



# Aferez Cihazları Fark Yaratıyor mu?

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Kayseri Eğitim ve Araştırma Hastanesi

Hematoloji Bilim Dalı

**Aferez= Hemaferез= Ferezis= Aphaios\***

**Kanın hasta veya donörden alınması**



**Antikoagülan solüsyon ile karıştırılması**



**Kanın komponentlerine ayrılacağı santrifüj veya filtrasyon bölümüne pompalanması**



**İstenen komponentin ayrı bir torbada tutulması**

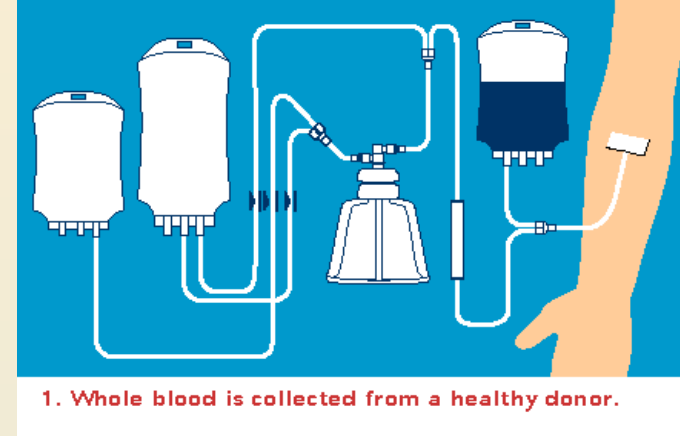


**Geri kalan komponentlerin hasta veya donöre geri verilmesi**

**\*ayırmak, çıkarmak**

# Aferez İşlemi

- Kan bileşenlerinin ayrıştırılması
- İstenilen bileşen(ler)in işlem bağlantılı otomatik bir sistem kullanılarak uzaklaştırılması



## HÜCRELER

Eritrosit

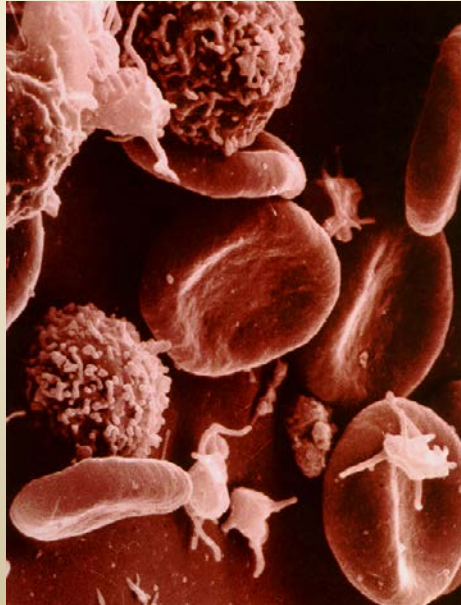
Lökosit

Granülosit

Lenfosit

Monosit

Trombosit



## PLAZMA

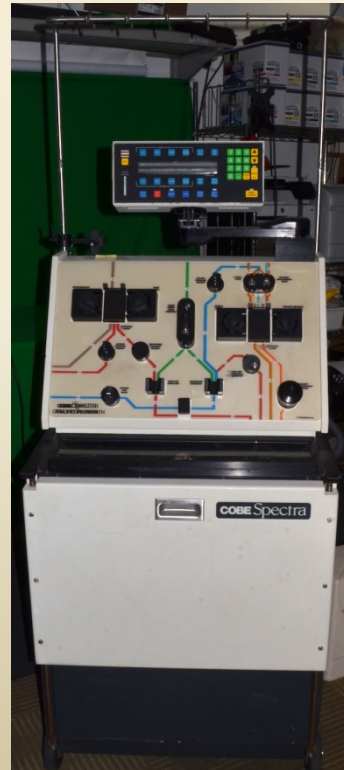
Su

Proteinler

Yağ

Karbohidrat

Elektrolitler



## ✓ DONÖR AFEREZİ

- Sitaferez

Plateletferez

Lökoferes

Granülosit aferezi

Kök hücre aferezi

Eritrosit aferezi

- Plazmaferes

## ✓ TERAPÖTİK AFEREZ

- Sitaferez

Plateletferez

Lökoferes

Lenfosit aferezi

Kök hücre aferezi

Eritrosit (exchange) aferezi

- Plazmaferes – plazma exchange

Terapötik plazma exchange

İmmünabsorbsiyon aferezi

LDL aferezi

Bilirubin aferezi

Hemodiyaliz

# Donör Aferezi



- Amaç, hasta için gerekli kan bileşenini sağlıklı kişiden temin etmek
- Aile fertleri
- Arkadaşlar
- Tanıdıklar
- Kan bağışı kuralları
- AABB\* standartları
- Donör reaksiyonları (Parestezi,vazovagal reak, hiperventilasyon, hemoliz, hava embolisi, hematom, allerjik reak.)

\*Amerikan Kan Bankaları Birliği

# Terapotik Aferez



- Amaç, hastalığa yol açtığı düşünölen bileşen(ler)i uzaklaştırmak
  - Replasman sıvısı
  - Antikoagölasyon
  - Hasta onamı
- 
- Endikasyonları ASFA\* standartları belirler..
  - Komplikasyonlar (parestezi,anaflaksi,hipokalemi,hipomagnezemi, kanama, ..)



# ASFA 2016 terapotik aferez endikasyonları....

TABLE IV. Category and Grade Recommendations for Therapeutic Apheresis

Disease name	TA Modality	Indication	Category	Grade	Page
Acute disseminated encephalomyelitis	TPE	Steroid Refractory	II	2C	163
Acute inflammatory demyelinating polyradiculoneuropathy/ Guillain-Barre syndrome	TPE	Primary Treatment	I	1A	165
	TPE	After IVIG	III	2C	
Acute liver failure	TPE		III	2B	167
	TPE-HV		I	1A	
Age related macular degeneration, dry	Rheopheresis		I	1B	169
Amyloidosis, systemic	$\beta_2$ microglobulin column		II	2B	171
	TPE		IV	2C	
ANCA-associated rapidly progressive glomerulonephritis (Granulomatosis with polyangiitis and Microscopic Polyangiitis)	TPE	Dialysis dependence	I	1A	173
	TPE	DAH	I	1C	
	TPE	Dialysis independence	III	2C	
Anti-glomerular basement membrane disease (Goodpasture's syndrome)	TPE	Dialysis dependence, no DAH	III	2B	175
	TPE	DAH	I	1C	
	TPE	Dialysis independence	I	1B	
Aplastic anemia, pure red cell aplasia	TPE	Aplastic anemia	III	2C	177
	TPE	Pure red cell aplasia	III	2C	
Atopic (neuro-) dermatitis (atopic eczema), recalcitrant	ECP		III	2C	179
	IA		III	2C	
	TPE		III	2C	
Autoimmune hemolytic anemia; WAIHA; cold agglutinin disease	TPE	Severe WAIHA	III	2C	181
	TPE	Severe cold agglutinin disease	II	2C	
Babesiosis	RBC exchange	Severe	II	2C	183
Burn shock resuscitation	TPE		III	2B	185
Cardiac neonatal lupus	TPE		III	2C	187
Cardiac transplantation	ECP	Cellular/recurrent rejection	II	1B	189
	ECP	Rejection prophylaxis	II	2A	
	TPE	Desensitization	II	1C	
	TPE	Antibody mediated rejection	III	2C	
Catastrophic antiphospholipid syndrome	TPE		II	2C	191
Chronic focal encephalitis (Rasmussen Encephalitis)	TPE		III	2C	193
Chronic inflammatory demyelinating polyradiculoneuropathy	TPE		I	1B	195
Coagulation factor inhibitors	TPE	Alloantibody	IV	2C	197
	TPE	Autoantibody	III	2C	
	IA	Alloantibody	III	2B	
	IA	Autoantibody	III	1C	
Complex regional pain syndrome	TPE	Chronic	III	2C	199
Cryoglobulinemia	TPE	Symptomatic/severe	II	2A	201
	IA	Symptomatic/severe	II	2B	
Cutaneous T-cell lymphoma; mycosis fungoides; Sezary syndrome	ECP	Erythrodermic	I	1B	203
	ECP	Non-erythrodermic	III	2C	
Dermatomyositis/polymyositis	TPE		IV	2B	205
	ECP		IV	2C	
Dilated cardiomyopathy, idiopathic	IA	NYHA II-IV	II	1B	207
	TPE	NYHA II-IV	III	2C	
Erythropoietic porphyria, liver disease	TPE		III	2C	209
	RBC Exchange		III	2C	

TABLE IV. Continued

Disease name	TA Modality	Indication	Category	Grade	Page
Familial hypercholesterolemia	LDL apheresis	Homozygotes	I	1A	211
	LDL apheresis	Heterozygotes	II	1A	
	TPE	Homozygotes with small blood volume	II	1C	
Focal segmental glomerulosclerosis	TPE	Recurrent in transplanted kidney	I	1B	213
	LDL apheresis	Steroid resistant in native kidney	III	2C	
Graft-versus-host disease	ECP	Skin (chronic)	II	1B	216
	ECP	Non-skin (chronic)	II	1B	
	ECP	Skin (acute)	II	1C	
	ECP	Non-skin(acute)	II	1C	
Hashimoto's encephalopathy; Steroid-responsive encephalopathy associated with autoimmune thyroiditis	TPE		II	2C	219
HELLP syndrome	TPE	Postpartum	III	2C	221
	TPE	Antepartum	IV	2C	
Hematopoietic stem cell transplantation, ABO Incompatible	TPE	Major HPC, Marrow	II	1B	223
	TPE	Major HPC, Apheresis	II	2B	
	RBC exchange	Minor HPC, Apheresis	III	2C	
Hematopoietic stem cell transplantation, HLA desensitization	TPE		III	2C	225
Hemophagocytic lymphohistiocytosis; Hemophagocytic syndrome; Macrophage activating syndrome	TPE		III	2C	227
Henoch-Schönlein purpura	TPE	Crescentic	III	2C	229
	TPE	Severe extrarenal disease	III	2C	
Heparin induced thrombocytopenia & thrombosis	TPE	Pre-cardiopulmonary bypass	III	2C	231
	TPE	Thrombosis	III	2C	
Hereditary hemochromatosis	Erythrocytapheresis		I	1B	233
Hyperleukocytosis	Leukocytapheresis	Symptomatic	II	1B	235
	Leukocytapheresis	Prophylactic or secondary	III	2C	
Hypertriglyceridemic pancreatitis	TPE		III	2C	237
Hyperviscosity in monoclonal gammopathies	TPE	Symptomatic	I	1B	239
	TPE	Prophylaxis for rituximab	I	1C	
Immune thrombocytopenia	TPE	Refractory	III	2C	241
	IA	Refractory	III	2C	
Immunoglobulin A nephropathy	TPE	Crescentic	III	2B	243
	TPE	Chronic progressive	III	2C	
Inflammatory bowel disease	Adsorptive cytapheeresis	Ulcerative colitis	III/II	1B/2B	245
	Adsorptive cytapheeresis	Crohn's Disease	III	1B	
	ECP	Crohn's Disease	III	2C	
Lambert-Eaton myasthenic syndrome	TPE		II	2C	247
Lipoprotein (a) hyperlipoproteinemia	LDL apheresis		II	1B	249
Liver transplantation	TPE	Desensitization, ABOi LD	I	1C	251
	TPE	Desensitization, ABOi DD	III	2C	
	TPE	Antibody mediated rejection (ABOi & HLA)	III	2C	
Lung transplantation	ECP	Bronchiolitis obliterans syndrome	II	1C	253
	TPE	Antibody mediated rejection	III	2C	
	TPE	Desensitization	III	2C	
Malaria	RBC exchange	Severe	III	2B	255
Multiple sclerosis	TPE	Acute CNS inflammatory demyelinating	II	1B	257
	IA	Acute CNS inflammatory demyelinating	III	2C	
	TPE	Chronic progressive	III	2B	



