Autotransfusion in hip prosthetics surgery

Summary

Background. Homologous blood transfusion (donor blood, SAG blood) is associated with a risk of transfer of infectious diseases and transfusion reactions. The purpose of the study was to compare the need for homologous blood transfusion with and without the use of mechanical autotransfusion perioperatively during the implantation of a total hip replacement prosthetic.

Material and method. Our patient material from the period June 2001 to June 2004 encompasses 111 patients: Group 1 encompassed 29 patients who were operated on in the period from June 2001 to June 2002 without autotransfusion, Group 2 encompassed 35 patients operated on from September 2002 to March 2003 with traditional blood recovery and Group 3 encompassed 47 patients who had been operated on from March 2003 to June 2004 with traditional blood recovery as well as intraoperative recovery of rinsing fluid containing blood.

Results. Group 3 had significantly higher haemoglobin values postoperatively (10.9 ± 0.3 g/100 ml) than Group 2 (9.6 ± 0.3 g/100 ml, $p < 0.01$) and Group 1 (9.5 ± 0.4 g/100 ml, $p < 0.01$). The amount of autologous erythrocyte concentrate produced in Group 3 was higher (440 ± 51 ml) than in Group 2 (238 ± 31 ml, $p < 0.01$). Fewer patients in Group 3 (9 %) received homologous blood transfusion than in Group 2 (29 %, $p < 0.04$) or in Group 1 (76 %, $p < 0.01$).

Interpretation. The use of perioperative blood recovery for later retransfusion leads to a significant reduction in homologous blood transfusion in implantation of a total hip prosthetic.

Conflicts of interest: None declared

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Homologous blood transfusion may cause a number of complications, including risk of infection (HIV, hepatitis), immunisation (antibodies to erythrocytes and leukocytes) and transfusion reactions. Furthermore, the availability of blood is limited, especially with regard to rare blood types. For these reasons, autotransfusion, meaning transfusion of the patient's own blood, has attracted ever-increasing attention. The purpose of the study was to compare the need for homologous blood transfusion with and without the use of mechanical autotransfusion during implantation of a total hip replacement prosthetic. In addition, we wished to study whether intraoperative recovery of rinsing fluid containing blood could further increase the amount of recovered blood, and thus reduce the need for homologous blood.

Material and methods

All patients who received a total hip prosthetic implant in our hospital in the period from September 2002 to June 2004 were included in a prospective study of mechanical autotransfusion. Two patients were excluded from the study. One patient suffered from iron-deficiency anaemia which required transfusion, and the blood of another patient could not be used because of an error committed during the addition of heparin. In addition, all patients who received a total primary hip prosthetic implant during the period from June 2001 to June 2002 were retrospectively included in the study. All the patients had been diagnosed with coxarthrosis.

In total, there were 111 patients (80 women and 31 men) with an average age of 71.5 (range: 56 to 88 years). Three groups of patients were formed:

- Group 1: 29 patients who had been operated on from June 2001 to June 2002 without autotransfusion.
- Group 2: 35 patients who had been operated on from September 2002 to 27 March 2003 with traditional blood recovery
- Group 3: 47 patients who had been operated on after 27 March 2003 with traditional blood recovery + recovery of rinsing fluid containing blood.

In Groups 2 and 3, all blood from surgical wounds/drainages was recovered, anti-coagulated, centrifuged and washed intra- and postoperatively (for up to six hours) (Cell Saver 5, Haemonetics) and subsequently retransfused. Haemoglobin was measured preoperatively and on the first postoperative day. Blood loss was estimated intra- as well as postoperatively (total amount). Recovered erythrocyte concentrate was carefully measured and documented (e.g. 517 ml of autologous erythrocyte concentrate, AEC). The recovered blood was anti-coagulated with a heparin solution (25000 IE heparin per 1 litre 0.9 % NaCl) and 0.9 % NaCl was used as a surgical rinsing fluid and as a washing fluid in Cell Saver. The indication for administering a homologous blood transfusion was a haemoglobin value of less than 8.5 g/100 ml.

The data were statistically assessed with a t-test. A chi-square test was used to investigate gender differences between the groups, and Fisher's test for differences in «the number of patients who received a homologous blood transfusion». Data are reported as averages ± standard deviations.

