



# Albumine traitement de l'hypoprotidémie en réanimation

karim.asehnoune@chu-nantes.fr Service d'Anesthésie-Réanimation, CHU Nantes, F-44000 France



### **Conflicts of interests**

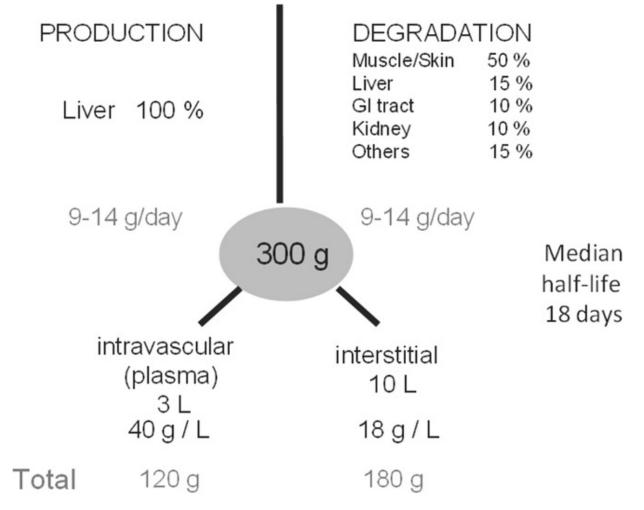
**Baxter** 

LFB

**Fisher and Paykel** 

**Edwards** 

# Physiologie



**Figure 1 Schematic illustration of metabolism of albumin in healthy adults.** Gl, gastrointestinal.

### albumin has multiple physiological effects

regulation of colloid osmotic pressure (COP),

acids

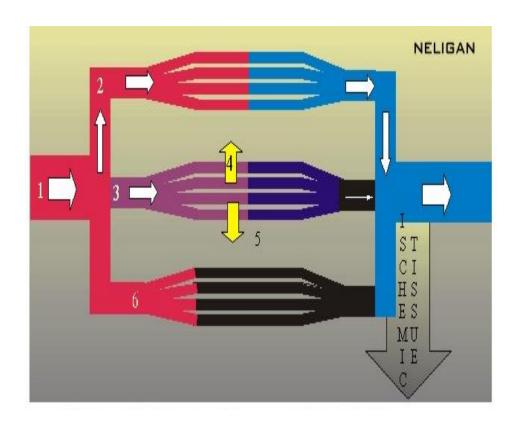
- binding and transportation of various substances (for example, drugs, hormones),
- antioxidant properties, nitric oxide modulation and buffer capabilities,

low serum albumin levels, a common occurrence in critically ill patients, are associated with worse outcomes

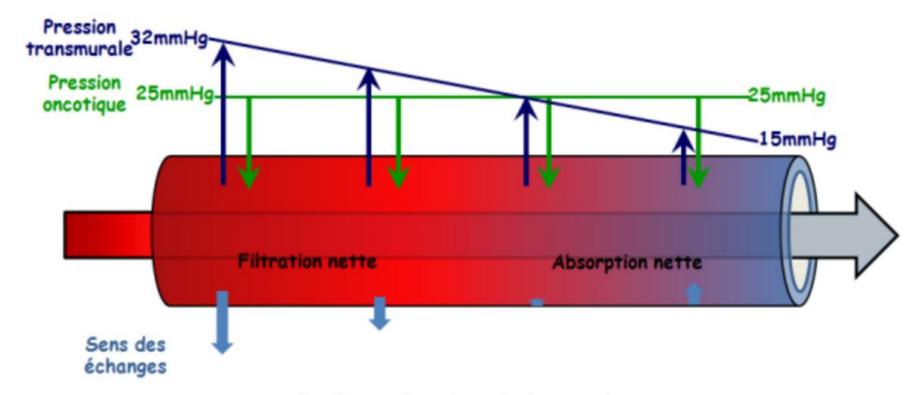
there is evidence to support its use in some patient populations

- Albumin decreases neutrophil activation induced by fluid infusion, crystalloids and synthetic colloids increase it. Rhee P, et al. *Crit Care Med* 2000; 28(1): 74-78.
- Albumin reduces TNF induced endothelial activation. Nohe et al *Intensive Care Med* 1999; 25: 1381-1385; Zhang et al *Cardiovasc Res*. 2002 Sep;55(4):820-9
- Albumin solution reverses the LPS induced albumin leakage across vessel walls. Powers KA, et al. Crit Care Med 2003; 31: 2355-63; Anning PB et Intensive Care Med. 2004 Oct; 30(10):1944-9
- Albumin infusion results in sustained thiol levels in septic patients. Quinlan G, et al. *Clin Sci* 1998; 95: 459-65.

