



Universidad  
Católica  
de Cuenca

CENTRO DE  
EDUCACIÓN  
CONTINUA



MINISTERIO  
DE SALUD PÚBLICA



TRAINING ALTATIERRA & ASOCIADOS  
ALTIERCAHEX S.A.

# **II CONGRESO INTERNACIONAL DE EMERGENCIAS PREHOSPITALARIAS**

ACTUALIZACIÓN EN MANEJO DE PACIENTE CRÍTICO.

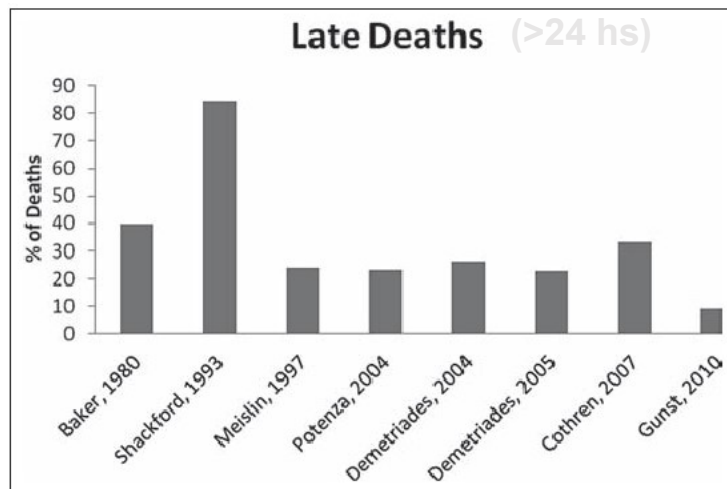
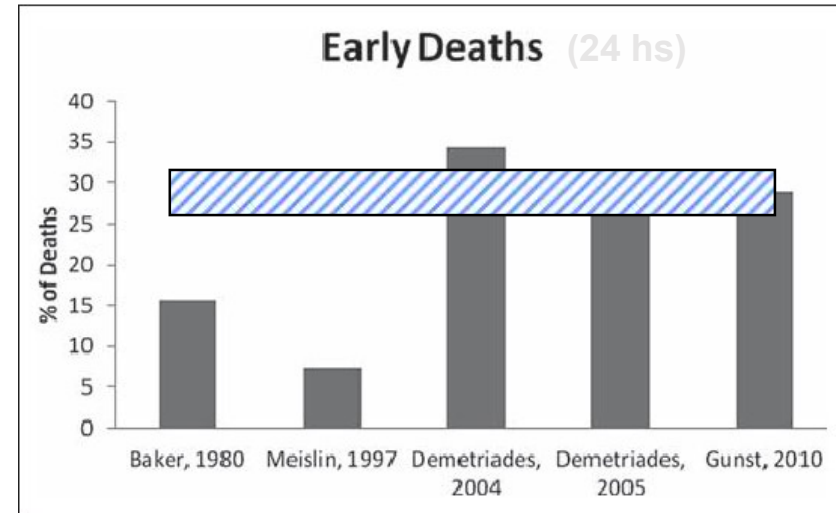
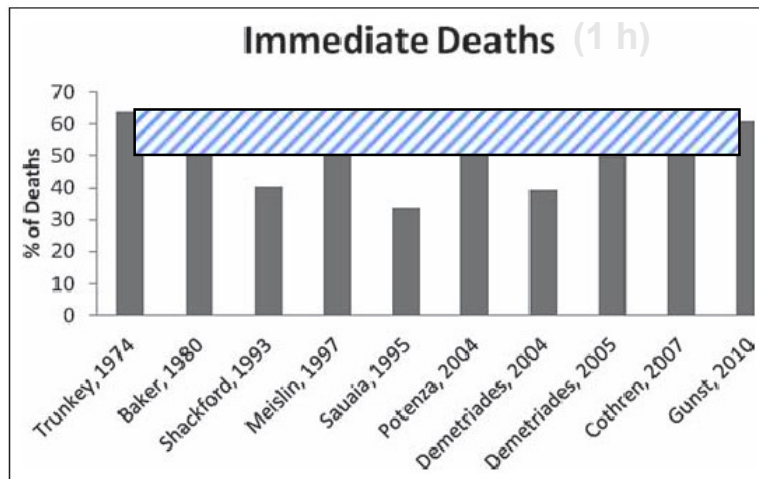
# Reanimación con líquidos en trauma



- Prof Silvio Aguilera
- Presidente Fundación emergencias
- Presidente ALACED
- Vicepresidente SAMPRE



# Causas de muerte en Trauma



## Causes of death by timing category

### Immediate and early deaths

Brain injury

Hemorrhage

### Late deaths

Infection

Multiple-organ failure

Brain injury

Hemorrhage

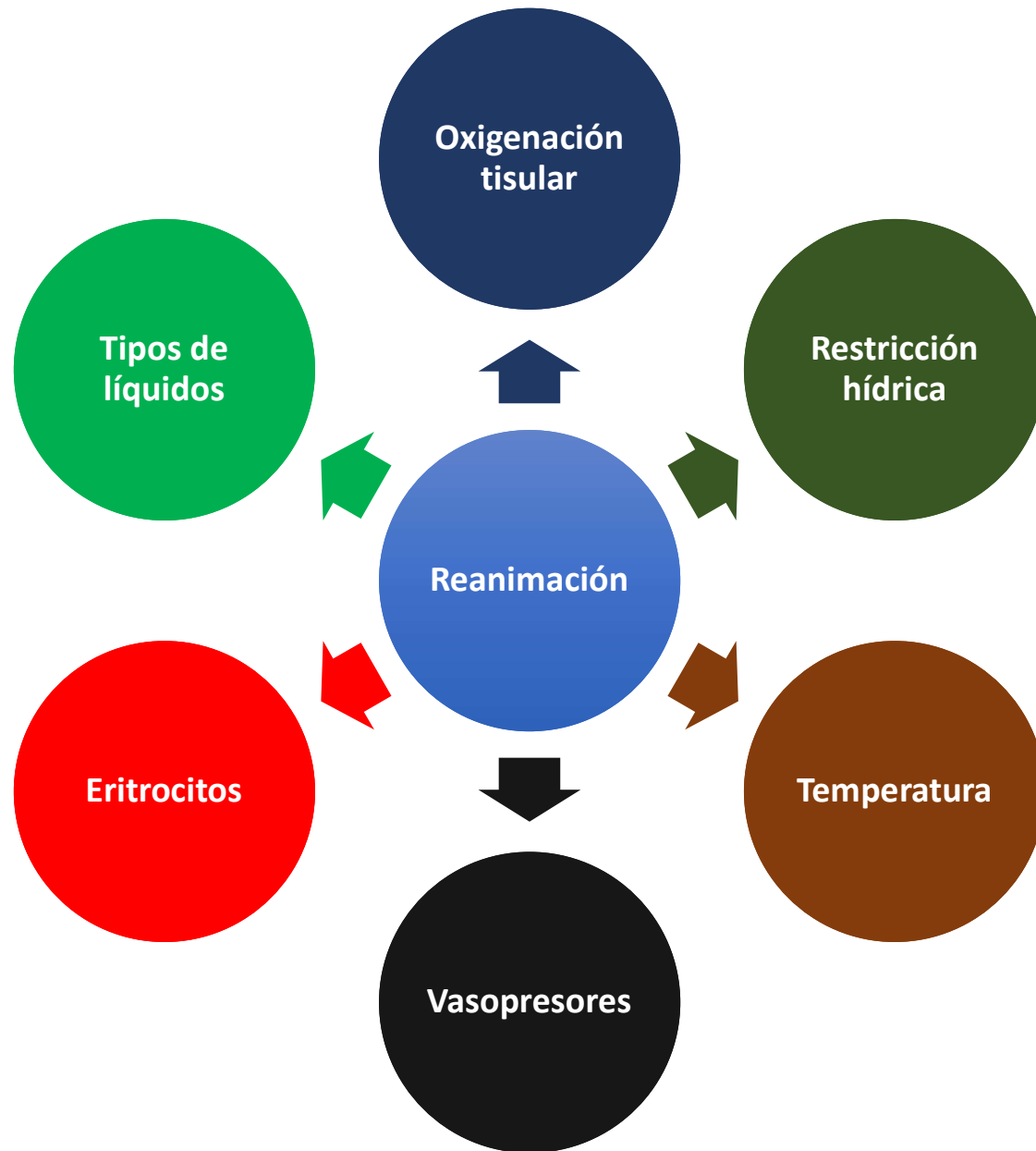
### Postdischarge

Cardiovascular disease

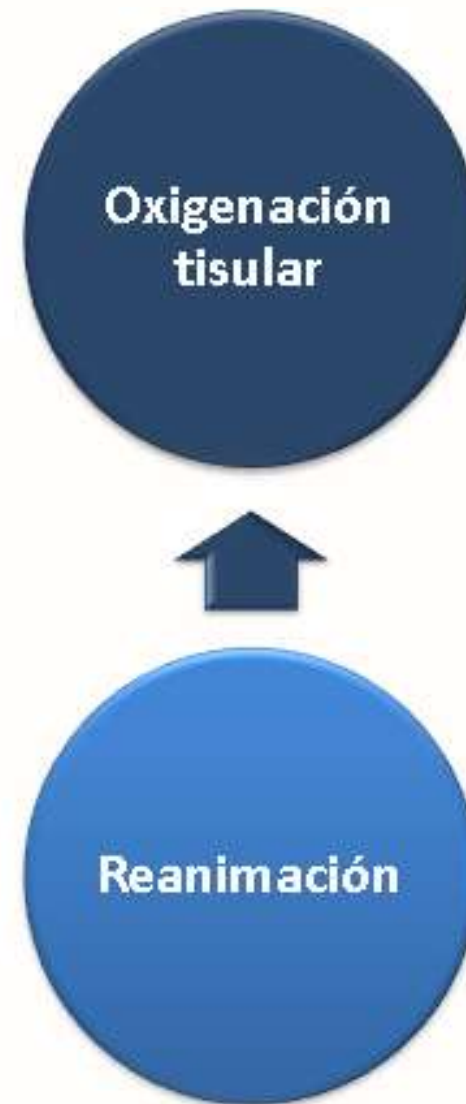
Second major trauma

Neurologic disease

Malignancy



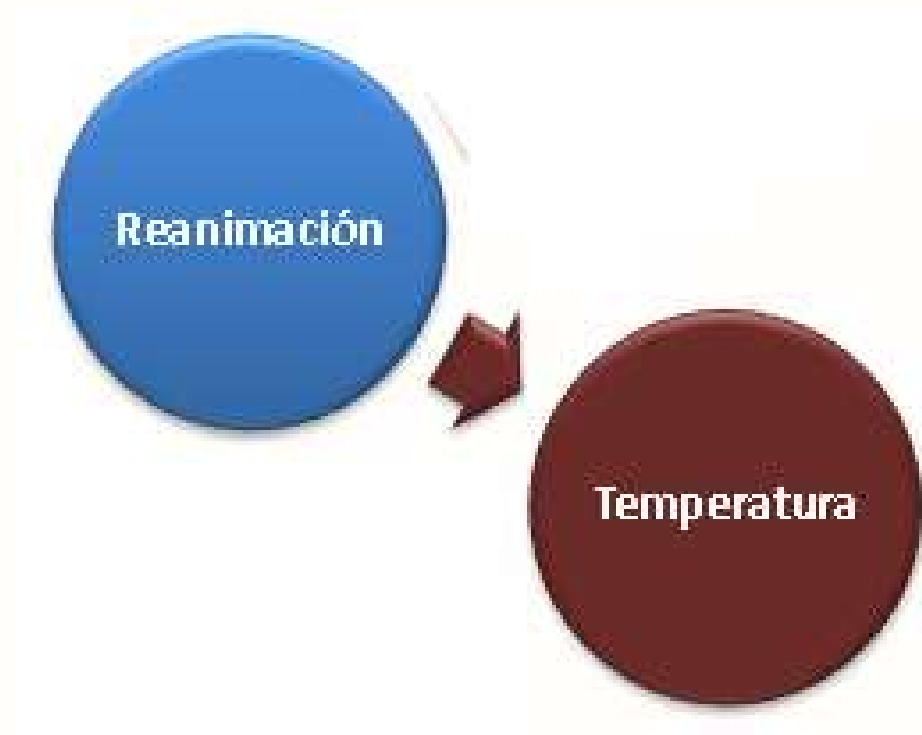
Mantener  
la TA  
sistólica  
adecuada



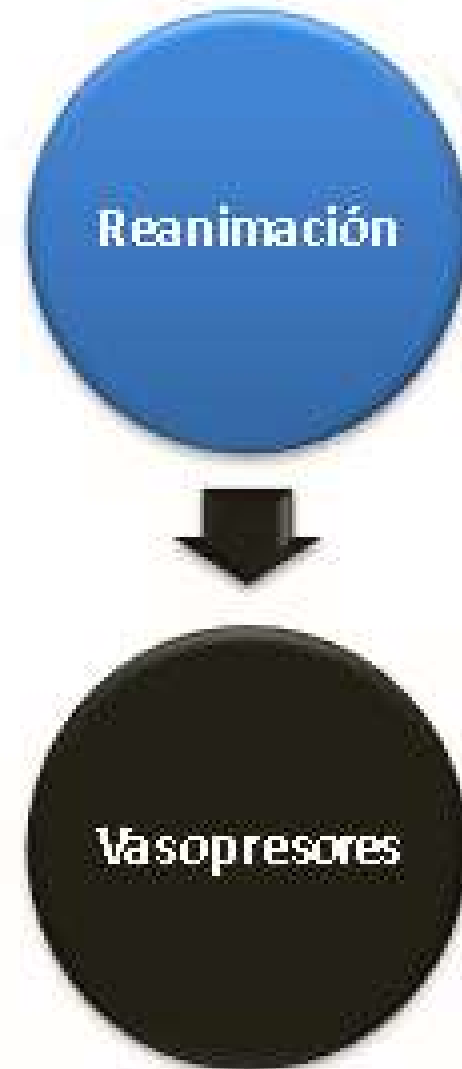
# Hipotensión permisiva



Evitar  
hipotermia



- Se sugiere administrar *vasopresores* para mantener la TA deseada en ausencia de respuesta a la administración de líquidos.
- Se sugiere infundir *agentes inotrópicos* en presencia de disfunción miocárdica.



