Kalp cerrahisinde transfüzyonu azaltmada farmakolojik olmayan yöntemler

Prof. Dr. Cem Alhan
Acıbadem Üniversitesi Tıp Fakültesi

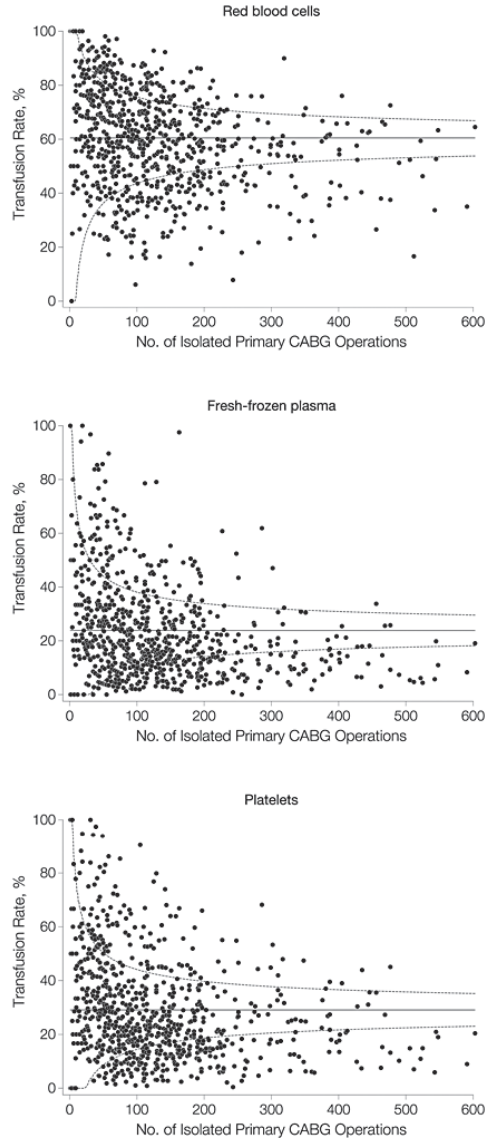
Kalp cerrahisinde transfüzyonu azaltmada farmakolojik olmayan yöntemler

Variation in Use of Blood Transfusion in Coronary Artery Bypass Graft Surgery

Bennett-Guerrero et al

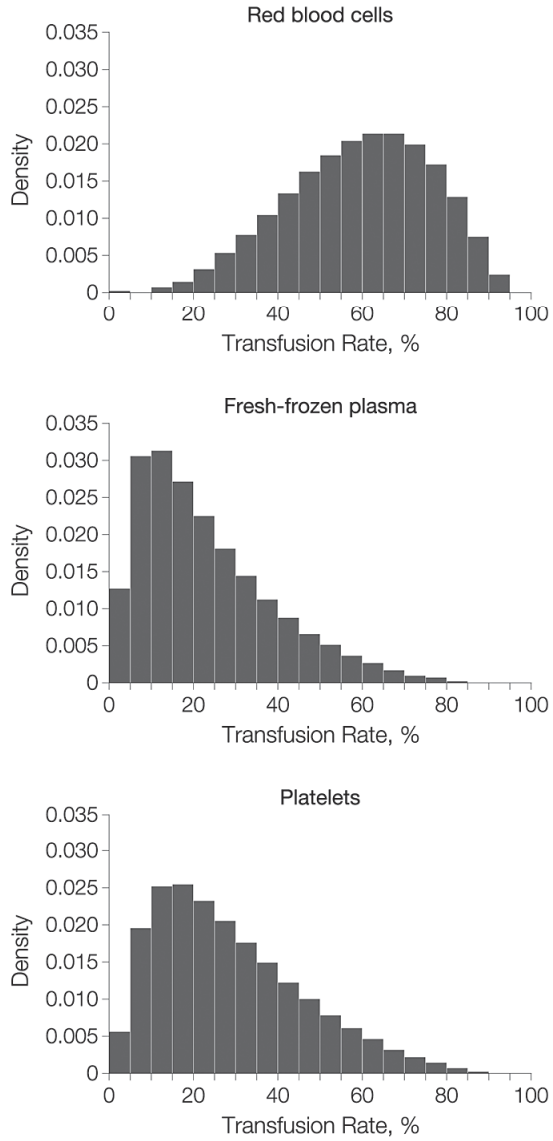
JAMA. 2010;304(14):1568-1575. doi: 10.1001/jama.2010.1406

Figure 1. Observed Variation in Hospital-Specific Transfusion Rates for Primary Isolated CABG Surgery With Cardiopulmonary Bypass During 2008 (N = 798 Sites)



Bennett-Guerrero, E. et al. JAMA 2010;304:1568-1575

Figure 2. Estimated Distribution of Hospital-Specific Transfusion Rates for Primary Isolated CABG Surgery With CPB During 2008 (N = 102 470)



Bennett-Guerrero, E. et al. JAMA 2010;304:1568-1575

ELSEVIER

European Journal of Cardio-thoracic Surgery 23 (2003) 678–683

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

www.elsevier.com/locate/ejcts

Fast track recovery of high risk coronary bypass surgery patients☆

Cem Alhan*, Fevzi Toraman, Esref Hasan Karabulut, Sümer Tarcan, Sinan Dağdelen, Nevnihal Eren, Nuri Çağlar

[a]*Department of Cardiovascular Surgery, Acibadem Kadikoy Hospital, Istanbul, Turkey*

Received 16 September 2002; received in revised form 4 January 2003; accepted 10 January 2003

Abstract

Objective: Fast track recovery protocols on younger, low risk patients result in shorter hospital stays and decreased costs. However, data is lacking on the impact of these protocols on high risk patients based on an objective scoring system. **Methods**: In this study, a high risk cohort of patients (EuroSCORE ≥ 6, $n = 158$) was compared with a low risk cohort of patients (EuroSCORE < 6, $n = 1004$) to define the safety and efficacy of fast track recovery among high risk patients. A standard perioperative data is collected prospectively for every patient. **Results**: Time to extubation was longer in the high risk group (299 ± 253 vs. 232 ± 256 min; $P = 0.003$), but intensive care unit (ICU) stay (25.6 ± 28.7 vs. 21.5 ± 9.4 h; $P =$ ns), and postoperative length of stay (5.8 ± 2.4 vs. 5.6 ± 2.7 days; $P =$ ns) was similar when compared with the low risk group. Of the high risk patients 81% were extubated within 6 h, 87% were discharged from the intensive care unit within 24 h, and 67% were discharged from the hospital within 5 days. Multiple regression analysis showed that any red blood cell transfusion ($P = 0.02$), and cross clamp time >60 min ($P = 0.03$) were the predictors of delayed extubation (≥6 h) in the high risk group. The predictors of extended ICU stay were any red blood cell transfusion ($P = 0.0001$), and peripheral vascular disease ($P = 0.05$). Any red blood cell transfusion was the only predictor for mortality ($P = 0.02$) and readmission to the hospital within the first 30 days ($P = 0.02$) in this cohort of patients. **Conclusions**: This study confirms the safety and efficacy of fast track recovery protocol among high risk patients undergoing coronary artery bypass surgery. All patients are basically suitable for fast track recovery and the preoperative risk factors are poor predictors of prolonged ventilation, increased ICU and hospital stay. Red blood cell transfusion is associated with delayed extubation and discharge from the ICU, and increased mortality and hospital readmission rate.

Keywords: Coronary artery bypass grafting; High risk; Fast track recovery

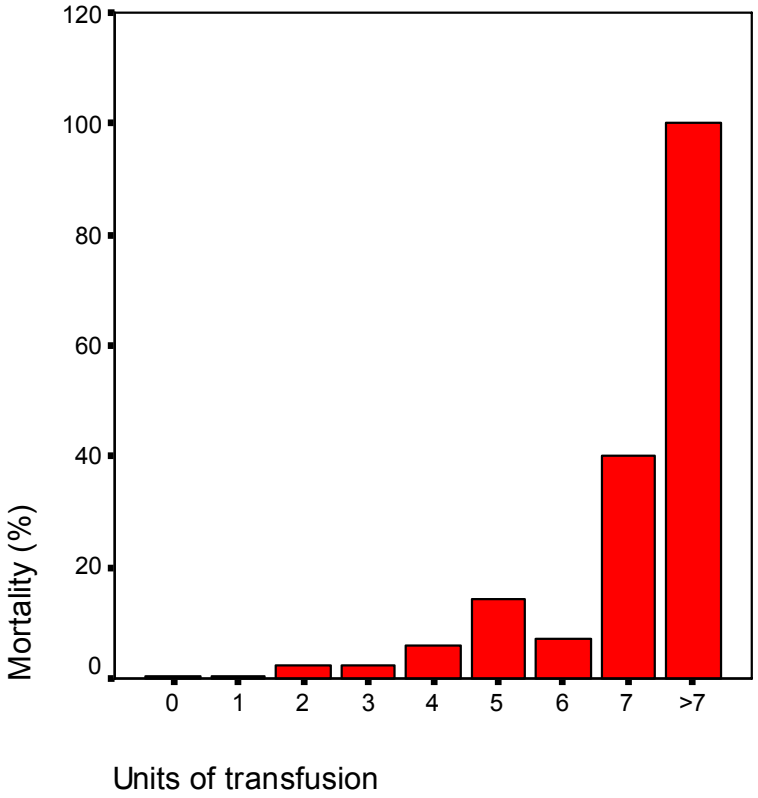
Perioperative allogeneic blood transfusion is associated with increased thirty day mortality after isolated coronary bypass surgery

Sahin Senay, Fevzi Toraman, Hasan Karabulut, Cem Alhan

Acıbadem Kadıköy Hospital, Department of Cardiovascular Surgery, Istanbul, Turkey

