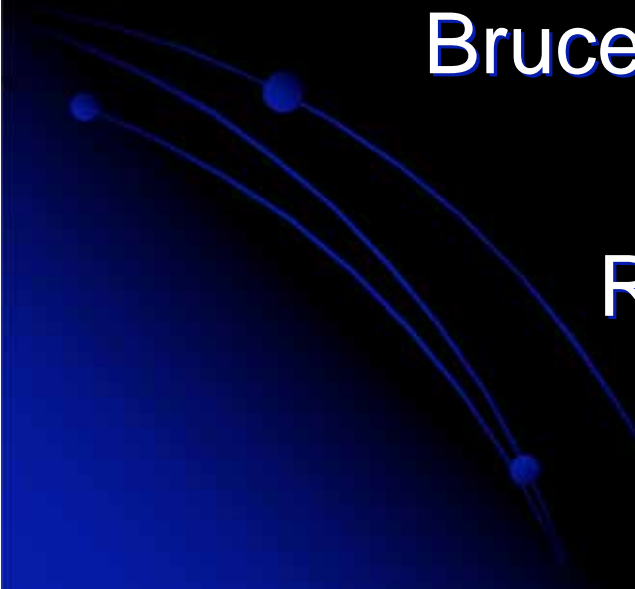


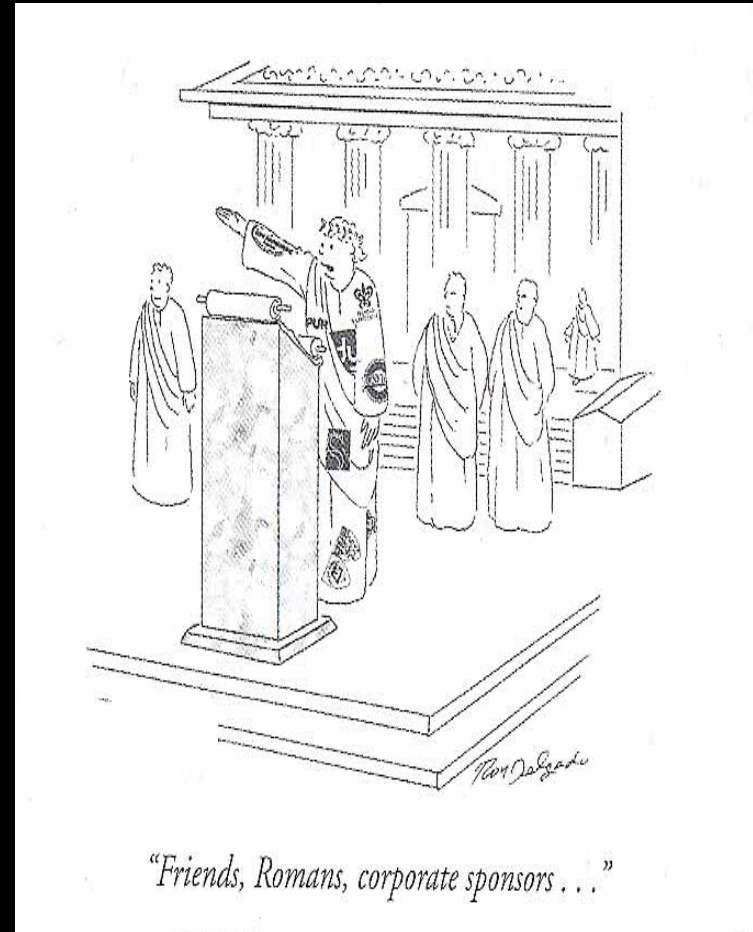
# Guidelines: Blood Management in Heart Surgery

Bruce D. Spiess, MD, FAHA  
VCURES  
Richmond, Virginia



# Disclosures

- Bayer  
Pharmaceuticals
- Synthetic Blood  
International
- The Medicines  
Company
- McSPI Hematology  
Sub-Group Director  
(Past)



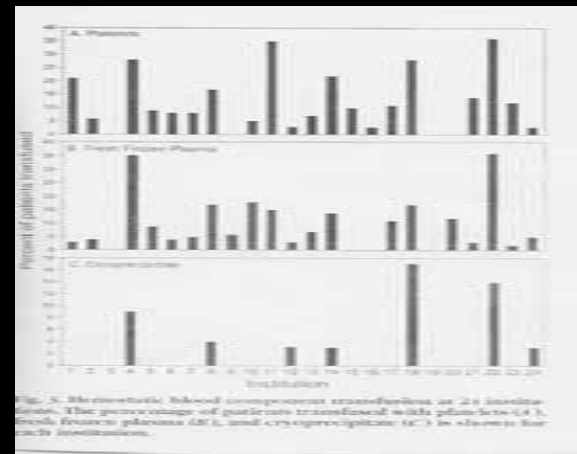
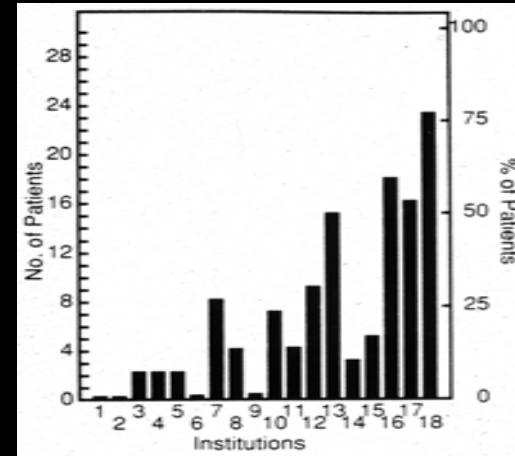
# Outline

- Why do we need “Guidelines”
- What are the “Guidelines”
- What if we all followed them?



# Transfusion Practice is Bizarre!

- Wide variability.
- No one knows what is “best”.
- **Everyone thinks they do!**
- Stover EP et al. Variability in transfusion practice for coronary artery bypass persists despite national consensus guidelines. *Anesthesiology* 1998;88:327-333.



# Heart surgery does not know when to transfuse?

- 25% of more than 4000 pts were tx. With Hgb >10gm/hg.
- Large assoc. with renal failure, LOS, infection, and death!