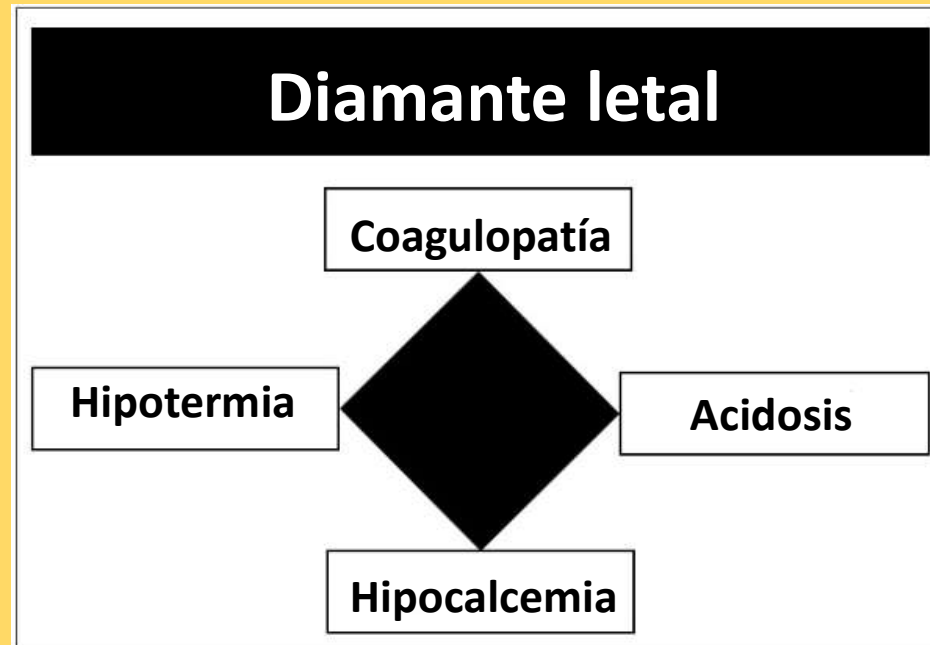
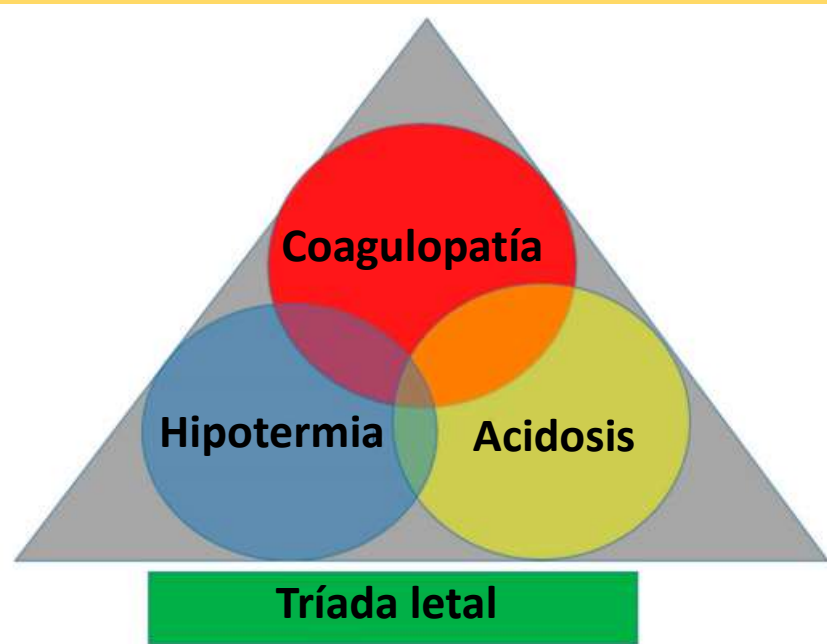


*Régimen  
restrictivo  
preferible  
sobre  
régimen  
liberal*



*Régimen  
con  
coloides o  
cristaloides*





**Trauma  
Severo**

**Coagulopatía  
traumática  
aguda**

**Maniobras de  
resucitación**

**Factores  
perjudiciales**

**Sistema activador proteína C  
Sistema neurohumoral  
Disfunción plaquetaria**

**Dilución factores coagulación  
Acidosis metabólica  
Edema intersticial  
Hipotermia**

**Acidosis  
Hipotermia  
Shock  
Trauma cerebral  
Edad  
Sexo masculino  
Comorbilidades  
Factores genéticos  
Inflamación  
Anticoagulantes orales  
previos**

**Coagulopatía inducida por trauma**



Plasma fresco congelado (PFC)

+

Concentrado de plaquetas

+

Concentrados de glóbulos rojos  
empaquetados (GR)

1:1:1      1:1:2

Concentrado de fibrinógeno y GR

Cantidad

Calidad

**Reanimación  
con altos  
volúmenes**

## **Aumento de presión**

- Ruptura del coágulo
- Reapertura de los vasos

## **Hemodilución**

- Disminución factores coagulación
- Disminución proteínas antifibrinolíticas

## **Líquidos fríos**

- Hipotermia

## **Otros**

- Síndrome compartimental abdominal
- Íleo postoperatorio
- Descompensación cardíaca

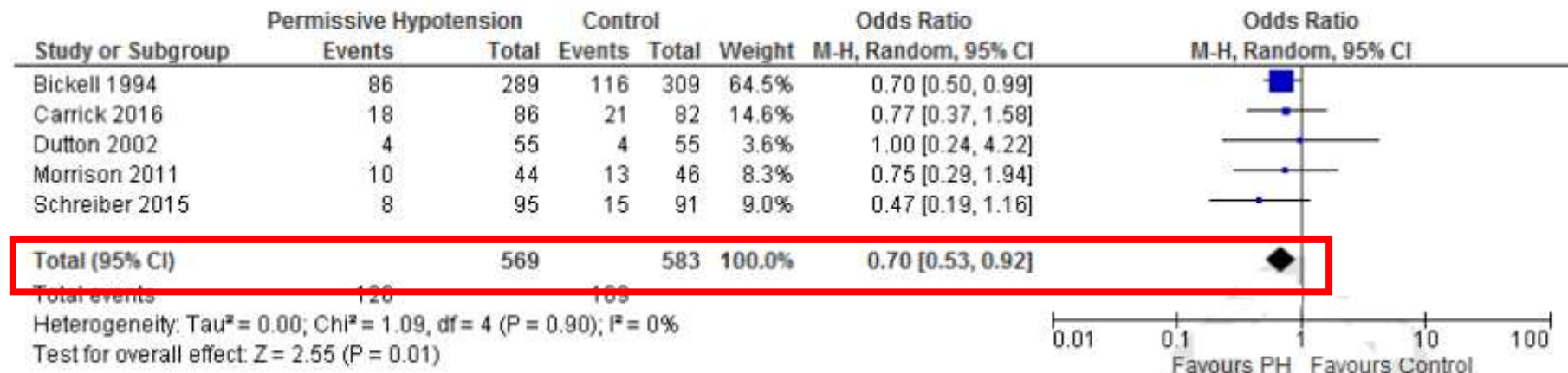
# Permissive hypotension versus conventional resuscitation strategies in adult trauma patients with hemorrhagic shock: A systematic review and meta-analysis of randomized controlled trials

Tran, Alexandre MD; Yates, Jeffrey MD; Lau, Aaron MD; Lampron, Jacinthe MD; Matar, Maher MD

[Author Information](#) ✓

Journal of Trauma and Acute Care Surgery: May 2018 - Volume 84 - Issue 5 - p 802-808

doi: 10.1097/TA.0000000000001816



Tran, Alexandre, et al. "Permissive hypotension versus conventional resuscitation strategies in adult trauma patients with hemorrhagic shock: a systematic review and meta-analysis of randomized controlled trials." *Journal of Trauma and Acute Care Surgery* 84.5 (2018): 802-808.