EACTA 2008, Antalya, Turkey

Transfüzyon ve Mortalite



- Euroscore: 3,6±2,5
- Mortalite: 0,9%
- Kan almayan hastalarda mortalite: 0,2%
- 1 Ü kan alan hastalarda mortalite: 0,5%
- 2 Ü kan alan hastalarda mortalite: 2,2%

doi:10.1510/icvts.2008.183608

INTERACTIVE CARDIOVASCULAR AND THORACIC SURGERY

Interactive CardioVascular and Thoracic Surgery 8 (2009) 93-99

www.icvts.org

ESCVS article - Cardiopulmonary bypass

The impact of allogenic red cell transfusion and coated bypass circuit on the inflammatory response during cardiopulmonary bypass: a randomized study☆

Sahin Senay[a,*], Fevzi Toraman[a], Serdar Gunaydin[b], Meltem Kilercik[c], Hasan Karabulut[a], Cem Alhan[a]

[a]*Department of Cardiovascular Surgery, Acibadem Kadikoy Hospital, Istanbul, Turkey*
[b]*Department of Cardiovascular Surgery, Kirikkale University School of Medicine, Ankara, Turkey*
[c]*Department of Clinical Laboratory, Acibadem Kadikoy Hospital, Istanbul, Turkey*

Received 13 May 2008; received in revised form 11 August 2008; accepted 11 August 2008

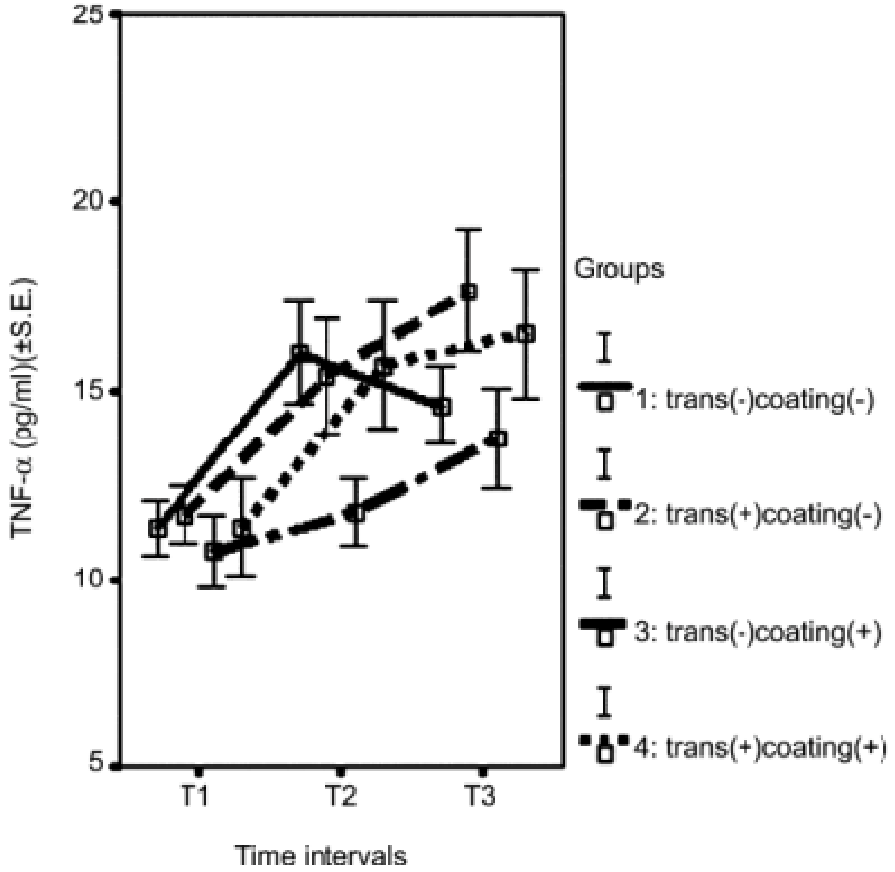


Fig. 1. TNF-α measurements of the groups (*group 1 vs. group 3 at T2; 16.0±4.2 vs. 11.7±2.8; $P=0.05$, group 2 vs. group 3; 15.2±4.6 vs. 11.7±2.8; at T2; $P=0.06$ and 17.6±5.0 vs. 13.7±3.9 at T3; $P=0.06$).

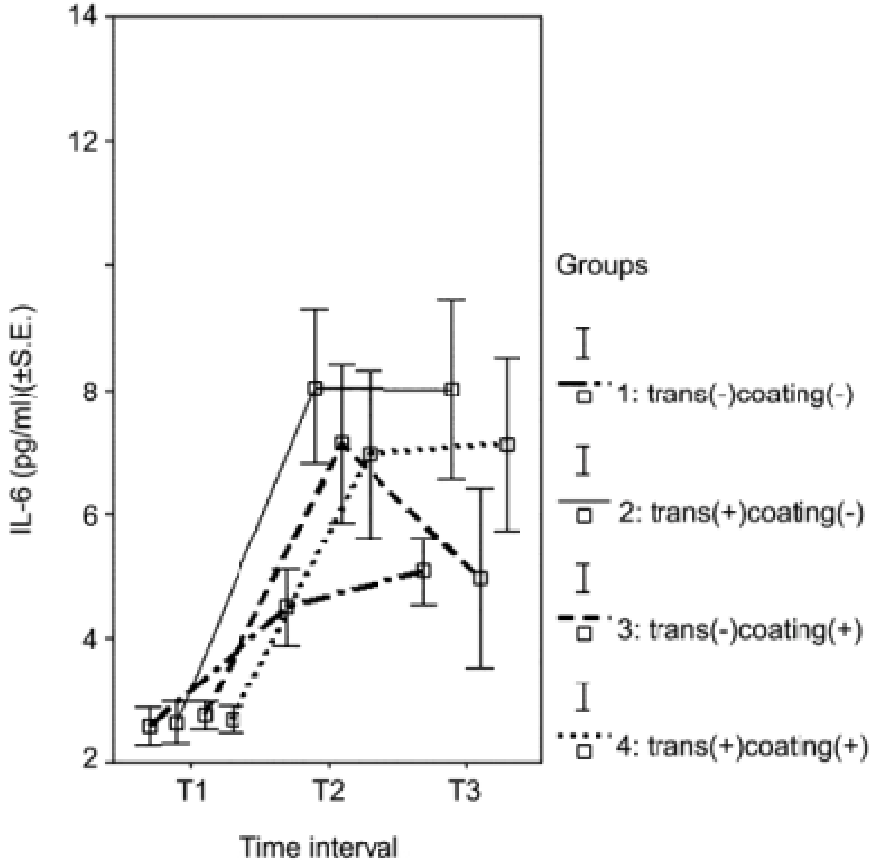


Fig. 2. IL-6 measurements of the groups (*group 2 vs. group 1 at T2; 8.0±3.9 vs. 4.4±1.8; $P=0.03$).

İnsan genomu: 29 farklı kan grubu sistemi geni mevcut; 3 tanesi yeni tanımlandı (I, GIL,GLOB)

Rh:1p36.11

ABO:9q34.2

Perioperatif transfüzyon için risk faktörleri

- İleri yaş
- Preoperatif azalmış eritrosit volümü
  - Düşük vücut kitlesi
  - Preoperatif anemi
- Acil veya kompleks cerrahi
  - Redo
  - Anevrizma
  - CABG dışı operasyonlar

Perfusion. 2004 Mar;19(2):85-91.

Highly positive intraoperative fluid balance during cardiac surgery is associated with adverse outcome.

Toraman F, Evrenkaya S, Yuce M, Turek O, Aksoy N, Karabulut H, Demirhisar O, Alhan C.

Department of Anesthesiology, Acibadem Kadiköy Hospital, Istanbul, Turkey.

Abstract

Hemodilution and increase in capillary permeability occurring with cardiopulmonary bypass (CPB) impose a risk for tissue edema and blood transfusion that may result in an increased complication rate after coronary artery bypass grafting (CABG). Of the 1280 consecutive patients undergoing isolated on-pump CABG, total fluid balance at the end of the operation was less than or equal to 500 mL in 1155 (Group 1) and more than 500 mL in 125 (Group 2). During CPB, blood was added to the reservoir only when the hematocrit fell to 17% or less and crystalloid solution only when the pump flow index fell below 2.0 L/min/m2. Anesthetic, surgical, and postoperative management and diagnoses were the same in all patients, and a single surgical and anesthesia team performed all operations. No patient was excluded from the study. Results: Hypertension, diabetes, chronic obstructive pulmonary disease, New York Heart Association (NYHA) Class III-IV, use of angiotensin converting enzyme (ACE) inhibitors, chronic renal failure, and female gender were the significant preoperative risk factors for increased volume replacement during CPB. The groups were similar in body mass index, preoperative hematocrit values, total fluid balance in the intensive care unit (ICU), and total chest tube output. However, red blood cells' transfusion rate, readmission rate to the ICU and length of hospital stay were significantly higher in Group 2 patients. Multiple logistic regression revealed that age > 70 years ($p < 0.001$, Odds Ratio (OR): 2, 95% CI: 1.4-2.8), and total fluid balance > 500 mL at the end of the operation ($p < 0.01$, OR: 2.2, 95% CI: 1.5-3.2) were the predictors of increased length of stay. For transfusion of red blood cells, age > 70 years ($p < 0.0001$, OR: 2.3, 95% CI: 1.6-3.3), and total fluid balance > 500 mL at the end of the operation ($p < 0.001$, OR: 2, 95% CI: 1.3-2.9) were the only significant risk factors. This study suggests that intraoperative volume overload increases blood transfusion and length of hospital stay in patients undergoing CABG.