SEARCH:  GO  
Advanced

First Edition  
Submit to Blood  
Browse Blood  
ASH™  
Meeting Abstracts  
E-Mail Alerts

**Morbidity Risks of Unnecessary Red Blood Cell Transfusion in Stable Coronary Artery Bypass Graft Patients.**  
Patrick Mochale, MD<sup>1,2,\*</sup>, Stephanie A. Snyder-Ramon, MD<sup>1,4,\*</sup>, Yi-Shin Weng, ScD<sup>1,\*</sup>, Alexander Kuller, MD<sup>1,4,\*</sup>, Bernd W. Boettger, MD<sup>1,4,\*</sup>, Shirley Wang, ScD<sup>1,\*</sup>, Jack Levin, MD<sup>1,4</sup> and Dennis T. Mangano, PhD, MD<sup>1,4,\*</sup>

**Abstract**  
The persistent variability in red blood cell transfusion practice in coronary artery bypass graft (CABG) patients, despite established guidelines, suggests inappropriate use. Our objective was to determine the impact of postoperative red blood cell (RBC) transfusion in entirely stable CABG patients. We investigated a cohort of 940 stable CABG patients from the 5,065 patients enrolled in the Multicenter Study of Postoperative Ischemia Epidemiology II (EM II) Study with (1) low to

1 Multicenter Study of Postoperative Ischemia Research Group (MCSPI), 2 Ischemia Research and Education Foundation, San Francisco, CA, 3 Department of Anesthesiology, Ludwig-Maximilians University, Munich, Germany, 4 Department of Anesthesiology, University of Heidelberg, Heidelberg, Germany, 5 Department of Anesthesiology and Intensive Care Medicine, Medical University, Graz, Austria and 6 University of California School of Medicine, San Francisco.

http://dx.doi.org/10.1182/blood-2005-10-2201

# No Change in 20 years in 16 Countries

- RBC Intra-op 9-100%
- RBC Post-op 25-87%
- FFP Intra-op 0-98%
- FFP Post-op 3-95%
- Plts. Intra-op 0-51%
- Plts. Post-op 0-39%
- No relationship to Euroscore!
- Snyder-Ramos S, et al McSPI. Ongoing variability in transfusion practices in cardiac surgery despite established guidelines. Blood (ASH Annual Meeting ) 2005 Abstract 947.

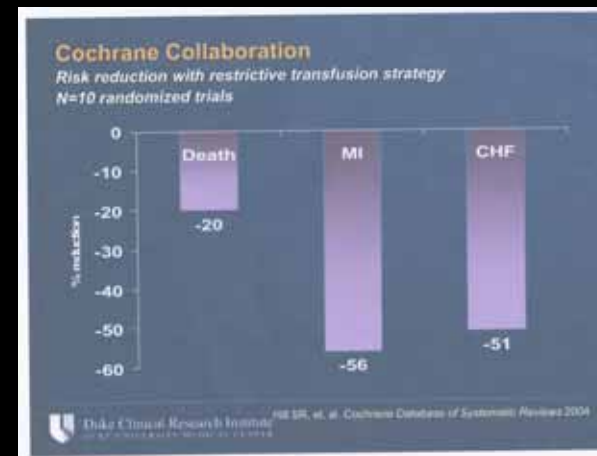
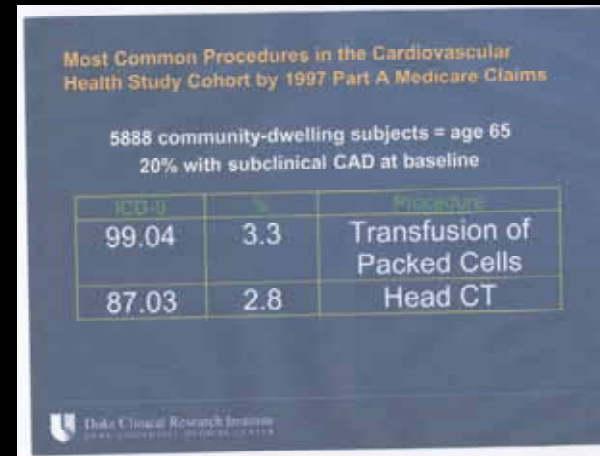
# Tx- “Top Ten Killers”

Rob Califf, MD- Vice Chancellor Duke U.

- Medical Error Perspective

- Having the wrong plan.
- Failure in execution of the right plan (human error)

