SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA
Azienda Unità Sanitaria Locale di Bologna

Emazie ed aferesi, tecniche a confronto, controllo prodotto e valutazione efficacia

Maurizio Soli - Bologna

Tipologia

Eritroplasmaferesi

Sacca RBC: max 250 ml GR

Sacca FFP: max 400 ml plasma (se reintegro)

Eritropiastrinoaferesi

Sacca RBC: max 250 ml GR

Sacca PLT: almeno $2x10^{11}$

Doppia eritroaferesi

2 sacche RBC: max 500 ml GR

Registro Nazionale Aferesi Produttiva-2009

Aferesi eritrocitarie: 33.821 (7,1% tot. aferesi)

•Eritroplasmaferesi:	24.216	(5,1%)
•Eritropiastrinoaferesi:	8.626	(1,8%)
•Doppia eritroaferesi:	979	(0,2%)

Emazie ed aferesi: Francia 2011

ANSM: Agence nationale de sécurìté du médicament et des produits de santé

Rapport d'activité hémovigilance 2011

•Aphérèse simple globules rouge:	191	0,0%
•Aphérèse combinée plasma/globules rouge:	157	0,0%
•Aphérèse combinée plaquettes/globules rouge:	13.268	0,4%
•Aphérèse combinée plq/globules rouge/pla:	14.366	0,4%
Aphérèse globules rouge total	**27.982**	**0,8%**

THE 2009 NATIONAL BLOOD COLLECTION AND UTILIZATION SURVEY REPORT

USA

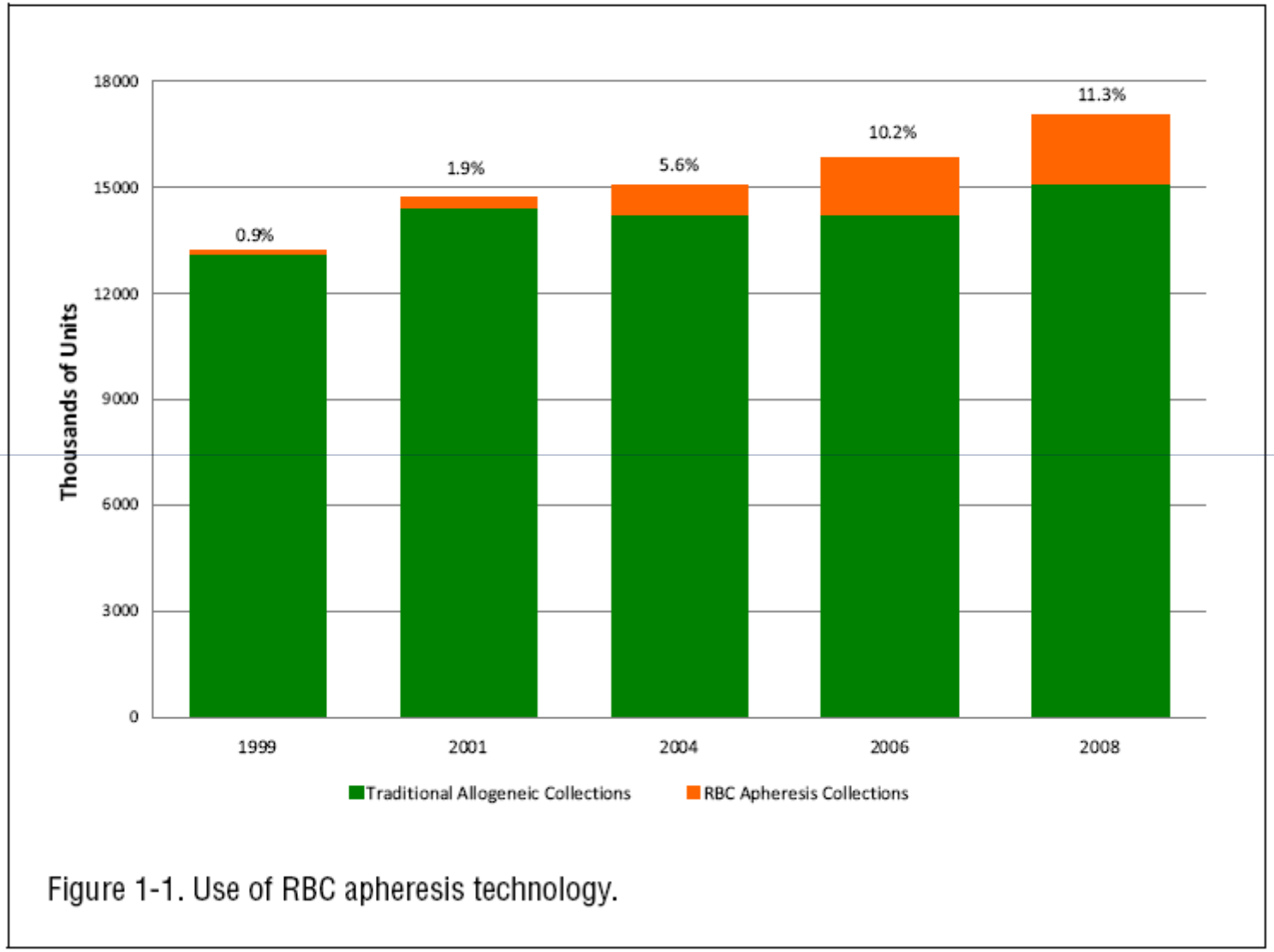


Figure 1-1. Use of RBC apheresis technology.

USA -The 2009 national blood collection and utilization survey report

Table 3-1. Estimated 2008 Collection and Transfusion by US (50 States and DC) Blood Centers and Hospitals for Whole Blood (WB) and Red Blood Cells (RBCs) (expressed in thousands of units)

Activity	Blood Centers	Hospitals		2008 Combined Total	% of Total Collections/ Transfusions	2006 Total	% Change 2006-2008
		Total	±95% CI				
Collections							
WB Allogeneic (excluding directed)	14,120	927	224	15,047	87.0	14,151	6.3
WB Autologous	172	81	13	253*	1.5	335	–24.5
WB Directed (fewer collected than transfused)	35	26	8	61*	0.4	70	–12.8
RBC Apheresis	1,884	41	22	1,926	11.1	1,619	18.9
Total Supply	16,212	1,074	243	17,286	100.0	16,174	6.9
Rejected on Testing	116	11	3	127	0.7	151	–15.9
Available Supply	16,096	1,063	240	17,159	99.3	16,023	7.1
Transfusions							
Allogeneic (excluding directed)	654	14,127	404	14,782*†	98.4	13,978	5.8
Autologous	5	154	25	159	1.1	189	–15.8
Directed (to designated patient)	0	73	36	73*	0.5	126	–41.7
Total Transfusions	660	14,355	411	15,014	100.0	14,650†	2.5
Outdated WB/RBCs	219	228	20	447	2.7	400	11.7

*Significantly different from 2006 data.
†Total includes pediatric transfusions.

USA -The 2009 national blood collection and utilization survey report

1.022.000 eritroaferesi

904.000 doppia eritroaferesi

1.926.000 unità di GRC raccolte da eritroaferesi

Parameter to be checked	Red cells, LD, AS	Red cells, Aph
Volume	To be defined by the system used	To be defined by the system used
Haematocrit	-	0.65 – 0.75
Haematocrit (if additive solution)	0.50-0.70	0.50 – 0.70
Haemoglobin	Minimum 40 g unit	Minimum 40 g unit
Residual leucocytes content	$< 1 \times 10^6$	$< 1 \times 10^6$
Haemolysis at the end of storage	< 0.8% of red cell mass	< 0.8% of red cell mass

Allison AC. Turnovers of erythrocytes and plasma proteins in mammals.
Nature 1960: 188:37

During its approximately four-month lifespan, the human RBC travels approximately 300 miles, making about 170.000 circuits through the heart, enduring cycles of osmotic swelling and shrinkage while traveling through the kidneys and lungs and an equal number of deformation while passing through capillary beds.