### **Effet oncotique**



- Vasodilation leads to slow organ perfusion pressure
- 2. capillary leak, resulting in
- edematous tissues, tissuecompression and prevention of oxygen exchange
- 4.Due to venous stasis and activation of coagulation, small vessels become obstructed and blood flow stops



Pression oncotique et pression transmurale



RESEARCH Open Access

### The intravascular volume effect of Ringer's lactate is below 20%: a prospective study in humans

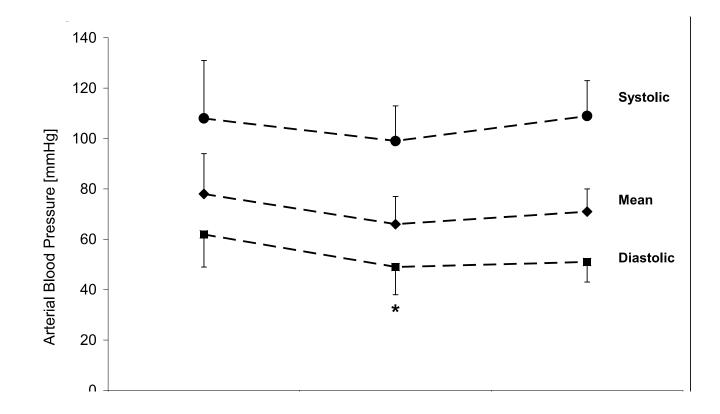
Matthias Jacob<sup>1+†</sup>, Daniel Chappell<sup>1†</sup>, Klaus Hofmann-Kiefer<sup>1</sup>, Tobias Helfen<sup>1</sup>, Anna Schuelke<sup>1</sup>, Barbara Jacob<sup>1</sup>, Alexander Burges<sup>2</sup>, Peter Conzen<sup>1</sup> and Markus Rehm<sup>1</sup>

10 volontaires sains

#### Hemodilution normovolémique

#### **Restauration volumique**

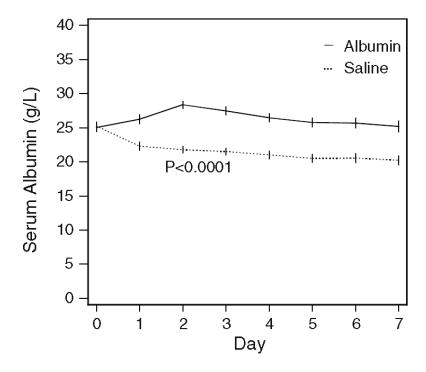
- 3000 RL: 460 ml BV
- 250 ml Alb (20%) restauration BV



### **Effet volume**

- RL 17%
- Alb 184%

NS



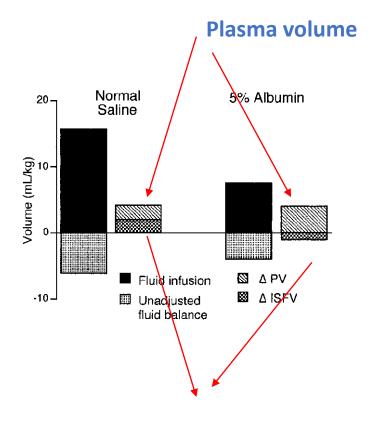
SAFE investigators Int Care Med 2011, 37 (1), 86-96

### Distribution of normal saline and 5% albumin infusions in cardiac surgical patients

David Ernest, MBBS; Allan S. Belzberg, MD; Peter M. Dodek, MD, MHSc

Crit Care Med 2001 Vol. 29, No. 12

- 40 patients post CEC
- Cible hémodynamique



#### **Intersitial volume**

# Hypoalbuminémie

Serum albumine concentration<30 g/l</li>

- Pertes
  - Hémorragie
  - Perte digestives
  - Defaillance d'organe
- ATCD
  - Denutrition
  - Age
  - Pathologie hépatiques

# Traiter l'hypoalbuminémie ou pas?

### Risk Factors for Hospital-acquired Bacteremia

Takuhiro Yoshida, Kenji Tsushima, Ayako Tsuchiya, Noriko Nishikawa, Kumiko Shirahata, Kazuma Kaneko, Ken-ichi Ito, Hirotaka Kawakami, Shin-ichi Nakagawa, Toshiro Suzuki\*, Keishi Kubo\*\* and Shu-ichi Ikeda\*\*\*

### 406 patients dont 176 ICU

Table 3. Comparison of Laboratory Data between Blood Culture-positives and -negative cases

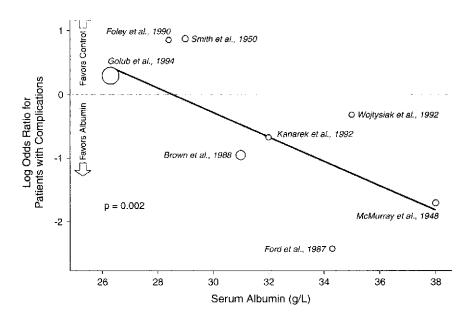
Variable	Culture- positive	Culture- negative	P-value (Univariate)	P-value (Multivariate)	AUC
Age	75.8±2.1	71.0±1.1	0.019		
Neutrophil (/mm³)	10,784±866	8,519±434	0.01		
C-reactive protein (mg/dl)	11.6±9.1	11.1±11.3	0.358		
Platelet (×10 <sup>4</sup> /mm <sup>3</sup> )	19.7±11.5	23.8±11.8	0.006	0.04	0.574
Total cholesterol (mg/dl)	157±49	155±39	0.396		
Total protein (g/dl)	6.3±1.0	6.6±0.8	0.009		
Albumin (g/dl)	$3.2 \pm 0.6$	3.5±0.6	< 0.001	< 0.001	0.644
Cholinesterase (U/dl)	161±71	192±81	0.003		

