# Akute Pankreatitis
# Neues aus der Intensivmedizin

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# Erinnerungen

- offene Bäuche
- Lavagen, Dauerspülungen
- Leaks
- Revisionen
- Blutungen
- hoher intensivmedizinischer Aufwand
- hohe Mortalität
- Defektheilungen

ihr müsst den Bauch aufmachen!!!!

Herd gehört ausgeräumt!!!!

wir können nicht mehr beatmen!!!!

abdominelles Compartment Syndrom!!

# Pankreatitis auf ICU - heute

- initial zur Schmerztherapie
- Stabilisierung in der Schockphase
  - wenige Tage
- Pankreatitis selten auf der Intensivstation
  - bei Komplikationen
- Nierenersatztherapie
  - meist nicht erforderlich

# Schmerztherapie = thorakaler Epidural-Kath.

- Vermeidung von Opioiden
- schmerzfreie Atmung möglich
- Vigilanz erhalten

Limitierung:
- Gerinnung
  - Thrombozyten
  - PTZ
  - Medikamente
- Liegedauer?
- Ziehen

# Paradigmenwechsel Intensivmedizin

- alt

- neu

Van Raemdonck D, Dobbels F, Hermans G:
**Extracorporeal membrane oxygenation as a bridge to lung transplantation is about more than just surviving**.
*J Thorac Cardiovasc Surg* 2018.

# Paradigmenwechsel Infusionen

**alt**

- hohe Plusbilanzen
- synthetische Kolloide
- hoher Chloridgehalt


**neu**

- Volumen zurückhaltend
- De-Resucitation (Minusbilanzen)
- keine synthetischen Kolloide
- Albumin nach GE / Albumin
- balancierte Vollelektrolytlösung

Marik *Annals of Intensive Care* 2014, **4**:21
http://www.annalsofintensivecare.com/content/4/1/21

Annals of Intensive Care
a SpringerOpen Journal

REVIEW Open Access

# Iatrogenic salt water drowning and the hazards of a high central venous pressure

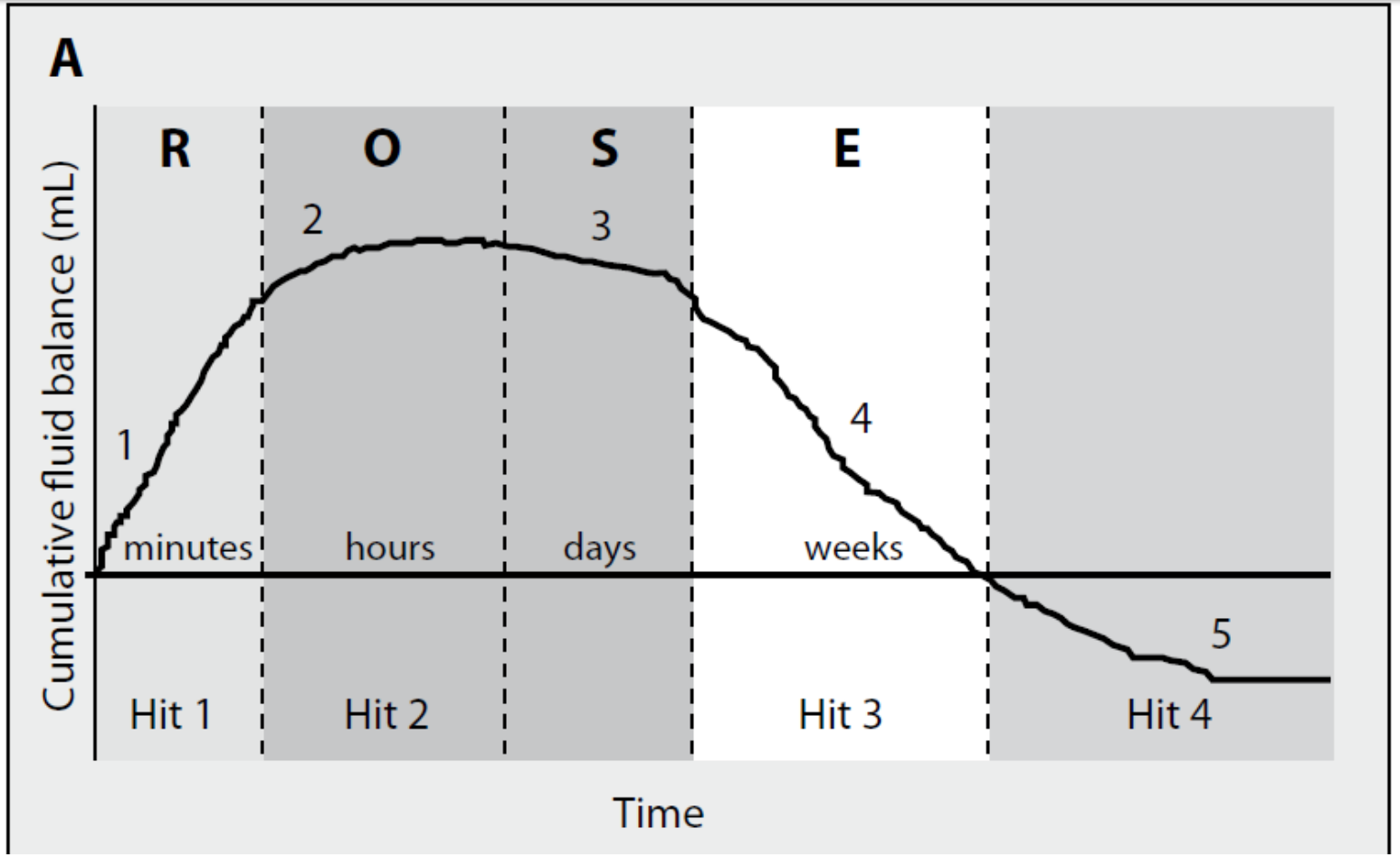
Paul E Marik

**Conclusions**

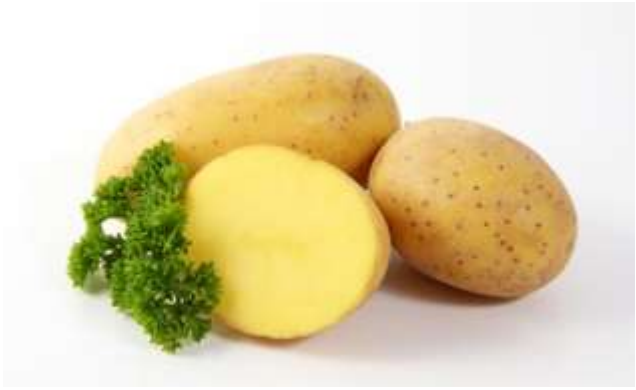
A liberal fluid resuscitation strategy, a CVP > than 8 mmHg and the use of 0.9% NaCl as the predominant resuscitation fluid are all associated with an increased risk of renal failure, respiratory failure, gastrointestinal dysfunction and death across a broad spectrum of clinical disorders. These three treatment strategies probably act synergistically to harm patients, forming the 'Deadly Trio'.

