Colloïdes-Cristalloïdes: le point en 2005

Frédérique Schortgen
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The next generation in shock resuscitation

Frederick A Moore, Bruce A McKinley, Ernest E Moore

THE LANCET • Vol 363 • June 12, 2004 • www.thelancet.com

Era	Focus	Resuscitation	Outcome
World War I	Wound toxins	None	Early death
World War II, Korean war	Intravascular repletion	Colloids, blood	↑ Early survival ARF → death
Vietnam war	Intravascular and extracellular fluid repletion	Crystalloids, banked blood	↑ Early survival ↓ ARF ARDS → death
1970s–80s	ICUs, organ failure, metabolic support	PA catheters, endpoints of resuscitation	↓ ARF ARDS ? MOF ↑ MOF deaths
Mid-1980s to present	Trauma centres, trauma systems	Rapid triage, damage control, shock and trauma ICUs	↑ Early survival ↑ ARDS/MOF ↓ ARDS/MOF deaths

ARF=acute renal failure. ARDS=adult respiratory distress syndrome. MOF=multiple organ failure.

Table 1: **Improvements in resuscitation and the changing epidemiology of trauma deaths over time**

Intensive Care Med (2004) 30:2222–2229
DOI 10.1007/s00134-004-2415-1

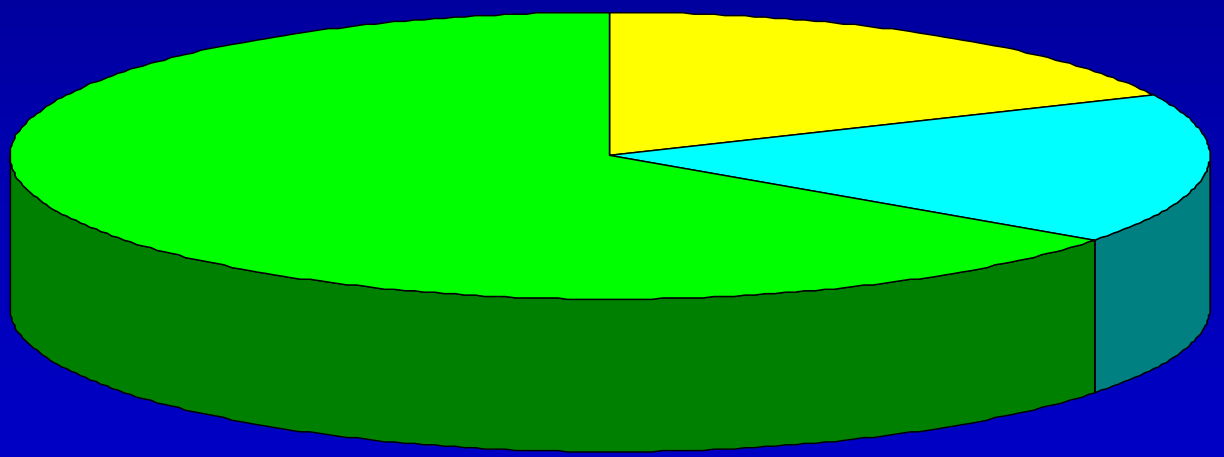
ORIGINAL

Frédérique Schortgen
Nicolas Deye
Laurent Brochard
for the CRYCO Study Group

Preferred plasma volume expanders for critically ill patients: results of an international survey

Colloids
n=173 (18%)

Colloids with Crystalloids
n=312 (65%)



Crystalloids
n=92 (17%)

Justifications of plasma expander choice: The most frequently cited arguments

Colloid users n=477

1) The rapidity to reverse intravascular volume loss	96%
2) The choice of volume expander is strongly dependent on the clinical situation	81%
3) The long lasting volume-expansion effect	66%
4) The reduced risk of pulmonary oedema	49%

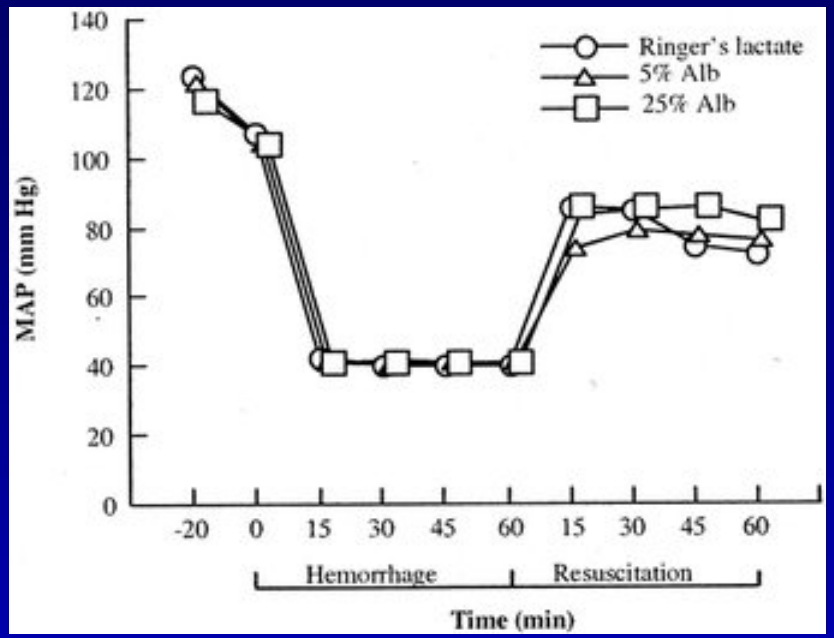
Colloid nonusers n=99

1) The low risk of adverse events	92%
2) Crystalloids are as effective as colloids if the volume administered is sufficient	90%
3) The low cost	86%

Pourquoi utiliser un colloïde?

Efficacité pour un moindre volume

Haemorrhagic shock



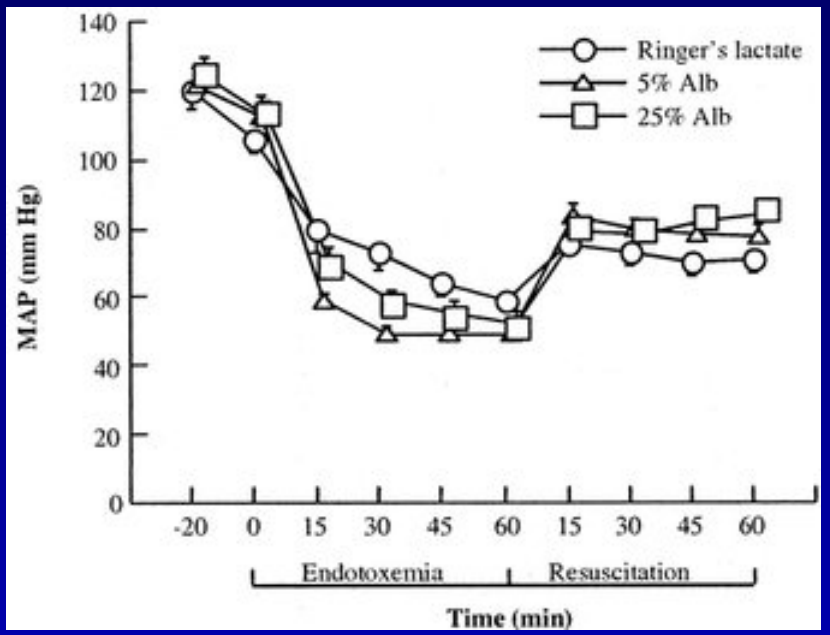
Amount of fluid required

5% albumin 11.6 ± 0.7 mL

25% albumin 5.1 ± 0.3 mL

RL group 50.2 ± 2.7 mL

Endotoxic shock



Amount of fluid required

5% albumin 18.6 ± 2.3 mL

25% albumin 7.6 ± 1.4 mL

RL group 63.5 ± 6.0 mL

Zhang et al. Crit. Care Med. 2003

	Indication	objective	Fluids	Colloids : Crystalloids
Rackow 1983	Septic shock	250 ml/15 mins until PAOP 15 mmHg	NS Hetastarch 5% alb	**1 : 1.8 to 2.4**
Haupt 1982	Hypovolemic shock	250 ml/15min until PAOP 10-15 mmHg	NS Hetastarch 5% alb	**1 : 1.4 to 2**
Moss 1981	Trauma+choc	PAM>80 mmHg	RL Alb 5%	**1 : 1**
Shires 1982	Vascular surgery	PAOP maintenance	RL Plasma	**1 : 1.9**
Virgilio 1979	Vascular surgery	PAOP and CI maintenance	RL Alb 5%	**1 : 1.7**
Dawidson 1991	Vascular surgery	PAOP maintenance	RL Dextran 60	**1 : 2.9**
Hankeln 1989	Critically ill patients	PAPO 16-18	RL HES 10%	**1 : 1.6**
Ueyama 1999	Surgery	Increase in Blood Volume: 500 ml	RL Pentastarch	**1 : 3**

Intensive Care Med (2004) 30:1356–1360
DOI 10.1007/s00134-004-2278-5

ORIGINAL

Zsolt Molnár
András Mikor
Tamás Leiner
Tamás Szakmány

Fluid resuscitation with colloids of different molecular weight in septic shock

30 hypovolemic septic shock (ITBVI<850 ml/m²)

