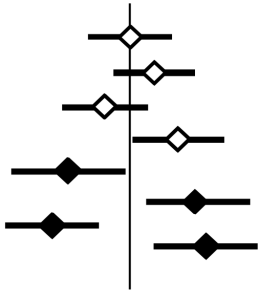
The 2024 Guideline on use of Intravenous Albumin from the International Collaboration for Transfusion Medicine Guidelines

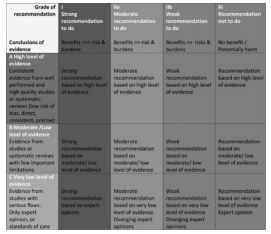
Link to Guidelines

Raza S.
Transfusion Medicine Fellow
Canadian Blood Services | University of Toronto | No relevant COI

Objectives



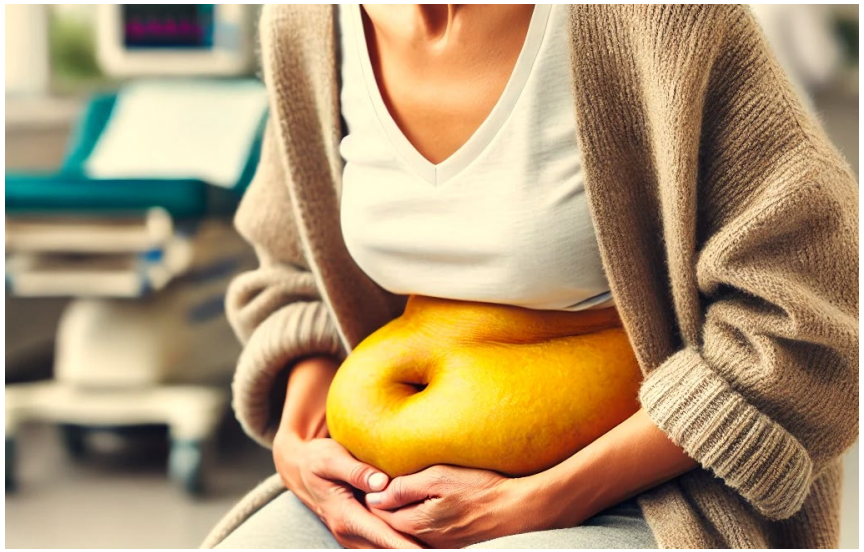
To review appraisal of existing evidence used to derive the 2024 ICTMG intravenous albumin guidelines.



To review ICTMG recommendations for the use of intravenous albumin.

To setup discussion with the *Breakthroughs in blood* expert panel following the presentation

Background



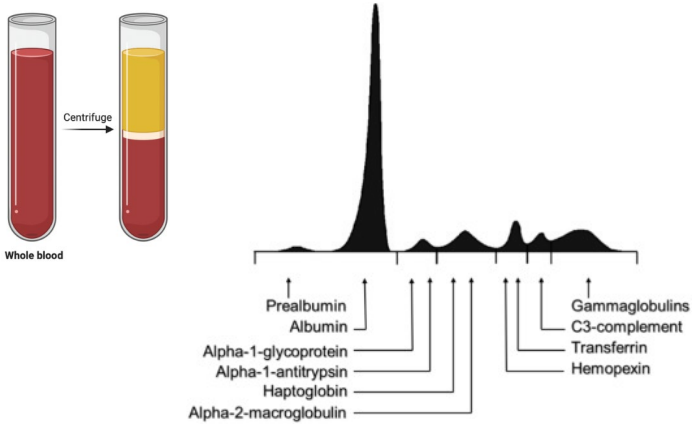
Sarah, 51-year old ♀, alcohol-related liver disease
Admitted hepato-pulmonary syndrome

The admitting physician is struggling because the patient is both hypotensive (low pressure) and anasarcous (diffusely swollen)

She wants to switch the patient from 0.9% saline infusion to a **5% albumin** for hypotension and peritonitis

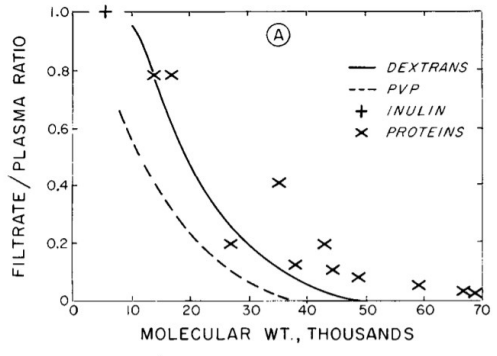
Albumin

The most abundant plasma protein

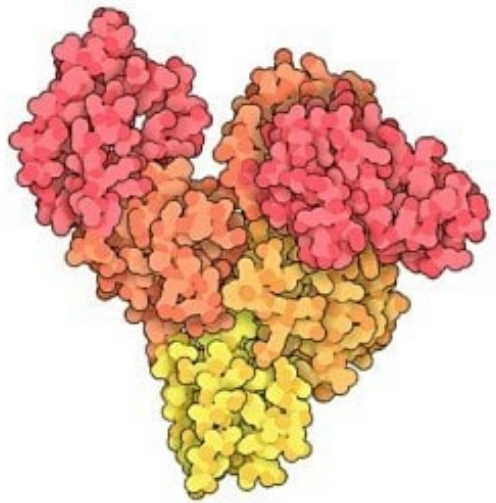


Albumin is a 67 kilo dalton protein

Negligible clearance due to (-) and wt



NEJM. 1974 Apr 4;290(14):785-92



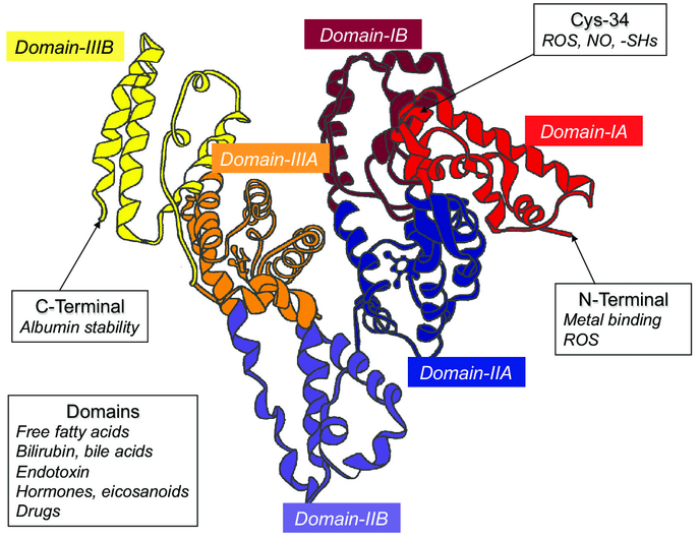
Albumin buffers pH

Some antioxidant effect

Albumin confers **oncotic pressure**

Albumin binds

- Water
- Electrolytes (Na/K/Ca)
- Hormones
- Fatty acids, fatty vitamins
- Bilirubin
- Thyroxine
- Drugs

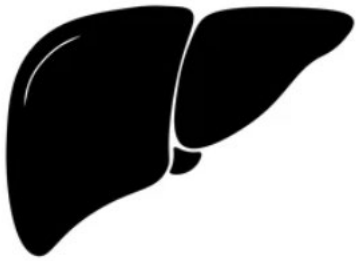


Physiology

Kwashiorkor (malnourishment)
Celiac disease (malabsorption)

Synthetic liver dysfunction

Food (Amino Acids)



Synthesized in liver at 16 g / day
e.g. 70 kg person, 5L blood
Makes ~ 3 g/L daily

Link to Guidelines

Increased transfer
Redistribution

60% extravascular ⟷ 40% intravascular

endothelium

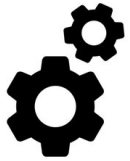
Typical plasma albumin concentration
35 to 50 g/L (3.5 to 5.0 g/dL)
(about 200 g in a 5L blood volume)

Under healthy conditions

Exchange rate is 5% per hour

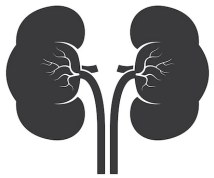
10% metabolized per day

Hypermetabolism



30 mg Renal filtration

Nephrotic Syndrome

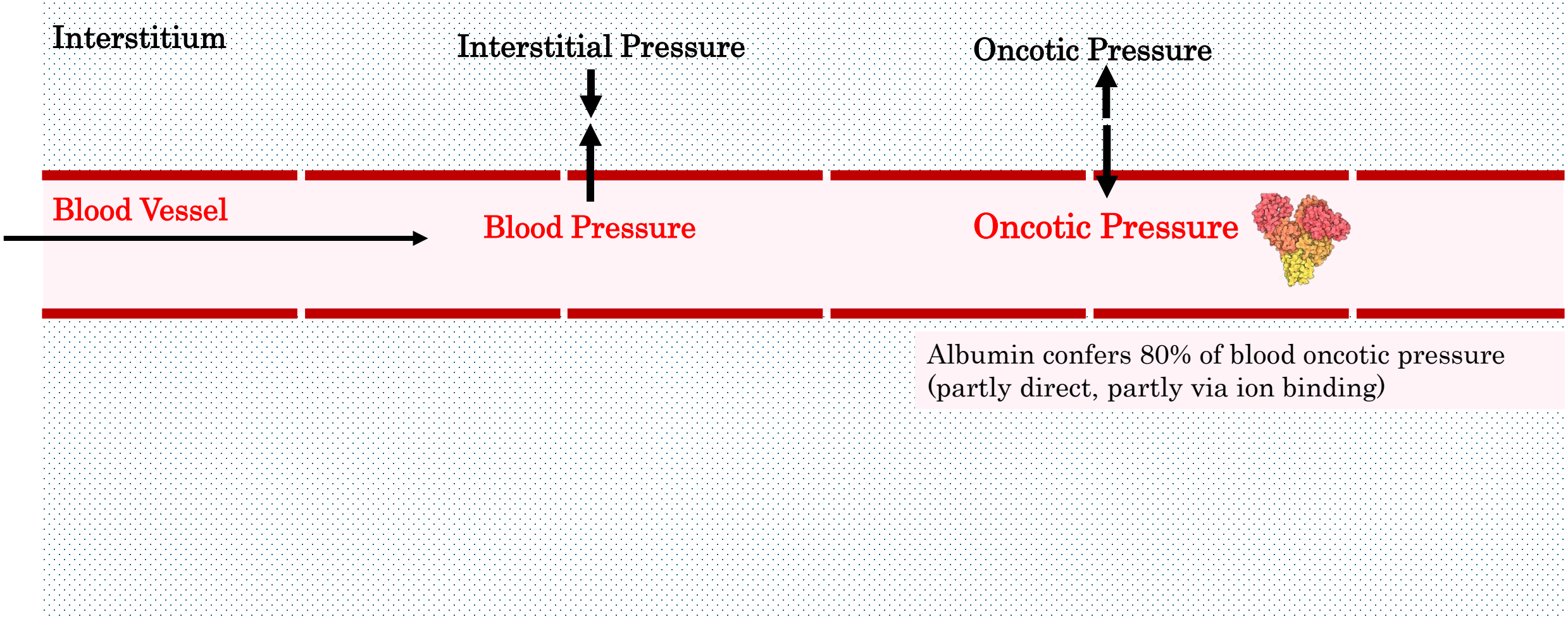


1% Gastrointestinal loss

Protein-Losing Enteropathy

Oncotic Pressure

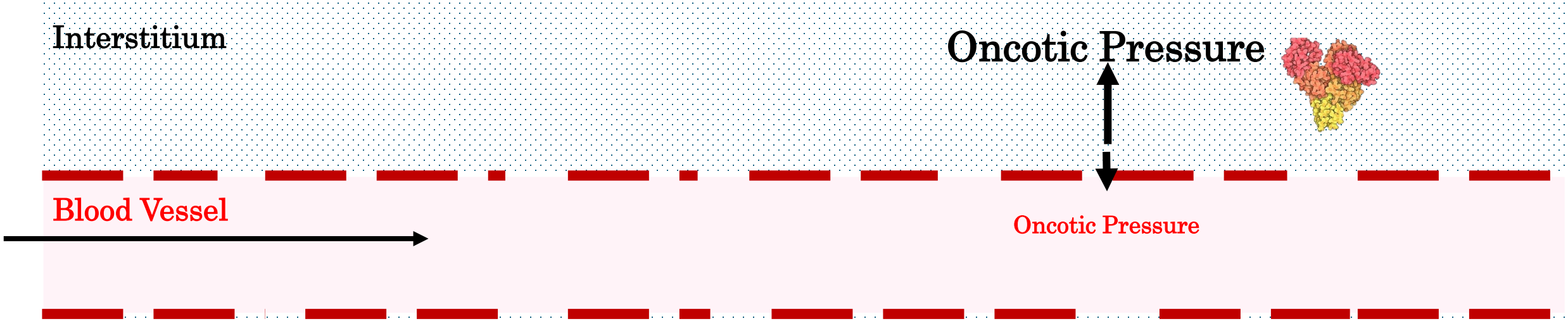
extravascular ⟷ endothelium ⟷ intravascular



Albumin confers 80% of blood oncotic pressure (partly direct, partly via ion binding)

Oncotic Pressure in *Deranged* Physiology

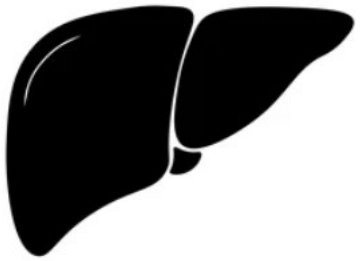
extravascular  intravascular



Net Result:
Low intravascular blood pressure (hypotension)
High extravascular fluid (swelling)

Deranged Physiology

Food (Amino Acids)



Negative Acute Phase Reactant

↑↑ extravascular ⟷ ↓↓ intravascular

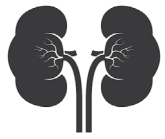
endothelium

Under critical illness

Exchange rate ↑↑

↑↑↑ metabolized per day

--/↑↑ Renal filtration

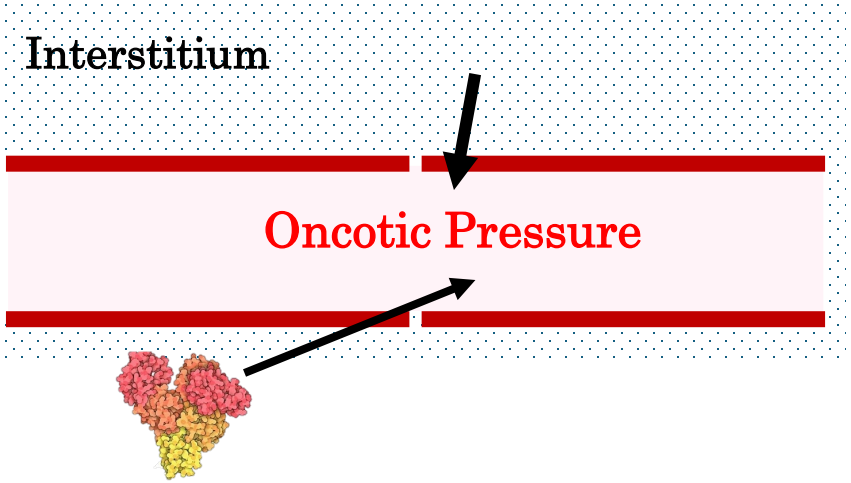


↑↑↑ Gastrointestinal loss

↑↑ Skin

Albumin Transfusion

Rationale



Albumin formulations

5% (or 5 g / 100 ml, or 50 g / L**)
20-25% (or 25 g / 100 ml) -- Hyperosmotic

5% given up to 5 ml/min
25% given up to 2 ml/min

Vial sizes
50 ml, 100 ml, 250 ml, 500 ml

Risks

Transfusion Associated Circulatory Overload, Hypotension, Anaphylaxis, More RBC Transfusions, Peripheral gangrene

Costs

5% is $40 USD per 100 ml
25% is $60 USD per 100 ml

48h infusion of 5% alb at 1 ml/kg/hr is about $3,000
NS would be $50-100

Ethics

The 5 billion + "plasma economy" is rife with scandals worldwide
Donors are often marginalized
Donors can be injured by adverse reactions
Donors often misreport on donor questionnaires


Latest Newsletters

HEALTH

Families suf

Public health initiatives over the decade to combat the disease h been haphazard, writes Raymor

The Plasn

Since 200 more tha incentive and the p

By Darry

CANADA'S NATIONAL NEWSPAPER

THE GLOBE AND MAIL

Toronto, Thursday, November 27, 1997

Tainted-blood tragedy: Never again

PAST / *Ottawa, Red Cross apologize to thousands as Krever chronicles 'unprecedented disaster.'*

BY ANDRE PICARD and ANNE McILROY
The Globe and Mail

OTTAWA — The tainted-blood tragedy could largely have been prevented if governments and the Red Cross had taken even minimal safety precautions and honestly informed Canadians about the risks of AIDS and hepatitis C, a long-awaited report concludes.

