



HOSPITAL ITALIANO
de Buenos Aires

*Servicio de Terapia Intensiva
de Adultos*

Fundación Cuidados Críticos

Cristaloides vs coloides ***Actualización a la fecha***

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Fisiopatología

La selección del tipo de fluido está basada en principios fisiológicos

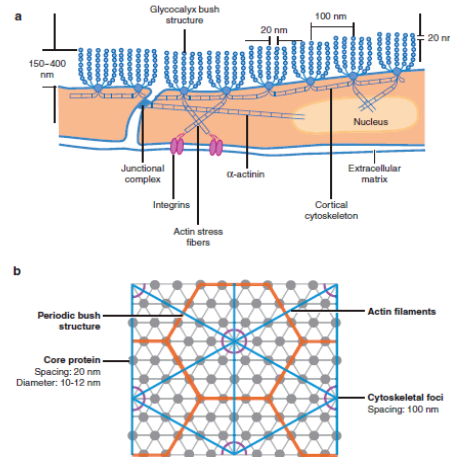


Figure 2
Structural model for the EGL. (a) Sketch of the arrangements of core proteins in the EGL and its anchorage to the underlying actin cortical cytoskeleton. (b) En face view of the idealized mathematical model in Weinbaum et al. (71) showing the hexagonal arrangement of core proteins and cluster foci. Adapted from Squire et al. (22) and figure 1 in Weinbaum et al. (71).

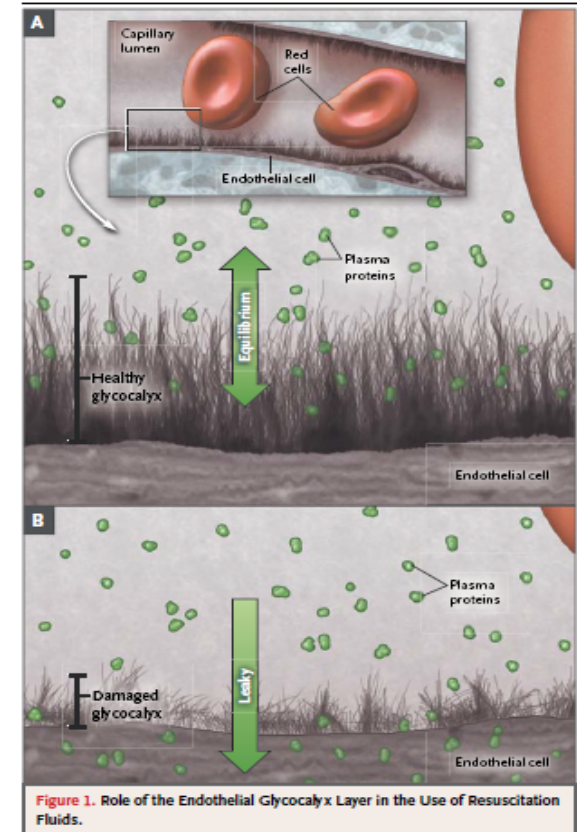


Figure 1. Role of the Endothelial Glycocalyx Layer in the Use of Resuscitation Fluids.

The Structure and Function of the Endothelial Glycocalyx Layer
Sheldon Weinbaum, 1,2 John M. Tarbell, 1 and Edward R. Damiano

El fluido ideal

Reposición de fluidos

-Fluido ideal:

- Aumento predecible e importante del IV.
- Composición similar al LEC.
- Metabolizado y excretado del organismo.
- Sin efectos adversos MTB o sistémicos.
- Costo-efectivo.