250 ml bolus
6% HES 200 kDa/0.62

ITBVI>900 ml/m²

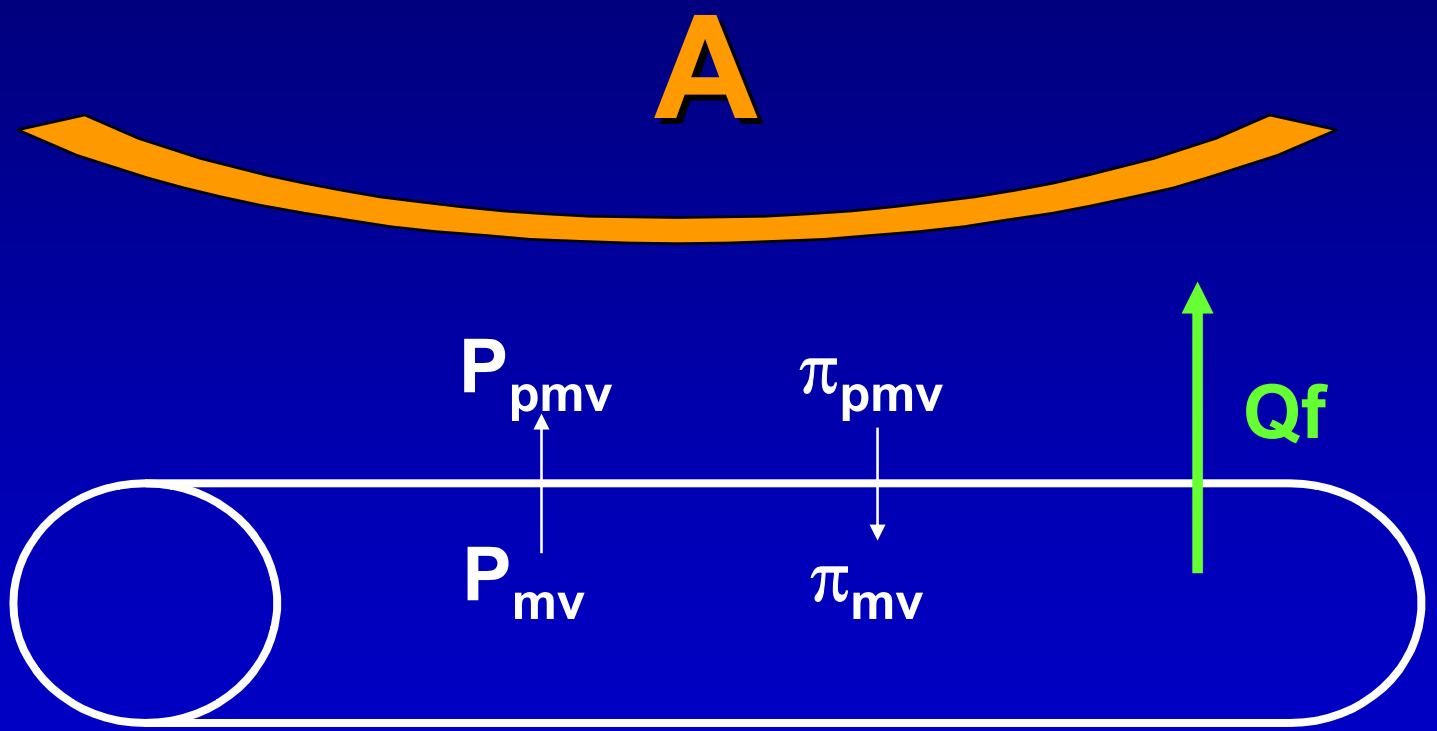
750±274 ml

250 ml bolus
4% Gelatine 35 kDa

ITBVI>900 ml/m²

714±254 ml

Pourquoi utiliser un colloïde?
Pour prévenir l'oedème pulmonaire

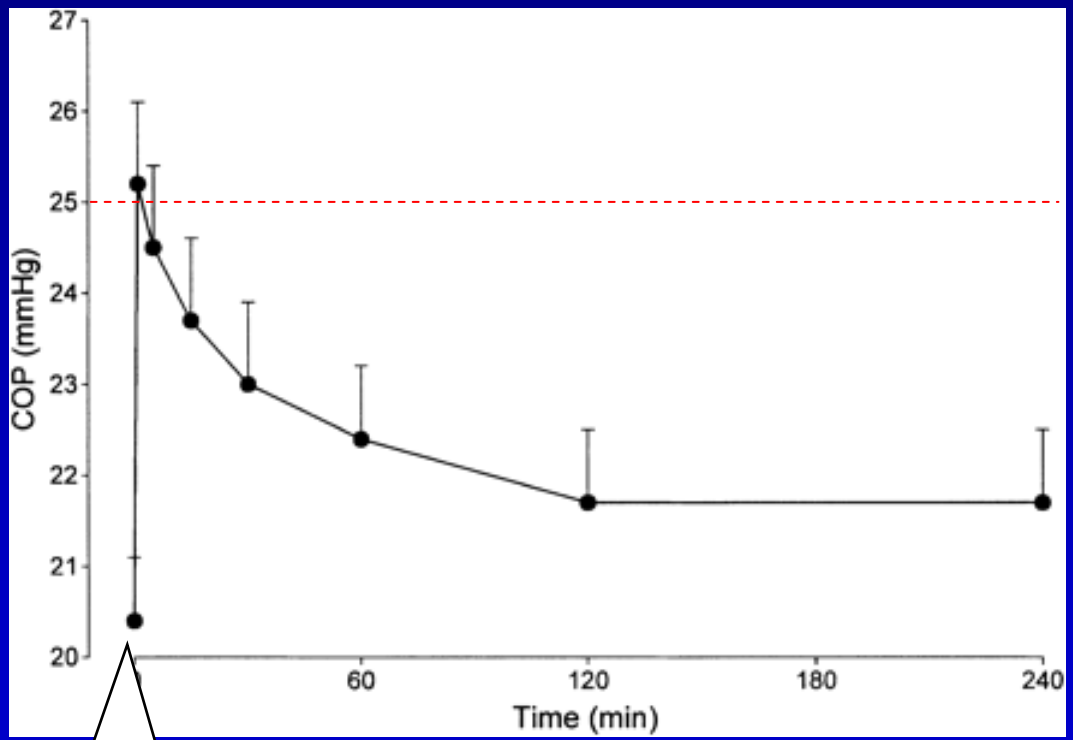


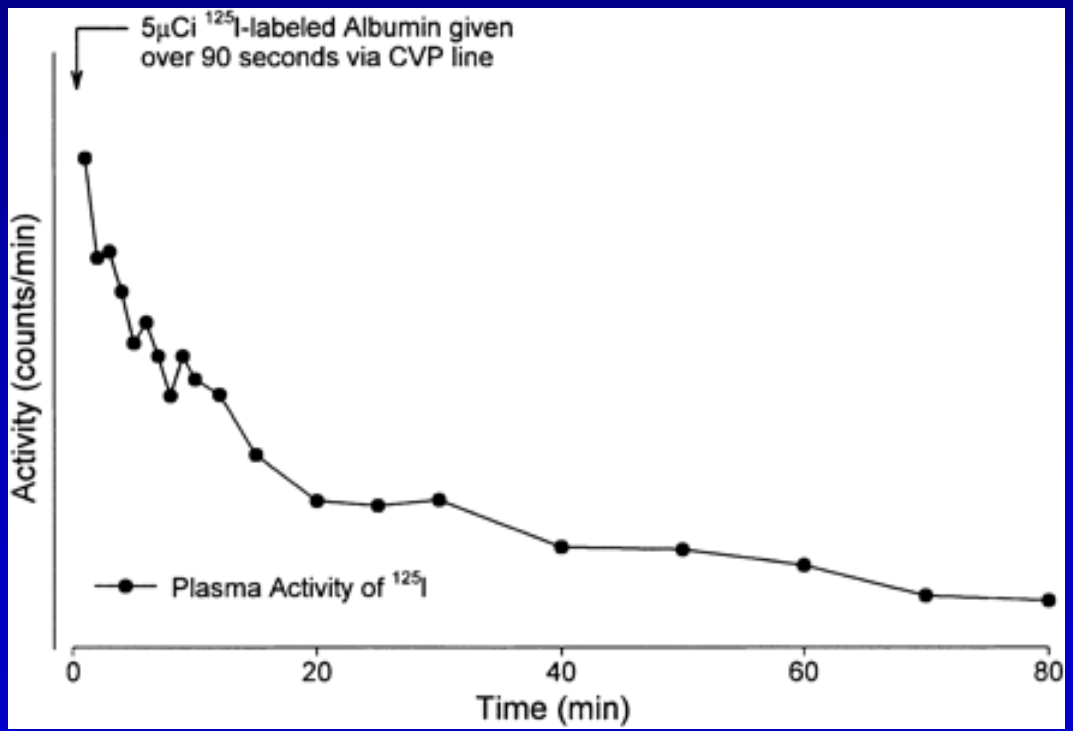
$$Qf = Kf\,[(P_{mv}-P_{pmv}) - \sigma(\pi_{mv}-\pi_{pmv})]$$

Journal of Applied Physiology

Effects of albumin supplementation on microvascular permeability in septic patients

Michael P. Margarson and Neil C. Soni Vol. 92, Issue 5, 2139-2145, May 2002

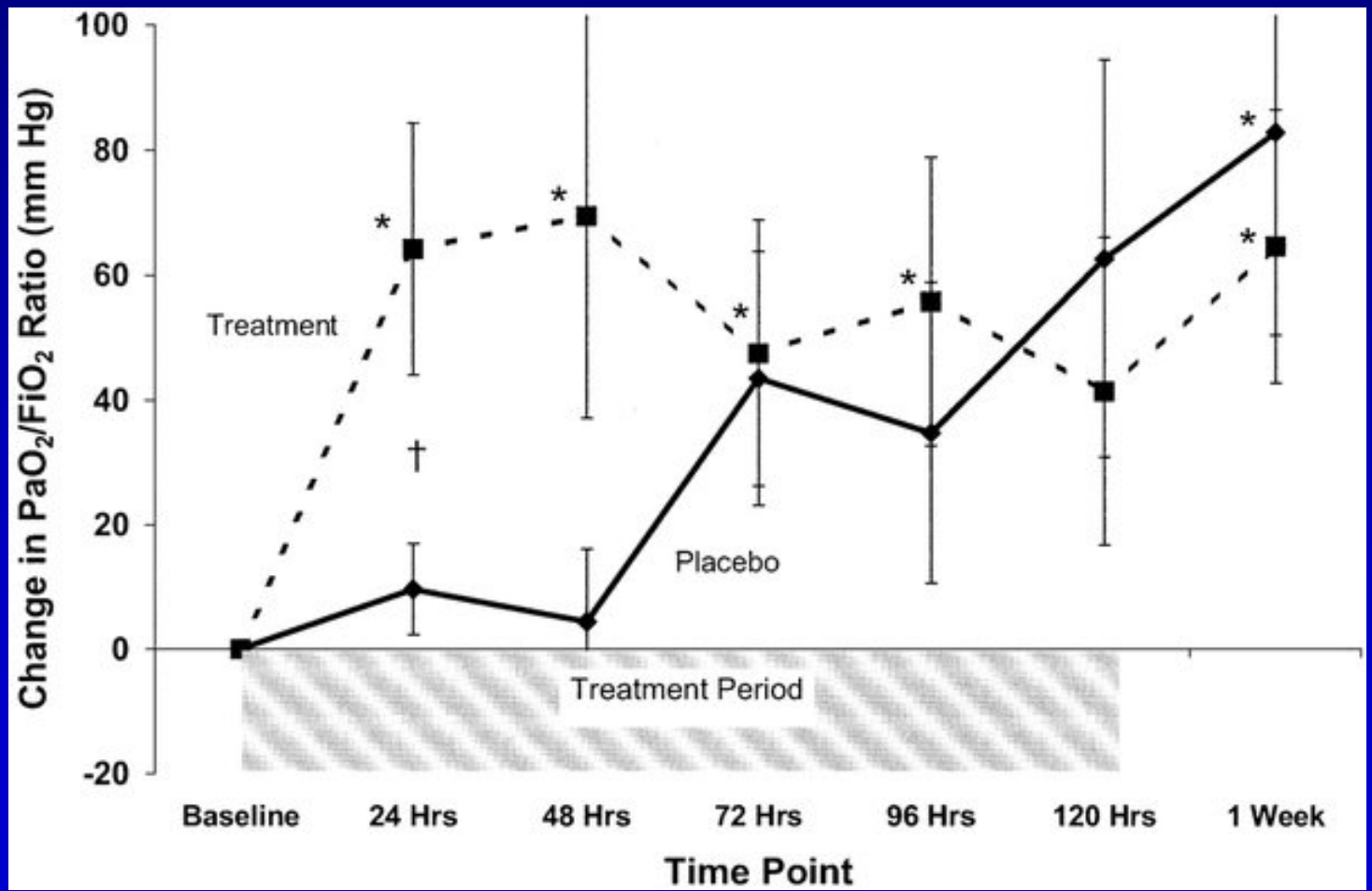




ALB 20%
200 ml (90sec)