Gibson JG. Am J Clin Pathol 1957; 28; 569-78

“Collection injury”

Nella raccolta per gravità i globuli rossi raccolti nella fase iniziale possono essere danneggiati dall’impatto con il ridotto pH, quando la soluzione acida stabilizzante è ancora disponibile in largo eccesso.

Eritroaferesi

- Standardizzazione
- Efficienza
- Sicurezza

Tecnologie

HAEMONETICS –Multi Component System (MCS)

- Doppia rossi
- Eritro-plasma
- Eritro-piastrine
- Eritro-pla-plt
- Plasma-piastrine
- Plasma

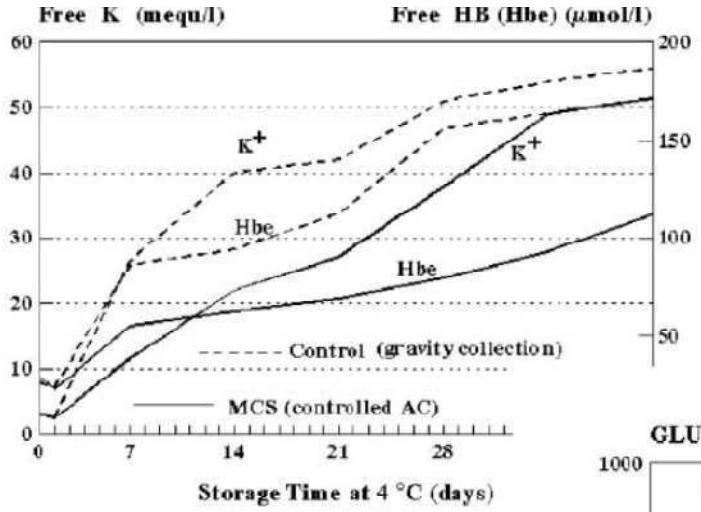
Options and cost effectiveness of multicomponent blood collection ☆

Gert A. Matthes *

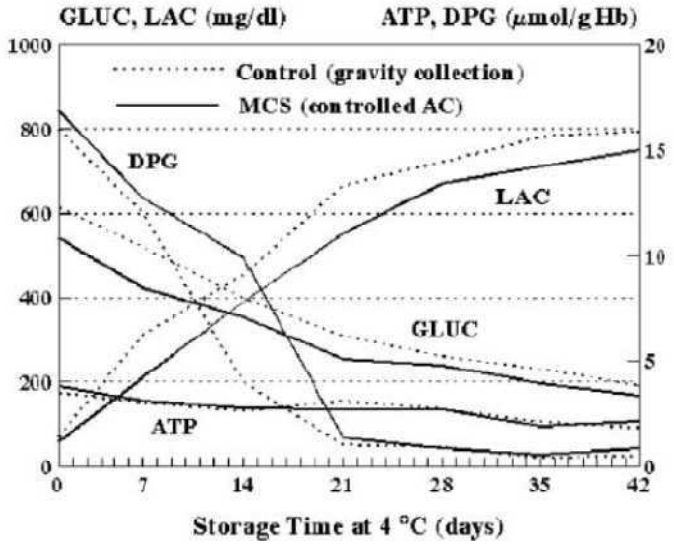
Institut für Transfusionsmedizin, Universitätsklinikum Leipzig AöR, Delitzscher Str. 135, D-04219 Leipzig, Germany
MedInnovation GmbH, Freiheitstr. 124/126, D-15745 Wildau, Germany

MCS

Transfusion and Apheresis Science 27 (2002) 115–121



MCBC vs. MANUAL COLLECTION
- **K^+ release delayed**
- **significant less Hb_e at the end of storage**



MCBC vs. MANUAL COLLECTION
- **2,3-DPG better maintained**
- **ATP identical**
- **GLUC, LAC corresponding**

Fig. 7. Multicomponent collection vs. manual collection: comparison of hemolysis parameter (free potassium ions K^+, free hemoglobin HB_e) and metabolic parameter (2,3-DPG, ATP, glucose, lactate) in RCC resuspended in SAG-M during storage at 4 °C for 42 days.

Vox Sanguinis

Original Paper

Vox Sang 1998;75:212–217

Received: April 24, 1997
Revised after revision: January 2, 1998
Accepted: January 14, 1998

MCS

S. Holme
M. Dean Elfath
P. Whitley

American Red Cross, Mid-Atlantic Region, Norfolk, Va., USA

Evaluation of in vivo and in vitro Quality of Apheresis-Collected RBC Stored for 42 Days

Table 3. RBC properties study 1 and 2 combined (n = 21)

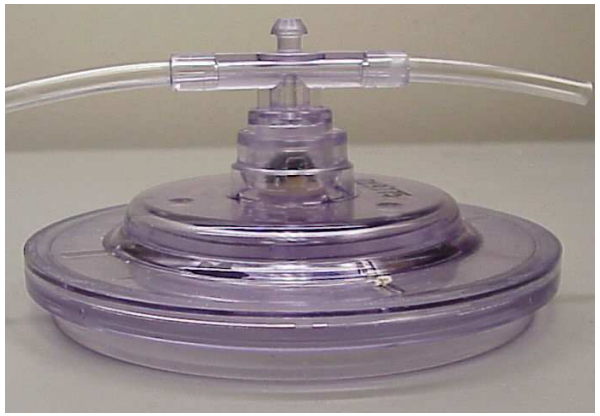
Parameter	Prestorage		Poststorage	
	apheresis	manual	apheresis	manual
pH	6.9 (0.04)*	6.8 (0.06)	6.40 (0.06)*	6.36 (0.05)
ATP, µmol/g Hb	4.2 (0.4)	4.1 (0.4)	3.0 (0.6)	2.9 (0.5)
DPG, µmol/g Hb	10.6 (1.1)*	9.0 (1.3)	0.1 (0.2)	0.3 (0.4)
Potassium, mEq/l	2.3 (0.3)	2.4 (0.3)	56 (7)*	63 (5)
LDH, IU/ml[a]	113 (60)	88 (60)	1,332 (765)	1,682 (487)
Osmotic fragility, %[a]	47 (3)	49 (3)	50 (3)*	52 (3)
Morphology score[a]	99 (1)	99 (1)	63 (9)	59 (6)
Glucose, mg/dl	497 (62)	608 (39)	249 (50)	402 (47)
Plasma g Hb, mg/dl	42 (33)	39 (19)	225 (138)*	372 (261)
Hemolysis, %			0.44 (0.26)*	0.61 (0.40)
24-hour recovery, %				
Single label			**80.6 (5.9)**	**80.7 83.8)**
Double label			78.8 (6.8)	78.3 (5.3)

Figures in parentheses are standard deviations. * $p < 0.05$ by paired t test, comparison between manual and apheresis collections.

[a] Study 1 data only.

Tecnologie

HAEMONETICS – Cymbal



Dynamic Disk

Automated collection of double red blood cell units with a variable-volume separation chamber

Transfusion 2008; 48:147-152

James P. AuBuchon, Larry J. Dumont, Louise Herschel, Jill Roger, Rachel L. Beddard, Harry L. Taylor, Pamela H. Whitley, Sherrie L. Sawyer, Sharon Graminske, Karen Martinson, Ross Dora, Sybil Heldke, John Adamson, and Leslie E. Rose

Conclusions: The Cymbal device provided quick and efficient collection of 2 RBC units with properties meeting regulatory requirements and consistent with good clinical utility.