The five fluid phases of shock

# **R**esucitation **O**ptimisation **S**tabilisation **E**vacuation




Malbrain ML, Marik PE, Witters I, Cordemans C, Kirkpatrick AW, Roberts DJ, Van Regenmortel N:
**Fluid overload, de-resuscitation, and outcomes in critically ill or injured patients: a systematic review with suggestions for clinical practice**. *Anaesthesiology intensive therapy* 2014, **46**(5):361-380.




RÖMERQUELLE


BALANCE
BALANCE
BALANCE
BALANCE
BALANCE
BALANCE

Richard Beale, London
Johan Groeneveld, Amsterdam
Christiane Hartog, Jena
Roman Jaeschke, Hamilton
Anders Perner, Copenhagen (COI)
Konrad Reinhart, Jena (COI)
Frederique Schortgen, Paris
Charles L. Sprung, Jerusalem


# Recommendations ESICM Task Force on Colloid Volume Therapy in Critically Ill Patients

**K. Reinhart**
Dept. of Anaesthesiology and Intensive Care Medicine
Friedrich-Schiller-University Jena, Germany

## Summary and Conclusions

We recommend not to use HES with molecular weight ≥200 kDa and/or degree of substitution >0.4 in patients with severe sepsis or risk of acute kidney injury and suggest not to use 6% HES 130/0.4 or gelatin in these populations outside the context of clinical trials. We recommend not to use colloids in patients with head injury and not to administer gelatins and HES in organ donors. We suggest not to use hyperoncotic solutions for fluid resuscitation. We conclude and recommend that any new colloid should be introduced into clinical practice only after its patient-important safety parameters are established.

Reinhart K, Perner A, Sprung CL, Jaeschke R, Schortgen F, Johan Groeneveld AB, Beale R, Hartog CS: **Consensus statement of the ESICM task force on colloid volume therapy in critically ill patients**. *Intensive Care Med* 2012, **38**(3):368-383.

# The Effects of Colloid Solutions on Renal Proximal Tubular Cells in Vitro

*Neuhaus, Anesth Analg Nov 2011*

HES Voluven

GEL Gelafundin

ALB 5%

Stero-fundin iso

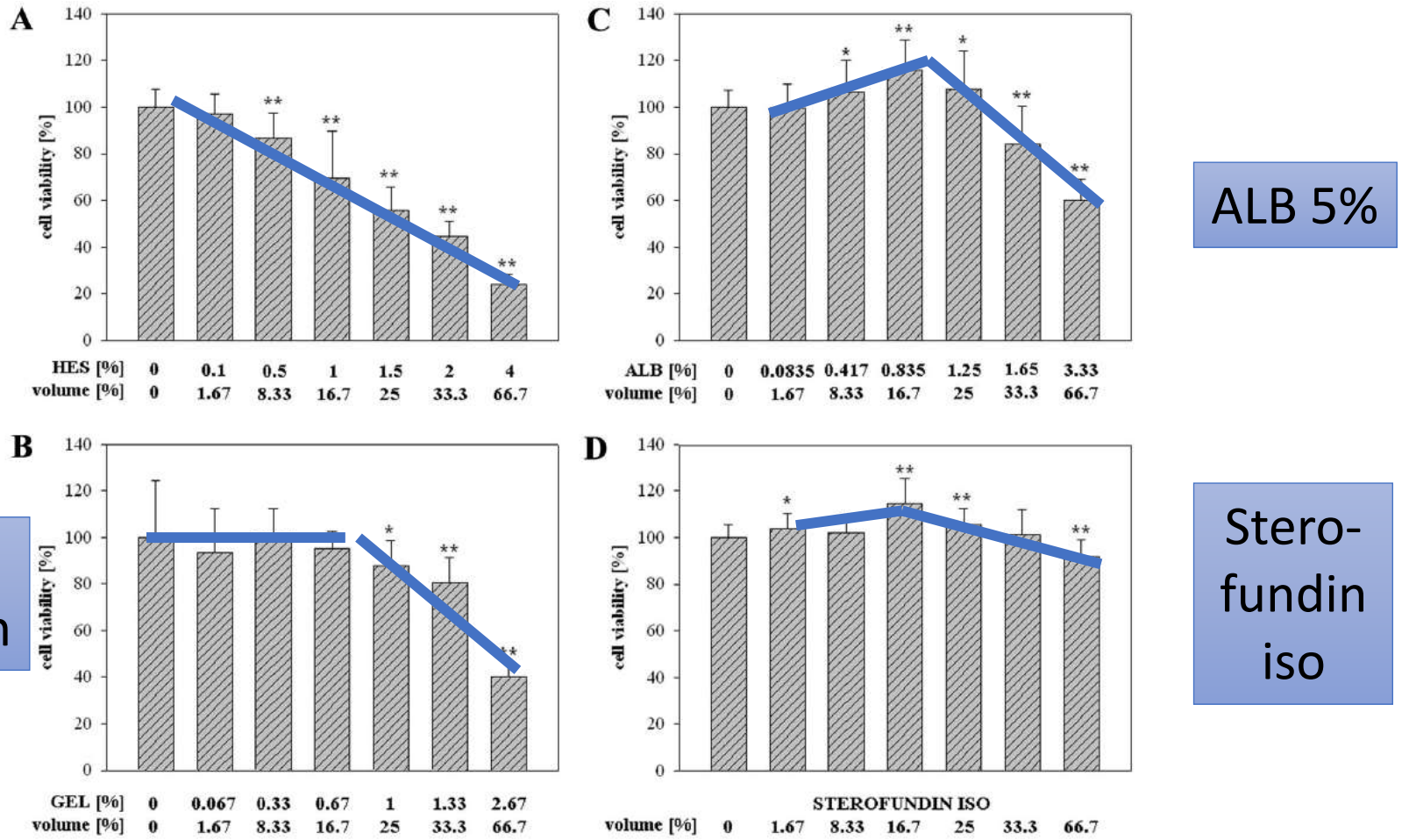



**Figure 1.** Relative reduction of cell viability of HK-2 cells by increasing hydroxyethyl starch (HES)130/0.4 (A), Gelafundin® (GEL) (B), human albumin (alb) (C), or Sterofundin®ISO (D) concentrations after 21 hours application time normalized to growth medium (27.5%) mixed with 0.9% NaCl (72.5%) as 0% control. HES [%], GEL [%], and ALB [%] means the percentage of HES130/0.4, Gelafundin®, and human albumin present in applied solutions, which consisted of the same amounts of growth medium and varying amounts of 6% HES130/0.4, Gelafundin®, human albumin, and 0.9% NaCl. Volume [%] means the percentage of colloid or crystalloid solution in the applied dilutions and is mentioned to enable comparison of cumulative volumes used. Data are presented as mean ± SD ($n$ = 32 to 48), statistical significance compared with the control (= volume 0%) is marked by the following: *$P < 0.05$, 2-sided $t$ test with same variances. **$P < 0.001$, 2-sided $t$ test with same variances.