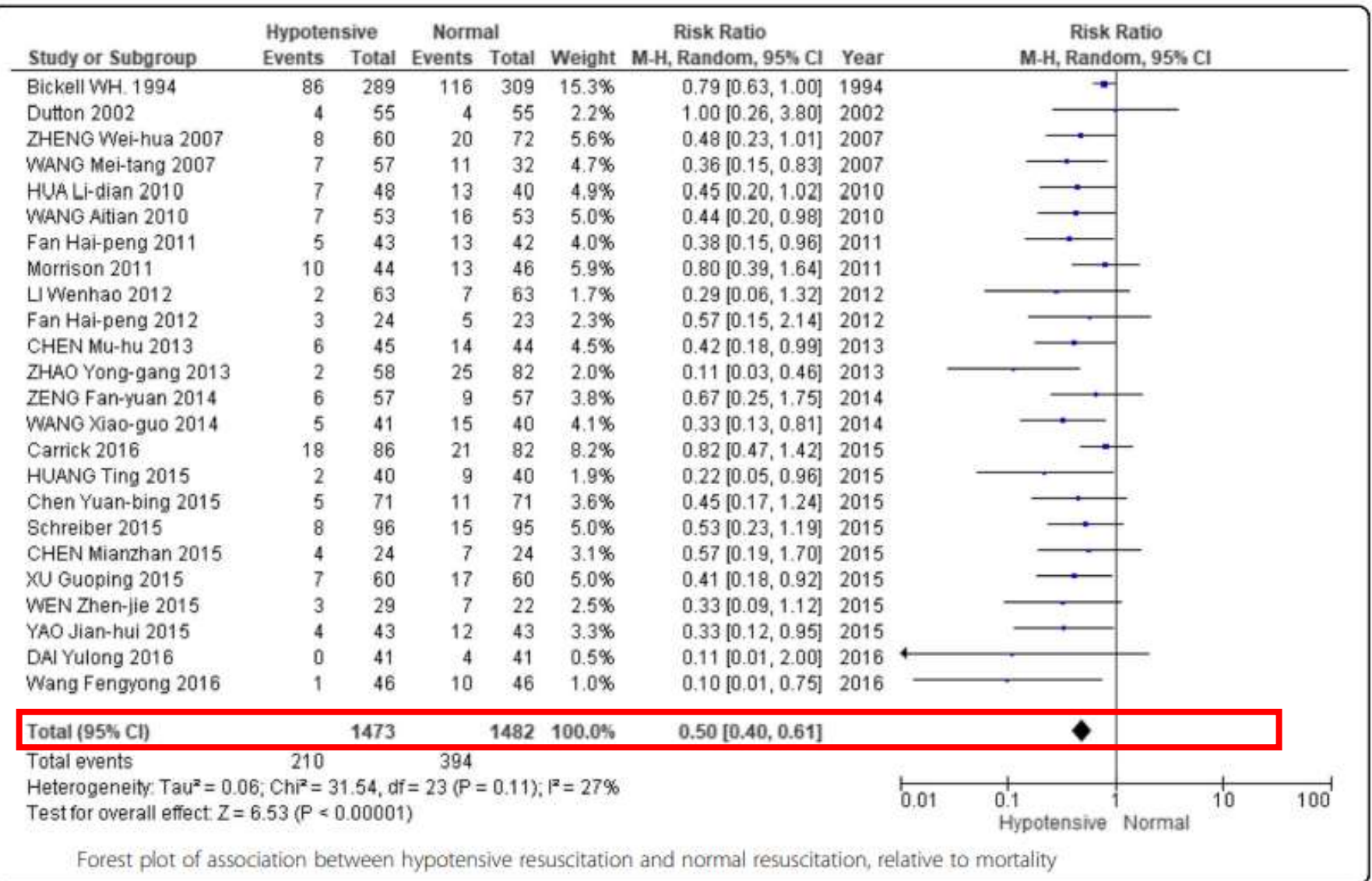


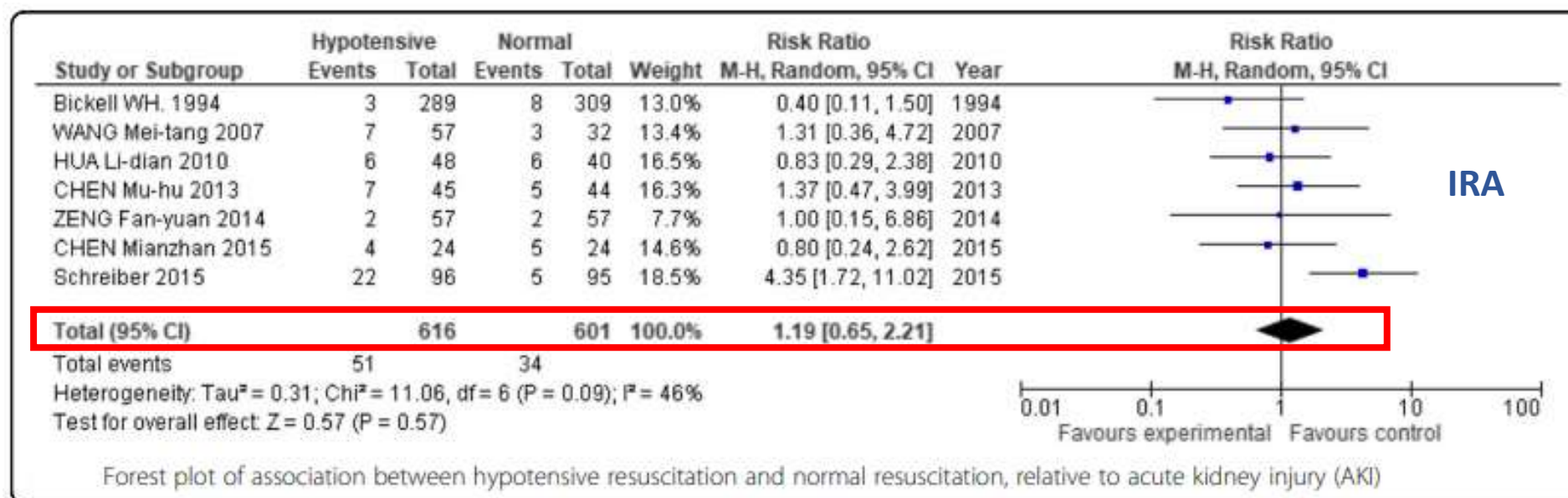
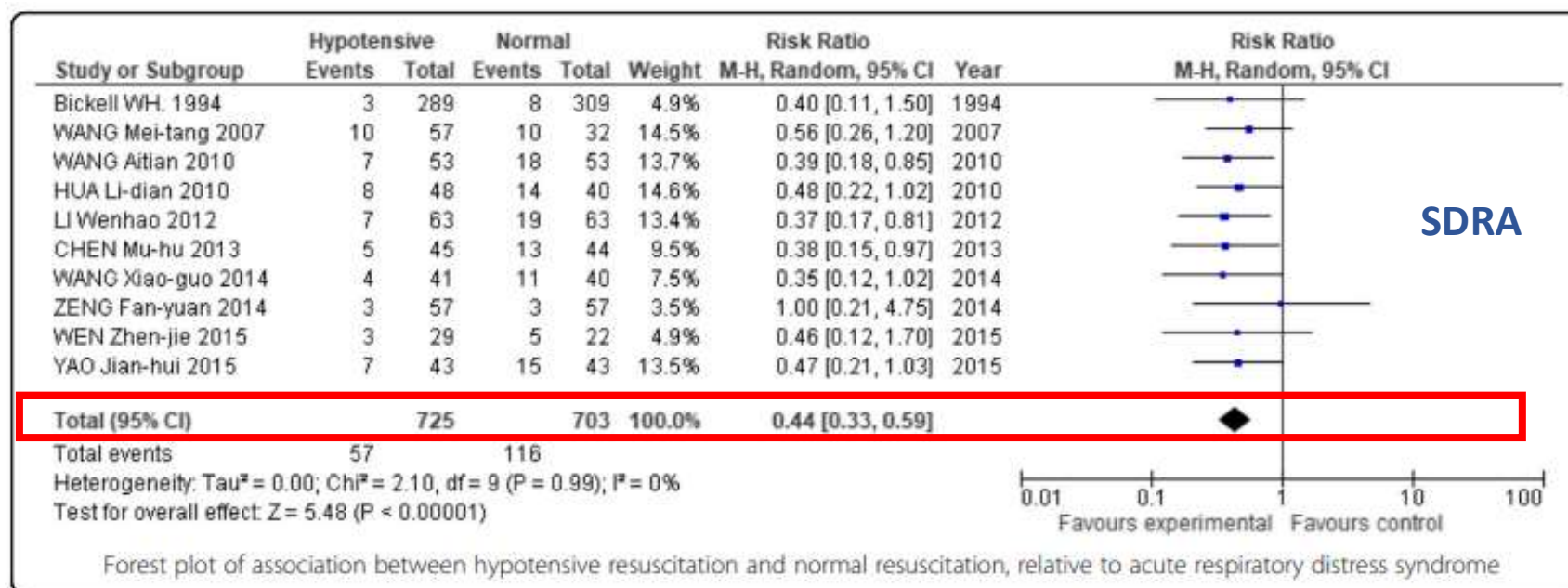
# Permissive hypotensive resuscitation in adult patients with traumatic haemorrhagic shock: a systematic review

Mohammed Albreiki      David Voegeli

Pooled mortality rate between hypotensive and aggressive resuscitation groups in the comparative studies

| Name, year                                      | Sample size of hypotensive patients | No of deaths                           |                                       | <i>P</i> value | Hazard ratio | Survival rate between restrictive versus large volume resuscitation (%) |
|-------------------------------------------------|-------------------------------------|----------------------------------------|---------------------------------------|----------------|--------------|-------------------------------------------------------------------------|
|                                                 |                                     | Death/patients (hypotensive group) (%) | Death/patients (aggressive group) (%) |                |              |                                                                         |
| Randomised control trials and prospective study |                                     |                                        |                                       |                |              |                                                                         |
| Bickell et al. [13]                             | 598                                 | 86/289 (29.7)                          | 116/309 (37.5)                        | 0.04           | N/M          | 70 versus 62                                                            |
| Dutton et al. [26]                              | 110                                 | 4/55 (7.2)                             | 4/55 (7.2)                            | N/M            | HR 1.00      | 92.7 versus 92.7                                                        |
| Morrison et al. [27]                            | 90                                  | 10/44 (22.7)                           | 13/46 (28.2)                          | 0.58           | HR 1.10      | 77.2 versus 71.7                                                        |
| Schreiber et al. [28]                           | 191                                 | 5/96 (5.2)                             | 14/95 (14.7)                          | N/M            | aOR 0.39     | 94.8 versus 85.2                                                        |
| Carrick et al. [29]                             | 168                                 | 18/86 (20.9)                           | 21/82 (25.6)                          | 0.47           | HR 0.48      | 78.5 versus 73.7                                                        |
| Total                                           | 1157                                | 123/570 (21.57%)                       | 168/587 (28.6%)                       |                |              |                                                                         |





Mantener la TA sistólica entre 60 a 70 mmHg hasta que el gran sangrado haya terminado cuando hay trauma penetrante.

Mantener la TA sistólica entre 80 a 90 mmHg hasta que el gran sangrado haya terminado cuando hay trauma contuso.

Mantener la TA sistólica entre 100 a 110 mmHg en pacientes con shock hemorrágico y TEC severo (GCS  $\leq 8$ ).

Cantidad

Calidad



# Tipos de Soluciones

- **Soluciones cristaloides:**
  - hipotónicas:** ClNa al 0.45%, Dextrosa 5%, Dextrosa 10%
  - isotónicas:** ClNa al 0.9%, Soluciones balanceadas o equilibradas
  - hipertónicas:** ClNa al 3%/7.5%
- **Soluciones coloides:**
  - sintéticos:** gelatinas  
almidones  
dextrans
  - naturales:** albúmina





# Soluciones cristaloideas

- Son soluciones electrolíticas y/o azucaradas que permiten:
  - Mantener el equilibrio hidroelectrolítico.
  - Expandir el volumen intravascular
  - Aportar energía
- El 50% del volumen infundido de una solución cristaloide tarda como promedio unos 15 min en abandonar el espacio intravascular.
- Mas baratos.
- No reacciones alérgicas.



# Soluciones cristaloides

- Favorecen la función cardíaca, disminuyen la viscosidad y mejoran la microcirculación.
- No alteran la coagulación, salvo en forma dilucional, no afectan la tipificación sanguínea .
- Solo el 25% del volumen infundido permanece alrededor de 76 minutos en el IV.
- El 75% restante trasvasó al liquido intersticial.
- Se necesitan infundir 4 veces el volumen de las pérdidas en cristaloides.





# Soluciones cristaloides

- Cristaloides hipotónicos
- Cristaloides isotónicos
- Cristaloides hipertónicos



# Soluciones cristaloides hipotónicas

77 mEq/L Na<sup>+</sup>, 77 mEq/L Cl<sup>-</sup>, 154 mOsm/L

## **Hiposalino al 0.45%**

Aporta la mitad del contenido de ClNa que la solución fisiológica. Ideal para el aporte de agua libre exenta de glucosa.

# Soluciones cristaloides isotónicas *emergencias*

## **Sol. Fisiológica al 0,9%:**

Na: 154mEq/l.

Cl: 154mEq/l.

Cloruro sódico 0,9 grs/100ml.

mOsm/l 308



# Soluciones cristaloides isotónicas *emergencias*

## Ringer lactato:

Na: 130mEq/l.

Cl: 109mEq/l.

K: 4mEq/l.

Ca: 3mEq/l.

Osmolaridad: 274mOsm/l.

Lactato: 28 mEq/l.

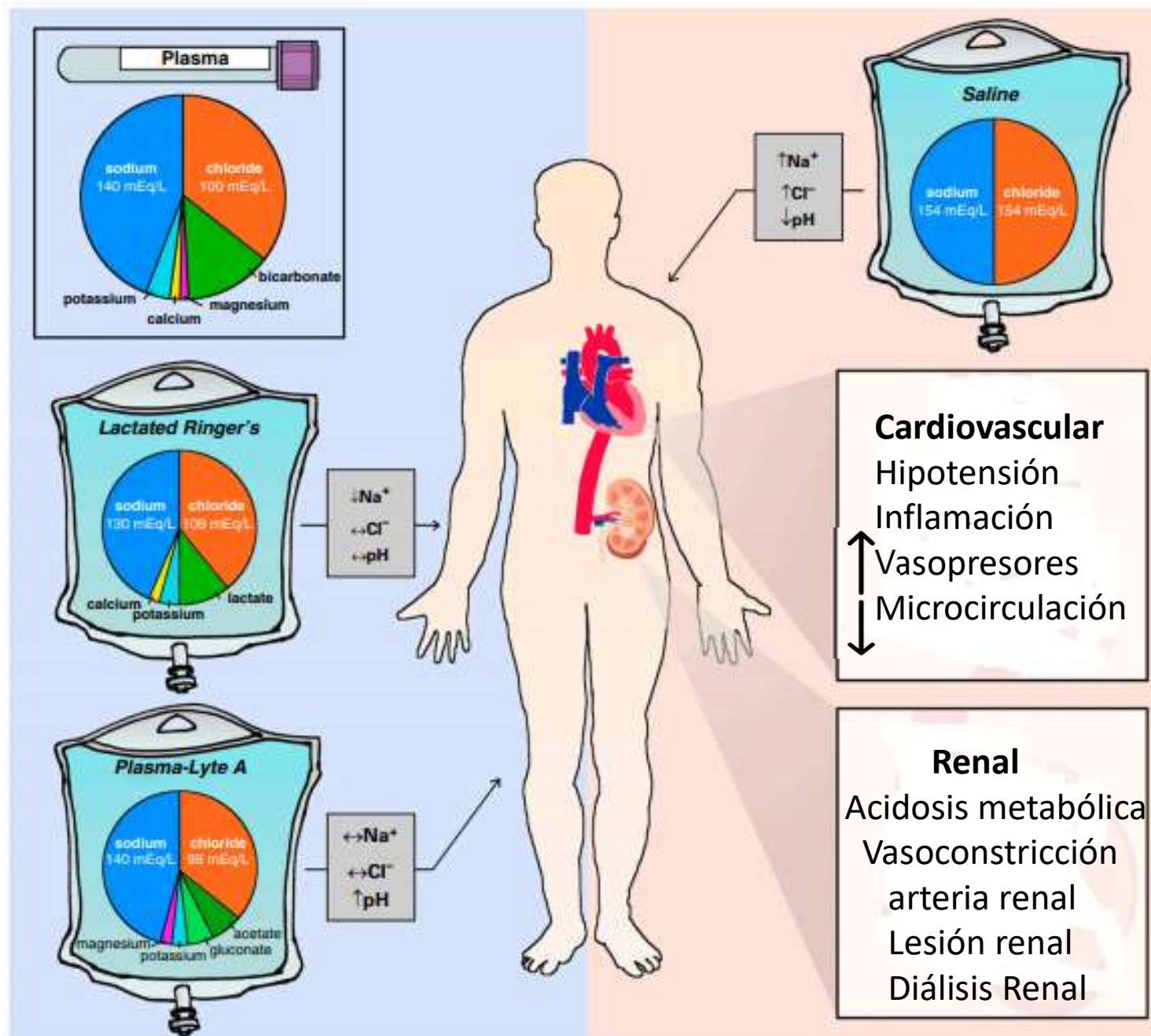
### VENTAJAS

45mEq Cl - que el suero fisiológico, causando solo hipercloremia transitoria y no acidosis

# Soluciones cristaloideas isotónicas

- Soluciones
- balanceadas o
- equilibradas

|               | Na  | K   | Mg  | Cl | Acetato | Gluconato | Osm |
|---------------|-----|-----|-----|----|---------|-----------|-----|
| Plasma-Lyte A | 140 | 5.0 | 3.0 | 98 | 27      | 23        | 294 |
| Normosol-R    | 140 | 5.0 | 3.0 | 98 | 27      | 23        | 294 |
| Isolyte S     | 141 | 5.0 | 3.0 | 98 | 27      | 23        | 294 |



**Sol. Hipertonica de  
NaCl 3%**

Na: 513mEq/l.

Cl: 513mEq/l.

Osmolaridad: 1026mOsm/l.

**Sol. Hipertonica de  
NaCl 20 %**

Na: 3420mEq/l.

Osmolaridad: 6840mOsm/l.

