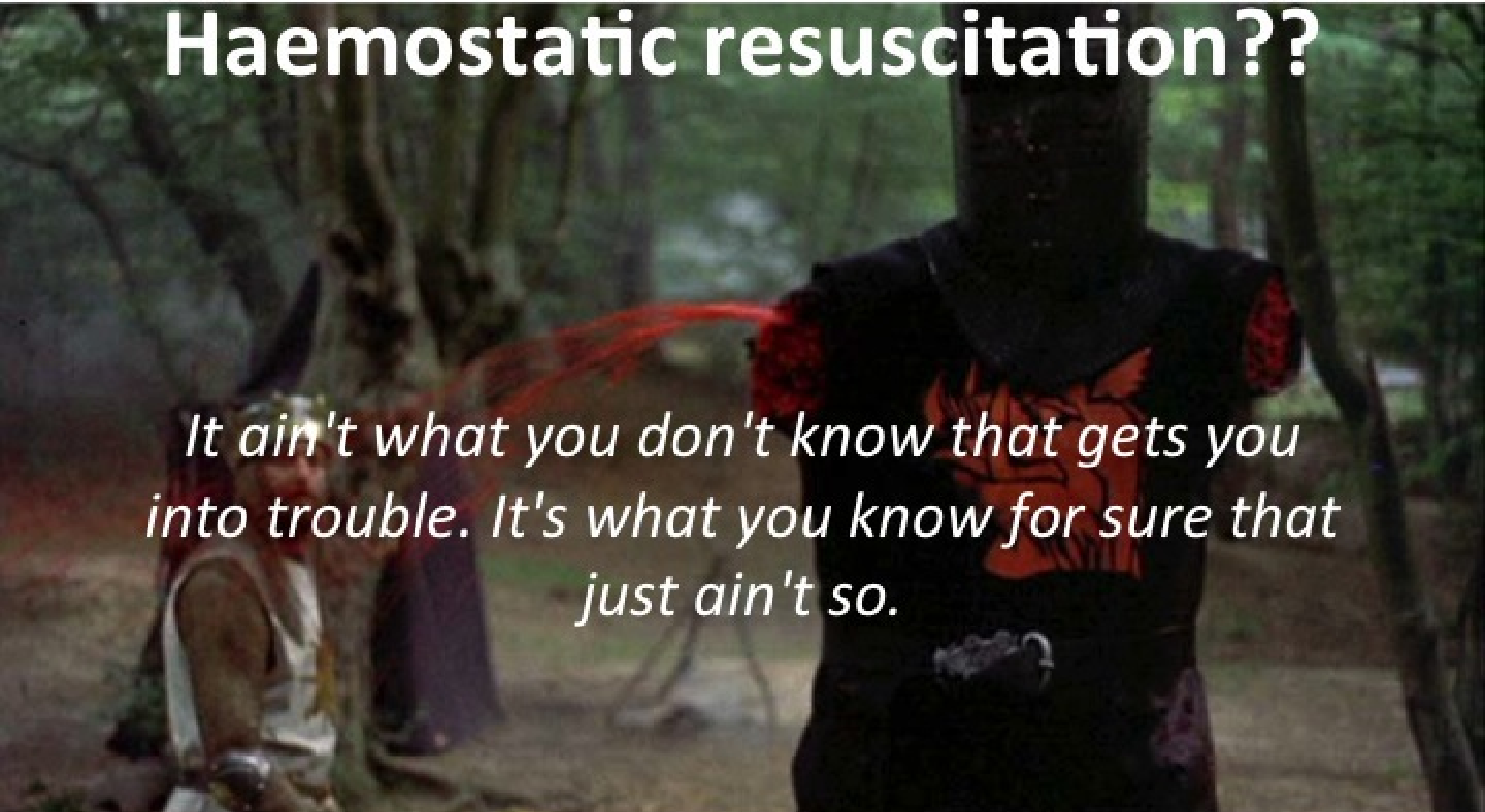
Haemostatic resuscitation??



It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so.

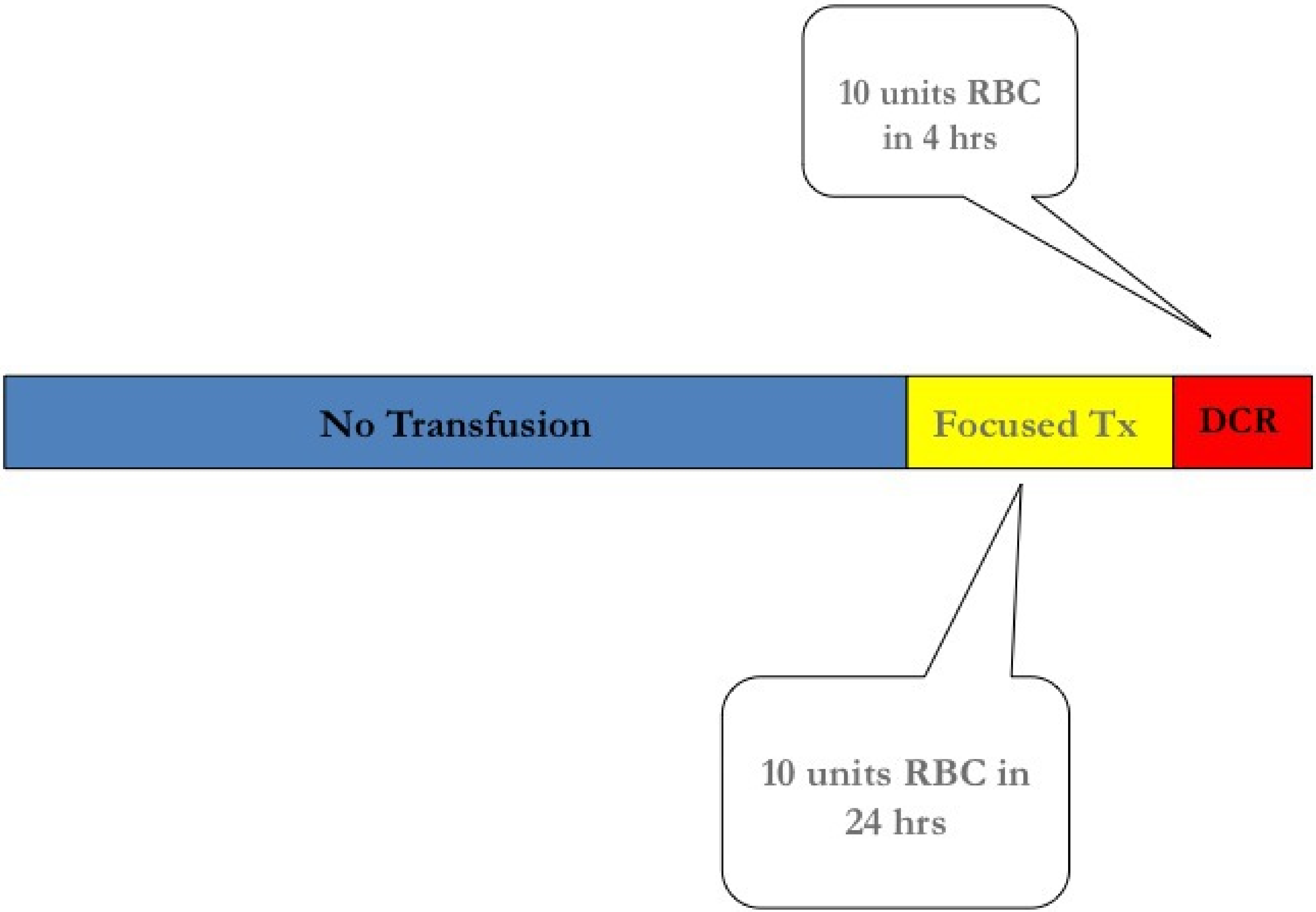
Kerry Gunn
Department of Anaesthesia and Perioperative Medicine
Auckland City Hospital