The exhaustive chronicling of the "unprecedented disaster" by a federal inquiry prompted apologies yesterday from Health Minister Allan Rock and the Canadian Red Cross Society, which operated the blood system for 40 years but will cease that function next September.

"We can't undo the damage — I wish we could — but we can express our profound sadness and our deep regret for the harm done to so many Canadians and their families," Mr. Rock said. "The federal government accepts its share of responsibility for past shortcomings in the system. We are sorry for all that has happened."

Red Cross President Gene Durnin echoed those sentiments. "To the victims and their families, while we cannot feel your pain, we hurt with you; while we cannot know your suffering, we weep with you; while we cannot feel your loss we grieve with you," Mr. Durnin told a news conference. "We are very sorry, we apologize."

There is indeed much to be sorry for, according to Mr. Justice Horace Krever of the Ontario Court of Appeal, who headed the Commission of Inquiry on the Blood System in Canada. His three-volume, 1,138-page report is severely critical of the behaviour of the "systemic failure" of institutions, including federal and provincial public-health agencies and the Red Cross.

Judge Krever also does not shy away from singling out individuals for criticism, many of them senior bureaucrats and administrators of the bureaucracy.

Please see Red / A14
Related stories / A14, A15, A16

Yesterday's Highlights

From the report:

- Governments should offer compensation to all past and future victims of tainted blood, including those with hepatitis C and spouses and children of those with AIDS.
- An independent blood authority should be created and the Canadian Red Cross Society should be removed from the blood system.
- Governments should beef up regulation and funding.
- The $300-million blood-fractionation plant slated for construction in Nova Scotia should be scrapped.
- Blood donations should remain voluntary and unpaid.
- Many of the infections with AIDS and hepatitis C were preventable.
- The Red Cross and the federal and provincial health departments failed to act quickly and were contemptuous of consumers.
- Individuals were named and blamed for a series of failings.

Reactions:

- The Red Cross and the federal government apologized to the victims of tainted blood.
- Victims called for criminal charges to be laid.
- Ottawa set up an independent safety council to ensure the implementation of the Krever recommendations.

FUTURE / *New blood system must be set up to ensure fatal errors are not repeated, report urges*

BY ANNE McILROY and ANDRE PICARD
The Globe and Mail

Judge Krever released 50 recommendations yesterday for the blood system of the future, one in which those who make decisions that affect the health of Canadians will be accountable for their actions.

It appears that his blueprint can be easily blended with the new system the federal and provincial governments began designing in March, 1996. They were afraid because they were unwilling to delay much-needed reforms while they waited for his report.

"If you look at the recommendations, we are going in the right direction," Health Minister Allan Rock said.

"I think there is much we have to learn from the report. We will take on board what is contained in the recommendations and to that extent we will improve the plans that are already in place."

Mr. Rock announced that the government will establish a Blood Safety Council to review all of Judge Krever's recommendations.

While the government has so far only sketched out what it views as the fundamental structure of a safe blood system, Judge Krever's report contains far more exacting detail on what must be put in place to prevent a repeat of the tainted-blood tragedy.

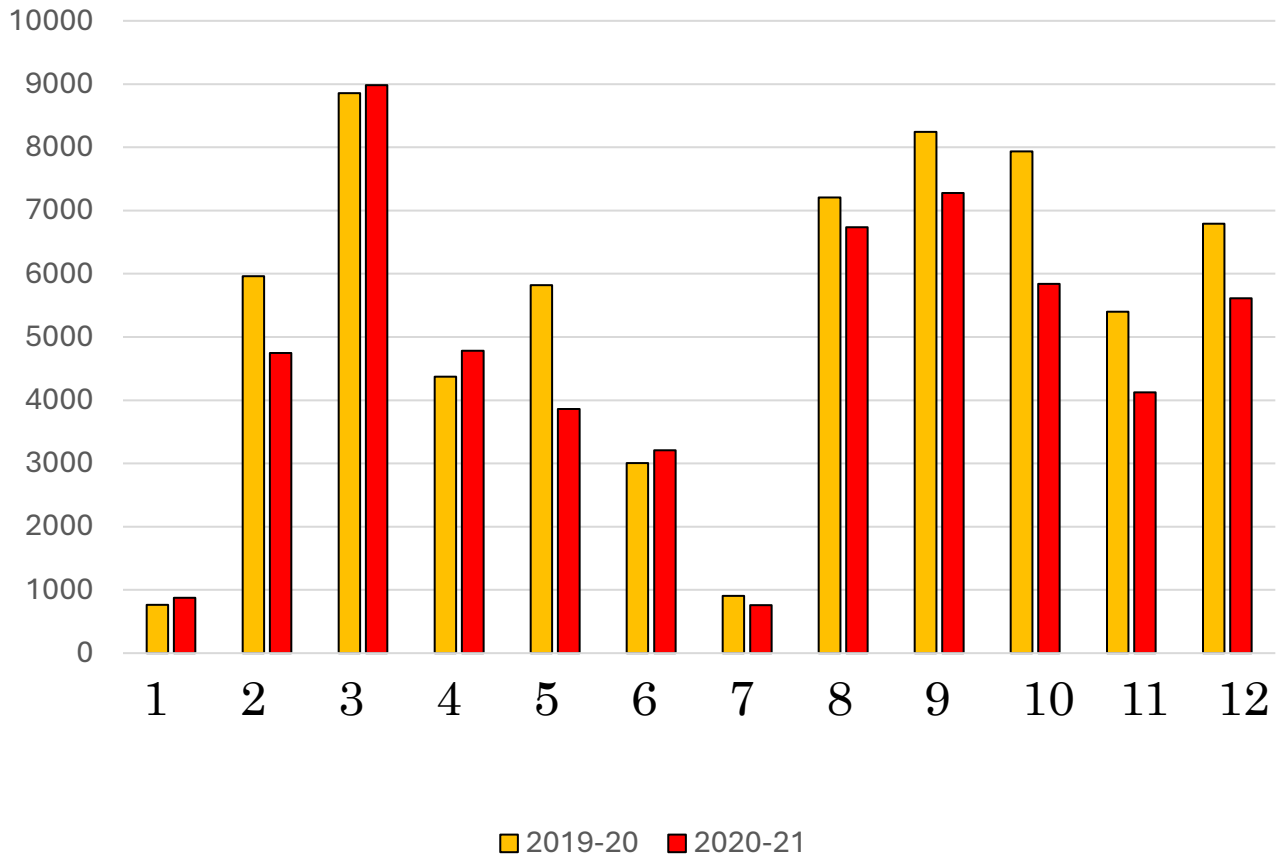
If his recommendations are followed, he says, "the likelihood that the tragedy will happen again will be markedly reduced."

The new system would replace the dysfunctional one that failed thousands of Canadians whose lives have been destroyed by tainted blood.

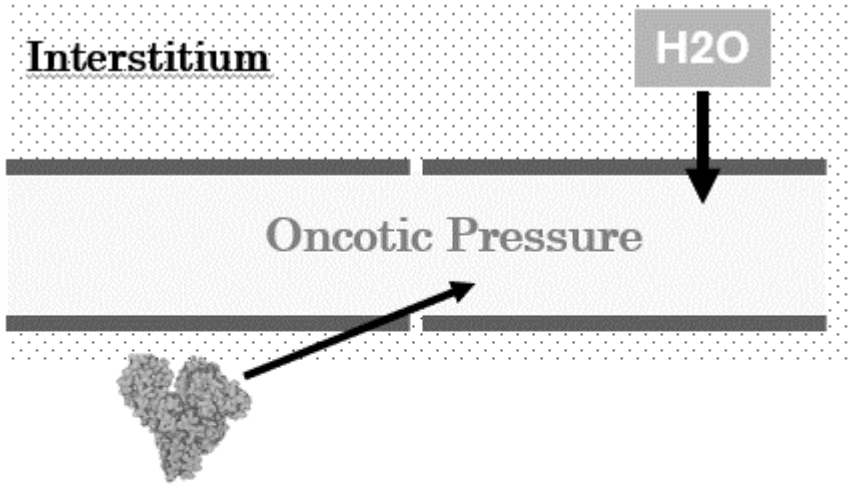
Please see New / A15

Prevailing Albumin Practice

Highly variable



Methodology Preamble



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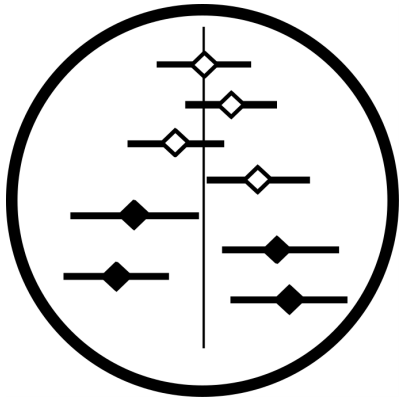
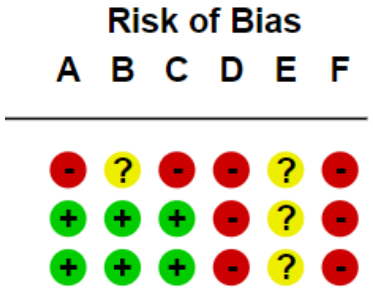
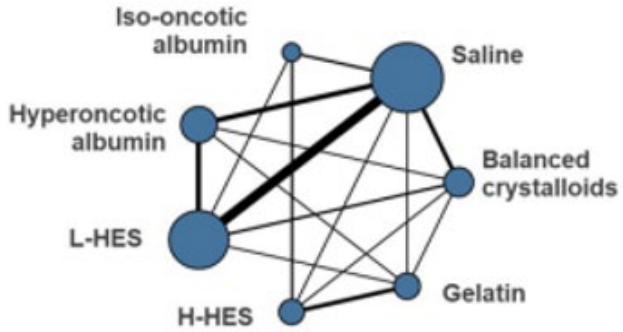


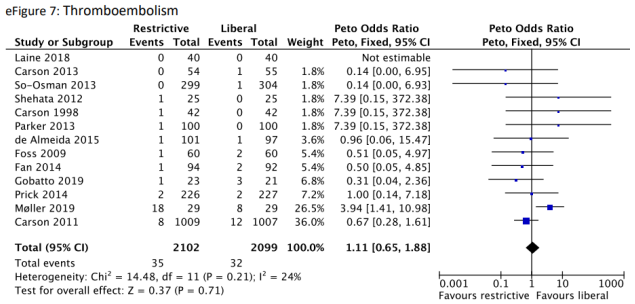


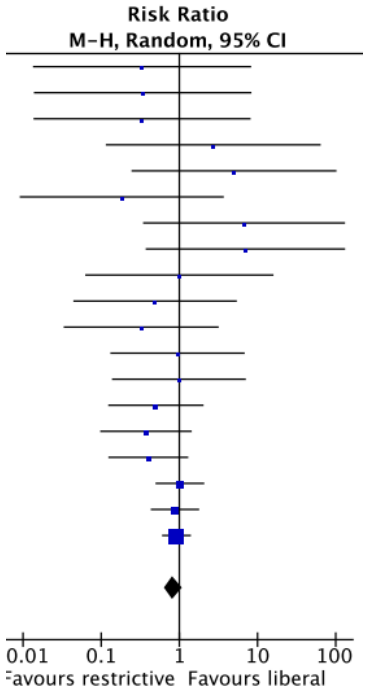


Methodology Preamble

Methods

1. Systematic Review

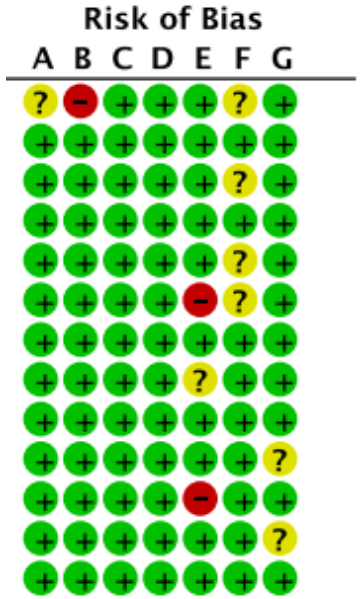




2. Risk of Bias Assessment

Risk of bias legend

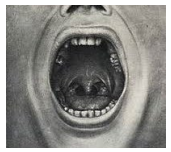
(**A**) Random sequence generation (selection bias)
(**B**) Allocation concealment (selection bias)
(**C**) Blinding of participants and personnel (performance bias)
(**D**) Blinding of outcome assessment (detection bias): Objective measures
(**E**) Incomplete outcome data (attrition bias)
(**F**) Selective reporting (reporting bias)
(**G**) Other bias



3. GRADE Methodology

Grade of recommendation	I Strong recommendation to do	IIa Moderate recommendation to do	IIb Weak recommendation to do	III Recommendation not to do
Conclusions of evidence	Benefits >>> risk & burdens	Benefits >> risk & burdens	Benefits >= risks & burdens	No benefit / Potentially harm
A High level of evidence Consistent evidence from well performed and high quality studies or systematic reviews (low risk of bias, direct, consistent, precise)	Strong recommendation based on high level of evidence	Moderate recommendation based on high level of evidence	Weak recommendation based on high level of evidence	Recommendation based on high level of evidence
B Moderate /Low level of evidence Evidence from studies or systematic reviews with few important limitations	Strong recommendation based on moderate/ low level of evidence	Moderate recommendation based on moderate/ low level of evidence	Weak recommendation based on moderate/ low level of evidence	Recommendation based on moderate/ low level of evidence
C Very low level of evidence Evidence from studies with serious flaws. Only expert opinion, or standards of care	Strong recommendation based on expert opinion	Moderate recommendation based on very low level of evidence Diverging expert opinions	Weak recommendation based on very low level of evidence Diverging expert opinions	Recommendation based on very low level of evidence Expert opinion
Wording in recommendations:				
	We recommend We should Is recommended Is indicated Is useful Is beneficial Is effective	We suggest Is reasonable Is probably recommended Can be useful Can be beneficial Can be effective	We might suggest Might be reasonable Might be considered Usefulness is unknown	We do not recommend Should not be performed Is not useful Is not beneficial Is not effective Is potentially harmful

Methodology Preamble



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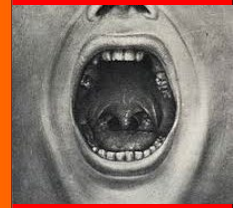
A High level of evidence Consistent evidence from well performed and high quality studies or systematic reviews (low risk of bias, direct, consistent, precise)		Moderate recommendation based on high level of evidence	Weak recommendation based on high level of evidence	
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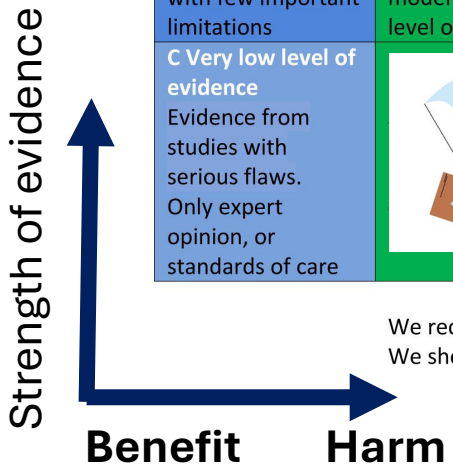
Wording in recommendations:	We recommend We should	We suggest Is reasonable	We might suggest Might be	We do not recommend



Guideline

[**Critical Care** Guideline and Consensus Statement]

CHEST

Use of Intravenous Albumin

A Guideline From the International Collaboration for Transfusion Medicine Guidelines

*Jeannie Callum, MD; Nikolaos J. Skubas, MD; Aarti Bathla, MPharm, MPH; Homa Keshavarz, PhD; Edward G. Clark, MD; Bram Rochwerg, MD; Dean Fergusson, PhD; Sesmu Arbous, MD; Seth R. Bauer, PharmD; Louise China, MD; Mark Fung, MD; Rachel Jug, MD; Michael Neill; Cary Paine, MD; Katerina Pavenski, MD; Prakesh S. Shah, MD; Susan Robinson, MD; Hua Shan, MD; Zbigniew M. Szczepiorkowski, MD, PhD; Thierry Thevenot, MD; Bovey Wu, MD; Simon Stanworth, MD, PhD; and Nadine Shehata, MD; on behalf of the International Collaboration for Transfusion Medicine Guidelines Intravenous Albumin Guideline Group**[*]

ICTMG
International Collaboration for Transfusion Medicine Guidelines
The right transfusion, always, everywhere.