Perfusion

Perfusion
24(6) 373–380

DOI: 10.1177/0267659109358118
http://prf.sagepub.com
SAGE

Is it the patient or the physician who cannot tolerate anemia? A prospective analysis in 1854 non-transfused coronary artery surgery patients

Sahin Senay, Fevzi Toraman, Hasan Karabulut, Cem Alhan

Abstract

Background and objective: Low hematocrit level and transfusion may coexist during cardiopulmonary bypass and the actual impact of one on the outcome parameters may be counfounded or masked by the other. This study aims to determine the impact of the lowest hematocrit level during cardiopulmonary bypass on outcome parameters in non-transfused patients. Methods: Two thousand six hundred and thirty-two consecutive patients who underwent isolated coronary artery bypass graft (CABG) surgery with cardiopulmonary bypass were evaluated prospectively: 1854 (70.4%) patients who did not receive any red blood cells during hospital stay were included in the study. Perioperative data and outcome parameters were recorded. Outcomes were evaluated in 2 groups according to the lowest level of hematocrit (>21%: high hematocrit group, n= 1680, (91.6%) and ≤21%: low hematocrit group, n=174, (9.4%)) during cardiopulmonary bypass. Results: Overall mean lowest hematocrit level of patients was 27.7±4.4% (19.7±1.9% in the low hematocrit group, 28.5±4.1% in the high hematocrit group). The comparison of outcome parameters regarding the time on ventilator, duration of intensive care unit stay, intensive care unit re-admission, hospital re-admission, reoperation for bleeding or tamponade, low cardiac output, postoperative atrial fibrillation, stroke, creatinine level at hospital discharge, new onset renal failure, mediastinitis, pulmonary complication and mortality rates were similar in both groups. Conclusions: Our findings suggest that a lowest hematocrit level of ≤21% during cardiopulmonary bypass has no adverse impact on outcome after isolated coronary surgery in non-transfused patients.

Homogenity of the group

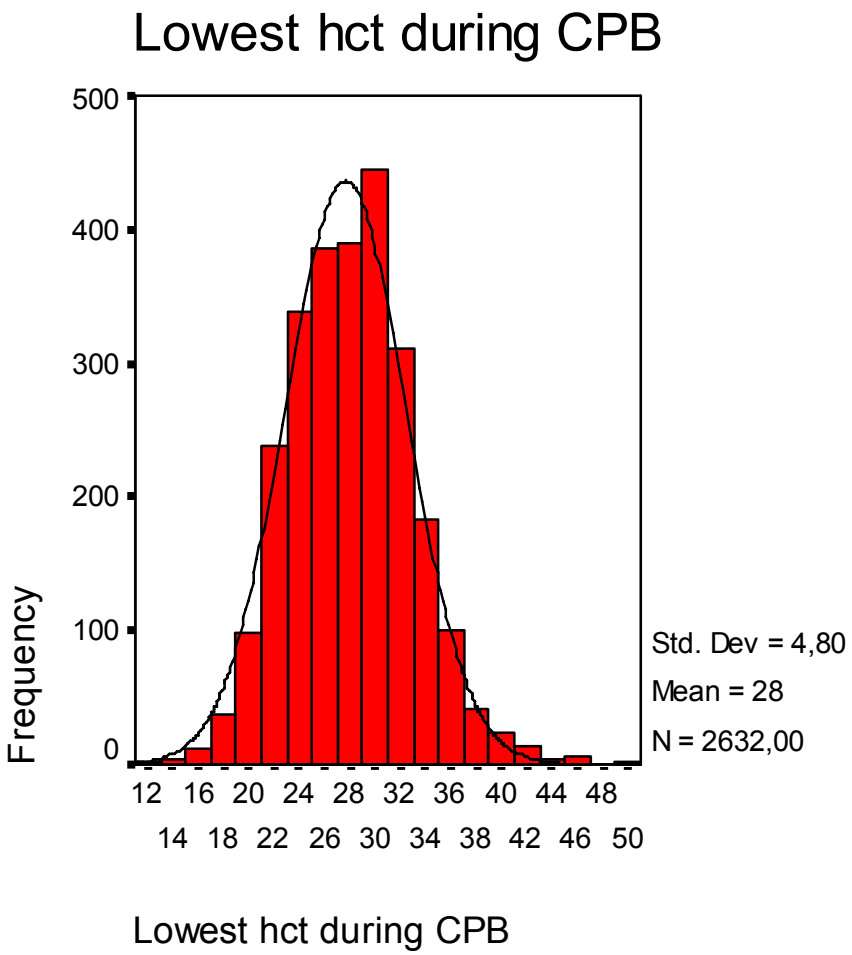


Table 1. Preoperative and intraoperative variables

	High hematocrit group (n=1680)	Low hematocrit group (n=174)	*p* value
*CCS≥3 (%)	32.3	34.5	NS
*NYHA≥3 (%)	6.9	9.8	NS
Preop. congestive heart failure (%)	1.3	1.2	NS
Hypertension (%)	46	50	NS
Chronic lung disease (%)	12.5	11.5	NS
Preoperative usage of aspirin (%)	57	55	NS
Preoperative usage of clopidogrel (%)	2.9	1.1	NS
Preoperative usage of heparin (%)	4.1	4.0	NS
Ejection fraction < % 50 (%)	39.5	42.4	NS
Nonelective operation (%)	8.9	10.3	NS
Redo operation (%)	3.4	3.5	NS
Preop. atrial fibrillation (%)	2.1	1.1	NS
Diabetes mellitus (%)	22.4	25.3	NS
Renal insufficiency with dialysis (%)	0.7	1.7	NS
Preop. cerebrovascular event (%)	0.5	0	NS
Body mass index (kg/m^2)	28.1±3.9	27.8±4.2	NS
Number of distal anastomosis (n)	3.1±1	3.2±1	NS
Cardiopulmonary bypass time (min.)	57±20	61±20	0.02
Cardiac arrest time (min.)	32±13	35±14	0.02

*CCS, Canadian Cardiovascular Society Score; NYHA, New York Heart Association Score.

Table 2. Risk factors for developing hematocrit levels of 21% or lower during cardiopulmonary bypass (univariate analysis)

	High hematocrit group (n=1680)	Low hematocrit group (n=174)	*p* value
Age (y) (mean±SD)	59±9	61±8	0.001
Female sex (%)	18.5	39.1	<0.001
Preoperative hematocrit (%)	40.9±4.4	34.1±4.7	<0.001
Preoperative hematocrit≤30% (%)	4.2	23.6	<0.001
Preoperative use of diuretics (%)	6.5	11.8	0.05
Preoperative use of intravenous nitrates (%)	6.4	12.9	0.02
Body mass index<25 kg/m^2 (%)	4.5	7.1	0.04
Serum creatinine>200 mmol/l (%)	2.1	7.1	0,014

Table 3. Risk factors for developing hematocrit levels of 21% or lower during cardiopulmonary bypass (multivariate analysis)

	Odds ratio	95 % CI	*p* value
Preoperative hematocrit ≤ 30%	28.5	13–62.2	<0.001
Female sex	5.2	3.1–8.8	<0.001
Body mass index < 25 kg/m^2	2	1.2–3.4	0.006
Serum creatinine > 200 mmol/l	4.4	1.5–12.5	0.01

Table 4. Operative variables including hematocrit levels and fluid balance

	High hematocrit group	Low hematocrit group	*p* value
Hematocrit level before the induction of anesthesia (%) (mean±SD)	41.9±5.4	35.9±4.7	<0.001
Lowest hematocrit during CPB (%) (mean±SD)	28.5±4.1	19.7±1.2	<0.001
Hematocrit at the end of CPB (%) (mean±SD)	33.0±4.3	26.0±3.3	<0.001
Hematocrit at hospital discharge (%) (mean±SD)	27.9±4.4	27.0±4.0	NS
Fluid balance at the end of the operation (ml) (mean±SD)	139±551	330±554	0.003
Fluid balance at the end of day 1 (ml) (mean±SD)	923±633	880±556	NS

Table 5. Outcome parameters

	High hematocrit group	Low hematocrit group	*p* value
Mean drainage (ml)	518±213	473±191	0.004
Ventilation time (h)	3.9±3.2	4.1±2.0	NS
Duration of intensive care unit stay (h)	21.8±34.6	20.9±6.4	NS
Duration of hospital stay (d)	5.0±2.5	5.4±2.5	0.04
ICU readmission (%)	1.0	1.7	NS
Hospital readmission (%)	2.2	3.4	NS
Reoperation for bleeding or tamponade (%)	0.2	0.6	NS
Low cardiac output (%)	3.9	6.9	NS
New onset atrial fibrillation (%)	10.4	6.9	NS
Stroke (%)	0.1	0.6	NS
Creatinine level at hospital discharge (mg/dl)	0.8±0.2	0.8±0.3	NS
New onset renal failure (%)	0.1	–	NS
Mediastinitis (%)	0.4	0.6	NS
Postoperative lung complication (%)	0.2	0.1	NS
Mortality (%)	1.0	–	NS

Transfusion Requirements After Cardiac Surgery

The TRACS Randomized Controlled Trial

Ludhmila A. Hajjar, MD, PhD
Jean-Louis Vincent, MD, PhD
Filomena R. B. G. Galas, MD, PhD
Rosana E. Nakamura, MD
Carolina M. P. Silva, MD
Marilia H. Santos, MD, PhD
Julia Fukushima, MSc
Roberto Kalil Filho, MD, PhD
Denise B. Sierra, MD
Neuza H. Lopes, MD, PhD
Thais Mauad, MD, PhD
Aretusa C. Roquim, MD
Marcia R. Sundin, MD
Wanderson C. Leão, MD
Juliano P. Almeida, MD
Pablo M. Pomerantzeff, MD, PhD
Luis O. Dallan, MD, PhD
Fabio B. Jatene, MD, PhD
Noedir A. G. Stolf, MD, PhD
Jose O. C. Auler Jr, MD, PhD

Context Perioperative red blood cell transfusion is commonly used to address anemia, an independent risk factor for morbidity and mortality after cardiac operations; however, evidence regarding optimal blood transfusion practice in patients undergoing cardiac surgery is lacking.