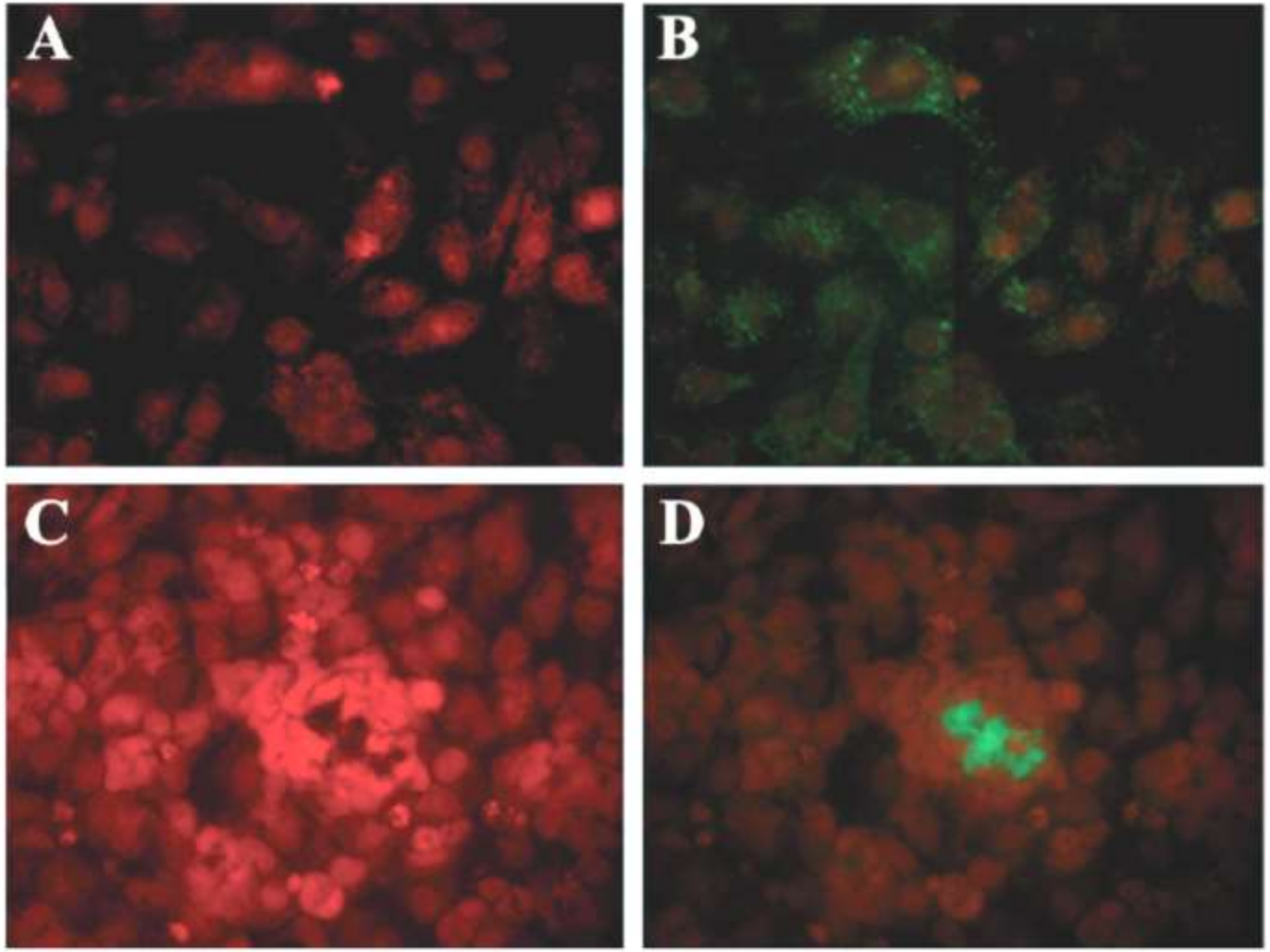
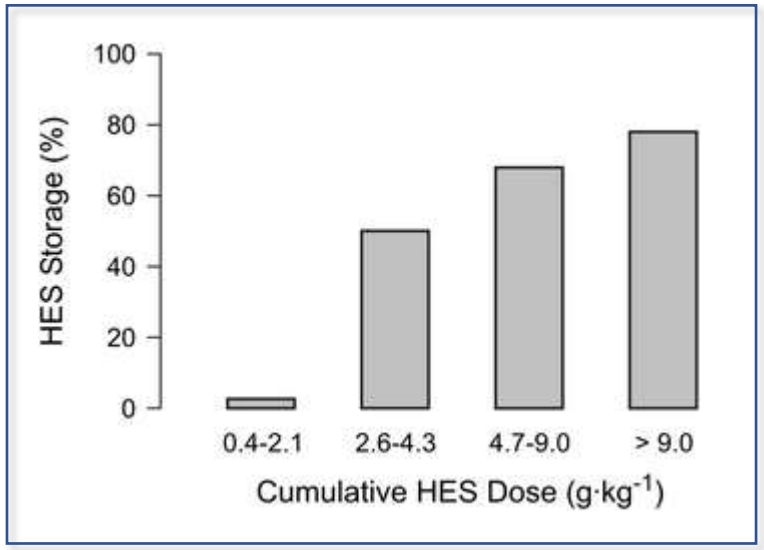
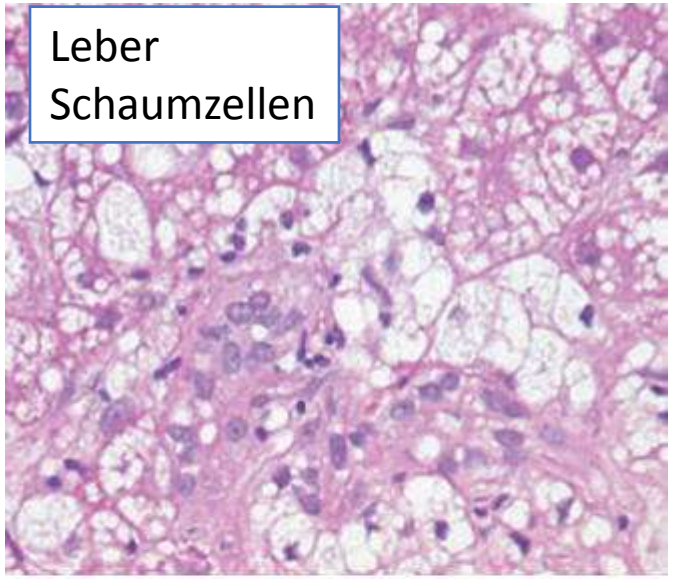