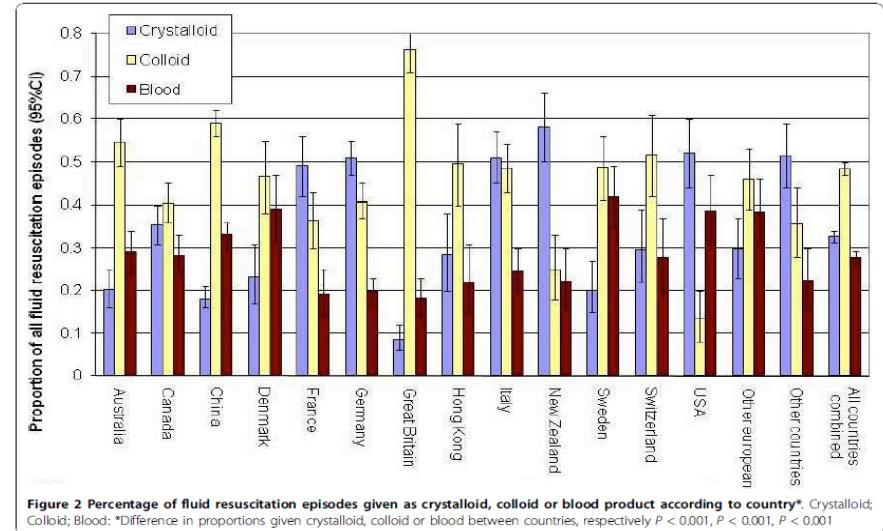
- Tipos de fluidos:

-Cristaloides:

- Solutos (iónicos y no iónicos).
- Libre difusión por las membranas.

-Coloides:

- Alto peso molecular.
- Alto poder osmótico.
- Incapaces de atravesar membranas Semipermeables sanas.



Resuscitation fluid use in critically ill adults: an international cross-sectional study in 391 intensive care units Simon Finfer, Bette Liu, Colman Taylor, Rinaldo Bellomo, Laurent Billot, Deborah Cook, Bin Du, Colin McArthur, John Myburgh for the SAFE TRIPS Investigators (2010 - Critical care)

Tipos de Coloides

Coloides:

- Albúmina:
 - Composición/presentación:
 - Ventajas (Reales y teóricas)
 - Desventajas:

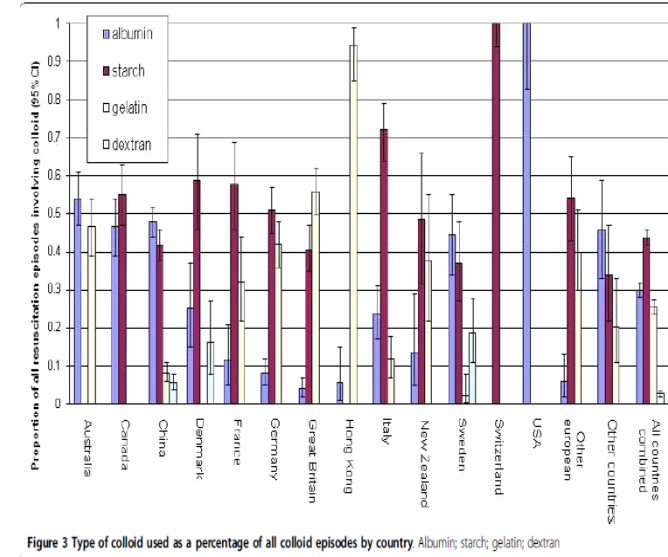
Evidencia: Cochrane (1998) - SAFE (2004) - FEAST (2011)

La disponibilidad limitada de Albúmina llevó al desarrollo de:

- Semisintéticos:
 - Composición/presentación
 - Ventajas
 - Desventajas

- **Dextranos** - **Gelatinas** - **Hidroxietilalmidones**

Evidencia: 6S- CHEST



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Tipos de cristaloides

Cristaloides:

- Solución fisiológica:
 - Composición/presentación
 - Ventajas
 - Desventajas
- Soluciones balanceadas:
 - Ringer:
 - Composición/presentación
 - Ventajas
 - Desventajas
 - Plasmalyte:
 - Composición/presentación
 - Ventajas
 - Desventajas