ICTMG

Collaborative of **volunteers (full and project members)** with a focus on rigorous **guideline development methodology** and **implementation**, engaging representatives from relevant disciplines, societies, and patient groups.

JAMA | Special Communication

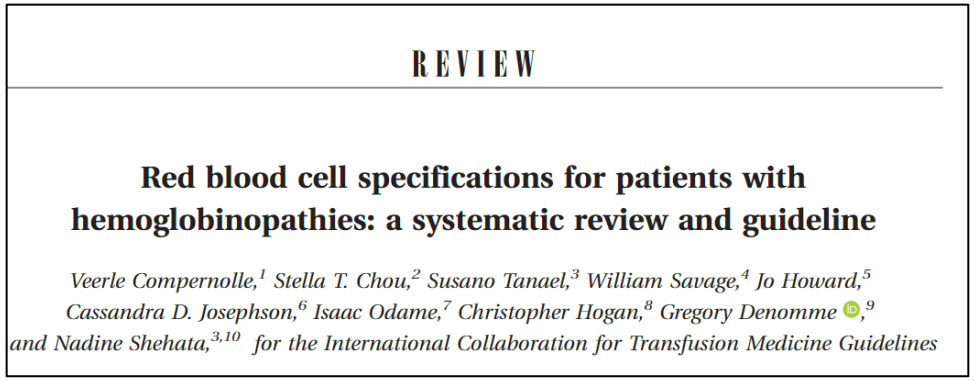
Red Blood Cell Transfusion
2023 AABB International Guidelines

Jeffrey L. Carson, MD; Simon J. Stanworth, MD, DPhil; Gordon Guyatt, MD; Stacey Valentine, MD, MPH; Jane Dennis, PhD; Sara Bakhtary, MD; Claudia S. Cohn, MD, PhD; Allan Dubon, MLS; Brenda J. Grossman, MD, MPH; Gaurav K. Gupta, MD, PhD; Aaron S. Hess, MD, PhD; Jessica L. Jacobson, MD; Lewis J. Kaplan, MD; Yulia Lin, MD; Ryan A. Metcalf, MD; Colin H. Murphy, MD; Katerina Pavenski, MD; Micah T. Prochaska, MD; Jay S. Raval, MD; Eric Salazar, MD, PhD; Nabiha H. Saifee, MD, PhD; Aaron A. R. Tobian, MD, PhD; Cynthia So-Osman, MD, PhD; Jonathan Waters, MD; Erica M. Wood, MD; Nicole D. Zantek, MD, PhD; Monica B. Pagano, MD

JAMA | Special Communication

Patient Blood Management
Recommendations From the
2018 Frankfurt Consensus Conference

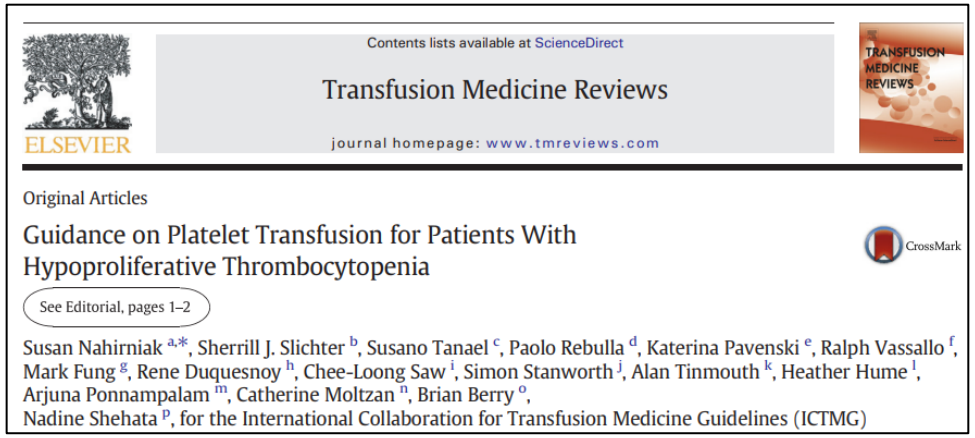
Markus M. Mueller, MD; Hans Van Remoortel, PhD; Patrick Meybohm, MD, PhD; Kari Aranko, MD, PhD; Cécile Aubron, MD, PhD; Reinhard Burger, PhD; Jeffrey L. Carson, MD, PhD; Klaus Cichutek, PhD; Emmy De Buck, PhD; Dana Devine, PhD; Dean Fergusson, PhD; Gilles Folléa, MD, PhD; Craig French, MB, BS; Kathrine P. Frey, MD; Richard Gammon, MD; Jerrold H. Levy, MD; Michael F. Murphy, MD, MBBS; Yves Ozier, MD; Katerina Pavenski, MD; Cynthia So-Osman, MD, PhD; Pierre Tiberghien, MD, PhD; Jimmy Volmink, DPhil; Jonathan H. Waters, MD; Erica M. Wood, MB, BS; Erhard Seifried, MD, PhD; for the ICC PBM Frankfurt 2018 Group



REVIEW

Red blood cell specifications for patients with hemoglobinopathies: a systematic review and guideline

Veerle Compernolle,[1] Stella T. Chou,[2] Susano Tanael,[3] William Savage,[4] Jo Howard,[5] Cassandra D. Josephson,[6] Isaac Odame,[7] Christopher Hogan,[8] Gregory Denomme,[9] and Nadine Shehata,[3,10] for the International Collaboration for Transfusion Medicine Guidelines



Contents lists available at ScienceDirect

Transfusion Medicine Reviews

journal homepage: www.tmreviews.com

ELSEVIER

Original Articles

Guidance on Platelet Transfusion for Patients With Hypoproliferative Thrombocytopenia

CrossMark

See Editorial, pages 1–2

Susan Nahirniak [a,*], Sherrill J. Slichter [b], Susano Tanael [c], Paolo Rebulla [d], Katerina Pavenski [e], Ralph Vassallo [f], Mark Fung [g], Rene Duquesnoy [h], Chee-Loong Saw [i], Simon Stanworth [j], Alan Tinmouth [k], Heather Hume [l], Arjuna Ponnampalam [m], Catherine Moltzan [n], Brian Berry [o], Nadine Shehata [p], for the International Collaboration for Transfusion Medicine Guidelines (ICTMG)

The ICTMG secretariat is hosted by Canadian Blood Services, the primary funder for ICTMG

Albumin Guideline Development Group

The international panel of expert volunteers for this guideline included:

CANADA
Jeannie Callum*
Aarti Bathla
Homa Keshavarz
Edward G. Clark
Bram Rochwerg
Michael Neil**
Dean Fergusson*
Katerina Pavenski*
Prakesh S. Shah
Bovey Wu
Nadine Shehata*

USA
Nikolaos J. Skubas
Seth R. Bauer
Mark Fung*
Rachel Jug*
Cary Paine
Hua Shan
Zbigniew M. Szczepiorkowski*

NETHERLANDS
Sesmu Arbous

UK
Louise China
Susan Robinson*
Simon Stanworth*

FRANCE
Thierry Thevenot

*** denotes ICTMG full membership at the time of guideline development**

**** indicates patient representation**

Visit www.ICTMG.org

Scope

Appropriate use of albumin in

- Liver disease
- Critical Care
- Renal replacement
- Pediatric and Neonatal
- CV Surgery

Not assessed: Plasma Exchange

Intended primarily to inform

- Nephrologists
- Hematologists
- Intensivist
- Hospitalists
- General Internists
- Hepatologists
- Gastroenterologists
- Anesthesiologists
- CV Surgeons
- Pathologists
- TM Physicians
- Lab Technologists
- Pharmacists
- Researchers
- Patients/Families

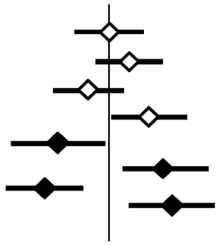
Link to Guidelines

Methods

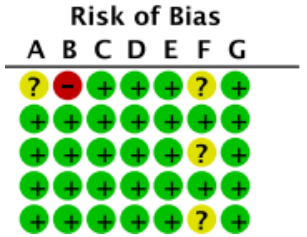
Guideline Panel

- Co-chairs (2)
- Clinicians
- Researchers
- Methodologists
- Patient Representative

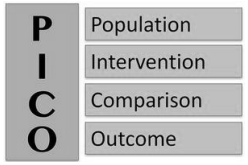
Systematic Review and Meta-Analyses were screened or conducted (**PROSPERO** + **PRISMA**)



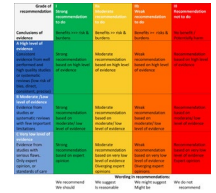
Quality of studies assessed using **Cochrane Risk of Bias** tool for RCTs and **AMSTAR** for Systematic Reviews.



Search terms determined by guideline panel based on **PICO**



Recommendations were developed using **GRADE** Methodology



References were screened and relevant data extracted and analysed using **Distiller SR**

The guideline recommendations were developed and reported in accordance with **AGREE** checklist

PICO

*In **patients with select clinical indications***, does **intravenous albumin** improve **pre-specified outcomes** when compared to **comparator therapies**?*

P*

- Hypovolemia
- Sepsis
- Hypoalbuminemia
- Thermal injuries
- Acute respiratory distress syndrome
- Cirrhosis
- Intradialytic hypotension
- Cardiovascular surgery

I

Intravenous albumin

C

- Synthetic colloids
- Crystalloids

O

- Mortality
- Kernicterus
- Acute neurological impairment
- Chronic neurological impairment
- Need for exchange transfusion
- Need for top-up transfusion
- Bilirubin level
- Anemia
- Length of hospital stay

Literature Review

Identification of studies from MEDLINE, EMBASE, Cochrane, National Health Service Economic Evaluation Database, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Ovid MEDLINE(R), Ovid MEDLINE(R) epub ahead of print and in-process and other non-indexed citations From Inception- November 2022

6783
total records identified

6186
records excluded after screening

597
full-text articles

54
studies

Limitation of the search to the English language

Lack of comparative dosing strategies leaves uncertainty in choice between 4-5% and 20-25% albumin formulations

Studies often did not report adverse reactions

The guideline is limited to common uses of albumin and cannot address every possible patient scenario

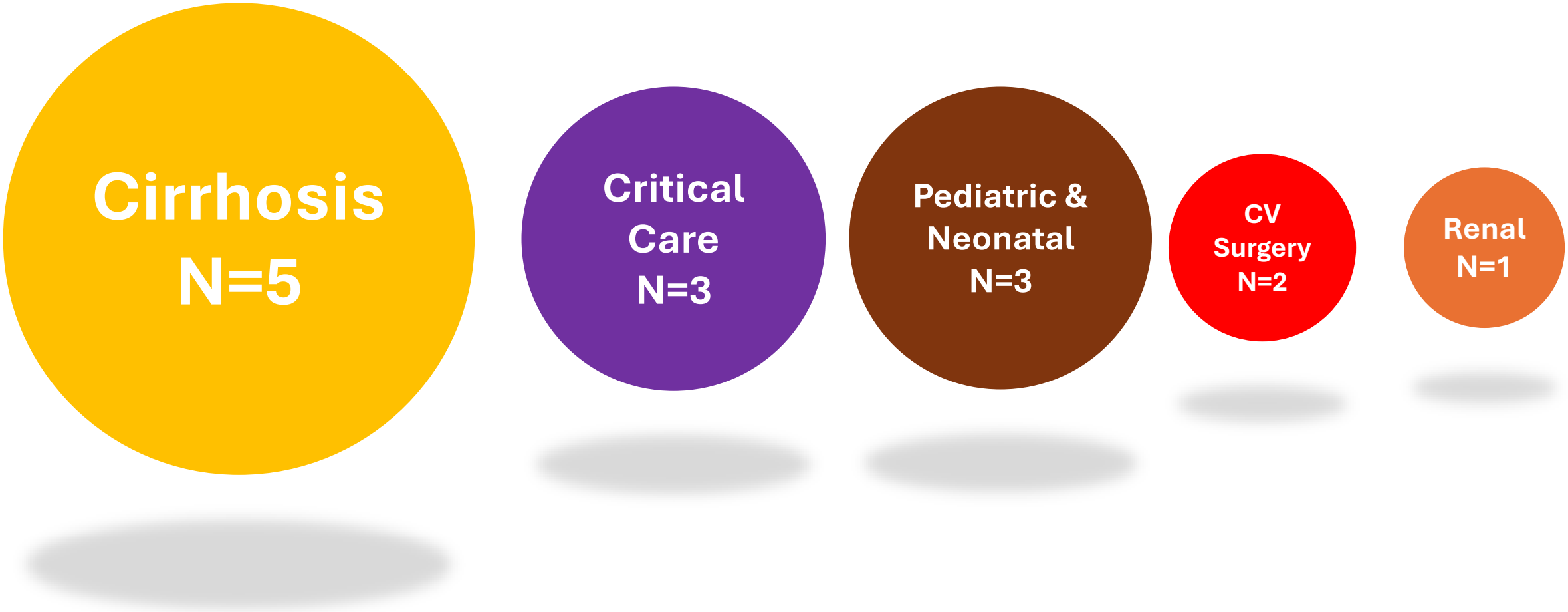
Quality Assessment

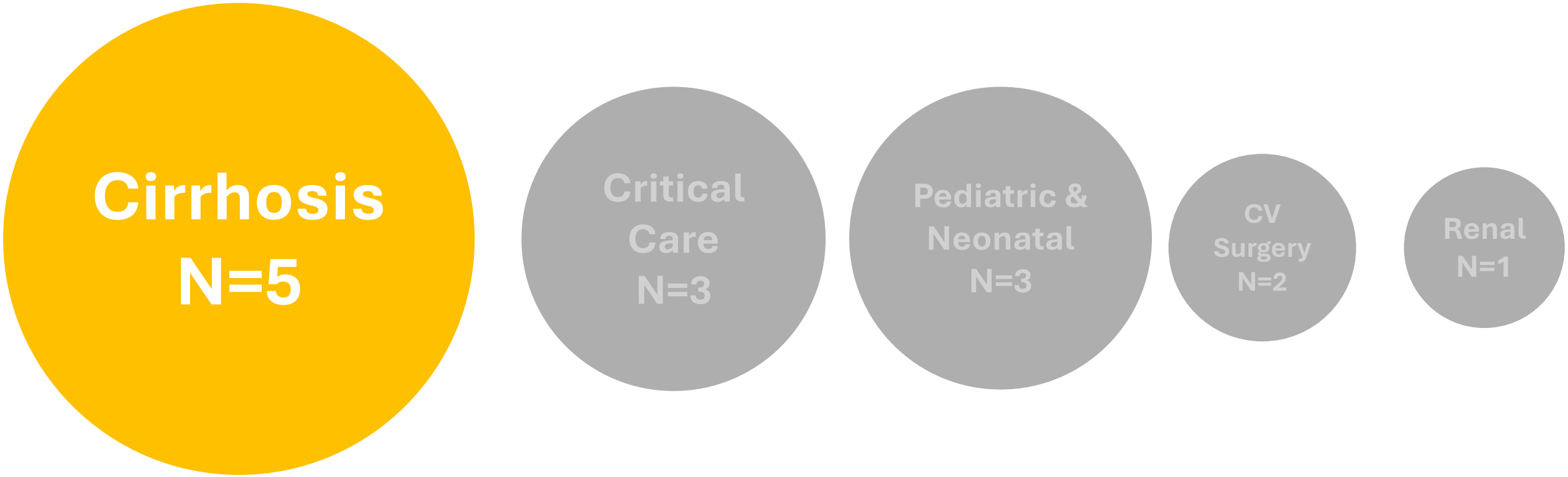
Statements

TABLE 1] The 14 Recommendations From the Panel, Ordered by Strength of the Recommendations