Albumin and furosemide therapy in hypoproteinemic patients with acute lung injury

GS Martin Critical Care Medicine 2002; 30(10):2175-2182



- 930 €

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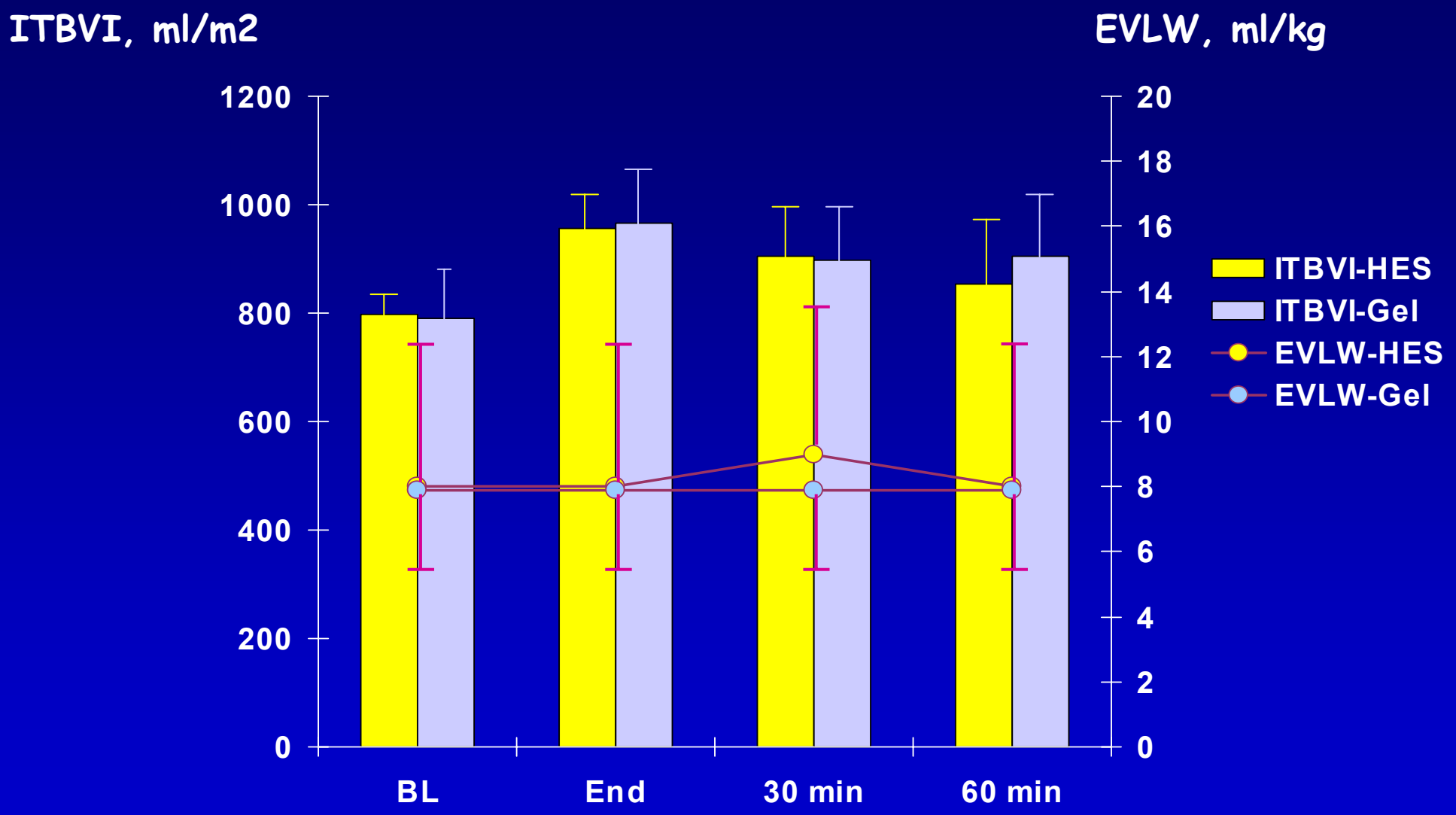


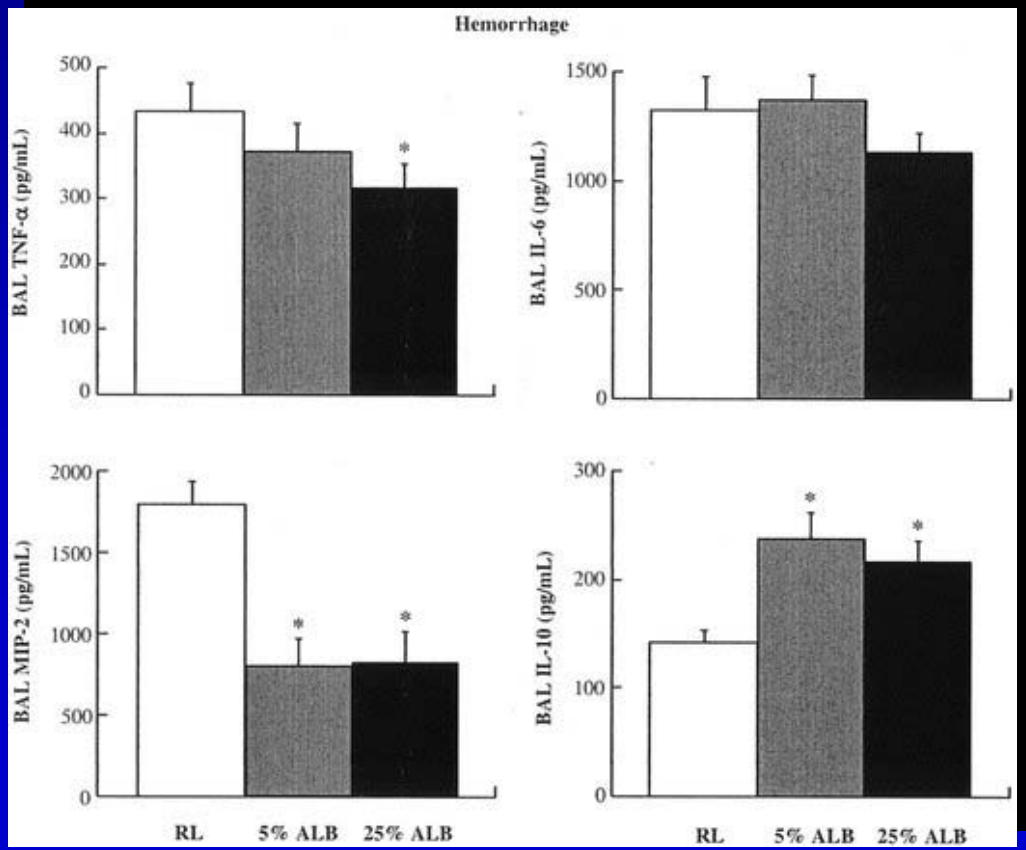
Molnar et al. Intensive Care Med 2004

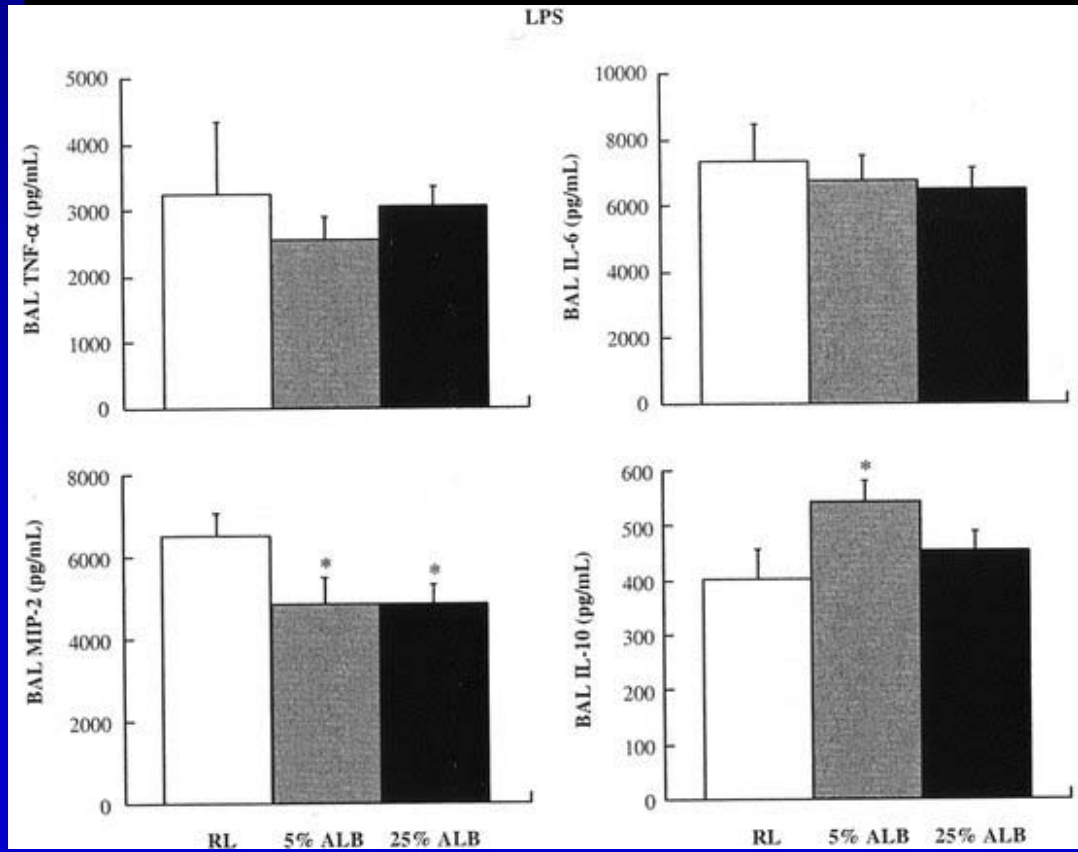
Critical Care Medicine
OFFICIAL JOURNAL OF THE SOCIETY OF CRITICAL CARE MEDICINE