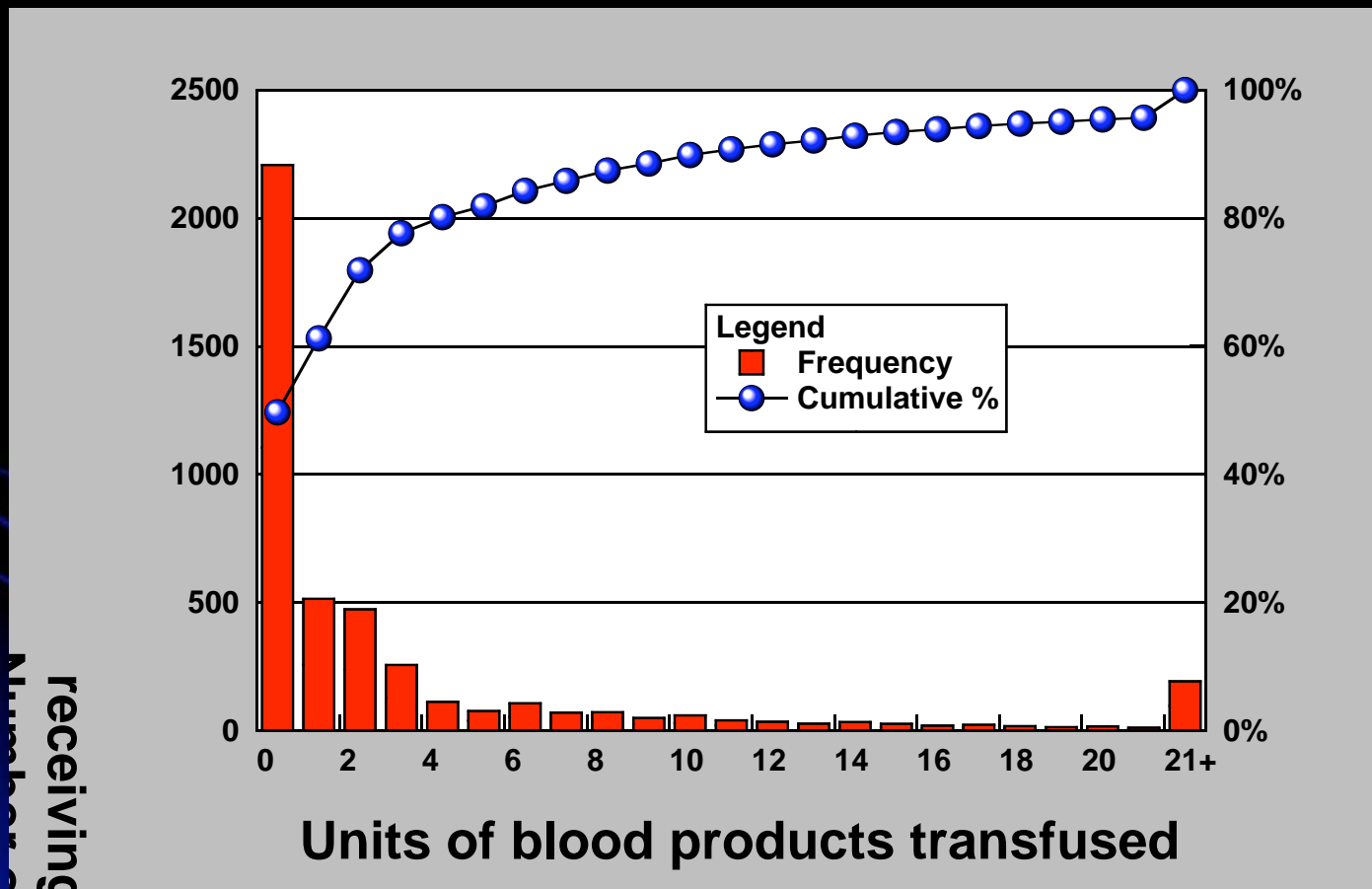
➤ **Blood industry has done a great job on the execution part, but may be perfectly delivering a lethal product.**



# JCAHO 2007

- 2-5-07 JCAHO stakeholders meeting.
- Universal agreement that blood management performance measures will need to be included in their accreditation process!
- Attendees included: NIH, FDA Society for Critical Care Medicine, SABM and American Association of Orthopedic Surgeons

Most blood is used in a smaller number of patients.



# The Work has Just Begun!

- Regarding D-Day:
- “....is not the end, not even the beginning of the end, but perhaps, the end of the beginning.”
- **Sir Winston Churchill**

***Peri-operative Blood Transfusion & Blood Conservation in  
Cardiac Surgery  
The Society of Thoracic Surgeons and The Society of  
Cardiovascular Anesthesiologists Practice Guideline Series=***

*A Report from the Society of Thoracic Surgeons Workforce on Evidence-Based  
Medicine#*

*In Collaboration with the Society of Cardiovascular Anesthesiologists Special  
Taskforce on Blood Transfusion\**

#Victor A. Ferraris, M.D., Ph.D. (Blood Conservation Guideline Taskforce Chair),  
Suellen P. Ferraris, Ph.D., Siby P. Saha, M.D., Eugene A. Hessel II, M.D., Constance  
K. Haan, M.D., B. David Royston, M.D., Charles R. Bridges, M.D., Sc.D., Robert S. D.  
Higgins, M.D., George Despotis, M.D., Jeremiah R. Brown, Ph.D.

From the University of Kentucky Chandler Medical Center, Lexington, KY, USA (VAF,  
SPF, SPS, and EAH), University of Florida, Jacksonville, FL (CKH), University of  
Pennsylvania Health System, Philadelphia, PA, USA (CRB), Harefield Hospital,  
London, UK (DR), Rush Presbyterian St. Lukes' Medical Center, Chicago, IL (RSDH),  
Washington University Medical Center, St. Louis, MO, USA (GD), and Center for the  
Evaluative Clinical Sciences, Dartmouth Medical School, Lebanon, NH (JRB)

\*Bruce D. Spiess, MD, FAHA (SCA Task Force Chair), Linda Shore-Lesserson, MD,  
Mark Stafford-Smith, MD, C. David Mazer, MD, Elliott Bennett-Guerrero, MD, Steven  
E. Hill, MD, Simon Body, MB,ChB, MPH..

Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA (SB).

**Ann Thorac Surg 2007; 83:S27-86**

[http://www.scahq.org/sca3/STS-SCA\\_Transfusion\\_Guideline.pdf](http://www.scahq.org/sca3/STS-SCA_Transfusion_Guideline.pdf)

# STS Committee

- Victor Ferraris MD, PhD (Blood Conservation Guideline Taskforce Chair) U Kentucky
- Suellen P Ferraris, PhD
- Sibu P. Saha, MD-University of Florida
- Constance K Haan, MD-University of Pennsylvania
- David Royston, MD- Harefield Hospital, UK
- Charles R Bridges-University of Pennsylvania
- Robert S. D Higgins, MD-Rush U.
- George Despotis, MD- Washington University

# SCA Committee

- Bruce D. Spiess, MD, FAHA (Chair of SCA Task Force)-VCUMC
- Linda Shore-Lesserson, MD-Albert Einstein Medical Center
- Mark Stafford-Smith, MD- Duke University
- C. David Mazer, MD- St Michael's Hospital/ University of Toronto
- Elliott Bennett-Guerrero, MD-Duke University
- Steven E. Hill, MD-Duke University
- Simon Body, MBBS- Brigham and Women's/ Harvard University

# Classification of the Quality of Evidence Available

- **Rank Order of Quality**
- **Level A:** Data from well-designed placebo-controlled, blinded, randomized clinical trials or meta-analyses or multiple clinical trials.
- **Level B:** Data from less well done single randomized trials or from non-randomized, analytical observational studies.
- **Level C:** Consensus “expert” opinion or data from descriptive studies, informative case reports and/or retrospective data associations.