Composición de los fluidos de reanimación

Table 1. Types and Compositions of Resuscitation Fluids.*

| Variable | Human Plasma | Colloids | | | | | | | | | | Crystalloids | | |
|--------------------------|--------------|---------------|---------------------|--------------|--------------|---------------|---------------|----------------|--|--------------------------|--------------------------------|---------------------------|------------------------|--|
| | | 4% Albumin | Hydroxyethyl Starch | | | | | | 4% Succinylated Modified Fluid Gelatin | 3.5% Urea-Linked Gelatin | 0.9% Saline | Compounded Sodium Lactate | Balanced Salt Solution | |
| | | | 10% (200/0.5) | 6% (450/0.7) | 6% (130/0.4) | 6% (130/0.42) | | | | | | | | |
| Trade name | Albumex | Hemohe | Hextend | Voluven | Volulyte | Venofundin | Tetraspan | Gelofusine | Haemaccel | Normal saline | Hartmann's or Ringer's lactate | Plasma lyte | | |
| Colloid source | Human donor | Potato starch | Maize starch | Maize starch | Maize starch | Potato starch | Potato starch | Bovine gelatin | Bovine gelatin | | | | | |
| Osmolarity (mOsm/liter) | 291 | 250 | 308 | 304 | 308 | 286 | 308 | 296 | 274 | 301 | 308 | 280.6 | 294 | |
| Sodium (mmol/liter) | 135–145 | 148 | 154 | 143 | 154 | 137 | 154 | 140 | 154 | 145 | 154 | 131 | 140 | |
| Potassium (mmol/liter) | 4.5–5.0 | | | 3.0 | | 4.0 | | 4.0 | | 5.1 | | 5.4 | 5.0 | |
| Calcium (mmol/liter) | 2.2–2.6 | | | 5.0 | | | | 2.5 | | 6.25 | | 2.0 | | |
| Magnesium (mmol/liter) | 0.8–1.0 | | | 0.9 | | 1.5 | | 1.0 | | | | | 3.0 | |
| Chloride (mmol/liter) | 94–111 | 128 | 154 | 124 | 154 | 110 | 154 | 118 | 120 | 145 | 154 | 111 | 98 | |
| Acetate (mmol/liter) | | | | | | 34 | | 24 | | | | | 27 | |
| Lactate (mmol/liter) | 1–2 | | | 28 | | | | | | | | 29 | | |
| Malate (mmol/liter) | | | | | | | | 5 | | | | | | |
| Gluconate (mmol/liter) | | | | | | | | | | | | | 23 | |
| Bicarbonate (mmol/liter) | 23–27 | | | | | | | | | | | | | |
| Octanoate (mmol/liter) | | 6.4 | | | | | | | | | | | | |

* To convert the values for potassium to milligrams per deciliter, divide by 0.2558. To convert the values for calcium to milligrams per deciliter, divide by 0.250. To convert the values for magnesium to milligrams per deciliter, divide by 0.4114.

Albumina vs Cristaloides

A Comparison of Albumin and Saline for Fluid Resuscitation in the Intensive Care Unit, The SAFE Study Investigators

- Ensayo multicèntrico, randomizado, doble ciego en terapias de nueva zelanda y australia
- comparó albúmina al 4% vs sol.fisiológica
- Población heterogénea
- outcome primario muerte a los 28 días
- 6997 pacientes

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. (%)‡ | | | | | |
| No failure | 1397 (52.7) | 1424 (53.3) | | | 0.85§ |
| 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 | | | |
| Death within 28 days according to subgroup — no./total no. (%) | | | | | |
| Patients with trauma | 81/596 (13.6) | 59/590 (10.0) | 1.36 (0.99 to 1.86) | | 0.06 |
| Patients with severe sepsis | 185/603 (30.7) | 217/615 (35.3) | 0.87 (0.74 to 1.02) | | 0.09 |
| Patients with acute respiratory distress syndrome | 24/61 (39.3) | 28/66 (42.4) | 0.93 (0.61 to 1.41) | | 0.72 |

Albumina Vs Cristaloides, resultados

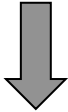
A Comparison of Albumin and Saline for Fluid Resuscitation in the Intensive Care Unit
The SAFE Study Investigators*