Soluciones  
cristaloides  
hipertónicas



# Soluciones cristaloides

| Composición               | NaCl<br>0,9% | Ringer<br>Simple | Ringer<br>Acetato | Ringer<br>Lactato | Plasma-Lyte®<br>148 | Isofundin® Plasma |                 |
|---------------------------|--------------|------------------|-------------------|-------------------|---------------------|-------------------|-----------------|
| Na <sup>+</sup> , mmol/l  | 154          | 147              | 130               | 131               | 140                 | 145               | 135-145         |
| Cl <sup>-</sup> , mmol/l  | 154          | 155              | 112               | 112               | 98                  | 127               | 98-105          |
| K <sup>+</sup> , mmol/l   | -            | 4                | 5                 | 5,4               | 5                   | 4                 | 3,5-5           |
| Ca <sup>2+</sup> , mmol/l | -            | 4                | 1                 | 1,8               | 3                   | 2,5               | 2,5             |
| Mg <sup>2+</sup> , mmol/l | -            | -                | 1                 |                   | -                   | 1                 | 1,5-2,5         |
| Lactato, mmol/l           | -            | -                |                   | 28                |                     |                   |                 |
| Acetato, mmol/l           | -            | -                | 27                |                   | 27                  | 24                |                 |
| Otros, mmol/l             | -            | -                |                   |                   | Gluconato 23        | Malato 5          | Bicarbonato 24- |
| Osmolaridad<br>mOsm/l     | 308          | 309              | 276               | 277               | 295                 | 309               | 28<br>291       |



# Soluciones coloides



- Fluidos de gran peso molecular.
- Restauración rápida del volumen circulante con menor administración.
- Expansión de volumen.
- Mantienen la presión coloidosmótica.



# Soluciones coloides



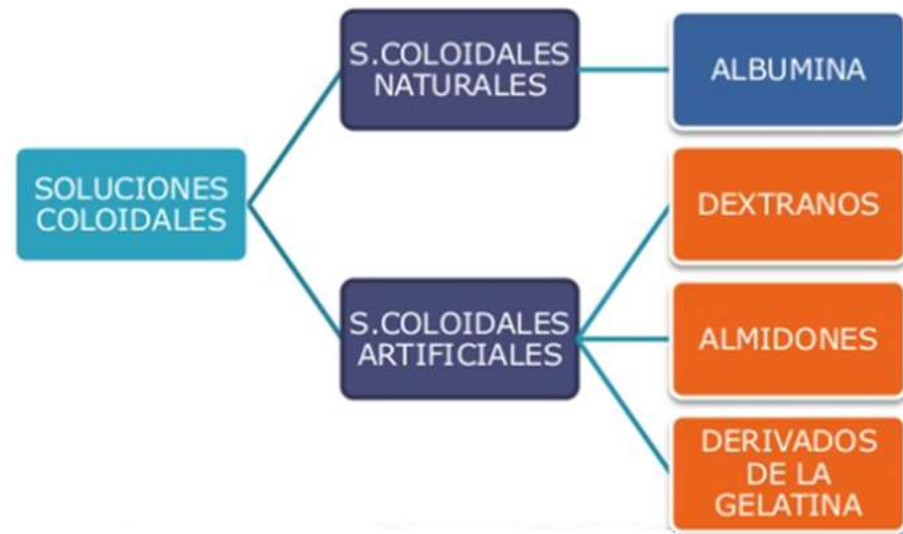
## Ventajas del uso de Coloides:

- Reduce el tiempo de reanimación.
- Reduce el volumen de administración.

## Desventajas del uso de Coloides:

- Alto costo económico
- Producen alergias
- Alteraciones en la coagulación

# Soluciones coloideas: clasificación



# Soluciones coloides: albúmina

**Albumina humana  
al 20 y 25%:**  
Vial de 50 ml.

**Albumina humana  
al 20%:**  
Vial de 10 ml (2grs).  
50 ml (10grs).  
100ml (20gs).

## VENTAJAS

- MENOS CAMBIOS EN LOS TIEMPOS DE PROTROMBINA
- DISMINUIR EDEMA
- NO CAUSA REACCION ANAFILÁCTICA

## DESVENTAJAS

- DISMINUCION DE LA AGREGACION PLAQUETARIA Y LOS FACTORES DE LA COAGULACION

# Soluciones coloides: dextranos

- Mezcla de polímeros de glucosa
- Disponibles en 2 soluciones:
  - dextrano 40 (peso molecular medio 40.000 Da)
  - dextrano 70 (peso molecular medio 70.000 Da).
- Asociados con efectos secundarios: reacciones alérgicas, fracaso renal o diátesis hemorrágica
- Prácticamente han caído en desuso en los últimos años



# Soluciones coloides: almidón

## HIDROXIETIL ALMIDON

AMILOPECTINA

CADENAS DE GLUCOSA RAMIFICADAS

MODIFICAR SU ESTRUCTURA PARA QUE SU  
TIEMPO EN EL ORGANISMO SEA PROLONGADO

**Hidroxietil  
almidón al 6 y  
10%:**  
Envase de 500 ml.

# Soluciones coloides: gelatinas

**Hay diferentes tipos de gelatinas comercializadas:**

- Poligelinas: al 3,5%. Alto contenido de Ca y K.
- Succiniladas: Poco contenido de Ca y K.

# Soluciones coloides: gelatinas

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- *Efecto adverso más temido:* posibilidad de reacción anafiláctica (1% con poligelina y 1% con succinilada)



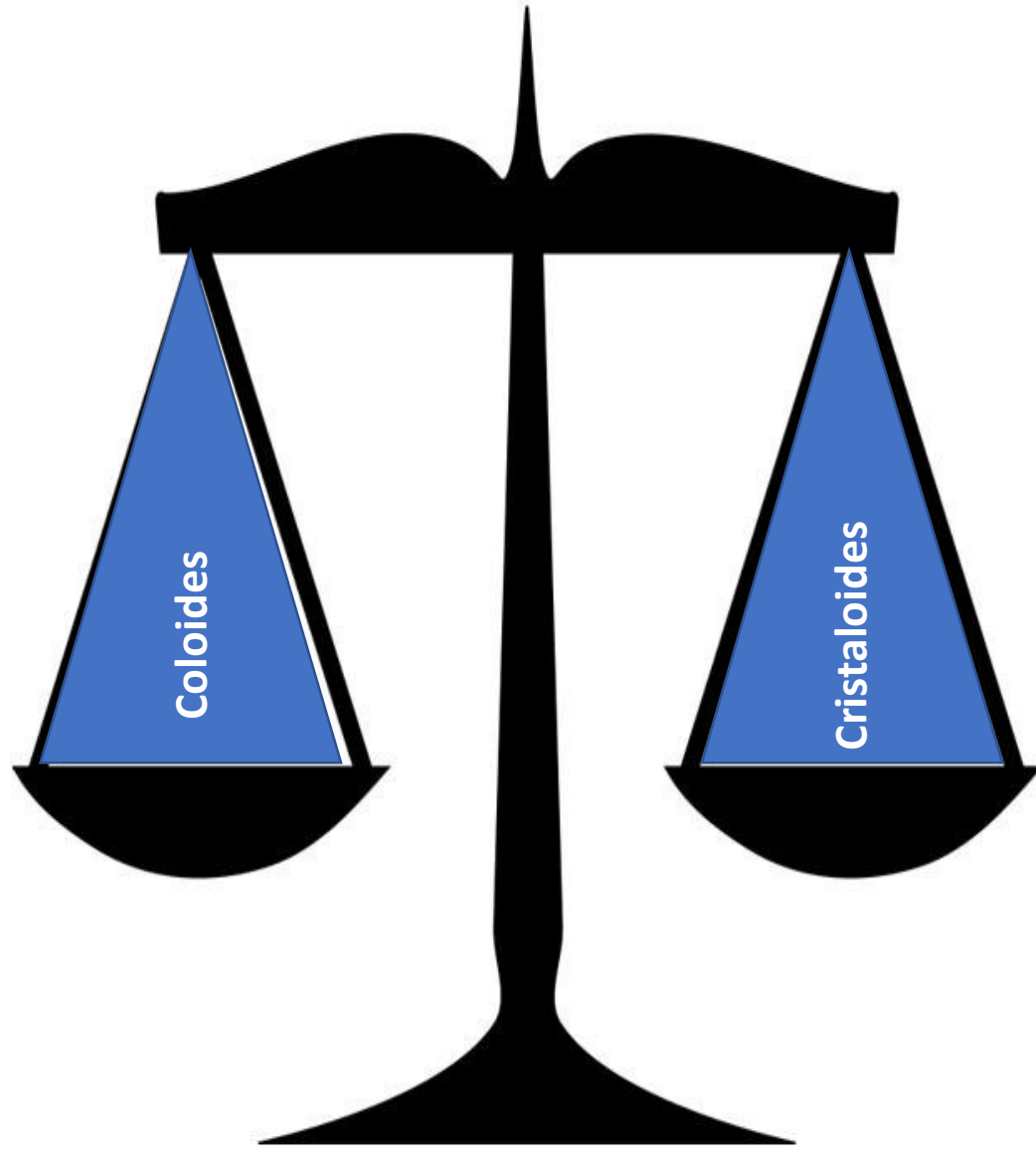
### Electrolyte composition (mmol/l) of commonly available colloids

|             | Albumin<br>4% | Plasmion<br>Geloplasma | Gelofusine | Voluven<br>(waxy maize<br>HES 6%<br>130/0.40) | Venofundin<br>(potato<br>HES 6%<br>130/0.42) | Hextend<br>(waxy maize<br>HES 6%<br>670/0.75) | Volulyte<br>(waxy maize<br>HES 6%<br>130/0.40) | PlasmaVolume<br>(potato<br>HES 6%<br>130/0.42) | Tetraspan<br>(potato<br>HES 6%<br>130/0.42) |
|-------------|---------------|------------------------|------------|-----------------------------------------------|----------------------------------------------|-----------------------------------------------|------------------------------------------------|------------------------------------------------|---------------------------------------------|
| Sodium      | 140           | 150                    | 154        | 154                                           | 154                                          | 143                                           | 137                                            | 130                                            | 140                                         |
| Potassium   | 0             | 5                      | 0          | 0                                             | 0                                            | 3                                             | 4                                              | 5.4                                            | 4.0                                         |
| Chloride    | 128           | 100                    | 125        | 154                                           | 154                                          | 124                                           | 110                                            | 112                                            | 118                                         |
| Calcium     | 0             | 0                      | 0          | 0                                             | 0                                            | 2.5                                           | 0                                              | 0.9                                            | 2.5                                         |
| Magnesium   | 0             | 1.5                    | 0          | 0                                             | 0                                            | 0.5                                           | 1.5                                            | 1                                              | 1.0                                         |
| Bicarbonate | 0             | 0                      | 0          | 0                                             | 0                                            | 0                                             | 0                                              | 0                                              | 0                                           |
| Lactate     | 0             | 30                     | 0          | 0                                             | 0                                            | 28                                            | 0                                              | 0                                              | 0                                           |
| Acetate     | 0             | 0                      | 0          | 0                                             | 0                                            | 0                                             | 34                                             | 27                                             | 24                                          |
| Malate      | 0             | 0                      | 0          | 0                                             | 0                                            | 0                                             | 0                                              | 0                                              | 5                                           |
| Octanoate   | 6.4           | 0                      | 0          | 0                                             | 0                                            | 0                                             | 0                                              | 0                                              | 0                                           |

# Tipos de Soluciones

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almidones  
dextrans
  - naturales:** albúmina







**Cochrane  
Library**

Cochrane Database of Systematic Reviews

## **Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)**

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

- ✓ **Metaanálisis: 69 estudios con 30.020 pacientes**
- ✓ **Pacientes críticos (trauma, quemados, sepsis)**
- ✓ **Comparan cristaloides vs coloides (almidones, dextranos, gelatinas, albúmina o plasma fresco).**

Cochrane Data base of Systematic Reviews 2018, Issue 8. Art. No.:  
CD000567. DOI: 10.1002/14651858.CD000567.pub7

## Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

| Outcome or subgroup title          | No. of studies | No. of participants | Statistical method               | Effect size        |
|------------------------------------|----------------|---------------------|----------------------------------|--------------------|
| 1 Mortality at end of follow-up    | 24             | 11177               | Risk Ratio (M-H, Random, 95% CI) | 0.97 [0.86, 1.09]  |
| 2 Mortality within 90 days         | 15             | 10415               | Risk Ratio (M-H, Random, 95% CI) | 1.01 [0.90, 1.14]  |
| 3 Mortality within 30 days         | 11             | 10135               | Risk Ratio (M-H, Random, 95% CI) | 0.99 [0.90, 1.09]  |
| 4 Transfusion of blood product     | 8              | 1917                | Risk Ratio (M-H, Random, 95% CI) | 1.19 [1.02, 1.39]  |
| 5 Renal replacement therapy        | 9              | 8527                | Risk Ratio (M-H, Random, 95% CI) | 1.30 [1.14, 1.48]  |
| 6 Adverse event: allergic reaction | 3              | 7757                | Risk Ratio (M-H, Random, 95% CI) | 2.59 [0.27, 24.91] |
| 7 Adverse event: itching           | 2              | 6946                | Risk Ratio (M-H, Random, 95% CI) | 1.38 [1.05, 1.82]  |
| 8 Adverse event: rash              | 2              | 7007                | Risk Ratio (M-H, Random, 95% CI) | 1.61 [0.90, 2.89]  |

Almidones vs cristaloides

## Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

| Outcome or subgroup title              | No. of studies | No. of participants | Statistical method               | Effect size        |
|----------------------------------------|----------------|---------------------|----------------------------------|--------------------|
| 1 Mortality at end of follow-up        | 19             | 4736                | Risk Ratio (M-H, Random, 95% CI) | 0.99 [0.88, 1.11]  |
| 2 Mortality within 90 days and 30 days | 10             | 3353                | Risk Ratio (M-H, Random, 95% CI) | 0.99 [0.87, 1.12]  |
| 3 Transfusion of blood products        | 3              | 1272                | Risk Ratio (M-H, Random, 95% CI) | 0.92 [0.77, 1.10]  |
| 4 Adverse events: allergic reaction    | 4              | 738                 | Risk Ratio (M-H, Random, 95% CI) | 6.0 [0.25, 144.93] |