TABLE IV. *Continued*

Disease name	TA Modality	Indication	Category	Grade	Page
Myasthenia gravis	TPE	Moderate-severe	I	1B	259
	TPE	Pre-thymectomy	I	1C	
Myeloma cast nephropathy	TPE		II	2B	261
Nephrogenic systemic fibrosis	ECP		III	2C	263
	TPE		III	2C	
Neuromyelitis optica spectrum disorders	TPE	Acute	II	1B	265
	TPE	Maintenance	III	2C	
N-methyl D-aspartate receptor antibody encephalitis	TPE		I	1C	267
Overdose, envenomation and poisoning	TPE	Mushroom poisoning	II	2C	269
	TPE	Envenomation	III	2C	
	TPE	Drug overdose/poisoning	III	2C	
Paraneoplastic neurological syndromes	TPE		III	2C	271
	IA		III	2C	
Paraproteinemic demyelinating neuropathies/chronic acquired demyelinating polyneuropathies	TPE	Anti-MAG neuropathy	III	1C	273
	TPE	Multifocal Motor Neuropathy	IV	1C	
	TPE	IgG/IgA	I	1B	
	TPE	IgM	I	1C	
	TPE	Multiple myeloma	III	2C	
	IA	IgG/IgA/IgM	III	2C	
Pediatric autoimmune neuropsychiatric disorders associated with streptococcal infections; Sydenham's chorea	TPE	PANDAS exacerbation	II	1B	275
	TPE	Sydenham's chorea, severe	III	2B	
Pemphigus vulgaris	TPE	Severe	III	2B	277
	ECP	Severe	III	2C	
	IA	Severe	III	2C	
Peripheral vascular diseases	LDL apheresis		II	1B	279
Phytanic acid storage disease (Refsum's disease)	TPE		II	2C	281
	LDL apheresis		II	2C	
Polycythemia vera; erythrocytosis	Erythrocytapheresis	Polycythemia vera	I	1B	283
	Erythrocytapheresis	Secondary erythrocytosis	III	1C	
Post transfusion purpura	TPE		III	2C	285
Prevention of RhD alloimmunization after RBC exposure	RBC exchange	Exposure to RhD(+) RBCs	III	2C	287
Progressive multifocal leukoencephalopathy associated with natalizumab	TPE		I	1C	289
Pruritus due to hepatobiliary diseases	TPE	Treatment resistant	III	1C	291
Psoriasis	ECP		III	2B	293
	Adsorptive cytaphe- resis	Disseminated pustular	III	2C	
	Lymphocytapheresis		III	2C	
	TPE		IV	2C	
Red cell alloimmunization in pregnancy	TPE	Prior to IUT availability	III	2C	295
Renal transplantation, ABO compatible	TPE/IA	Antibody mediated rejection	I	1B	297
	TPE/IA	Desensitization, LD	I	1B	
	TPE/IA	Desensitization, DD	III	2C	
Renal transplantation, ABO incompatible	TPE/IA	Desensitization, LD	I	1B	299
	TPE/IA	Antibody mediated rejection	II	1B	
	TPE/IA	A <sub>2</sub> /A <sub>2</sub> B into B, DD	IV	1B	
Scleroderma (systemic sclerosis)	TPE		III	2C	301
	ECP		III	2A	
Sepsis with multi-organ failure	TPE		III	2B	303

TABLE IV. *Continued*

Disease name	TA Modality	Indication	Category	Grade	Page
Sickle cell disease, acute	RBC Exchange	Acute stroke	I	1C	305
	RBC Exchange	Acute chest syndrome, severe	II	1C	
	RBC Exchange	Priapism	III	2C	
	RBC Exchange	Multiorgan failure	III	2C	
	RBC Exchange	Splenic/hepatic sequestration; intrahepatic cholestasis	III	2C	
Sickle cell disease, non-acute	RBC exchange	Stroke prophylaxis/iron overload prevention	I	1A	307
	RBC exchange	Recurrent vaso-occlusive pain crisis	III	2C	
	RBC exchange	Pre- operative management	III	2A	
	RBC exchange	Pregnancy	III	2C	
Stiff-person syndrome	TPE		III	2C	309
Sudden sensorineural hearing loss	LDL apheresis		III	2A	311
	Rheopheresis		III	2A	
	TPE		III	2C	
Systemic lupus erythematosus	TPE	Severe	II	2C	313
	TPE	Nephritis	IV	1B	
Thrombocytosis	Thrombocytapheresis	Symptomatic	II	2C	315
	Thrombocytapheresis	Prophylactic or secondary	III	2C	
Thrombotic microangiopathy, coagulation mediated	TPE	THBD mutation	III	2C	317
Thrombotic microangiopathy, complement mediated	TPE	Complement factor gene mutations	III	2C	319
	TPE	Factor H autoantibodies	I	2C	
	TPE	MCP mutations	III	1C	
Thrombotic microangiopathy, drug associated	TPE	Ticlopidine	I	2B	321
	TPE	Clopidogrel	III	2B	
	TPE	Calcineurin inhibitors	III	2C	
	TPE	Gemcitabine	IV	2C	
	TPE	Quinine	IV	2C	
Thrombotic microangiopathy, hematopoietic stem cell transplantation associated	TPE		III	2C	323
Thrombotic microangiopathy, Shiga toxin mediated	TPE/IA	Severe neurological symptoms	III	2C	325
	TPE	Streptococcus pneumoniae	III	2C	
	TPE	Absence of severe neurological symptoms	IV	1C	
Thrombotic thrombocytopenic purpura	TPE		I	1A	327
Thyroid storm	TPE		III	2C	329
Toxic epidermal necrolysis	TPE	Refractory	III	2B	331
Vasculitis	TPE	HBV-PAN	II	2C	333
	TPE	Idiopathic PAN	IV	1B	
	TPE	EGPA	III	1B	
	Adsorption granulocytapheresis	Behcet's disease	II	1C	
	TPE	Behcet's disease	III	2C	
Voltage-gated potassium channel antibodies	TPE		II	2C	335
Wilson's disease, fulminant	TPE	Fulminant	I	1C	337

# Terapotik Aferezde Cihaz tercihi..

- Hasta özellikleri (yaş, ortam, damar yolu..)
- Personel deneyimi
- İşlem özellikleri : İşlem tipi (exchange, LDL aferezi..)  
İşlem sayısı/uygulama aralığı  
Cihaz sayısı/tipi  
Hedef



## Ayrıştırma seçenekleri:

Santrifüj / Filtrasyon / Santrifüj + Filtrasyon

### Santrifüj

- Kan bileşenlerinin özgül ağırlık farkı

Tam kan santrifüjü



plazma



buffy coat



eritrosit

COBE Spectra  
Spectra Optia  
AS104  
COM.TEC  
UVAR.XTS  
CELLEX

Kanın alete giriş hızı ve santrifüj gücü önemli..  
Aralıklı akım/devamlı akım sistemi

### Filtrasyon

- Partikül boyutundaki farklılık
- Membran ayırıştırıcılar

Liposorber  
HELP  
Evaflux  
DALI



### **Santrifujle TPD**

Sitrat (genellikle)  
Düşük kan akım hızı  
Periferik venler ya da santral kateter  
İşlem kan hacminin ~1,5 katı  
Plazma ekstraksiyonu ~%80

### **Membranla TPE**

Heparin (genellikle)  
Yüksek kan akım hızı  
Santral kateter  
İşlem kan hacminin ~3 katı  
Plazma ekstraksiyonu ~%30

Plazma replasmanı

Plazma rejenerasyonu

TTP için

Diğer endikasyonlar  
için %5 albümin

Adsorbsiyon  
kolonu

Kaskad  
filtrasyon

# A Needs Assessment and Instrument Comparison for a Therapeutic Apheresis Medicine Service

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TABLE VII. Comparison of Centrifugation-Based Instruments

	COBE <sup>®</sup> Spectra	Spectra Optia <sup>®</sup>	AS104 <sup>a</sup>	COM.TEC
Weight	177 kg	92 kg	145 kg	130 kg
Display	LED	Graphic user interface (touch screen)	LED	Touch screen
Interface adjustments	Manual	Automated interface management or manual	Automated or manual	Automated or manual
Procedure data manager	Pen and paper	Stores 30 procedures then printed with a network compatible printer.	Printout from the instrument	Printout from the instrument
Saline needle	One	None	One	One
Saline spike	One	One (this line bifurcates to both the access and return lines)	One	One
Maximum centrifuge speed (RPM)	2400	3000	2000	2200
Inlet rate (mL/min)	0–150	0–142	13–120	10–120
Anticoagulant (AC)	ACD	ACD	ACD	ACD
AC ratio range	1–15	1–15	7–25	7–25
Comparison for a dual needle TPE procedure using albumin as the replacement fluid and a 100% fluid balance (FB) setting.				
ECV (mL)	285	185	169	169
AC default ratio	10 <sup>b</sup>	10 <sup>b</sup>	12 <sup>c</sup>	12 <sup>c</sup>
FB (mL) after rinseback	195	0	160	160

LED, light emitting diode display; RPM, rotations per minute; ACD, acid-citrate-dextrose; SN, single needle; DN, dual needle; ECV, extracorporeal volume; BV, blood volume; PV, plasma volume; DS, dual stage; SS, single stage.

<sup>a</sup>The AS104 is no longer manufactured, but continues to be supported by Fresenius-Kabi.

<sup>b</sup>For the TerumoBCT instruments an AC ratio of 10 is defined as 9 parts whole blood to 1 part anticoagulant.

<sup>c</sup>For the Fresenius-Kabi instruments an AC ratio of 12 is defined as 12 parts whole blood to 1 part anticoagulant.