Moderate Certainty of Evidence
Recommendation 1: In critically ill adult patients (excluding patients with thermal injuries and ARDS), intravenous albumin is not suggested for first-line volume replacement or to increase serum albumin levels (Conditional Recommendation, Moderate Certainty of Evidence of Effect).
Recommendation 8: In adult patients undergoing cardiovascular surgery, intravenous albumin is not suggested for priming the cardiovascular bypass circuit or for volume replacement (Conditional Recommendation, Moderate Certainty of Evidence of Effect).
Low Certainty of Evidence
Recommendation 4: In pediatric patients with infection and hypoperfusion, intravenous albumin is not recommended to reduce mortality (Strong Recommendation, Low Certainty of Evidence of Effect).
Recommendation 11: In patients with cirrhosis and spontaneous bacterial peritonitis, intravenous albumin is suggested to reduce mortality (Conditional Recommendation, Low Certainty of Evidence of Effect).
Recommendation 12: In patients with cirrhosis and extraperitoneal infections, intravenous albumin is not suggested to reduce mortality or kidney failure (Conditional Recommendation, Low Certainty of Evidence of Effect).
Recommendation 13: In hospitalized patients with decompensated cirrhosis with hypoalbuminemia (< 30 g/L), repeated intravenous albumin to increase albumin levels to > 30 g/L is not suggested to reduce infection, kidney dysfunction, or death (Conditional Recommendation, Low Certainty of Evidence of Effect).
Recommendation 14: In outpatients with cirrhosis and uncomplicated ascites despite diuretic therapy, intravenous albumin is not routinely suggested to reduce complications associated with cirrhosis (Conditional Recommendation, Low Certainty of Evidence of Effect).
Very low Certainty of Evidence
Recommendation 2: In critically ill adult patients with thermal injuries or ARDS, intravenous albumin is not suggested for volume replacement or to increase serum albumin level (Conditional Recommendation, Very Low Certainty of Evidence of Effect).
Recommendation 3: In critically ill adult patients, intravenous albumin in conjunction with diuretics is not suggested for removal of extravascular fluid (Conditional Recommendation, Very Low Certainty of Evidence of Effect).
Recommendation 5: In preterm neonates ($\leq$ 36 wk) with respiratory distress and low serum albumin levels, intravenous albumin is not suggested to improve respiratory function (Conditional Recommendation, Very Low Certainty of Evidence of Effect).
Recommendation 6: In preterm neonates ($\leq$ 32 wk or $\leq$ 1,500 g) with or without hypoperfusion, intravenous albumin is not suggested for volume replacement (Conditional Recommendation, Very Low Certainty of Evidence of Effect).
Recommendation 7: In patients undergoing kidney replacement therapy, intravenous albumin is not suggested for the prevention or treatment of intradialytic hypotension or for improving ultrafiltration (Conditional Recommendation, Very Low Certainty of Evidence of Effect).
Recommendation 9: In pediatric patients undergoing cardiovascular surgery, intravenous albumin is not suggested for priming the cardiovascular bypass circuit or for volume replacement (Conditional Recommendation, Very Low Certainty of Evidence of Effect).
Recommendation 10: In patients with cirrhosis and ascites undergoing large-volume paracentesis (> 5 L), intravenous albumin is suggested to prevent paracentesis-induced circulatory dysfunction (Conditional Recommendation, Very Low Certainty of Evidence of Effect).

Link to Guidelines


Cirrhosis
N=5
Critical
Care
N=3
Pediatric &
Neonatal
N=3
CV
Surgery
N=2
Renal
N=1


Cirrhosis
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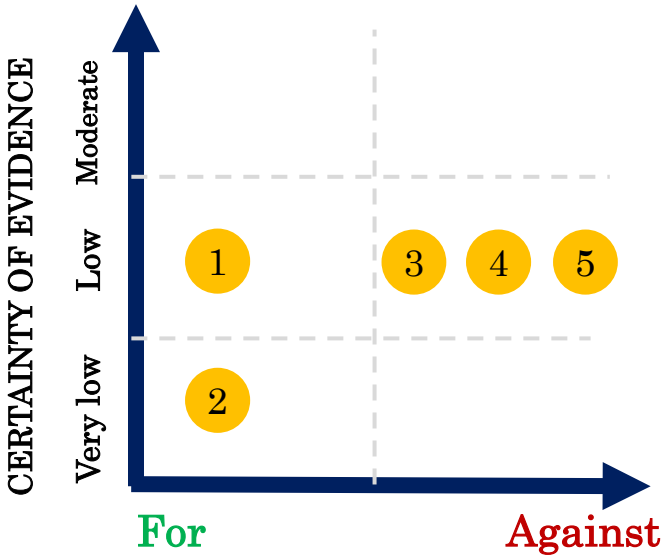
Cirrhosis N=5



1. In patients with cirrhosis and ascites undergoing large-volume paracentesis (> 5 L), intravenous albumin is suggested to prevent paracentesis-induced circulatory dysfunction

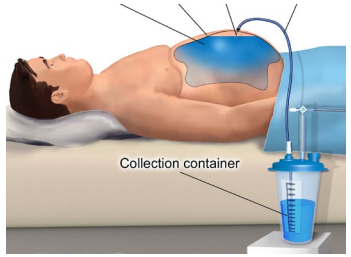
2. In patients with cirrhosis and spontaneous bacterial peritonitis, intravenous albumin is suggested to reduce mortality

3. In patients with cirrhosis and extraperitoneal infections, intravenous albumin is not suggested to reduce mortality or kidney failure

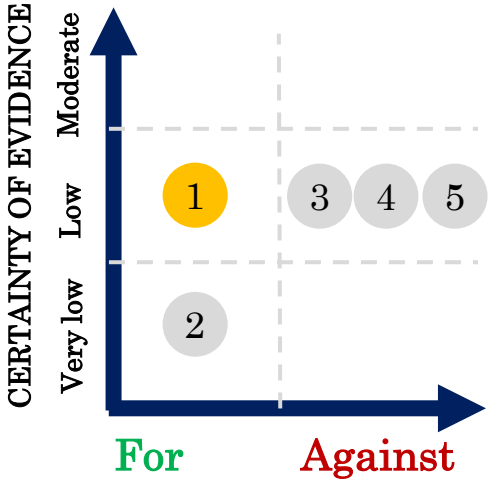
4. In hospitalized patients with decompensated cirrhosis with hypoalbuminemia (< 30 g/L), repeated intravenous albumin to increase albumin levels to > 30 g/L is not suggested to reduce infection, kidney dysfunction, or death

5. In outpatients with cirrhosis and uncomplicated ascites despite diuretic therapy, intravenous albumin is not routinely suggested to reduce complications associated with cirrhosis

1. In patients with cirrhosis and ascites undergoing large-volume paracentesis (> 5 L), intravenous albumin is suggested to prevent paracentesis-induced circulatory dysfunction



Recommended dose:
Alb 20-25%, 6-8 g/L of fluid removed



Cochrane Library
Cochrane Database of Systematic Reviews

Plasma expanders for people with cirrhosis and large ascites treated with abdominal paracentesis (Review)

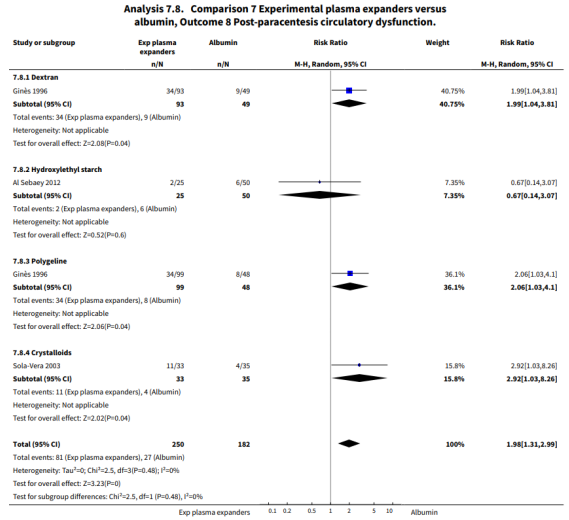
Simonetti RG, Perricone G, Nikolova D, Bjelakovic G, Gluud C
Cochrane Database Syst Rev. 2019 Jun 28;6(6):CD004039.

27 RCTs (N = 1,592) examining plasma volume expanders cirrhosis + paracentesis

Included patients having large-volume paracentesis (> 5 L)

Compared with no plasma expander, hyperoncotic albumin (20-25%) showed

- **No effect** of using hyperoncotic (20%-25%) albumin on
  - Mortality (RR, 0.52; 95% CI, 0.06-4.83)
  - Kidney impairment (RR, 0.32; 95% CI, 0.02-5.88),
  - Recurrence of ascites (RR, 1.3; 95% CI, 0.49-3.42)
- **Benefit** for paracentesis-induced circulatory dysfunction (RR, 1.98; 95% CI, 1.31-2.99)



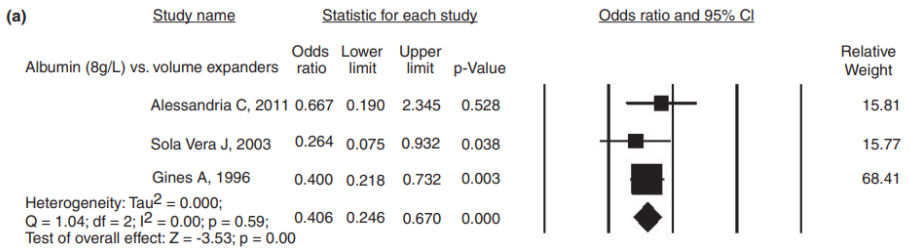
Prevention of paracentesis-induced circulatory dysfunction—A systematic review and network meta-analysis

Anand V. Kulkarni[1] | Pramod Kumar[1] | Siddharth Singh[2] | Mithun Sharma[1] | Rupjyoti Talukdar[3] | Vivekananda H.V. Murthy[4] | Virendra Singh[5] | Nageshwar D Reddy[3] | Nagaraja Padaki Rao[1]

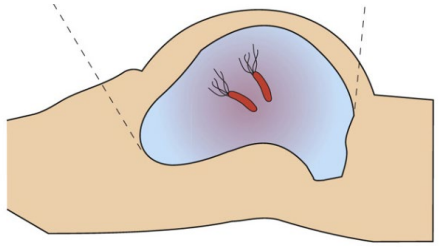
A 2020 systematic review focused on the impact of different therapies (albumin, other fluids, vasoactive drugs) on the rate of postparacentesis circulatory dysfunction

Included (n=9 RCTs, 620 patients)

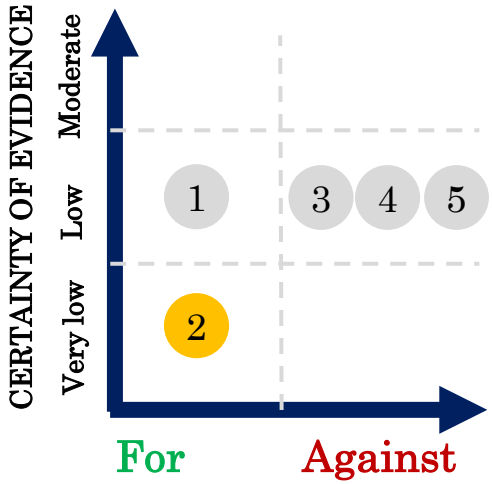
Found albumin at a dose of 8 g/L was found to be superior to other volume expanders for preventing post-paracentesis circulatory dysfunction



2. In patients with cirrhosis and spontaneous bacterial peritonitis, intravenous albumin is suggested to reduce mortality



Recommended dose:
Alb 20-25%, Day 1: 1.5 g/kg, Day 3: 1.0 g/kg*



Giacomo Zaccherini
Manuel Tufoni
Mauro Bernardi
Department of Medical and Surgical Sciences, Alma Mater Studiorum - University of Bologna, Bologna 40138, Italy

Albumin Administration is Efficacious in the Management of Patients with Cirrhosis: A Systematic Review of the Literature

Two SRs identified 5 unblinded RCTs
Trials used variable doses and duration of hyperoncotic albumin

Albumin reduced:
- Rate of kidney impairment (OR, 0.21; 95% CI, 0.11-0.42)
- Mortality (OR, 0.34; 95% CI, 0.19-0.60)

SYSTEMATIC REVIEWS AND META-ANALYSES

Fasiha Kanwal, Section Editor

Albumin Infusion Improves Outcomes of Patients With Spontaneous Bacterial Peritonitis: A Meta-analysis of Randomized Trials

Effect of Intravenous Albumin on Renal Impairment and Mortality in Patients with Cirrhosis and Spontaneous Bacterial Peritonitis

Authors: 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. Author Info & Affiliations

Published August 5, 1999 | N Engl J Med 1999;341:403-409 | DOI: 10.1056/NEJM199908053410603

Largest RCT, randomized 126 patients to albumin + abx, or abx alone

Patients treated with albumin showed
- Lower kidney impairment (10% vs 33%; P = .002)
- Lower in-hospital mortality (10% vs 29%; P = .01)

Efficacy of Albumin Treatment for Patients with Cirrhosis and Infections Unrelated to Spontaneous Bacterial Peritonitis

Javier Fernández, Paolo Angeli, Jonel Trebicka, Manuela Merli, Thierry Gustot, Carlo Alessandria, Niels Kristian Aagaard, Andrea de Gottardi, Tania M. Welzel, Alexander Gerbes, German Soriano, Victor Vargas, Agustin Albillos, Francesco Salerno, Francois Durand, Rafael Bañares, Rudolf Stauber, Verónica Prado, Mireya Arteaga, María Hernández-Tejero, Fátima Aziz, Filippo Morando, Christian Jansen, Barbara Lattanzi, Christophe Moreno, Daniela Campion, Henning Gronbaek, Rita Garcia, Cristina Sánchez, Elisabet García, Alex Amorós, Marco Pavesi, Joan Clària, Richard Moreau, and Vicente Arroyo

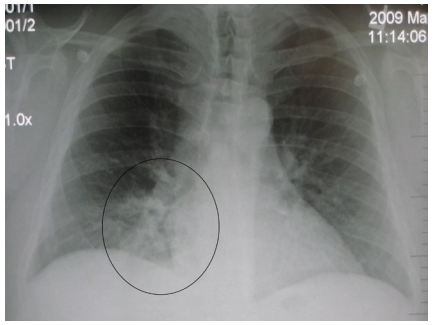
Clinical Gastroenterology and Hepatology 2020;18:963–973

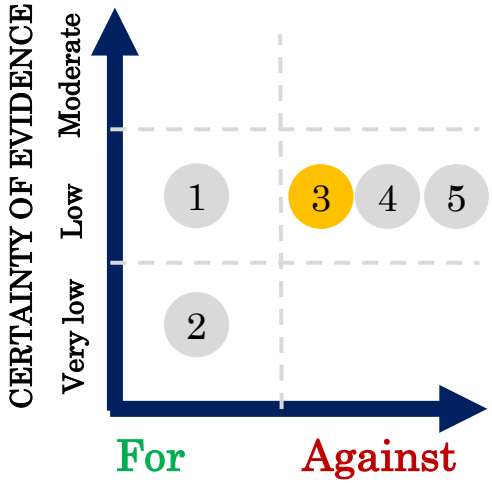
Second largest RCT, randomized 118 patients to albumin (plus antibiotics) or antibiotics alone

No effect on in-hospital mortality (13% vs 11%; P = .66)

Benefit seen for acute-on-chronic liver failure and new infections

3. In patients with cirrhosis and extraperitoneal infections, intravenous albumin is not suggested to reduce mortality or kidney failure





Efficacy and Safety of IV albumin for non-spontaneous bacterial peritonitis infection among patients with cirrhosis: A systematic review and meta-analysis

Yu-Jun WONG[a], Tian-Yu QIU[a], Yew-Chong TAM[b], Babu P MOHAN[c,d], Juan-F GALLEGOS-OROZCO[d], Douglas G ADLER[d,*]

2020 systematic review and meta-analysis of RCTs (3 RCTs, n=406)

- No effect on mortality or kidney impairment
- Higher rates of pulmonary edema with albumin (three studies [N = 406]; OR, 5.17; 95% CI, 1.62-16.47)
- Higher resolution of acute on chronic liver failure (OR=0.11, 95%CI: 0.02-0.69, p=0.02)

Comparison of 5% human albumin and normal saline for fluid resuscitation in sepsis induced hypotension among patients with cirrhosis (FRISC study): a randomized controlled trial