**Dextranos vs cristaloides**

## Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

| Outcome or subgroup title       | No. of studies | No. of participants | Statistical method               | Effect size       |
|---------------------------------|----------------|---------------------|----------------------------------|-------------------|
| 1 Mortality at end of follow-up | 6              | 1698                | Risk Ratio (M-H, Random, 95% CI) | 0.89 [0.74, 1.08] |

**Gelatinas vs cristaloides**

## Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

| Outcome or subgroup title       | No. of studies | No. of participants | Statistical method               | Effect size       |
|---------------------------------|----------------|---------------------|----------------------------------|-------------------|
| 1 Mortality at end of follow-up | 20             | 13047               | Risk Ratio (M-H, Random, 95% CI) | 0.98 [0.92, 1.06] |
| 2 Mortality within 90 days      | 10             | 12492               | Risk Ratio (M-H, Random, 95% CI) | 0.98 [0.92, 1.04] |
| 3 Mortality within 30 days      | 10             | 12506               | Risk Ratio (M-H, Random, 95% CI) | 0.99 [0.93, 1.06] |
| 4 Transfusion of blood product  | 3              | 290                 | Risk Ratio (M-H, Random, 95% CI) | 1.31 [0.95, 1.80] |
| 5 Renal replacement therapy     | 2              | 3028                | Risk Ratio (M-H, Random, 95% CI) | 1.11 [0.96, 1.27] |