# Retrospective Data Based Analysis: Level C Evidence

- Fraught with problems
- The only conclusions to be drawn are **ASSOCIATIONS.**
- Retrospective data based analysis is useful for **hypothesis generation!**
- Retrospective data base analysis always wrestles with confounders, time of study, changes in practice, widespread bias.
- Retrospective data analysis **cannot prove cause and effect!**

# Classification Scheme used to Summarize Clinical Recommendations

- **Class I:** General agreement that a procedure or intervention is useful and effective.
- **Class II:** Conflicting evidence.
  - **IIa:** Weight of evidence favors intervention.
  - **IIb:** Less well established acceptance for intervention.
- **Class III:** Evidence shows the intervention is not useful or potentially harmful.

# Evidence Based

- *“... the science of medicine becomes a structured and organized way of using probability...to best benefit the patient and the community.”*

- *Jenicek M. Foundations of evidence-based medicine. New York: Parthenon Pub. Group. 2002.*

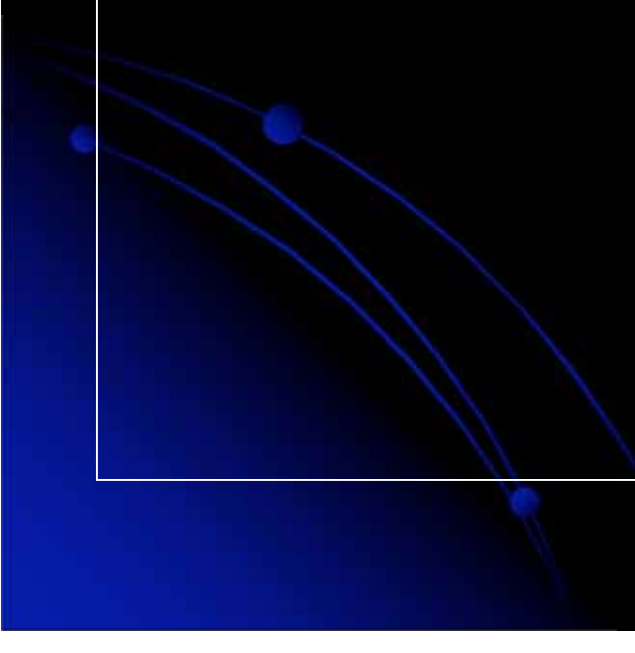
# Every Therapy has Consequences

- Medicine and surgical interventions have both systemic and random effects of which some are beneficial and some are of unintended consequences.
- The practice of medicine necessitates a balancing of these conflicting effects recognizing that there will always be a residual level of uncertainty.

# The Fine Points: What an Effort!

- 753 Peer reviewed literature citations
- 15 reviewers/readers of literature
- Consensus sought regarding meaning and importance of each paper by reviewers
- 113 page manuscript written
- Process: over 3 years of work!

# The Problem/The Dilemma

- “There is lack of clear evidence regarding the benefit of blood transfusion. However, clinical reports of survival benefit support transfusion in certain clinical situations.”
- 

# Causes of Blood Transfusion After Cardiac Operations

## ● Class I

- ...high-risk patients.... account for 80% of blood products transfused.
- Patient related bleeding issues.
- Physician-related causes of bleeding.
- Procedure-related causes of bleeding.
- Drug-related causes of bleeding.

# Indications for Transfusion- Transfusion Trigger

- **Class IIa:** ..treatment of inadequate tissue oxygen delivery, signs or symptoms, morbidity (6-7gm/dl>)...
  - ...non red cell haemostatic products ..on clinical evidence of bleeding supplemented with (preferably point-of-care) tests...Level C evidence.

**Class IIb:** ...certain patients with non-cardiac end-organ ischemia (CNS, gut).. May benefit from Hgb potentially as high as 10gm/dl... Level C evidence.

**Class III:**...transfusion for Hgb. above 10gm/dl ..is not recommended.

# Anti-Fibrinolytics

## D) HEMOSTATIC DRUGS WITH ANTIFIBRINOLYTIC PROPERTIES

### Class I

1. High-dose aprotinin is indicated to reduce the number of patients requiring blood transfusion, to reduce total blood loss, and to limit reexploration in high-risk patients undergoing cardiac operations. Benefits of use should be balanced against the increased risk of renal dysfunction. (Level of evidence A)
2. Low-dose aprotinin is indicated to reduce the number of patients requiring blood transfusion and to reduce the total blood loss in patients having cardiac procedures. (Level of evidence A)
3. Lysine analogues like epsilon-aminocaproic acid (EACA) and tranexamic acid (TXA) are indicated to reduce the number of patients who require blood transfusion, and to reduce total blood loss after cardiac operations. These agents are slightly less potent blood-sparing drugs and the safety profile of these drugs is less well studied compared with aprotinin. (Level of evidence A)

Mangano DT, Tudor JC, Dietzel C. The risk associated with aprotinin in cardiac surgery. *N Engl J Med* 2006; 354 :353-65.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

## The Risk Associated with Aprotinin in Cardiac Surgery

Dennis T. Mangano, Ph.D., M.D., Iulia C. Tudor, Ph.D., and Cynthia Dietzel, M.D.,  
for the Multicenter Study of Perioperative Ischemia Research Group  
and the Ischemia Research and Education Foundation\*