# Hypoalbuminemia in Acute Illness: Is There a Rationale for Intervention?

#### A Meta-Analysis of Cohort Studies and Controlled Trials

Jean-Louis Vincent, MD, PhD, FCCM,\* Marc-Jacques Dubois, MD,\* Roberta J. Navickis, PhD,† and Mahlon M. Wilkes, PhD†

### 90 études >290 000 patients



Cut-off morbidité >30g/l

#### safe

Study		Mort	oidity							OR	CI	% Wgt
	Albumir	1	Control									
	Patients with Complications	Total	Patients with Complications	Total								
McMurray et al, 1948 <sup>111</sup>	4	16	11	17	-		<u> </u>	т,		0.18	0.04-0.82	10.3
Smith et al, 1950 <sup>112</sup>	6	26	3	27			_			2.40	0.53-10.8	10.3
Ford et al. 1987 <sup>113</sup>	2	20	10	18				;		0.09	0.02-0.50	9.0
Brown et al, 1988 <sup>114</sup>	16	34	23	33			—П-	1		0.39	0.14-1.05	14.0
Foley et al. 1990 <sup>115</sup>	16	18	•7	22				<u> </u>	]	2.35	0.40-13.9	8.7
Kanarek et al, 1992 <sup>176</sup>	5	12	7	12		_		!		0.51	0.10-2.59	9.6
Wojtysiak et al. 1992 <sup>117</sup>	10	15	11	15				<u>.</u>	_	0.73	0.15-3.49	9.9
Golub et al., 1994 <sup>118</sup>	51	116	38	103						1.34	0.78-2.31	17.5
Rubin et al, 1997 <sup>119</sup>	9	16	5	15			_		<b></b>	2.57	0.60-11.1	10.6
	:19	273	125	262			4			0.74	0.36-1.49	100.0
					Favors Albumín				Favors Control			
					0.01	0.1	Odds Rat	1 io	10			

Figure 3. Morbidity in controlled trials evaluating the correction of hypoalburninemia.

Par 10g de diminution 137% OR of death 89% morbidity 71% durée de séjour

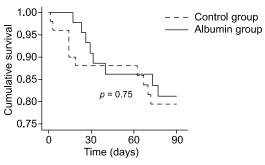
### EFFECT OF INTRAVENOUS ALBUMIN ON RENAL IMPAIRMENT AND MORTALITY IN PATIENTS WITH CIRRHOSIS AND SPONTANEOUS BACTERIAL PERITONITIS

PAU SORT, M.D., MIQUEL NAVASA, M.D., VICENTE ARROYO, M.D., XAVIER ALDEGUER, M.D., RAMON PLANAS, M.D., LUIS RUIZ-DEL-ARBOL, M.D., LLUIS CASTELLS, M.D., VICTOR VARGAS, M.D., GERMÁN SORIANO, M.D., MÓNICA GUEVARA, M.D., PERE GINÈS, M.D., AND JOAN RODÉS, M.D.

OUTCOME VARIABLE	CEFOTAXIME (N=63)	CEFOTAXIME PLUS ALBUMIN (N=63)	P Value
Resolution of infection — no. (%)†	59 (94)	62 (98)	0.36
Duration of antibiotic therapy — days	6±1	$5\pm1$	0.48
Paracentesis for ascites after resolution of infection — no. (%)‡	16 (25)	14 (22)	0.83
Hospital stay — days	$13\pm1$	$14\pm1$	0.48
Renal impairment — no. (%)	21 (33)	6 (10)	0.002
Death — no. (%)			
In hospital§	18 (29)	6 (10)	0.01
At three months¶	26 (41)	14 (22)	0.03

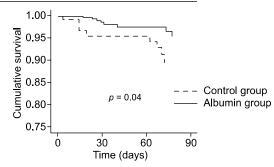
- 126 patients
- Alb 20% 1.5 g/kg D1 and D3
- IR et mortalité

### Non ajustée



#### Ajustée

Patients at risk				
Control group	51	45	42	38
Albumin group	46	40	35	32



### Albumin for bacterial infections other than spontaneous bacterial peritonitis in cirrhosis. A randomized, controlled study $^{\!\!\!\!\!/}$