Tecnologie

trima® accel™

V5.1 – V6

- Doppia rossi
- Eritro-plasma
- Eritro-piastrine
- Eritro-pla-plt
- Plasma-piastrine
- Plasma

CCT. The Cochrane Central Register of Controlled Trials: ID CN-00163399

A feasibility evaluation of an automated blood component collection system platelets and red cells

460 TRANSFUSION Volume 39, May 1999

N. Rugg, C. Pitman, J.E. Menitove, T.J. Greenwalt, and M.J. McAteer

Trima Accel

TABLE 1. In vitro RBC function (n = 10)*

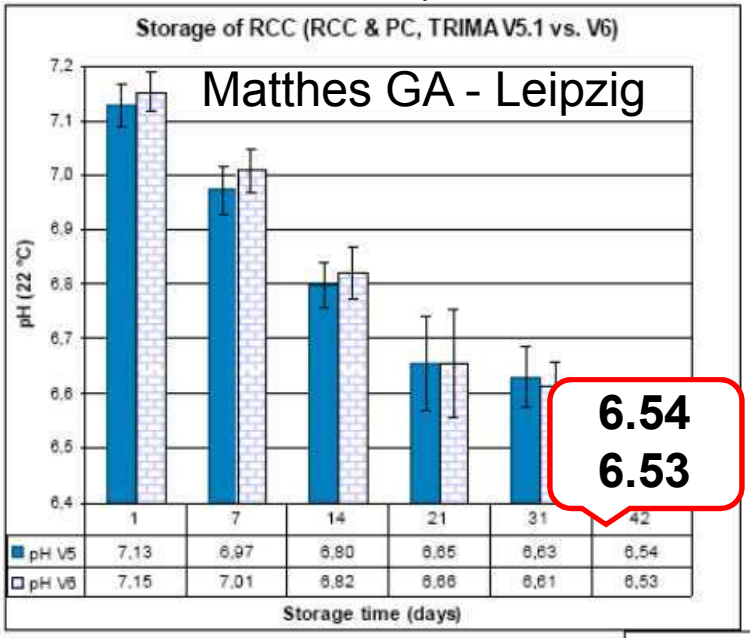
Assay	Value at Day 0	Value at Day 42
Hct (%)	63.6±2.4	61.0±2.0
Plasma hemoglobin (mg/dL)	34.1±12.6	203.5±72.4
Hemolysis (%)	0.07±0.03	0.46±0.19
pH (at 37°C)	6.7±0.04	<6.4
Sodium	157.3±1.9	124.3±3.1
Potassium	1.8±0.3	46.6±3.9
ATP (µmol/g hemoglobin)	3.7±0.3	2.8±0.5 (76.8 ± 10.5%)†
2,3 DPG (µmol/g of hemoglobin)	13.8±3.4	0.61±0.17

* Values reported as mean ± SD.
† Percentage of recovery of ATP Day 0 value on Day 42.

Recupero in vivo 24 h dopo 42 gg conservazione

Doppia marcatura ^{51}Cr e ^{99m}Tc secondo Heaton (Vox Sang 1989;57:37-42)

Recupero 83.6 ± 5.4% (76.2-92.0)



Tecnologie

- ~~Doppia rossi~~
- Eritro-plasma
- Eritro-piastrine
- Eritro-pla-plt
- Plasma-piastrine
- Plasma

Tecnologie

- Doppia rossi
- Eritro-plasma

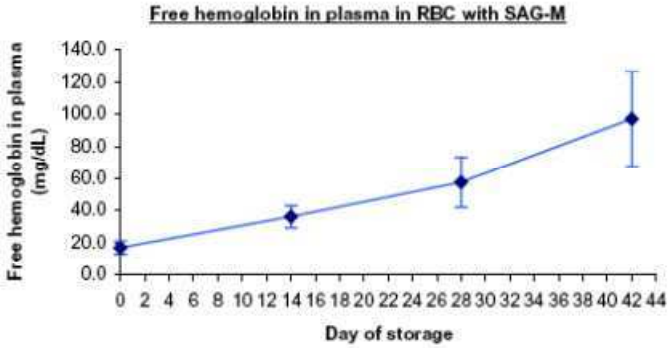
Two red blood cell units collected in SAG-M additive solution with the ALYX component collection system

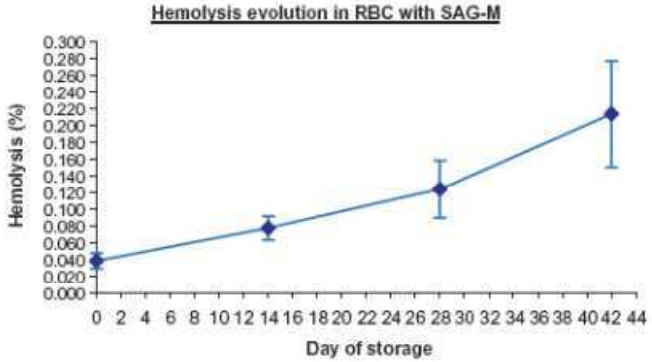
F. Schooneman *, J.J. Huart, D. Dernis, V. Tunez, D. Aguettaz

EFS Nord de France, 21 rue C Guerin, BP 2018, Lille Cedex, France

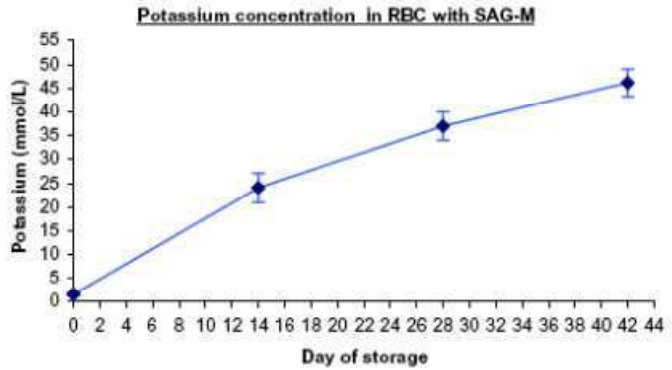
Received 5 March 2005; received in revised form 14 March 2005; accepted 14 March 2005

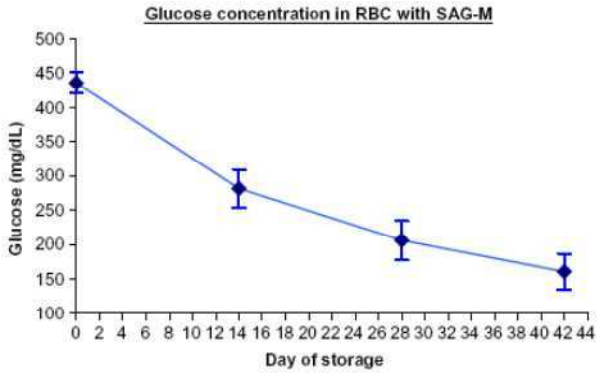
Transfusion and Apheresis Science 32 (2005) 305–313

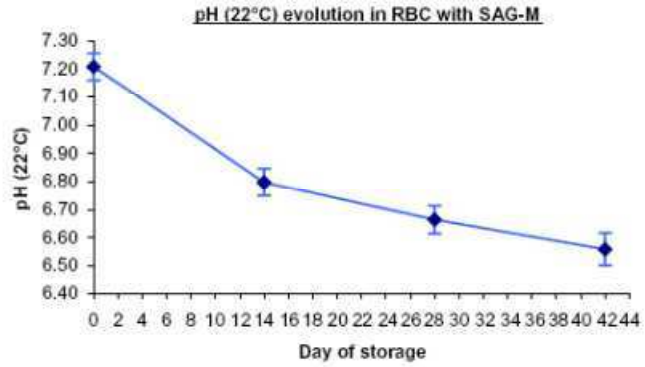




ALIX







Prospective evaluation of double RBC collection using three different apheresis systems

Susanne M. Picker *, Stela M. Radojska, Birgit S. Gathof

Transfusion Medicine, University of Cologne, Kerpenerstr. 62, 50937 Cologne, Germany