Effects of albumin and Ringer's lactate on production of lung cytokines and hydrogen peroxide after resuscitated hemorrhage and endotoxemia in rats

Haibo Zhang, MD, PhD; Stefanos Voglis, BSc; Chang-Ho Kim, MD; Arthur S. Slutsky, MD 2003; 31(5):1515-1522

Cytokines pulmonaires

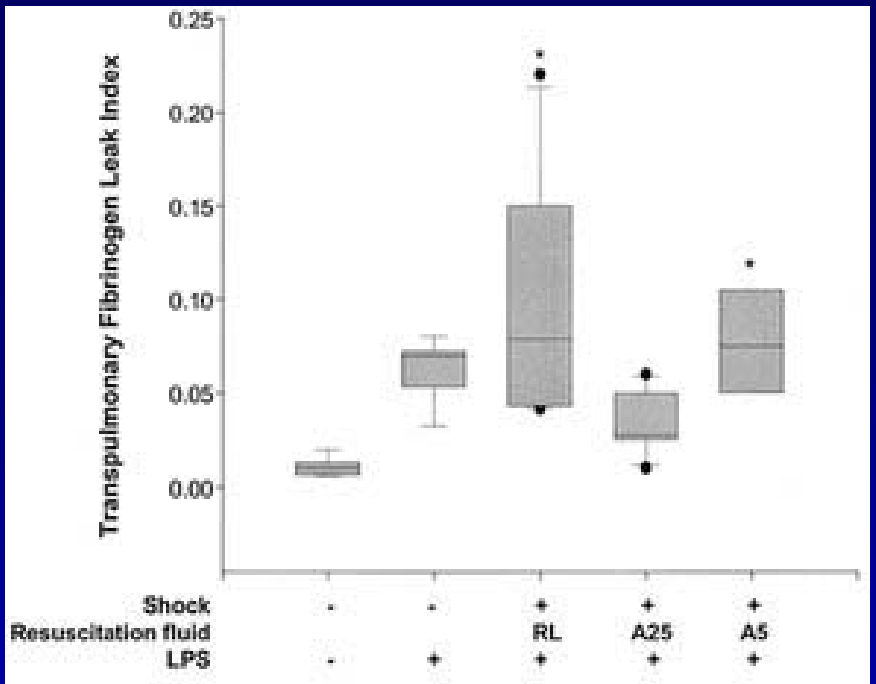


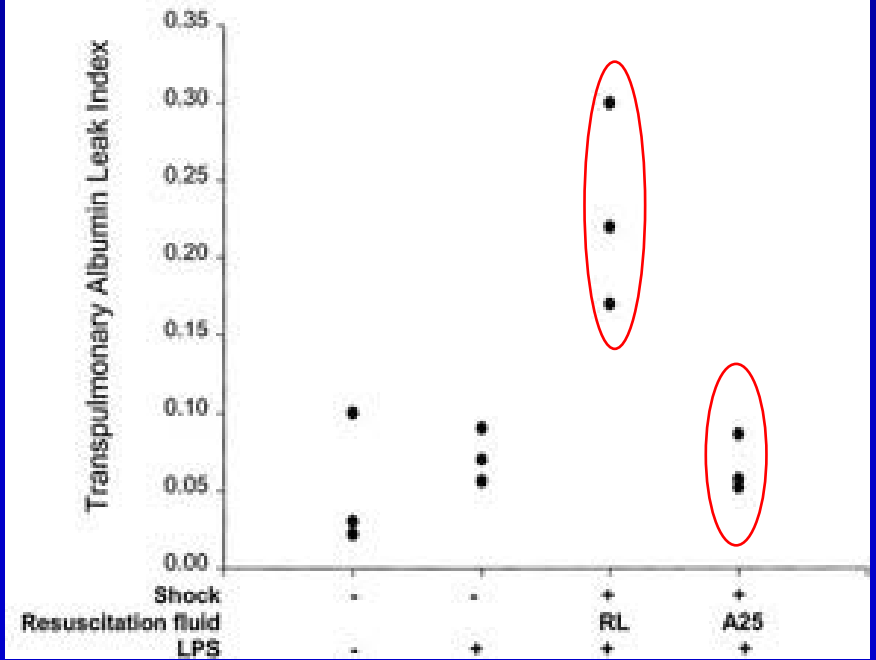


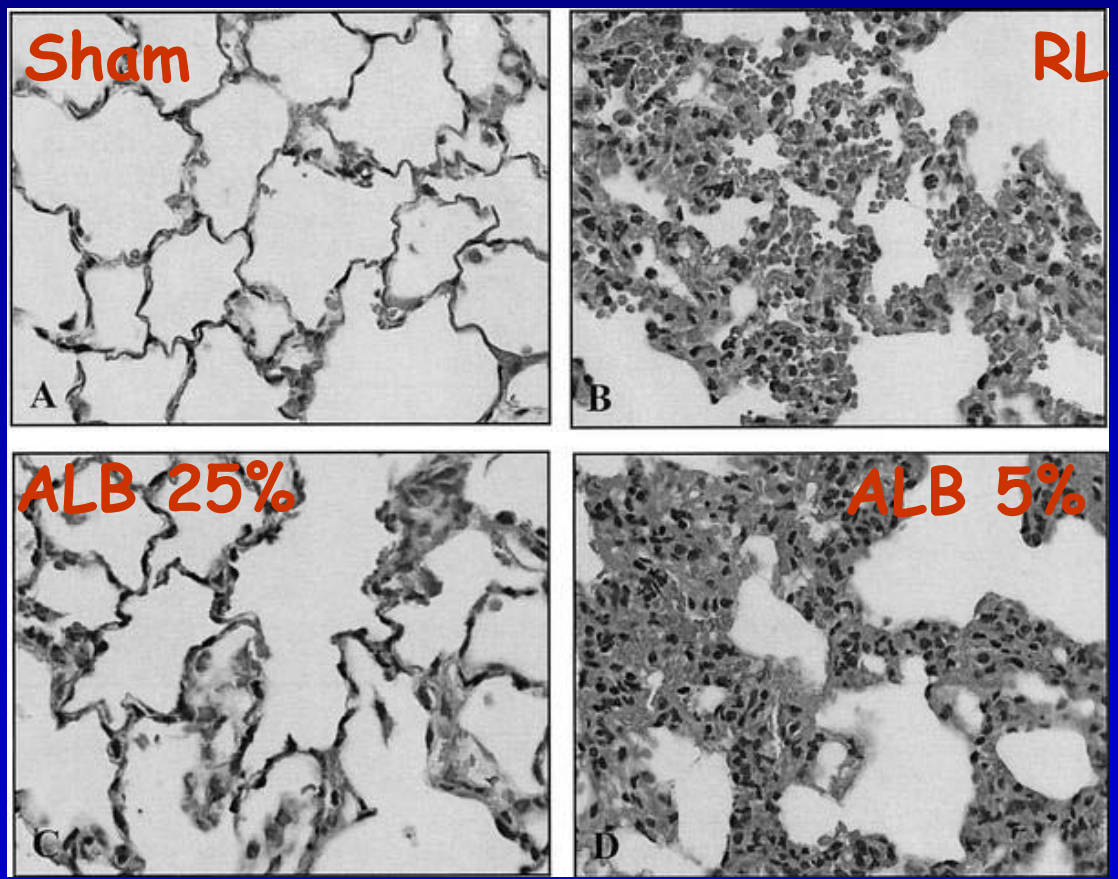
Critical Care Medicine
OFFICIAL JOURNAL OF THE SOCIETY OF CRITICAL CARE MEDICINE