Table 2. Fluids Administered and Physiological Effects of Treatment.*

| Variable | Albumin Group | | Saline Group | | P Value† |
|--|-----------------|---------------|-----------------|---------------|----------|
| | No. of Patients | Value | No. of Patients | Value | |
| Study fluid (ml) | | | | | |
| Day 1 | 3410 | 1183.9±973.6 | 3418 | 1565.3±1536.1 | <0.001 |
| Day 2 | 3059 | 602.7±892.7 | 3068 | 954.0±1484.4 | <0.001 |
| Day 3 | 2210 | 268.0±554.5 | 2202 | 348.3±753.5 | 0.03 |
| Day 4 | 1686 | 192.3±427.0 | 1664 | 228.6±642.6 | 0.57 |
| Nonstudy fluid (ml) | | | | | |
| Day 1 | 3392 | 1459.4±1183.2 | 3405 | 1505.6±1254.3 | 0.30 |
| Day 2 | 3051 | 2615.9±1372.5 | 3057 | 2707.3±1435.7 | 0.009 |
| Day 3 | 2199 | 2618.5±1346.5 | 2191 | 2660.9±1319.3 | 0.15 |
| Day 4 | 1680 | 2691.5±1228.7 | 1656 | 2707.7±1255.4 | 0.36 |
| Packed red cells (ml) | | | | | |
| Day 1 | 3411 | 97.8±360.7 | 3415 | 71.7±296.8 | <0.001 |
| Day 2 | 3066 | 106.5±321.4 | 3074 | 61.1±235.2 | <0.001 |
| Day 3 | 2217 | 59.8±225.5 | 2210 | 49.5±190.8 | 0.30 |
| Day 4 | 1692 | 43.6±167.5 | 1668 | 46.0±189.0 | 0.77 |
| Net positive fluid balance (ml) | | | | | |
| Day 1 | 3363 | 1543.6±1619.7 | 3382 | 1990.5±2061.7 | <0.001 |
| Day 2 | 3044 | 1015.3±1826.9 | 3052 | 1505.1±2215.9 | <0.001 |
| Day 3 | 2190 | 422.1±1633.3 | 2182 | 553.0±1732.3 | 0.007 |
| Day 4 | 1671 | 137.2±1491.0 | 1649 | 155.7±1650.6 | 0.70 |
| Mean arterial pressure (mm Hg) | | | | | |
| Day 1 | 3406 | 81.4±14.4 | 3408 | 80.9±14.5 | 0.14 |
| Day 2 | 3068 | 84.4±15.1 | 3075 | 84.2±15.7 | 0.49 |
| Day 3 | 2215 | 87.2±15.3 | 2209 | 86.9±16.1 | 0.62 |
| Day 4 | 1688 | 88.3±15.9 | 1666 | 88.4±16.3 | 0.87 |
| Heart rate (beats/min) | | | | | |
| Day 1 | 3398 | 88.0±20.2 | 3406 | 89.7±20.8 | <0.001 |
| Day 3 | 3071 | 88.5±19.5 | 3075 | 89.5±19.2 | 0.06 |
| Day 3 | 2216 | 88.8±19.1 | 2213 | 89.7±18.8 | 0.10 |
| Day 4 | 1691 | 89.5±18.9 | 1668 | 89.9±18.5 | 0.52 |
| Central venous pressure (mm Hg) | | | | | |
| Day 1 | 2204 | 11.2±4.8 | 2270 | 10.0±4.5 | <0.001 |
| Day 2 | 2095 | 11.6±4.9 | 2135 | 10.4±4.3 | <0.001 |
| Day 3 | 1531 | 11.4±4.8 | 1589 | 10.7±4.4 | <0.001 |
| Day 4 | 1221 | 11.1±4.8 | 1230 | 10.5±4.4 | <0.001 |
| Serum albumin (g/liter) | | | | | |
| Day 1 | 2081 | 28.7±7.0 | 2061 | 24.7±6.5 | <0.001 |
| Day 2 | 2708 | 30.8±6.4 | 2703 | 24.5±5.9 | <0.001 |
| Day 3 | 1921 | 30.0±6.4 | 1905 | 23.6±5.6 | <0.001 |
| Day 4 | 1498 | 29.0±6.2 | 1478 | 23.1±5.5 | <0.001 |