Mónica Guevara<sup>1,2,3,4,†</sup>, Carlos Terra<sup>1,2,3,4,†</sup>, André Nazar<sup>1,2,3,4</sup>, Elsa Solà<sup>1,2,3,4</sup>, Javier Fernández<sup>1,2,3</sup>, Marco Pavesi<sup>1,2,3</sup>, Vicente Arroyo<sup>1,2,3</sup>, Pere Ginès<sup>1,2,3,4,\*</sup>



- 110 patients
- Alb 20% 1.5 g/kg D1 and D3
- Mortalité à 3 mois

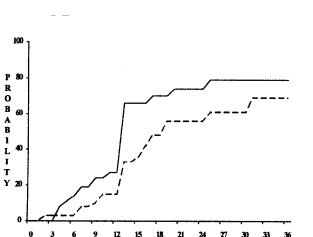
# Albumin improves the response to diuretics in patients with cirrhosis and ascites: results of a randomized, controlled trial

Paolo Gentilini, Vincenzo Casini-Raggi, Giuseppe Di Fiore, Roberto Giulio Romanelli, Giampiero Buzzelli, Massimo Pinzani, Giorgio La Villa and Giacomo Laffi

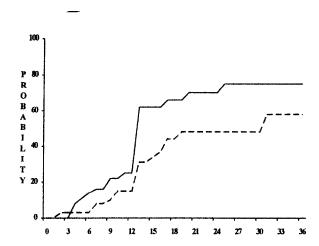
Institute of Internal Medicine, University of Florence School of Medicine, Florence, Italy

- >1000 patients
- Ascite refractaire repos lit/restriction sodique

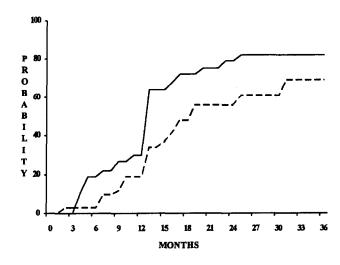
### **Toutes causes**



#### **Cause ascite**



**Re hospitalisation** 



**Recurrence** ascite

Furosémide

**LILE Furosemide+Alb 20%** 

# **Albumin Infusion in Patients Undergoing Large-Volume Paracentesis: A Meta-Analysis of Randomized Trials**

Mauro Bernardi, Paolo Caraceni, Roberta J. Navickis, and Mahlon M. Wilkes

### Hyponatrémie

#### Odds Ratio (CI) Hyponatremia Albumin Control Event Total Event Total Planas et al., 199017 3 43 0.77 (0.16-3.65) 0.77 (0.18-3.23) 1.33 (0.26-6.88) 42 192 0.60 (0.31-1.17) 0.26 (0.01-6.74) García-Compeán et al., 200224 0.57 (0.13-2.55) Sola-Vera et al., 200326 0.34 (0.06-1.90) Moreau et al., 200627 0.49 (0.15-1.61) Abdel-Khalek and Arif, 201032 0.65 (0.10-4.00) Subtotal 79 499 0.61 (0.40-0.93) Vasoconstrictor Moreau et al., 200225 Singh et al., 200629 20 0.18 (0.01-4.01) Singh et al., 200628 0.33 (0.03-3.53) 0.38 (0.01-11.2) Subtotal 0.37 (0.09-1.49) Total 39 458 86 557 0.58 (0.39-0.87) Odds Ratio (CI)

#### Mortalité

Control		Mor	tality			
	Albu	ımin	Cor	ntrol		
	Event	Total	Event	Total		
Other volume expander						
Planas et al., 1990 <sup>17</sup>	13	43	17	45	$\dashv$	-П-
Salerno et al., 199118	13	27	13	27	_	——————————————————————————————————————
Fassio et al., 1992 <sup>19</sup>	6	21	7	20		<u>—</u>
Ginès et al., 1996 <sup>22</sup>	2	97	10	192		<del></del>
García-Compeán et al., 2002 <sup>24</sup>	11	48	18	48	-	— <u> </u>
Sola-Vera et al., 2003 <sup>26</sup>	1	37	1	35		<del></del>
Moreau et al., 2006 <sup>27</sup>	1	30	3	38		
Abdel-Khalek and Arif, 2010 <sup>32</sup>	2	68	2	67		
Subtotal	49	371	71	472	<	
Vasoconstrictor						
Moreau et al., 2002 <sup>25</sup>	1	10	1	10	-	
Appenrodt et al., 200830	0	13	1	11		•
Singh et al., 200831	0	20	1	20		•
Subtotal	1	43	3	41		
Total	50	414	74	513	•	•
					Favors Albumin	
					0.01 0.1	0.01 0.1 1 10 Odds Ratio (CI)
					Ouus nalio	Odds Hallo (OI)

- 17 études 1225 patients
- Pas d'hétérogénéité ou de biais
- Objectif principal hypoNa, mortalité