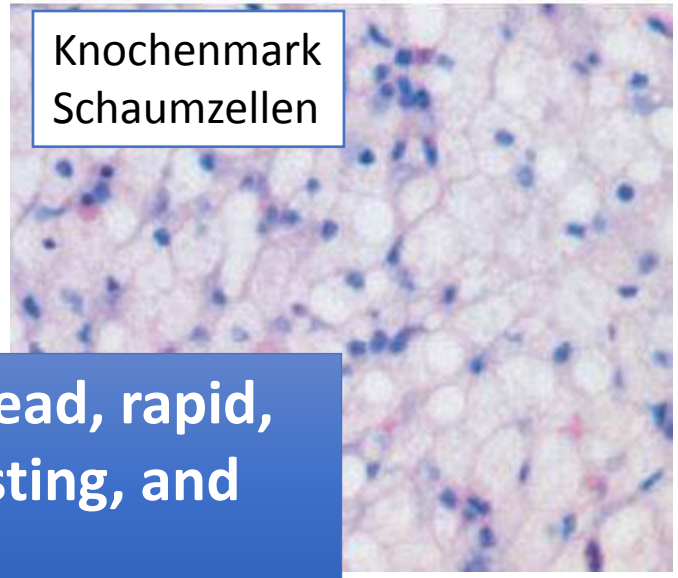

**Figure 2.** Fluorescence images of APTS-hydroxyethyl starch (HES) uptake in HK-2 cells. Pictures were generated of HK-2 cells after 21 hours incubation with growth medium containing 4.35% APTS-HES130/0.4 and revealed vesicular structures (B) as well as agglomerates (D) of APTS-HES. Corresponding red cell nuclei counterstaining was accomplished with propidium iodide (A, C).

*Neuhaus, Anesth Analg Nov 2011*




Percentages of patients with moderate to heavy vacuolization of dermal histiocytes as a function of cumulative HES dose




Voluven / Volulyte HES 60g/l
max Tagesdosis 30ml/kg
70kg: 2100ml = 126g ~ 1,8 g/kg
es gilt aber die kumulative Gesamtdosis !!!

**Tissue storage of HES is widespread, rapid, cumulative, frequently long-lasting, and potentially harmful**

Wiedermann CJ, Joannidis M: **Accumulation of hydroxyethyl starch in human and animal tissues: a systematic review**. *Intensive Care Med* 2014, **40**(2):160-170.

# HES wann nicht:

2011

- Septischer Schock
- Niereninsuffizienz
- Schädel Hirn Trauma
- Trauma
- Blutungsgefahr
- Intrazerebrale Blutung
- Spender

# Volulyte – Austria Codex

***Kinder und Jugendliche:***
Es liegen nur begrenzt Daten zur Anwendung von HES bei Kindern vor. Daher wird eine Anwendung von HES-Produkten in dieser Patientengruppe nicht empfohlen.
Anwendungshinweise, siehe Abschnitt 6.6.

**4.3 Gegenanzeigen**

- Überempfindlichkeit gegen die Wirkstoffe oder einen der in Abschnitt 6.1 genannten sonstigen Bestandteile
- Sepsis
- Verbrennungen
- Nierenfunktionsstörung oder Nierenersatztherapie
- Intrakranielle oder zerebrale Blutung
- Kritisch kranke Patienten (in der Regel Patienten, die auf die Intensivstation aufgenommen werden müssen)
- Hyperhydratation
- Lungenödem
- Dehydratation
- Schwere Hyperkaliämie
- Schwere Hypernatriämie oder schwere Hyperchlorämie
- Schwere Leberfunktionsstörungen
- Dekompensierte Herzinsuffizienz
- Schwere Gerinnungsstörung
- Organtransplantierte Patienten

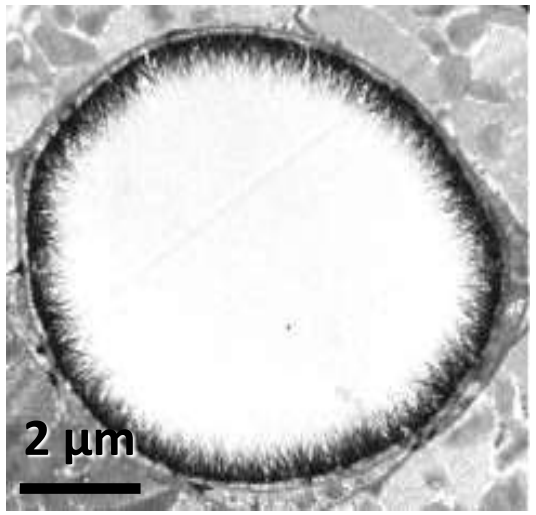
# Volumseffekt Kolloide : Kristalloide 1:3 ???

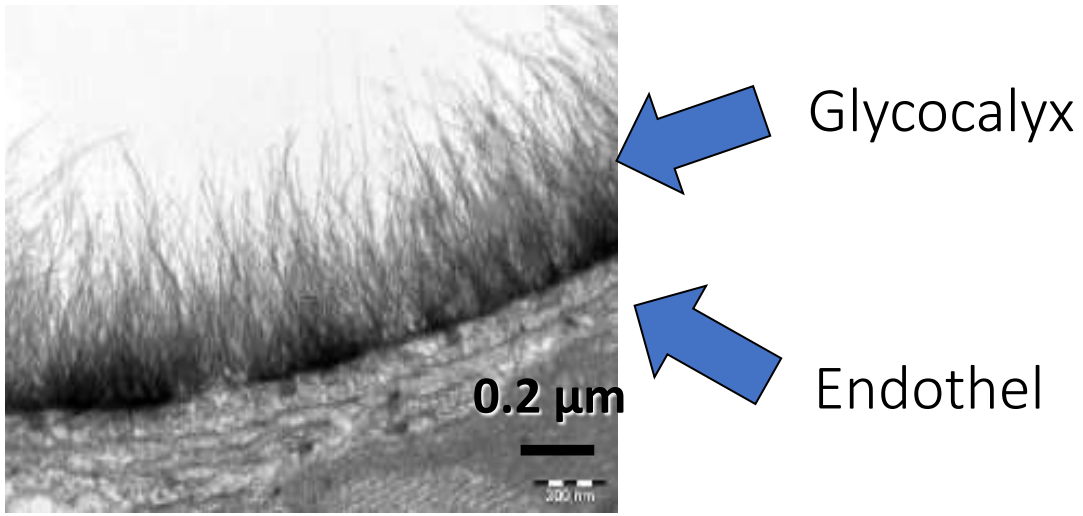
| Studie | | Koll : Krist |
|---|---|---|
| Yates | Bauch Chirurgie | 1:1,6 |
| Crystmas | Sepsis | 1:1,2 |
| James | Trauma | 1:1,5 |
| Chest | ICU allgemein | 1:1,2 |
| Cristall | ICU allgemein | 1:1,5 |
| 6S | Sepsis | 1:1,1 |

It appears that the concept of the 1:3 replacement ratio in hypovolaemic patients is obsolete.