Haemostatic Resuscitation

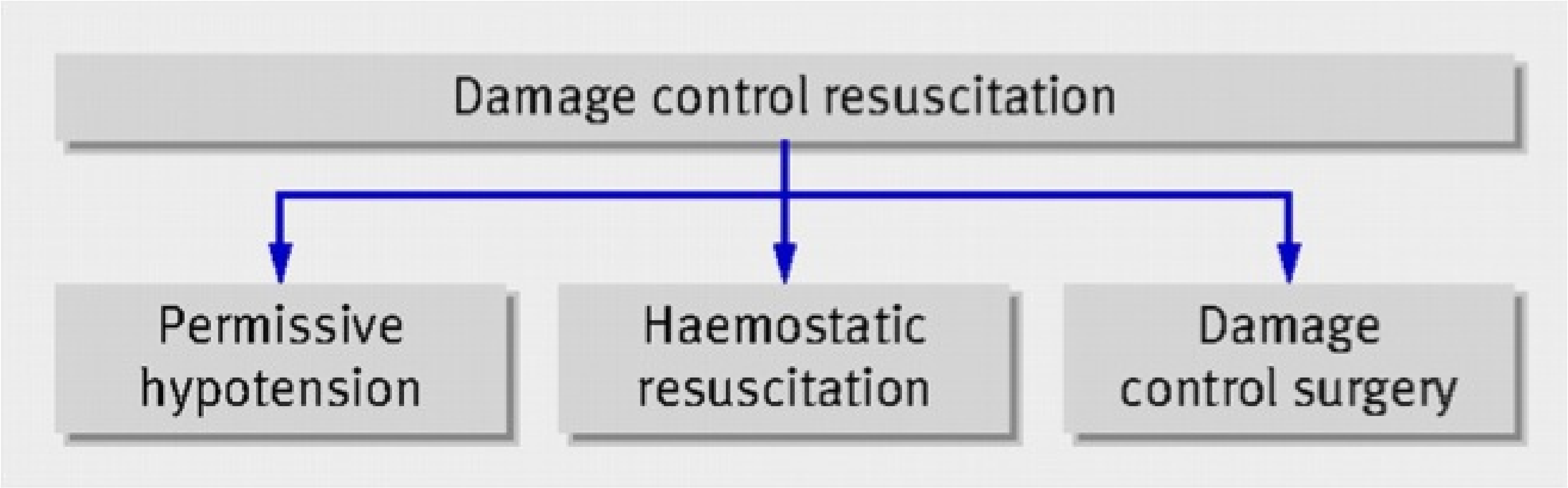
- Does not stop bleeding

- Is part of a paradigm shift in trauma management
  - Rapid triage
  - Damage Controlled Surgery
  - Limited crystalloid

  - Is stealing the thunder!

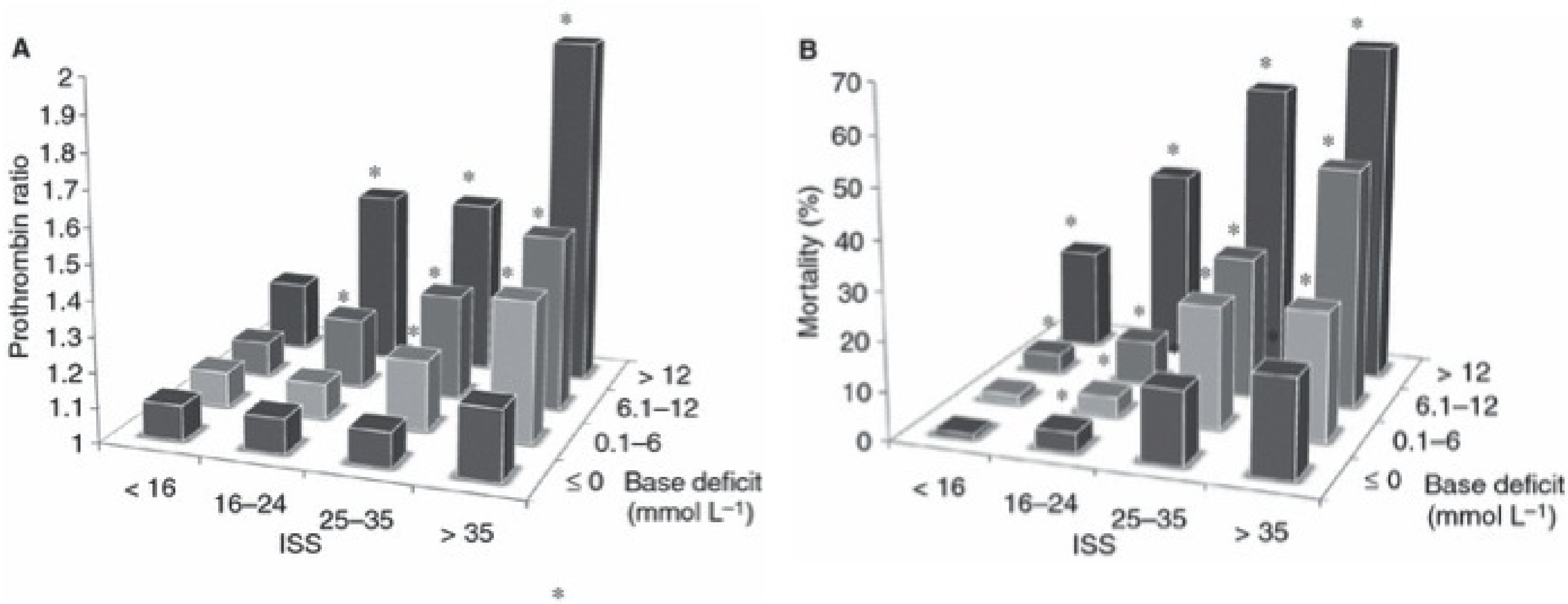

10 units RBC
in 4 hrs
No Transfusion
Focused Tx
DCR
10 units RBC in
24 hrs

The components of damage control resuscitation



Jansen, J. O et al. BMJ 2009;338:b1778

Acute Traumatic Coagulopathy



Hemostatic resuscitation is neither hemostatic nor resuscitative in trauma hemorrhage

Sirat Khan, MD, Karim Brohi, MD, Manik Chana, MD, Imran Raza, MD, Simon Stanworth, MD, Christine Gaarder, MD, PhD, Ross Davenport, MD, PhD,
***on behalf of* the International Trauma Research Network (INTRN),** *London, United Kingdom*

- ACIT study (Activation of Coagulation and Inflammation in Trauma)
- 106 patients
- Lactate and ROTEM during MTP