Cyriac Abby Philips[1] · Rakhi Maiwall[1] · Manoj Kumar Sharma[1] · Ankur Jindal[1] · Ashok Kumar Choudhury[1] · Guresh Kumar[2] · Ankit Bhardwaj[2] · Lalita Gouri Mitra[3] · Prashant Mohan Agarwal[3] · Shiv Kumar Sarin[1,2]

n = 308

- Similar survival at 7 days in the albumin-treated patients (saline, 39.0% vs albumin, 43.5%; P = .42, Fisher exact test)
- Higher reversal of hypotension in patients receiving 5% albumin at 1 hr and 3 hr transfusion

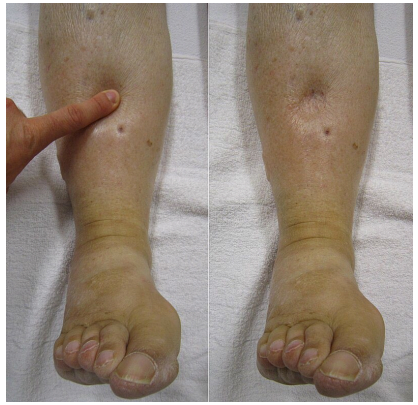
Research Article
Cirrhosis and Liver Failure
JOURNAL OF HEPATOLOGY

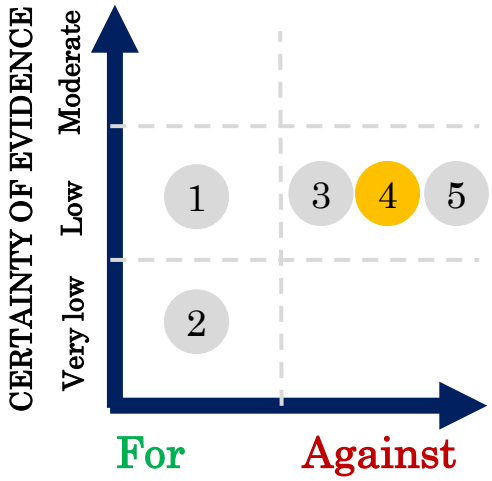
A randomized-controlled trial comparing 20% albumin to plasmalyte in patients with cirrhosis and sepsis-induced hypotension [ALPS trial]

n = 100

- No effect on initiation of dialysis, length of stay, or mortality at 28 days
- Superior to crystalloid for reversal of hypotension without initiation of vasopressors at 3 h (22% vs 62%; $P < .001$)

4. In hospitalized patients with decompensated cirrhosis with hypoalbuminemia (< 30 g/L), repeated intravenous albumin to increase albumin levels to > 30 g/L is not suggested to reduce infection, kidney dysfunction, or death





A Randomized Trial of Albumin Infusions in Hospitalized Patients with Cirrhosis

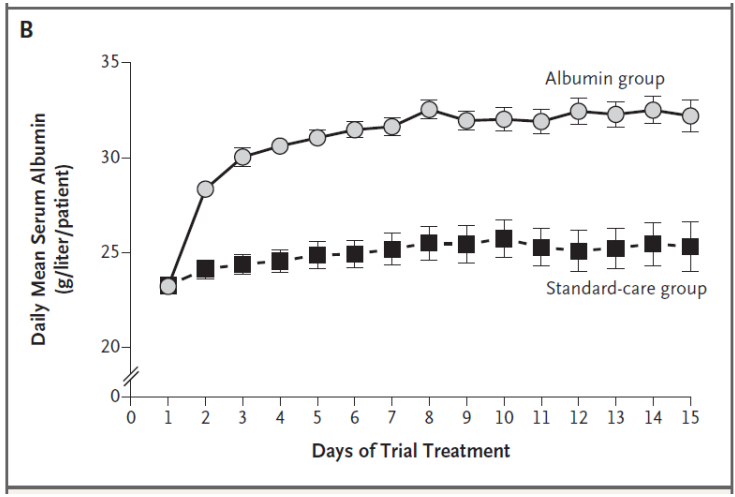
ATTIRE Study

Authors: Louise China, Ph.D., Nick Freemantle, Ph.D., Ewan Forrest, M.D., Yiannis Kallis, Ph.D., Stephen D. Ryder, D.M., Gavin Wright, Ph.D., Andrew J. Portal, M.D., Natalia Becares Salles, Ph.D., Derek W. Gilroy, Ph.D., and Alastair O'Brien, Ph.D., for the ATTIRE Trial Investigators* Author Info & Affiliations

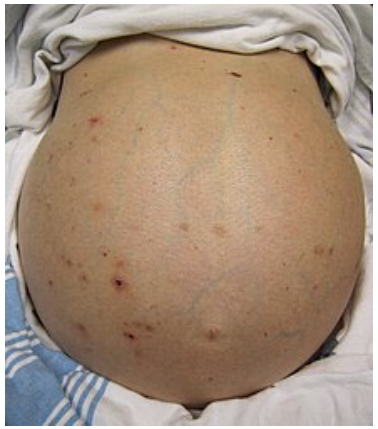
Published March 3, 2021 | N Engl J Med 2021;384:808-817 | DOI: 10.1056/NEJMoa2022166 | VOL. 384 NO. 9

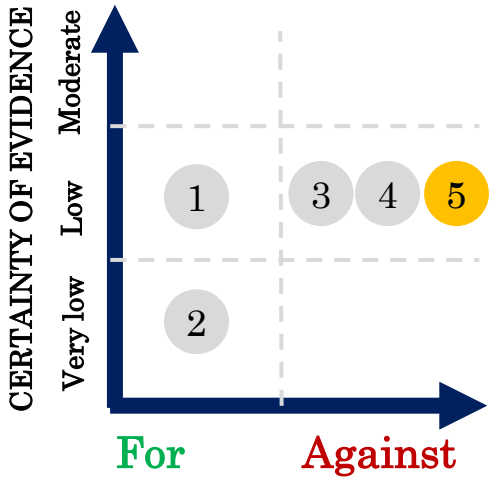
- Patients with hypoalbuminemia included (n=777)
- Randomly received either targeted 20% human albumin solution for up to 14 days or until discharge, whichever came first, or standard care
- No difference was found in the primary end point (composite of new infections, kidney dysfunction, or death between days 3 and 15) (OR, 0.98; 95% CI, 0.71-1.33)
- More severe or life-threatening serious adverse events were reported in the albumin-treated patients, primarily a numerical increase in pulmonary edema.

Median Albumin given: 200 g



5. In outpatients with cirrhosis and uncomplicated ascites despite diuretic therapy, intravenous albumin is not routinely suggested to reduce complications associated with cirrhosis





Midodrine and albumin for prevention of complications in patients with cirrhosis awaiting liver transplantation. A randomized placebo-controlled trial

J Hepatol. 2018;69(6):1250-1259.

- Randomized 440 patients with cirrhosis and uncomplicated, persistent ascites despite diuretic therapy
- Albumin (40 g twice weekly for 2 weeks and then 40 g weekly for up to 18 months) or no albumin.

- Patients randomized to albumin experienced
  - Longer time to first paracentesis; required fewer paracenteses
  - Lower hepatic encephalopathy, hepatorenal syndrome, spontaneous bacterial peritonitis, nonperitonitis infections, hyponatremia, or kidney dysfunction; experienced fewer days in hospital; lower all-cause mortality

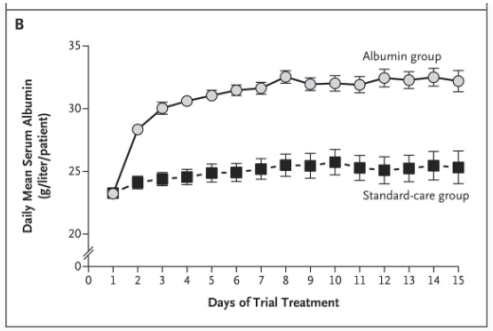
Limitation—**Performance Bias:** albumin-treated patients underwent weekly health care interactions and the control group did not (!!)

A Randomized Trial of Albumin Infusions in Hospitalized Patients with Cirrhosis

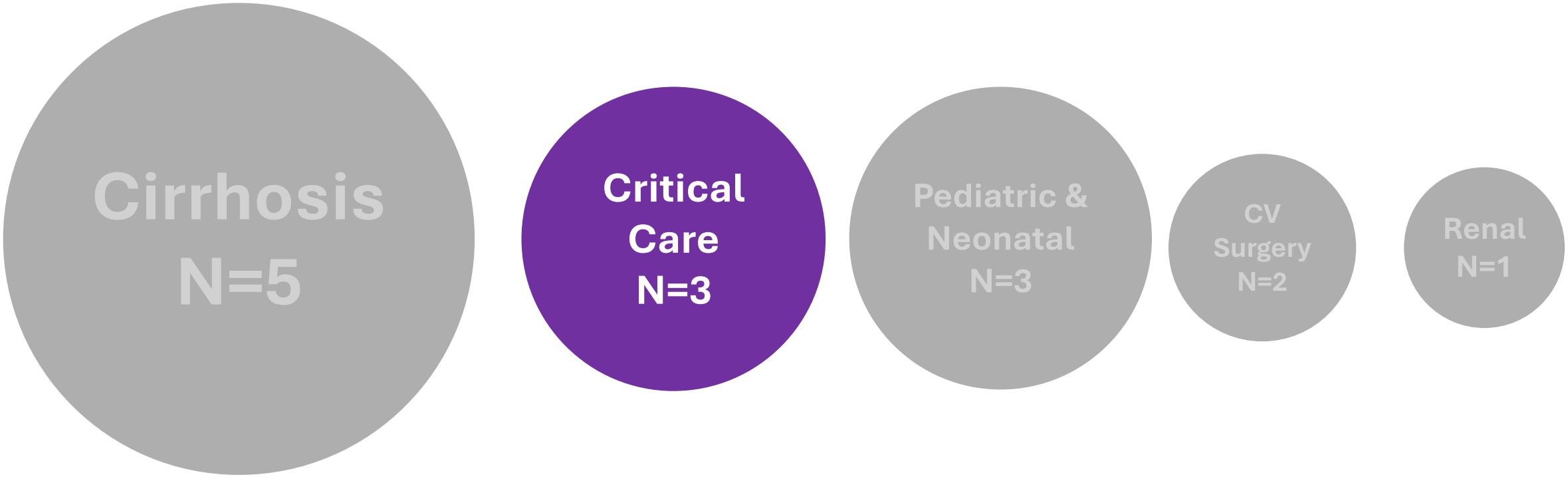
The NEW ENGLAND JOURNAL of MEDICINE

- N = 196 outpatients, ascites awaiting liver transplantation
- RCT: Oral midodrine and albumin or saline placebo

The dose of albumin given as part of the intervention was lower (40 g every 15 days).



No difference in patient outcomes (end point was new infection, kidney dysfunction, or death, days 3-15)


Cirrhosis
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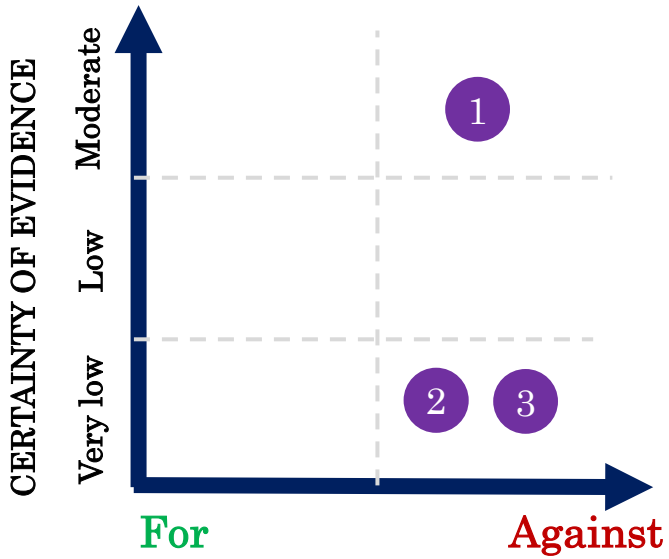
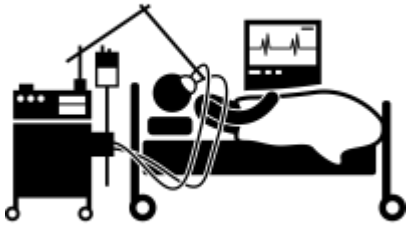
Critical Care N=3



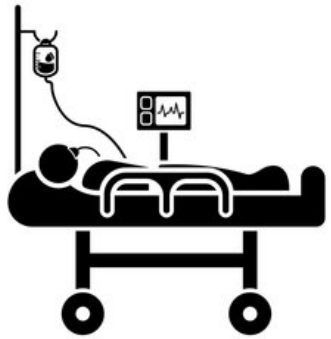
1. In critically ill adult patients (excluding patients with thermal injuries and ARDS), intravenous albumin is not suggested for first-line volume replacement or to increase serum albumin levels

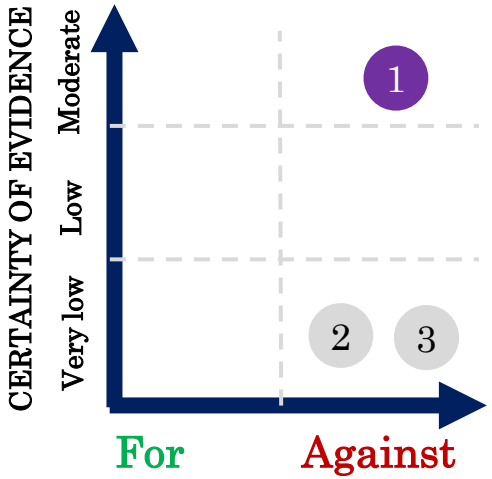
2. In critically ill adult patients with thermal injuries or ARDS, intravenous albumin is not suggested for volume replacement or to increase serum albumin level

3. In critically ill adult patients, intravenous albumin in conjunction with diuretics is not suggested for removal of extravascular fluid



1 In critically ill adult patients (excluding patients with thermal injuries and ARDS), intravenous albumin is not suggested for first-line volume replacement or to increase serum albumin levels





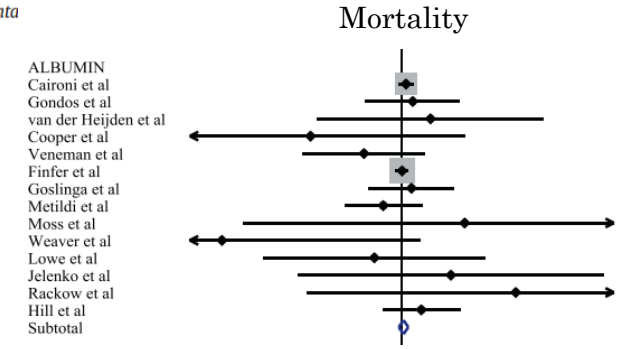
Crystalloids vs. colloids for fluid resuscitation in the Intensive Care Unit: A systematic review and meta-analysis

Greg S. Martin [a,*], Paul Bassett [b]

[a] Division of Pulmonary, Allergy, Critical Care and Sleep Medicine, Department of Medicine, Emory University School of Medicine, Grady Memorial Hospital, Atlanta
[b] Meridian HealthComms, Plumley Moor Road, Plumley, UK

A systematic review from 2019 identified 55 RCTs comparing crystalloid with colloids in critical care. Data on mortality were available for 26,329 patients from 46 studies.