Yates DR et al: *British journal of anaesthesia* 2014

# Glycocalyx




van den Berg, B.M., H. Vink, and J.A.E. Spaan, *The Endothelial Glycocalyx Protects Against Myocardial Edema.* Circulation Research, 2003. **92**(6): p. 592-594.

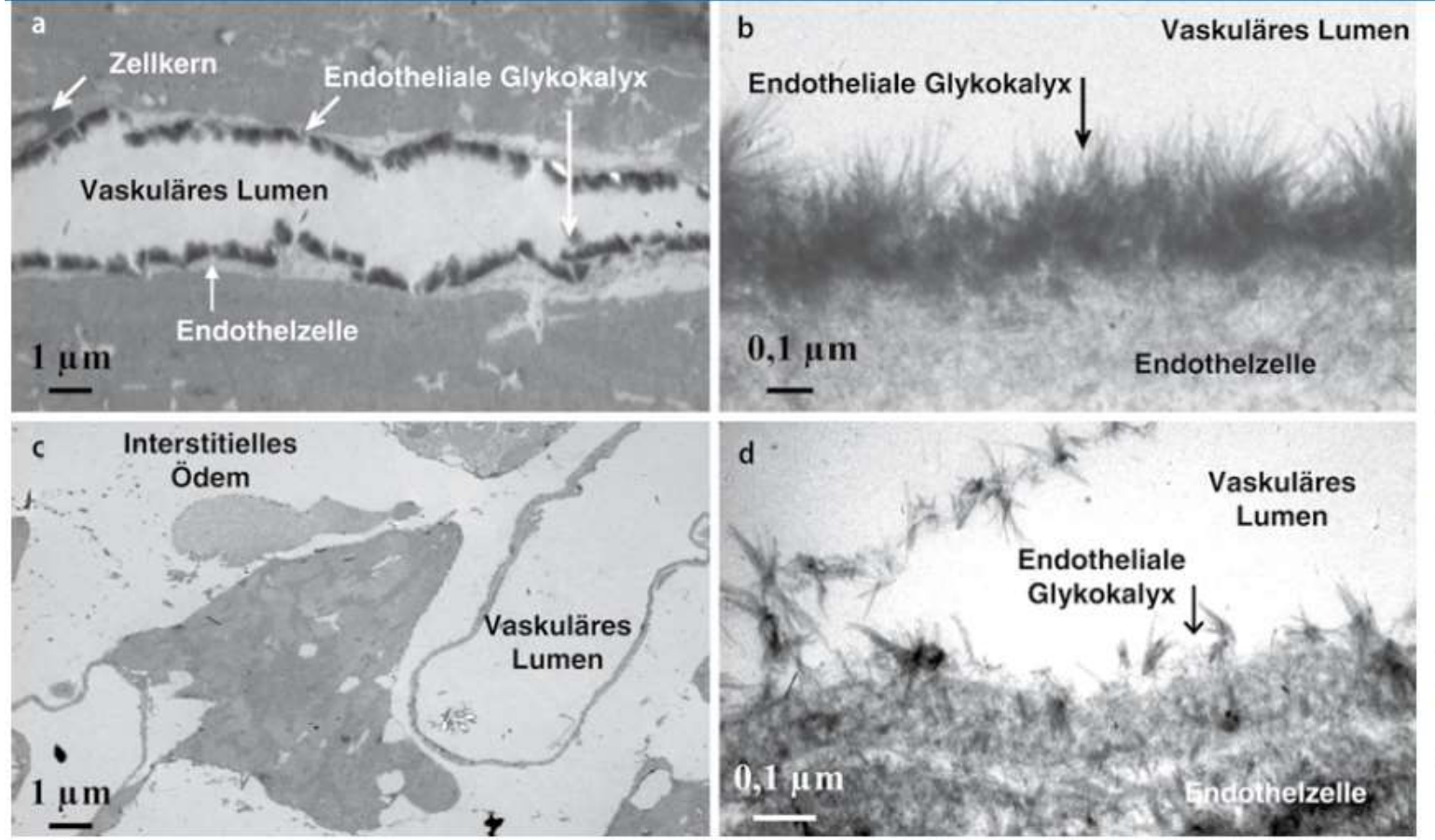
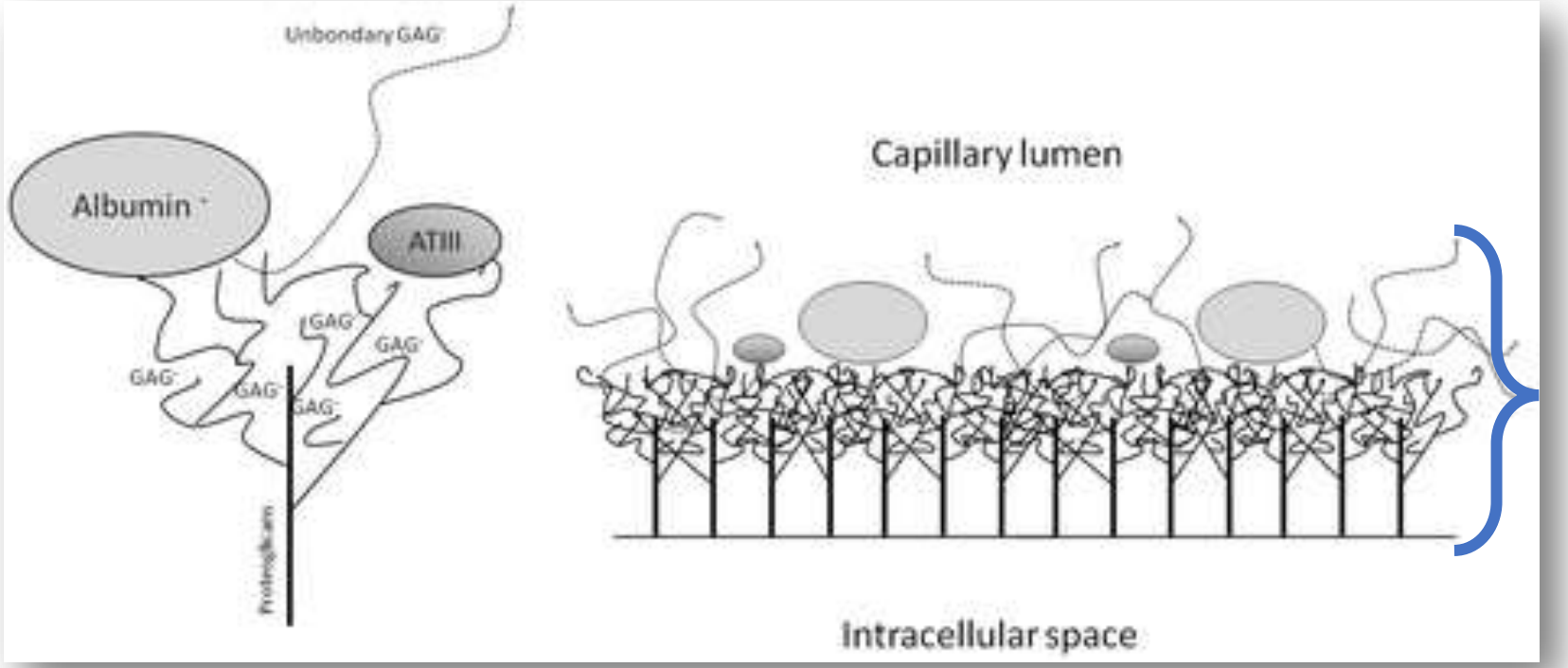