Results

There was no significant difference between the three groups in terms of preoperative haemoglobin values, age or gender (Table 1). Group 3 had statistically significantly higher haemoglobin values postoperatively (10.9 ± 0.3 g/100 ml) than Group 2 (9.6 ± 0.3 g/100 ml, $p < 0.01$) and Group 1 (9.5 ± 0.4 g/100 ml, $p < 0.01$). There was no significant difference between Groups 1 and 2 in terms of postoperative haemoglobin values.

The amount of autologous erythrocyte concentrate (AEC) recovered in Group 3 was higher (440 ± 51 ml) than in Group 2

! Main message

- In patients who receive a total hip prosthetic implant, the use of mechanical autotransfusion reduces the need for homologous blood transfusions from 76 % to 29 %.
- Recovery of rinsing fluid containing blood as well as traditional blood recovery further reduces the need for homologous blood transfusions to 9 %.

Table 1: Comparison of the three treatment groups with regard to the different measurements. Figures are averages ± standard deviations.

	Group 1 (no autotransfusion)	Group 2 (traditional blood recovery)	Group 3 (traditional blood recovery + recovery of rinsing fluid containing blood)
Preoperative haemoglobin value (g/100 ml)	13.7 ± 0,5	13.3 ± 0,4	13.7 ± 0,4
Postoperative haemoglobin value (g/100 ml)	9.5 ± 0,4	9.6 ± 0,3	10.9 ± 0,3
Estimated blood loss (ml)	871 ± 115	741 ± 70	946 ± 108
Autologous erythrocyte concentrate recovered (ml)	0	238 ± 31	440 ± 51
Donor blood (SAG) (units/patient)	1.79 ± 0,49	0.69 ± 0,48	0.15 ± 0,15
Number of patients (%) who received homologous blood transfusions	22 (76 %)	10 (29 %)	4 (9 %)

(238 ± 31 ml, $p < 0.01$). There were fewer patients in Group 3 (9 %) who received homologous blood than in Group 2 (29 %, $p < 0.04$) and in Group 1 (76 %, $p < 0.01$). The average estimated blood loss was higher in Group 1 (871 ± 115 ml) than in Group 2 (741 ± 70 ml, $p < 0.05$) and higher in Group 3 (946 ± 108 ml) than in Group 2 (741 ± 70 ml, $p < 0.01$).

Two patients who received homologous blood transfusions suffered «chills», but these were most likely related to falling blood pressure and the spinal anaesthetic. One patient suffered a transfusion reaction with rising temperature, facial erythema and nausea. The patient and the blood donor were examined with negative findings (no irregular erythrocyte antibodies or bacteriological findings were detected).

Discussion

Autotransfusion reduces the need for homologous blood transfusions (1–9). Ideally, all planned operations involving a risk of major blood loss should be undertaken with intra- and postoperative blood recovery and processing. Major orthopaedic operations are well suited for intra- and postoperative blood recovery. There are only two contraindications for mechanical autotransfusion: contamination with micro-organisms and cancerous cells.

Our results show that 91 % of the patients who received a total hip prosthetic with the use of traditional blood recovery and recovery of rinsing fluid containing blood had no need for homologous blood transfusions. In the study by Magrini and collaborators (10) a similar result was achieved (91.6 %), although this also included preoperative blood collection. A somewhat poorer result (76 %) was obtained by Turner and collaborators (11) in a corresponding study involving preoperative blood collection and intraoperative blood recovery. Two other studies found that 63 % (1) and 81 % (12) of the patients have no need for homologous blood transfusions when only postoperative blood recovery is being used.

Despite the fact that the average estimated blood loss in Group 2 was smaller (741 ml) than in Group 3 (946 ml), there was less need for homologous blood transfusion in Group 3. The average estimated blood loss in Group 2 was also smaller than in Group 1. However, the control in Group 1 is historical, while Groups 2 and 3 have been investigated prospectively.

Before we started using Cell Saver, altogether 76 % of the patients received homologous blood. This corresponds to 1.79 blood units per patient. After the introduction of mechanical autotransfusion 29 % of the patients received homologous blood. This corresponds to 0.69 blood units per patient. After we started recovering rinsing fluid containing blood in addition to traditional blood recovery, only 9 % of the patients received homologous transfusions. This corresponds to 0.15 blood units per patient.

The manuscript was approved 20 February 2006.

I wish to thank my colleagues Sigbjørn Lid and Rune Heggedal for their help with the language. I also wish to thank Jan Fredrik Hovden for his support with the statistical part.

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