Received 17 March 2006; received in revised form 23 August 2006; accepted 26 August 2006

Transfusion and Apheresis Science 35 (2006) 197–205

ALIX

Table 5
Productivity of three different apheresis systems during 2-RBC apheresis

Parameter	Instruments		
	Alyx	MCS+	Trima Accel
	$n = 10$	$n = 10$	$n = 8$
Collection volume (ml)[d]	**629.4 ± 5.1**[b,c]	605.1 ± 4.7[a]	596.3 ± 5.2[a]
Volume per unit (ml)[e]	278.9 ± 3.8[b]	277.5 ± 3.4[b]	**261.2 ± 3.9**[a,c]
Collection RBC mass (ml)	360.3 ± 6.6[c]	348.4 ± 3.5[a]	350.3 ± 12.8
RBC mass per unit (ml)[e]	**161.1 ± 3.3**[b,c]	148.3 ± 2.0[a]	147.4 ± 6.5[a]
Hemoglobin content per unit (g)[e]	**54.0 ± 1.3**[b,c]	48.5 ± 1.6[a]	48.6 ± 2.4[a]
Collection yield ($\times 10^{12}$)	**4.15 ± 0.09**[b,c]	3.68 ± 0.12[a]	3.82 ± 0.21[a]
RBC yield per unit ($\times 10^{12}$)[e]	**1.85 ± 0.04**[b,c]	1.69 ± 0.05[a]	1.66 ± 0.10[a]
SAGM addition per unit (ml)	**88.0 ± 0.3**[b,c]	**102.3 ± 2.9**[a,b]	**72.5 ± 1.2**[a,c]
RBC recovery after filtration (%)[f]	89.0 ± 0.6[c]	**92.5 ± 0.6**[a,b]	88.9 ± 1.4[c]
Collection rate ($\times 10^{12}$/min)	**0.214 ± 0.006**[b,c]	**0.125 ± 0.013**[a,b]	**0.186 ± 0.012**[a,c]
Collection efficiency (%)	**87.0 ± 1.8**[b,c]	79.3 ± 2.5[a]	79.6 ± 2.2[a]

Values shown as median ± 95% CI.
Bold letters illustrate values which were significantly different from all other systems.

[a] Significant compared to Alyx.
[b] Significant compared to Trima Accel.
[c] Significant compared to MCS+.
[d] Prior filtration and after SAGM addition.
[e] After SAGM addition and filtration.
[f] As displayed (AX), as measured from pre-/post-filtration samples (MCS+, TA).

Volume 47, April 2007 TRANSFUSION 687

In vitro quality of red blood cells (RBCs) collected by multicomponent apheresis compared to manually collected RBCs during 49 days of storage

Susanne M. Picker, Stela M. Radojska, and Birgit S. Gathof

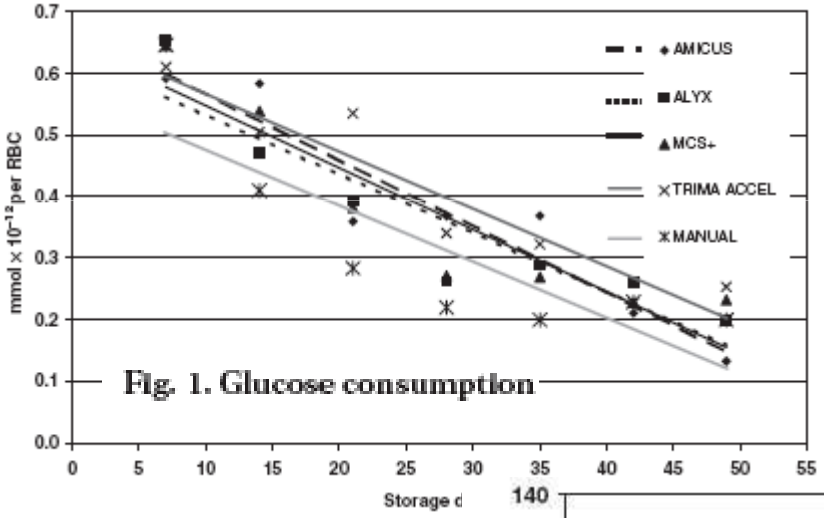


Fig. 1. Glucose consumption

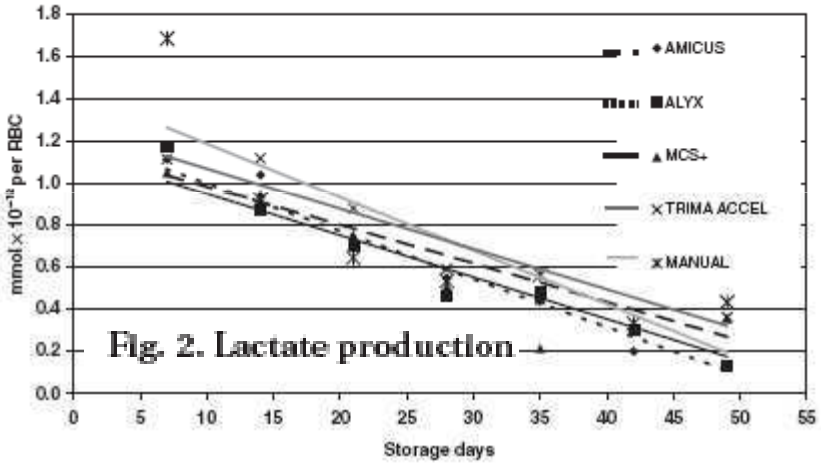


Fig. 2. Lactate production

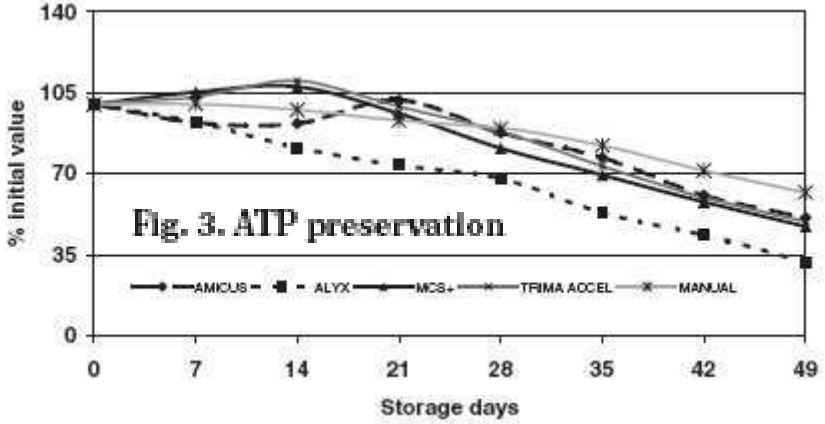


Fig. 3. ATP preservation

Volume 47, April 2007 TRANSFUSION 687

In vitro quality of red blood cells (RBCs) collected by multicomponent apheresis compared to manually collected RBCs during 49 days of storage