J Trauma Acute Care Surg
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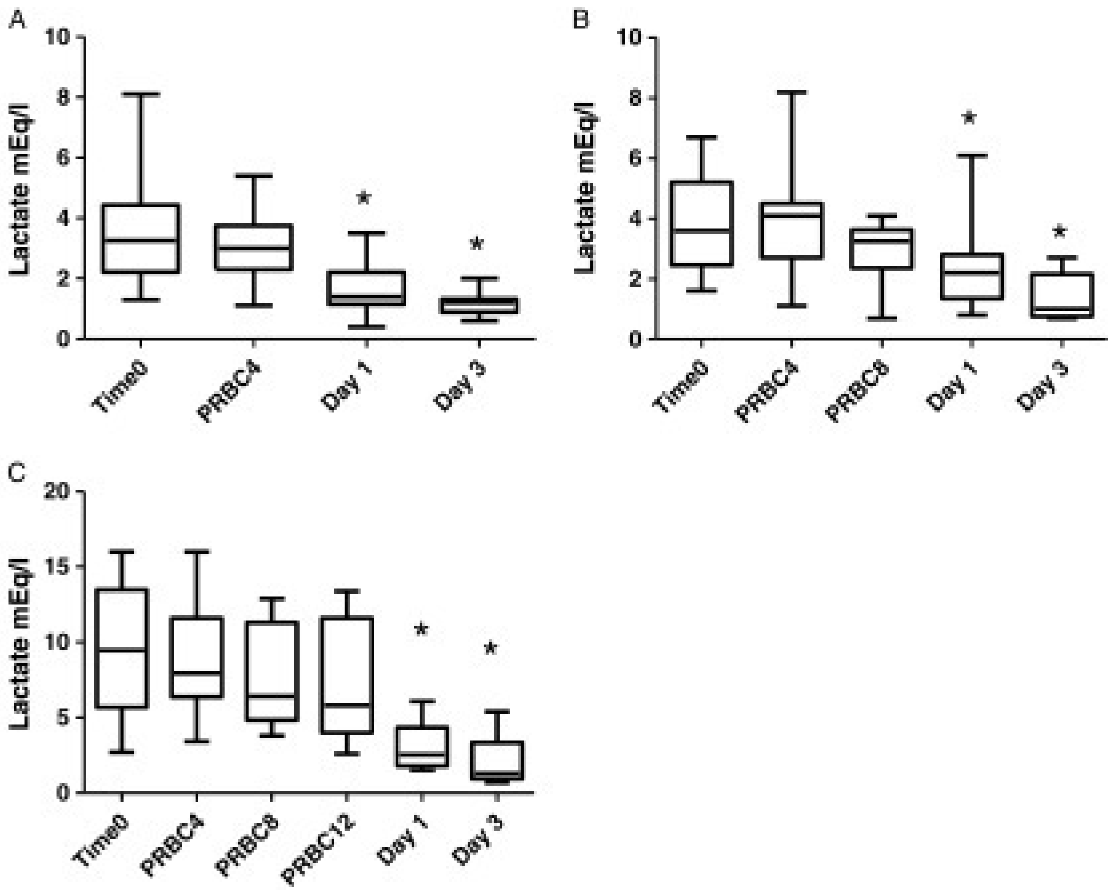

Figure 1. Lactate clearance during hemorrhage. *A–C box* and *whisker plots*, median, IQR and adjusted range. *Versus Time 0. *A*, Patients receiving 4 U to 7 U of PRBC. *B*, Patients receiving 8 U to 11 U of PRBC. *C*, Patients receiving 12 U or more PRBCs.

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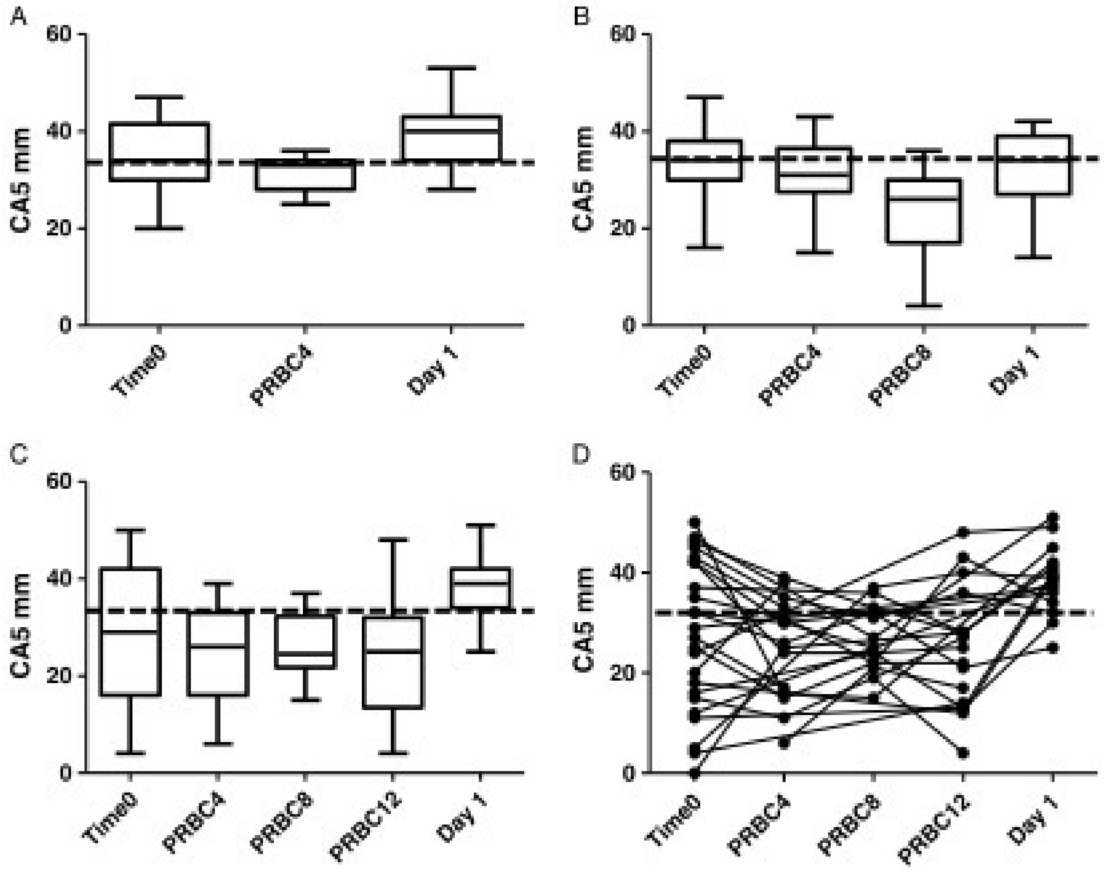

Figure 2. Change in CA5 (mm) during bleeding episode in coagulopathic patients (CA5 ≤ 35 mm) stratified by transfusion requirements. *Dotted line* is diagnostic threshold for ATC (CA5 ≤ 35 mm). *A*, Patients receiving 4 U to 7 U of PRBC. Time 0: CA5, 35 mm versus Day 1: CA5, 39 mm ($p < 0.05$). *B*, Patients receiving 8 U to 11 U of PRBC. Time 0: CA5, 33 mm versus Day 1: CA5, 32 mm ($p = 0.78$). *C*, Patients receiving 12 U or more PRBCs. Time 0: CA5, 27 mm versus Day 1: CA5, 39 mm ($p < 0.05$). *D*, Individual response in all patients receiving four or more PRBC units.