Twenty-five percent albumin prevents lung injury following shock/resuscitation

Kinga A. Powers 2003; 31(9):2355-2363







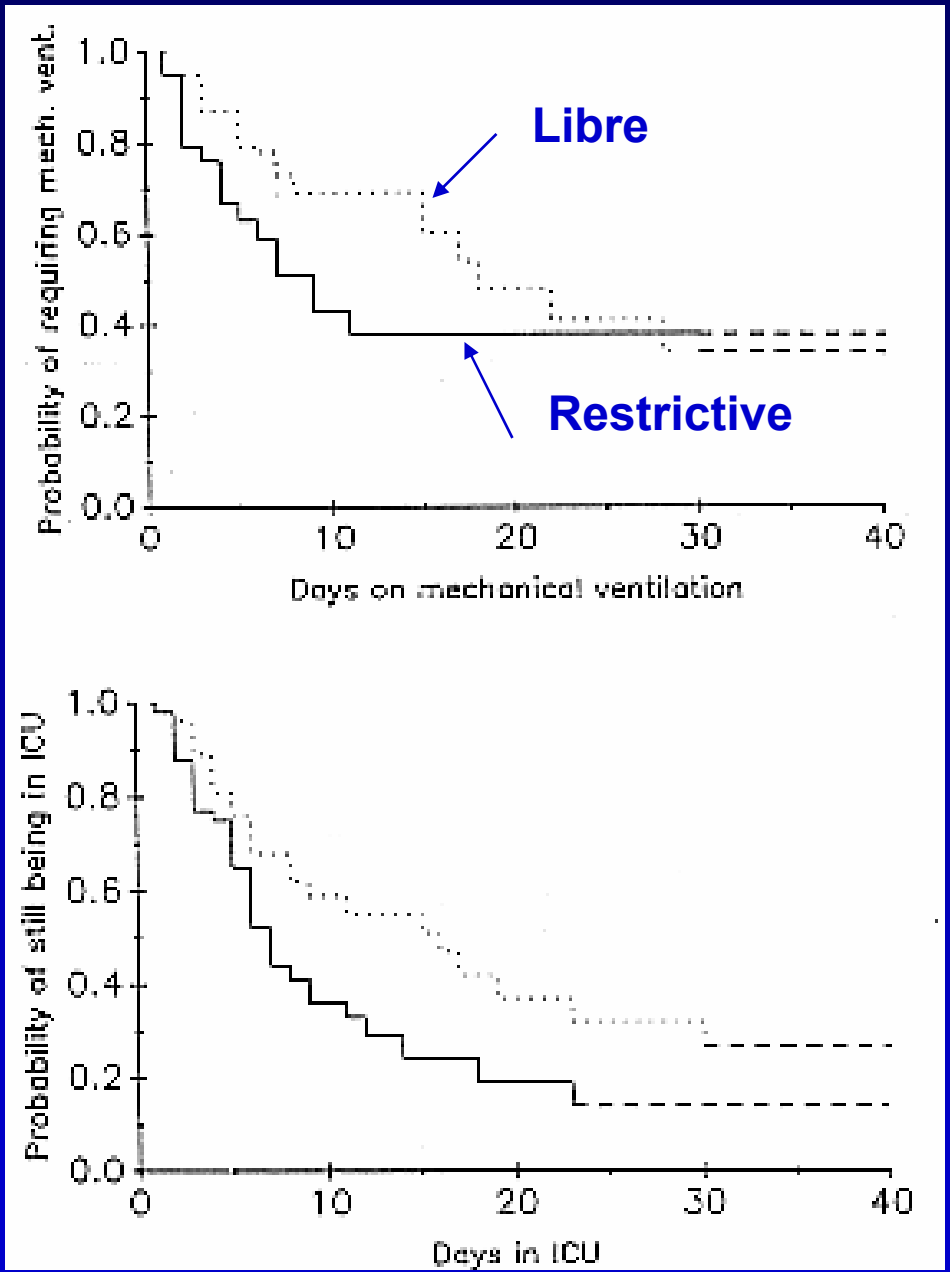
Journal of Applied Physiology

Effects of albumin supplementation on microvascular permeability in septic patients

Michael P. Margarson and Neil C. Soni Vol. 92, Issue 5, 2139-2145, May 2002

Comparison before and after 40-g albumin infusion

	Preinfusion	Postinfusion	*P* value
Albumin, g/l	9.9 ± 3.9	18.3 ± 4.1 (at 30 min)	<0.001
CVP, mmHg	11.2 ± 3.3	13.2 ± 3.6 (at 30 min)	<0.001
TER, %/h	6.6 ± 1.5	6.1 ± 2.2	0.406
$t_{1/2}$ of ^{125}I-albumin min	571 (Median) (95% CI 545-752)	672 (Median) (95% CI 575-918)	0.511



Improved outcome based on fluid management in critically ill patients requiring pulmonary artery catheterization

Mitchell et al. ARRD 1992

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Comparison of Albumin and Saline for Fluid Resuscitation in the Intensive Care Unit

2004;350:2247

The SAFE Study Investigators*

RCT

6997 patients

18 months

16 ICUs

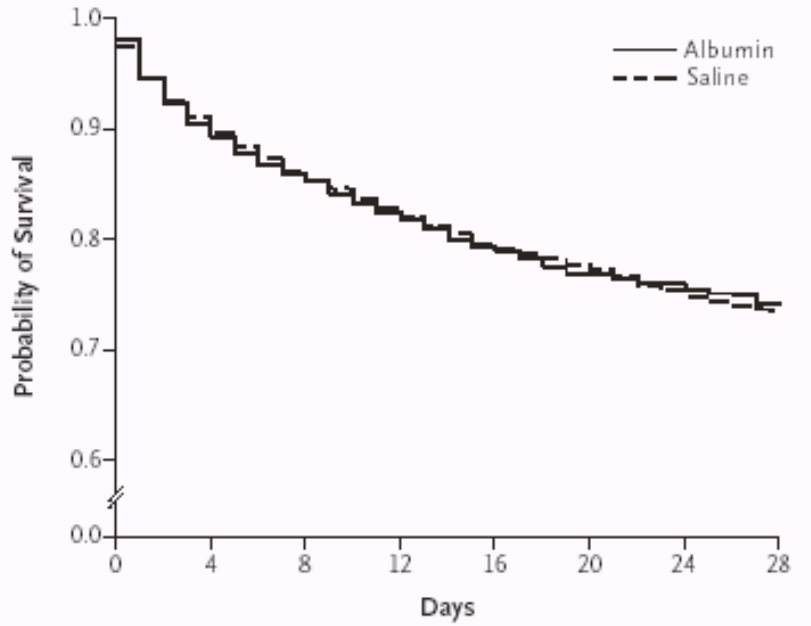


Figure 1. Kaplan–Meier Estimates of the Probability of Survival.
P=0.96 for the comparison between patients assigned to receive albumin and those assigned to receive saline.

The NEW ENGLAND JOURNAL of MEDICINE

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Table 1. Baseline Characteristics of the Patients.*

Characteristic	Albumin Group	Saline Group
Age — yr	58.6±19.1	58.5±18.7
Female sex — no. (%)	1424 (40.7)	1376 (39.3)
Reason for admission to ICU — no. (%)		
Surgical	1473 (43.0)	1465 (42.8)
Medical	1955 (57.0)	1958 (57.2)
Predefined subgroups — no. (%)		
Trauma	597 (17.4)	590 (17.2)
Severe sepsis	603 (18.1)	615 (18.4)
Acute respiratory distress syndrome	61 (1.8)	66 (1.9)
APACHE II score†	18.7±7.9	19.0±8.0
Physiological variables		
Heart rate — beats/min	91.4±23.5	92.3±23.5
Mean arterial pressure — mm Hg	77.8±16.4	78.2±16.3
Central venous pressure — mm Hg	9.0±4.7	8.6±4.6‡
Urine output — ml/hr	89.7±132.4	95.0±161.4
Serum albumin — g/liter	27.4±7.8	27.7±7.9
Organ failure— no. (%)§		
No failure	1962 (57.2)	1885 (55.1)
1 organ	1075 (31.4)	1148 (33.5)
2 organs	335 (9.8)	329 (9.6)
3 organs	50 (1.5)	57 (1.7)
4 organs	5 (0.1)	4 (0.1)
5 organs	1 (<0.1)	0
Mechanical ventilation — no. (%)	2186 (63.8)	2217 (64.8)
Renal-replacement therapy — no. (%)	45 (1.3)	41 (1.2)
Albumin in previous 72 hr — no. (%)	127 (3.7)	135 (3.9)

Table 3. Primary and Secondary Outcomes.*

Outcome	Albumin Group	Saline Group	Relative Risk (95% CI)	Absolute Difference (95% CI)	P Value
Status at 28 days — no./total no. (%)					
Dead	726/3473 (20.9)	729/3460 (21.1)	0.99 (0.91 to 1.09)		0.87
Alive in ICU	111/3473 (3.2)	87/3460 (2.5)	1.27 (0.96 to 1.68)		0.09
Alive in hospital†	793/3473 (22.8)	848/3460 (24.5)	0.93 (0.86 to 1.01)		0.10
Length of stay in ICU — days	6.5±6.6	6.2±6.2		0.24 (–0.06 to 0.54)	0.44
Length of stay in hospital — days†	15.3±9.6	15.6±9.6		–0.24 (–0.70 to 0.21)	0.30
Duration of mechanical ventilation — days	4.5±6.1	4.3±5.7		0.19 (–0.08 to 0.47)	0.74
Duration of renal-replacement therapy — days	0.48±2.28	0.39±2.0		0.09 (–0.0 to 0.19)	0.41
New organ failure — no. (%)‡					0.85§
No failure	1397 (52.7)	1424 (53.3)			
1 organ	795 (30.0)	796 (29.8)			
2 organs	369 (13.9)	361 (13.5)			
3 organs	68 (2.6)	75 (2.8)			
4 organs	18 (0.7)	17 (0.6)			
5 organs	2 (0.1)	0			

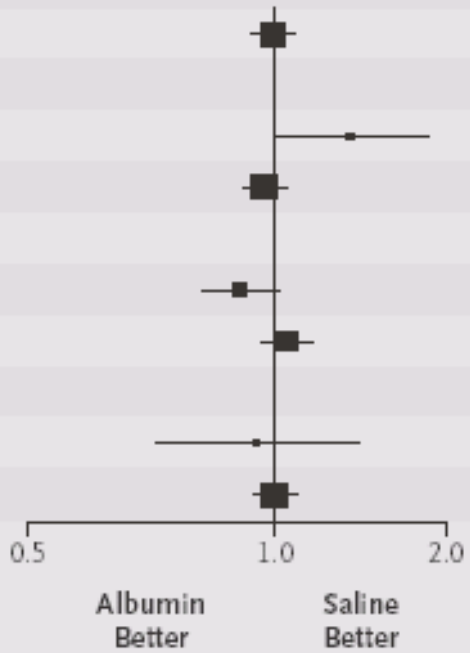
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Comparison of Albumin and Saline for Fluid Resuscitation in the Intensive Care Unit