**Abb. 1** ◀ Elekronenmikroskopische Aufnahmen der endothelialen Glykokalyx im isoliert perfundierten Meerschweinchenherzen. **a**, **b** Ausschnitt eines Koronargefäßes nach spezieller Anfärbung auf Lanthanbasis. Auf der luminalen Seite des Gefäßes ist eine intakte endotheliale Glykokalyx zu sehen. **c**, **d** Ausschnitt eines Koronargefäßes nach 20-minütiger Ischämie/Reperfusion. Es sind rudimentäre Glykokalyxreste und deutliche interstitielle Ödeme zu sehen. **a**, **c** sind Übersichts-, **b**, **d** sind Nahaufnahmen. ([10])

Chappell, D., et al., *[Expedition glycocalyx. A newly discovered "Great Barrier Reef"].* Anaesthesist, 2008. **57**(10): p. 959-69.

Glycocalyx – ***Shedding*** = Das Haaren, Die Ablösung




ESL

Chelazzi, C., et al., *Glycocalyx and sepsis-induced alterations in vascular permeability.* Critical Care, 2015. **19**(1): p. 26.

Membrangebundene Proteoglykane
Core Proteine (Syndekan,…)
Fadenförmige Glukosaminoglykane

**ESL Endothelial Surface Layer**
Gesamtvolumen ca 800 ml !!

<u>In dieser Schicht:</u>
Endothelrezeptoren geschützt
Albumin und andere Plasmaproteine gebunden
Gerinnungsaktive Rezeptoren und Moleküle

# Glycocalyx

## Aufgaben

- Regulierung des Gefäßtonus
- Barriere und Filter in der endothelialen Permeabilität
- Adhäsion und Migration von Leukozyten
- Verhinderung intravaskulärer Thrombosen
- Regulierung Blutfluss, O2 Versorgung
- Aufrechterhaltung des onkotischen Gradienten

## Schädigung durch

- ANP
- Adrenalin
- Entzündungsmediatoren Sepsis
- Ischämie, Reperfusion
- Hyperglykämie

## Reparatur:

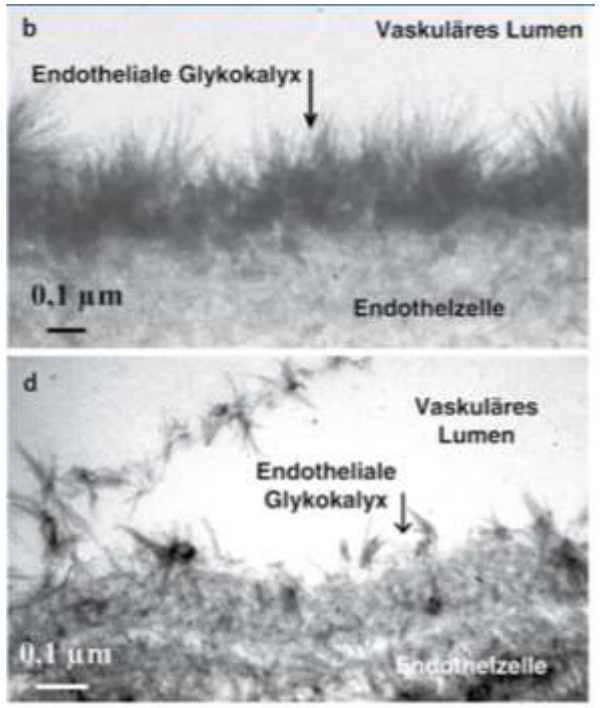
- Lowdose Hydrocortison ?
- BZ Kontrolle ?
- AT III ???
- Protein C ???
- Polymyxin B hemoperfusion?
- Hyaluronidase???

## Zeichen der Schädigung:

- zirkulierende Bestandteile
  - Syndecan
  - Endocan
  - Angiopoetin 2
  - Heparansulfat
- Mikroalbuminurie
  - MACR (microalbuminuria-urinary creatinine ratio)

# Glycocalyx kaputt - was tun?

- Infusionstherapie:
  - balancierte Vollelektrolytlösung
  - keine Kolloide
  - EK bei Hb < 7 mg/dl
  - Stopp bei (besser vor) Entstehung ausgeprägter Ödemen
    - pralle Finger, pralle harte Extremitäten
    - erhöhter IAP
  - nach Stabilisierung:
    - Albumin 20% bei Plasma- Albumin < 2mg/dl oder Gesamteiweiß < 4 mg/dl
- Hydrocortison
  - 50 -100mg als Kurzinfusion über 15 -30 Minuten
  - 300mg /24h BP, Reduzierung sobald stabilisiert
- Noradrenalin
  - bis 0,5 yg/kg/min ohne Bedenken, früh starten
  - wenn keine Wirksamkeit oder > 0,5 yg/kg/min -> Vasopressin
- Vasopressin: Arginin Vasopressin 10-20-40 IE Bolus, BP 0,03 IE/min