**Albúmina o plasma fresco vs cristaloides**



## **Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)**

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

**Mortalidad a 30/90 días o final estudio: a favor de ninguno de los dos**

**Almidones vs  
Dextranos vs  
Albúmina vs  
Plasma fresco vs**

**Cristaloides**

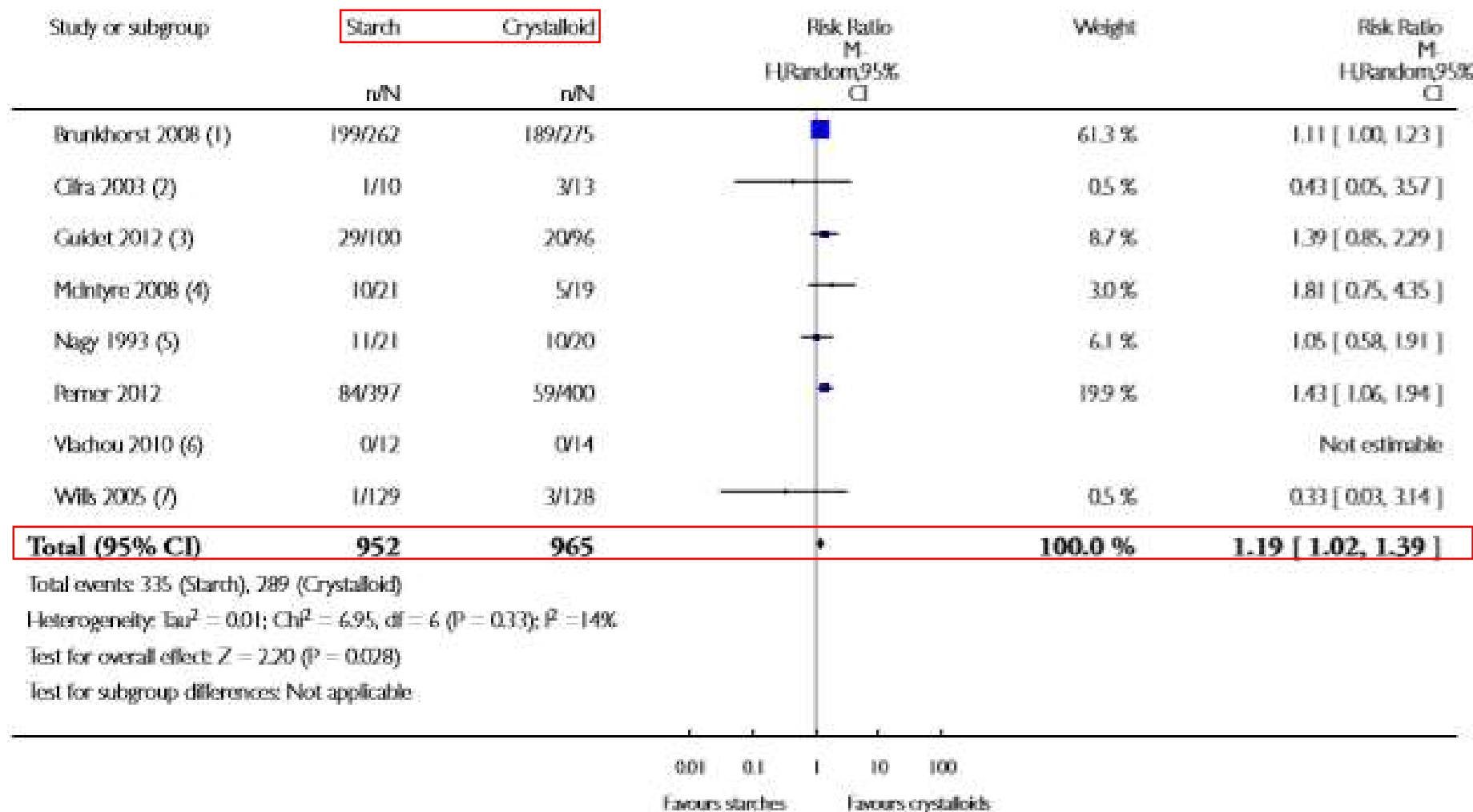
**Evidencia moderada**

**Gelatinas vs**

**Cristaloides**

**Evidencia baja**

# Necesidad de transfusión de sangre



## Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

**Mayor tasa de transfusiones de sangre**

**Almidones vs**

**Cristaloides**

**Evidencia baja**

**Gelatinas vs**

**Dextranos vs**

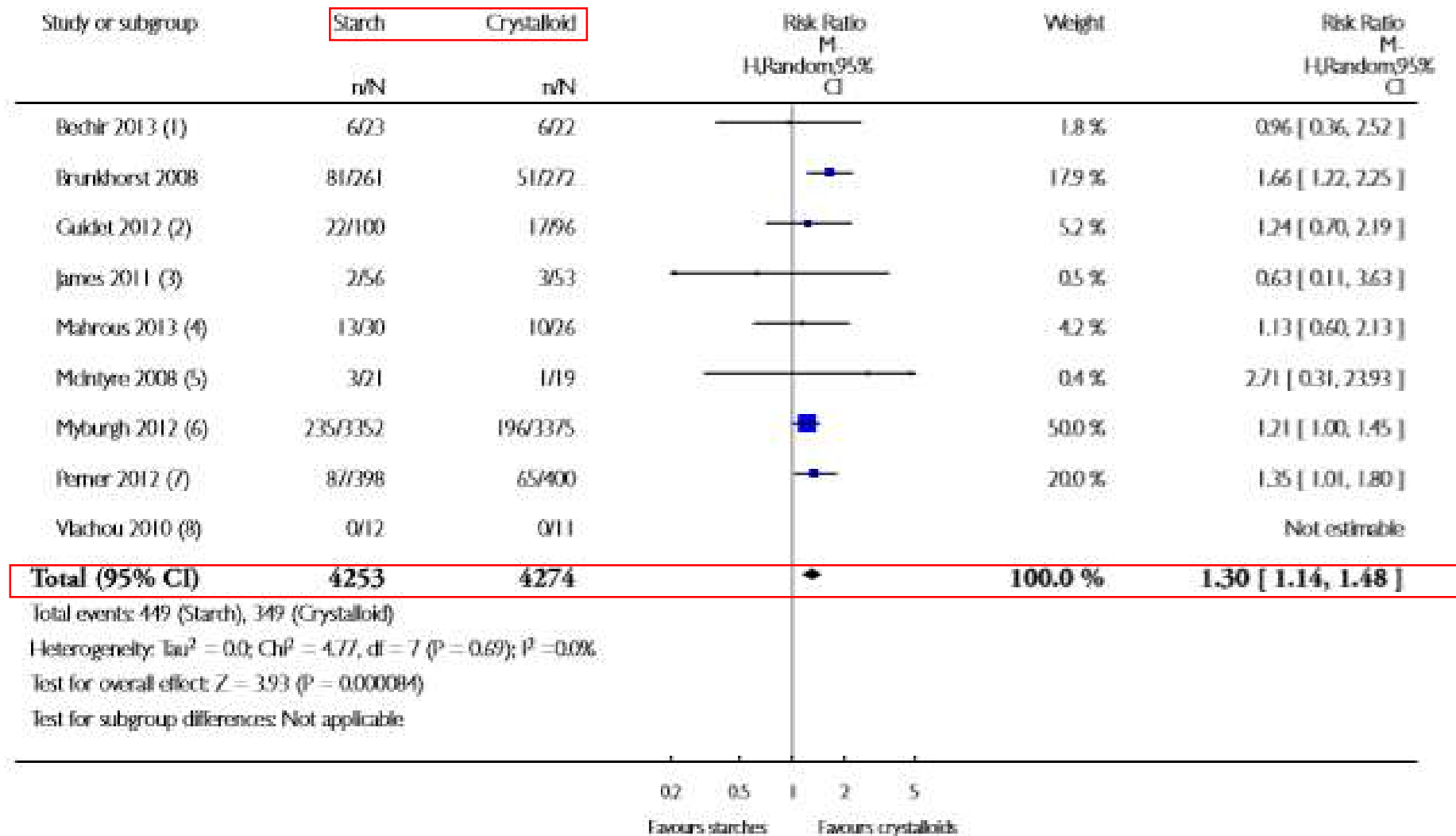
**Albúmina vs**

**Plasma fresco vs**

**Cristaloides**

**Sin evidencia**

# Terapia de reemplazo renal



## Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

**Mayor tasa de terapia de reemplazo renal**

**Almidones vs**

**Cristaloides**

**Evidencia baja**

**Gelatinas vs**

**Dextranos vs**

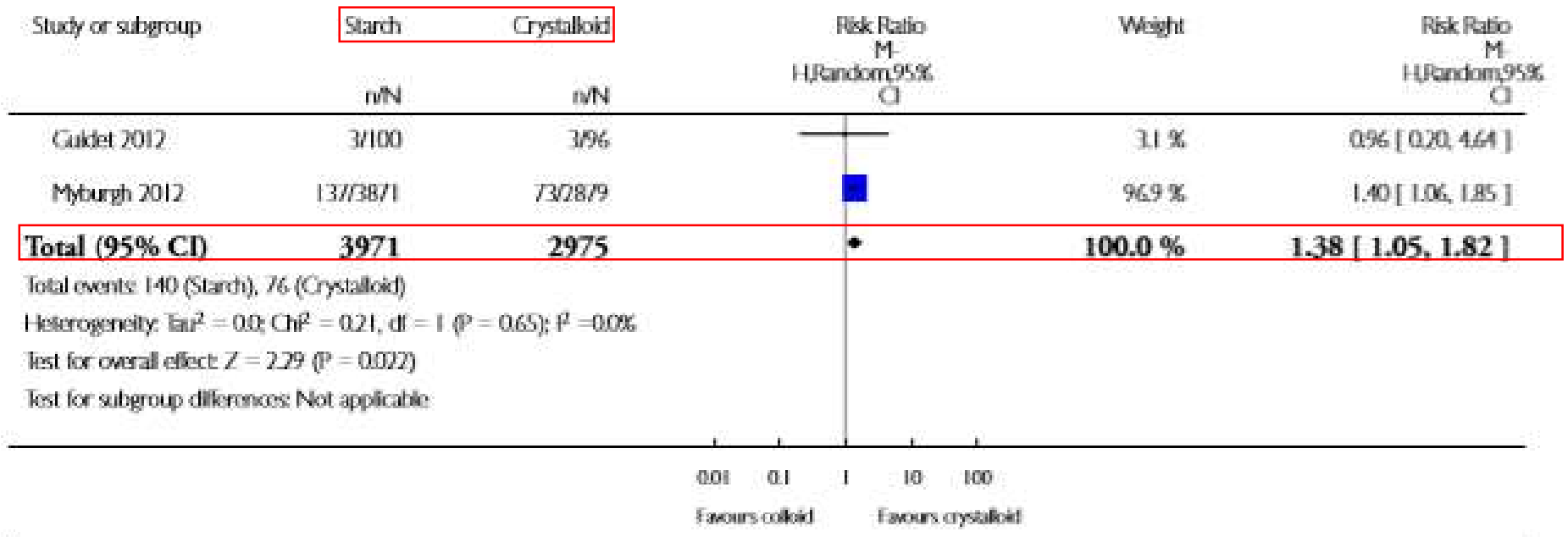
**Albúmina vs**

**Plasma fresco vs**

**Cristaloides**

**Sin evidencia**

# Urticaria



# Colloids versus crystalloids for fluid resuscitation in critically ill people (Review)

Lewis SR, Pritchard MW, Evans DJW, Butler AR, Alderson P, Smith AF, Roberts I

## Urticaria

**Almidones vs**

**Cristaloides**

**Evidencia baja**

**Gelatinas vs**

**Dextranos vs**

**Albúmina vs**

**Plasma fresco vs**

**Cristaloides**

**Sin evidencia**

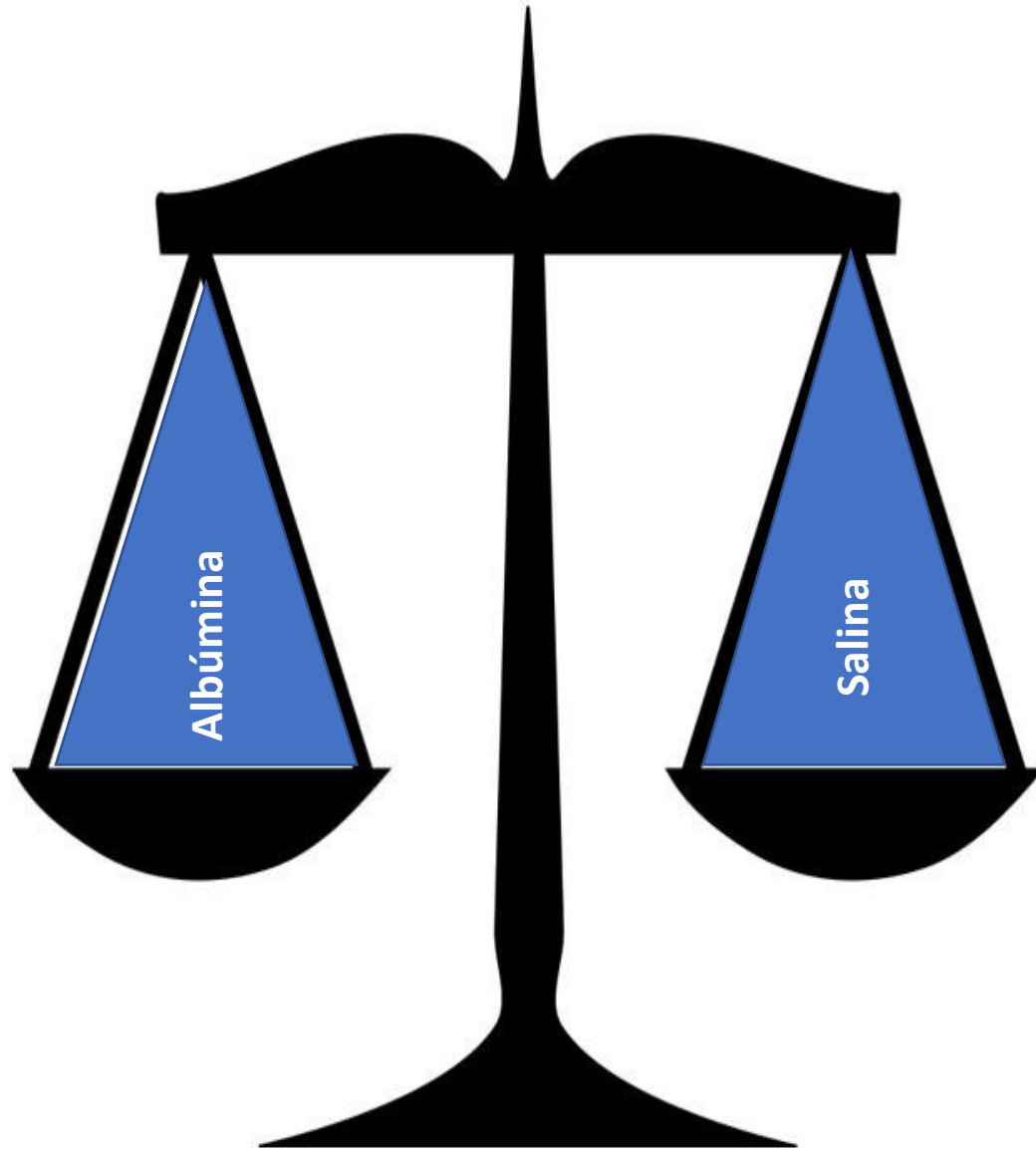
## Hidroxietilalmidón (HES)

1. Se recomienda no emplear soluciones de HES en la reanimación del paciente crítico dados los datos existentes que apuntan a que su uso se asocia a una mayor morbilidad (desarrollo de insuficiencia renal).
1. Su uso está especialmente desaconsejado en pacientes con alto riesgo de desarrollo de fracaso renal, como son los pacientes con sepsis grave/shock séptico.



## Gelatinas

1. En pacientes con shock (con la excepción del shock séptico) en los que se requiera una rápida expansión de volumen se recomienda considerar el empleo de gelatina al 4%.
2. Si se decide emplear gelatina, se recomienda la succinilada, dado su mejor perfil de seguridad.
3. Dadas las incertidumbres que aún existen sobre su seguridad, se recomienda no superar la dosis de 30ml/kg de gelatina al 4% succinilada durante la fase de reanimación.



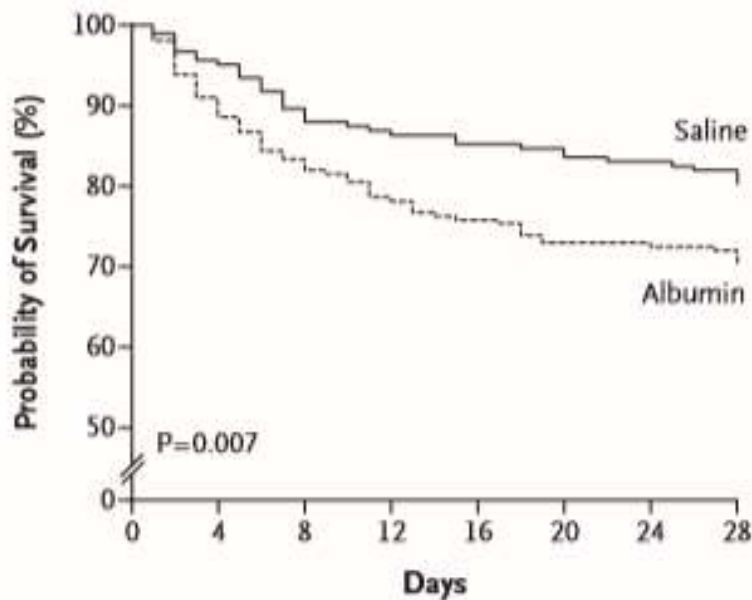
ORIGINAL ARTICLE

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

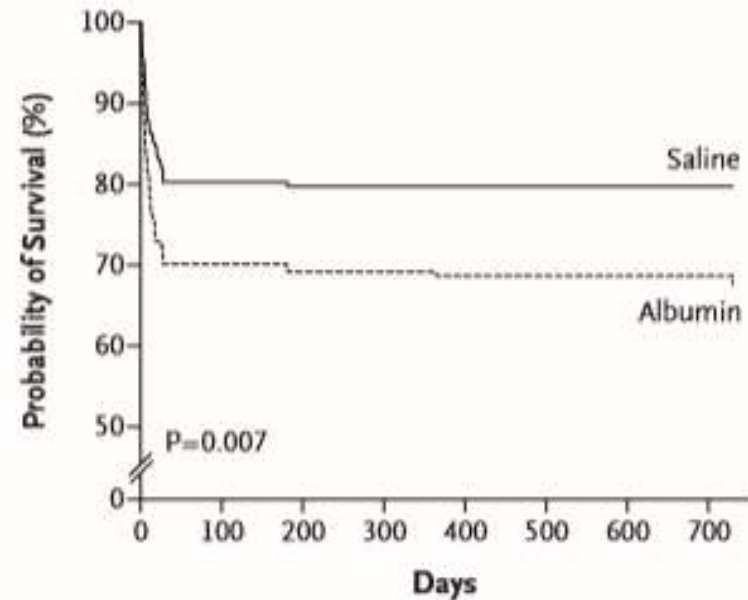
The SAFE Study Investigators\*

Albumin Group  
(N = 231)

Saline Group  
(N = 229)



Sobrevida a 28 dias



Sobrevida a 24 meses

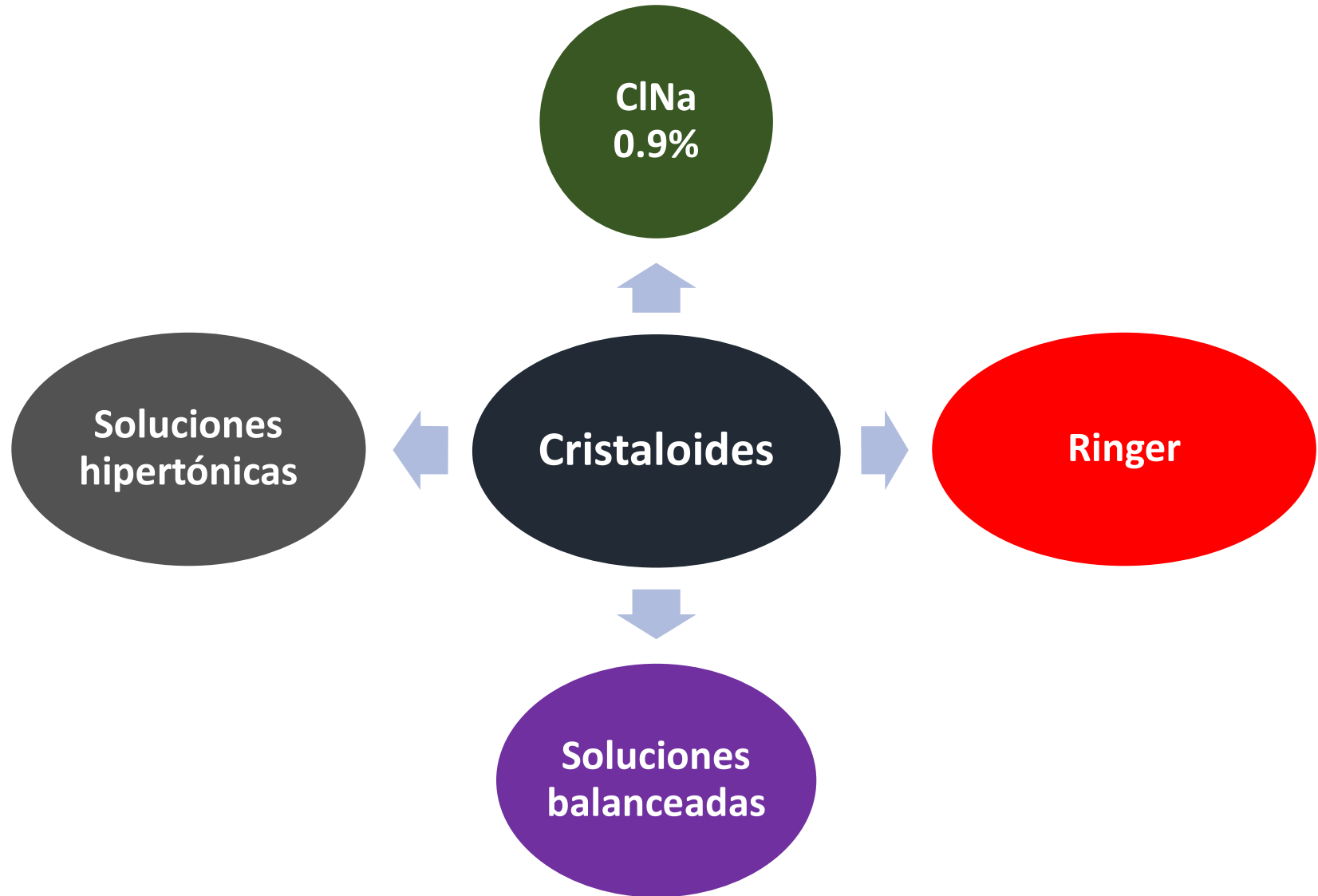
The SAFE Study Investigators

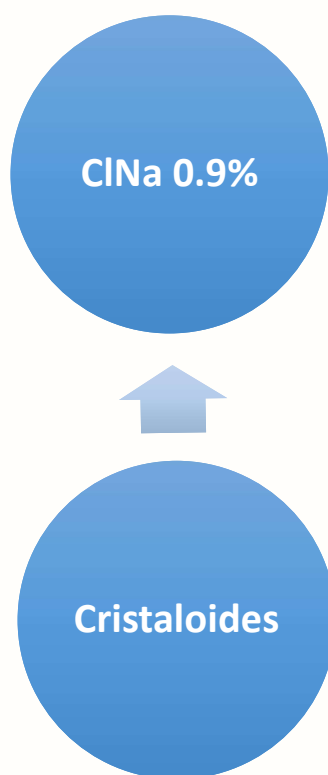
**Impact of albumin compared to saline  
on organ function and mortality of patients  
with severe sepsis**

| Characteristic          |                             | <i>p</i> value | Odds ratio (95% CI) |
|-------------------------|-----------------------------|----------------|---------------------|
| Treatment assignment    | Reference or unit of change |                |                     |
| Albumin                 | Saline                      | 0.03           | 0.71 (0.52–0.97)    |
| Baseline covariates     |                             |                |                     |
| Male                    | Female                      | 0.04           | 1.40 (1.02–1.93)    |
| Age                     | Per 1 year increase         | <0.001         | 1.04 (1.03–1.05)    |
| Postoperative admission | Non-operative               | 0.005          | 0.49 (0.30–0.80)    |
| APACHE-II Score         | Per 1 point increase        | <0.001         | 1.05 (1.03–1.07)    |
| SOFA, coagulation       | Per 1 point increase        | 0.01           | 1.20 (1.03–1.39)    |
| SOFA, liver             | Per 1 point increase        | 0.09           | 1.15 (0.98–1.37)    |
| Heart rate              | Per 1 point increase        | <0.001         | 1.01 (1.00–1.02)    |
| Serum albumin           | Per 1 g/l decrease          | <0.001         | 1.05 (1.03–1.08)    |
| Sepsis source           |                             |                |                     |
| Pulmonary               | No confirmed source         | 0.3            | 0.69 (0.34–1.41)    |
| Intra-abdominal         |                             | 0.04           | 0.43 (0.19–0.96)    |
| Urinary                 |                             | 0.003          | 0.25 (0.10–0.62)    |
| Other confirmed source  |                             | 0.2            | 0.58 (0.27–1.24)    |

# Albúmina

- La administración de albúmina en el paciente crítico no se asocia a efectos adversos demostrados, pero debe reservarse para aquellos grupos específicos de pacientes en los que se ha demostrado beneficio.
- Se recomienda considerar la albúmina en la reanimación del paciente en shock séptico que no responde a cristaloides.
- No debe emplearse la albúmina en el paciente con traumatismo craneal.
- La administración de albúmina debe considerarse en los pacientes con cirrosis y peritonitis bacteriana espontánea.