**Table 2.** Results of Multivariable Logistic Regression for the Renal Composite Outcome in 4374 Patients.\*

Risk Factor	Analysis in Presence of Covariates without Propensity Adjustment†		Analysis in Presence of Covariates with Propensity Adjustment‡	
	Odds Ratio (95% CI)	P Value	Odds Ratio (95% CI)	P Value
Aprotinin vs. control	2.52 (1.66–3.82)	<0.01	2.41 (1.49–3.90)	<0.001
Aminocaproic acid vs. control	1.03 (0.61–1.76)	0.91	0.84 (0.44–1.58)	0.58
Tranexamic acid vs. control	1.25 (0.74–2.13)	0.40	1.23 (0.68–2.21)	0.49
Propensity score	—	—	1.03 (0.97–1.11)	0.33
Complex vs. primary surgery	1.55 (1.12–2.16)	0.009	1.47 (1.02–2.13)	0.04
History of renal disease	2.50 (1.76–3.57)	<0.001	2.53 (1.70–3.75)	<0.001
Creatinine >1.3 mg/dl on admission§	2.71 (1.91–3.87)	<0.001	3.12 (2.11–4.60)	<0.001
Heart failure on admission	2.33 (1.68–3.24)	<0.001	2.64 (1.84–3.80)	<0.001
History of angina	0.57 (0.36–0.89)	0.01	0.58 (0.35–0.96)	0.03
History of liver disease	0.35 (0.18–0.68)	0.002	0.28 (0.13–0.61)	0.001
History of intravenous drug use	3.29 (1.08–10.04)	0.04	2.98 (0.82–10.84)	0.10
Preoperative nitrate administration	1.95 (1.29–2.93)	0.001	2.15 (1.36–3.40)	0.001
Preoperative inotrope administration	2.31 (1.45–3.67)	<0.001	2.36 (1.42–3.92)	<0.001
Preoperative administration of ACE inhibitor	1.38 (1.00–1.91)	0.05	1.57 (1.10–2.24)	0.01
Intraoperative transfusion of fresh frozen plasma	2.51 (1.72–3.65)	<0.001	2.40 (1.58–3.66)	<0.001
Intraoperative transfusion of red cells	1.64 (1.15–2.34)	0.007	1.71 (1.16–2.52)	0.007

## Other papers by Mangano and McSPI that relate to aprotinin, renal dysfunction, and Tx.

- Moehnle P et al. Morbid risks of unnecessary red blood cell transfusion in stable coronary artery bypass graft patients. *Blood* (American Society of Hematology Abstracts) 2005; 106; abstract 427.
- Snyder-Ramos S et al. On going variability in transfusion practices in cardiac surgery despite established guidelines. *Blood* (American Society of Hematology Abstracts) 2005; 106:abstract 947.
- Kullier A et al. Impact of preoperative anemia on outcome in patients undergoing coronary artery bypass graft surgery. *Circulation* 2007; 116:471-479.
- Aronson S et al. Risk index for perioperative renal dysfunction/failure: critical dependence on pulse pressure hypertension. *Circulation* 2007;115: 733-42.
- Ott E et al. Coronary artery bypass graft surgery--care globalization: the impact of national care on fatal and nonfatal outcome. *J Thorac Cardiovasc Surg* 2007; 133: 1242-51.

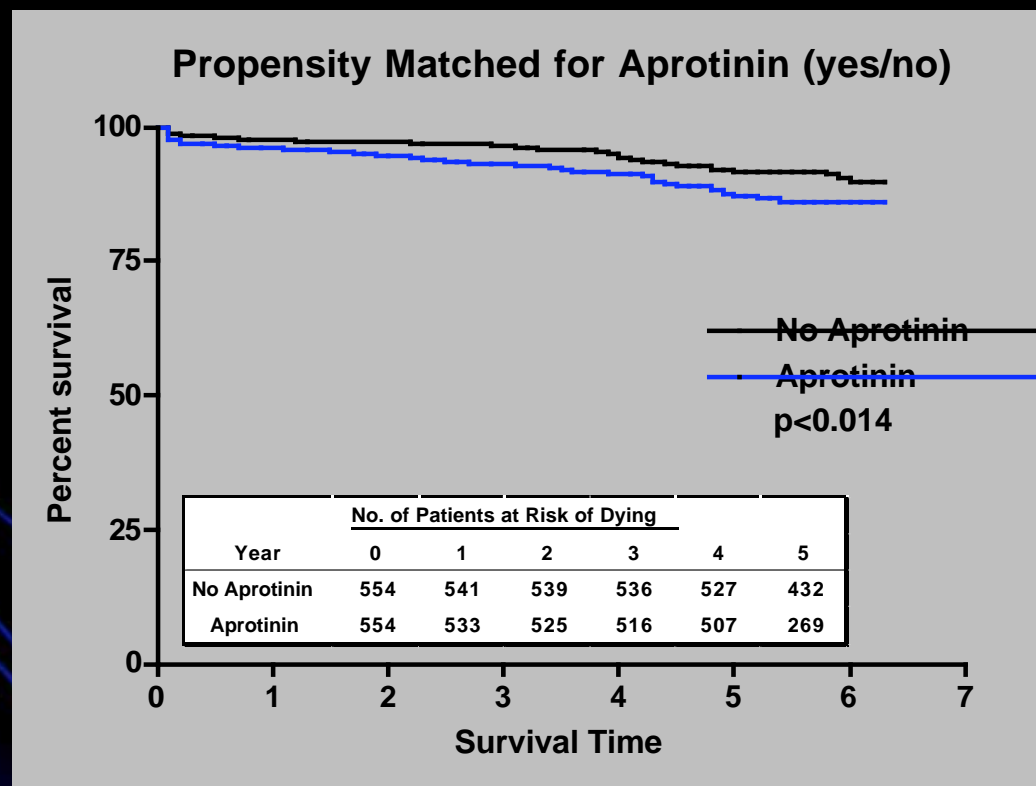
Ott E et al. Coronary artery bypass graft surgery--care globalization: the impact of national care on fatal and nonfatal outcome. *J Thorac Cardiovasc Surg* 2007; 133: 1242-51.

- Dramatic differences in aprotinin use:  
Germany 69%, Canada 5.7%
- Dramatic differences in FFP usage: 10.6%  
Germany, 1.4% Canada
- Dramatic differences in renal  
dysfunction/failure: More patients dialyzed  
in Germany than had renal dysfunction???