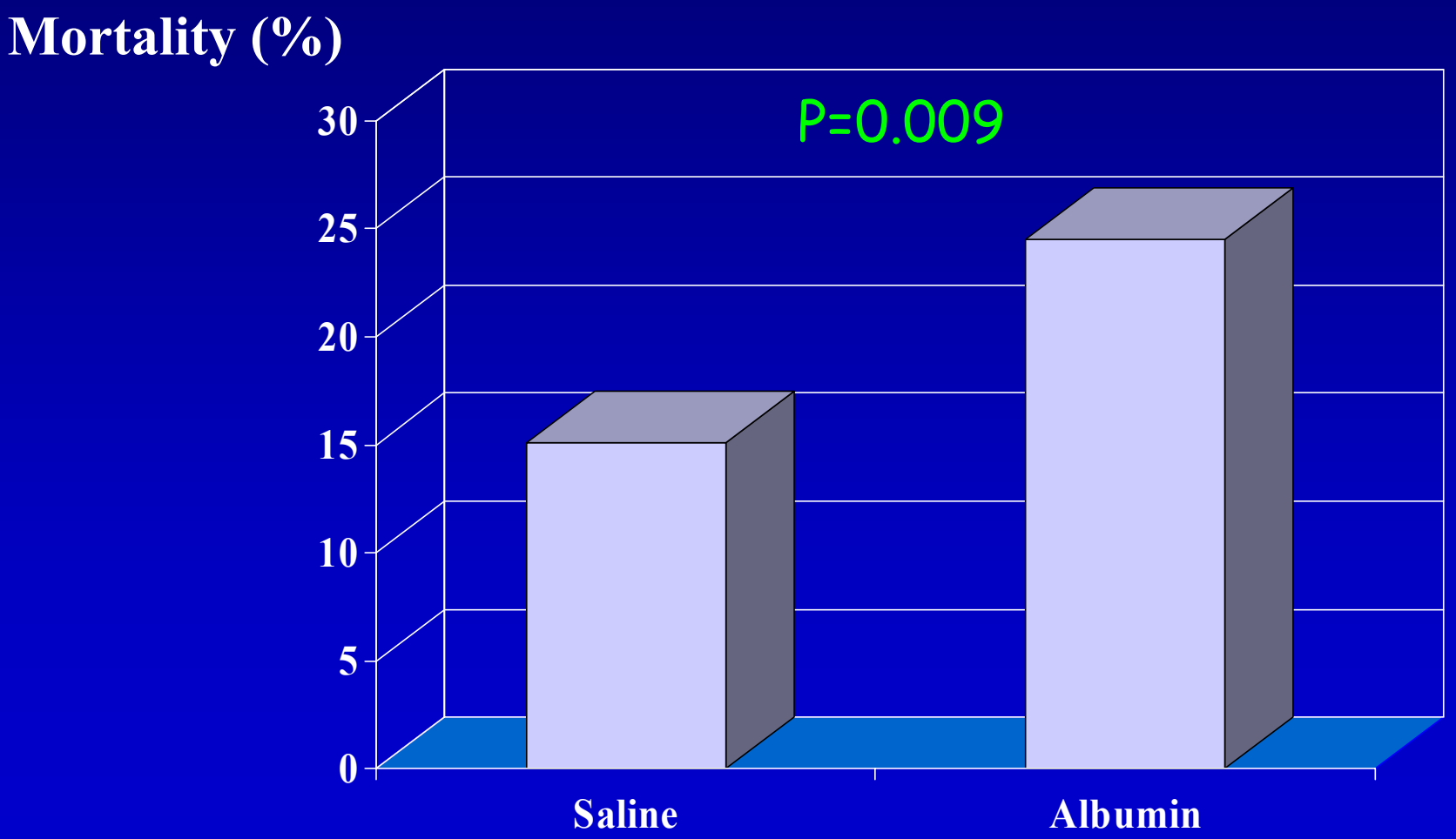
The SAFE Study Investigators*

Patients	Albumin Group	Saline Group	Relative Risk (95% CI)
	no. of deaths/total no.		
Overall	726/3473	729/3460	0.99 (0.91–1.09)
Trauma			
Yes	81/596	59/590	1.36 (0.99–1.86)
No	641/2831	666/2830	0.96 (0.88–1.06)
Severe sepsis			
Yes	185/603	217/615	0.87 (0.74–1.02)
No	518/2734	492/2720	1.05 (0.94–1.17)
ARDS			
Yes	24/61	28/66	0.93 (0.61–1.41)
No	697/3365	697/3354	1.00 (0.91–1.09)

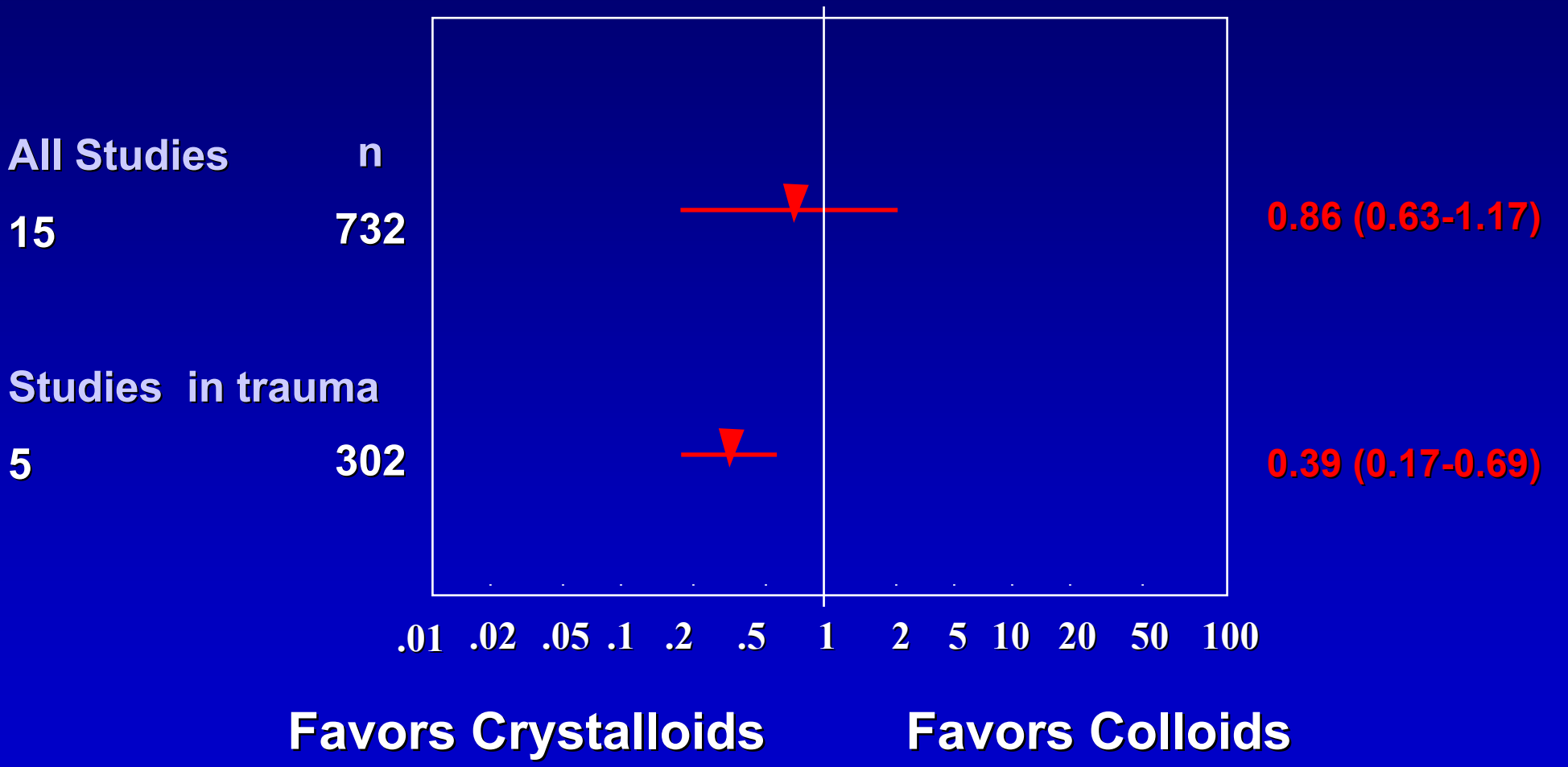


N Engl J Med 2004; 350: 2247

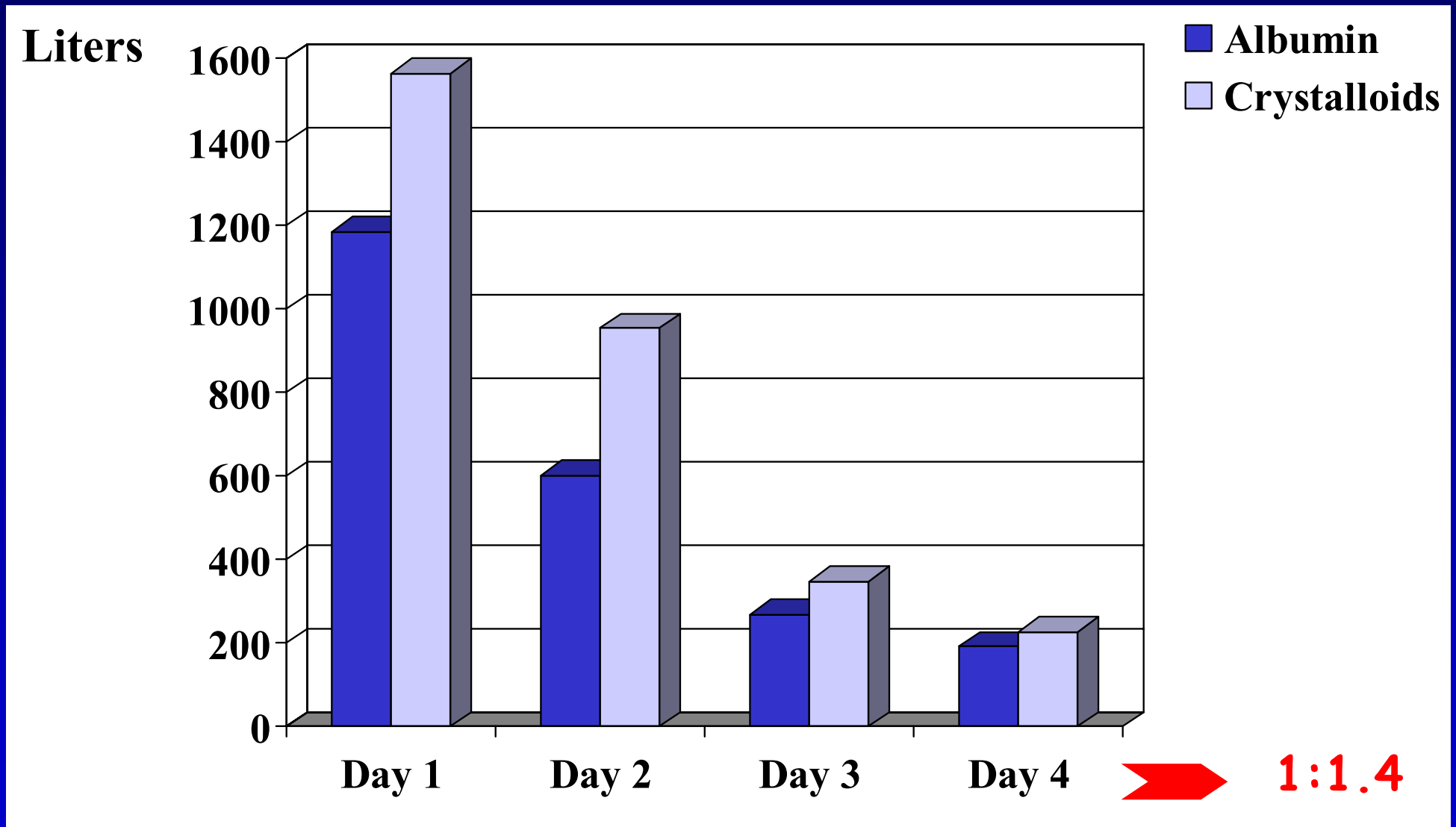
Patients with trauma and an associated brain injury



Crystalloids vs. colloids in fluid resuscitation: a systematic review.