**Más usado en trauma**

**Produce varias alteraciones**

**disminuye la velocidad del flujo renal**

**disminuye la perfusión cortical renal**

**produce acidosis hiperclorémica**

**aumenta la incidencia de IRA**

**reduce la mortalidad**

Cristaloides



Soluciones balanceadas

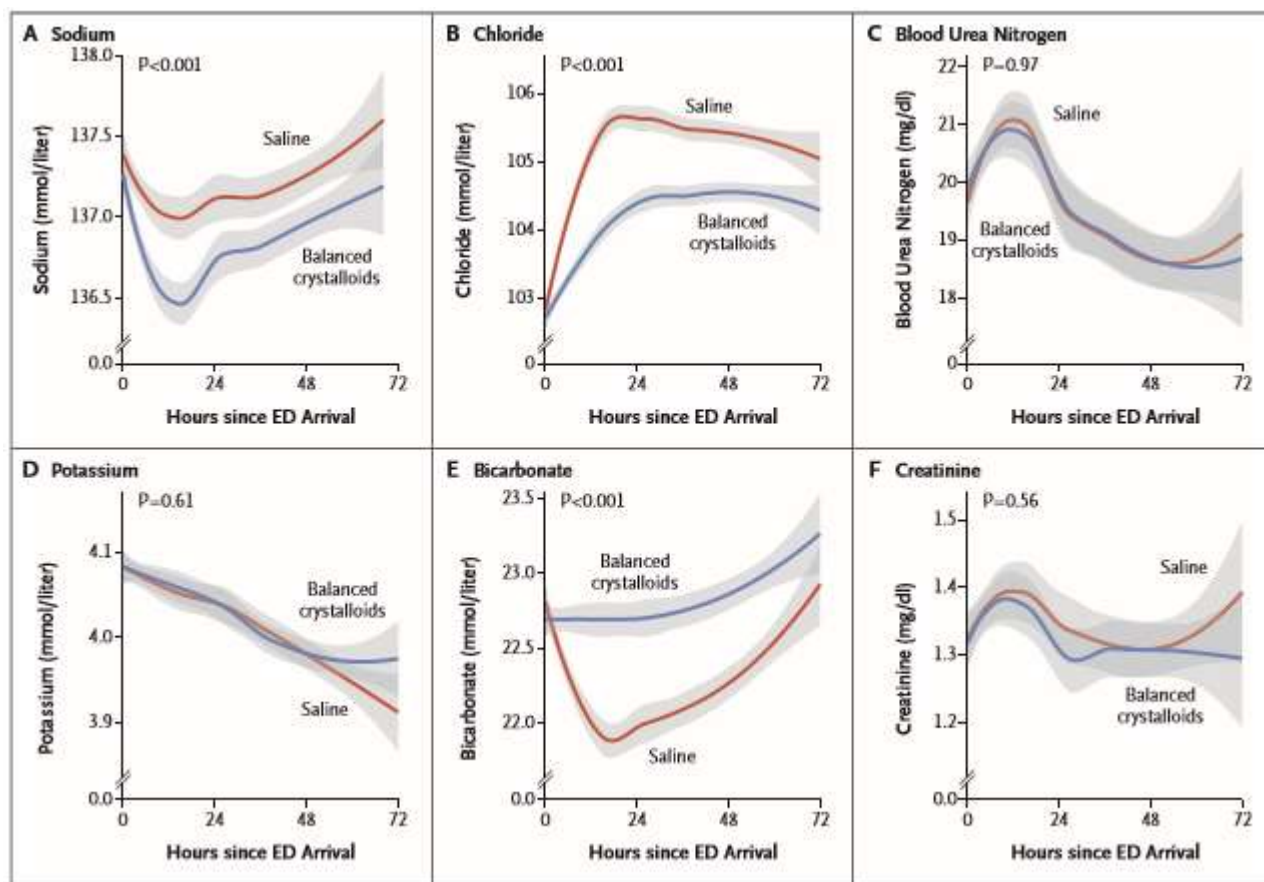
| Composición               | NaCl<br>0,9% | Ringer<br>Acetato | Ringer<br>Lactato | Plasma-Lyte®<br>148 | Isofundin® |
|---------------------------|--------------|-------------------|-------------------|---------------------|------------|
| Na <sup>+</sup> , mmol/l  | 154          | 130               | 131               | 140                 | 145        |
| Cl <sup>-</sup> , mmol/l  | 154          | 112               | 112               | 98                  | 127        |
| K <sup>+</sup> , mmol/l   | -            | 5                 | 5,4               | 5                   | 4          |
| Ca <sup>2+</sup> , mmol/l | -            | 1                 | 1,8               | 3                   | 2,5        |
| Mg <sup>2+</sup> , mmol/l | -            | 1                 |                   | -                   | 1          |
| Lactato, mmol/l           | -            | -                 | 28                | -                   |            |
| Acetato, mmol/l           | -            | 27                |                   | 27                  | 24         |
| Otros, mmol/l             | -            |                   |                   | Gluconato 23        | Malato 5   |
| Osmolaridad<br>mOsm/l     | 308          | 276               | 277               | 295                 | 309        |



ORIGINAL ARTICLE

## Balanced Crystalloids versus Saline in Noncritically Ill Adults

5% pacientes de trauma  
Plasmalite y Ringer Lact.



## ORIGINAL ARTICLE

## Balanced Crystalloids versus Saline in Noncritically Ill Adults

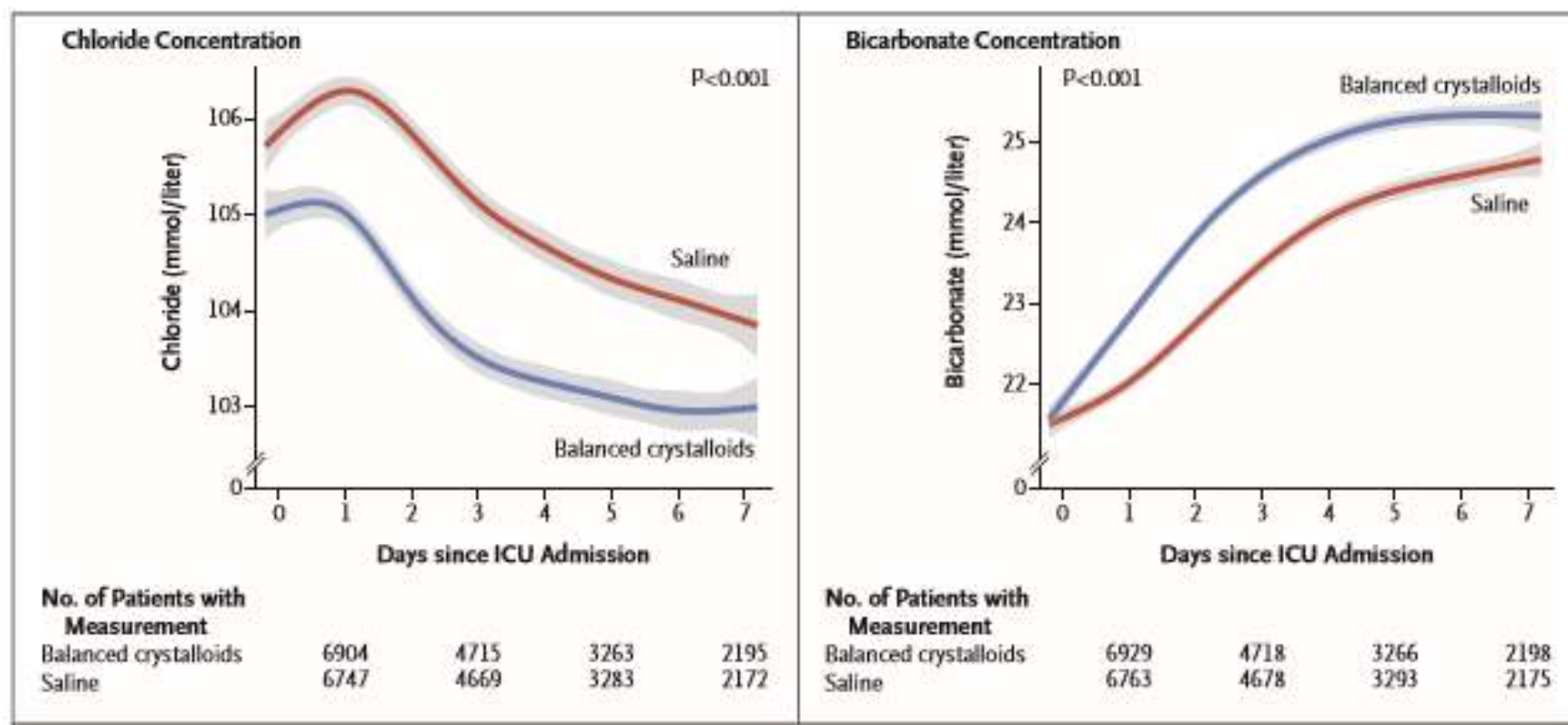
Clinical Outcomes According to Assigned Treatment Group in the Intention-to-Treat Analysis.

| Outcome                                                                             | Balanced<br>Crystalloids<br>(N = 6708) | Saline<br>(N = 6639) | Adjusted Odds<br>Ratio (95% CI) <sup>a</sup> | Adjusted<br>P Value |
|-------------------------------------------------------------------------------------|----------------------------------------|----------------------|----------------------------------------------|---------------------|
| Median hospital-free days to day 28 (IQR)                                           | 25 (22–26)                             | 25 (22–26)           | 0.98 (0.92–1.04)                             | 0.41                |
| Major adverse kidney event within 30 days<br>no. (%)                                | 315 (4.7)                              | 370 (5.6)            | 0.82 (0.70–0.95)                             | 0.01                |
| Death — no. (%)                                                                     | 94 (1.4)                               | 102 (1.5)            | 0.89                                         |                     |
| New renal-replacement therapy<br>— no./total no. (%) <sup>†</sup>                   | 18/6582 (0.3)                          | 31/6530 (0.5)        | 0.56                                         |                     |
| Final serum creatinine $\geq 200\%$ of baseline<br>— no./total no. (%) <sup>†</sup> | 253/6582 (3.8)                         | 293/6530 (4.5)       | 0.84                                         |                     |
| Stage 2 or higher acute kidney injury<br>— no./total no. (%) <sup>†</sup>           | 528/6582 (8.0)                         | 560/6530 (8.6)       | 0.91 (0.80–1.03)                             | 0.14                |
| In-hospital death — no. (%)                                                         | 95 (1.4)                               | 105 (1.6)            | 0.88 (0.66–1.16)                             | 0.36                |

ORIGINAL ARTICLE

# Balanced Crystalloids versus Saline in Critically Ill Adults

8.5% pacientes de trauma  
Plasmalite y Ringer Lact.



## ORIGINAL ARTICLE

Balanced Crystalloids versus Saline  
in Critically Ill Adults

| Clinical Outcomes.                                                           |                                     |                      |                                              |                      |
|------------------------------------------------------------------------------|-------------------------------------|----------------------|----------------------------------------------|----------------------|
| Outcome                                                                      | Balanced Crystalloids<br>(N = 7942) | Saline<br>(N = 7860) | Adjusted Odds Ratio<br>(95% CI) <sup>†</sup> | P Value <sup>‡</sup> |
| <b>Primary outcome</b>                                                       |                                     |                      |                                              |                      |
| Major adverse kidney event within 30 days — no. (%) <sup>‡</sup>             | 1139 (14.3)                         | 1211 (15.4)          | 0.90 (0.82 to 0.99)                          | 0.04                 |
| <b>Components of primary outcome</b>                                         |                                     |                      |                                              |                      |
| In-hospital death before 30 days — no. (%)                                   | 818 (10.3)                          | 875 (11.1)           | 0.90 (0.80 to 1.01)                          | 0.06                 |
| Receipt of new renal-replacement therapy<br>— no./total no. (%) <sup>§</sup> | 189/7558 (2.5)                      | 220/7458 (2.9)       | 0.84 (0.68 to 1.02)                          | 0.08                 |