Albúmina vs Cristaloides

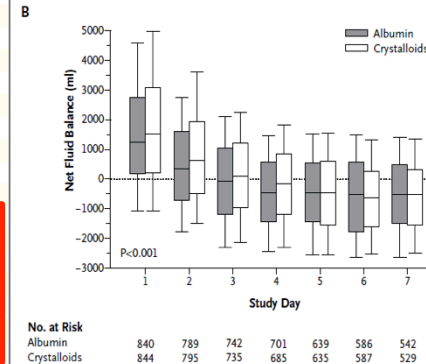
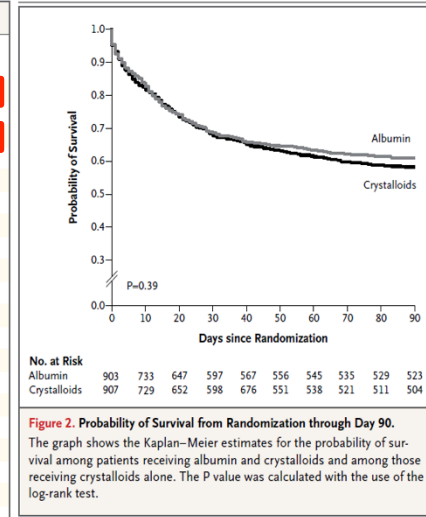
Albumin Replacement in Patients with Severe Sepsis or Septic Shock



- Multicéntrico, abierto y randomizado
- Sepsis severa
- n: 1.818
- Alb (20%) + Cristaloides vs Cristaloides
- Outcomes:
 - Mortalidad a 28 días
 - Mortalidad a 90 días
 - Estadía en UCI y hospitalaria

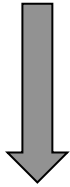
Table 2. Outcomes.

| Outcome | Albumin Group | Crystalloid Group | Relative Risk (95% CI) | P Value |
|---|----------------|-------------------|------------------------|---------|
| Primary outcome: death at 28 days — no./total no. (%) | 285/895 (31.8) | 288/900 (32.0) | 1.00 (0.87–1.14) | 0.94 |
| Secondary outcomes | | | | |
| Death at 90 days — no./total no. (%) | 365/888 (41.1) | 389/893 (43.6) | 0.94 (0.85–1.05) | 0.29 |
| New organ failures — no./total no. (%)* | | | | 0.99 |
| None | 372/836 (44.5) | 383/841 (45.5) | | |
| 1 organ | 283/836 (33.9) | 287/841 (34.1) | | |
| 2 organs | 130/836 (15.6) | 123/841 (14.6) | | |
| 3 organs | 40/836 (4.8) | 36/841 (4.3) | | |
| 4 organs | 10/836 (1.2) | 11/841 (1.3) | | |
| 5 organs | 1/836 (0.1) | 1/841 (0.1) | | |
| SOFA score† | | | — | 0.23 |
| Median | 6.00 | 5.62 | | |
| Interquartile range | 4.00–8.50 | 3.92–8.28 | | |
| SOFA subscore‡ | | | | |
| Cardiovascular | | | — | 0.03 |
| Median | 1.20 | 1.42 | | |
| Interquartile range | 0.46–2.31 | 0.60–2.50 | | |
| Respiratory | | | — | 0.63 |
| Median | 2.00 | 2.00 | | |
| Interquartile range | 1.56–2.48 | 1.57–2.50 | | |
| Renal | | | — | 0.15 |
| Median | 0.83 | 0.75 | | |
| Interquartile range | 0.14–2.14 | 0.07–2.00 | | |
| Coagulation | | | — | 0.04 |
| Median | 0.64 | 0.50 | | |
| Interquartile range | 0.00–1.62 | 0.00–1.59 | | |
| Liver | | | — | 0.02 |
| Median | 0.28 | 0.20 | | |
| Interquartile range | 0.00–1.00 | 0.00–0.92 | | |
| Length of stay — days | | | | |
| In ICU | | | — | 0.42 |
| Median | 9 | 9 | | |
| Interquartile range | 4–18 | 4–17 | | |
| In hospital‡ | | | — | 0.65 |
| Median | 20 | 20 | | |
| Interquartile range | 10–36 | 9–38 | | |