#### Guidelines

#### Management of liver failure in general intensive care unit $^{\Leftrightarrow, \Leftrightarrow \Leftrightarrow}$

C. Paugam-Burtz <sup>1,2</sup>, E. Levesque <sup>3,4</sup>, A. Louvet <sup>5</sup>, D. Thabut <sup>6</sup>, R. Amathieu <sup>7,8</sup>,

C. Bureau <sup>9,10,11</sup>, C. Camus <sup>12</sup>, G. Chanques <sup>13</sup>, S. Faure <sup>14</sup>, M. Ferrandière <sup>15</sup>, C. Francoz <sup>16,17</sup>, A. Galbois <sup>18</sup>, T. Gustot <sup>19,20</sup>, C. Ichai <sup>21</sup>, P. Ichai <sup>22,23,24</sup>, S. Jaber <sup>25</sup>, T. Lescot <sup>26</sup>, R. Moreau <sup>27,28,29,30</sup>, S. Roullet <sup>31,32</sup>, F. Saliba <sup>33</sup>, T. Thévenot <sup>34</sup>, L. Velly <sup>35,36</sup>, E. Weiss <sup>37,38,\*</sup>



R5.2 - In patients with cirrhosis hospitalised in the ICU, we suggest treating hepatorenal syndrome with a vasoconstrictor agent (terlipressin as first-line therapy) and concentrated albumin

**GRADE 2+, STRONG AGREEMENT** 

R7.1 - In cirrhotic patients hospitalised in the ICU, we recommend the use of a concentrated albumin infusion after highvolume paracentesis (more than 4 to 5 litres of ascites fluid removed)

**GRADE 1+, STRONG AGREEMENT** 

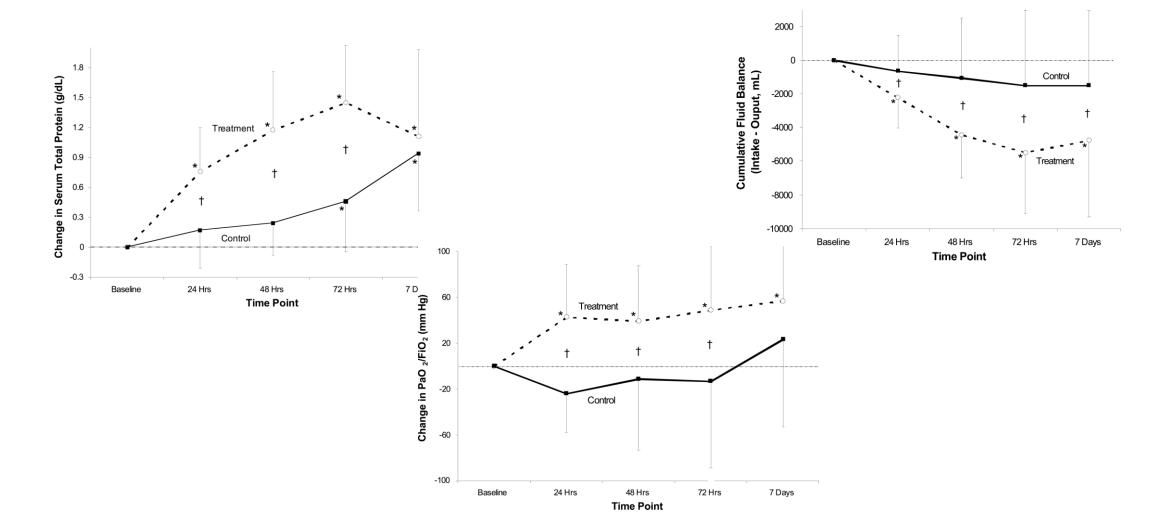
R7.2 – In patients with cirrhosis hospitalised in the ICU, we suggest that concentrated albumin infusions should be used in the event of spontaneous bacterial peritonitis (SBP)

**GRADE 2+, STRONG AGREEMENT** 

# A randomized, controlled trial of furosemide with or without albumin in hypoproteinemic patients with acute lung injury\*

Greg S. Martin, MD, MSc; Marc Moss, MD; Arthur P. Wheeler, MD; Meredith Mealer, RN; John A. Morris, MD; Gordon R. Bernard, MD

### 40 patients hypoprotidémiques Furosemide versus furosemide + Alb 20% (dose titrée sur protidémie)



# Les « grandes » études

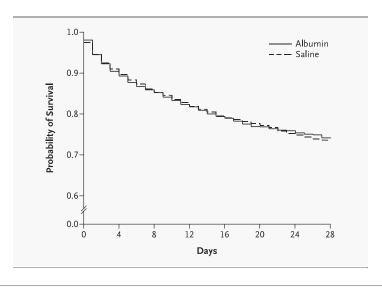
#### ORIGINAL ARTICLE

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

The SAFE Study Investigators\*

- 7000 patients
- Alb 4% vs Isotonique
- ICU patients
- Meilleure survie Sepsis sévère