TABLE VIII. Comparison of Extracorporeal Photopheresis Instruments

	UVAR®XTS™	CELLEX™
Weight	95 kg	155 kg
User interface	Touch screen	Touch screen
Vascular access	SN access with intermittent flow	SN access with intermittent flow DN access with continuous flow
Kits	125 mL bowl 225 mL bowl	125 mL bowl
Maximum centrifuge speed (RPM)	Bowl 4,800	Frame 2,400 plus bowl 4,800
Flow rates	0–100 mL/min	0–100 mL/min
Inlet rate	10–30 mL/min	5–50 mL/min
Anticoagulant (AC)	Heparin	Heparin
AC ratio range	8–16	8–50
AC default ratio	10 <sup>a</sup>	10 <sup>a</sup>
Blood prime	No	Yes
Fluid balance	450 mL positive	SN access: 400 mL positive DN access: 450 mL positive
Cycles per procedure	125 mL bowl: 6 cycles; 225 mL bowl: 3 cycles	125 mL bowl: 1 cycle
Average procedure time	2.5–3.5 h	SN access: 90 min DN access: 70 min
Interface management	Light deflection hematocrit sensor	Automated interface detection
Whole blood processed default (range)	1.5 L (0.5–1.7 L)	1.5 L (0.5–2 L)
Percent of total WBC collected	5–10% ( $5 \times 10^9$ )	5–10% ( $5 \times 10^9$ )
Total volume of collected product	250–270 mL	~200 mL
Buffy coat volume in collected product	140–160 mL	120 mL
Hematocrit of total collected product	1.5–2%	1.5–2%
Normal saline volume in collected product	90 mL	35 mL
Anticoagulant volume in collected product	~18 mL	45 mL
Methoxsalen dose calculation	Manual	Automated
Photoactivation exposure	1.5–2.0 J/cm <sup>2</sup> of UVA	1.5–2.0 J/cm <sup>2</sup> of UVA
Average photoactivation time	35–45 min	10–12 min

SN, single needle, DN, dual needle, UVA, ultraviolet-A radiation (320–400 nm wavelength).

<sup>a</sup>For the Therakos™ instruments an AC ratio of 10 is defined as 10 parts whole blood to 1 part AC.

- Tüm cihazlar yeterli aferez tekniğine sahip, biri diğerine üstün değil..
- Takım çalışması önemli (tedavi alanı,süresi, personel eğitimi, yan etkilerin yönetimi..)
- Uygun endikasyonda paydaşların işbirliği, etkin ve başarılı aferez sonucunu getirecektir..





# Membrane versus centrifuge-based therapeutic plasma exchange: a randomized prospective crossover study

Carsten Hafer<sup>1</sup> · Paulina Golla<sup>1</sup> · Marion Gericke<sup>2</sup> · Gabriele Eden<sup>1,4</sup> ·  
Gernot Beutel<sup>3</sup> · Julius J. Schmidt<sup>1</sup> · Bernhard M. W. Schmidt<sup>1</sup> · Stef De Reys<sup>2</sup> ·  
Jan T. Kielstein<sup>1,4</sup>

Octonova'ya karşı Spectra Optia..

Sonuç: Plazma uzaklaştırma etkinliği ve  
Süre bakımından CTPE (Optia) üstün..

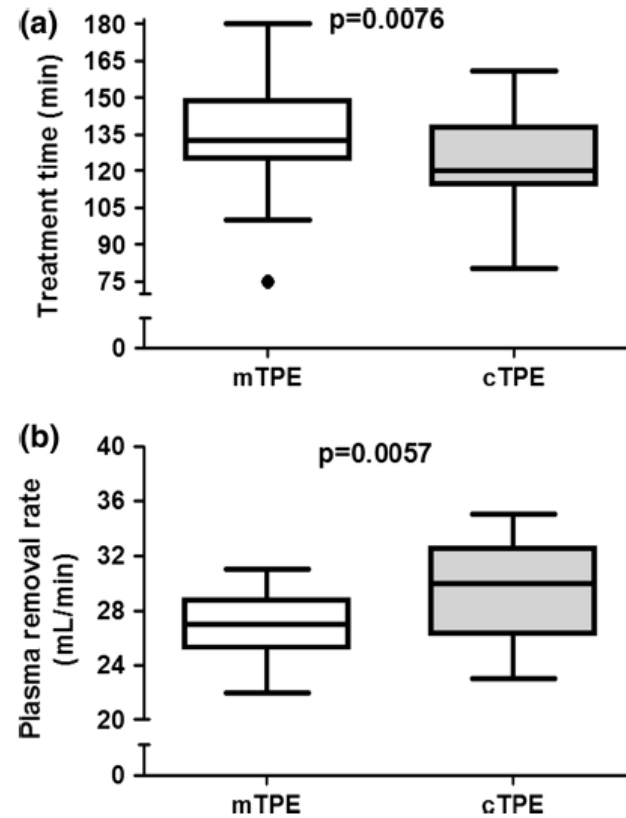


Fig. 1 a Procedure time during the mTPE and cTPE treatment. b Plasma removal rate during the mTPE and cTPE treatment



## Comparison of plasma exchange procedures using three apheresis systems

*Joan Cid, Juan M. Molina, Maria J. Mustieles, Montse Periañez, and Miguel Lozano*

**TABLE 2. Data of the PE procedures**

Parameter	Amicus (n = 18)	Optia (n = 44)	Spectra (n = 14)	p value*
PV removed (mL)	3978 ± 504†	4381 ± 571	4184 ± 553	0.035
PV of the patient (mL)	3090 ± 329	3251 ± 445	3070 ± 505	0.244
PV exchanged (%)	128 ± 6‡§	135 ± 7	137 ± 9	0.005
Whole blood processed (mL)	6669 ± 2341	6796 ± 1266	7768 ± 1337	0.104
Procedure time (min)	101 ± 40	115 ± 21	115 ± 20	0.160
Mean flow (mL/min)	67 ± 8	60 ± 12	68 ± 11	0.027
Anticoagulant (mL)	542 ± 196	687 ± 120	647 ± 111	0.002
Ca-Mg solution (mL)	81 ± 28¶**	56 ± 16	63 ± 15	<0.001
PRE (%)	79.84 ± 8.22	82.92 ± 5.77	70.38 ± 8.18††‡‡	<0.001

**Sonuç:**

Plazma uzaklaştırma etkinliği bakımından Amicus ve Optia benzer, Spectra'dan üstün..  
Yan etkiler bakımından anlamlı fark yok..

# Paired comparison of therapeutic plasma exchange using the Fenwal Amicus versus TerumoBCT Spectra Optia

Edwin A. Burgstaler<sup>1</sup>  | Sandra C. Bryant<sup>2</sup> | Jeffrey L. Winters<sup>1</sup> 

Variable	Amicus	Optia	Difference (Amicus – Optia)	P value
Inlet volume processed (mL)	5995 (3451, 12,595)	5978 (3445, 9549)	33 (–1592, 4910)	.003 <sup>s</sup>
AC used (mL)	229 (134, 482)	230 (133, 490)	–3 (–243, 197)	.12
Whole blood processed (mL)	5766 (3317, 12,113)	5748 (3312, 9182)	51 (–1541, 4713)	.002 <sup>s</sup>
Average inlet rate (mL/min)	97 (46, 122)	100 (47, 124)	–1 (–20, 40)	.02 <sup>s</sup>
Plasma volume removed (mL)	3196 (1975, 4743)	3120 (1837, 4745)	28 (–550, 497)	.19
Procedure time (min) <sup>a</sup>	71 (45, 155), 75.8	71 (45, 123), 70.2	3 (–22, 55)	<.0001 <sup>s</sup>
AC to patient (mL)	36 (11, 287)	34 (11, 89)	4 (–42, 209)	<.0001 <sup>s</sup>

Sonuç: Plazma uzaklaştırmada cihazlar benzer, süre ve kullanılan antikoagülan bakımından Optia avantajlı..



# Hyperleukocytosis, leukostasis and leukapheresis: Practice management

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World Journal of  
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## Treating inflammatory bowel disease by adsorptive leucocytapheresis: A desire to treat without drugs

Abbi R Saniabadi, Tomotaka Tanaka, Toshihide Ohmori, Koji Sawada, Takayuki Yamamoto, Hiroyuki Hanai

World J Gastroenterol 2014 August 7; 20(29): 9699-9715

Cihaz detayı ?

# Long-term red blood cell exchange in children with sickle cell disease: Manual or automatic?

C. Duclos<sup>a,\*</sup>, E. Merlin<sup>b</sup>, C. Paillard<sup>b</sup>, I. Thuret<sup>c</sup>, F. Demeocq<sup>b</sup>, G. Michel<sup>c</sup>, J. Kanold<sup>b</sup>

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**Table 1**

Comparison of automated and manual chronic exchanges.

	Erythrocytapheresis n = 60 (Clermont-Ferrand)	Manual exchange n = 124 (Marseille)	p
Number of patients	5	5	NS
Age (year)	12 (5–18)	11 (3–17)	NS
Sex (F/M)	4/1	3/2	
Weight (kg)	39 (18–52)	26 (15–74)	NS
No. of children with hydroxyurea treatment	1	2	
Chronic exchange indication:			
Cerebral injury <sup>a</sup>	3	3	
Acute chest syndrome	0	1	
>3 acute vaso-occlusive crises/year	3	2	
Time between the exchanges (days)	63 (19–91)	28 (14–114)	<.0001
Hemoglobin pre-exchange (g/l)	94 (84–105)	91 (73–121)	NS
Hematocrit pre-exchange (%)	25.5 (19–31.6)	27 (22–35)	<.001
Hemoglobin S pre-exchange (%)	47.5 (22–84)	45.6 (20.6–81)	.05
Platelet count pre-exchange (giga/L)	467 (148–698)	594 (123–807)	<.001
Blood volume transfused (ml/kg)	41 (19.6–60)	11.1 (6.6–20)	<.0001
Exchanges performed less than 40 days after the previous exchange	n = 15	n = 109	
Pre-exchange hemoglobin S (%)	32 (22–60)	44.3 (20.6–63)	<.0001
Blood volume transfused (ml/kg)	29 (19.6–52)	11 (6.6–20)	<.0001

<sup>a</sup> Cerebral injury: stroke, ischemia on cerebral imaging or blood flow velocity >200 cm/s on transcranial doppler.

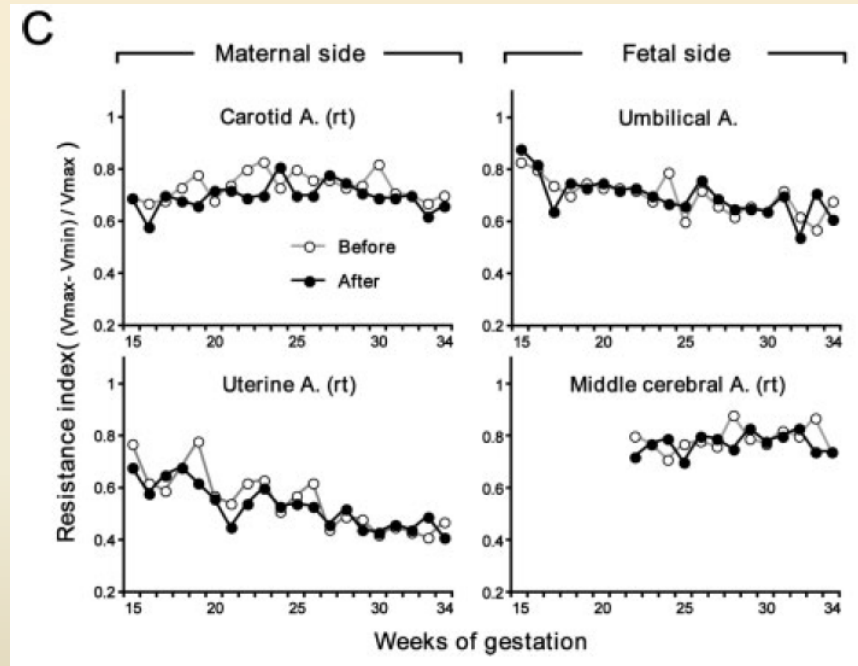
Cobe Spectra daha etkin..