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Christine Gaarder, MD, PhD, Ross Davenport, MD, PhD,
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performance improvement

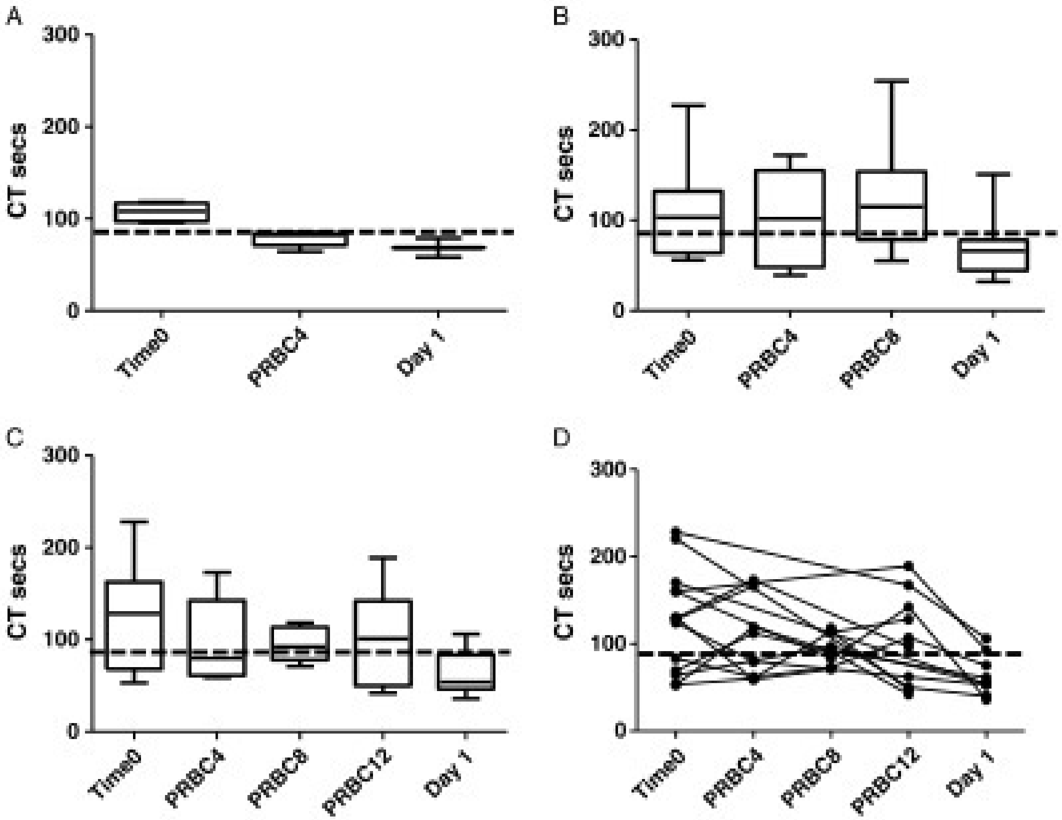

Figure 4. Change in CT (seconds) during bleeding episode in coagulopathic patients (CT > 94 seconds) stratified by transfusion requirements. *Dotted line* is diagnostic threshold for ATC (CT > 94 seconds). *A*, Patients receiving 4 U to 7 U of PRBC. Time 0: CT, 108 seconds versus Day 1: CT, 69 seconds ($p < 0.05$). *B*, Patients receiving 8 U to 11 U of PRBC. Time 0: CT, 107 seconds versus Day 1: CT, 69 seconds ($p = 0.07$). *C*, Patients receiving 12 U or more PRBCs. Time 0: CT, 126 seconds versus Day 1: CT, 63 seconds ($p < 0.05$). *D*, Individual response in all patients receiving four or more PRBC units.

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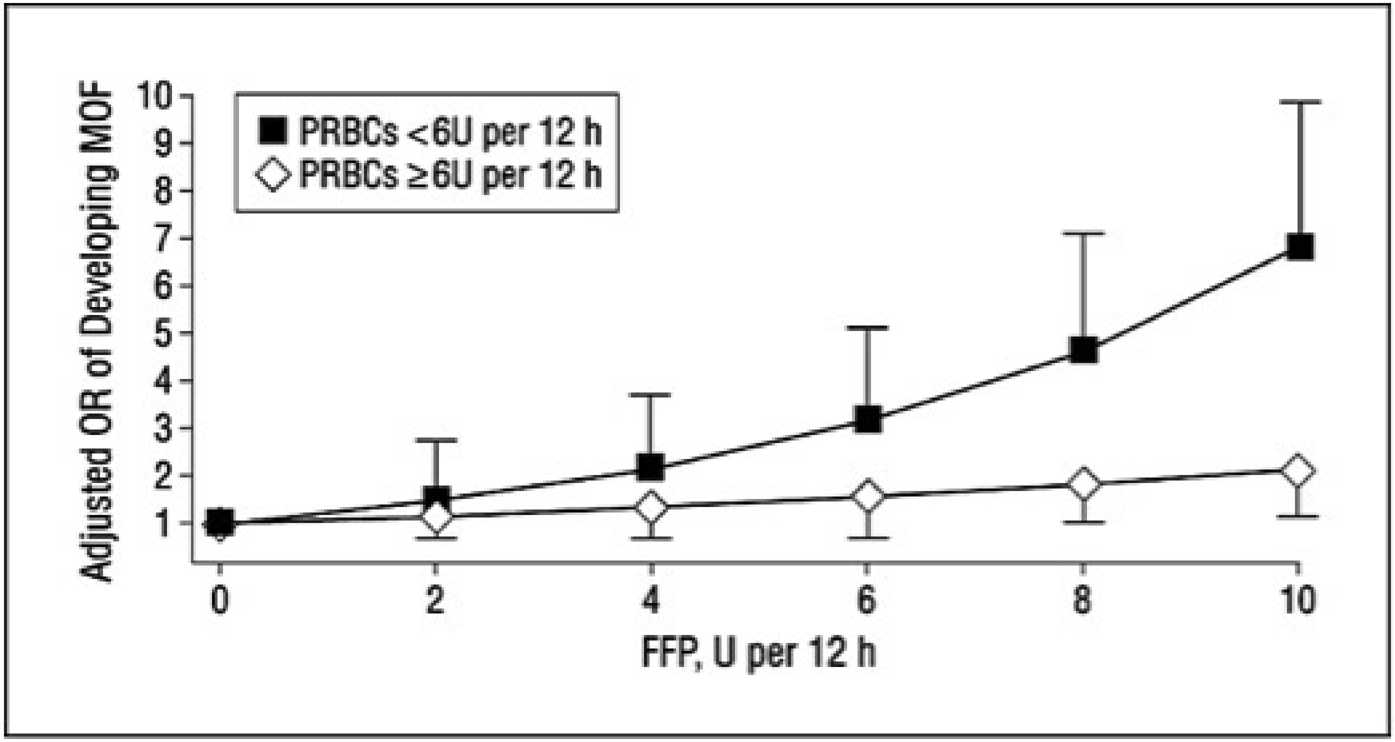
on behalf of the International Trauma Research Network (INTRN), *London, United Kingdom*