N ENGL J MED 350;22 WWW.NEJM.ORG MAY 27, 2004

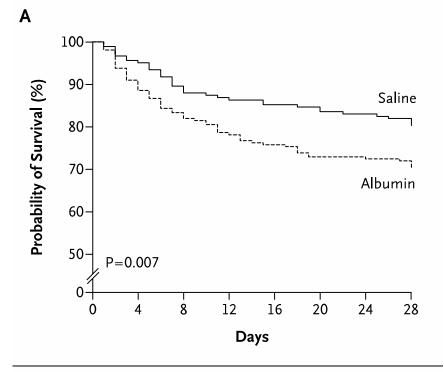


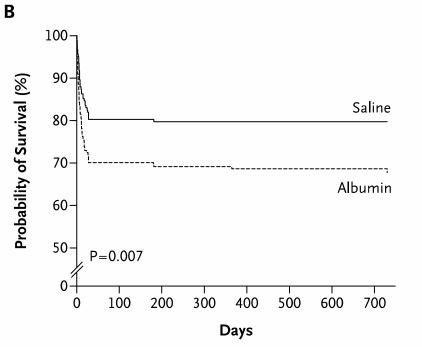
Patients	Albumin Group	Saline Group	Relative Risk (95% C	:1)
	no. of death	is/total no.		
Overall	726/3473	729/3460	<b>+</b>	0.99 (0.91-1.09)
Trauma				
Yes	81/596	59/590	-	1.36 (0.99-1.86)
No	641/2831	666/2830	+	0.96 (0.88-1.06)
Severe sepsis				
Yes	185/603	217/615	-	0.87 (0.74-1.02)
No	518/2734	492/2720		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)
			0.5 1.0 2.0	
			Albumin Saline Better Better	

# Saline or Albumin for Fluid Resuscitation in Patients with Traumatic Brain Injury

The SAFE Study Investigators\*

- 461 TBI patients
- Alb 4% vs Isotonique
  - HTIC
  - Hypotonic/hypooncotic





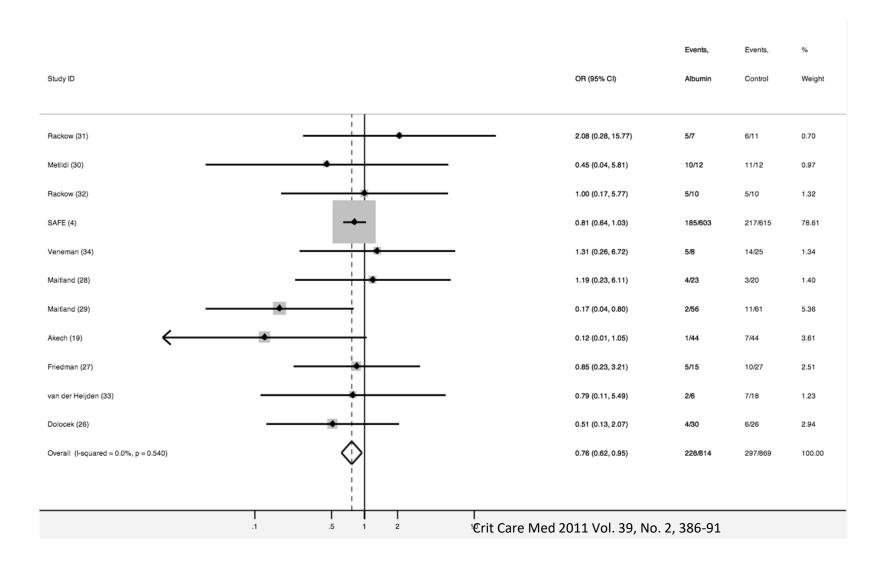
# The role of albumin as a resuscitation fluid for patients with sepsis: A systematic review and meta-analysis\*

Anthony P. Delaney, MD, FCICM; Arina Dan, MD, FCICM; John McCaffrey, MD, FCICM; Simon Finfer, MD, FCICM

Crit Care Med 2011 Vol. 39, No. 2

- Sepsis
- Alb vs tout le reste...
- 17 RCT

		Events,	Events,	%
Study ID	OR (95% CI)	Albumin	Control	Weight
Rackow et al (32)	2.08 (0.28, 15.77)	5/7	6/11	0.61
Metildi et al (31)	0.45 (0.04, 5.81)	10/12	11/12	0.84
Rackow et al (33)	1.00 (0.17, 5.77)	5/10	5/10	1.14
Boldt et al (20)	1.00 (0.22, 4.56)	5/15	5/15	1.52
Boldt et al (19)	0.73 (0.15, 3.49)	4/15	5/15	1.67
Boldt et al (21)	1.33 (0.30, 5.91)	7/14	6/14	1.37
Boldt et al (22)	0.72 (0.15, 3.54)	4/14	5/14	1.63
Boldt et al (23)	1.88 (0.39, 9.01)	6/14	4/14	1.04
Boldt et al (24)	1.29 (0.64, 2.58)	25/75	21/75	6.38
The SAFE study investigators (4)	0.81 (0.64, 1.03)	185/603	217/615	67.91
Veneman et al (35)	1.31 (0.26, 6.72)	5/8	14/25	1.16
Maitland et al (29)	1.19 (0.23, 6.11)	4/23	3/20	1.21
Maitland et al (30)	0.17 (0.04, 0.80)	2/56	11/61	4.63
Akech et al (26)	0.12 (0.01, 1.05)	1/44	7/44	3.12
Friedman et al (28)	0.85 (0.23, 3.21)	5/15	10/27	2.17
van der Heijden et al (34)	0.79 (0.11, 5.49)	2/6	7/18	1.06
Dolecek et al (27)	0.51 (0.13, 2.07)	4/30	6/26	2.54
Overall (I-squared = 0.0%, p = 0.728)	0.82 (0.67, 1.00)	279/961	343/1016	100.00