Objective To define whether a restrictive perioperative red blood cell transfusion strategy is as safe as a liberal strategy in patients undergoing elective cardiac surgery.

Design, Setting, and Patients The Transfusion Requirements After Cardiac Surgery (TRACS) study, a prospective, randomized, controlled clinical noninferiority trial conducted between February 2009 and February 2010 in an intensive care unit at a university hospital cardiac surgery referral center in Brazil. Consecutive adult patients (n=502) who underwent cardiac surgery with cardiopulmonary bypass were eligible; analysis was by intention-to-treat.

Intervention Patients were randomly assigned to a liberal strategy of blood transfusion (to maintain a hematocrit ≥30%) or to a restrictive strategy (hematocrit ≥24%).

Main Outcome Measure Composite end point of 30-day all-cause mortality and severe morbidity (cardiogenic shock, acute respiratory distress syndrome, or acute renal injury requiring dialysis or hemofiltration) occurring during the hospital stay. The noninferiority margin was predefined at −8% (ie, 8% minimal clinically important increase in occurrence of the composite end point).

Results Hemoglobin concentrations were maintained at a mean of 10.5 g/dL (95% confidence interval [CI], 10.4-10.6) in the liberal-strategy group and 9.1 g/dL (95% CI, 9.0-9.2) in the restrictive-strategy group ($P<.001$). A total of 198 of 253 patients (78%) in the liberal-strategy group and 118 of 249 (47%) in the restrictive-strategy group received a blood transfusion ($P<.001$). Occurrence of the primary end point was similar between groups (10% liberal vs 11% restrictive; between-group difference, 1% [95% CI, −6% to 4%]; $P=.85$). Independent of transfusion strategy, the number of transfused red blood cell units was an independent risk factor for clinical complications or death at 30 days (hazard ratio for each additional unit transfused, 1.2 [95% CI, 1.1-1.4]; $P=.002$).

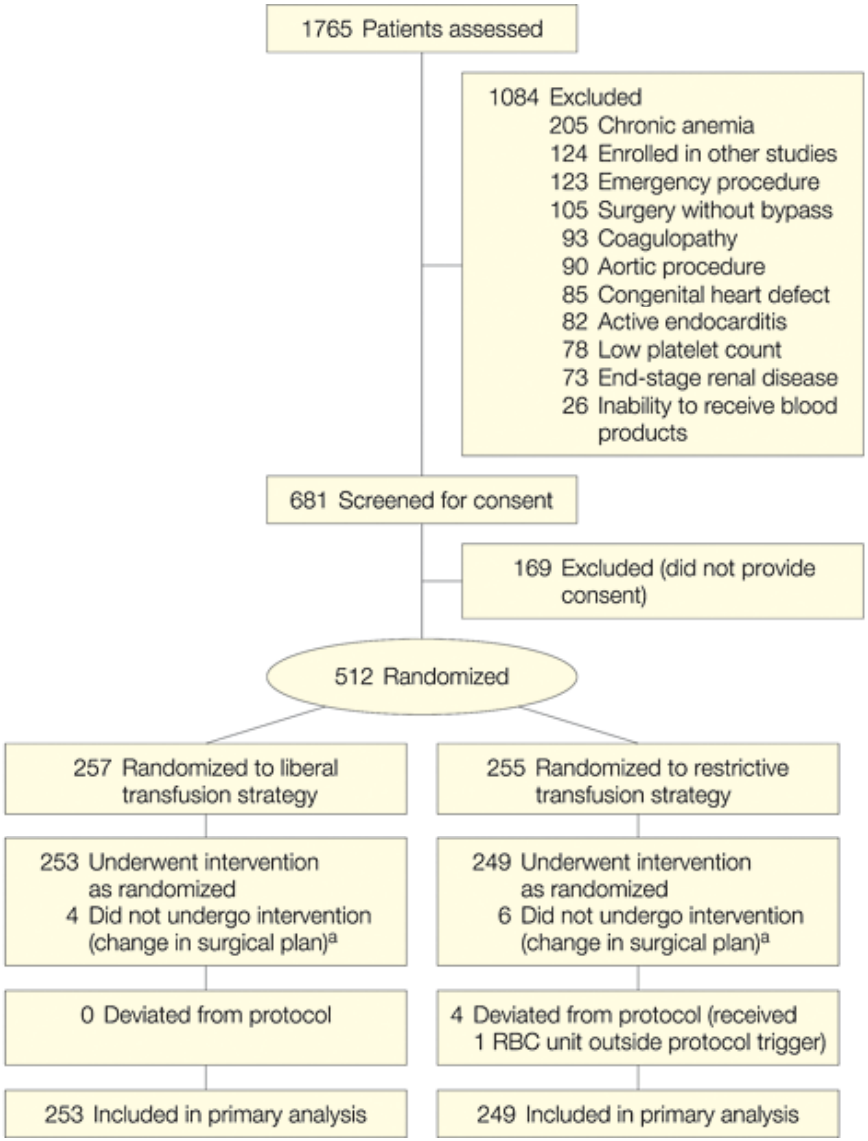
Conclusion Among patients undergoing cardiac surgery, the use of a restrictive perioperative transfusion strategy compared with a more liberal strategy resulted in noninferior rates of the combined outcome of 30-day all-cause mortality and severe morbidity.

Trial Registration clinicaltrials.gov Identifier: NCT01021631

CARDIAC SURGERY IS ASSOCIATED with a high rate of allogeneic blood transfusion, varying from 40% to 90% in most reports.[1-3] The rationale for perioperative red blood cell (RBC) transfusion is based on the observation that anemia is an independent risk factor for morbidity and mortality af-

JAMA. 2010;304(14):1559-1567 www.jama.com

Figure 1. Study Flow



Hajjar, L. A. et al. JAMA 2010;304:1559-1567

Table. Baseline Characteristics of Study Patients.

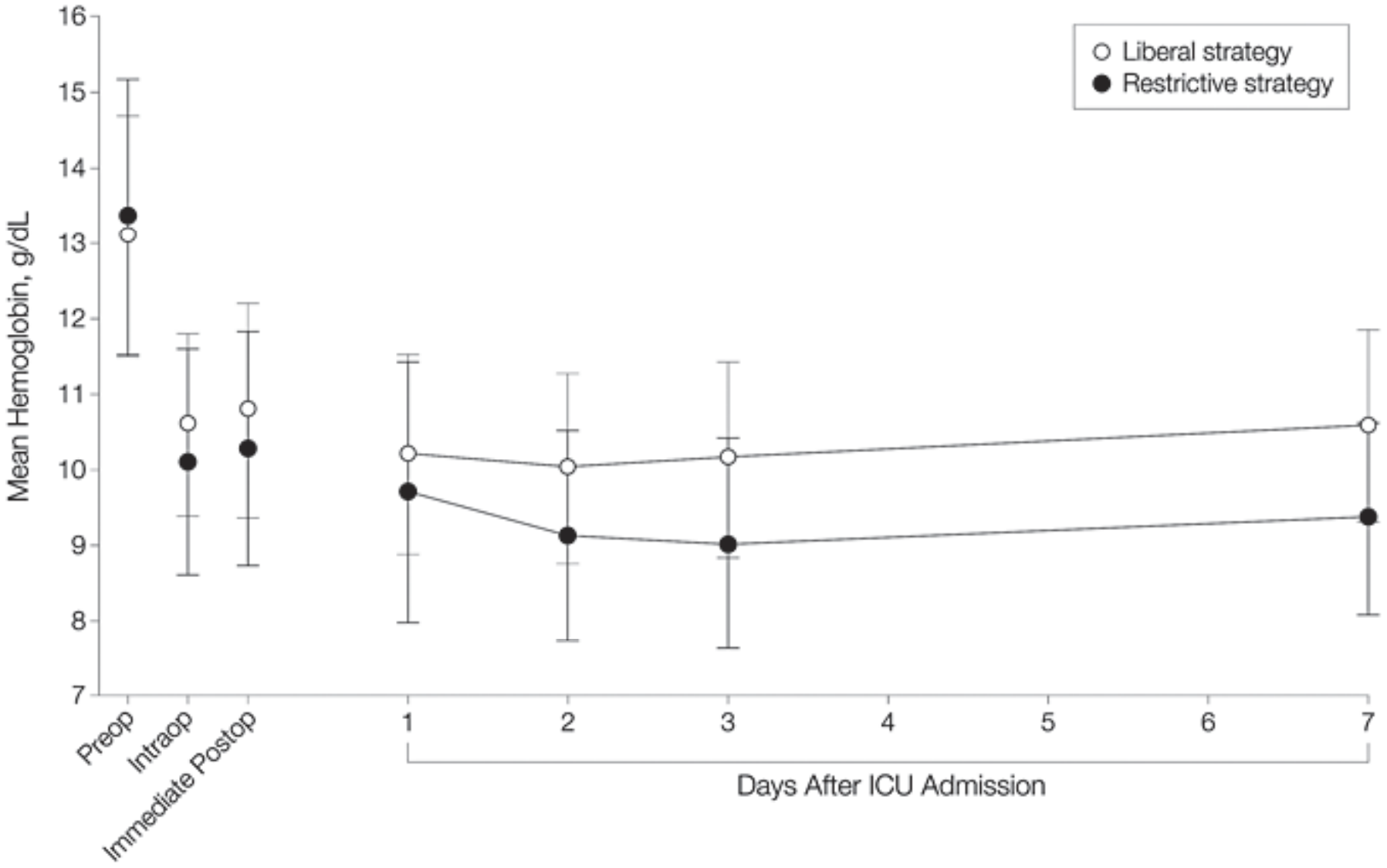
Table. Baseline Characteristics of Study Patients

