



# Perioperative hemodilutional autologous blood transfusion in burn surgery

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## KEYWORDS

Haemodilutional autologous blood transfusion;  
Autologous blood transfusion;  
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**Summary** It is important to avoid or minimise allogeneic blood transfusion, because of possible alloimmunisation or disease transmission. In burn cases these risks are high, and predonated autologous transfusion is not practical. Perioperative haemodilutional autologous blood transfusion is considered applicable in burn surgery. This study evaluates the effectiveness of the technique in the treatment of burns.

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## Introduction

Large blood loss is routine in excision and grafting of burns, and allogeneic blood transfusion is common even in the less serious cases in spite of the associated risks of alloimmunisation and transmitted diseases such as hepatitis or HIV.<sup>11</sup> To reduce or avoid allogeneic blood transfusion, we usually use a tourniquet or epinephrine during the procedure. In elective surgery predonated autologous blood transfusion is popular, but this is not practical for burns. In this study we evaluated the feasibility and effectiveness of perioperative haemodilutional autologous blood transfusion<sup>1,5</sup> in burn surgery.

## Materials and methods

Inclusion criteria for the investigation are shown in Table 1. In evaluating autologous transfusion, we estimated haematocrit values at five time points for each patient: before haemodilution (P1), after haemodilution (P2), before autologous blood transfusion (P3), after autologous blood transfusion, i.e. during operation (P4) and 2 weeks after surgery (P5). Allogeneic blood transfusion was considered when the haematocrit value was 20% or less, providing the vital signs would support surgery.

We also evaluated seven consecutive similar adult cases just before allogeneic blood transfusion was carried out, to form a control group.

## Perioperative haemodilutional autologous blood transfusion

After induction of general anaesthesia, 800 ml of autologous blood were withdrawn and replaced with

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**Table 1** Inclusion criteria

Less than 30% total body surface area burned
Age 18–80 years
Preoperative haemoglobin >9 g/dl, haematocrit >27%
No pre-existing history of myocardial failure, cardiac valve functional disorder, intracardiac shunt, obstructive lung disease, liver failure or coagulation disorder
Wound closure could be completed in one procedure
Estimated blood loss between 600 ml and 1500 ml

500 ml lactated Ringer's solution and 500 ml 6% hydroxyethylated starch. After excision and skin harvesting, when intraoperative bleeding had stopped, autologous blood transfusion was started. Administration of intravenous saccharated ferric oxide was started on postoperative day 1.

## Results

Haemodilutional autologous blood transfusion was carried out for seven consecutive adults with burns (Table 2). Ages ranged from 33 to 79 years, total body surface area (TBSA) burned was between 5.5% and 20% and TBSA grafted was also between 5.5% and 20%. The operation was performed between 1 and 8 days after burn. In the control group (Table 3), ages ranged from 19 to 82 years, TBSA burned was between 5% and 23%, and TBSA grafted area was between 5% and 13%. The operations were performed between 4 and 21 days after burn. There was no statistically significant difference in age, grafted area or preoperative haematocrit value between the two groups.

In the haemodilution group, intraoperative haemorrhage ranged from 524 ml to 2016 ml (mean 1120 ml, S.D.  $\pm$ 454 ml). In one case (case 7), 1471 ml of intraoperative haemorrhage required allogeneic blood transfusion intraoperatively and postoperatively. In the control group, intraopera-

**Table 3** Characteristics of control group of patients receiving allogeneic blood transfusion

Case	Age <sup>a</sup>	Gender	TBSA <sup>b</sup>	Area <sup>c</sup>	Loss <sup>d</sup>	P <sup>e</sup>
1	34	M	13.0	13.0	1922	39.3
2	19	M	5.0	5.0	512	48.5
3	51	F	10.0	10.0	1814	41.5
4	23	M	9.0	9.0	1633	41.4
5	40	M	23.0	23.0	2099	43.2
6	71	F	15.0	15.0	2024	36.9
7	82	F	9.0	6.00	300	27.8
Average	45.7		12.0	11.6	1472	33.5

M, male; F, female.

<sup>a</sup> Years.

<sup>b</sup> % total body surface area burned.

<sup>c</sup> % total body surface area grafted.

<sup>d</sup> Intraoperative blood loss (mls).

<sup>e</sup> Haematocrit % before operation.

tive haemorrhage ranged from 300 ml to 2099 ml (mean 1472 ml, S.D.  $\pm$ 745 ml) and five cases needed allogeneic blood transfusion intraoperatively (cases 1, 3, 4, 5 and 6).

For the six people in the haemodilution group who received no allogeneic blood, the haematocrit (mean  $\pm$  S.D.) was  $35.3 \pm 7.9$  before haemodilution,  $26.3 \pm 4.9$  after haemodilution,  $23.6 \pm 3.1$  before autologous transfusion,  $28.7 \pm 5.3$  after autologous transfusion and  $27.1 \pm 4.2$  at 2 weeks after operation (Fig. 1). There was no significant difference in haematocrit value between P1 and P5. There was no intraoperative or postoperative anaemia, decline of liver or renal function, skin graft loss or progression of burn depth attributable to autologous transfusion.

## Discussion

It has been reported that blood loss is 0.7–11.4% of blood volume/1% TBSA debrided during burn surgery.<sup>14</sup> Blood transfusions are performed in many burn cases, even for the smaller burns under 30%

**Table 2** Characteristics of patients receiving haemodilutional autologous blood transfusion

Case	Age <sup>a</sup>	Gender	TBSA <sup>b</sup>	Area <sup>c</sup>	Loss <sup>d</sup>	P1 <sup>e</sup>	P2 <sup>f</sup>	P3 <sup>g</sup>	P4 <sup>h</sup>	P5 <sup>i</sup>
1	33	M	20.0	20.0	2016	40.7	30.7	26.7	31.2	23.0
2	42	F	27.0	8.0	1126	28.5	25.0	25.0	26.8	24.0
3	42	F	12.0	10.0	962	42.8	32.2	22.6	25.3	23.0
4	79	F	5.5	5.5	950	41.1	25.0	23.2	30.8	31.2
5	53	F	15.5	11.5	788	35.4	26.3	26.3	36.5	31.0
6	36	F	10.0	9.0	524	23.2	18.5	18.2	21.5	30.5
7	52	M	14.0	1.00	1471	27.8	21.2	14.4	16.6	34.2
Average	48.1		14.9	10.6	1120					

M, male; F, female. <sup>a</sup>Years; <sup>b</sup>% total body surface area burned; <sup>c</sup>% total body surface area grafted; <sup>d</sup>intraoperative blood loss (mls); <sup>e,f</sup>haematocrit % before and after haemodilution, <sup>g,h</sup>before and after autologous transfusion, <sup>i</sup>2 weeks after transfusion.

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