# Morbidity in hospitalized patients receiving human albumin: A meta-analysis of randomized, controlled trials\*

Jean-Louis Vincent, MD, PhD, FCCM; Roberta J. Navickis, PhD; Mahlon M. Wilkes, PhD

Crit Care Med 2004 Vol. 32, No. 10

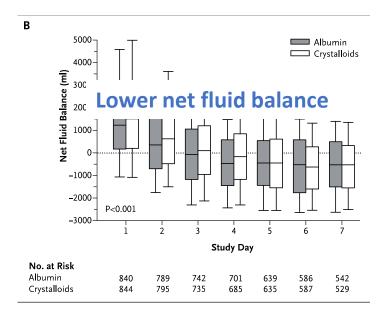
Clinical Indication	Trials		Morb	oidity			RR (CI)
		Albumi	in Group	Contro	l Group		
Surgery or Trauma		Events	Patients	Events	Patients		
Albumin vs no albumin	12	44	245	72	249		0.58 (0.40-0.85)
Albumin vs low-dose albumin	10	27	143	28	153		0.95 (0.56-1.61)
Albumin vs moderate-dose albumin	18	561	530	520	518	; <del></del>	1.06 (0.94-1.19)
Pooled	40	632	918	620	920		1.00 (0.89-1.11)
Other indications						1	

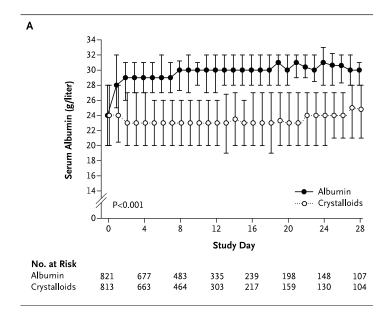
#### **ORIGINAL ARTICLE**

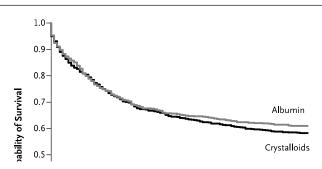
# Albumin Replacement in Patients with Severe Sepsis or Septic Shock

Pietro Caironi, M.D., Gianni Tognoni, M.D., Serge Masson, Ph.D., Roberto Fumagalli, M.D., Antonio Pesenti, M.D., Marilena Romero, Ph.D., Caterina Fanizza, M.Stat., Luisa Caspani, M.D., Stefano Faenza, M.D., Giacomo Grasselli, M.D., Gaetano Iapichino, M.D., Massimo Antonelli, M.D., Vieri Parrini, M.D., Gilberto Fiore, M.D., Roberto Latini, M.D., and Luciano Gattinoni, M.D., for the ALBIOS Study Investigators\*

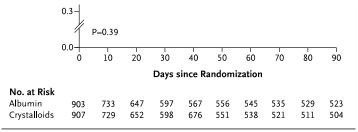
- 1818 patients sepsis sévère/shock
- 300 ml Alb 20%+cristalloides/j
- Réanimation agressive (Rivers)
- Maintien Alb>30 g/l







#### Mortalité J90 septic shock plus basse



		Albumin					
	Dead	Survive	Total	Dead	Survive	Total	Р
	Deau	Survive	iotai	Deau	Survive	iotai	r
SAFE	185	418	603	217	398	615	0.09
EARSS	96	303	399	103	290	393	>0.05
ALBIOS	244	409	653	274	374	648	0.07
Total	525	1130	1655	594	1062	1656	

### Comparison of the effects of albumin and crystalloid on mortality among patients with septic shock: systematic review with meta-analysis and trial sequential analysis

Yan Zou<sup>I</sup>, Ke Ma<sup>II</sup>, Ji-Bin Xiong<sup>III</sup>, Cai-Hua Xi<sup>I</sup>, Xiao-Jun Deng<sup>I</sup>