# Periodic Plateletpheresis During Pregnancy in a High-Risk Patient With Essential Thrombocythemia

Koushi Yamaguchi,\* Michi Hisano, Mariko Sakata, Yasuyuki Minatogawa, Teruaki Suzuki, Nobuaki Ozawa, Michihiro Kitagawa, and Atsuko Murashima

*Department of Perinatology, National Center for Child Health and Development, Tokyo, Japan*

- CS 3000 Baxter







# Long-term Effect of Low-density Lipoprotein Apheresis in Patients with Heterozygous Familial Hypercholesterolemia

Toshinori Higashikata and Hiroshi Mabuchi

**TABLE 1.** Summary of the effects of long-term LDL apheresis on coronary artery disease in familial hypercholesterolemia

Study (type)	Participants (No)	System for Apheresis (mean interval days)	Follow-up (mean years)	Endpoints	Outcome	Publication Year
LARS (open)	FH Hm (7)	DSC (7-28) + drugs	3.0	QCA	regression in 4 Hm pts and in 10 Ht pts	1992
LDL apheresis Study (open)	Ht (25) FH Ht (25)	IM-A (7)	3.0	semi QCA by digital caliper	regression in 8 of 111 lesions progression in 11 lesions	1994
FHRS (randomized)	FH Ht (39)	DSC (14) + simvastatin vs. simvastatin + colestipol (cholesterol level matched)	2.1	QCA	similar angiographic changes both two groups	1995
Münich Study (open)	FH Ht (34)	IM-A, HELP, or DSC (7-14) + simvastatin	8.6	CAG (visual score)	regression in 4 pts	1998
Liposorber Study (open)	FH Ht (39)	DSC (11-14)	5.0	clinical status	prevent progression in 29 pts	1998
Hokuriku-FH-LDL-Apheresis Study (open, case-control)	Hm (10) FH Ht (130)	DSC (15) + drugs vs. drug combination	6.0	cardiac event	3.5 events/1000 pts-months in treatment vs. 6.3 events before treatment	1998
L-CAPS	FH Ht (36)	DSC (17) + drugs vs. drug combination	2.1	QCA	72% reduction of events	1999
RACMART (case-control)	FH Ht (18)	DSC (14) + drugs vs. drug	1.0	IVUS, QCA	regression in 4 of 25 pts receiving apheresis no regression in 11 pts receiving drugs alone plaque regression in pts receiving apheresis no regression in pts receiving drugs alone	2002

CAG; coronary angiography, DSC; dextran sulfate cellulose column, FH; familial hypercholesterolemia, HELP; heparin-induced extracorporeal LDL precipitation, Hm; homozygote, Ht; heterozygote, IM-A; immuno-apheresis, QCA; quantitative coronary angiography IVUS; intravascular ultrasound

Tüm metodlar benzer etkinlik ve güvenlikte..

# The Selective Therapeutic Apheresis Procedures

Amber P. Sanchez,<sup>1\*</sup> Robyn Cunard,<sup>1,2</sup> and David M. Ward<sup>1,3\*</sup>

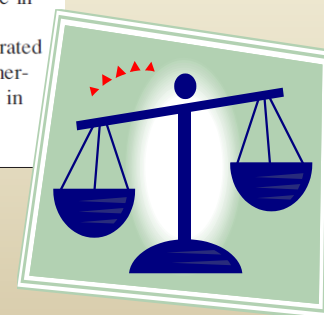
<sup>1</sup>Therapeutic Apheresis Program, Department of Medicine, Division of Nephrology and Hypertension, University of California San Diego Medical Center, San Diego, California

<sup>2</sup>Veterans Affairs San Diego Healthcare System, Department of Medicine and Research, San Diego, California

<sup>3</sup>Kidney and Pancreas Transplantation Program, Center for Transplantation, University of California San Diego Medical Center, San Diego, California

TABLE I. LDL Apheresis Procedures

Procedure	Manufacturer	Ligand	LDL reduction	Advantages	Disadvantages
Liposorber®	Kaneka	Dextran sulfate	73–83%	Selective, unlimited volume of plasma can be treated, available worldwide including the USA	Bradykinin reactions, expensive, columns cannot be reused
H.E.L.P.	B. Braun	Heparin	45–67%	Safe, can use ACEi, available in the USA	Complex system, however new machine is now compatible outside of a dialysis unit, LDL removal limited by capacity of the precipitate filter
DFPP	EvaFlux 5A: Kawasumi, Japan		30–56%	Semiselective, can use ACEi	Capacity of removal limited by filter, loss of other proteins, including HDL. Not available in the USA
TheraSorb™-LDL	Miltenyi Biotec	Anti-Apoprotein B100-antibodies	60–70%	Selective, effective, reusable	Expensive and regeneration of the columns cumbersome. Not available in the USA
DALI	Fresenius	Anti-Apo B antibodies	60–75%	Selective, effective, simple technology, plasma separation not required	Columns cannot be regenerated. Not available in the USA
Liposorber® D	Kaneka	Dextran sulfate	60–75%	Selective, effective, simple technology, plasma separation not required, removes the least amount of HDL	Columns become saturated and cannot be regenerated. Not available in the USA



# Technical comparison of four different extracorporeal photopheresis systems

Andreas Brosig,<sup>1†</sup> Viola Hähnel,<sup>1†</sup> Evelyn Orsó,<sup>1</sup> Daniel Wolff,<sup>2</sup>  
Ernst Holler,<sup>2</sup> and Norbert Ahrens<sup>1</sup>

TABLE 2. ECP procedure data\*

Procedure parameter	Amicus	Cobe Spectra	Spectra Optia	Therakos	Overall
Procedure time†‡ (min)	166 (120-245)	160 (123-195)	140 (120-193)	192 (155-275)	164 (120-275)
Volume of apheresate† (mL)	200 (183-208)	200 (150-233)	197 (195-200)	268 (207-342)	200 (150-342)
Processed volume† (L)	7.9 (7.8-8.0)	8.3 (2.8-11.7)	7.5 (6.9-7.6)	NA	7.9 (2.8-11.7)
Anticoagulation rate†	1:11.4 (11.1-12.3)	1:10.3 (7.8-11.2)	1:11.0 (9.6-11.0)	NA	1: 10.9 (7.8-12.3)
WBC CE (%)	16 (6-44)	12 (1-47)	21 (4-38)	NA	14 (1-47)
MNC CE (%)	60 (41-86)	50 (10-88)	60 (41-81)	NA	54 (10-88)
WBC throughput (mL/min)	7 (2-23)	7 (0.7-26)	11 (2-19)	3 (0.07-5)	7 (0.07-26)
MNC throughput (mL/min)	31 (19-38)	28 (2-46)	33 (16-45)	6 (0.2-9)	27 (0.2-46)

\* Data are expressed as median (range).

† Variables with significant differences ( $p < 0.05$ ).

‡ Procedure time using the specified apheresis device (including UV irradiation and retransfusion time for Therakos).

NA = not available.

**WBC içeriği Therakos'da düşük..**

**Htc Optia'da düşük.. Plt Amicus'da düşük..**

✓ **Amicus, Cobe ve Optia benzer etkinlikte..**

✓ **Therakos ile MNC sayısı düşük..**

✓ **Yan etkiler benzer..**

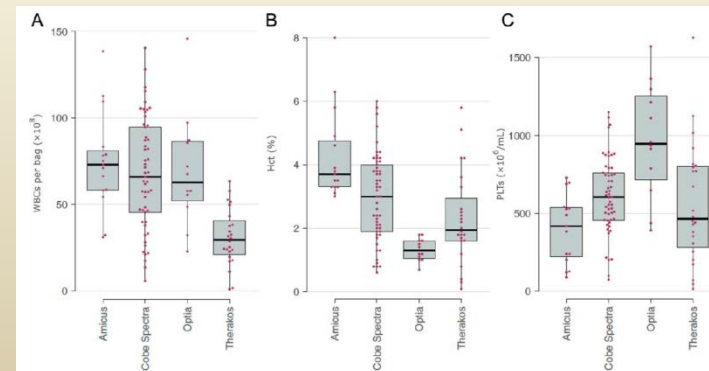


Fig. 2. Box- and beeswarm plots of WBC content (A), Hct (B), and PLT concentration (C) in photopheresis cell suspensions.

# Donör Aferezinde Cihaz Farkı...?



## Double red blood cell collection: comparison of three apheresis systems

*Edwin A. Burgstaler, Kimberly J. Duffy, and Manish J. Gandhi*

**TABLE 2. Comparison of DRBC apheresis systems\***

Variable	Trima	Alyx	MCS+
Procedures (n = 40 procedures/system)			
Volume processed (mL)	1385 ± 88	1132 ± 74†, p < 0.0001	1063 ± 77††, p < 0.0001
AC used (mL)	164 ± 6	132 ± 7†, p < 0.0001	88 ± 6††, p < 0.0001
Blood processed (mL)	1221 ± 82	1000 ± 68†, p < 0.0001	973 ± 74†, p < 0.0001
Procedure time (min)	38 ± 5	29 ± 6†, p < 0.0001	36 ± 4††, p < 0.0053, p < 0.0001
Donor time (min)	52 ± 6	45 ± 9† (n = 38), p = 0.0002	52 ± 9†, p = 0.0015
Total technician time (min)	87 ± 8	73 ± 9† (n = 38), p < 0.0001	64 ± 10††, p < 0.0001, p = 0.0002
RBC CE2 (%)	65 ± 2	78 ± 4†, p < 0.0001	72 ± 4††, p < 0.0001
RBC recovery (%)	85	88.9 ± 1.5	90.7 ± 1.1†, p < 0.0001
Products (n = 80 products/system)			
RBCs			
Hb (g)	59.2 ± 2.5	56.8 ± 3.1†, p < 0.0001	51.5 ± 1.4††, p < 0.0001
Hct (%)	53 ± 1	56 ± 1†, p < 0.0001	54 ± 1††, p < 0.0001
Unit RBC (mL)	172 ± 6	167 ± 7†, p < 0.0001	151 ± 3††, p < 0.0001
Total volume (mL)	322 ± 6	300 ± 11†, p < 0.0001	278 ± 5††, p < 0.0001
WBCs			
WBC count (×10 <sup>6</sup> )	0.32 ± 0.03	0.31 ± 0.07†, p < 0.0001	0.46 ± 0.48††, p < 0.0001, p = 0.0074
<5 × 10 <sup>6</sup> (%)	100	100	100
<1 × 10 <sup>6</sup> (%)	100	100	93.8