# Cost-minimization analysis of two fluid products for resuscitation of critically injured trauma patients

CAITLIN A. SMITH, JEREMIAH J. DUBY, GARTH H. UTTER, JOSEPH M. GALANTE,  
LYNETTE A. SCHERER, AND CAROL R. SCHERMER

100 % pacientes de trauma  
Plasmalite vs ClNa 0.9%

| Average Daily Cost of Magnesium Replacement at Study Site, by Treatment Group |                                         |                                 |                                 |                                |
|-------------------------------------------------------------------------------|-----------------------------------------|---------------------------------|---------------------------------|--------------------------------|
| Expense Item                                                                  | 0.9% Sodium Chloride Injection (n = 24) |                                 |                                 | Plasma-Lyte A (n = 22)         |
|                                                                               | Cost (\$) Including Labor               |                                 | Cost (\$) Excluding Labor       |                                |
|                                                                               | Administration of 2 g Magnesium         | Administration of 4 g Magnesium | Administration of 4 g Magnesium |                                |
| Mean $\pm$ S.D. resuscitation fluid cost (per 24 hr) <sup>a</sup>             | 7.65 $\pm$ 4.92                         | 7.65 $\pm$ 4.92                 | 7.65 $\pm$ 4.92                 | 20.46 $\pm$ 12.94 <sup>b</sup> |
| Safety syringe with attached needle (1 unit)                                  | 0.72 <sup>b</sup>                       | 0.72 <sup>b</sup>               | 0.72 <sup>b</sup>               | 0.00                           |
| 0.9% sodium chloride i.v. flush, 10 mL                                        | 1.34 <sup>b</sup>                       | 1.34 <sup>b</sup>               | 1.34 <sup>b</sup>               | 0.00                           |
| Surgical gloves (pair)                                                        | 0.17 <sup>b</sup>                       | 0.17 <sup>b</sup>               | 0.17 <sup>b</sup>               | 0.00                           |
| Tubing (single tubing)                                                        | 1.82 <sup>b</sup>                       | 1.82 <sup>b</sup>               | 1.82 <sup>b</sup>               | 0.00                           |
| Alcohol wipes (per swab)                                                      | 0.01 <sup>b</sup>                       | 0.01 <sup>b</sup>               | 0.01 <sup>b</sup>               | 0.00                           |
| Drug acquisition cost                                                         | 6.77 <sup>b</sup>                       | 13.54                           | 13.54 <sup>b</sup>              | 0.00                           |
| Labor cost (for average) <sup>d</sup>                                         | 7.56 <sup>bc</sup>                      | 7.56 <sup>bc</sup>              | <sup>d</sup>                    |                                |
| Total (per 24 hr)                                                             | 26.04                                   | 32.81                           | 25.25                           | 20.46                          |

Cristaloides



Ringer

## Sydney Ringer Field Note

for the 100th memorial Year in 2010

Biography of Dr.Sydney Ringer (1835-1910)



Produced by LISA INOUE copyright(c)Lisa Inoue 1997

**A FURTHER CONTRIBUTION REGARDING THE INFLUENCE OF THE DIFFERENT CONSTITUENTS OF THE BLOOD ON THE CONTRACTION OF THE HEART. By SYDNEY RINGER, M.D., *Professor of Medicine at University College, London.* (Plate I.)**

*J Physiol* 1883; 4, 29–42.

Cristaloides



Ringer

| Composición               | NaCl<br>0,9% | Ringer<br>Simple | Ringer<br>Acetato | Ringer<br>Lactato |
|---------------------------|--------------|------------------|-------------------|-------------------|
| Na <sup>+</sup> , mmol/l  | 154          | 147              | 130               | 131               |
| Cl <sup>-</sup> , mmol/l  | 154          | 155              | 112               | 112               |
| K <sup>+</sup> , mmol/l   | -            | 4                | 5                 | 5,4               |
| Ca <sup>2+</sup> , mmol/l | -            | 4                | 1                 | 1,8               |
| Mg <sup>2+</sup> , mmol/l | -            | -                | 1                 |                   |
| Lactato, mmol/l           | -            | -                | -                 | 28                |
| Acetato, mmol/l           | -            | -                | 27                |                   |
| Otros, mmol/l             | -            | -                |                   |                   |
| Osmolaridad<br>mOsm/l     | 308          | 309              | 276               | 277               |



# The Impact of Pre-Hospital Administration of Lactated Ringer's Solution versus Normal Saline in Patients with Traumatic Brain Injury

Susan E. Rowell,<sup>1</sup> Kelly A. Fair,<sup>1</sup> Ronald R. Barbosa,<sup>2</sup> Jennifer M. Watters,<sup>1</sup>  
Eileen M. Bulger,<sup>3</sup> John B. Holcomb,<sup>4</sup> Mitchell J. Cohen,<sup>5</sup> Mohammad H. Rahbar,<sup>4</sup>  
Erin E. Fox,<sup>4</sup> and Martin A. Schreiber<sup>1</sup> on behalf of the PROMMTT Study Group

**Con TEC (n=308):**

**> mortalidad con RL :OR = 1.78 (1.04-3.04, p=0.035)**

**Sin TEC (n=483):**

**= mortalidad :OR = 1.49 (0.757-2.95, p=0.247)**



Nor'azim Mohd Yunos  
Rinaldo Bellomo  
Neil Glassford  
Harvey Sutcliffe  
Que Lam  
Michael Bailey

**Chloride-liberal vs. chloride-restrictive  
intravenous fluid administration and acute  
kidney injury: an extended analysis**

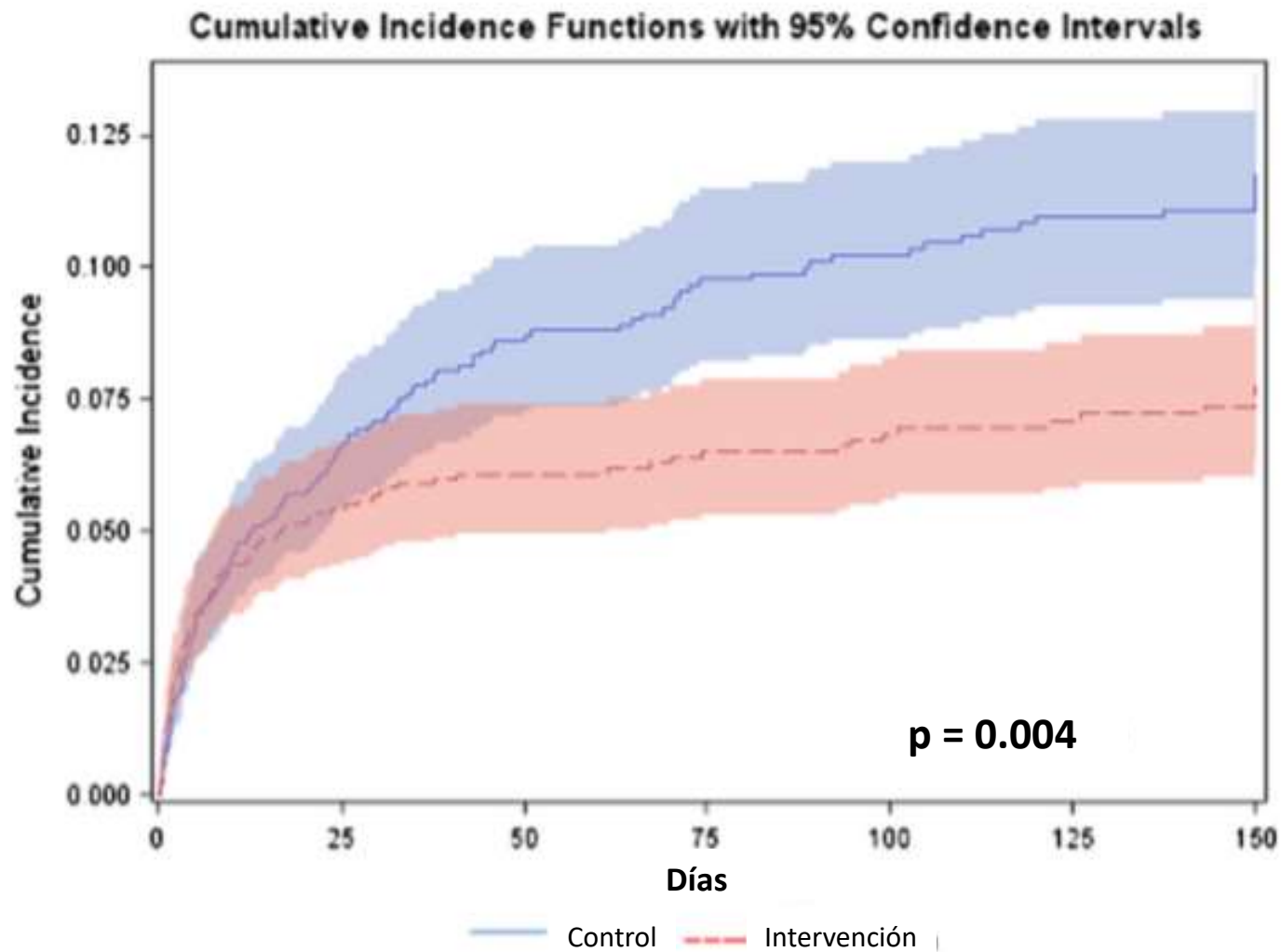
**Período de control (n=1.476 pacientes): 1 año**

**líquidos estándar (alto contenido de Cl)**

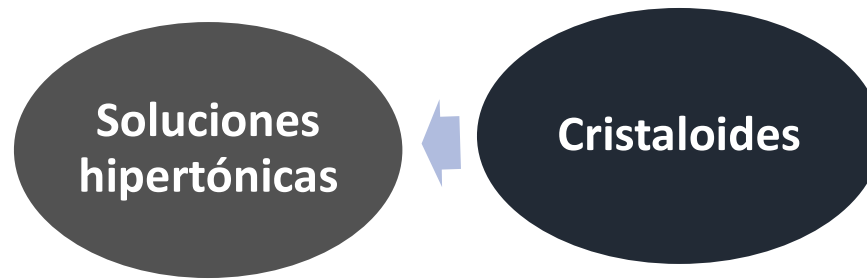
**Período de intervención (n=1.518 pacientes): 1 año**

**líquidos con bajo contenido de Cl)**

## Incidencia de terapia de reemplazo renal



*Intensive Care Medicine*, 2015, vol. 41, no 2, p. 257-264.



de Crescenzo C, Gorouhi F, Salcedo ES, Galante JM. Prehospital hypertonic fluid resuscitation for trauma patients: a systematic review and meta-analysis. J Trauma Acute Care Surg. 2017;82(5):956–62

Metanálisis: 9 publicaciones, 3.490 pacientes con trauma en prehospitalario

Wu MC, Liao TY, Lee EM, Chen YS, Hsu WT, Lee MG, Tsou PY, Chen SC, Lee CC. Administration of hypertonic solutions for hemorrhagic shock: a systematic review and meta-analysis of clinical trials. Anesth Analg. 2017;125(5):1549–57.

Metanálisis: 12 publicaciones, 2.932 pacientes con shock hemorràgico

**Las soluciones hipertónicas no demostraron efecto  
beneficioso en pacientes con trauma**

RESEARCH

# Resuscitation fluid types in sepsis, surgical, and trauma patients: a systematic review and sequential network meta-analyses

Chien-Hua Tseng<sup>1</sup>, Tzu-Tao Chen<sup>2</sup>, Mei-Yi Wu<sup>3</sup>, Ming-Cheng Chan<sup>4</sup>, Ming-Chieh Shih<sup>5</sup> and Yu-Kang Tu<sup>6\*</sup>

| Condición | Evolución   | Solución cristalina balanceada | Solución salina  | Albúmina         | Almidón          |
|-----------|-------------|--------------------------------|------------------|------------------|------------------|
| Trauma    | Mortalidad  | Menor mortalidad               | Menor mortalidad | Mayor mortalidad | Mayor mortalidad |
|           | IRA         | Menos IRA                      | Más IRA          | Menos IRA        |                  |
|           | Transfusión | Menos volumen                  | Más volumen      | Menos volumen    |                  |
|           | Líquido     | Más                            |                  |                  |                  |

RESEARCH

Open Access



# The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition

Donat R. Spahn<sup>1</sup>, Bertil Bouillon<sup>2</sup>, Vladimír Cerný<sup>3,4,5,6</sup>, Jacques Duranteau<sup>7</sup>, Daniela Filipescu<sup>8</sup>, Beverley J. Hunt<sup>9</sup>, Radko Komadina<sup>10</sup>, Marc Maegele<sup>11</sup>, Giuseppe Nardi<sup>12</sup>, Louis Riddez<sup>13</sup>, Charles-Marc Samama<sup>14</sup>, Jean-Louis Vincent<sup>15</sup> and Rolf Rossaint<sup>16</sup>

## Sociedades Europeas:

- ✓ Anestesiología
- ✓ Terapia Intensiva
- ✓ Shock
- ✓ Trauma
- ✓ Emergencias

## Hemorragia masiva

- Transfusión
- Hipotensión permisiva
- Evitar hipotermia
- Líquidos

RESEARCH

Open Access

## The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition



Donat R. Spahn<sup>1</sup>, Bertil Bouillon<sup>2</sup>, Vladimir Cerny<sup>3,4,5,6</sup>, Jacques Duranteau<sup>7</sup>, Daniela Filipescu<sup>8</sup>, Beverley J. Hunt<sup>9</sup>, Radko Komadina<sup>10</sup>, Marc Maegele<sup>11</sup>, Giuseppe Nardi<sup>12</sup>, Louis Riddez<sup>13</sup>, Charles-Marc Samama<sup>14</sup>, Jean-Louis Vincent<sup>15</sup> and Rolf Rossaint<sup>16</sup>

### Recomendaciones:

1. En pacientes con trauma, sangrando e hipotensos iniciar la fluidoterapia con soluciones cristaloides. (Grado 1A)
2. Evitar el uso de soluciones salinas y usar soluciones electrolíticas balanceadas. (Grado 1B)
3. Las soluciones hipotónicas como el Ringer lactato se deben evitar en pacientes con traumatismo de cráneo severo. (Grado 1B)
4. El uso de coloides debe estar restringido debido a los efectos adversos sobre la hemostasia. (Grado 1C)

# **II CONGRESO INTERNACIONAL DE EMERGENCIAS PREHOSPITALARIAS**

**ACTUALIZACIÓN EN MANEJO DE PACIENTE CRÍTICO.**

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