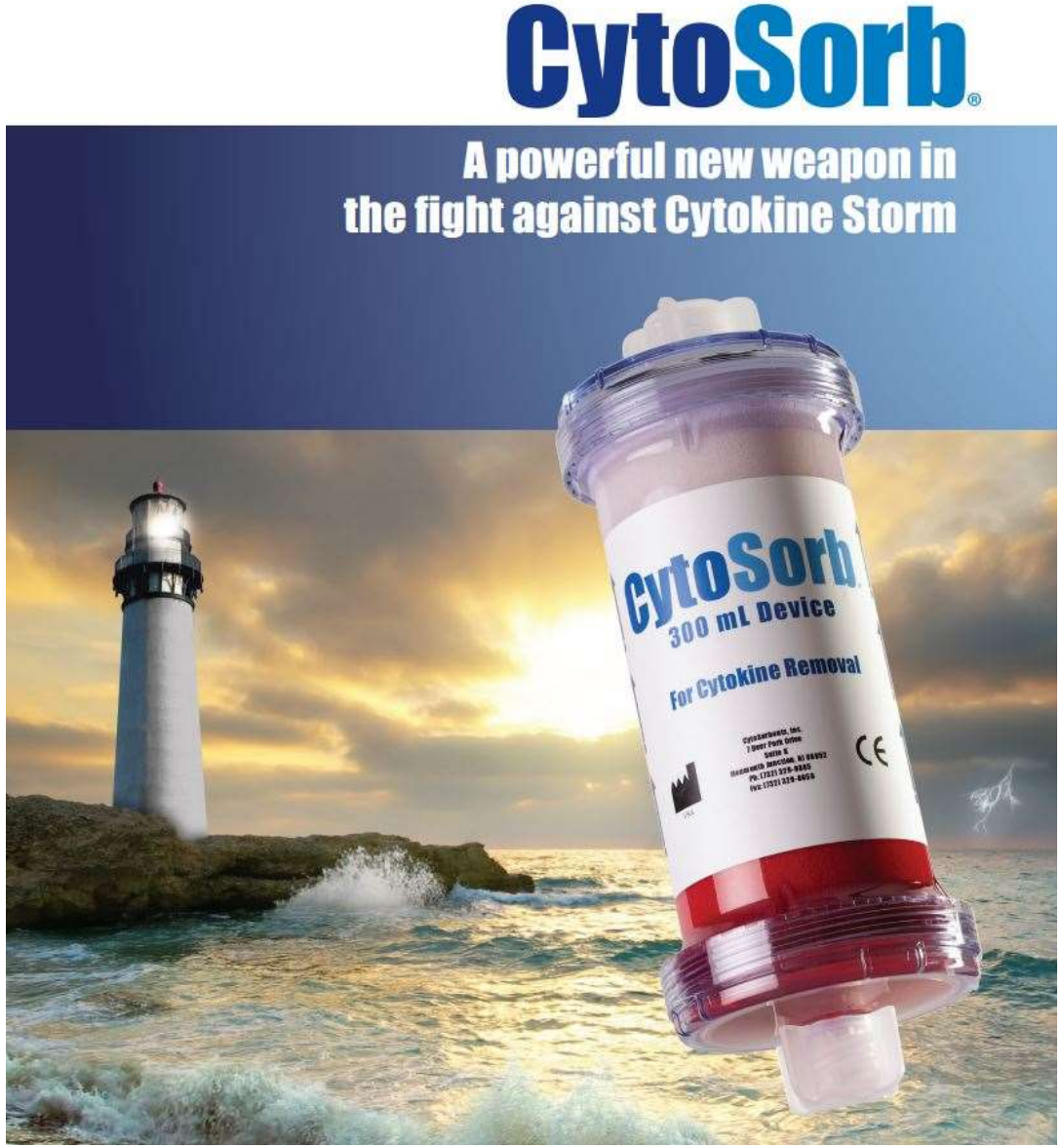



Chappell D et al: *Der Anaesthesist* 2008

# International registry on the use of the CytoSorb® adsorber in ICU patients

## Study protocol and preliminary results


**Fig. 2** ◄ Patient recruitment from May 18, 2015 to January 17, 2017 (248 patients)




Friesecke S, Träger K, Schittek GA, Molnar Z, Bach F, Kogelmann K, Bogdanski R, Weyland A, Nierhaus A, Nestler F *et al*: **International registry on the use of the CytoSorb® adsorber in ICU patients**. *Med Klin Intensivmed Notfmed* 2017.

## CYTOSORBENTS CHART


https://www.finanzen.net/aktien/Cytosorbents_2-Aktie


**Fig. 3** ◄ There were 130 participating study centers from 22 countries, as of January 17, 2017

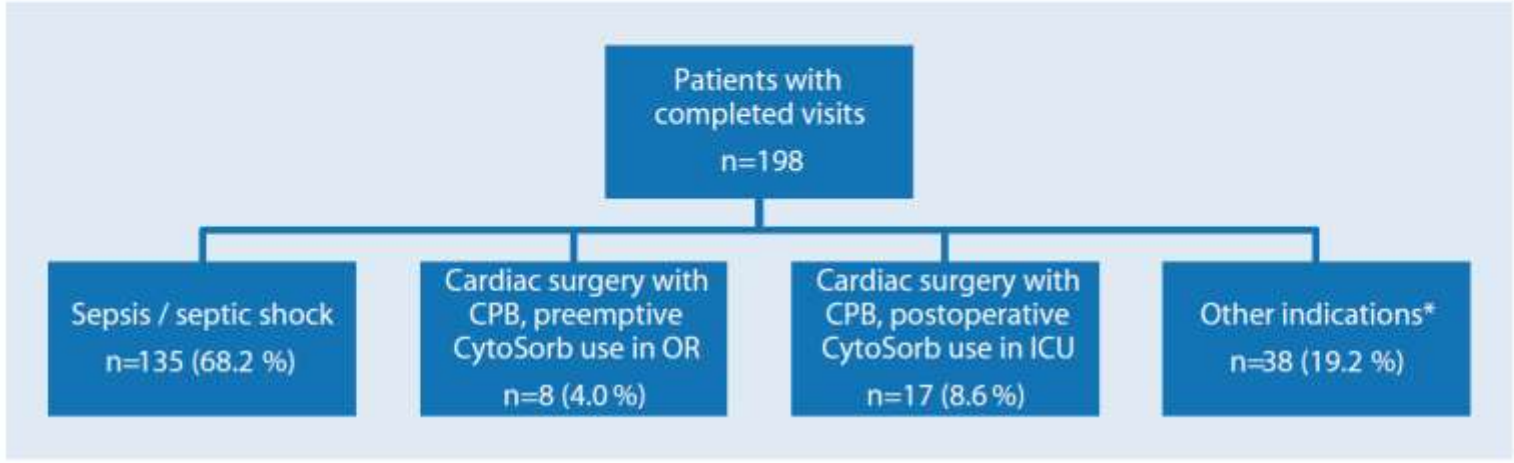



**Fig. 4** ◄ Indications for CytoSorb treatment. *CPB* cardiopulmonary bypass; *OR* operation room; *ICU* intensive care unit. *other indications were: liver failure ($n = 11$), acute pancreatitis ($n = 4$), trauma ($n = 6$), ARDS with ECMO ($n = 12$), others ($n = 10$)