Albumina vs Cristaloides

Hydroxyethyl Starch 130/0.42 versus Ringer's Acetate in Severe Sepsis



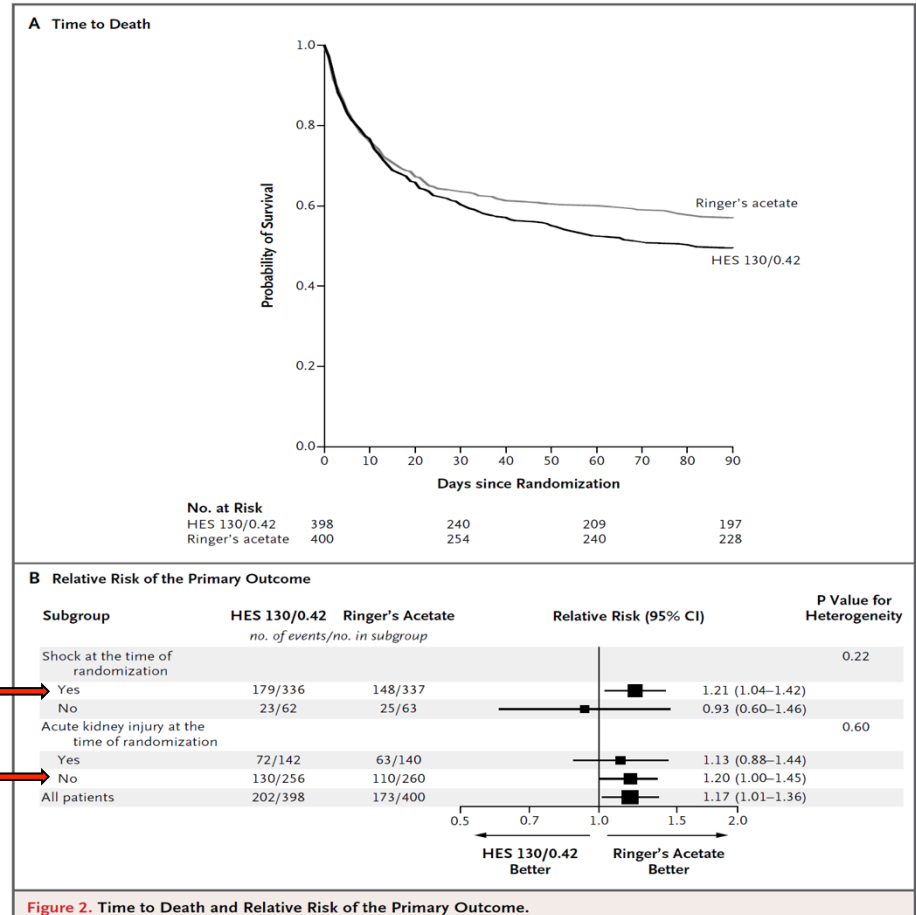
- Multicéntrico, randomizado y ciego.
- Sepsis severa
- n: 804
- HES 6% 130/0,42 vs Ringer-Lactato
- Outcomes:
 - Mortalidad a 90 días
 - Insuficiencia renal dialítica

Table 3. Primary and Secondary Outcomes.*

| Outcome | HES 130/0.42 (N=398) | Ringer's Acetate (N=400) | Relative Risk (95% CI) | P Value |
|--|-------------------------|-----------------------------|---------------------------|---------|
| Primary outcome | | | | |
| Dead or dependent on dialysis at day 90 — no. (%) | 202 (51) | 173 (43) | 1.17 (1.01–1.36) | 0.03 |
| Dead at day 90 — no. (%) | 201 (51) | 172 (43) | 1.17 (1.01–1.36) | 0.03 |
| Dependent on dialysis at day 90 — no. (%) | 1 (0.25) | 1 (0.25) | — | 1.00 |
| Secondary outcome measures | | | | |
| Dead at day 28 — no. (%) | 154 (39) | 144 (36) | 1.08 (0.90–1.28) | 0.43 |
| Severe bleeding — no. (%) [†] | 38 (10) | 25 (6) | 1.52 (0.94–2.48) | 0.09 |
| Severe allergic reaction — no. (%) [†] | 1 (0.25) | 0 | — | 0.32 |
| SOFA score at day 5 — median (interquartile range) | 6 (2–11) | 6 (0–10) | — | 0.64 |
| Use of renal-replacement therapy — no. (%) [‡] | 87 (22) | 65 (16) | 1.35 (1.01–1.80) | 0.04 |
| Use of renal-replacement therapy or renal SOFA score ≥3 — no. (%) [§] | 129 (32) | 108 (27) | 1.20 (0.97–1.48) | 0.10 |
| Doubling of plasma creatinine level — no. (%) [†] | 148 (41) | 127 (35) | 1.18 (0.98–1.43) | 0.08 |
| Acidosis — no. (%) ^{†¶} | 307 (77) | 312 (78) | 0.99 (0.92–1.06) | 0.72 |
| Alive without renal-replacement therapy — mean % of days | 91 | 93 | — | 0.048 |
| Use of mechanical ventilation — no. (%) [†] | 325 (82) | 321 (80) | 1.02 (0.95–1.09) | 0.61 |
| Alive without mechanical ventilation — mean % of days | 62 | 65 | — | 0.28 |
| Alive and out of hospital — mean % of days | 29 | 34 | — | 0.048 |