Variable	No. (%)		*P* Value
	Liberal Strategy (n = 253)	Restrictive Strategy (n = 249)	
Age, mean (SD), y	60.7 (12.5)	58.6 (12.5)	.06
Men	161 (64)	149 (60)	.38
Body mass index, mean (SD)[a]	26.1 (4.3)	26.3 (4.4)	.65
Comorbid conditions			
Hypertension	201 (79)	192 (77)	.53
Diabetes	79 (31)	86 (35)	.45
Dyslipidemia	139 (55)	147 (60)	.33
Renal disease	26 (11)	26 (11)	.50
Smoking	34 (14)	38 (16)	.74
COPD	6 (2)	8 (3)	.55
Unstable angina	79 (31)	76 (31)	.87
Previous myocardial infarction	86 (34)	89 (36)	.61
Heart failure, NYHA classification			
I	8 (6)	8 (7)	.50
II	42 (34)	48 (41)	
III	65 (52)	49 (42)	
IV	10 (8)	11 (10)	
LVEF, %			
30-39	32 (13)	37 (15)	.75
40-59	76 (30)	75 (30)	
≥60	145 (57)	137 (55)	
Reoperation	11 (4)	13 (5)	.65
EuroSCORE, median (IQR)	5 (3-6)	4 (3-7)	.07
Preoperative laboratory values, mean (SD)			
Hemoglobin, g/dL	13.1 (1.6)	13.4 (1.8)	.18
Hematocrit, %	39.5 (4.3)	39.9 (5.2)	.65
Prothrombin time, s	11.3 (1.1)	11.3 (2.2)	.54
Platelet count, $\times 10^3/\mu L$	222 (67)	225 (66)	.83
Creatinine level, mg/dL	1.12 (0.4)	1.12 (0.3)	.99
Leukocyte count/μL	7600 (2100)	7700 (2000)	.56
Preoperative drug exposure			
Aspirin	103 (41)	94 (38)	.52
Heparin	3 (1)	2 (1)	>.99

Abbreviations: COPD, chronic obstructive pulmonary disease; EuroSCORE, European System for Cardiac Operative Risk Evaluation; IQR, interquartile range; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association.
SI conversion factor: To convert creatinine values to μmol/L, multiply by 88.4.
[a] Calculated as weight in kilograms divided by height in meters squared.

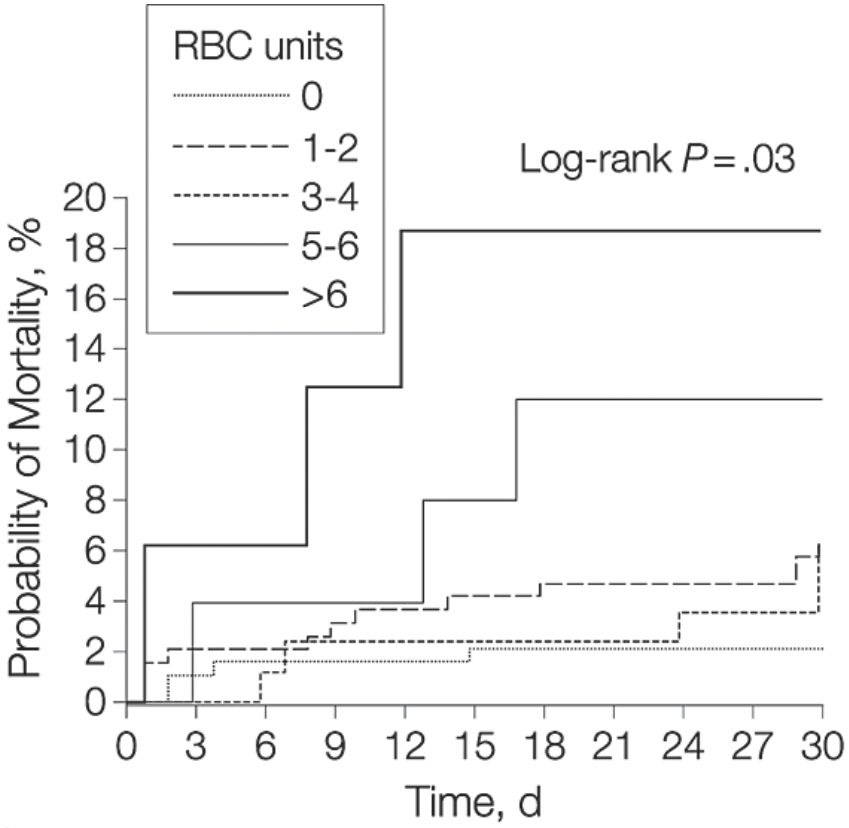
Hajjar, L. A. et al. JAMA 2010;304:1559-1567

Figure 2. Mean Hemoglobin Levels During the Study According to Transfusion Strategy



Hajjar, L. A. et al. JAMA 2010;304:1559-1567

Figure 4. Kaplan-Meier Estimates of 30-Day Survival Based on Number of Red Blood Cell (RBC) Units Transfused



No. at risk

RBC units						
0	186	184	183	182	182	181
1-2	191	187	184	182	182	179
3-4	84	83	82	82	81	80
5-6	25	24	24	22	22	21
>6	16	15	13	13	13	12

Hajjar, L. A. et al. JAMA 2010;304:1559-1567

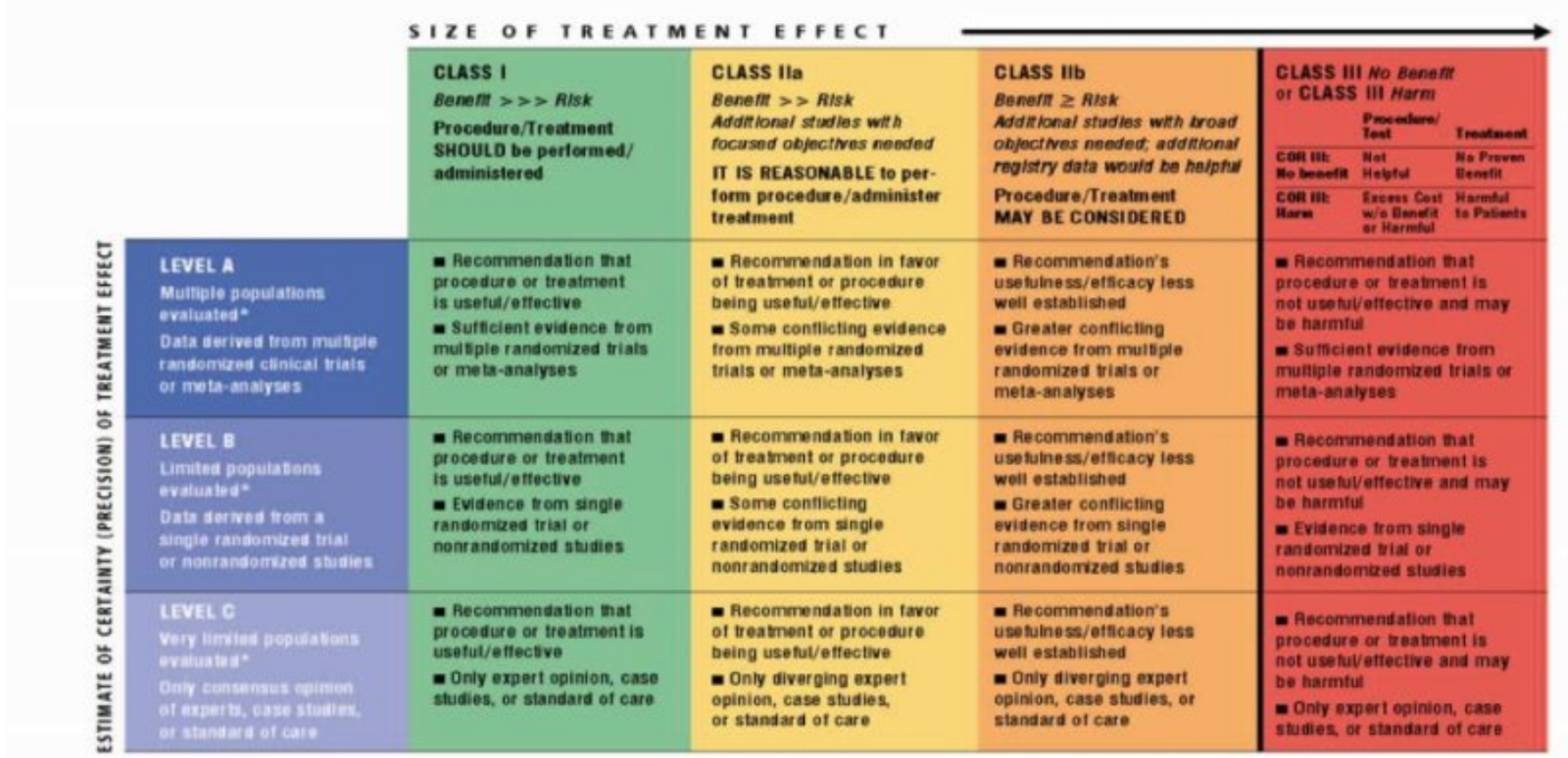
2011 Update to The Society of Thoracic Surgeons and the Society of Cardiovascular Anesthesiologists Blood Conservation Clinical Practice Guidelines*

The Society of Thoracic Surgeons Blood Conservation Guideline Task Force:
Victor A. Ferraris, MD, PhD (Chair), Jeremiah R. Brown, PhD, George J. Despotis, MD, John W. Hammon, MD, T. Brett Reece, MD, Sibu P. Saha, MD, MBA, Howard K. Song, MD, PhD, and Ellen R. Clough, PhD

The Society of Cardiovascular Anesthesiologists Special Task Force on Blood Transfusion:
Linda J. Shore-Lesserson, MD, Lawrence T. Goodnough, MD, C. David Mazer, MD, Aryeh Shander, MD, Mark Stafford-Smith, MD, and Jonathan Waters, MD