Choi PT et al. CCM 1999



SAFE N. Engl. J. Med. 2004; 350: 2247

Impact of fluid choice on the outcome of critically ill patients with shock

F. Schortgen, S Bastuji-Garin, N. Deye, L. Brochard
Medical ICU and Public health

Henri Mondor Hospital
Créteil-France

CRYCO Study

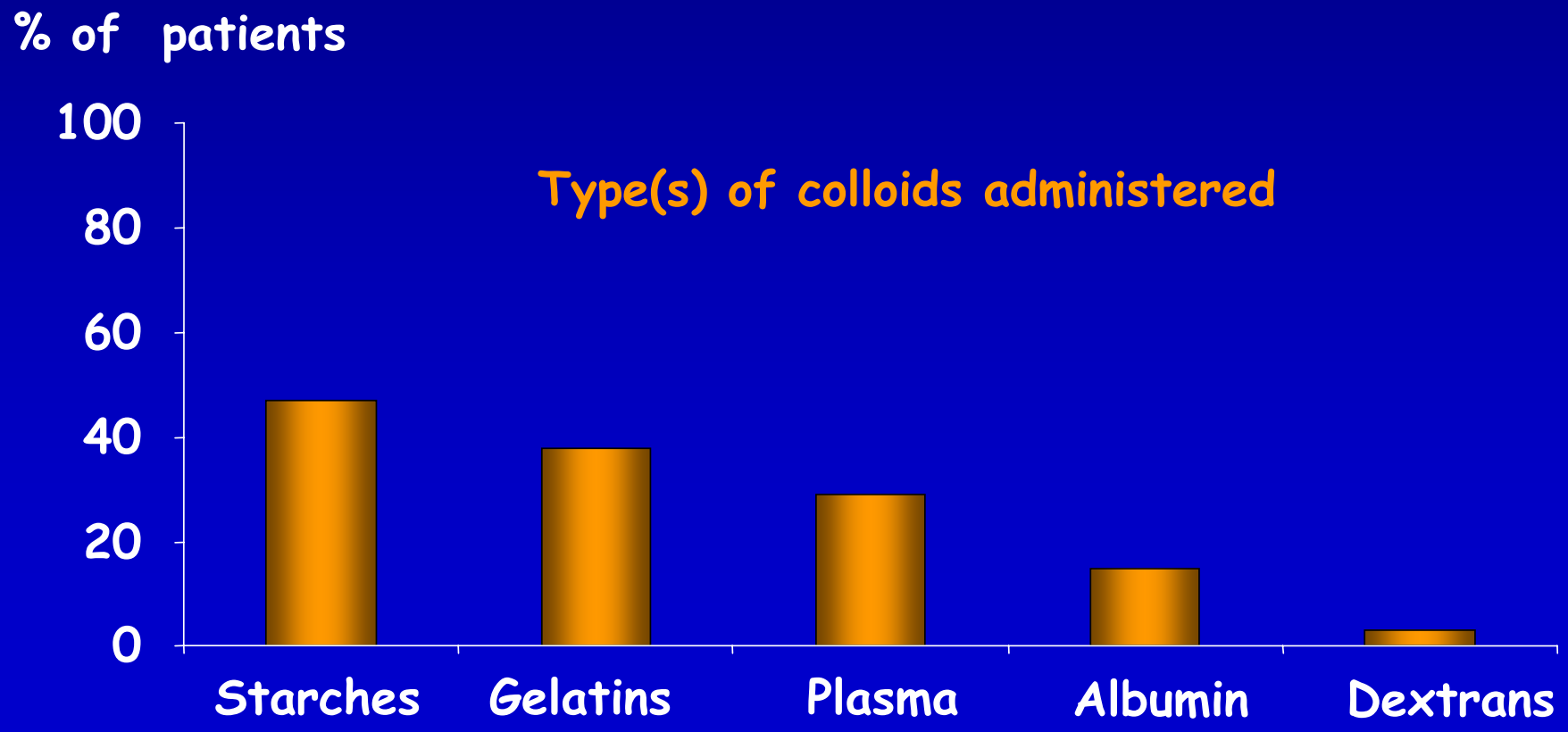
Methods

- Prospective cohort study
- Consecutive adult patients admitted in 115 ICUs (30 countries) during a 4 weeks period and needing fluid resuscitation for shock in the intensive care unit