Department of Emergency Medicine, Shanghai Jao Tong University Affiliated Sxth People's Hospital, Shanghai, China

	albumin	(no.)	crystallo	id (no.)	Risk ratio		Risk ratio
Study or subgroup	Events	Total	Events	Total	Weight <sup>Te</sup> x	te Vantel-Haenszel random. 95% CI year	Mantel-Haenszel random.95% CI
1.3.1 Hypooncotic (4-5%	albumin) s	ubgro	ир				
Rackow et al 1983	5	7	3	4	6.9%	0.95 [0.46, 1.99] 1983	<del></del>
The SAFE study 2011	70	209	90	229	59.6%	0.85 [0.66, 1.09] 2011	
The RASP study 2015	30	50	31	60	33.5%	1.16 [0.83, 1.62] 2015	<b>-</b>
Subtotal (95% CI)		266		293	100.0%	0.96 [0.78, 1.18]	•
Total events	105		124				
Heterogeneity: Tau <sup>2</sup> = 0.0	0; $Chi^2 = 2.7$	8, df =	2 (P = 0.3	4); I <sup>2</sup> = 8%	6		
Teste for overall effect: Z	= 0.41 (P =	0.68)					
1.3.2 Hyperoncotic (20%	albumin)						
The EARSS study 2011	96	399	103	393	21.4%	0.92 [0.72, 1.17] 2011	<u> </u>
The ALBIOS study 2014	243	558	281	563	78.6%	0.87 [0.77, 0.99] 2014	•
Subtotal (95% CI)		957		956	100.0%	0.88 [0.79, 0.99]	•
Total events	339		384				
Heterogeneity: $Tau^2 = 0.0$	0; $Chi^2 = 0.1$	4, df =	1 (P = 0.7	1); I <sup>2</sup> = 0%	6		
Teste for overall effect: Z	= 2.21 (P = 0	0.03)					

# Choice of Fluids in Severe Septic Patients - A Cost-effectiveness Analysis Informed by Recent Clinical Trials

Fluid	Life Expectancy (LY)	Total medical Costs	Incremental Costs	Total Costs per LY
Crystalloid	2.00	\$20,133	Reference	\$10,036
Albumin	2.21	\$20,403	\$270	\$9,253
Hydroxyethyl starch	1.15	\$28,091	\$76	\$24,363

<sup>\*</sup>LY – Life Years

# Heterogeneity and oxidation status of commercial human albumin preparations in clinical use\*

David Bar-Or, MD; Raphael Bar-Or, BS; Leonard T. Rael, MS; David K. Gardner, PhD; Denetta S. Slone, MD; Michael L. Craun, MD

Crit Care Med 2005 Vol. 33, No. 7

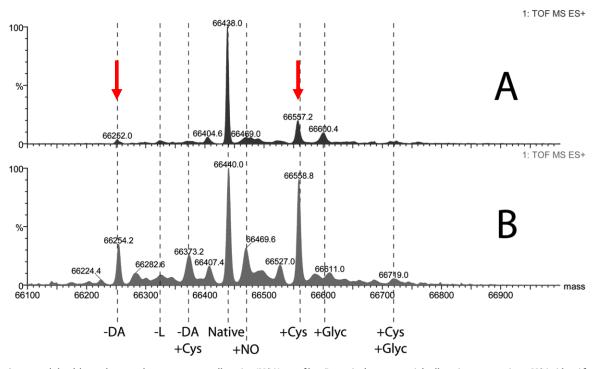


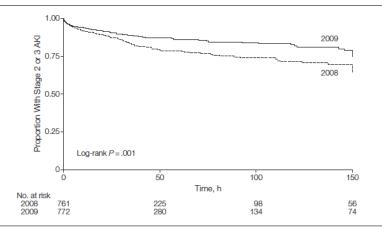
Figure 1. A, normal healthy volunteer human serum albumin (HSA) profile. B, typical commercial albumin preparation. HSA identification: DA, aspartate-alanine absent from N-terminus; L, leucine absent from C-terminus; +Cys, Cysteine 34 is bound by a free cysteine; NO, cysteine 34 is bound by nitric oxide; +Glyc, glycated albumin.

# En pratique

- Viser 1 cible Albuminémie> 30g/l (Albios)
- Alb 20%: 100 ml/8 h sur 3 j : Alb 26-29 g/l (EARSS)
- Privilégier Alb hyperoncotique (attention au Chlore)

#### Yunos et al. JAMA 2012

**Figure 1.** Development of Stage 2 or 3 Acute Kidney Injury (AKI) While in the Intensive Care Unit (ICU)



Stage 2 or 3 defined according to the Kidney Disease: Improving Global Outcomes clinical practice guideline.

### Conclusion

- Pas de crainte concernant la safety, mais pas à tous les patient en choc...
- Pas de solutés iso/hypotoniques en particulier TBI (SAFE study)
- Recommandée si:
  - Cirrhose et péritonite bactérienne spontanée
  - Cirrhose et ascite réfractaire > 4-5 l
- Données de sous groupes/physiopathologie-données biologiques
  - Cirrhose et syndrome hépatorénal
  - Patients « hypo-oncotiques » en SDRA
  - Choc septique sévère et hypo albuminémie/oedemes