The International Consortium for Evidence Based Perfusion:
Robert A. Baker, PhD, Dip Perf, CCP (Aus), Timothy A. Dickinson, MS, Daniel J. FitzGerald, CCP, LP, Donald S. Likosky, PhD, and Kenneth G. Shann, CCP

Division of Cardiovascular and Thoracic Surgery, University of Kentucky, Lexington, Kentucky (VAF, SPS), Department of Anesthesiology, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania (JW), Departments of Anesthesiology and Critical Care Medicine, Englewood Hospital and Medical Center, Englewood, New Jersey (AS), Departments of Pathology and Medicine, Stanford University School of Medicine, Stanford, California (LTG), Departments of Anesthesiology and Cardiothoracic Surgery, Montefiore Medical Center, Bronx, New York (LJS-L, KGS), Departments of Anesthesiology, Immunology, and Pathology, Washington University School of Medicine, St. Louis, Missouri (GJD), Dartmouth Institute for Health Policy and Clinical Practice, Section of Cardiology, Dartmouth Medical School, Lebanon, New Hampshire (JRB), Department of Cardiothoracic Surgery, Wake Forest School of Medicine, Winston-Salem, North Carolina (JWH), Department of Anesthesia, St. Michael's Hospital, University of Toronto, Toronto, Ontario (CDM), Cardiac Surgical Research Group, Flinders Medical Centre, South Australia, Australia (RAB), Department of Surgery, Medicine, Community and Family Medicine, and the Dartmouth Institute for Health Policy and Clinical Practice, Dartmouth Medical School, Hanover, New Hampshire (DSL), SpecialtyCare, Nashville, Tennessee (TAD), Department of Cardiac Surgery, Brigham and Women's Hospital, Harvard University, Boston, Massachusetts (DJF), Division of Cardiothoracic Surgery, Oregon Health and Science University Medical Center, Portland, Oregon (HKS), Department of Cardiothoracic Surgery, University of Colorado Health Sciences Center, Aurora, Colorado (TBR), Department of Anesthesiology, Duke University Medical Center, Durham, North Carolina (MS-S), and The Society of Thoracic Surgeons, Chicago, Illinois (ERC)


SIZE OF TREATMENT EFFECT
ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT
CLASS I
Benefit >>> Risk
Procedure/Treatment SHOULD be performed/ administered
CLASS IIa
Benefit >> Risk
Additional studies with focused objectives needed
IT IS REASONABLE to perform procedure/administer treatment
CLASS IIb
Benefit ≥ Risk
Additional studies with broad objectives needed; additional registry data would be helpful
Procedure/Treatment MAY BE CONSIDERED
CLASS III No Benefit or CLASS III Harm
Procedure/ Test
Treatment
COR III: No benefit
Not Helpful
No Proven Benefit
COR III: Harm
Excess Cost w/o Benefit or Harmful
Harmful to Patients
LEVEL A
Multiple populations evaluated*
Data derived from multiple randomized clinical trials or meta-analyses
■ Recommendation that procedure or treatment is useful/effective
■ Sufficient evidence from multiple randomized trials or meta-analyses
■ Recommendation in favor of treatment or procedure being useful/effective
■ Some conflicting evidence from multiple randomized trials or meta-analyses
■ Recommendation's usefulness/efficacy less well established
■ Greater conflicting evidence from multiple randomized trials or meta-analyses
■ Recommendation that procedure or treatment is not useful/effective and may be harmful
■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B
Limited populations evaluated*
Data derived from a single randomized trial or nonrandomized studies
■ Recommendation that procedure or treatment is useful/effective
■ Evidence from single randomized trial or nonrandomized studies
■ Recommendation in favor of treatment or procedure being useful/effective
■ Some conflicting evidence from single randomized trial or nonrandomized studies
■ Recommendation's usefulness/efficacy less well established
■ Greater conflicting evidence from single randomized trial or nonrandomized studies
■ Recommendation that procedure or treatment is not useful/effective and may be harmful
■ Evidence from single randomized trial or nonrandomized studies
LEVEL C
Very limited populations evaluated*
Only consensus opinion of experts, case studies, or standard of care
■ Recommendation that procedure or treatment is useful/effective
■ Only expert opinion, case studies, or standard of care
■ Recommendation in favor of treatment or procedure being useful/effective
■ Only diverging expert opinion, case studies, or standard of care
■ Recommendation's usefulness/efficacy less well established
■ Only diverging expert opinion, case studies, or standard of care
■ Recommendation that procedure or treatment is not useful/effective and may be harmful
■ Only expert opinion, case studies, or standard of care

Ameliyat öncesinde

	Class	Level
Yüksek riskli hastaların saptanması ve buna yönelik önlemlerin alınması	I	A
P2Y12 inhibitörlerinin en az 3 gün önce kesilmesi	I	B
Preop intrensek koagülasyon sisteminin rutin taranması	III	B
Kan tetkiklerine alternatif yöntemlerin kullanılması (ör. kan gazı yerine oksimetre)	II a	B
Yüksek riskli olgular veya preop antiplatelet ajan kullananlarda kanama zamanı bakılması	II b	B

Minimal invazif girişimler

	Class	Level
TEVAR	I	B
OPCAB	II a	A

Kan koruma yöntemleri

	Class	Level
Rutin cell saver	I	A
Kanserli hastalarda cell saver	II b	B
Pompada kalan kanın direkt geri verilmesi	II a	C
Pompada kalan kanın santrifüje edilip geri verilmesi	II a	A
Postop mediastinal drendeki kanın santrifüje edilip geri verilmesi	II b	B
Postop mediastinal drendeki kanın direkt geri verilmesi	III	B

CPB döneminde

	Class	Level
Mikropleji (özellikle KKY de)	II b	B
HIT hastalarında heparin yerine danaparoid veya direkt thrombin inhibitörleri (eg, lepirudin, bivalirudin or argatroban	I	C
Hemodilüsyon için yüksek riskli hastalarda mini devrelerin kullanımı	I	A
Mini devrelere ek olarak vakum destekli drenaj kullanımı	II b	C

CPB döneminde

	Class	Level
Biyolojik uyumlu (kaplı) devrelerin kullanımı	II b	A
Modifiye ultrafiltrasyon	I	A
Retrograd otolog priming	II b	B
CPB süresi uzayabilecek vakalarda heparin seviyesinin yüksek tutulması	II b	B
CPB devrelerinde lökosit filtrelerinin kullanımı	III	B

Postop dönemde

	Class	Level
Kanamayı engellemek için profilaktik PEEP kullanımı	III	B

Table 3. Topical Hemostatic Agents Used in Cardiac Operations for Local Control of Bleeding

Agent	Commercial Name	Composition	Mechanism of Action	Class of Recommendation
Oxidized regenerated cellulose for wound compression	Surgicel and Oxycel	Oxidized cellulose	Accelerate clotting by platelet activation followed by swelling and wound compression. Some bacteriostatic properties.	Class IIb
Microfibrillar collagen	Avitene, Colgel, or Helitene	Bovine collagen shredded into fibrils	Collagen activates platelets causing aggregation, clot formation, and wound sealing.	Class IIb
Combined compression and sealant topical agent	Recothrom or Thrombin JMI added to USP porcine Gelfoam, Costasis, or FloSeal	Bovine fibrillar collagen or bovine gelatin combined with thrombin and mixed with autologous plasma	Activation of platelet-related clotting followed by swelling and wound compression. Recombinant thrombin has potential safety advantage. Combination of compression and sealant agents.	Class IIb
Fibrin sealants ("fibrin glue")	Tisseel, Beriplast, Hemaseel, Crosseal	Source of fibrinogen and thrombin mixed with antifibrinolytics combined at anastomotic sites	Fibrin matrix serves to seal the wound. Contains either aprotinin or tranexamic acid.	Class IIb
Synthetic cyanoacrylate polymers	Omnex	Polymers of two forms of cyanoacrylate monomers	Seals wounds without need for intact clotting mechanism.	Class IIb

Synthetic polymers of polyethylene glycol	CoSeal and DuraSeal	Polymers of polyethylene glycol cross link with local proteins	Polymers and proteins form matrix sealant.	Class IIb
Sealant mixture of bovine albumin and glutaraldehyde	BioGlue	Albumin and glutaraldehyde dispensed in 2-syringe system	Sealant created without need for intrinsic clotting system by denaturation of albumin. Safety concerns because of glutaraldehyde toxicity.	Class IIb
Large surface area polysaccharide hemospheres	Arista, HemoStase	Plant-based polysaccharides with a very large surface area	Rapidly dehydrate blood by concentrating serum proteins, platelets, and other blood elements on the surface of contact.	Class IIb
Chitin-based sealants	Celox, HemCon, Chitoseal	Naturally occurring polysaccharide polymer	Chitin forms clots in defibrinated or heparinized blood by a direct reaction with the cell membranes of erythrocytes. Probably induces local growth factors.	Class IIb
Antifibrinolytic agents in solution	Trasylol or tranexamic acid	Antifibrinolytic agents dissolved in saline	Limit wound-related generation of plasmin.	Class IIa

Kan kaynaklarının yönetimi

	Class	Level
Multidisipliner kan yönetimi (anestezist, cerrah, yoğun bakım, kardiyolog, perfüzyonist, hemşire, kan bankası) ekibinin oluşturulması	II a	B
Toplam kalite yönetimi (sürekli ölçüm ve analiz)	II a	B

CPB da öneriler

- Trendelenburg
- Kaval kanülün kontrolü
- Gereksiz sıvı yüklenmesinden kaçınmak
  - perfüzyonist anestezist işbirliği

CPB da transfüzyon kararından önce

- KI >2,5L/dak
- Perfüzyon basıncı>60 mmHg
- İdrar çıkışı >0,5 ml/saat
- Kan laktat düzeyi değişimi
- Metabolik asidoz varlığı sorgulanmalı

Ameliyatta öneriler

- Kana saygı göstermek
  - Waste suction'ın gereksiz kullanılmaması
  - Yüksek riskli hastalarda cell saver
  - Gazlı bezlerin sık değiştirilmemesi
  - Sternum kenarlarına emici materyal konulmaması
  - Pompa kanının retransfüzyonu
  - Bacak insizyonları !