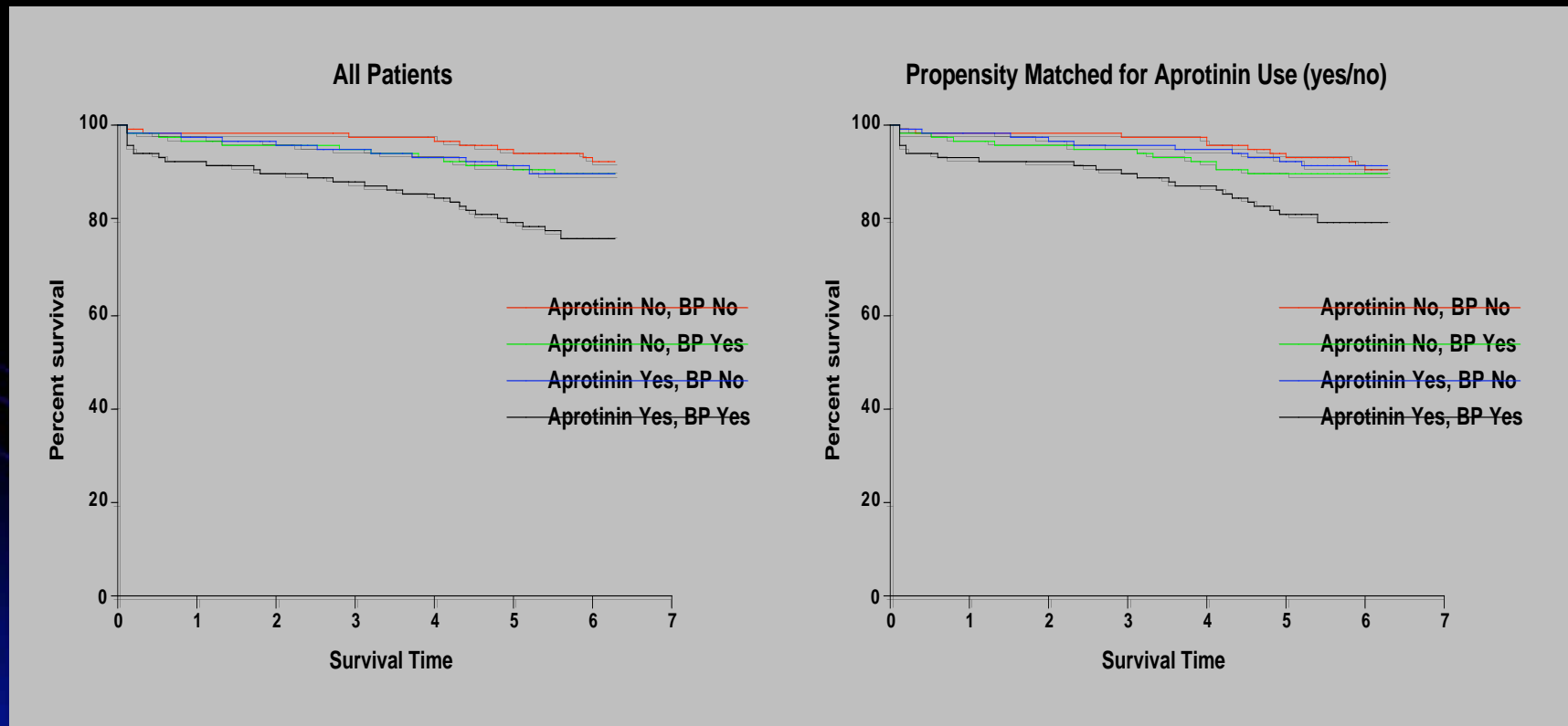
# Some McSPI/Mangano quotes!

- ***“The effect of low preoperative hemoglobin on non-cardiac outcomes was greatest for postoperative renal events.”...***
- ***“Multivariate logistic regression demonstrated that the number of units of intraoperative RBC transfusion was independently associated with an increased risk of both cardiac and non-cardiac outcome”.***
- ***“Patients with low preoperative hemoglobin had a higher rate of postoperative adverse events, but at the same hemoglobin level, the risk of suffering postoperative complication increased significantly with transfusion of RBC’s”.***
- Kullier et al.

# Niv Ad Propensity Matched Survival



# Niv Ad, Survival with and without Tx. added into the analysis!



# The Right Analysis?

## Aprotinin Does Not Increase the Risk of Renal Failure in Cardiac Surgery Patients

Anthony P. Furnary, MD; YingXing Wu, MD; Loren F. Hiratzka, MD;  
Gary L. Grunkemeier, PhD; U. Scott Page 3rd, MD

**Background**—Aprotinin is frequently used in high-risk cardiac surgery patients to decrease bleeding complications and transfusions of packed red blood cells (PRBC). Transfusions of PRBC are known to directly increase the risk of new onset postoperative renal failure (ARF) in cardiac surgery patients. A recent highly publicized report implicated aprotinin as an independent causal factor for postoperative renal failure, but ignored the potential confounding affect of numerical PRBC data on ARF. We sought to investigate that claim with an analysis that included all perioperative risk factors for renal failure, including PRBC transfusion data.

**Methods and Results**—Prospectively collected patient data from 12 centers contributing to the Merged Cardiac Registry, an international multicenter cardiac surgery database, operated on between January 2000 and February 2006 were retrospectively analyzed. A previously published risk model for ARF incorporating 12 variables was used to calculate a baseline ARF risk score for each patient in whom those variables were available (n=15 174). After adding transfused PRBC data 11 198 patients remained for risk-adjusted assessment of ARF in relation to aprotinin use. Risk-adjusted multivariable analyses were carried out with, and without, consideration of transfused PRBC. Aprotinin was used in 24.6% (2757/11 198). The overall incidence of ARF was 1.6% (180/11 198) and was higher in the aprotinin subset (2.6%, 72/2757 versus 1.3%, 108/8441;  $P<0.001$ ). The incidence of ARF directly and significantly increased with increasing transfusions of PRBC ( $P<0.001$ ). Risk-adjusted analysis without transfused PRBC in the model suggests that aprotinin significantly impacts ARF ( $P=0.008$ ; OR=1.5). However, further risk adjustment with the addition of the highly significant transfused PRBC variable ( $P<0.0001$ ; OR=1.23/transfused PRBC) to the model attenuates the purported independent affect of aprotinin ( $P=0.231$ ) on ARF.

**Conclusions**—The increase in renal failure seen in patients who were administered aprotinin was directly related to increased number of transfusions in that high-risk patient population. Aprotinin use does not independently increase the risk of renal failure in cardiac surgery patients. (*Circulation*. 2007;116[suppl 1]:I-127-I-133.)