Susanne M. Picker, Stela M. Radojska, and Birgit S. Gathof

TABLE 3. Unit processing characteristics after SAGM addition and filtration*

Characteristic	Instrument					p Value†
	Amicus	Alyx	MCS+	Trima Accel	Manual	
Total number of RBC units	n = 15	n = 30	n = 29	n = 25	n = 14	
Volume (mL/unit)	323.2 ± 5.6[b,c,d,e]	281.0 ± 5.1[a,b,c,e]	269.6 ± 5.8[a,d,e]	260.5 ± 5.7[a,d]	252.3 ± 18.5[a,c,d]	<0.001
RBC mass (mL/unit)	172.5 ± 4.3 d[b,c,d,e]	160.3 ± 5.3[a,b,c]	145.5 ± 4.7[a,d]	146.8 ± 8.2[a,d]	147.3 ± 16.6[a]	<0.001
Hct (%)	53.5 ± 1.0[b,d,e]	57.0 ± 1.8[a,c]	53.8 ± 1.4[b,d,e]	56.3 ± 2.3[a,c]	58.3 ± 2.9[a,c]	<0.001
Hb content (g/unit)	57.8 ± 2.4[b,c,d,e]	53.4 ± 2.1[a,b,c,e]	46.1 ± 3.4[a,d]	48.7 ± 3.0[a,d]	46.8 ± 5.1[a,d]	<0.001
RBC count (×10^{12}/unit)	1.91 ± 0.08[b,c,d,e]	1.81 ± 0.07[a,b,c,e]	1.65 ± 0.09[a,d]	1.65 ± 0.13[a,d]	1.55 ± 0.16[a,d]	<0.001
PLT count (×10^{9}/unit)	3.75 ± 4.96	0.39 ± 0.64[c]	2.20 ± 1.05[b,d,e]	1.06 ± 1.36[c]	0.31 ± 0.53[c]	<0.001
WBC count (×10^{6}/unit)	0.35 ± 0.25	0.35 ± 0.37	0.26 ± 0.18	0.15 ± 0.08	0.34 ± 0.39	0.038
SAGM addition (mL/unit) before filtration	93.7 ± 1.4[b,d,e]	88.3 ± 0.5[a,b,e]	89.1 ± 11.9[b,e]	72.2 ± 1.9[a,c,d,e]	103.3 ± 1.9[a,b,c,d]	<0.001
Citrate (mL/mL RBC mass)	6.15 ± 0.42[d,e]	4.78 ± 0.53[a,b,e]	5.72 ± 3.01[e]	6.05 ± 0.64[d,e]	1.88 ± 0.31[a,b,c,d]	<0.001

* Paired post hoc comparisons (U test) led to significant differences compared to: [a]Amicus, [b]Trima Accel, [c]MCS+, [d]Alyx, and [e]manual RBCs.

† According to Kruskal-Wallis test.

Volume 46, January 2006 TRANSFUSION 137

Red blood cells intended for transfusion: quality criteria revisited

Claes F. Högman and Harold T. Meryman

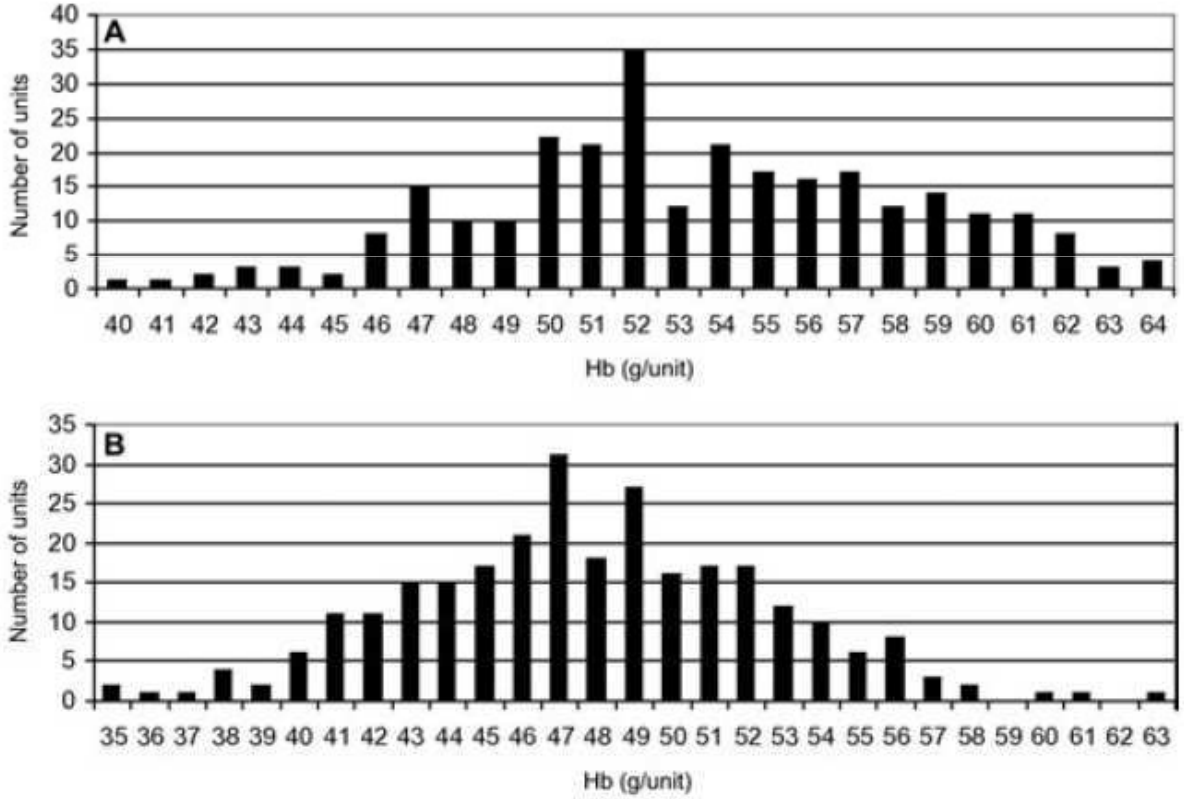


Fig. 1. The contents of RBCs Hb (g per unit) in RBCs in AS, buffy coat removed (A, E3844) and RBCs, leukodepleted (buffy coat removed and leukofiltered, B, E3846). Data from the Quality Assurance Program 2004, University Hospital, Uppsala, Sweden.

Evaluation of haemoglobin, haematocrit, haemolysis, residual protein content and leucocytes in 345 red blood cell concentrates used for the treatment of patients with β-thalassaemia

Roberta Mancini, Leonardo Marinelli, Nadia Mirante, Assunta Gallo, Antonella Matteocci, Filomena Terlizzi, Maria Palange, Daniela Fioravanti, Lorella Donnini, Luca Pierelli

Immunohaematology and Transfusion Medicine Unit, San Camillo Forlanini Hospital, Rome, Italy

Blood Transfus 2012; 10: 39-44 DOI 10.2450/2011.0056-10

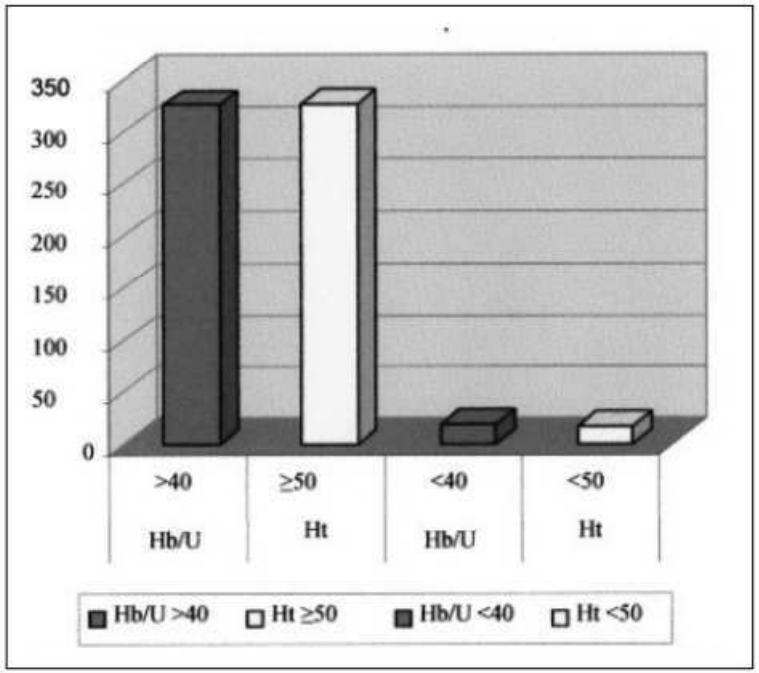


Figure 1 - Distribution of the values of haemoglobin and haematocrit per unit in the 345 units of red cell concentrates after treatment.

