HIV. This aim can be achieved by hypotensive anesthesia or autolog blood transfusion either by predeposited blood or intraoperative autotransfusion. This study evaluates the results of intraoperative autotransfusion in 134 patients who are operated between June 1991 and April 1994. Twenty one of operations were revision surgery of total hip replacement while 12 of them were primary cementless total hip replacement, 20 were posterior vertebral instrumentation for vertebral fractures, 15 were anterior discectomies for treatment of scoliosis, 4 were one-stage anterior discectomy and posterior instrumentation, 62 were correction and posterior instrumentation for scoliosis. The average amount of blood saved during surgery was 768.6 ± 52.8 cc. and the amount of blood used for homolog transfusion was 1.5 ± 0.82 units. At the same time period 62 patients were operated for primary total hip arthroplasty and 18 patients had spinal instrumentation without having autotransfusion. 2.94 ± 0.73 units of homolog blood was used. The results show that the difference between the preoperative and postoperative values of haematocrite are significant. The need for homolog transfusion was 45% less in the autotransfusion group.

INTRODUCTION

The idea of transfusion of the blood which is lost during the operation was first introduced by Dr. J. Blundell in 1818. In 1864, Dr. Duncan transfused 50 cc. of blood which was obtained from the amputated limb of a patient. Later on a few research was performed about this subject. In 1950's autotransfusion was repopularized by Dr. Gibbon who transfused the blood obtained intraoperatively during cardiac surgery. With the increase in incidences of HIV and Hepatitis infections in the population, the autotransfusion of intraoperatively collected blood became a widely used procedure (1).

Homologous blood transfusion has some disadvantages, such as; risk of viral infection, antigene-antibody immune reaction, increased demand for blood with increased frequency of trauma, possibility of error of the blood bank staff. Also in some cases the blood demand may be more than the blood that is owned.

Intraoperative autologous blood transfusion may reduce the total blood loss of the patient up to 50% (2, 3). This procedure minimizes the blood need intraoperatively and postoperatively.

MATERIALS AND METHODS

The results of autotransfusion in 134 major orthopaedic surgical procedures, which were performed in the 1st and 2nd Departments of Orthopedics and Trau-

matology of Ankara Social Security Hospital between June 1991 and December 1993 was evaluated. The diagnoses and types of operations of the patients for whom autotransfusion was used, is shown in Table 1. 74 of the patients were female and 60 of them were male. The mean age of the patients was 61 (47-69) for revisional hip replacement, 34 (17-54) for vertebral fractures and 15 (11-18) for scoliosis.

For autotransfusion, AT 750 autotransfusion system (Electromedics, Englewood, U.S.A.) was used. In all operations, the blood was collected from the wound and transferred to the autotransfusion system. The blood was centrifuged at 5600 rpm, washed at least 5 minutes, then transfused as erythrocyte suspension.

For all patients hematocrit values was measured preoperative, intraoperative and at 24th hour postoperatively. Also for all patients, autologous and homologous blood quantity transfused intraoperatively was recorded.

70 patients who were operated between the same dates and for whom autotransfusion was not used, were accepted as a control group. The same laboratory and blood volume measurements were collected for the control group.

All operations were performed by the same surgical team.

For 62 of these patients total hip replacement for primary hip osteoarthritis and for 18 patients posterior instrumentation for vertebral fractures were performed.

* 1st and 2nd Departments of Orthopaedics and Traumatology, Ankara Social Security Hospital, Ankara, Turkey.

Table 1. The distribution of autotransfusion group patients regarding diagnoses and operations.

DIAGNOSE	TYPE OF OPERATION	N. OF CASES	(%)
Previously operated hip arthroplasty	Revision arthroplasty	21	15.7
Hip Osteoarthritis	Primary arthroplasty	12	8.9
Vertebral fractures	Posterior instrumentation	20	14.9
Scoliosis	* Anterior release + discectomy	15	11.3
	* One stage anterior release and posterior instrumentation	4	2.9
	* Posterior instrumentation	62	4.6
Total		134	100

RESULTS

a) Autotransfusion Group:

Maximum blood was tried to be collected during the operation either by direct suction from the wound or by suction of the suspension which was prepared by washing the bloody sponges with %0.9 saline. In this group, nearly 1300 cc. of blood was obtained during the operation and the average of transfused blood suspension collected blood was 768 ± 52.8 cc. by the autotransfusion system. After being washed and centrifuged in the system, the hematocrit value of the obtained blood was about 58%. Averagely 1.5 ± 0.82 units of this high hematocrit blood was transfused to the patients of the autotransfusion group.

The mean hematocrit value was 36.9 ± 4.9 in the preoperative period. Intraoperatively it decreased to $32.1 \pm 3.7\%$ and postoperatively, after the autotransfusion, it was measured as 34.9 ± 3.9 (Table 2).