Albúmina vs Cristaloides

Hydroxyethyl Starch 130/0.42 versus
Ringer's Acetate in Severe Sepsis



Albumina vs Cristaloides

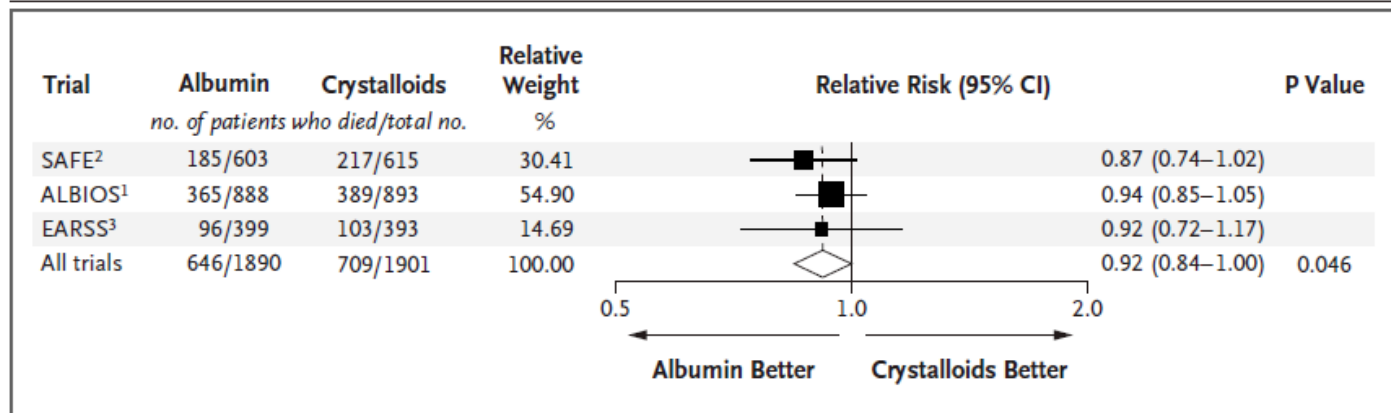


Figure 1. Meta-Analysis of Mortality in Large-Scale Randomized Trials Comparing Albumin with Crystalloids in Adult Patients with Severe Sepsis.

A fixed-effect model was used in the analysis. The size of the squares indicates the data points from the individual trials scaled according to the percentage of total weight (with individual trial weight equaling the proportion of total patients receiving albumin multiplied by the number of deaths in the crystalloids group), and the diamond indicates the pooled findings. The dashed line indicates the pooled relative risk. The proportion of variation attributable to heterogeneity (I^2) was 0% ($P=0.71$). ALBIOS denotes Albumin Italian Outcome Sepsis, CI confidence interval, EARSS Early Albumin Resuscitation during Septic Shock, and SAFE Saline versus Albumin Fluid Evaluation.

Albúmina vs Cristaloides

Conclusiones:

La reanimación con los distintos tipos de fluidos es extremadamente heterogénea.

Los outcomes duros son similares en ambos grupos.

Los coloides demostraron mejorar los parámetros fisiológicos y menor balance hídrico positivo.

Los hidroxietilalmidones requieren mayores estudios que demuestren seguridad en su utilización.