**Key Words:** renal failure ■ transfusion ■ cardiac surgery ■ kidney ■ risk factors

# Furnary Analysis 3-Ways!

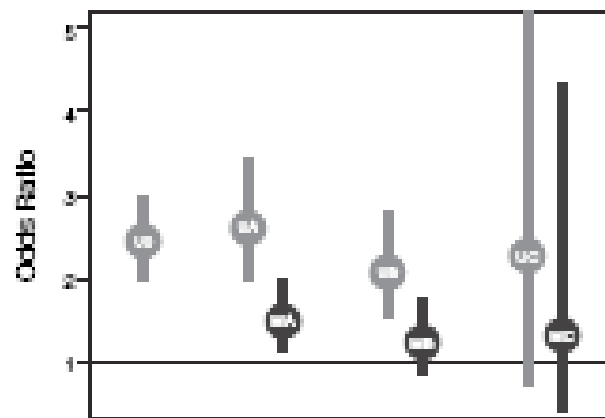


Figure 3. Odds ratios (both univariate and multivariate) for the effect of aprotinin on ARF in the different populations tested. The circles represent the point estimates of the various odds ratios, and the vertical bars are the 95% confidence intervals. UA indicates univariate model assessing the single predictor 'aprotinin' using all 23 105 patients; UA, univariate model assessing the single predictor 'aprotinin' based on the 15 174 patients with all variables available to perform CCF-ARF risk adjustment as done in Model "A"; MA, multivariate model "A" (n=15 174) with CCF-ARF risk adjustment; UB, univariate model assessing the single predictor 'aprotinin' based on the 11 198 patients with numerical PRBC data available for analysis in Model "B"; MB, multivariate model "B" (n=11 198) with both CCF-ARF and PRBC risk adjustment; UC, univariate model assessing the single predictor 'aprotinin' based on the 5729 patients who received no transfusions and were analyzed in Model "C"; MC, multivariate model "C" (n=5729) with CCF-ARF risk adjustment in nontransfused patients.

# Tx. Causes Renal Failure!

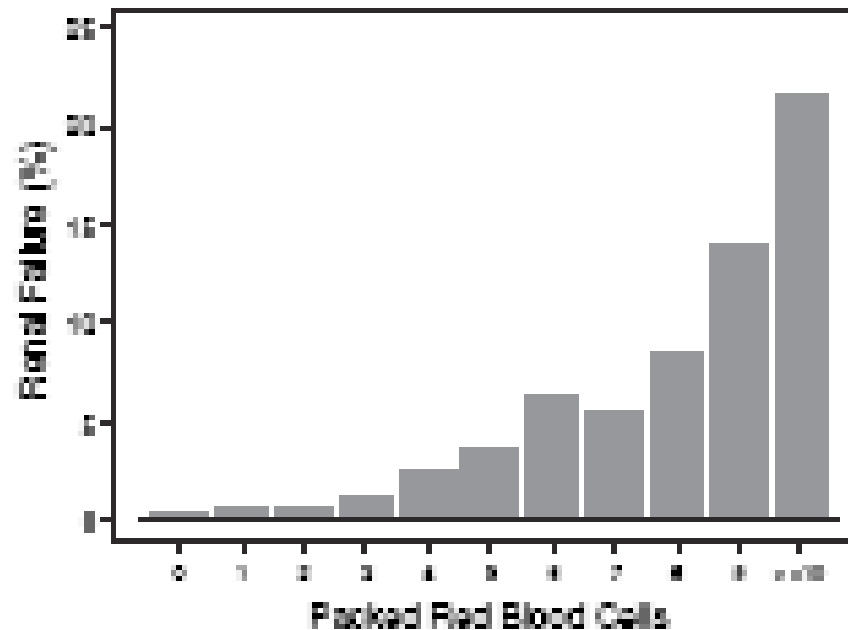


Figure 2. Number of transfused PRBC used vs incidence of ARF.

# The Latest

- 8548 Pts at Munich Heart Center
- Various dosages of aprotinin
- Renal failure (dialysis)
- Renal dysfunction (increased creatinine)
- No evidence of increased renal failure or dysfunction even with increased dosing,
- Risk factors (patient and operative) were related to outcome.
- Dietrich W, Busley R, Boulesteix A-L. Effects of aprotinin dosage on renal function. *Anesthesiology*; 2008:189-98.

# What About BART?

- Not published yet!
- Mortality data is being adjudicated!
- Renal findings etc may not support Mangano!
- But, don't judge until it is published!

# Renal Injury, Hemodilution and Transfusion

- Retrospective 1760 Pts
- Single center
- 31% female
- CABG with CPB
- Major Outcome: Delta Creatinine
- Renal Injury= Delta Creatinine >50%
- Acute Renal Failure=100% increase in Creatinine and > 2.1mg/dl.
- **Anemia associated with renal failure**
- Habib R et al. Role of Hemodilutional Anemia and Transfusion during Cardiopulmonary Bypass in Renal Injury After Coronary Revascularization: Implications on Operative Outcome. Critical Care Medicine 2005;33:1749-56.

# Propensity Analysis: Tx and Cr Change

- % Change Cr. 0.0029
- %Cr-Clearance 0.0043
- Renal Injury 0.0030
- ARF 0.0010
- LOS 0.0027

- Habib R et al. Role of Hemodilutional Anemia and Transfusion during Cardiopulmonary Bypass in Renal Injury After Coronary Revascularization: Implications on Operative Outcome. Critical Care Medicine 2005;33:1749-56.