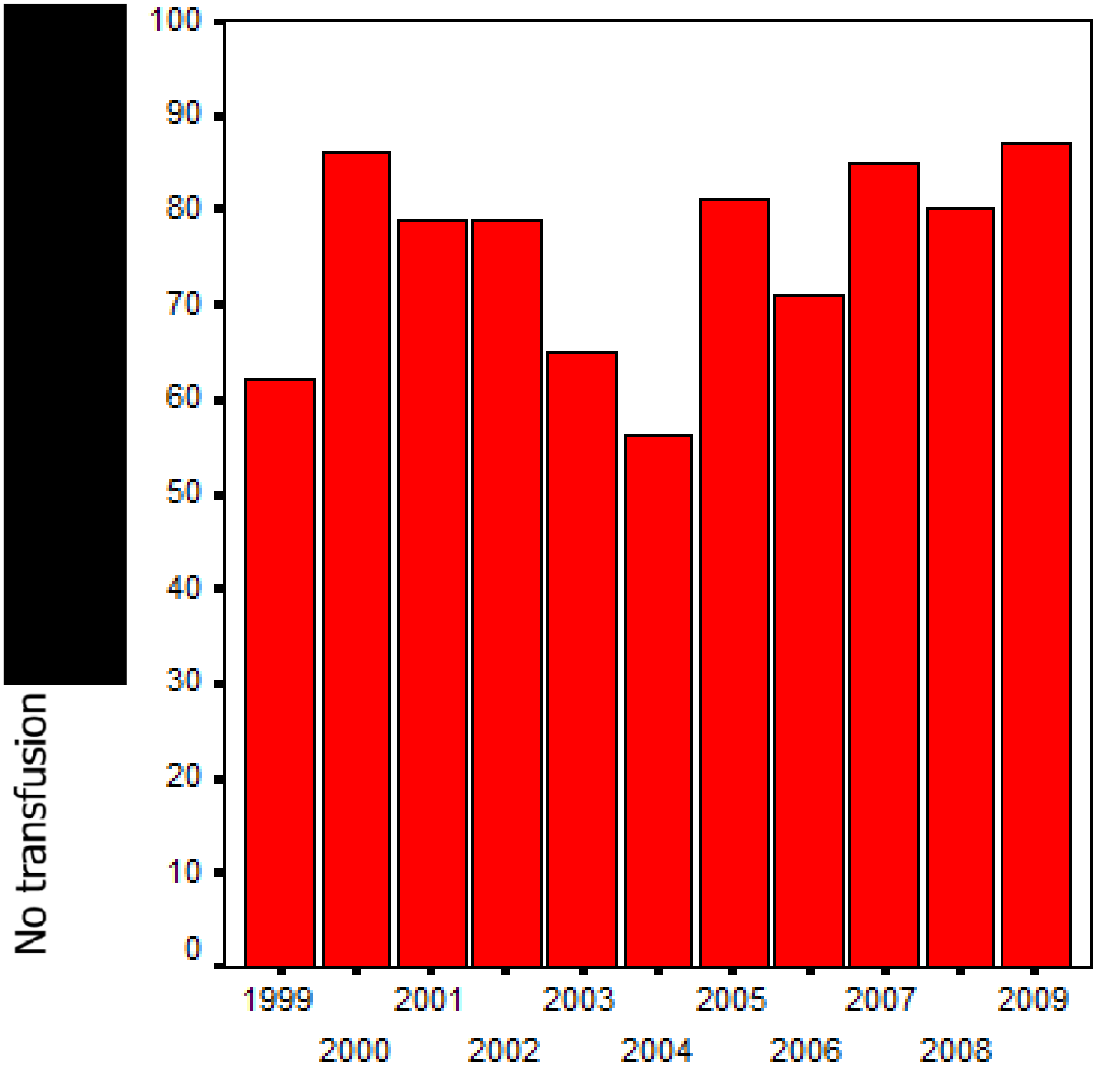
Yoüun bakımda öneriler

- Revizyon kararının geciktirilmemesi
- Hedefe yönelik tedavi ve transfüzyon
  - Tam kan kullanımı !!!

Öneriler

- Postop dönemde
  - Kalp hızı
  - Laktat düzeyi değişimi, metabolik asidoz varlığı
  - İdrar çıkışı
  - Cilt sıcaklığı ve nemi
  - Efor kapasitesi
  - Ateş$\rightarrow VO_2\uparrow$ sorgulanmalı

Transfüzyon yapılmayan hasta oranları



Herşeye rağmen kan verecekseniz…

ELSEVIER

European Journal of Cardio-thoracic Surgery 39 (2011) 329–334

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

www.elsevier.com/locate/ejcts

Storage time of allogeneic red blood cells is associated with risk of severe postoperative infection after coronary artery bypass grafting☆

Jan Jesper Andreasen [a,*], Claus Dethlefsen [a], Ivy S. Modrau [b], John Baech [c], Henrik C. Schonheyder [d], Jens K. Moeller [e], Soren P. Johnsen [f], for the North-West Denmark Transfusion Study Group[1]

[a] *Department of Cardiothoracic Surgery, Center for Cardiovascular Research, Aalborg Hospital, Aarhus University Hospital, Aalborg, Denmark*
[b] *Department of Cardiothoracic and Vascular Surgery, Aarhus University Hospital – Skejby, Aarhus, Denmark*
[c] *Department of Clinical Immunology, Aalborg Hospital, Aarhus University Hospital, Aalborg, Denmark*
[d] *Department of Clinical Microbiology, Aalborg Hospital, Aarhus University Hospital, Aalborg, Denmark*
[e] *Department of Clinical Microbiology, Aarhus University Hospital – Skejby, Aarhus, Denmark*
[f] *Department of Clinical Epidemiology, Aarhus University Hospital, Aarhus, Denmark*

Received 21 December 2009; received in revised form 6 June 2010; accepted 17 June 2010; Available online 10 August 2010

Table 2. Crude and adjusted odds ratios (OR) with 95% confidence intervals (CI) for the development of severe postoperative infection according to transfusion and storage time of transfused red blood cells.

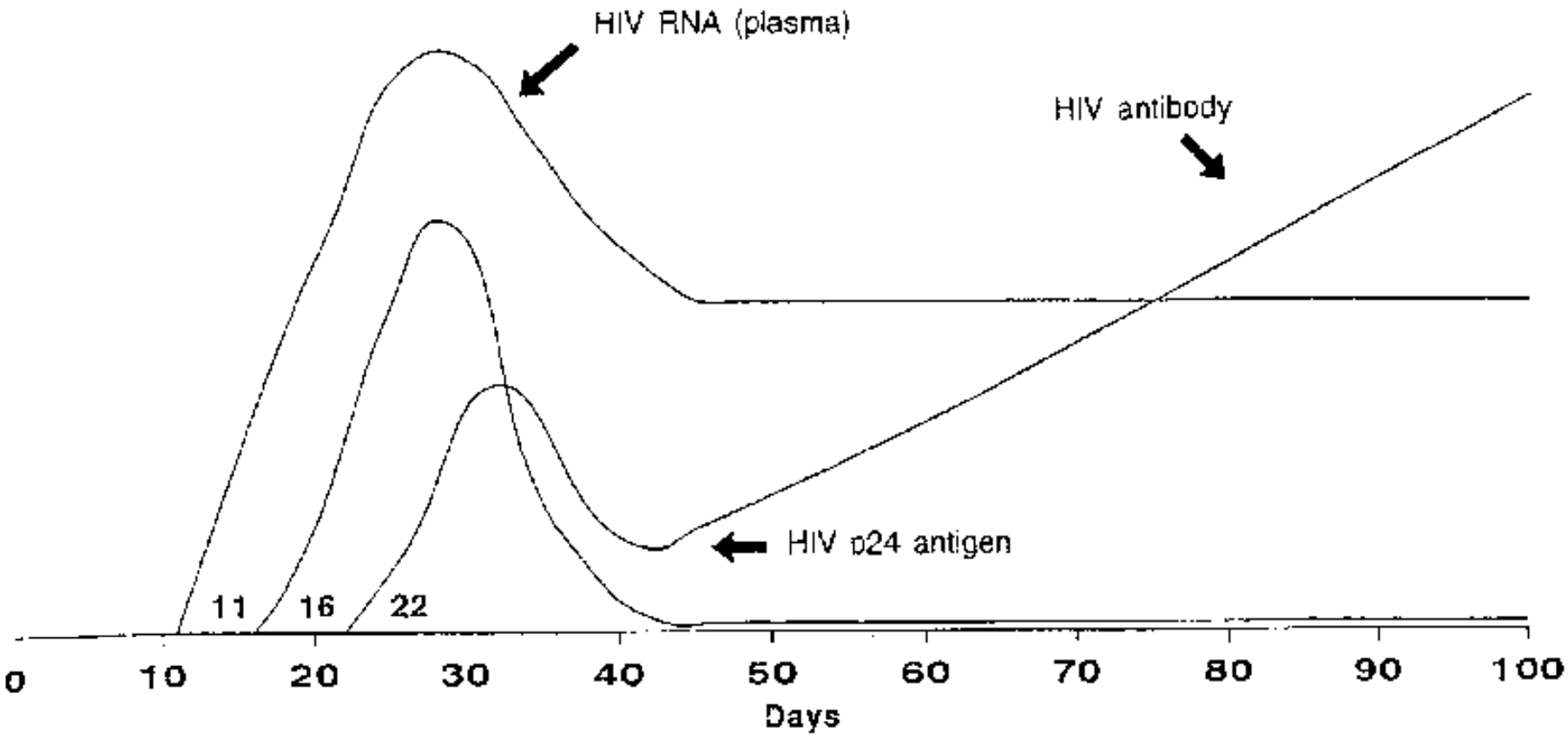
	All patients (n = 4240)	Patients developing severe infection (n = 165)	Crude OR (95% CI)	Adjusted OR (95% CI)
Non-transfused	2492	55	1.0 (reference)	1.0 (reference)
Transfused (red blood cells)	1748	110	3.0 (2.1—4.1)	1.6 (0.9—2.8)
Storage time only <14 days	953	44	2.1 (1.4—3.6)	1.2 (0.6—2.1)
Storage time only ≥14 days	548	38	3.3 (2.6—5.4)	2.5 (1.2—4.2)

The ORs were adjusted for age, gender, body mass index, preoperative hemoglobin concentration, diabetes mellitus, reoperation due to bleeding, use of extracorporal circulation, concomitant cardiac surgery, hospital of surgery, Charlson comorbidity index score, number of transfused red blood cell units, number of transfused platelet units, ABO blood group of the patient, minor and major ABO-incompatibility of platelet transfusions.