- Better peak mean arterial pressure with albumin
- No mortality benefit was found when crystalloid was compared with albumin (relative risk [RR] 1.02; 95% CI, 0.96-1.10)



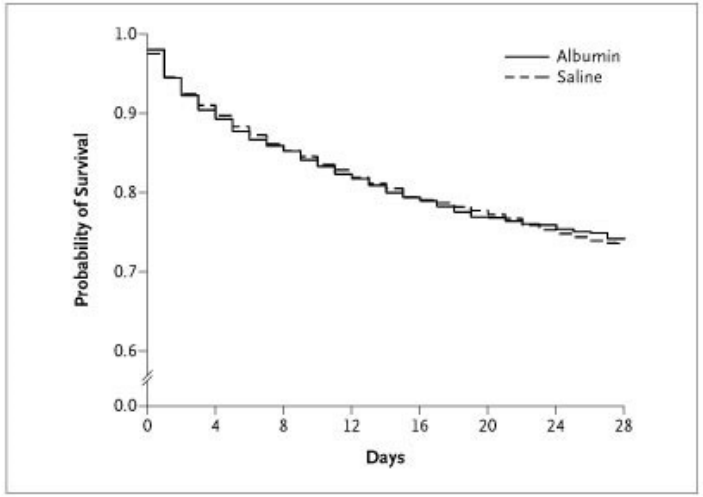
ORIGINAL ARTICLE

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

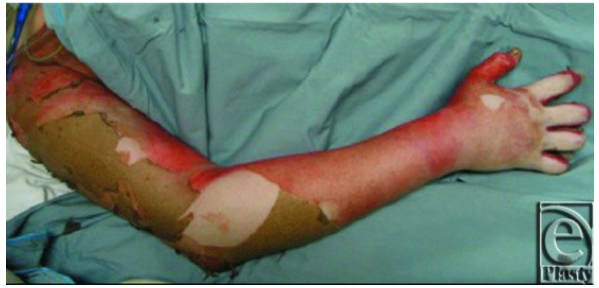
Author: The SAFE Study Investigators* Author Info & Affiliations

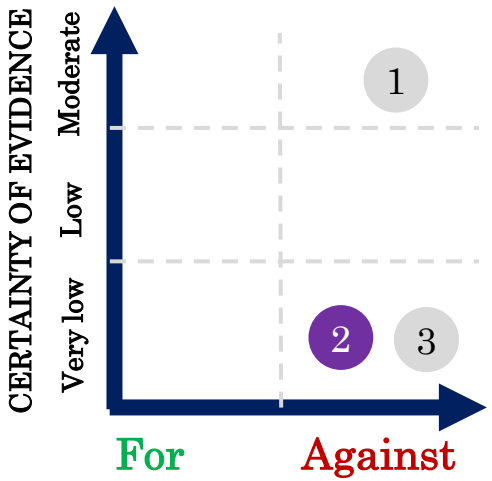
Published May 27, 2004 | N Engl J Med 2004;350:2247-2256 | DOI: 10.1056/NEJMoa040232 | VOL. 350 NO. 22

- 6,997 patients receiving critical care (including a mix of medical and surgical patients)
- Compared 4% albumin with 0.9% normal saline.
- No differences were found in outcomes, including 28-day mortality (RR, 0.99; 95% CI, 0.91-1.09)
- Subgroup analysis found that patients with traumatic brain injury showed a higher mortality rate (RR, 1.62; 95% CI, 1.12- 2.34)



2. In critically ill adult patients with thermal injuries or ARDS, intravenous albumin is not suggested for volume replacement or to increase serum albumin level



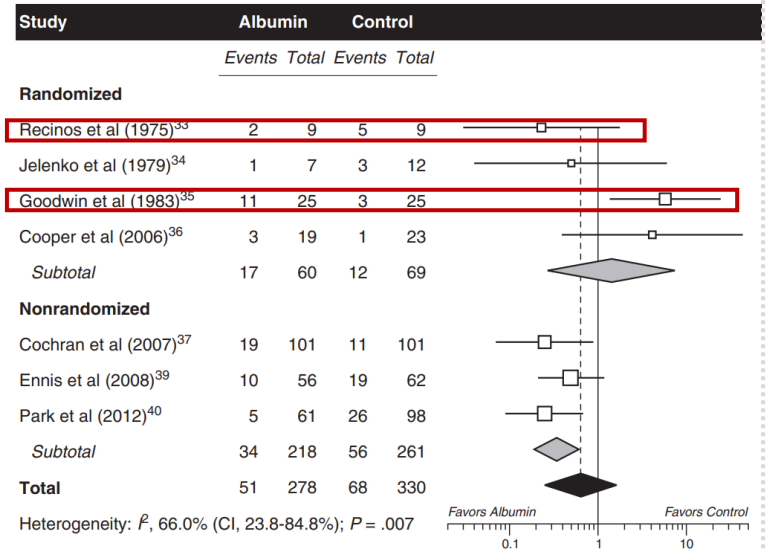


Albumin in Burn Shock Resuscitation: A Meta-Analysis of Controlled Clinical Studies

Roberta J. Navickis, PhD,* David G. Greenhalgh, MD, FACS,†‡
Mahlon M. Wilkes, PhD*

Included 4 RCTs and 4 observational studies

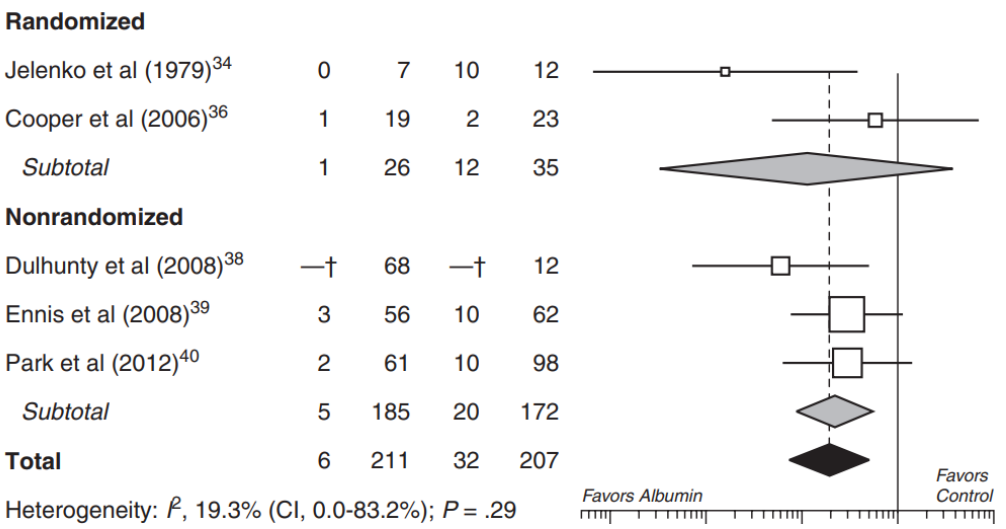
Overall, albumin infusion during the first 24 hours showed no significant overall effect on mortality



Study	Albumin Events	Albumin Total	Control Events	Control Total
Randomized				
Recinos et al (1975)[33]	2	9	5	9
Jelenko et al (1979)[34]	1	7	3	12
Goodwin et al (1983)[35]	11	25	3	25
Cooper et al (2006)[36]	3	19	1	23
Subtotal	17	60	12	69
Nonrandomized				
Cochran et al (2007)[37]	19	101	11	101
Ennis et al (2008)[39]	10	56	19	62
Park et al (2012)[40]	5	61	26	98
Subtotal	34	218	56	261
Total	51	278	68	330

Heterogeneity: I^2, 66.0% (CI, 23.8-84.8%); $P = .007$

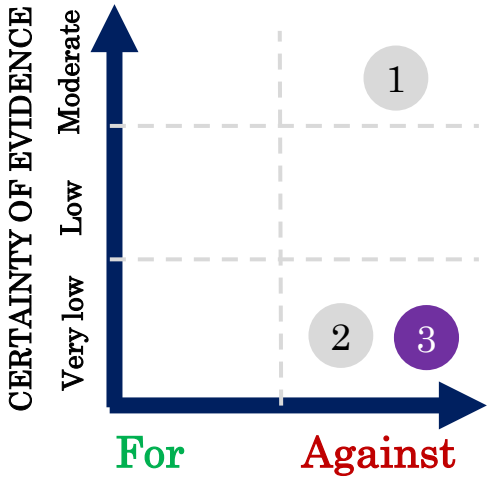
After those exclusions, albumin infusion was associated with reduced mortality. The pooled odds ratio was 0.34 with a 95% confidence interval of 0.19 to 0.58 ($P < .001$).



Randomized				
Jelenko et al (1979)[34]	0	7	10	12
Cooper et al (2006)[36]	1	19	2	23
Subtotal	1	26	12	35
Nonrandomized				
Dulhunty et al (2008)[38]	—†	68	—†	12
Ennis et al (2008)[39]	3	56	10	62
Park et al (2012)[40]	2	61	10	98
Subtotal	5	185	20	172
Total	6	211	32	207

Heterogeneity: I^2, 19.3% (CI, 0.0-83.2%); $P = .29$

3. In critically ill adult patients, intravenous albumin in conjunction with diuretics is not suggested for removal of extravascular fluid



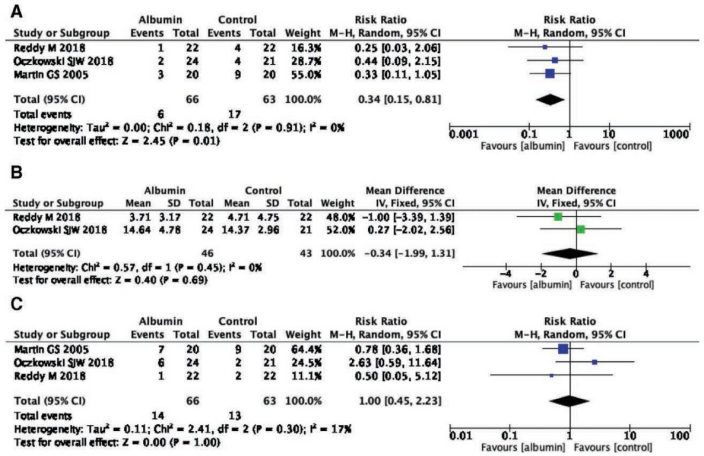
Efficacy of albumin with diuretics in mechanically ventilated patients with hypoalbuminemia

A systematic review and meta-analysis

Yuki Itagaki, MD[a,b,c,*], Naofumi Yoshida, MD, PhD[c,d], Masahiro Banno, MD, PhD[c,e,f], Ryo Momosaki, MD, MPH, PhD[c,g], Kohei Yamada, MD, MPH[c,h], Mineji Hayakawa, MD, PhD[b]

2022 SR/MA identified 3 RCTs (n=129)

- Trials of albumin + diuretics vs. placebo + diuretics
- Albumin reduced hypotensive episodes
- No effect on mortality, days of mechanical ventilation



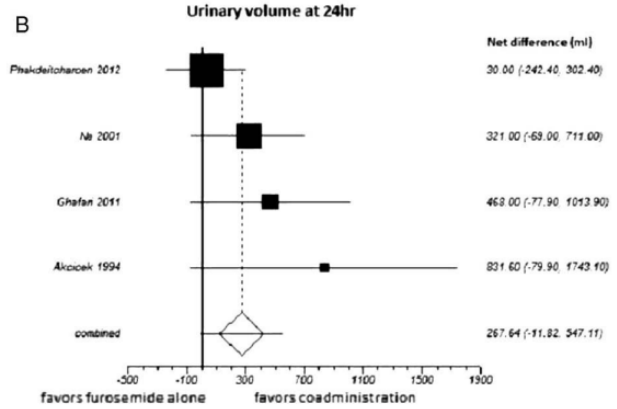
Renal/Metabolic

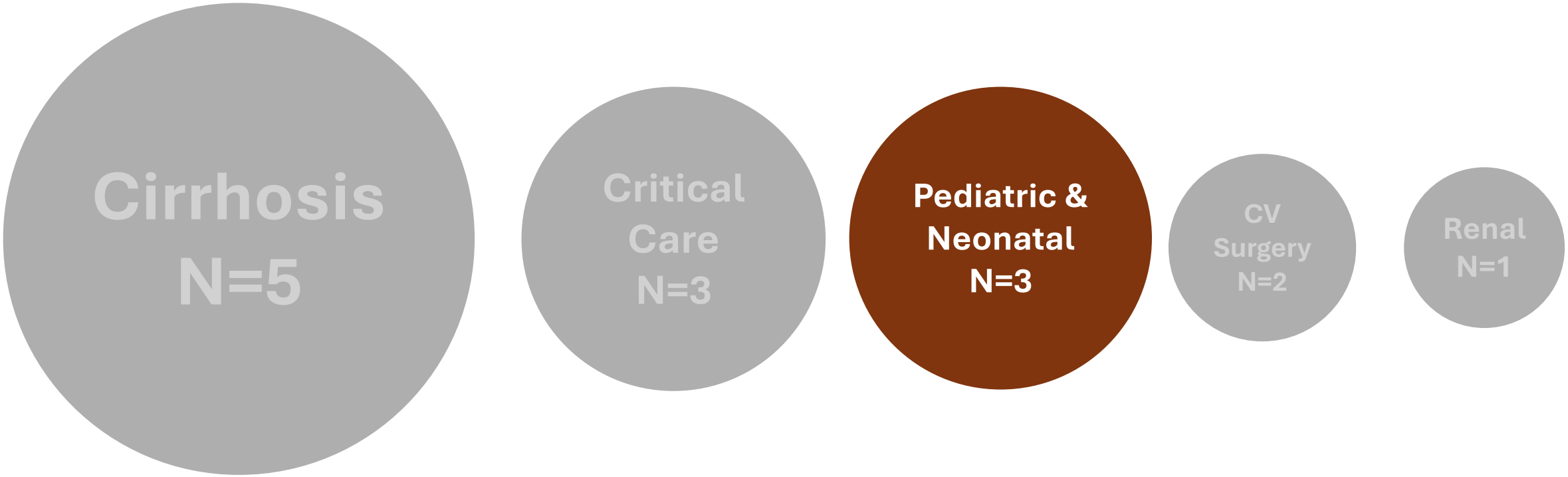
Co-administration of furosemide with albumin for overcoming diuretic resistance in patients with hypoalbuminemia: A meta-analysis ☆

Georgios D. Kitsios, MD PhD [a,b,*], Paolo Mascari, MD PharmD [a], Riad Ettunsi, MD MSc [a], Anthony W. Gray, MD [a]

Included 10 RCTs of albumin with furosemide, compared with furosemide alone (N = 343).

- **Urine output** was higher at 6h in the patients receiving albumin-furosemide, no difference was found in urine output at 24h.




Cirrhosis
N=5
Critical
Care
N=3
Pediatric &
Neonatal
N=3
CV
Surgery
N=2
Renal
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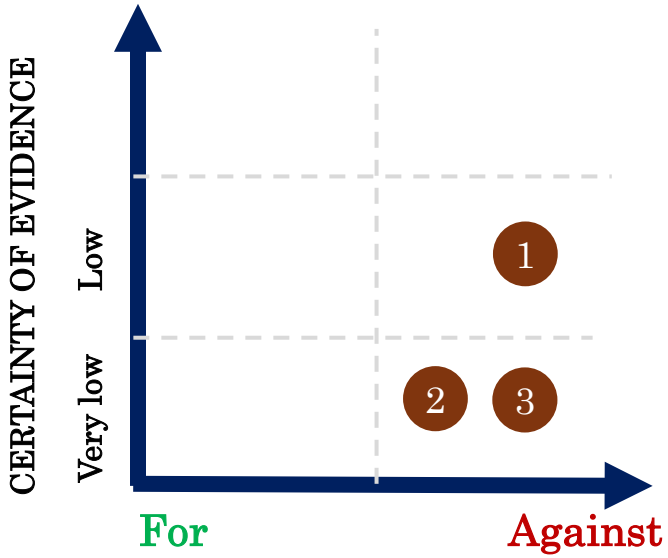
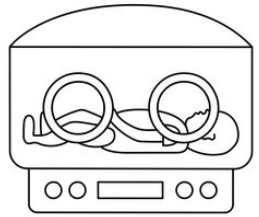
Pediatric & Neonatal N=3



1. In pediatric patients with infection and hypoperfusion, intravenous albumin is not recommended to reduce mortality (Strong Recommendation, Low Certainty of Evidence of Effect).

2. In preterm neonates (≤ 36 weeks) with low serum albumin levels and respiratory distress, intravenous albumin is not suggested to improve respiratory function



3. In preterm neonates (≤ 32 weeks or ≤ 1,500 g) with or without hypoperfusion, intravenous albumin is not suggested for volume replacement

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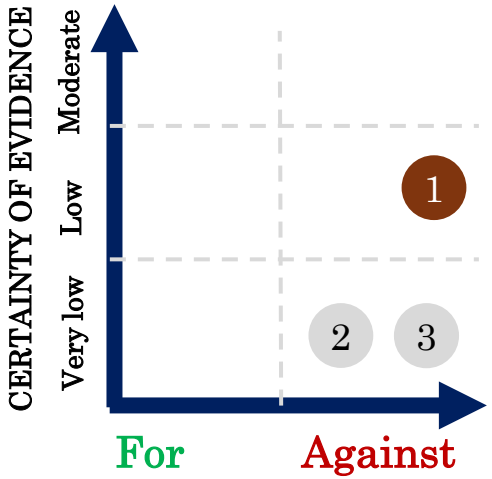


Mortality after Fluid Bolus in Children with Shock Due to Sepsis or Severe Infection: A Systematic Review and Meta-Analysis

Nathan Ford, Sally Hargreaves, Leslie Shanks

Included n = 13 studies

Better mortality outcomes in no bolus (albumin or saline) arms at 48 hours for children with general septic shock (RR 0.69; 95%CI 0.54–0.89), and children with malaria (RR 0.64; 95%CI 0.45–0.91) when compared to giving any bolus.