**Sonuç:** Tüm cihazlar etkin olmakla birlikte, Alyx süre ve toplama etkinliği bakımından daha avantajlı..

# Comparison of two double red cell collection settings on Fenwal Alyx apheresis instrument

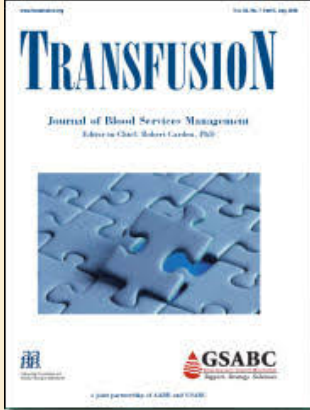
Edwin A. Burgstaler  | Kimberly J. Duffy | Manish J. Gandhi

**TABLE 2** Comparison of products with a fixed target versus a variable target using the Alyx

	Fixed	Variable
<b>PRODUCTS</b>	36	80
Total Volume (ml)	286 ± 11	300 ± 11 <i>P</i> < .0001
Hct (%)	55 ± 1	56 ± 2
Unit Hb (g)	53 ± 2	57 ± 3 <i>P</i> < .0001
≥ 51 gm (%)	80.6	96.3 <i>P</i> < .05
≥ 42.5 gm (%)	100	100
Unit RBC ml (ml)	158 ± 7	167 ± 7 <i>P</i> < .0001
≥ 153 ml (%)	55.6	96.3 <i>P</i> < .05
≥ 128 ml (%)	100	100

Sonuç: Değişken hedefli sistem daha etkili ürün eldesi sağladı, üstelik toplama ve işleme süresinde anlamlı artışa yol açmadı..





# A randomized crossover trial comparing three plateletpheresis machines

*Luis Bueno, Fernando García, Emma Castro, Luisa Barea, and Rocío González*

**TABLE 4. Outcomes\***

Variable	Machine			p value
	Amicus Crescendo	MCS Plus	Trima Accel	
Separation variables				
TSD3.5 (min)†	60.3 (1.0)‡	66.7 (1.0)§	47.9 (1.0)¶	<0.0001
Collection rate (PLT × 10 <sup>11</sup> /min)	0.060 (0.002)‡	0.051 (0.002)§	0.071 (0.002)¶	<0.0001
Yield per hour (×10 <sup>11</sup> )	3.56 (0.13)‡	3.07 (0.15)§	4.26 (0.11)¶	<0.0001
Efficiency (%)	72.7 (2.4)‡	64.5 (2.2)§	65.6 (2.9)	0.0028
Laboratory variables				
PLT volume‡	257 (1)‡	270 (1)§	247 (1)¶	0.0012
PLTs concentration (×10 <sup>9</sup> /L)	1677 (52)	1364 (54)§	1579 (39)¶	<0.0001
PLT yield	4.24 (0.11)‡	3.64 (0.13)§	3.85 (0.10)	0.0002
Plasma volume	267 (11)‡	280 (11)	294 (11)	0.0026
WBCs per unit (logarithm)¶¶	−9.7 (0.20)	−11.1 (0.21)§	−10.2 (0.19)¶	<0.0001

\* Data are shown as means (SEM) adjusted for the order of the procedure and the previous machine.

† Analysis of this variable was made after logarithm transformation. The results shown are the antilogarithm of the regression estimates.

‡ p < 0.05, Amicus Crescendo versus Trima 5.0 Accel.

§ p < 0.05, Amicus Crescendo versus MCS Plus.

¶ p < 0.05, MCS Plus versus Trima 5.0 Accel.

¶¶ A MCS Plus procedure that showed  $4.16 \times 10^6$  WBCs per unit was excluded from the statistical analysis.

✓Toplama oranı Trima ile daha yüksek..

# Comparison of Plateletpheresis on the Fresenius AS.TEC 204 and Haemonetics MCS 3p

Sudha Ranganathan\*

*Transfusion Medicine, Global Hospital, Hyderabad, India*

TABLE II. Comparison of Plateletpheresis on AS.TEC 04 and MCS 3p

	MCS 3p	AS.TEC 204	P
Parameter			
Time (in minutes)	74.5 ± 3.12	60 ± 2.49	>0.05
Volume processed (in litres)	3.2–3.4	2.8–3.0	>0.05
Separation efficiency (%)	50–52%	40–45%	<0.001
Decrease in post-platelet apheresis counts	25%	12%	<0.001
ACD-A used	330 ml	300 ml	>0.05
Predictor vs. actual yield (%)	75	90	<0.001
Complications			
Citrate toxicity (perioral numbness, numbness) (%)	4	2.5	>0.05
Vasovagal reactions (%)	3.5	1	>0.05
Quality control			
Visible red cell contamination	3%	nil	<0.05
Swirling present (%)	100	100	
ph (using litmus paper)	>7	>7	
Platelet counts ( $>3 \times 10^{11}$ ) (%)	85	90	
WBC counts/unit	40–50 × 10 <sup>6</sup>	100–200 × 10 <sup>6</sup>	<0.001

✓Toplama etkinliği Haemonetics ile daha yüksek..

# Comparison of Plateletpheresis on the Fenwal Amicus and Fresenius Com.Tec Cell Separators

Fevzi Altuntas<sup>a</sup> Ismail Sari<sup>b</sup> Ismail Kocyigit<sup>a</sup> Leylagul Kaynar<sup>a</sup> Sibel Hacıoglu<sup>b</sup>  
Ahmet Ozturk<sup>c</sup> Mehmet Oztekin<sup>a</sup> Musa Solmaz<sup>a</sup> Bulent Eser<sup>a</sup> Mustafa Cetin<sup>a</sup> Ali Unal<sup>a</sup>

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	Amicus	COM.TEC	p value
Blood volume processed, ml; median (range)	2,850 (2,500–3,500)	3,481 (2,742–4,139)	<0.001
Flow rate, ml/min; median (range)	65 (55–75)	58 (50–65)	<0.001
ACD-A volume, ml; median (range)	300 (210–341)	373 (294–407)	<0.001
Separation time, min; median (range)	44 (37–58)	61 (48–72)	<0.001
Product volume, ml; median (range)	285 (260–340)	300 (300–304)	<0.001
	Amicus	COM.TEC	p value
Swirling percent	100	100	
PLT yield/bag ( $\times 10^{11}$ ); median (range)	3.39 (2.84–4.03)	3.33 (2.87–3.94)	0.185
Number of PLT yield $\geq 3.3 \times 10^{11}$ /bag	29/32 (91%)	28/32 (88%)	0.325
PLT yield/blood volume processed	0.42	0.33	<0.001*
WBC count/bag ( $\times 10^6$ ); median (range)	0.30 (0.30–1.20)	0.57 (0.26–1.43)	0.805
Number of yield with WBC $< 1 \times 10^6$	30 (94%)	28 (87%)	0.399
RBC count/bag ( $\times 10^6$ ); mean $\pm$ SD	4.3 $\pm$ 10.2	13.18 $\pm$ 15.18	0.008*
Collection efficiency, %; mean $\pm$ SD	55 $\pm$ 15	57 $\pm$ 15	0.477
Collection rate (PLT $10^{11}$ /min); mean $\pm$ SD	0.077 $\pm$ 0.012	0.057 $\pm$ 0.008	<0.001*
PLT = platelet, WBC = white blood cell.			
*p = Statistically significant.			

✓Toplama oranı Amicus ile daha yüksek.

# Comparison of Plateletpheresis on the Fenwal Amicus, Fresenius COM.TEC, and Trima Accel Cell Separators

Muzaffer Keklik,<sup>1\*</sup> Bulent Eser,<sup>1</sup> Leylagul Kaynar,<sup>1</sup> Serdar Sivgin,<sup>1</sup> Ertugrul Keklik,<sup>2</sup> Musa Solmaz,<sup>3</sup> Ahmet Ozturk,<sup>4</sup> Ruksan Buyukoglan,<sup>5</sup> Mehmet Yay,<sup>6</sup> Mustafa Cetin,<sup>1</sup> and Ali Unal<sup>1</sup>

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Variables	Amicus	COM.TEC	Trima	P
Blood volume processed (mL) <sup>b</sup>	3,060 (1,320–4,789)	3,651 (2,193–6,445)	3,150 (1,859–4,057)	<0.001 <sup>a</sup>
ACD-A volume (mL) <sup>b</sup>	380 (159–495)	400 (243–496)	312 (171–414)	<0.001 <sup>a</sup>
Separation time (min) <sup>b</sup>	60 (34–80)	58.5 (34–79)	61 (27–79)	0.676
Product volume (mL) <sup>b</sup>	285 (170–408)	300 (180–450)	400 (200–400)	<0.001 <sup>a</sup>
PLT yield ( $\times 10^{11}$ ) <sup>b</sup>	4 (3–5.5)	3.5 (3–5.5)	4.5 (3–5)	0.001 <sup>a</sup>
Collection efficiency (%) <sup>c</sup>	58.41 $\pm$ 6.53	47.37 $\pm$ 5.12	64.94 $\pm$ 7.33	<0.001 <sup>a</sup>
Collection rate (PLT $\times 10^{11}$ /min) <sup>c</sup>	0.064 $\pm$ 0.013	0.065 $\pm$ 0.011	0.063 $\pm$ 0.015	0.814

ACD-A, acid citrate dextrose-A; PLT, platelet.

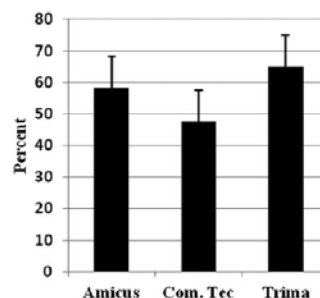


Fig. 1. Mean collection efficiencies of three plateletpheresis systems. Amicus Fenwal Amicus (58.41  $\pm$  6.53%); Com.Tec Fresenius COM.TEC (47.37  $\pm$  5.12%); Trima Trima Accel (64.94  $\pm$  7.33%).

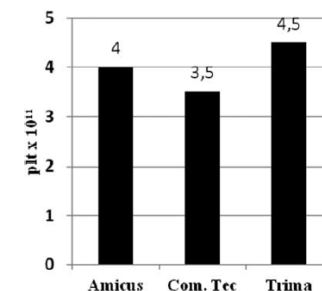


Fig. 2. Median platelet yields of three plateletpheresis systems. Amicus Fenwal Amicus (range 3–5.5  $\times 10^{11}$ ); Com.Tec Fresenius COM.TEC (range 3–5.5  $\times 10^{11}$ ); Trima Trima Accel (range 3–5  $\times 10^{11}$ ).

✓İşlenen kan hacmi ve ACD miktarı  
COM.TEC ile fazla  
✓Toplama etkinliği ve ürün miktarı  
COM.TEC ile düşük..