- 11/205 5% U filtrate pre-storage e lavate
- 5/62 8% U filtrate post-storage (48h)
- 5/78 6% U filtrate post-storage e lavate

< 40 g Hb/unità

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Transfusion and Apheresis Science 34 (2006) 213–218
TRANSFUSION AND APHERESIS SCIENCE
intl.elsevierhealth.com/journals/tras

Standardization of the red cell product

Joseph D. Sweeney *

Brown University, Transfusion Services and Coagulation, Lifespan Academic Medical Center, Providence, RI 02904, United States

Received 28 November 2005; accepted 29 November 2005

Table 1
Variation in red cell content of whole blood derived red blood cells

Donor	Donor Hct	Donor Hb (g/dL)	Volume blood collected (mls)	Pre-leukoreduction RBC volume	Hb (g)	Post leukoreduction RBC volume	Hb (g)
A	0.38	12.5	405	154	51	131	43
B	0.41	13.5	550	225	74	207	68
C	0.52	17.5	550	286	96	270	91

Hct = hematocrit; Hb = hemoglobin; RBC = red blood cells.
For Donor A, minimal collections from a 450 ml bag and 15% red cell loss in leukoreduction. Donor B, closer to average, with maximal collection using a 500 ml bag and 8% loss in leukoreduction. Donor C, at the extreme, with maximal collection using a 500 ml bag and minimal (5%) loss in leukoreduction.

Standardizzazione: definizioni

Unità: è generalmente una ben definita misura quantitativa ed è utilizzata nei prodotti farmaceutici e biologici al fine di esprimere la "potenza" di un lotto di un prodotto.

"Potenza": è l'espressione della quantità assoluta di un costituente definito ed è misurata in unità di massa o di attività biologica, calibrata vs uno standard.

Dose: in clinica si prescrive in "dosi", che è la quantità assoluta di un definito farmaco o prodotto biologico per un definito ricevente.

Con alcuni prodotti cellulari il concetto di "potenza" e di dose sono oscurati dall'utilizzo del termine di unità.

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Received 28 November 2005; accepted 29 November 2005

Table 3
Theoretical estimations of absolute volume whole blood of collections and mls/kg collected in order to achieve a standardized red cell product with a post leukoreduction potency of 50 G

Weight (kg)	Hb (g/dL)	Volume collected (mls)	mls/kg	Pre-leukoreduced Hb (g)	Post leukoreduced Hb (g)
50	12.5	440	8.8	55	50
55	12.5	440	8.0	55	50
60	13.5	407	6.8	55	50
65	13.5	407	6.3	55	50
70	13.5	407	5.8	55	50
75	14.0	390	5.2	55	50

Assumes 5 G (10%) loss with leukoreduction.

Hb content-based transfusion policy successfully reduces the number of RBC units transfused

Volume 44, April 2004 TRANSFUSION 485

Önder Arslan, Selami Toprak, Mutlu Arat, and Yasemin Kayalak

TABLE 1. Patient and RBC variables

Variable	Total	Median	Range
Patients (n)	51		
Age (years)		38	16-69
Male/Female (n)	28/23		
Patient weight (kg)		64	40-100
Pretransfusion Hb (g/dL)		7.3	5.6-9.8
Targetted Hb (g/dL)		9.3	7.0-11.3
Volume of RBCs (mL)		425	345-480
Hb content of RBCs (g/bag)		78	62.5-90
Date of RBCs on transfusion (days)		4	1-37
Total RBCs ordered (n)	104		
RBCs transfused (n)	72		
Saved pRBC (%)	30		

Hemosoft Blood Banking Management & Information System

Modeling red cell procurement with both double-red-cell and whole-blood collection and the impact of European travel deferral on units available for transfusion

Volume 47, November 2007 TRANSFUSION 2025

Erin Madden, Edward L. Murphy, and Brian Custer

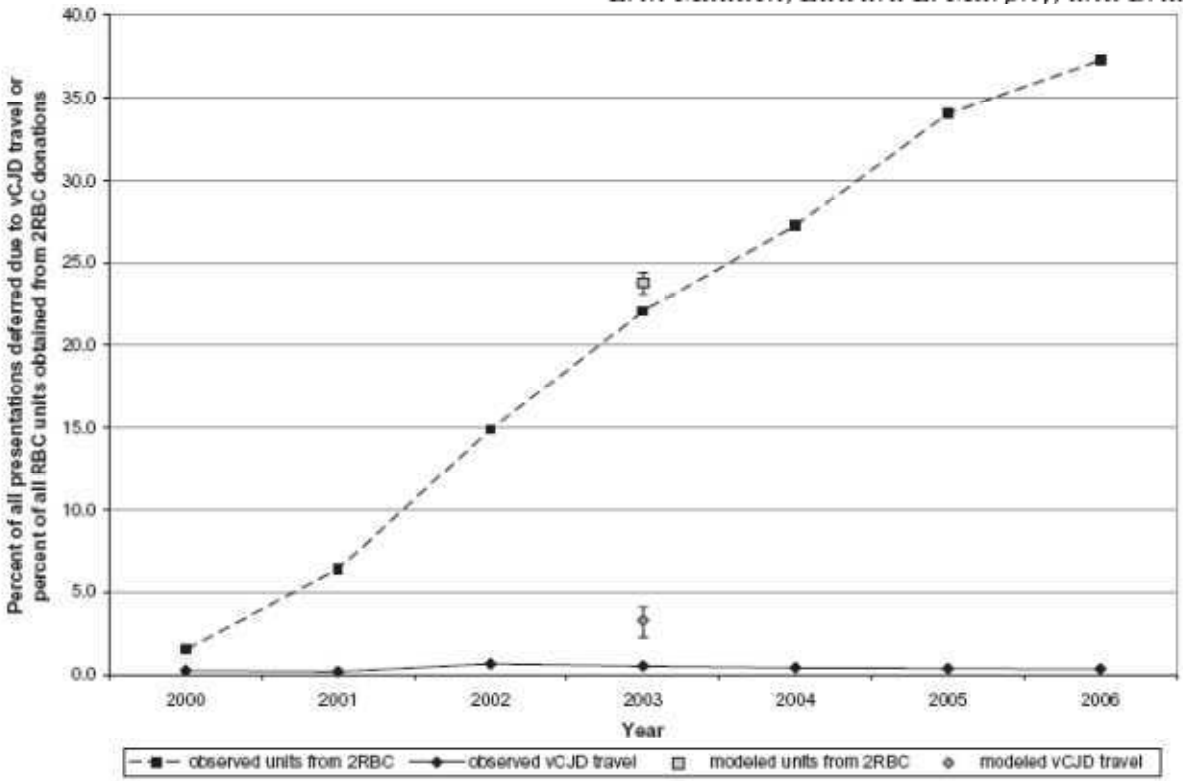

Fig. 3. Observed results for 2RBC collections and vCJD travel deferral at the 16 UBS blood centers over a 7-year period.

CONCLUSION: Shifting to 2RBC collection led to a substantial gain in available RBCs: even with policies that adversely affect the quantity of RBCs in the supply, 2RBC collection results in a net gain.

A randomized, double-blind comparison of donor tolerance of 400 mL, 200 mL, and sham red cell donation

K.J. SMITH, D.S. JAMES, W.C. HUNT, W. MCDONOUGH, AND R. QUINTANA

TRANSFUSION 1996;36:674–680.

