Intraoperative autotransfusion in hip arthroplasty

A retrospective study of 214 cases with matched controls

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The transfusion requirements in 214 patients who received intraoperatively collected autologous blood during total hip arthroplasty (Study Group) were compared with 214 age- and sex-matched controls who received homologous bank blood (Control Group). There were 132 patients with primary operations, 27 bilateral, and 55 revisions in each group.

In the Study Group, there was a reduction in the amount of homologous blood transfusion, intraoperatively as well as totally, and also in postoperative blood loss in all three operation subsets. The Study and Control Groups were equal in pre- and postoperative hemoglobin and hematocrit values.

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Homologous blood transfusion may transmit diseases such as hepatitis (Tremolada et al. 1982, Mattson 1989), cytomegalovirus, T-cell lymphotropic virus, malaria and acquired immunodeficiency syndrome (Tabor 1982, Ward et al. 1988). Intraoperative blood salvage during hip arthroplasty has proved effective in reducing loss of blood and hence the need for homologous blood transfusion (Bovil et al. 1986, Law and Wiedel 1989, McMurray et al. 1990, Elawad et al. 1991). Postoperative autotransfusion has also been used to increase the effectiveness of autologous blood transfusion (Semkiw et al. 1989, Groh et al. 1990).

We report our experience with intraoperative autotransfusion in hip arthroplasty during the period 1988–1990.

Patients and methods

We retrospectively studied the blood transfusions in 214 patients in whom intraoperative autotransfusion (IAT) was used during total hip arthroplasty at our department between December 1988 and December 1990 (Table 1).

Primary hip arthroplasty was performed in 159 patients, of whom 27 had a bilateral operation, and 55 patients had revision of one or both prosthetic components. The transfusion and the blood loss in this Study Group were compared with an age- and sex-matched Control Group of patients who had 132 primary, 55 revision and 27 bilateral operations with the use of only homologous blood. The Control patients were operated on before the introduction of the cell saver in our department. Epidural anesthesia was used in all patients except in 15 Study patients and 12 Control patients who had general anesthesia.

The autotransfusion device (Electromedics-Autotrans AT-1000 Autotransfusion®, Englewood, CO, U.S.A.) was used intraoperatively, and it was also, in 71 cases, connected with the drain tubes for use in the recovery room. Blood was retrieved from the operation field with a double-lumen suction catheter and immediately anticoagulated with sodium citrate. Larger debris, such as fat, bone and cement particles, were removed by a 240 micron filter in the cardiotomy reservoir. The filtered blood was pumped to a bowl centrifuge, centrifuged and washed in a small bowl with 1,500 mL of saline. The supernatant was discarded, the erythrocyte concentrate was pumped to the reinfusion bag and then retransfused to the patient. Postoperatively, the autotransfusion device was used only in 71 of the 214 patients (33 percent) due to shortage of staff. 5 patients in this series deposited blood preoperatively (3 patients in the primary group and 2 in the revision group).

The amount of blood salvaged and retransfused to the patients intraoperatively or postoperatively, as well as the amount of homologous blood or banked autologous blood transfusion, were recorded. Hemoglobin and hematocrit values were measured preoperatively, 24 hours postoperatively and at discharge from the hospital (7–25 days). CRP and ESR were recorded preoperatively, 24 hours postoperatively, at discharge, and at the postoperative follow-up after 6 weeks to 1 year.

Table 1. Autotransfusion compared with homologous transfusion in hip arthroplasty. Mean *SD*