One unit of fresh homologous blood was transfused to the patients whose hematocrit value was measured under 30% intraoperatively. For no patient second unit of homologous blood was needed. Totally for 42 patients homologous blood was transfused when hematocrit was under 30% and insufficient blood was collected in the autotransfusion system. There was no statistical difference between preoperative and postoperative hematocrit values ($t = 0.21$, $p > 0.05$).

b) **Control Group:** In this group mean blood loss was 1450 cc. It was more than the loss in the transfusion group and was tried to be compensated by transfusing meanly 2.94 ± 0.73 units of homologous blood. The mean hematocrit value was $36.6 \pm 5.1\%$ in the preoperative period and it decreased to $25.6 \pm 5.3\%$ intraoperatively. Although homologous blood had been transfused preoperatively (minimum 2, maximum 6 units of blood), postoperative hematocrit value was measured as $28.6 \pm 4.9\%$ (Table 2). Statistically there was a significant difference between preoperative and postoperative hematocrit values ($t = 4.74$, $p < 0.05$). For 31 (44.3%) patients of this group, 1 unit of blood was transfused in the postoperative period as hematocrit values fell down under 27%.

c) **Overall Evaluation:** Although all operations had been performed by the same surgical team and under the same circumstances, more blood loss was observed in the control group. The blood that must be replaced has been calculated 45% less in the autotransfusion group than in the control group. There was no statistical difference between preoperative and postoperative hematocrit values in the autotransfusion group as there was a statistically significant difference between those of the control group. There was no statistical difference regarding preoperative hematocrit values ($t = -0.14$, $p > 0.05$), but there was a statistically significant difference regarding intraoperative and

Table 2. Preoperative, intraoperative and postoperative hematocrit values of autotransfusion group and control group.

	PREOP.	INTRAOP.	POSTOP.	t	p
Autotransfusion n = 70	36.9±4.9	32.1±3.7	34.9±3.9	(-0.21)	p<0.05
Control n = 70	36.6±5.1	25.8±5.3 20	28.6±4.9	4.74	p<0.05
t	(-0.14)	6.76	13.13	-	-
p	p>0.05	p<0.05	p<0.05	-	-

postoperative hematocrit values ($t_{10} = 6.73$, $p < 0.05$; $t_{20} = 13.13$, $p < 0.05$) between the two groups.

In the autotransfusion group for 31.3% of the patients, 1 unit of homologous blood was used to compensate the bleeding until sufficient amount of blood has been collected in the autotransfusion system. In the control group although 2.94 ± 0.73 units of blood has been transfused during the operation, for 44.3% of the patients 1 unit of extra blood has been needed postoperatively.

59.1% of lost blood has been conserved with cell-saver apparatus.

DISCUSSION

50% of the lost blood can be transfused back to the patient by using autotransfusion techniques and Cell-saver. Thus homologous blood need may be reduced or may totally disappear (1, 3).

In this study, 59.1% of intraoperatively lost blood has been conserved and 1.5 ± 0.2 units of blood has been autotransfused. This ratio is 45% less than that of control group. Besides, the risk of viral infection may disappear. The risks for viral infections were postulated as 1/250,000 for HIV₁ and HIV₂, 250/250,000 for Hepatitis C, 90/250,000 for Hepatitis B, 7500/250,000 for Non A-Non B-Non C Hepatitis, 1/100,000 for Parvovirus B₁₉ by Prof. Viars from Paris, in 1992 (4, 5). The risk of viral infection was totally prevented in the patients for whom homologous blood was not used. Also with the use of autologous transfusion, the use of homologous blood decreased, so the risk of infection has been minimized.

In addition, 2,3 diphosphoglycerate level of intraoperatively collected blood is more than that of bank blood, so it is more resistant to osmotic stresses.

In this study, no difference has been observed between preoperative and postoperative hematocrit values of 134 patients for whom autotransfusion has been used. But in the control group, a significant decrease has been observed in the hematocrit values. The postoperative hematocrit values of the two groups were also statistically different though they were not statistically different preoperatively.

As a result, the hematocrit values of the autotransfusion group has not changed, but hematocrit values of the control group has decreased although more homologous blood has been transfused.

REFERENCES:

1. Autologous Blood Component therapy: A new dimension in surgical transfusion practices. Electromedics, Inc. Englewood, Colorado, 1993.
2. Ray JM, Flynn LC, Bierman A: Erythrocyte survival following intraoperative autotransfusion in spine surgery. An in vivo comparative study and 5- year update. Spine, 11: 879-882, 1986.
3. Turner RH, Scheller A, Flynn JC et al: Current concepts of blood conservation, AAOS, Las Vegas, Nevada, Jan. 24-28, 1985.
4. Bovil DF, Moulton CW, Jackson WST, et al: The efficacy of intraoperative autologous transfusion in major orthopaedic surgery: a regression analysis. Orthopaedics, 9: 1403-1407, 1986.
5. Keeling MM, Gray LA, Brink MA, et al: Intraoperative autotransfusion experience in 725 consecutive cases. Ann Surg., 197: 536-541, 1983.
6. Orr MD, Blanko JW: Autotransfusion of concentrated selected washed red cell from surgical field: a biochemical and physiological comparison with homologous cell transfusion from 1978. In: proceedings of the blood conservation institute, 1978.
7. Senkiw LB, Schurman DJ, Goodman SB, Woolson ST: Postoperative blood salvage using the cell saver after total joint arthroplasty. J Bone Joint Surg, 71-A (6): 823-827, 1986.