# Transfuse or Don't Transfuse?



# Erythropoietin

- **Class I:** ...Epo may be helpful in restoring red blood cell volume in patients undergoing autologous preoperative donation..
- **Class IIa:** ...Epo can be useful in anemic patients at low risk for elective cardiac procedures ...in conjunction with iron therapy (Level B and C evidence).
- **Class IIb:** ...Epo given at least a few days before operation may be considered to increase red cell mass in elective patients....postoperative (Level C)

# DDAVP and Factor VIIa

- **Class IIb:** ...factor VIIa.. Intractable non-surgical bleeding after CPB procedures...(Level C evidence)
- ...DDAVP may be helpful in patients with demonstrable specific platelet dysfunction....(Level B evidence).
- **Class III:** ...prophylactic use of DDAVP is not helpful (level A evidence)

# Heparin Management

- **Class IIb:** ..during CPB it is reasonable to consider higher /and or patient specific heparin concentrations to reduce haemostatic activation.... (Level B and C evidence)

# Acute Normovolemic Hemodilution

- **Class IIb:** ...not well established...it could be utilized as part of a multi-pronged approach.. (Level B evidence)

# Shed Blood Postoperatively

- **Class IIb:** ...washed shed mediastinal blood may be of use in a blood conservation program... (Level of evidence B &C)
- **Class III:** ...direct infusion of shed mediastinal blood ...may cause harm.. (Level B evidence).

# RAP, Ultra filtration

- **Class IIb:** ..retrograde autologous prime may be reasonable for blood conservation (Level B evidence).
- **Class IIa:** ... modified ultra filtration can be effective... in pediatric and patients where priming volume is a very significant fraction of total blood volume..(Level B)
- **Class III:** ...modified or conventional ultra filtration alone is not helpful in conservative and routine CPB... (Level B evidence)

# Off Pump for Blood Conservation

- **Class IIa:** ...OPCAB can be effective as a means of blood conservation... (level of evidence A)

# Transfusion Algorithms and TQM

- **Class I:** ..... A multimodality approach involving multiple stakeholders, institutional support, enforceable transfusion algorithms supplemented with point of care testing... (Levels A, B and C evidence)
- **Class IIa:** ....continuous measurement and analysis of blood conservation interventions ... can be beneficial.. (Level B of evidence)

# What if we all did it?

- Blood supply 1.5 days in the United States
- **20% of blood is used in cardiac surgery**
- Costs of a unit of blood are rapidly rising:  
Could we as a group change the world economics of blood?
- Blood is a homeland defense commodity
- **What would happen to pt. outcomes?**

# What if

- As early as 1973 a “Blood Action Plan” noted that adequate supply was a “unique national resource”.<sup>6</sup> In 2001 blood availability was identified as “critical national resource” with the goal of a 5-7 day supply ready in the United States.
- Britain 7 day supply of O neg! You can check the supply on the internet.
- Israel has at least that much!

# How much could we save!

- 1.4-1.6 million units!!
- What heros the cardiac teams would be for the nation!



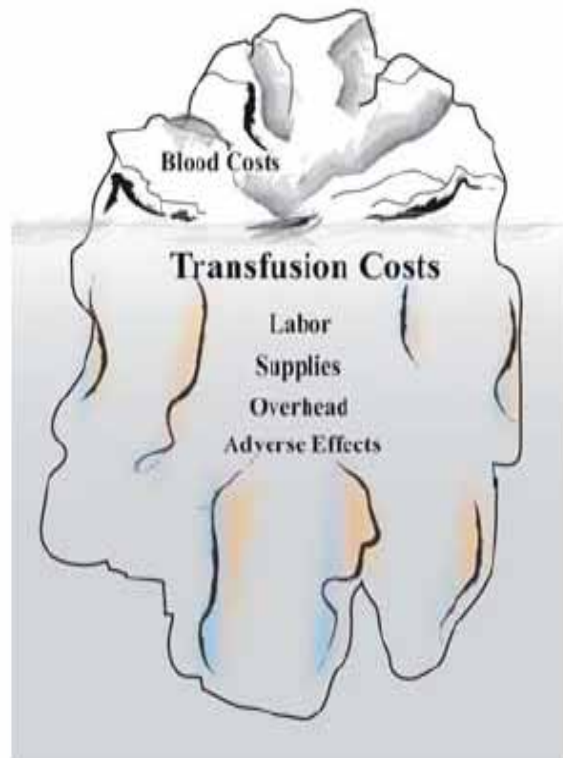
# New Data Northern New England Group

- Transfusion is associated with increased risk of ventricular failure, inability to wean from bypass, and use of two or more inotropes.
- Prior work from this same group claimed it was low-Hct that was associated with adverse events.
- Surgenor SD et al. Intraoperative red blood cell transfusion during coronary artery bypass graft surgery increases the risk of postoperative low-output heart failure. *Circulation* 2006;114:Supp I43-8.

# Musings on Transfusion Costs: CABG

- 515,000 CABGs
- 25% Tx. “unnecessary /prophylactic” (136,000)- average is 2.5 units per patient (340,625 units)
- Assume \$250.00/unit **\$85,156,250.00**
- Assume \$2000.00/unit **\$681,250,000.00**
- ***A Societal Burden!***
- ***Based on: Goodnough LT, JAMA 1991.***

# How much would you transfuse at \$2000.00/unit?



**Figure 5. The tip of the iceberg.**

Transfusion costs are substantially more than blood costs, reflecting the consumption of numerous hospital resources as well as the incidence of adverse events associated with blood transfusions. Accounting for all resources, the incremental cost of transfusing a single unit of red blood cells exceeds \$2000<sup>35</sup>.

# Scarcity-Could **We** as a Group Change this?

- 1990-US imported 2% of its blood supply (France and Western Europe)
- 5% decrease in donations from 1994-97
- CJD, European travel restrictions will decrease immediately donations by estimates 7-9% reduction
- Aging population-donor-recipient shift
- Elective Surgery Halted
- Effects of Sept 11, 2001 ???
- FFP no longer from multiparous donors-TRALI.
- Leukoreduction

# Conclusion

- STS/SCA Guidelines for Transfusion and Blood Conservation are here!
- Embrace them!
- Evidence Based- Opinion Interpretation by “Experts”
- Are patients and our world will be better because of these guidelines!

# Some Thoughts for the Day

- If everyone thinks you have a good idea, you are too late! Paul Hawken
- There are two types of creativity: the creativity of making zero to one, and the creativity of making one to 1000! Kazuhiko Nishi
- We are the people we have been waiting for!  
Navajo Medicine Man

# Lead or Follow/ Learn/Question: What is the Truth?