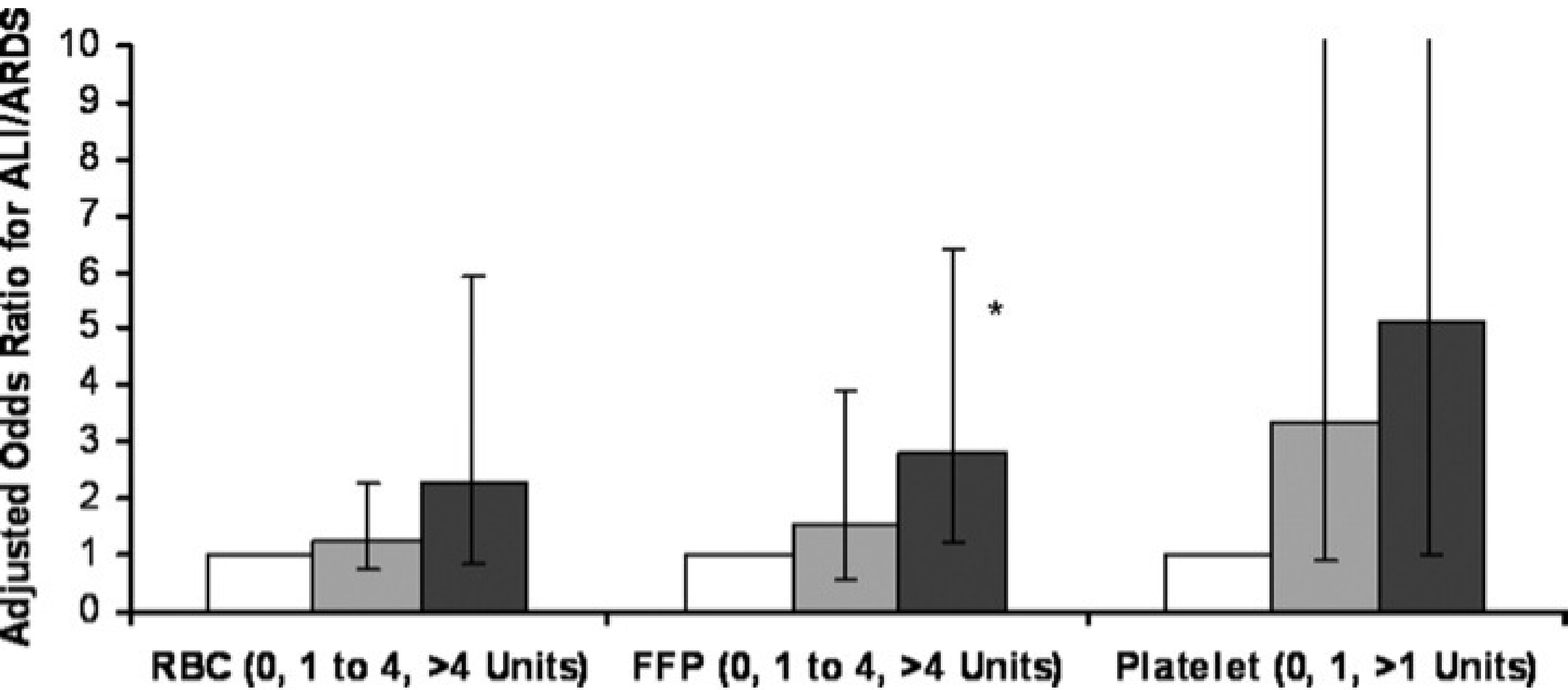
Multisystem failure and transfusion

CONCORD performance improvement



Johnson, J. L. et al. Arch Surg 2010;145:973-977.

ARCHIVES OF SURGERY


Adjusted Odds Ratio for ALI/ARDS
0
1
2
3
4
5
6
7
8
9
10
*
RBC (0, 1 to 4, >4 Units)
FFP (0, 1 to 4, >4 Units)
Platelet (0, 1, >1 Units)

Fresh Frozen Plasma Is Independently Associated With a Higher Risk of Multiple Organ Failure and Acute Respiratory Distress Syndrome

Gregory A. Watson, MD, Jason L. Sperry, MD, MPH, Matthew R. Rosengart, MD, MPH, Joseph P. Minei, MD, Brian G. Harbrecht, MD, Ernest E. Moore, MD, Joseph Cuschieri, MD, Ronald V. Maier, MD, Timothy R. Billiar, MD, and Andrew B. Peitzman, MD, The Inflammation and the Host Response to Injury Investigators

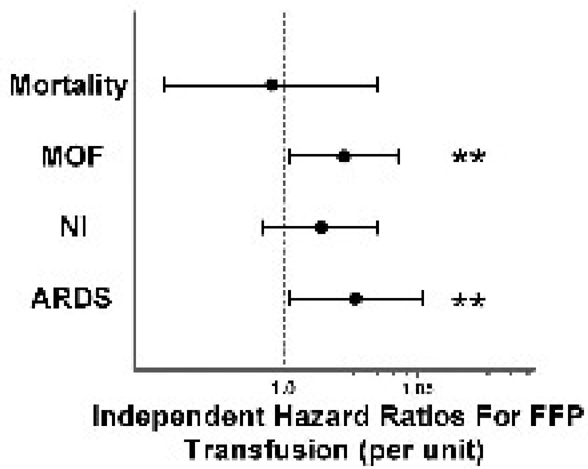


Figure 1. Independent outcome risks attributable to FFP transfusion (per unit).

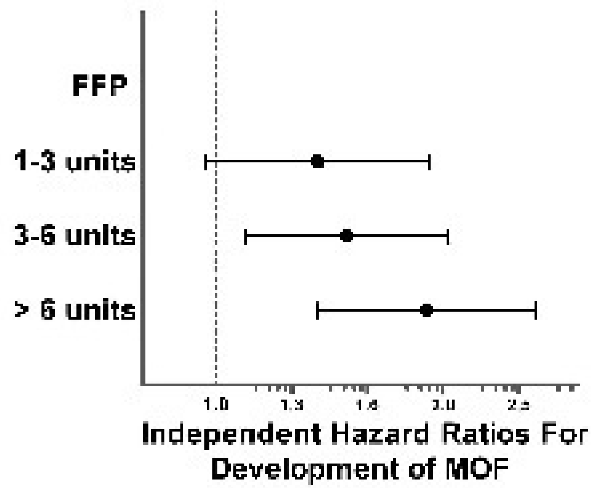


Figure 3. Independent MOF risk attributable to FFP transfusion (categorized by quartiles).

The Journal of TRAUMA® *Injury, Infection, and Critical Care* • Volume 67, Number 2, August 2009

Transfusion of fresh frozen plasma in critically ill surgical patients is associated with an increased risk of infection

Babak Sarani, MD, FACS; W. Jonathan Dunkman, BA; Laura Dean; Seema Sonnad, PhD;
Jeffrey I. Rohrbach, RN, MSN; Vicente H. Gracias, MD, FACS