‘Pencere dönemi’

HIV	22 gün
HBV	60 gün
HCV	80 gün

Erken enfeksiyon döneminde HIV testleri



Theoretical Infectivity — Day 0

HIV RNA — Day 11

HIV p24 antigen — Day 16

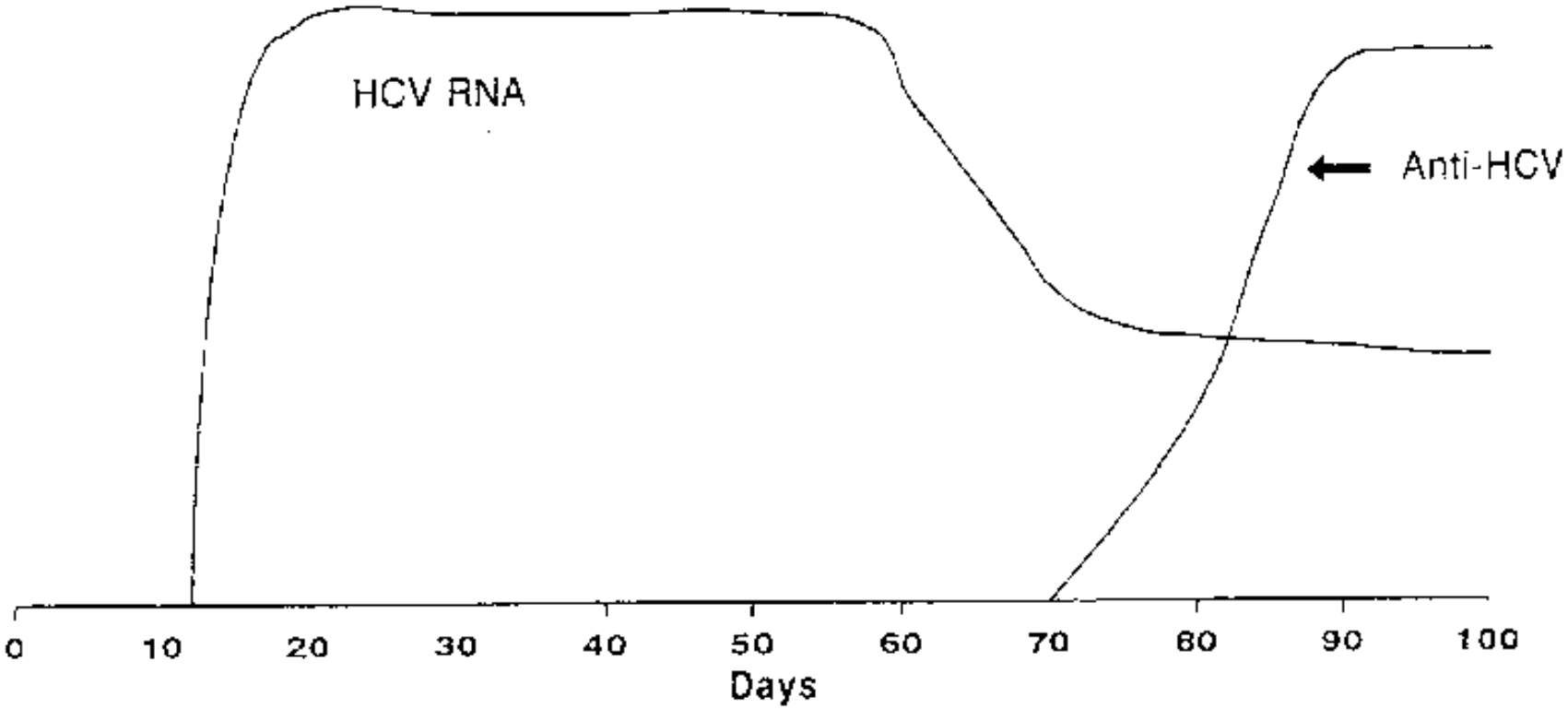
HIV antibody — Day 22

5 Days

6 Days

11 Days

HCV testleri



Infection	Day 0
HCV RNA	Day 12
HCV Antibody	Day 70

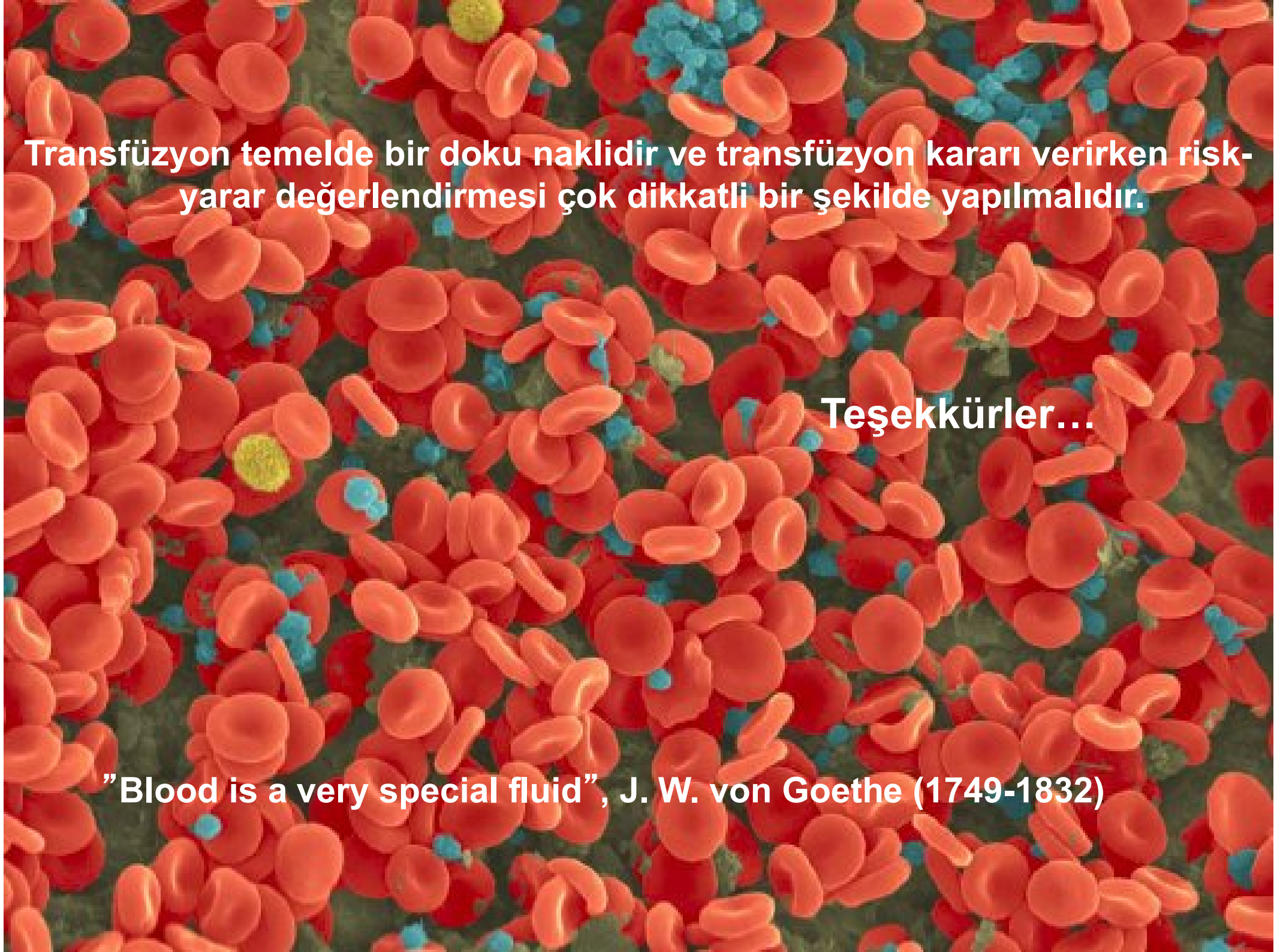
Transfüzyonla hastalık bulaştırma olasılıkları

- HIV 1:3 000 000
- HCV 1: 500 000
- HBV 1: 100 000

JOR after Shreiber et al NEJM 1996

1 yılda ölüm riski

	Olası Risk
• Transfüzyon	1: 8 000
• Futbol oynarken	1: 25 000
• Cinayet	1: 100 000
• Tren kazası	1: 100 000-1:1^{6}
• Yıldırım çarpması	1: 1 000 000



Transfüzyon temelde bir doku naklidir ve transfüzyon kararı verirken risk-yarar değerlendirmesi çok dikkatli bir şekilde yapılmalıdır.

Teşekkürler…

”Blood is a very special fluid”, J. W. von Goethe (1749-1832)