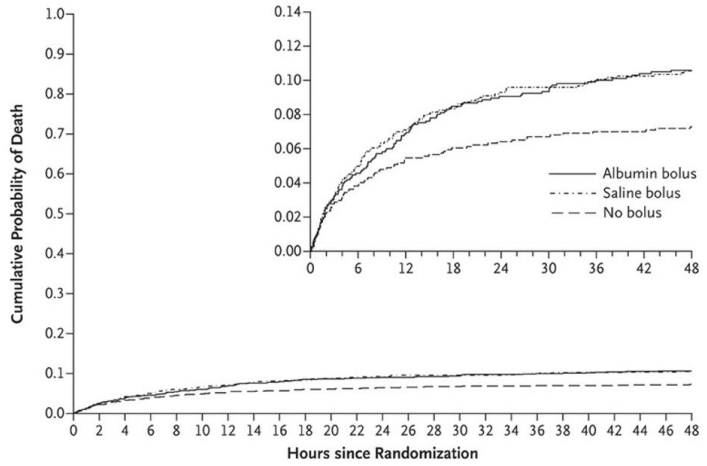
ORIGINAL ARTICLE

Mortality after Fluid Bolus in African Children with Severe Infection

Authors: Kathryn Maitland, M.B., B.S., Ph.D., Sarah Kiguli, M.B., Ch.B., M.Med., Robert O. Opoka, M.B., Ch.B., M.Med., Charles Engoru, M.B., Ch.B., M.Med., Peter Olupot-Olupot, M.B., Ch.B., Samuel O. Akech, M.B., Ch.B., Richard Nyeko, M.B., Ch.B., M.Med., +11, for the FEAST Trial Group* Author Info & Affiliations

Children (n= 3141) with febrile illnesses randomly assigned to receive boluses of 5% albumin or 0.9% saline (20-40 ml/kg) or nothing

The 4-week mortality was **12.2%, 12.0%,** and 8.7% in the three groups, respectively (P=0.004 for the comparison of bolus with control). Trial stopped prematurely



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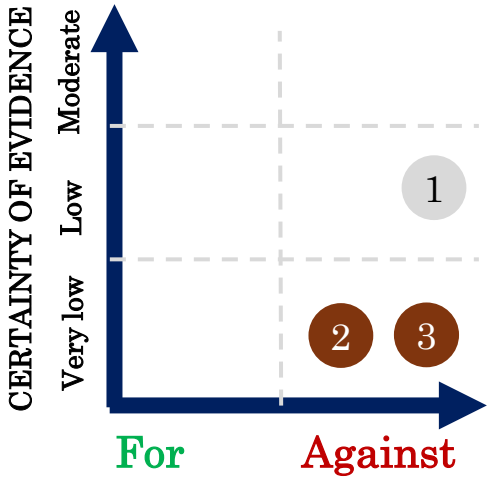


Albumin infusion for low serum albumin in preterm newborn infants (Review)

THE COCHRANE COLLABORATION®

Early volume expansion for prevention of morbidity and mortality in very preterm infants (Review)

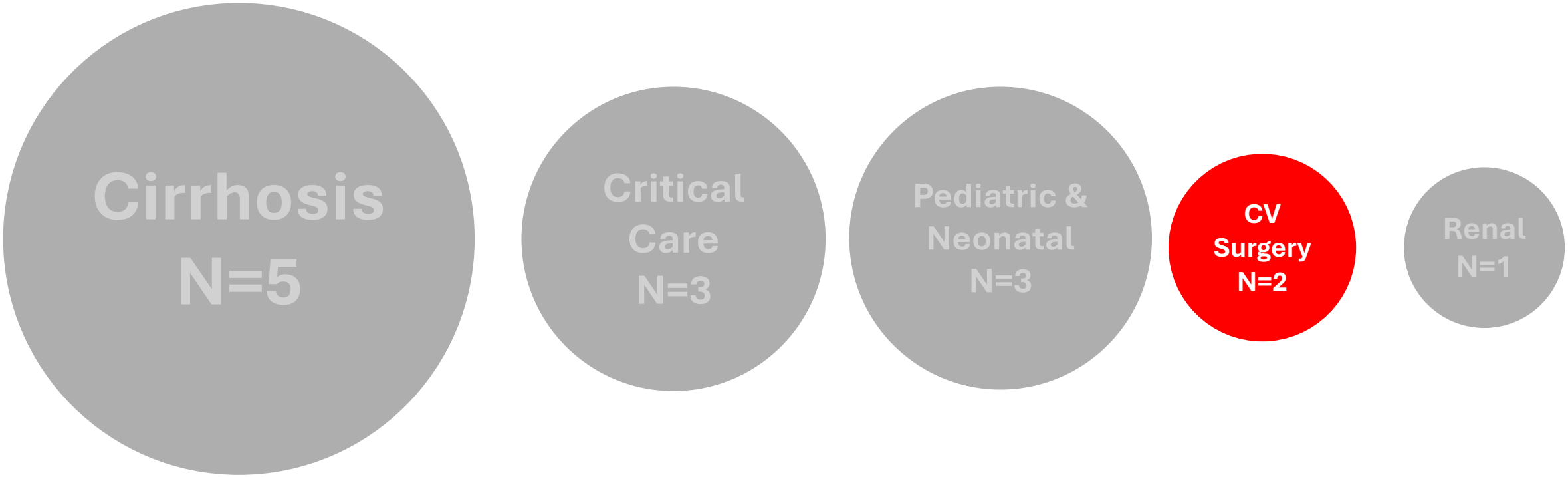
Study	Participants	Intervention	Comparator	Outcome (Effect Measure)	Results
Cochrane SR 1 (2004)	64 preterm neonates (≤ 36 weeks' gestation)	Albumin	No treatment	Mortality (RR not significant)	No difference in mortality or other outcomes observed.
Cochrane SR 2 (2004)	Variable preterm neonates (≤ 32 weeks or ≤ 1,500 g)	Various fluids (including albumin)	Normal saline, plasma, no treatment	Mortality (RR)	- **Albumin vs normal saline** (N = 102): RR 1.02 (95% CI 0.50-2.06), no difference. - **Albumin vs no treatment** (N = 25): RR 0.92 (95% CI 0.23-3.72), no difference. - **Albumin vs plasma** (N = 20): No difference in duration of ventilation (mortality not reported).

Journal of Perinatology

Albumin versus normal saline for dehydrated term infants with metabolic acidosis due to acute diarrhea

J J Han, H E Yim, J H Lee, Y K Kim, G Y Jang, B M Choi, K H Yoo & Y S Hong

Single RCT	33 term infants with dehydration, metabolic acidosis, diarrhea	5% albumin (10 mL/kg)	Normal saline (10 mL/kg)	Various outcomes	No differences in outcomes observed.


Cirrhosis
N=5
Critical
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Pediatric &
Neonatal
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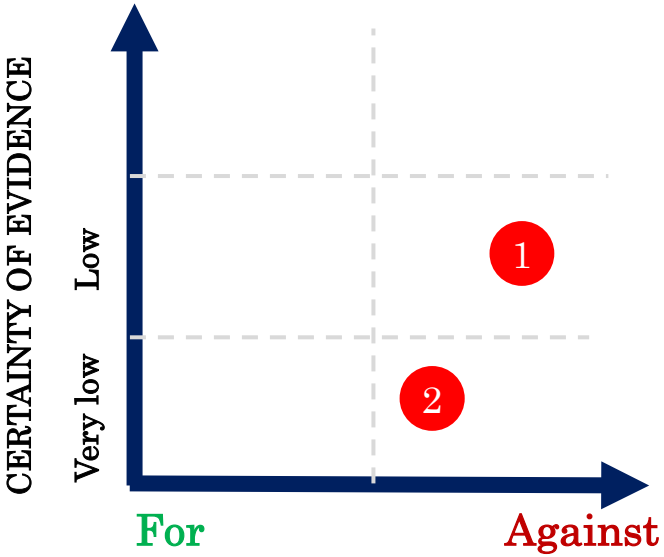
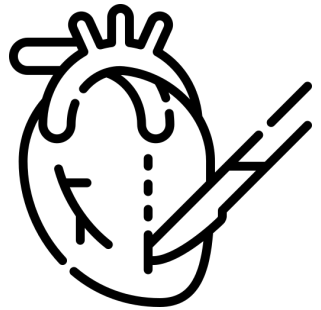
Surgery
N=2
Renal
N=1

CV Surgery
N=2



1. In adult patients undergoing cardiovascular surgery, intravenous albumin is not suggested for priming the cardiovascular bypass circuit or volume replacement

2. In pediatric patients undergoing cardiovascular surgery, intravenous albumin is not suggested for priming the cardiovascular bypass circuit or volume replacement



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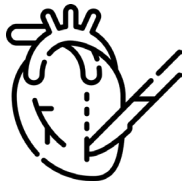

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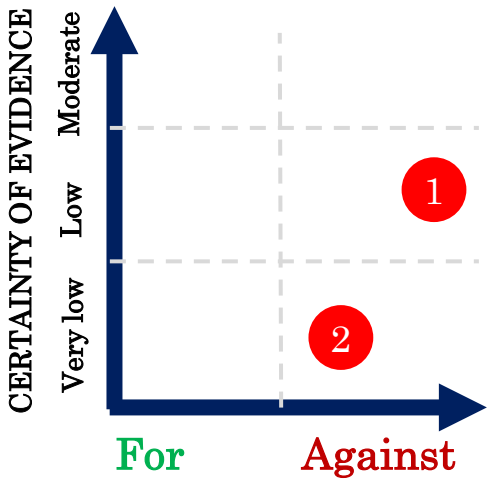


CARDIOVASCULAR

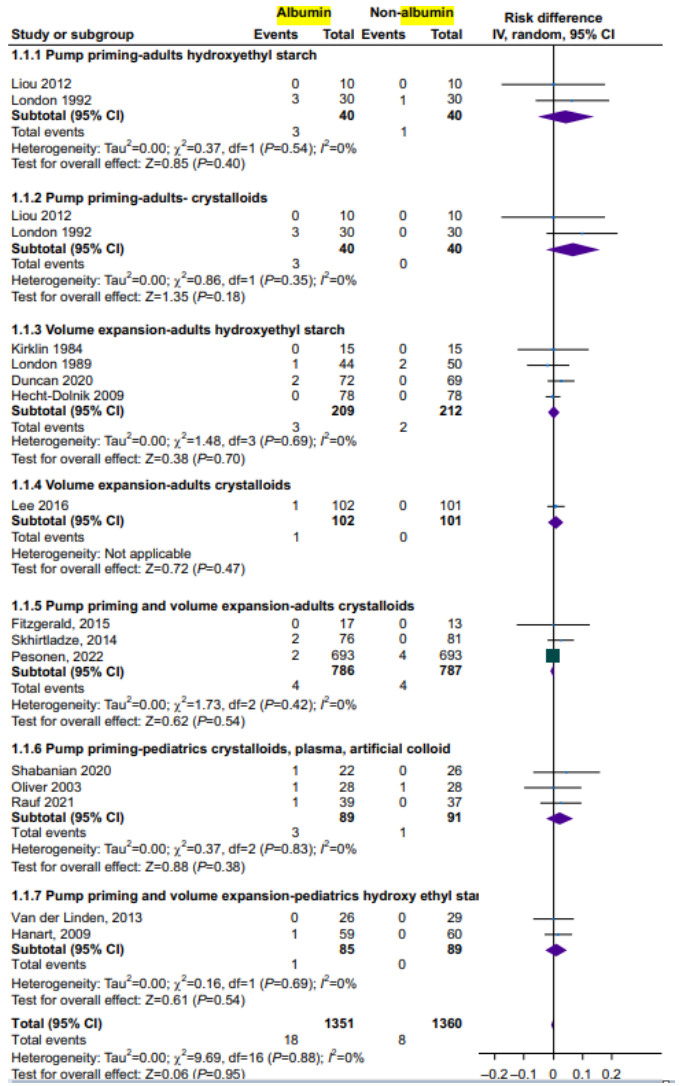
Intravenous albumin in cardiac and vascular surgery: a systematic review and meta-analysis

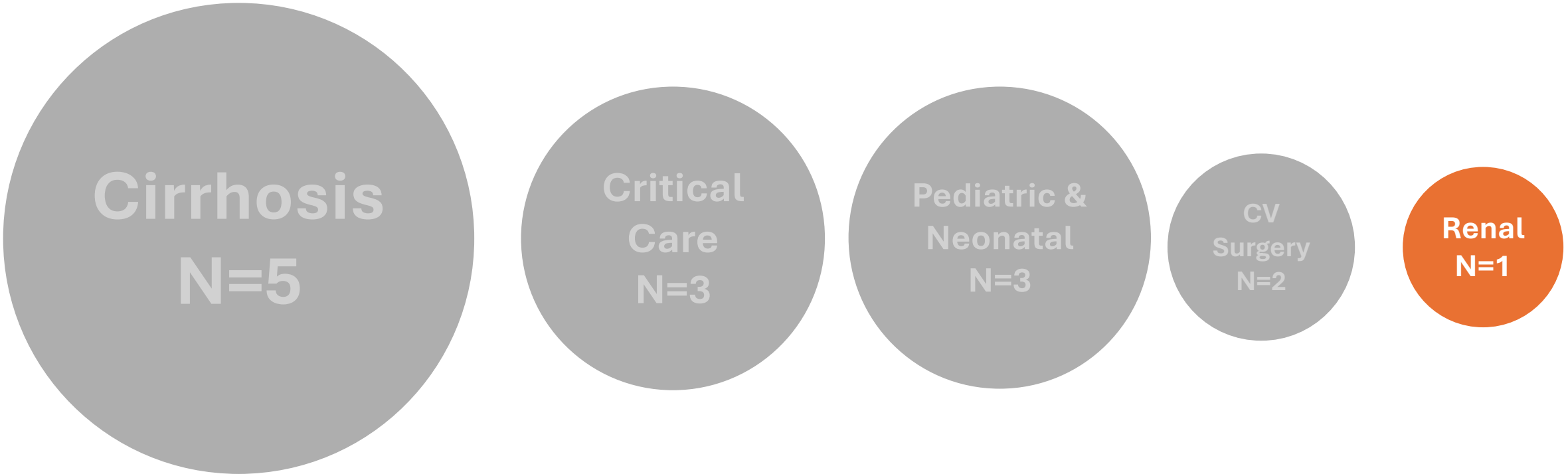
Nikolaos J. Skubas[1,*], Jeannie Callum[2], Aarti Bathla[3], Homa Keshavarz[8], Dean Fergusson[4], Bovey Wu[5], Simon Stanworth[6], Nadine Shehata[7] on behalf of the International Collaboration for Transfusion Medicine Guidelines

[1]Department of Cardiothoracic Anaesthesiology, Anaesthesiology Institute, Cleveland Clinic, and Cleveland Clinic, Lerner College of Medicine of Case Western Reserve University, Cleveland, OH, USA, [2]Department of Pathology and Molecular Medicine, Queen's University and Kingston Health Sciences Centre, Kingston, ON, Canada, [3]Canadian Blood Services, Toronto, Canada, [4]Ottawa Hospital Research Institute, Ottawa, ON, Canada, [5]Department of Internal Medicine, School of Medicine, Loma Linda University, Loma Linda, CA, USA, [6]NHS Blood and Transplant, Bristol, UK, [7]Departments of Medicine, Laboratory Medicine and Pathobiology, Institute of Health Policy Management and Evaluation, University of Toronto, Division of Hematology, Mount Sinai Hospital, Toronto, ON, Canada and [8]Canadian Blood Services, Ottawa, Canada

- 42 randomized controlled trials comparing intravenous albumin with synthetic colloids and crystalloids in cardiovascular surgery.
- Primary outcome: all-cause mortality.
- Secondary outcomes included renal failure, blood loss, duration of hospital or ICU stay, cardiac index, and blood component use.
- Subgroups of age, comparator fluid, and intended use (priming, volume replacement, or both).