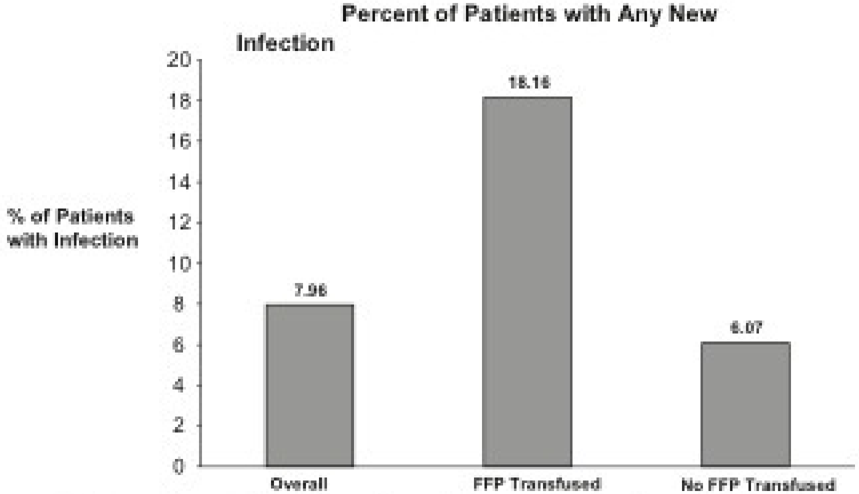
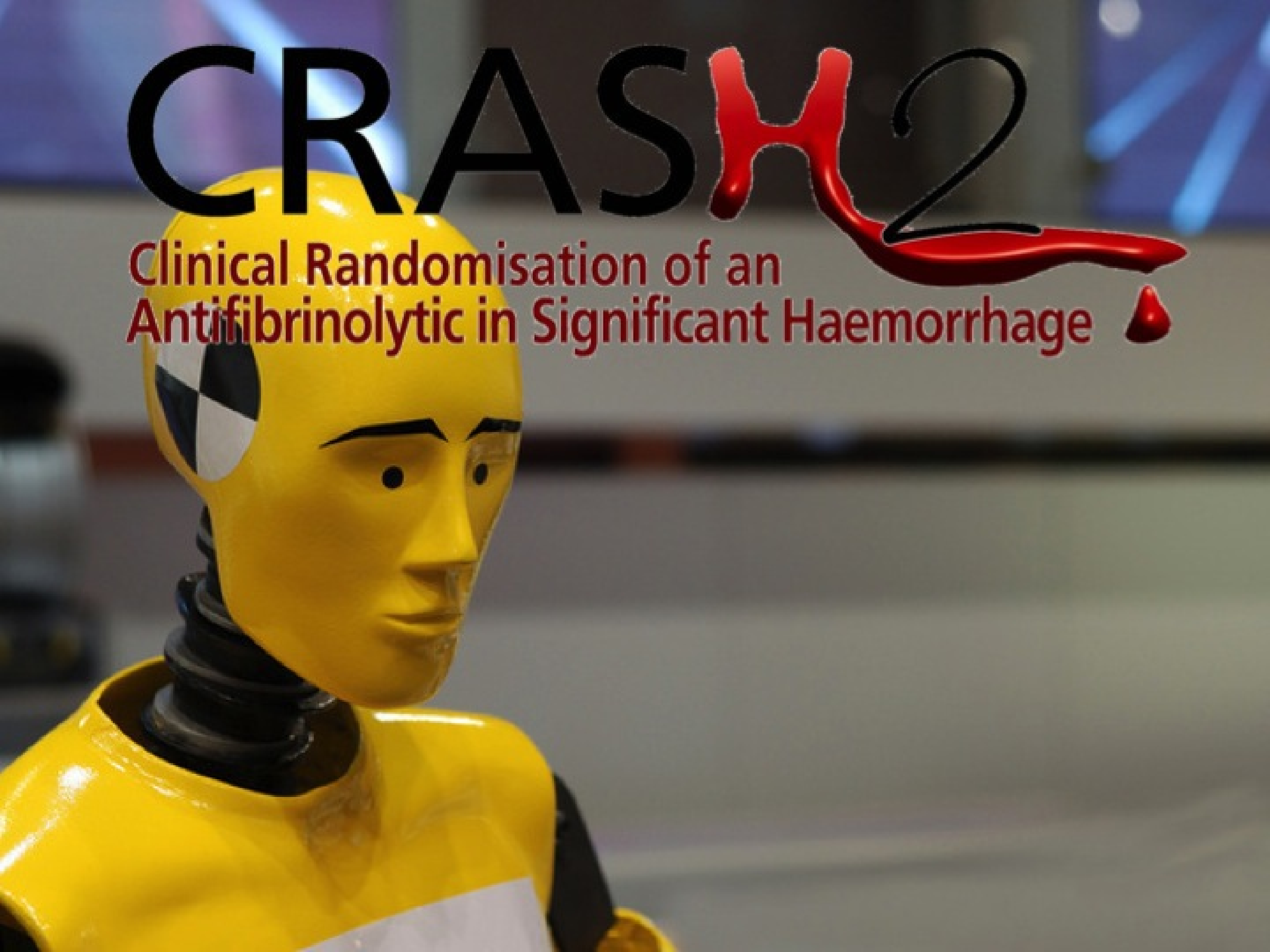


Figure 1. Patients who received fresh frozen plasma (*FFP*) were significantly more likely to develop an infection than those who did not receive FFP in a univariate model ($p < .01$).