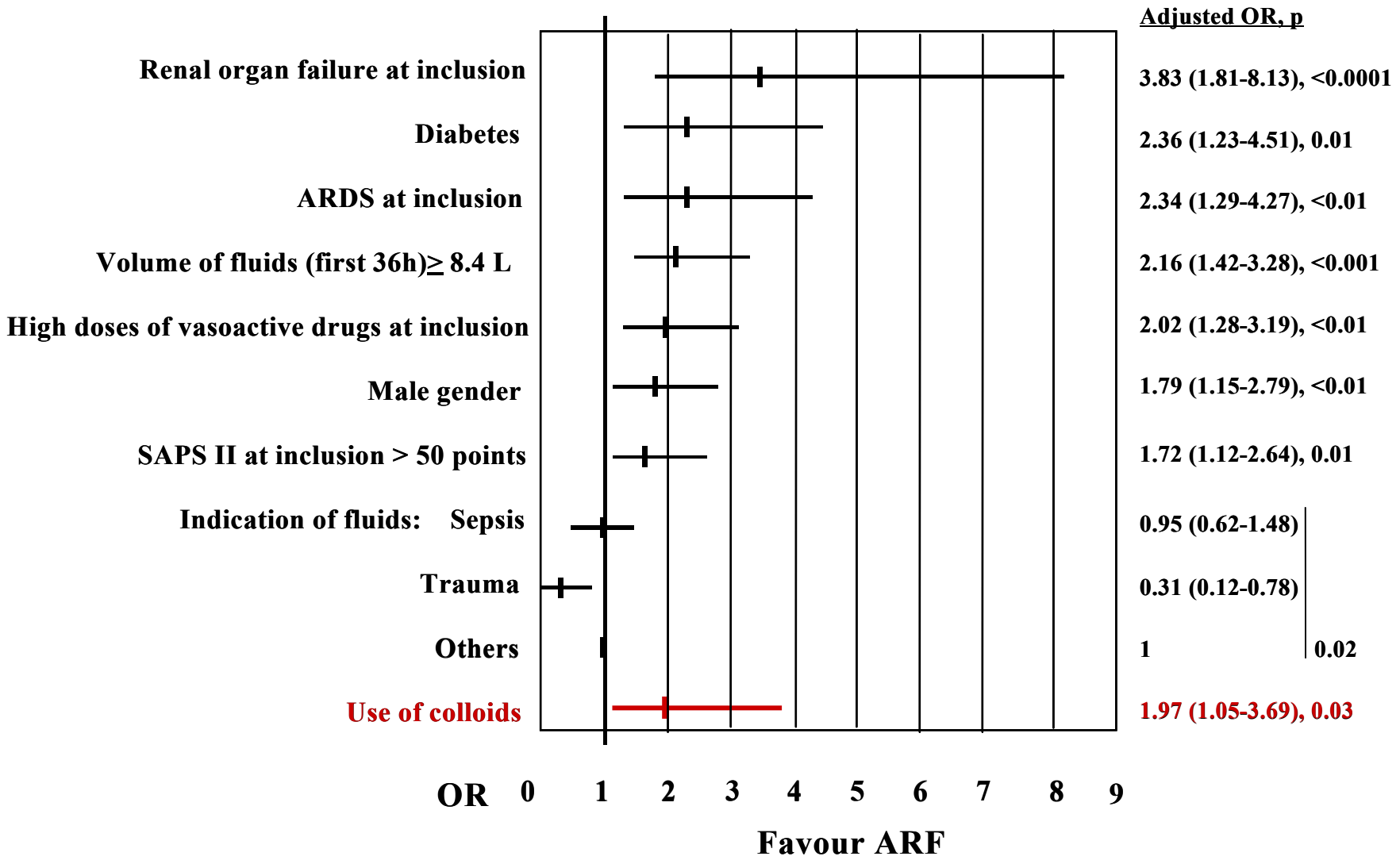
736 patients with shock

611 receiving colloids

125 receiving crystalloids



Risk factors for acute renal failure: multivariate analysis



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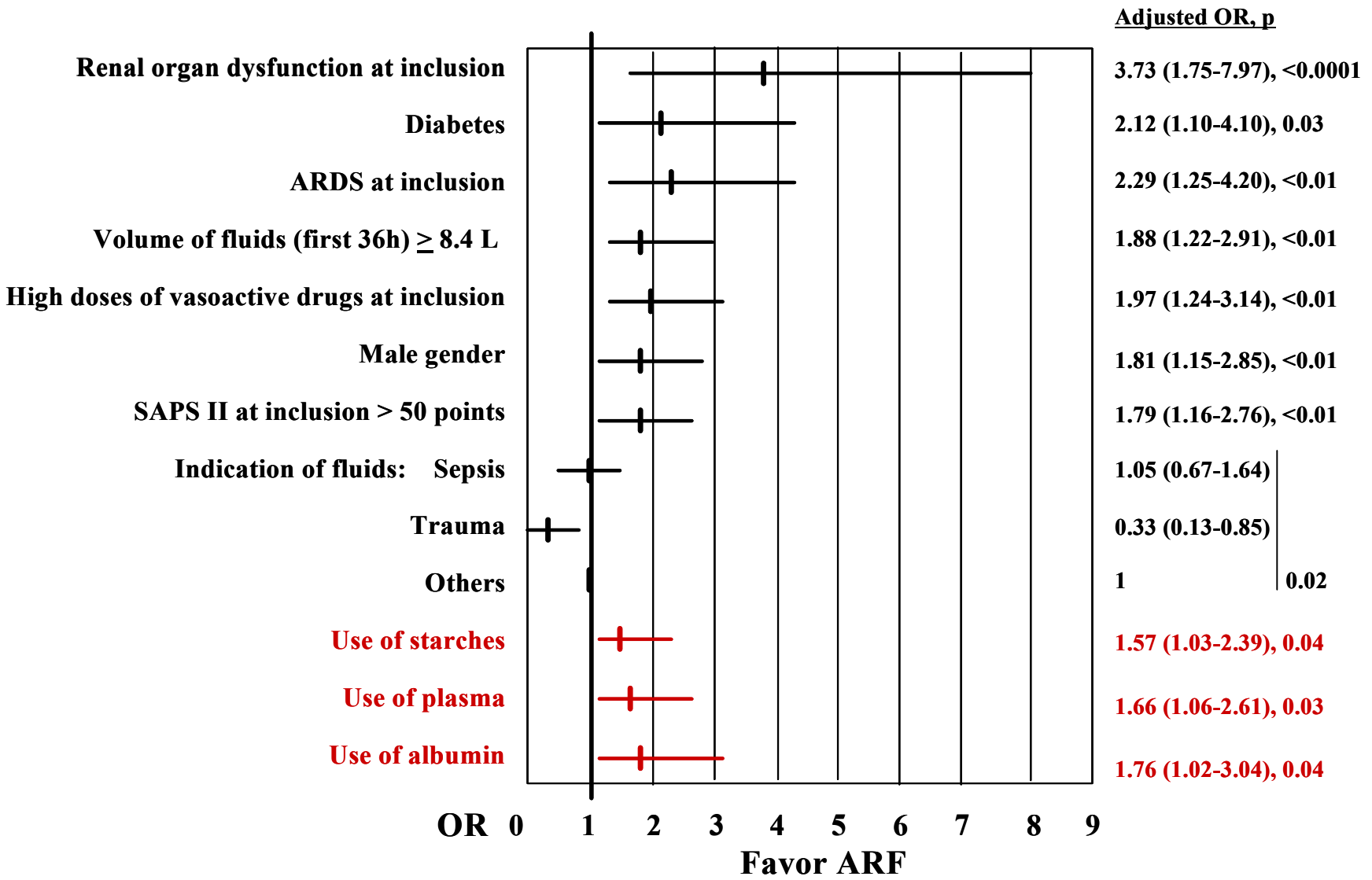
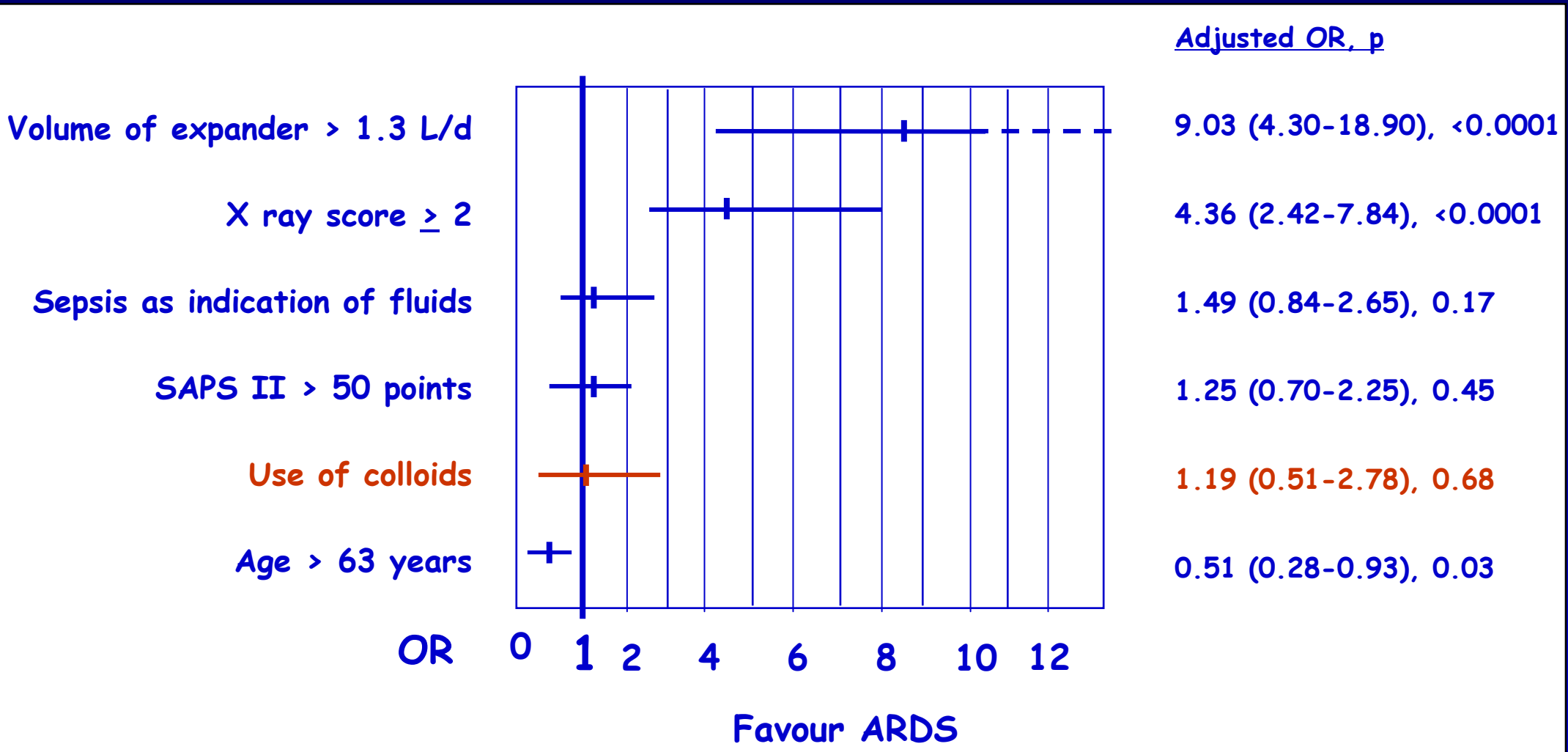
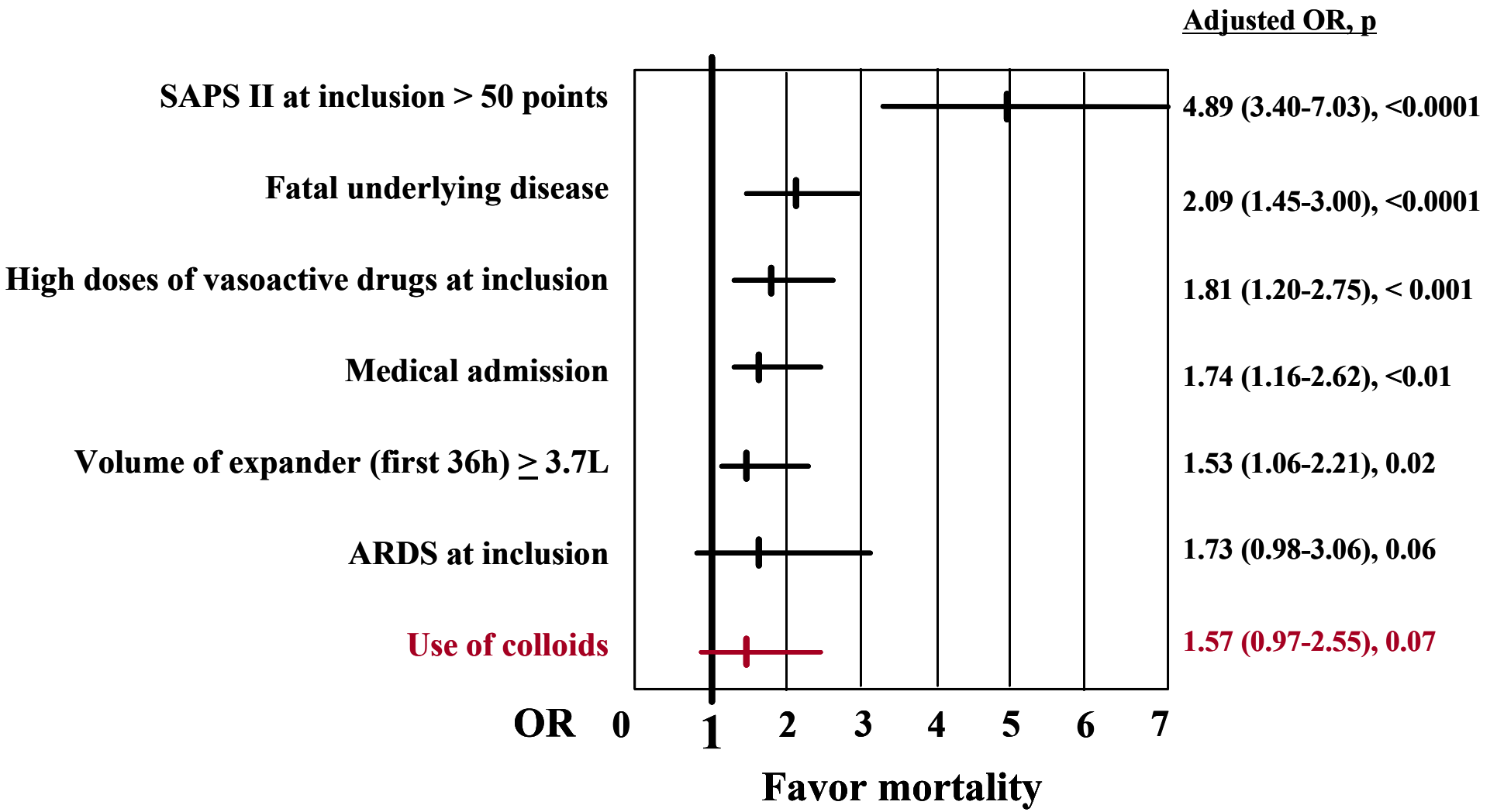


Risk factors for ARDS: multivariate analysis



CRYCO Study

Risk factors for mortality:multivariate analysis



Experts recommendations

SCCM 2004

Isotonic crystalloids or iso-oncotic colloids are equally effective when titrated to the same hemodynamic end points.

Surviving Sepsis Campaign

Use crystalloids or colloids.

AMERICAN JOURNAL OF
Respiratory and
Critical Care Medicine

ATS
consensus statement

Therapeutic Implications

1. Crystalloids should be administered first in nonhemorrhagic shock resuscitation (III).
2. Hydroxyethyl starch solutions should be used with caution in cardiopulmonary bypass (meta-analysis) and in patients with sepsis (II-A).
3. Colloids should be avoided or used with caution in patients with traumatic brain injury (I).
4. Fluid restriction is appropriate for patients with hemodynamically stable ALI/ARDS (II-A); the combination of colloids and diuretics may be considered in patients with hypo-oncotic ALI/ARDS (III).
5. Colloids are preferred for treating dialysis-associated hypotension and in maintaining hemodynamics to achieve dialysis goals (II-A).
6. Hyperoncotic albumin should be administered in conjunction with large-volume paracentesis for diuretic-refractory ascites (II-A).
7. Albumin may be administered in conjunction with antimicrobial therapy to patients with spontaneous bacterial peritonitis (II-A).

Am J Respir Crit Care Med Vol 170. pp 1247–1259, 2004
DOI: 10.1164/rccm.200208-909ST
Internet address: www.atsjournals.org

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