- Results
  - No significant difference in mortality between albumin and comparator fluids.
  - No difference in rates of kidney failure, blood loss, hospital length of stay, cardiac index
  - Albumin resulted in smaller fluid balance and higher albumin concentrations compared to other fluids.




Cirrhosis
N=5
Critical
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CV
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Renal
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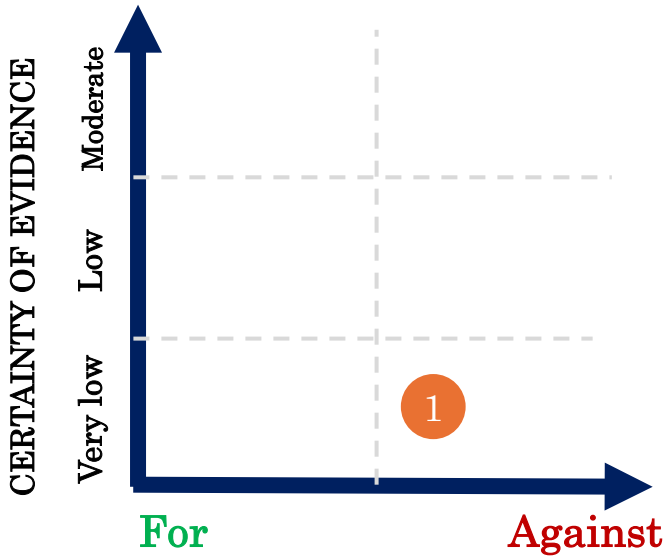
Renal
N=1



1. In patients undergoing kidney replacement therapy, intravenous albumin is not suggested for prevention or treatment of intradialytic hypotension or for improving ultrafiltration

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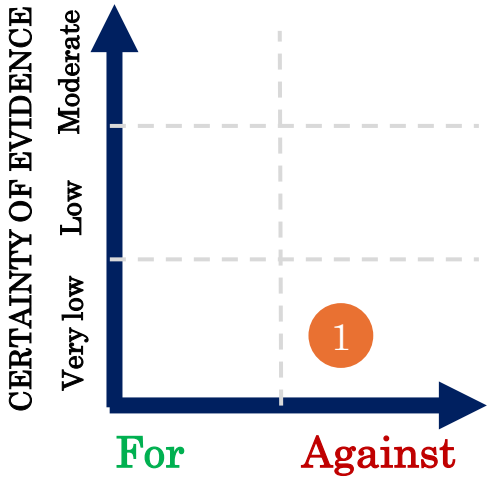
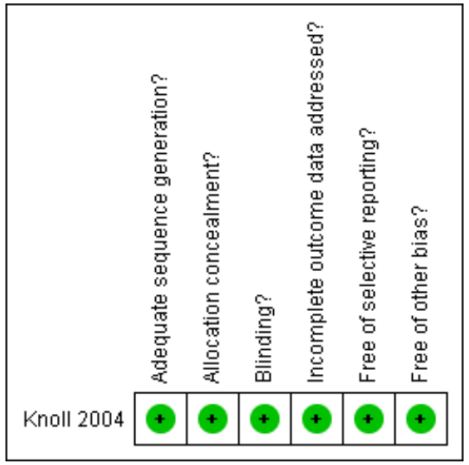


Human albumin for intradialytic hypotension in haemodialysis patients (Review)

Fortin PM, Bassett K, Musini VM

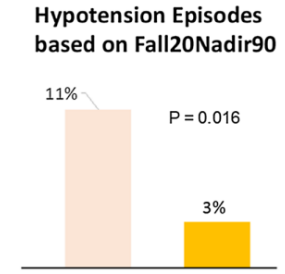
- 1 single (N = 45) randomized crossover trial of 5% albumin compared with normal saline
- No difference in the primary outcome (percentage target ultrafiltration achieved) or other clinical outcomes.
- There were no significant differences in the nursing time required to treat IDH and the time to restore BP

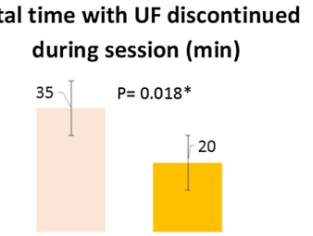


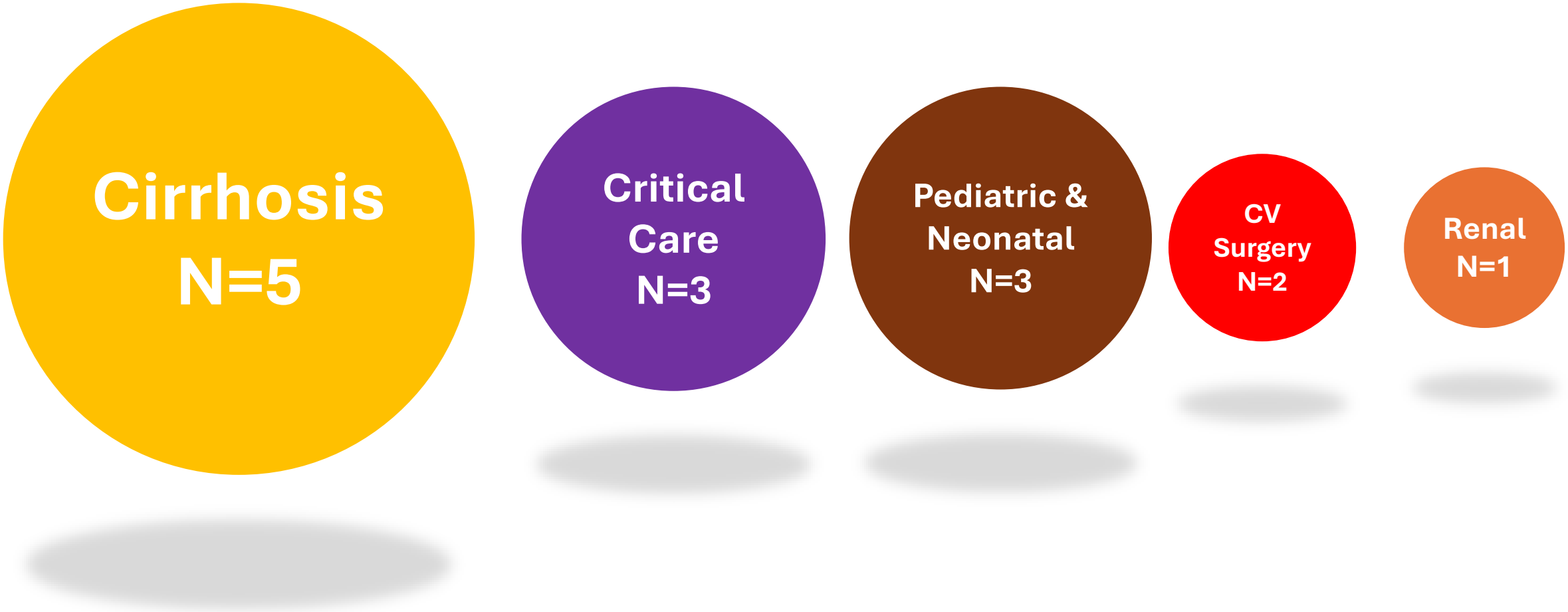
A randomized trial of albumin infusion to prevent intradialytic hypotension in hospitalized hypoalbuminemic patients

Etienne Macedo[1*], Bethany Karl[1], Euyhyun Lee[2] and Ravindra L. Mehta[1]

- 2021 RCT comparing patients receiving 0.9% saline or 25% albumin at the initiation of dialysis
- 65 hospitalized patients requiring hemodialysis with serum albumin levels of < 30 g/L
- Improvement in hypotension, lowest intradialytic systolic BP, and ultrafiltration rate



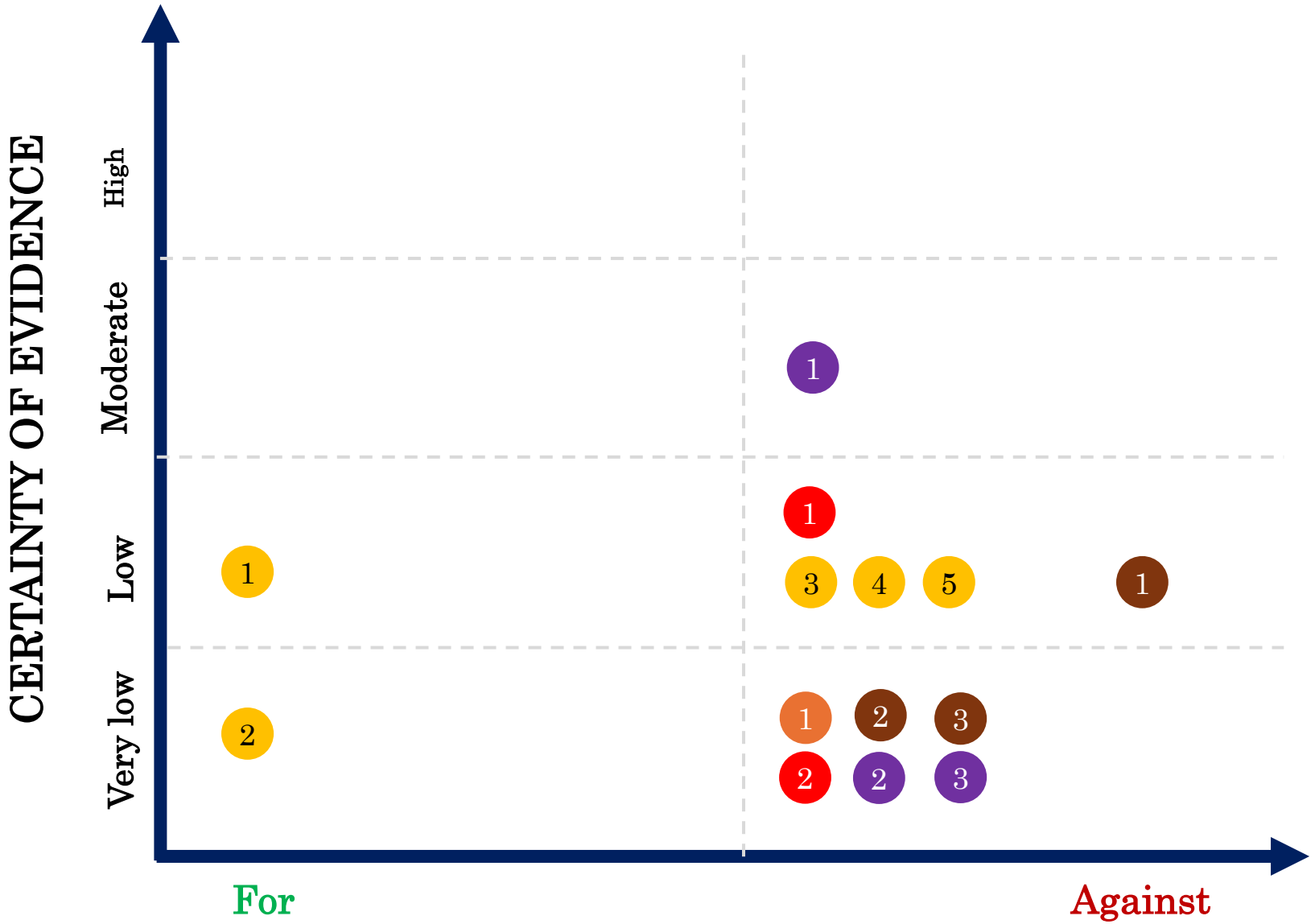



Cirrhosis
N=5
Critical
Care
N=3
Pediatric &
Neonatal
N=3
CV
Surgery
N=2
Renal
N=1

Takeaway 1

Group	Population	Indication	Stance	Strength	Evidence
Cirrhosis	Patients with cirrhosis and spontaneous bacterial peritonitis **Recommended dose**: Alb 20-25%, Day 1: 1.5 g/kg, Day 3: 1.0 g/kg*	Reduce mortality	For	Conditional	Low
Cirrhosis	Patients with cirrhosis and ascites undergoing large volume paracentesis (>5 liters) **Recommended dose**: Albumin 20-25%, 6-8 g/L of fluid removed	Prevent paracentesis-induced circulatory dysfunction	For	Conditional	Very low
Cirrhosis	Outpatients with cirrhosis and uncomplicated ascites despite diuretic therapy	Reduce complications associated with cirrhosis	Against	Conditional	Low
Cirrhosis	Hospitalized patients with decompensated cirrhosis with hypoalbuminemia (<30 g/L)	Reduce infection, kidney dysfunction or death	Against	Conditional	Low
Cirrhosis	Patients with cirrhosis and extraperitoneal infections	Reduce mortality or kidney failure	Against	Conditional	Low
CV Surg	Adult patients undergoing cardiovascular surgery	Priming the cardiovascular bypass circuit or volume replacement	Against	Conditional	Moderate
CV Surg	Pediatric patients undergoing cardiovascular surgery	Priming the cardiovascular bypass circuit or volume replacement	Against	Conditional	Very low
ICU	Critically ill adults (excluding thermal injuries and ARDS)	First-line volume replacement or increase serum albumin levels	Against	Conditional	Moderate
ICU	Critically ill adults	Removal of extravascular fluid with diuretics	Against	Conditional	Very low
ICU	Critically ill adults with thermal injuries or ARDS	Volume replacement or increase serum albumin level	Against	Conditional	Very low
Neonate	Preterm neonates (<36 weeks) with low serum albumin levels and respiratory distress	Improve respiratory function	Against	Conditional	Very low
Neonate	Preterm neonates (<32 weeks or <1,500 g) with or without hypoperfusion	Volume replacement	Against	Conditional	Very low
Peds	Pediatric patients with infection and hypoperfusion	Reduce mortality	Against	Strong	Low
Renal	Patients undergoing renal replacement therapy	Prevention or treatment of intradialytic hypotension or improving ultrafiltration	Against	Conditional	Very low

Takeaway 2


CERTAINTY OF EVIDENCE
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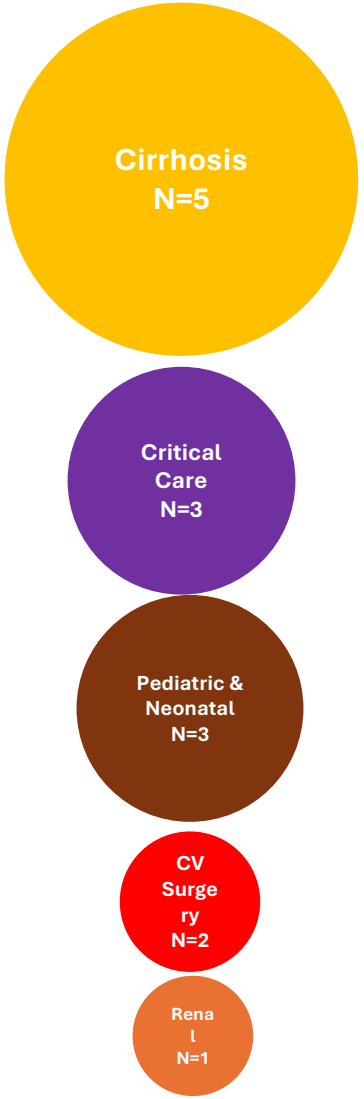
Cirrhosis N=5
Critical Care N=3
Pediatric & Neonatal N=3
CV Surgery N=2
Renal N=1

Takeaway 3

ICTMG
International Collaboration for Transfusion Medicine Guidelines
The right transfusion, always, everywhere.

Ongoing implementation research project

Objective:

- Using a behavioural science approach to support the implementation of recommendations in ICTMG's clinical guideline on albumin use.

Next steps:

- Survey healthcare providers in Canada about barriers and enablers to using specific recommendations in the new ICTMG albumin clinical guideline.

Team:

Justin Presseau
Jacob Crawshaw
Fabiana Lorencatto
Jeannie Callum
Simon Stanworth
Sheharyar Raza

Sophie Chargé
Abby Wolfe

Interested in supporting and participating in such projects?

Reach out info@ictmg.org

Thank you

Kimberly Figures
Abby Wolfe
Casey Kapitany

Guideline Authors
Jeannie Callum
Simon Stanworth

Questions