	Primary operations n 132				Bilateral operations n 27				Revisions n 55			
	S		C		S		C		S		C	
Age	67	*13*	67	*10*	64	*12*	63	*11*	69	*10*	69	*11*
Women	69		71		21		19		28		34	
Men	63		61		6		8		27		21	
Operation time (min)	129	*32*	127	*21*	262	*34*	268	*39*	213	*56*	202	*46*
Hospital stay (days)	15	*7*	16	*4*	21	*10*	21	*9*	17	*7*	16	*8*
Diagnosis												
Arthrosis	94		90		22		24		–		–	
Fracture sequelae	22		26		1		–		–		–	
Rheumatoid arthritis	12		11		1		3		–		–	
CDH	4		5		1		–		–		–	
Cup loosening	–		–		–		–		3		5	
Femoral component loosening	–		–		–		–		5		3	
Both components loosening	–		–		–		–		42		47	
Others	–		–		2		–		5		–	
Blood loss (mL)												
Peroperative	1220	*624*	1198	*432*	2148	*937*	2171	*952*	2722	*1393*	2643	*1324*
Postoperative	683	*327*	855	*424* [b]	960	*390*	1303	*602* [b]	973	*570*	1278	*509* [b]
Total	1887	*793*	2039	*595* [a]	3661	*1177*	3382	*1120*	3655	*1740*	3903	*1373* [a]
Transfusion (mL)												
Operative												
Cell saver	344	*219*	0		631	*264*	0		809	*545*	0	
Homologous	128	*228*	502	*318* [c]	324	*292*	1183	*533* [c]	541	*434*	1431	*620* [c]
Postoperative												
Cell saver	193	*130*	0		183	*107*	0		228	*161*	0	
Homologous	289	*325*	296	*299*	486	*282*	530	*282*	485	*277*	503	*351*
Total												
Autologous	425	*260*	0		692	*274*	0		877	*610*	0	
Homologous	407	*374*	669	*386* [b]	810	*438*	1710	*788* [b]	1026	*549*	2026	*960* [c]
Hemoglobin (g/L)												
Preoperative	130	*16*	131	*15*	130	*13*	129	*12*	135	*13*	133	*16*
Postoperative (24 h)	106	*9*	108	*11*	105	*7*	104	*10*	108	*8*	104	*12*
Discharge (7–25 days)	125	*12*	125	*13*	126	*14*	123	*15*	128	*10*	130	*14*
Hematocrit (percent)												
Preoperative	39	*4*	39	*4*	39	*4*	38	*5*	40	*4*	40	*5*
Postoperative (24 h)	30	*2*	30	*3*	31	*2*	30	*2*	32	*2*	30	*2*
Discharge (7–25 days)	37	*3*	37	*2*	36	*4*	34	*3*	37	*3*	37	*5*
CRP (mg/L)												
Preoperative	14	*15*	14	*12*	15	*22*	14	*17*	15	*17*	15	*16*
Postoperative (24 h)	133	*54*	146	*63*	156	*70*	152	*71*	152	*73*	145	*69*
Discharge (7–25 days)	13	*11*	12	*11*	14	*12*	13	*12*	12	*11*	13	*10*
Follow-up (3–12 months)	9	*10*	9	*9*	9	*5*	9	*6*	8	*2*	9	*5*

S Study Group
C Control Group
[a] $P < 0.05$
[b] $P < 0.01$
[c] $P < 0.001$

Analysis of data was done using analysis of variance (ANOVA), Student's *t*-test, and the Mann-Whitney test.

Results

In the Study Group, 2 patients had superficial wound infection which healed uneventfully. One patient in the primary total hip arthroplasty group had signs of deep infection 2 months postoperatively, and the prosthesis was extracted. In the Control Group, 1 patient had a superficial wound infection and 2 patients with primary operation had a deep infection—the prostheses were extracted.

3 patients in the primary group, 4 in the bilateral and 2 in the revision groups, had a deep vein thrombosis which was diagnosed clinically and verified by phlebography, as compared with 9 in the control group. No patient in the whole series showed any clinical sign of renal impairment or any other complication.

There was no difference between the two groups in operative blood loss (Table 1). The postoperative blood loss was less in the Study Group for all three types of operations. There was a reduction in total homologous transfusions in the Study Group.

In the Study Group, 97 patients who had primary operations, 16 revisions and 10 bilateral operations did not receive homologous blood peroperatively. Postoperatively, 66 primary operation patients, 11 revisions and 5 bilaterals managed without homologous blood transfusion.

Of the 5 patients who donated blood preoperatively, 3 patients in the primary group did not require any homologous blood transfusions; in 2 of them, two units of their 3 predonated units were used postoperatively while the third patient received one unit postoperatively. One of the patients in the revision group received two homologous units in addition to her two predonated units. She had an operative bleeding of 3,100 mL and received the two predonated autologous units in addition to the salvaged blood. The postoperative blood loss was 1,330 mL and her Hb was 90 g/L; she received another two units of homologous blood postoperatively. The other patient who predonated three units, did not require any homologous blood; he received two units of autologous blood intraoperatively and one unit postoperatively.

The mean hematocrit values at discharge were above 34 percent in both groups (Table 1). The first postoperative values of CRP and ESR showed the usual postoperative increase. The values were within the normal range at about 3 months postoperatively.

The use of the cell saver reduced the need for intraoperative homologous blood transfusion by more than 60 percent; an average of 425 mL was saved in the primary group, 877 mL in the revision group and 692 mL in the bilateral group.

Discussion

In the Study Group, homologous blood was transfused in the primary operation group at an average of 128 mL intraoperatively and 289 mL postoperatively. This amount could have been easily reduced with more precise indications (Grindon et al. 1985). In a recent study we reported that primary hip arthroplasty could be safely and effectively performed using intraoperative autotransfusion alone (Elawad et al. 1991).

In the Study Group, postoperative homologous transfusion was required in 45/55 revisions and in 21/27 bilateral operations with an average of 400–500 mL. Predonation of 2–3 units in those patients would have almost eliminated the need for homologous blood transfusion. Also, the indication for transfusion should be reconsidered to match the recommendations given by the American Association of Blood Banks (AABB) in order to reduce the need for homologous blood transfusion in those patients.

Our data indicated that autotransfusion did not disturb the hematologic capacity of the patients. No evidence of increased risk of infection was observed; infectious agents, such as Staphylococcus epidermidis, are not transfused by IAT (Decker and Heeg 1990).

Primary hip arthroplasty may be performed using intraoperative autotransfusion alone if the guidelines set by the AABB are followed. However, in revision and bilateral hip arthroplasty additional preoperative blood donation is required.

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