CRASH2
Clinical Randomisation of an
Antifibrinolytic in Significant Haemorrhage

CONCORD

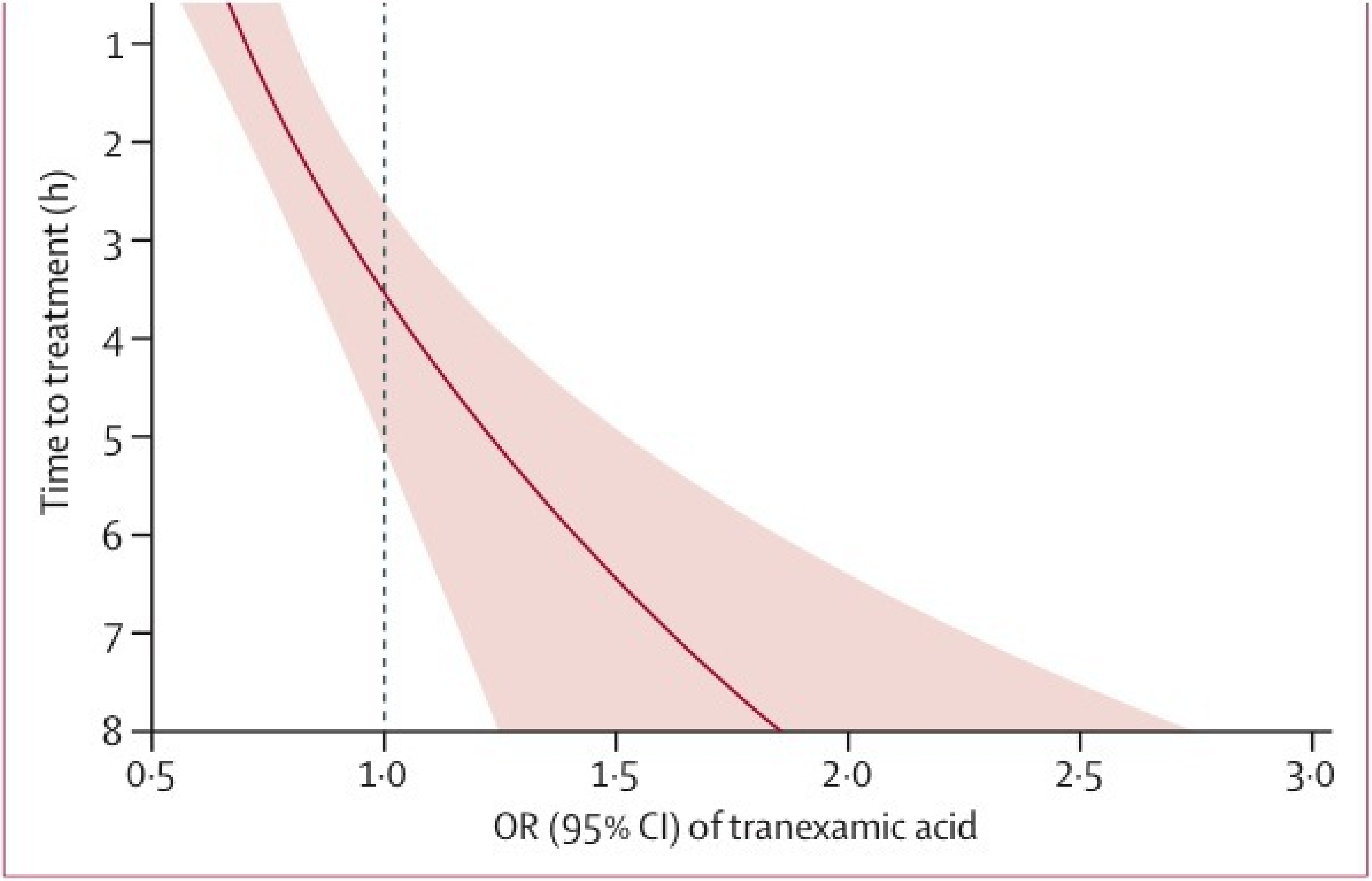
About 2 %

	Tranexamic acid (n=10 060)	Placebo (n=10 067)	RR (95% CI)	p value
Vascular occlusive events*				
Any vascular occlusive event	168 (1·7%)	201 (2·0%)	0·84 (0·68–1·02)	0·084
Myocardial infarction	35 (0·3%)	55 (0·5%)	0·64 (0·42–0·97)	0·035
Stroke	57 (0·6%)	66 (0·7%)	0·86 (0·61–1·23)	0·42
Pulmonary embolism	72 (0·7%)	71 (0·7%)	1·01 (0·73–1·41)	0·93
Deep vein thrombosis	40 (0·4%)	41 (0·4%)	0·98 (0·63–1·51)	0·91
Need for transfusion and surgery				
Blood product transfused	5067 (50·4%)	5160 (51·3%)	0·98 (0·96–1·01)	0·21
Any surgery	4814 (47·9%)	4836 (48·0%)	1·00 (0·97–1·03)	0·79
Neurosurgery	1040 (10·3%)	1059 (10·5%)	0·98 (0·91–1·07)	0·67
Chest surgery	1518 (15·1%)	1525 (15·1%)	1·00 (0·93–1·06)	0·91
Abdominal surgery	2487 (24·7%)	2555 (25·4%)	0·97 (0·93–1·02)	0·28
Pelvic surgery	683 (6·8%)	648 (6·4%)	1·05 (0·95–1·17)	0·31
Median (IQR) units of blood product transfused†	3 (2–6)	3 (2–6)	..	0·59‡
Dependency				
No symptoms	1483 (14·7%)	1334 (13·3%)	1·11 (1·04–1·19)	0·0023
Minor symptoms	3054 (30·4%)	3061 (30·4%)	1·00 (0·96–1·04)	0·94
Some restriction	2016 (20·0%)	2069 (20·6%)	0·97 (0·92–1·03)	0·36
Dependent (not requiring constant attention)	1294 (12·9%)	1273 (12·6%)	1·02 (0·95–1·09)	0·63
Fully dependent	696 (6·9%)	676 (6·7%)	1·03 (0·93–1·14)	0·57
Alive (disability status not known)	54 (0·5%)	41 (0·4%)		
Dead	1463 (14·5%)	1613 (16·0%)	0·91 (0·85–0·97)	0·0035

Data are number (%), unless otherwise indicated. Counts are for numbers of patients with at least one such event. RR=relative risk. *Includes both fatal and non-fatal events. †Transfused patients only. ‡Analysis used logarithmic transformation of mean units of blood products transfused.

Table 3: **Vascular occlusive events, need for transfusion and surgery, and level of dependency**

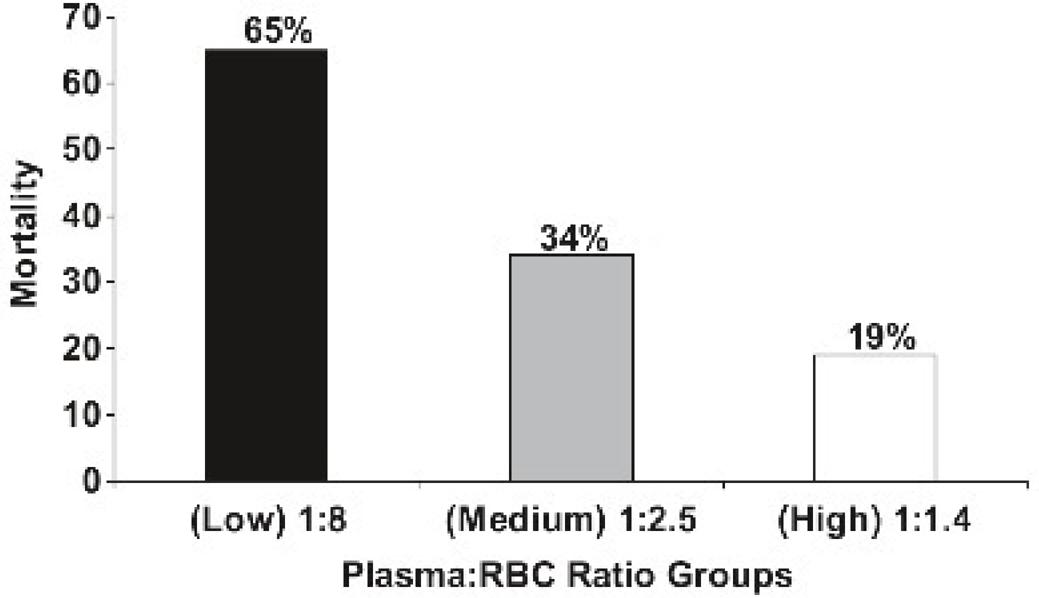
Give TXA before 3 hrs after injury



The Journal of TRAUMA® Injury, Infection, and Critical Care

The Ratio of Blood Products Transfused Affects Mortality in Patients Receiving Massive Transfusions at a Combat Support Hospital

Matthew A. Borgman, MD, Philip C. Spinella, MD, Jeremy G. Perkins, MD, Kurt W. Grathwohl, MD, Thomas Repine, MD, Alec C. Beekley, MD, James Sebesta, MD, Donald Jenkins, MD, Charles E. Wade, PhD, and John B. Holcomb, MD