Table 2. *Diary entries for symptoms before and after donation**

Symptom	Time of occurrence	Donation group: Sham (n = 9)	1-unit (n = 10)	2-unit (n = 9)
Tiredness	Before†	4	3	6
	After†	2	3	5
Lightheadedness	Before	1	1	2
	After	1	3	3
Faintness	Before	1	0	0
	After	0	0	0
Nausea	Before	0	0	1
	After	0	0	0
Breathlessness	Before	2	2	3
	After	0	1	2
Any symptom	Before	4	4	8
	After	4	7	7

* Donors recorded symptoms in a diary while wearing equipment to monitor ambulatory heart rate. Entries show the number of donors who noted a designated symptom. Some donors experienced more than one symptom.

† Before donation; after donation.

The safety profile of automated collections: an analysis of more than 1 million collections

1002 TRANSFUSION Volume 47, June 2007

Thomas B. Wiltbank and Gerald F. Giordano

TABLE 2. UBS definitions for moderate and severe reactions

	Mild	Moderate	Severe
Subjective	Nervousness, weakness, nausea, or lightheadedness	Same as mild	Same as mild
Objective	Pallor, sweating, or hyperventilation	Same as mild plus vomiting, syncope, or slight twitching or ↓BP	Same as mild and moderate plus incontinence, convulsions, chest pains, or cardiac arrest
Time	Recovery < 15 min	Recovery 15-30 min	Recovery > 30 min

TABLE 3. Reaction rates for each studied procedure expressed in absolute numbers, reactions per 10,000, and percentage

		Moderate reactions			Severe reactions		
Procedure	Number of units collected	Number	Rate per 10,000 donations	Percent	Number	Rate per 10,000 donations	Percent
Whole blood	1,023,682	3864	37.75	0.38	957	9.35	0.09
Automated double RBC	249,154	317	12.72	0.13	73	2.93	0.03
Automated single RBC	40,870	121	29.61	0.30	32	7.83	0.08
Plateletpheresis with or without concurrent plasma	90,082	105	11.62	0.12	29	3.22	0.03

The relative safety of automated two-unit red blood cell procedures and manual whole-blood collection in young donors

Richard J. Benjamin, Beth A. Dy, Jean M. Kennedy, Edward P. Notari IV, and Anne F. Eder

TABLE 3. Total adverse event rates after WB and 2RBC donations in calendar year 2007

	WB		2RBC		
Adverse events	Events	Rate per 10,000	Events	Rate per 10,000	OR (95% CI)
Minor reaction categories					
Presyncope	120,561	277.2	3,833	185.6	0.67 (0.64-0.68)
Hematoma (small)	61,029	140.3	6,400	309.8	2.25 (2.19-2.31)
Citrate (minor)*	31	0.1	2,428	117.5	ND
Other (minor)	165	0.4	20	1.0	2.55 (1.57-3.99)
Allergic (minor)	30	0.1	11	0.5	7.72 (3.87-15.40)
Composite minor reaction categories	*181,816*	*418.1*	*12,692*	*614.4*	*1.50 (1.47-1.53)*
LOC and major reaction categories					
LOC (<1 min)	4,269	9.8	150	7.3	0.74 (0.63-0.87)
LOC (>1 min)	591	1.4	21	1.0	0.75 (0.48-1.16)†
Prolonged recovery	842	1.9	19	0.9	0.48 (0.30-0.75)
LOC with injury	438	1.0	3	0.1	0.14 (0.05-0.45)
Other (major)	82	0.2	9	0.4	2.31 (1.16-4.60)
Citrate (major)*	3	0.0	8	0.4	ND
Allergic (major)	2	0.0	1	0.0	ND
Composite major systemic	*6,227*	*14.3*	*211*	*10.2*	*0.71 (0.62-0.82)*
Major phlebotomy-related					
Hematoma (large)	387	0.9	53	2.6	2.88 (2.16-3.84)
Nerve irritation	314	0.7	11	0.5	0.73 (0.40-1.35)†
Arterial puncture	449	1.0	4	0.2	0.18 (0.07-0.50)
Composite major phlebotomy-related	*1,150*	*2.6*	*68*	*3.3*	*1.24 (0.97-1.59)†*
All adverse events	189,193	435.1	12,971	627.9	1.44 (1.41-1.47)
Outside medical care	1,814	4.2	71	3.4	0.82 (0.65-1.04)†

* Citrate reactions after WB donations represent errors in classification.

LOC = loss of consciousness; ND = not determined; † 95% confidence interval includes 1.0.

Prolonged iron depletion after allogeneic 2-unit RBC apheresis

TRANSFUSION 2001;41:602-605.

Wolfgang Högler, Wolfgang Mayer, Christian Messmer, Günther Eibl, Petra Innerhofer, Diether Schönitzer, and Walter Nussbaumer

TABLE 1. Measures of hematologic recovery

Day	Hb (13.3-17.7 mg/dL)*	RBCs (4.4-5.9 × 10^6/μL)*	Platelets (140-400 × 10^3/μL)*	EPO (6-25 U/mL)*	Reticulocytes (0.4-2.5%)*
0	15.89 ± 0.82	5.19 ± 0.26	218.8 ± 41.6	7.11 ± 2.92	1.21 ± 0.48
1	14.16 ± 1.22†	4.62 ± 0.39†	248.25 ± 39.6†	19.64 ± 12.75†	1.45 ± 0.47‡
7	14.08 ± 0.97†	4.61 ± 0.32†	261.9 ± 42.55†	14.03 ± 6.26†	2.31 ± 0.77†
30	15.08 ± 1.01†	4.95 ± 0.34†	238.26 ± 44.04‡	8.65 ± 4.08‡	1.61 ± 0.42‡
60	15.82 ± 1.04	5.19 ± 0.34	238.7 ± 45.04‡	9.12 ± 3.82‡	1.21 ± 0.34
90	15.71 ± 0.91	5.24 ± 0.34	247.35 ± 47.16†	9.09 ± 3.67‡	1.13 ± 0.40
120	15.74 ± 0.78	5.25 ± 0.3	242.79 ± 46.07‡	10.14 ± 6.05‡	1.04 ± 0.40

* Normal range.
† $p \leq 0.001$.
‡ $p < 0.05$.

TABLE 2. Measures of iron balance

Day	Serum iron (7-35 μmol/L)*	Ferritin (12-307 μg/L)*	Transferrin (200-360 mg/dL)*	Transferrin saturation (16-45%)*
0	18.48 ± 4.66	54.2 ± 33.78	275.35 ± 31.57	28.8 ± 11.75
1	20.54 ± 10.56	52.95 ± 31.83	275.4 ± 31.98	30.7 ± 16.91
7	14.36 ± 4.45†	31.5 ± 27.83‡	296.0 ± 28.8‡	19.55 ± 6.28†
30	16.66 ± 11.24	23.42 ± 21.94‡	310.74 ± 36.77†	21.0 ± 11.77†
60	18.1 ± 9.71	28.4 ± 24.91‡	325.2 ± 35.83‡	21.95 ± 10.67
90	16.92 ± 5.79	27.2 ± 26.37‡	317.3 ± 27.11‡	21.5 ± 8.15†
120	18.79 ± 7.33	30.32 ± 29.89‡	306.89 ± 39.32‡	24.68 ± 10.89

* Normal range.
† $p < 0.05$.
‡ $p \leq 0.001$.