# Effectiveness of the haemonetics MCS cell separator in the collection of apheresis platelets

Muzaffer Keklik <sup>a,\*</sup>, Ertugrul Keklik <sup>b</sup>, Serdal Korkmaz <sup>a</sup>, Bilal Aygun <sup>a</sup>, Ferhat Arik <sup>c</sup>, Ozcan Kilic <sup>c</sup>, Murat Sarikoc <sup>d</sup>

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<sup>d</sup> Apheresis Unit, Kayseri Education and Research Hospital, Kayseri, Turkey

## Donors' characteristics and pre- and post-apheresis laboratory data.

Variables	n = 526
Male/Female	505/21
Age (years) <sup>a</sup>	32.8 ± 10.3
Height (cm) <sup>b</sup>	175 (153–190)
Weight (kg) <sup>a</sup>	76.5 ± 13.2
Preapheresis WBC (×10 <sup>9</sup> /L) <sup>b</sup>	8.25 (5.12–11.48)
Postapheresis WBC (×10 <sup>9</sup> /L) <sup>b</sup>	7.95 (4.76–10.81)
Preapheresis Hb (g/dl) <sup>a</sup>	15.6 ± 1.8
Postapheresis Hb (g/dl) <sup>a</sup>	14.4 ± 1.5
Preapheresis PLT (×10 <sup>9</sup> /L) <sup>b</sup>	245 (164–425)
Postapheresis PLT (×10 <sup>9</sup> /L) <sup>b</sup>	203 (134–345)

## Plateletpheresis procedure and product data.

Variables	Median	Range
Blood volume processed (ml)	3290	2420–4370
ACD-A volume (ml)	385	196–517
Separation time (min)	63	45–83
Product volume (ml)	400	200–450
PLT yield (×10 <sup>11</sup> )	3.7	3–5.7

ACD-A, acid citrate dextrose-A; PLT, platelet.

mean CE was 66.69 ± 13.73%

- ✓ Haemonetics MCS platelet aferezinde etkin
- ✓ Lökoredüksiyon avantajı mevcut..





# Comparison of Plateletpheresis on the Haemonetics and Trima Accel Cell Separators

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**TABLE 2.** Plateletpheresis procedure and product data

Variables (mean ± standard deviation)	Haemonetics	Trima	P-value
Blood volume processed, mL	3418.20 ± 673.44	3556.77 ± 924.76	0.350
ACD-A volume, mL	365.08 ± 63.70	374.65 ± 62.49	0.408
Separation time, min	59.73 ± 8.24	61.90 ± 9.73	0.191
PLT yield/unit (×10 <sup>11</sup> )	4.4 ± 0.8	3.9 ± 0.8	<b>0.001*</b>
Collection efficiency, %	59.50 ± 19.44	60.38 ± 22.38	0.827
Collection rate (PLT 10 <sup>11</sup> /min)	0,076 ± 0.016	0,065 ± 0,015	<b>&lt; 0,001*</b>

ACD-A acid citrate dextrose-A; PLT platelet; \*statistically significant

**TABLE 1.** Donors' characteristics and pre-apheresis laboratory data

Variables	Haemonetics (N = 60)	Trima (N = 60)
Male/female	58/2	55/5
Age, years <sup>#</sup>	30 (18–53)	32 (18–51)
Weight, kg*	82.17 ± 13.16	78.88 ± 11.99
Height, cm*	175.22 ± 6.86	173.67 ± 8.21
WBC (× 10 <sup>3</sup> /μL) <sup>#</sup>	7.30 (4.10–12)	7.10 (3.20–11)
Hb level, g/dL*	15.84 ± 0.99	15.68 ± 1.35
Htc level, %*	46.70 ± 2.70	46.35 ± 3.75
PLT count (×10 <sup>3</sup> /μL) <sup>#</sup>	269 (160–381)	231 (162–409)

Hb hemoglobin; Htc hematocrit; PLT platelet; WBC white blood cell. \*mean ± standard deviation; <sup>#</sup>median (min–max)

✓ Plt ürün hacmi ve Toplama oranı Haemonetics ile fazla..



# Prospective, paired crossover comparison of multiple, single-needle plateletpheresis procedures with the Amicus and Trima Accel cell separators

Stefano Fontana, Livio Mordasini, Peter Keller, and Behrouz Mansouri Taleghani

**TABLE 1. Basic donor characteristics\***

Donor characteristics	A	T	p Value
Number	59	59	
Height (cm)	176 (174-178)		
Weight (kg)	77 (74-81)		
Blood volume (mL)	5013 (4829-5198)		
Sex (M/F)	49/10		
PLT count ( $\times 10^9/L$ )	262 (249-275)	260 (247-272)	0.553
WBC count ( $\times 10^9/L$ )	5.85 (5.45-6.25)	5.81 (5.41-6.20)	0.771
Hct (%)	42.8 (41.9-43.7)	42.7 (41.9-43.6)	0.482

\* Data are reported as mean (95% CI).

**TABLE 2. Donation data and PLT yields\***

Donation data and PLT yields	A	T	p Value
Duration (min)	89 (88-90)	79 (76-82)	<0.001
ACD-A used (mL)	489 (479-499)	469 (449-489)	0.039
Processed blood volume corrected for ACD-A (mL)	3963 (3841-4085)	4331 (4148-4514)	<0.001
Donation volume	485 (463-507)	484 (456-512)	0.687
Calculated yield ( $\times 10^{11}$ )	5.84 (5.55-6.14)	6.79 (6.38-7.21)	<0.001
Obtained yield ( $\times 10^{11}$ )	6.06 (5.65-6.47)	7.48 (6.95-8.01)	<0.001
CR ( $\times 10^{11}/hr$ )	4.10 (3.81-4.38)	5.68 (5.33-6.03)	<0.001
Obtained units with $2 \times 10^{11}$ (number)	2.57 (2.35-2.78)	3.19 (2.95-3.43)	<0.001
Donations resulting in†			
One product	7 (11.9)	1 (1.7)	0.061
Two products	16 (27.1)	16 (27.1)	1.000
Three products	31 (52.6)	16 (27.1)	0.008
Four products	5 (8.5)	26 (44.1)	<0.001
Total donation number	59	59	
Total produced units	152	187	

\* Data are reported as mean (95% CI).

† Data are reported as number (%).

✓ Plt ürün eldesi ve toplama oranı Trima ile daha yüksek..



# Paired comparison of Gambro Trima Accel versus Baxter Amicus single-needle plateletpheresis

Edwin A. Burgstaler, Jeffrey L. Winters, and Alvaro A. Pineda

**TABLE 1. Mean donor and PLT procedure characteristics with the Trima Accel and Amicus single-needle procedures**

Variable	Trima Accel	Amicus single-needle	p value
Number	26	26	
Preprocedure PLT count ( $\times 10^9/L$ )	259 $\pm$ 38	251 $\pm$ 46	0.1528
Postprocedure PLT count ( $\times 10^9/L$ )	199 $\pm$ 36	175 $\pm$ 35	0.0006
Mean PLT count ( $\times 10^9/L$ )	230 $\pm$ 33	213 $\pm$ 38	0.0067
Preprocedure Hct (%) (centrifuged)*	42 $\pm$ 3	42 $\pm$ 3	0.8795
Preprocedure WBC count ( $\times 10^9/L$ )	6.5 $\pm$ 1.6	6.5 $\pm$ 1.7	0.9602
Postprocedure WBC count ( $\times 10^9/L$ )	8.5 $\pm$ 2.4	7.1 $\pm$ 1.7	0.0001
Preprocedure Hct (%) (Coulter)*	41 $\pm$ 4	41 $\pm$ 3	0.5581
Postprocedure Hct (%) (Coulter)*	40 $\pm$ 5	39 $\pm$ 3	0.0753
Whole blood processed (mL)	3795 $\pm$ 655	3520 $\pm$ 632	0.0137
AC used (mL)	378 $\pm$ 68	435 $\pm$ 69	<0.0001
Processing time (min)	73 $\pm$ 17	78 $\pm$ 14	0.4092
Needle time (min)	78 $\pm$ 18	84 $\pm$ 13	0.0842
Procedure time (min)	92 $\pm$ 18	103 $\pm$ 13	0.0029

\* Qualifying Hcts were determined by centrifuged Hcts. Automated counter (Coulter) Hcts were determined with the PLT counts.

**TABLE 2. Mean PLT collection characteristics with Trima Accel and Amicus single-needle procedures**

	Trima Accel	Amicus single-needle	p value
Number	26	26	
Volume (mL)	389 $\pm$ 82	447 $\pm$ 233	<0.0001
Concentration ( $\times 10^9/L$ )	1705 $\pm$ 225	1436 $\pm$ 93	<0.0001
PLTs ( $\times 10^{11}$ )	6.7 $\pm$ 1.7	6.5 $\pm$ 1.9	0.5052
CE (%)	75.9 $\pm$ 9.7	85.7 $\pm$ 11.3	0.0011
Collection rate (PLTs $\times 10^{11}/min$ )	0.090 $\pm$ 0.020	0.084 $\pm$ 0.023	0.1950
Frequency			
$\geq 3.0 \times 10^{11}$ PLTs (%)	100	100	
$\geq 6.2 \times 10^{11}$ PLTs (%)	65	65	
$< 5 \times 10^6$ WBCs (%)	100	100	
$< 1 \times 10^6$ WBCs (%)	100	96	

✓Toplama etkinliği Amicus ile daha yüksek..

# Comparison of double dose plateletpheresis on the Fenwal Amicus, Fresenius COM.TEC and Trima Accel cell separators

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Plateletpheresis procedure and product data.

Variables	Amicus	COM.TEC	Trima	p
Blood volume processed (ml) <sup>a</sup>	3780 (2480–5180)	4394 (3500–5370)	3340 (2420–4398)	<0.001*
PLT yield (×10 <sup>11</sup> ) <sup>b</sup>	6.1 ± 0.9	6 ± 0.5	6.2 ± 1.1	0.636
ACD-A volume (ml) <sup>a</sup>	387 (265–473)	426 (350–546)	329 (196–468)	<0.001*
Separation time (min) <sup>a</sup>	62 (45–80)	66 (50–82)	63 (48–83)	0.024*
Product volume (ml) <sup>b</sup>	363.11 ± 62.04	386.40 ± 53.28	395.56 ± 29.81	0.008*
Collection efficiency (%) <sup>b</sup>	66.71 ± 3.47	58.79 ± 5.14	83.57 ± 17.19	<0.001*
Collection rate (plt × 10 <sup>11</sup> /min) <sup>b</sup>	0.099 ± 0.013	0.092 ± 0.011	0.097 ± 0.013	0.039*

ACD-A, acid citrate dextrose-A; PLT, platelet.

CE (%) = total PLT yield (10<sup>11</sup>) × 100 / (pre-apheresis PLT count + post-apheresis PLT count / 2) × blood volume processed.

CR = PLT yield / separation time.

- ✓ İşlenen kan hacmi ve ACD miktarı COM.TEC ile fazla
- ✓ Toplama oranı COM.TEC ile düşük..
- ✓ Toplama etkinliği Trima ile yüksek..