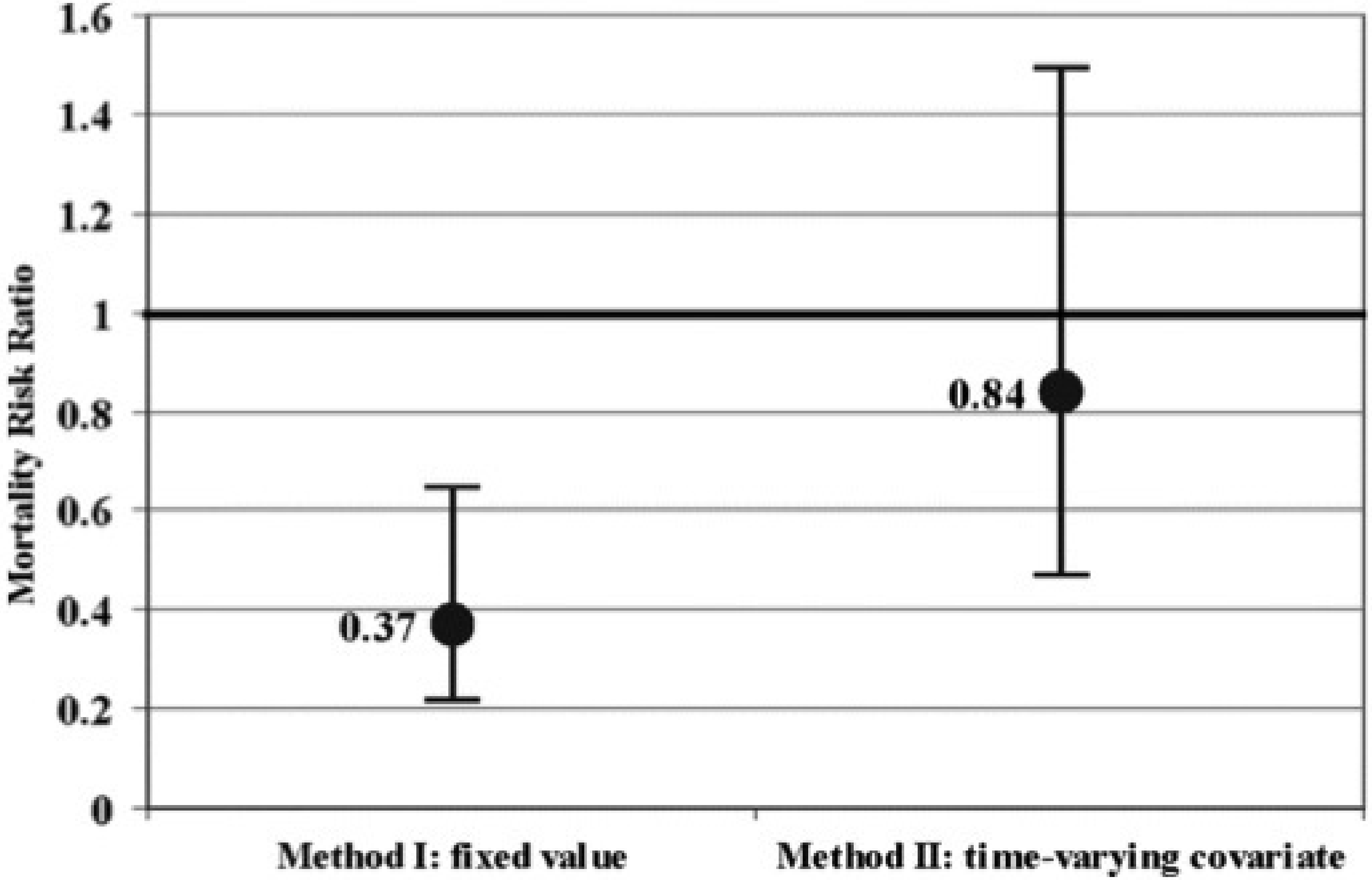


J Trauma. 2007;63:805–813.

CONCORD performance improvement

Do you survive because of early plasma, or because you survive you get plasma?

It you look at when plasma was available the advantage of 1:1:1 disappears



Snyder: J Trauma, Volume 66(2).February 2009.358-364

Review Articles

Liberal Versus Restricted Fluid Resuscitation Strategies in Trauma Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials and Observational Studies*

Chih-Hung Wang, MD[1]; Wen-Han Hsieh, MS[2]; Hao-Chang Chou, MD[1]; Yu-Sheng Huang, MD[1]; Jen-Hsiang Shen, MS[3]; Yee Hui Yeo, MS[4]; Huai-En Chang, MS[5]; Shyr-Chyr Chen, MD, MBA[1]; Chien-Chang Lee, MD, MSc[6,7]

Restictive Fluids are the key

CONCORD performance improvement

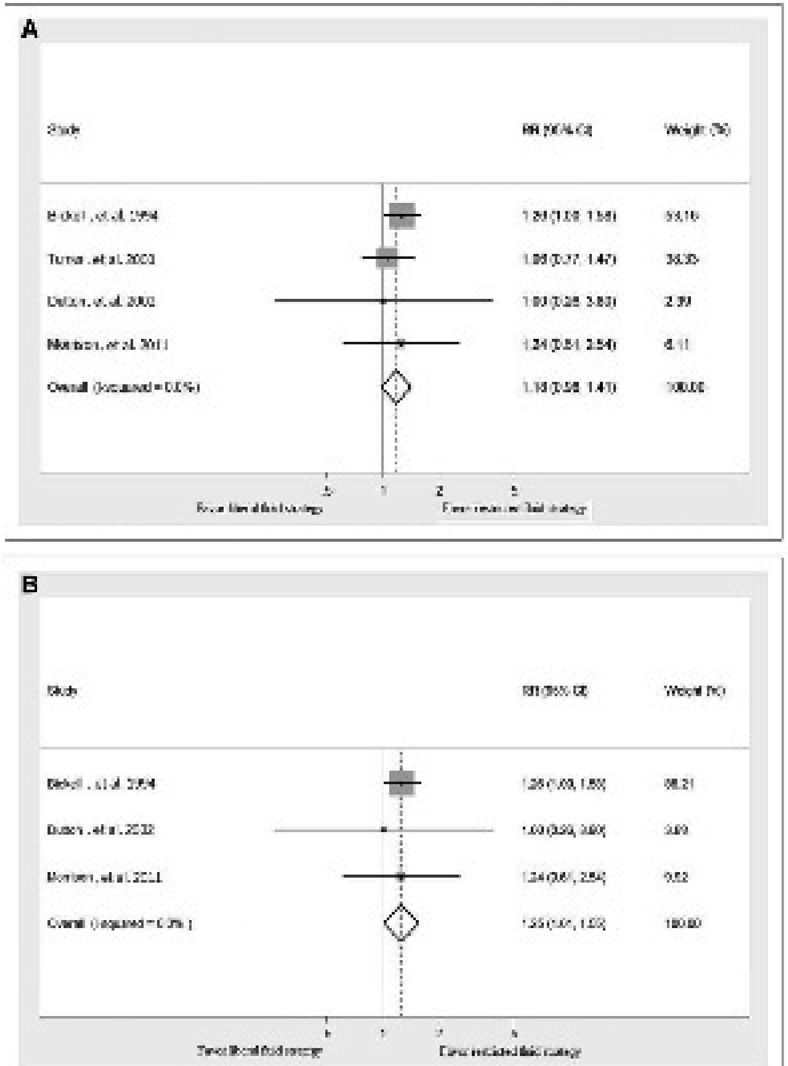


Figure 2. A, Forest plot for randomized controlled trials. Comparison of the effects of liberal versus restricted fluid resuscitation on overall mortality, expressed as risk ratio (RR) and 95% CI. **B**, Forest plot for randomized controlled trials after exclusion of the trial by Turner et al (25). Comparison of the effects of liberal versus restricted fluid resuscitation on overall mortality, expressed as RR and 95% CI.

So if it isn't the blood products who are saving the patients what is it?

Everything revolves the ultimate good guy- the surgeon

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