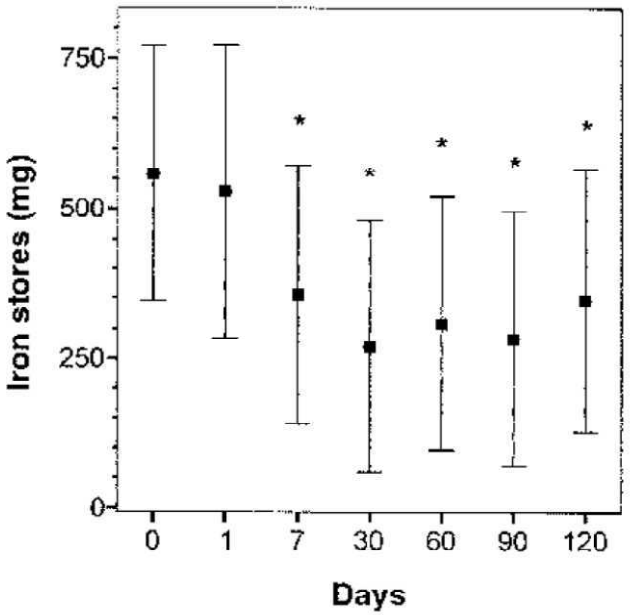

Fig. 1. The course of iron stores over the study period of 4 months as calculated by the method of Cook et al.[19] and modified by Garry et al.[20] At 1 month, iron stores were less than half of predonation levels (269.01 ± 209.66 mg vs. 557.87 ± 213.57 mg). *p<0.001.

Journal of Clinical Apheresis 21: 142–151 (2006)

Blood Component Collection by Apheresis

Edwin A. Burgstaler*

Division of Transfusion Medicine, Mayo Clinic, Rochester, Minnesota

Vantaggi

- Controllo volumi e dosi
- Riduzione esposizione pazienti
- Impiego + efficiente dei donatori
- Miglior controllo delle giacenze
- Meno errori di etichettatura

Svantaggi

- Costi maggiori
- Personale + specializzato

Costi-Efficacia: ?

A parità di qualità

- Numero procedure/macchina
- Macchine nuove/usate
- Durata della fornitura
- Ammontare complessivo della fornitura
- Pagamenti (tempo di attesa)

Transfusion and Apheresis Science 34 (2006) 219–226

The future of automated red blood cell collection

James W. Smith *, Ronald O. Gilcher [1]

Oklahoma Blood Institute, 1001 N. Lincoln Blvd., Oklahoma City, OK 73104, United States

Received 28 November 2005; accepted 29 November 2005

Table 1
Multiple component donations—Economic analysis

(1) Revenue is variable per procedure type and products derived
(2) Some costs may be fixed and allocated for several products
(a) Donor screening
(b) Infectious disease testing
(c) Post-donation processing
(3) Variable costs allocated to procedure
(a) Disposables
(b) Product QC
(c) Equipment allocation, maintenance
(d) Labor
(e) Component manufacturing
(4) Variable costs for center
(a) Recruitment
(b) Overhead
(c) Fixed site collection costs

Lavoratore dipendente retribuito ad ore (operaio)

Un lavoratore retribuito ad ore, si è assentato 8 ore per una donazione sangue regolarmente certificata da un Centro autorizzato. Ha nel mese lavorato per 168 ore. La sua retribuzione oraria è di 7,55 euro. Il conteggio delle sue competenze mensili sarà:

Competenze mese (ore ordinarie) 168 x 7,55 =	1.268,40
Contributi INPS (9,19% su 1,268,00) =	116,53
	1.151,87
Donazione sangue (a carico INPS) 8 * 7,55 =	60,40
Imponibile fiscale	1.212,27

Approfondimenti su internet -

Il trattamento dei permessi donazione sangue

Lavoratore dipendente mensilizzato (impiegato)

Un lavoratore "mensilizzato", si è assentato 8 ore per una donazione sangue regolarmente certificata da un Centro autorizzato. Ha nel mese lavorato nel rispetto del suo orario di lavoro. La sua retribuzione mensile è di 1.268,40 euro. Il conteggio delle sue competenze mensili sarà:

Competenze mese (fisso mensile) =	1.268,40
Permesso donazione sangue (1.268,40 / 26) =	- 48,78
Retribuzione lorda	1.219,62
Contributi INPS (9,19% su 1,220,00) =	112,12
	1.107,50
Donazione sangue (a carico INPS) 1.268,40 / 26 =	48,78
Imponibile fiscale	1.156,28

Approfondimenti su internet -

Eritropiastrinoaferesi

Driving product: piastrine

PLT: non meno di $2x10^{11}$

Produttività e profittabilità?

Eritroplasmaferesi (1)

Standardizzazione della unità viene utilizzata? **SI : stop** **NO :** ↓

Plasma raccolto: 400 mL vs 280 mL: guadagno 120 mL

24.216 (eritropla 2009) x 120 mL = 2.906 L

Programma autosufficienza nazionale 2012

Prodotto strategico: plasma per lavorazione industriale

749.365 kg (2012) vs 729.307 kg (2011) = + 2,8%

Eritroplasma incide per 0,4% al costo di ~ 1.200.000 €

Eritroplasmaferesi (2)

CNS: consumo albumina stimato **~ 580 g/1.000pop/anno**

Jones D et al. International albumin use: 1995 to 2006. Anaesth Intensive Care. 2010: 38(2): 266-273 (15 paesi)

1995: **2,54 kg/10.000/pop/anno** (max CH 3,92)

1998 Cochrane Injuries Group Reviewers meta-analisi 30 RCT: administration of albumin-containing fluids resulted in a 6% absolute increase in the risk of death.

1999: **1,40 kg/10.000/pop/anno** $\Rightarrow$ **1,51 (2000)** $\Rightarrow$ **1,35 (2004)**

Doppia eritroaferesi

Transfusion and Apheresis Science 30 (2004) 55–59

The selection of donors in multicomponent collection management

Pietro Bonomo [a,b], Giovanni Garozzo [a,b,*], Franco Bennardello [a,b]

[a] *Immunohaemotological and Transfusional Medicine Service, "Civile-M.P.Arezzo" Hospital, Piazza Igea 1, Ragusa 97100, Italy*
[b] *AVIS Permanent Collection Center, Via V.E. Orlando 1°, Ragusa 97100, Italy*

Received in revised form 24 April 2003; accepted 28 May 2003

Theoretically eligible for the different procedures

Type of donation	Total donors	Males	Females
R–R	457/3851 (11.8%)	457/3017 (15.1%)	0/834 (0.0%)
R–P	274/3851 (7.1%)	255/3017 (8.4%)	0/834 (0.0%)
P–PLT	1286/3851 (33.4%)	723/3017 (23.9%)	567/834 (68%)
2PLT	754/3851 (19.6%)	523/3017 (17.3%)	225/834 (27%)
R–PLT	1080/3851 (28.1%)	1026/3017 (34.0%)	34/834 (4%)

Transfusion Clinique et Biologique 14 (2007) 542–550

Original article

Clinical effects of different types of red cell concentrates in patients with thalassemia and sickle cell disease

Effets cliniques de différents types de concentrés érythrocytaires dans les hémoglobinopathies

S. Cabibbo *, C. Fidone, A. Antolino, O.G. Manenti, G. Garozzo, S. Travali, F. Bennardello, R. Di Stefano, P. Bonomo

Immunohematology and Transfusion Medicine Service, Civile-Arezzo Hospital, Piazza Igea 1, 97100 Russa, Italy

Available online 22 April 2008

Table 7
Characteristics of the RCC from single-donor red cell double apheresis (SDR) filtered prestorage

		Total ($n = 81$)	Expected values R(95) 15
Volume (ml)	Median	554	540–620 ml (including SAG-M)
	Minimum–maximum	520–597	
	S.D.	17,0	
Hb (g/unit)	Median	111,5	Greater than 80 g/unit
	Minimum–maximum	102,8–126,7	
	S.D.	4,9	
HCT (%)	Median	58,9	50–70%
	Minimum–maximum	54,2–63,4	
	S.D.	1,7	
Leukocytes 10^6/unit	Median	0,19	Less than 2.0×10^6 leukocytes/unit
	Minimum–maximum	0,05–0,88	
	S.D.	0,23	


2 REDS
ARE BETTER
THAN ONE
American
Red Cross