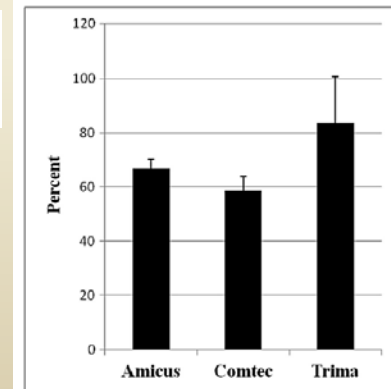


Fig. 1. Mean collection efficiencies of three plateletpheresis systems. Amicus, Fenwal Amicus (66.71 ± 3.47%); Com.Tec, Fresenius COM.TEC (58.79 ± 5.14%); Trima, Trima Accel (83.57 ± 17.19%).



# Effectiveness of the Trima Accel cell separator in the double dose plateletpheresis

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## Donors' characteristics and laboratory data.

Variables	n = 110
Male/Female	104/6
Age (years) <sup>a</sup>	32.51 ± 9.47
Height (cm) <sup>b</sup>	174 (156–192)
Weight (kg) <sup>a</sup>	83.87 ± 11.83
WBC (×10 <sup>9</sup> /L) <sup>b</sup>	8.22 (4.40–13.20)
Hb (g/dL) <sup>a</sup>	15.46 ± 1.07
PLT (×10 <sup>9</sup> /L) <sup>b</sup>	299 (172–456)

WBC, white blood cell; Hb, hemoglobin; PLT, platelet.

## Plateletpheresis procedure and product data.

Variables	
Blood volume processed (mL) <sup>a</sup>	3724 (2420–5370)
ACD-A volume (mL) <sup>a</sup>	375 (196–546)
Separation time (min) <sup>a</sup>	62 (45–83)
Product volume (mL) <sup>b</sup>	395.35 ± 18.95
PLT yield (×10 <sup>11</sup> ) <sup>b</sup>	6.0 ± 0.5
Collection efficiency (%) <sup>b</sup>	74.99 ± 14.40
Collection rate (PLT × 10 <sup>11</sup> /min) <sup>b</sup>	0.096 ± 0.012

ACD-A, acid citrate dextrose-A; PLT, platelet.

<sup>a</sup> Median (range).

<sup>b</sup> Mean ± standard deviation.

✓Çift doz platelet aferezinde Trima Accel etkin..

# Prospective comparison of high-dose plateletpheresis with the latest apheresis systems on the same donors

*Susanne Maria Picker, Stela Marinova Radojska, and Birgit Sybille Gathof*

**TABLE 2. Productivity\***

Variables	DDC			TDC		
	TA (n = 4)	AM (n = 4)	MCS+ (n = 4)	TA (n = 4)	AM (n = 4)	MCS+ (n = 4)
Volume (mL)						
EU	467.0 ± 7.7†‡	484.9 ± 4.2‡§	425.8 ± 28.6†§  ¶	699.8 ± 7.7‡	684.5 ± 14.9‡	638.5 ± 25.3†§  ¶
US	584.3 ± 9.2†	613.0 ± 5.5‡§	557.9 ± 32.3†	837.8 ± 18.3‡	809.0 ± 14.6	761.2 ± 47.7§
PLT yield (×10 <sup>11</sup> )						
EU	5.97 ± 0.16	5.68 ± 0.22	4.92 ± 0.87¶	7.66 ± 0.70	8.29 ± 0.70	7.84 ± 0.39¶
US	7.47 ± 0.16	7.18 ± 0.22	6.42 ± 0.87	9.16 ± 0.70	9.79 ± 0.70	9.34 ± 0.39
PT (min)						
EU	71.1 ± 7.2‡	88.0 ± 12.2‡	120.1 ± 3.9†§	92.1 ± 15.3‡	120.0 ± 8.5	143.7 ± 15.1§
US	88.9 ± 8.8‡	111.4 ± 16.1‡	157.5 ± 9.5†§	110.4 ± 20.2‡	141.9 ± 10.9	171.2 ± 18.4§
CE (%)						
EU	76.6 ± 0.9†‡	71.3 ± 0.4§	59.6 ± 8.8§	72.4 ± 4.8	70.9 ± 5.9	68.4 ± 3.1
US	78.4 ± 1.9†‡	75.7 ± 0.4§	63.4 ± 9.3§	74.2 ± 4.4	74.5 ± 6.4	71.4 ± 3.3
CR (×10 <sup>9</sup> /min)						
EU	10.7 ± 1.2‡	9.8 ± 1.9‡	4.9 ± 0.9†§	11.2 ± 1.3‡	10.4 ± 1.2‡	7.1 ± 1.0†§
US	10.7 ± 1.2‡	9.8 ± 1.9‡	4.9 ± 0.9†§	11.2 ± 1.3‡	10.4 ± 1.2‡	7.1 ± 1.0†§
Number (%) of procedures finished in 120 min						
EU	4 (100.0)	4 (100.0)	2 (50.0)	4 (100.0)	2 (50.0)	0 (0.0)
US	4 (100.0)	3 (75.0)	0 (0.0)	3 (75.0)	0 (0.0)	0 (0.0)

\* Values according to US standards were calculated from the values obtained by EU standards with an augmented collection dose (plus 1.5 × 10<sup>11</sup> PLTs) for each collection.

† Significant compared to AM.

‡ Significant compared to MCS+.

§ Significant compared to TA.

|| Values that were highest or lowest compared to all other systems.

¶ After filtration.

✓ İkili ve Üçlü doz platelet aferezinde  
Trima etkin..



# Feasibility and Safety of Triple Dose Platelet Collection by Apheresis

Rainer Moog\*

*Munich Blood Bank, Munich, Germany*

**TABLE I. Donors' Blood Cell Counts Before and After Apheresis**

	Before apheresis	After apheresis
Platelets/nl	303 ± 64	195 ± 49
Red blood cells/ $\mu$ l	4.69 ± 0.35	4.73 ± 0.37
Hematocrit (%)	42.6 ± 3.0	42.9 ± 3.6
Hemoglobin (g/dl)	14.6 ± 1.0	14.6 ± 1.6
White blood cells/nl	7.1 ± 1.6	7.9 ± 2.1

✓Üçlü doz platelet aferezinde Trima Accel etkin ve güvenli..



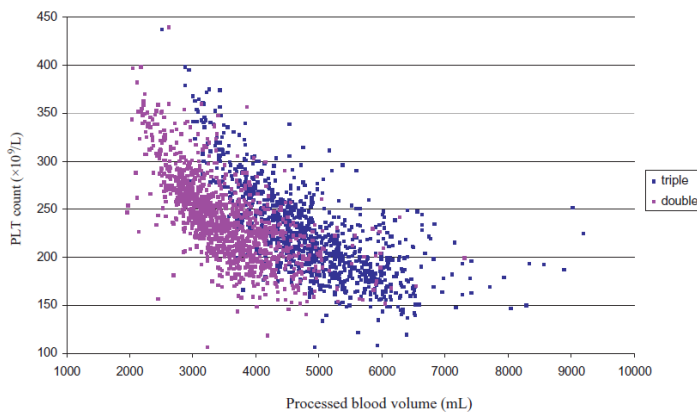
# Donor safety in triple plateletpheresis: results from the German and Austrian Plateletpheresis Study Group multicenter trial

*Hans-Gert Heuft, Rainer Moog, Eike G. Fischer, and Jürgen Zingsem, for the German and Austrian Plateletpheresis Study Group*

**TABLE 2. Hematologic changes in donors after DP or TP\***

Measure	DP		TP		Difference; p value
	Before donation	After donation	Before donation	After donation	
PLT loss per apheresis procedure ( $\times 10^{11}$ )	$5.86 \pm 0.9$		$8.29 \pm 1.1$		$2.43 \pm 0.5$ ; $\leq 0.0001$
PLT donors					
PLT count ( $\times 10^9/L$ )	$326 \pm 44$	$240 \pm 42$	$339 \pm 45$	$225 \pm 47$	86 vs. 114; $\leq 0.0001$
MPV (fL)	$7.6 \pm 0.9$	$7.4 \pm 1.0$	$7.5 \pm 0.9$	$7.4 \pm 1.0$	0.2 vs. 0.1; 0.21
Hct (L/L)	$43.4 \pm 3.3$	$42.5 \pm 0.7$	$43.2 \pm 3.3$	$43.3 \pm 4.0$	0.8 vs. 0.1; $\leq 0.0001$
WBC ( $\times 10^9/L$ )	$6.7 \pm 1.6$	$6.3 \pm 1.6$	$6.9 \pm 1.5$	$6.9 \pm 1.9$	0.4 vs. $\pm 0$ ; $\leq 0.0001$

\* Data are reported as mean  $\pm$  SD.



**TABLE 1C. Distribution of apheresis devices among DP and TP\***

Device	Software version	DP	TP
Amicus	2.51.5, 2.52	195 (17.2)	153 (15.1)
COMTEC	4.0	200 (17.7)	195 (19.1)
MCS+	C.5	21 (1.9)	1 (0.1)
Spectra	7.0, 7.1	26 (2.3)	35 (3.4)
Trima	5.0, 5.1	691 (61.0)	636 (62.3)
Total	2153	1133 (100)	1020 (100)

\* Data are reported as number (%).

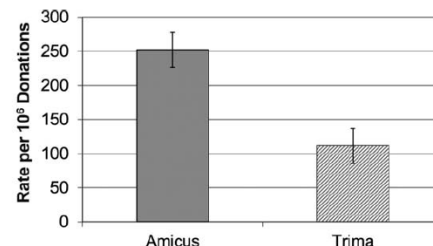
✓ Triple plt aferezi donör güvenliğini etkilemez..

# Apheresis technology correlates with bacterial contamination of platelets and reported septic transfusion reactions

Anne F. Eder,<sup>1</sup> Beth A. Dy,<sup>2</sup> Barbara DeMerse,<sup>2</sup> Stephen J. Wagner,<sup>3</sup> Susan L. Stramer,<sup>4</sup>  
E. Mary O'Neill,<sup>2</sup> and Ross M. Herron<sup>5</sup>

**TABLE 1. Confirmed-positive bacterial culture of apheresis PLT donations, all American Red Cross regional blood centers, 2010 to 2014**

	Amicus	Trima
<i>Streptococcus</i> spp. (total)	147 (39%)	36 (48%)
Including [subtotal]		
<i>S. viridans</i> group ( <i>S. mitis/oralis</i> , <i>S. anginosus</i> , <i>S. mutans</i> , <i>S. salivarius</i> )	[63 (17%)]	[14 (19%)]
<i>S. bovis</i> group ( <i>S. bovis</i> , <i>S. gallolyticus</i> , <i>S. infantarius</i> )	[32 (9%)]	[5 (7%)]
$\beta$ -Hemolytic <i>Streptococcus</i> spp.	[21 (6%)]	[12 (17%)]
Other <i>Streptococcus</i> spp.	[27 (7%)]	[4 (5%)]
<i>Streptococcus pneumoniae</i>	[4 (1%)]	[1 (1%)]
<i>Staphylococcus</i> spp. (total)	128 (34%)	19 (25%)
Including [subtotal]		
Coagulase-negative <i>Staphylococcus</i>	[91 (24%)]	[16 (21%)]
<i>S. aureus</i>	[33 (9%)]	[3 (4%)]
Other <i>Staphylococcus</i> spp.	[4 (1%)]	[0]
<i>Escherichia coli</i>	31 (8%)	7 (9%)
<i>Klebsiella</i> spp.	16 (4%)	1 (0.2%)
<i>Serratia</i> spp.	13 (3%)	5 (7%)
<i>Bacillus</i> spp.	7 (2%)	2 (3%)
<i>Enterobacter</i> spp.	6 (2%)	0 (0)
<i>Enterococcus</i> spp.	6 (2%)	0 (0)
<i>Listeria monocytogenes</i>	3 (1%)	2 (3%)
Other	18 (5%)	3 (4%)
Number confirmed positive BacT (n)	375	75
Total number of donations (procedures)	1,486,888	671,955
Confirmed-positive BacT per 10 <sup>6</sup> donations	252	112
OR (95% CI), p value	2.3 (1.8-2.9) p < 0.0000001	



Confirmed Pos (n)	375	75
Total Donations (n)	1,486,888	671,955

Error bars, 95% CI for proportion; OR, 2.3; 95% CI, 1.8-2.9; p < 0.0000001

**Fig. 1. Confirmed-positive bacterial cultures of plateletpheresis donations. Systemwide (all American Red Cross regional blood centers), 2010 to 2014.**

Amicus 1,486,888 Trima 671,955 işlem

✓ Doğrulanmış + bakteriyel kültür oranı (/10<sup>6</sup>)

Amicus:252 Trima:112

✓ Septik reak oranı (/10<sup>6</sup>)

Amicus:16.8 Trima:4.5

✓ Trima avantajlı..

✓ Kullanılan cihaz platelet aferezinde bakteriyel kontaminasyon üzerine etkilidir..

**TABLE 2. Definite and probable septic transfusion reactions systemwide (all American Red Cross regional blood centers), 2007 to 2014**

Device	Implicated bacteria	2007	2008	2009	2010	2011	2012	2013	2014	Total
Amicus	Coagulase-negative <i>Staphylococcus</i>	1	8	4*	2	1	2	3		21
	<i>S. aureus</i>	1	1*	1*	4		2*	4	1	14
	<i>S. viridans</i> group			1	1	1	1		2	6
	<i>Klebsiella oxytoca</i>	1								1
	<i>Klebsiella pneumoniae</i>						2			2
	<i>Acinetobacter</i> spp.				1				1	2
	<i>Clostridium perfringens</i>					1				1
	<i>Ralstonia pickettii</i>							1*		1
	Subtotal	3	9	6	8	3	7	8	4	48
	Coagulase-negative <i>Staphylococcus</i>	1	2	2		1				6
Trima	<i>S. aureus</i>	1*								1
	<i>S. mitis/oralis</i>					1				1
	<i>Enterobacter cloacae</i>			1						1
	<i>Enterococcus faecalis</i>							1		1
	Subtotal	2	2	3		2		1		10
Total	All cases (including fatalities)	5	11	9	8	5	7	9	4	58

\* Category includes one reported fatality.

# Comparison of Two Apheresis Systems of COBE and Optia for Autologous Peripheral Blood Stem Cell Collection

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**Table 2.** Parameters of apheresis, products, and collection

Variable	COBE Spectra (N=111)	Spectra Optia MNC (N=105)	P value
	Median (range)		
Apheresis information			
TBV (mL)	4,210 (2,950–5,350)	4,190 (2,970–5,420)	0.896
TPV (mL)	18,000 (10,000–20,433)	16,241 (9,052–21,219)	0.001
Blood flow (mL/min)	80 (65–90)	80 (70–90)	<0.001
Duration (min)	245 (140–325)	250 (170–325)	0.111
Products			
Volume (mL)	261 (130–357)	250 (90–430)	0.262
Total WBCs ( $\times 10^{10}$ )	3.18 (1.15–6.14)	3.66 (0.84–11.46)	<0.001
Total MNCs ( $\times 10^{10}$ )	2.09 (0.57–4.45)	2.51 (0.57–10.77)	0.007
Total CD34+ ( $\times 10^8$ )	0.61 (0.01–18.34)	0.94 (0.07–11.78)	0.138
Total PLT ( $\times 10^9$ )*	351 (84.49–1237)	320 (70.69–1599)	0.438
Hct (%)	9.8 (2.6–33.4)	8 (1.9–20.1)	0.002
Collection efficiency			
CD34 efficiency (%)	43.5 (6.6–121.4)	42.1 (7.8–91.4)	0.644
PLT loss (%)*	40.1 (0–88.5)	44.7 (8.3–71.0)	0.165

\*After excluding patients transfused before apheresis.

Abbreviations: TBV, total blood volume; TPV, total processed volume; WBC, white blood cell; MNC, mononuclear cell; PLT, platelet.

✓ CD34 hücre sayısı, toplama etkinliği bakımından fark yok..

# Efficiency of autologous stem cell collection: Comparison of three different cell separators

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Characteristics of the three protocols. Results are expressed as median (and interquartile range).

	COBE Spectra (Terumo BCT)	Amicus (Fenwall)	ComTec (Fresenius Kabi)
CD34+ cells per microliter pre-collection	34,6 (20,6–43,0)	30,2 (17,3–53,4)	36,1 (18,7–55,1)
Flow rate (ml per minute)	55,2 (53,1–60,7)	44,7 (39,5–50,5)	53,5 (47,7–57,4)
Total duration of the apheresis (minute)	206 (182–227)	236 (213–267)	194 (172–225)
Collection efficiency (%)	50,2 (40,0–53,9)	47,3 (35,5–58,1)	47,3 (37,1–53,5)
Yield: % procedures → $2 \times 10^6$ CD34+ cells/kg	64%	53%	57%
Volume of the final product (mL)	217 (180–236)	134 (119–178)	191 (164–230)
Number of cryopreserved bags (mean per procedure)	3,4	2,7	3,6
Hb content in the product (g/dL)	0,7 (0,5–0,9)	1,3 (1,0–1,8)	0,5 (0,3–0,7)
PLT content in the product ( $\times 10^3/\mu\text{L}$ )	2466 (1171–2945)	518 (224–819)	893 (339–1727)
WBC content in the product ( $\times 10^3/\mu\text{L}$ )	195 (181–223)	294 (208–340)	216 (167–286)
Decrease of haemoglobin level after collection (%)	9,9 (6,0–12,3)	13,9 (8,2–24,9)	10,4 (8,9–13,4)
Decrease of platelet count after collection (%)	35,9 (28,1–50,8)	22,6 (10,6–26,4)	38,5 (26,7–49,0)

✓ CD34 hücre sayısı ve Toplama etkinliği benzer..

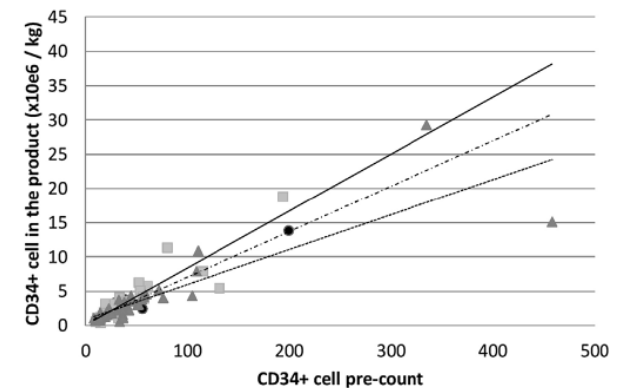



Fig. 1. Correlation between the CD34+ cell pre-count and the total CD34+ cell in the final product expressed as  $n \times 10^6$  per kg body weight of the patient. The three devices are presented as follows: COBE Spectra (black circle, tendency curve —), Amicus (grey square, tendency curve - - -), ComTec (grey triangle, tendency curve .....).



# Autologous lymphapheresis for the production of chimeric antigen receptor T cells

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**TABLE 1. Patient characteristics**

Variable	Diagnosis		
	ALL (n = 58)	Solid tumor* (n = 13)	Total (n = 71)
Age (years)			
Mean	14.9	16.6	15.2
Median	14.8	16.2	14.9
Range	4.2-30.3	8.1-25.9	4.2-30.3
Male:female (patients)	44:14	10:3	54:17
Clinical trial (patients)			
CD19-CAR	49	1	50
CD22-CAR	9	0	9
GD2-CAR	0	12	12
Weight (kg)			
Mean	49.5	59.9	51.4
Median	44.2	62.7	48.0
Range	16.0-140.0	21.0-127.0	16.0-140.0
<25 kg (patients)	12	2	14
≥25 kg (patients)	46	11	57

\* Solid tumors included osteosarcoma (nine patients), neuroblastoma (three patients), and diffuse large B-cell lymphoma (one patient).

Variable	ALL (n = 58)	Solid tumor (n = 13)	Total (n = 71)	p value*
TNCs ( $\times 10^9$ )				
Mean	8.83	11.9	9.39	0.19
Median	6.71	9.80	7.08	
Range	0.875-41.3	2.66-26.9	0.875-41.3	
TNC/kg ( $\times 10^8$ )				
Mean	2.31	2.31	2.31	0.99
Median	1.68	2.12	1.69	
Range	0.161-14.3	0.858-8.00	0.161-14.3	
Granulocytes (%)				
Mean	8	8	8	0.98
Median	4	2	3	
Range	0-58	0-55	0-58	
Lymphocytes (%)				
Mean	71	57	69	0.02
Median	72	60	70	
Range	7-99	8-82	7-99	
Monocytes (%)				
Mean	18	32	21	0.26
Median	19	34	20	
Range	0-54	13-49	0-54	
Percent CD3+ of CD45+				
Mean	52	47	51	0.44
Median	52	53	52	
Range	2-97	10-68	2-97	
Number CD3+ ( $\times 10^9$ )				
Mean	3.85	5.73	4.19	0.06
Median	3.25	5.13	3.43	
Range	0.288-13.8	0.625-18.3	0.288-18.3	
CD3+ cells/L processed ( $\times 10^6$ )				
Mean	4.78	4.60	4.74	0.87
Median	4.01	4.09	4.09	
Range	0.259-16.3	0.625-12.2	0.259-16.3	
CD3+ yield (patients)				
<0.6 $\times 10^9$	2	0	2	1.00
>0.6 $\times 10^9$ and <2.0 $\times 10^9$	12	2	14	
>2.0 $\times 10^9$	44	11	55	

✓ Cobe spectra ile  
yeterli CD3+ lenfosit elde edildi..



# Son Sözler..

- Aferez cihazları hızlı bir şekilde gelişmekte ve hem komponent toplanması hem de terapötik aferez işlem yelpazesi artmaktadır.
- Cihazlardaki otomasyonun artması işlem güvenliğini arttırmış ve işlem sürecinin rahat monitorize edilebilmesini sağlamıştır.
- Cihaz teknolojileri konusunda teorik bilgilerin gelişmesi pratik kazanımlara da yol açacaktır.
- Firmalar arası rekabetin bilime katkısı aşikardır..





**TEŞEKKÜR EDERİM**