# Pankreatitis Intensivmedizin

- EDK – Schmerztherapie
- Kreislaufstabilisierung
  - balancierte Vollelektrolytlösungen
  - Noradrenalin
  - hämodynamisches Monitoring
  - Ödeme vermeiden
- septischer Schock:
  - Vasopressin
  - Hydrocortison
  - Cytokin – Elimination ?
- Procalcitonin zur Steuerung der Antibiose
- Messung IAP

Kommunikation

# Danke

| IAH grade | IAP [mmHg] |
|---|---|
| Grade I | 12 - 15 |
| Grade II | 16 - 20 |
| Grade III | 21 - 25 |
| Grade IV | > 25 |
| ACS | > 20 with new organ disfunction/failure |

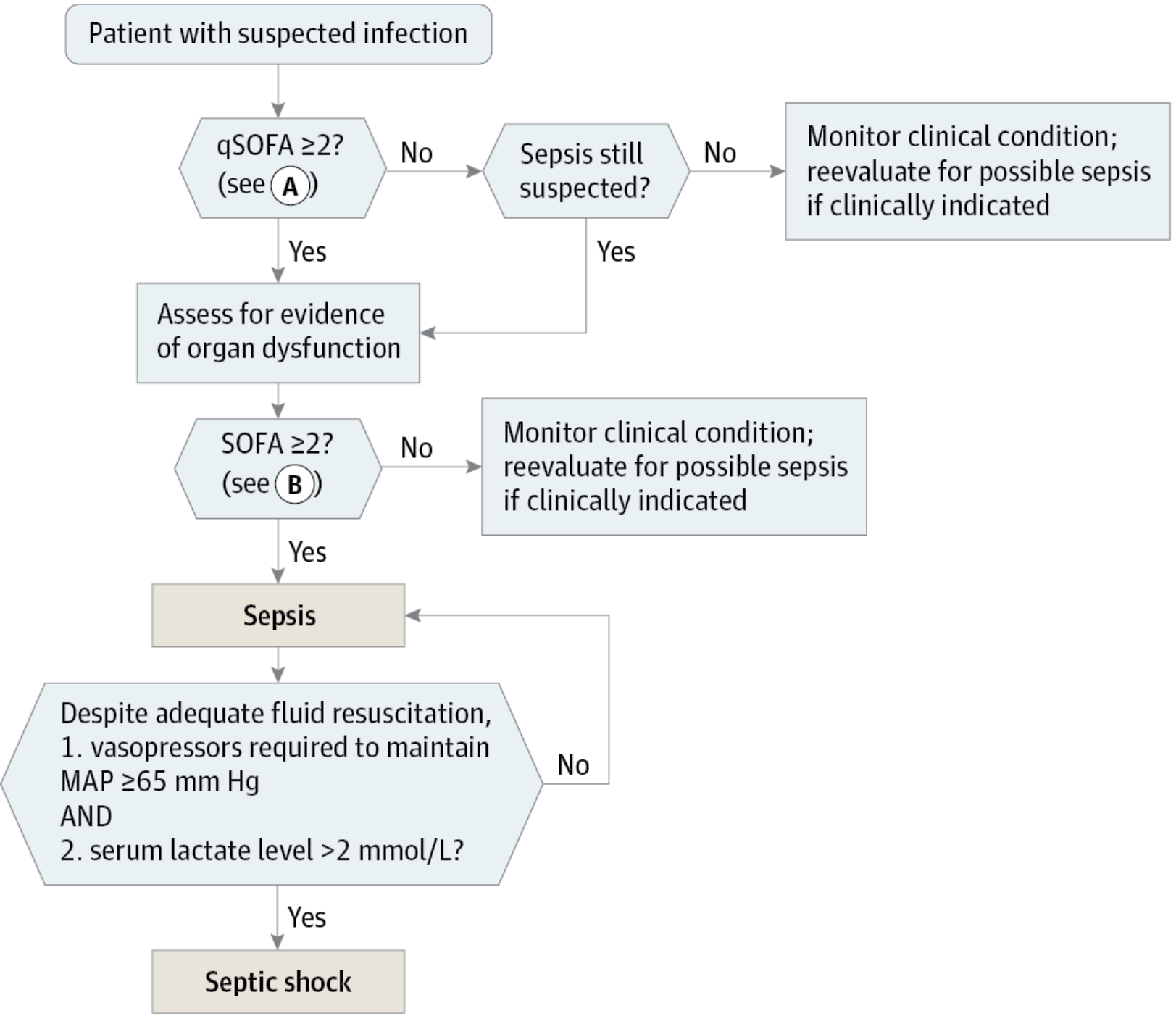
**Fig. 1** WSACS grading of intra-abdominal hypertension (IAH) (IAP intra-abdominal pressure, ACS abdominal compartment syndrome) [4]

## Pancreatitis

*In patients with severe acute pancreatitis unresponsive to step-up conservative management surgical decompression and open abdomen open are effective in treating abdominal compartment syndrome (Grade 2C)*

*Leaving the abdomen open after surgical necrosectomy for infected pancreatic necrosis is not recommended except in those situations with high risk factors to develop abdominal compartment syndrome (Grade 1C)*

Coccolini F, Roberts D, Ansaloni L, Ivatury R, Gamberini E, Kluger Y, Moore EE, Coimbra R, Kirkpatrick AW, Pereira BM *et al*: **The open abdomen in trauma and non-trauma patients: WSES guidelines**. *World journal of emergency surgery : WJES* 2018, **13**:7.




Singer M, Deutschman CS, Seymour C, et al.:
**The third international consensus definitions for sepsis and septic shock (sepsis-3)**.
*JAMA* 2016, 315(8):801-810.

**A qSOFA Variables**

- Respiratory rate
- Mental status
- Systolic blood pressure

**B SOFA Variables**

- $PaO_2/FiO_2$ ratio
- Glasgow Coma Scale score
- Mean arterial pressure
- Administration of vasopressors with type and dose rate of infusion
- Serum creatinine or urine output
- Bilirubin
- Platelet count

**Table 1. Sequential [Sepsis-Related] Organ Failure Assessment Score**[a]

| System | Score | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| Respiration | | | | | |
| $Pao_2/Fio_2$, mm Hg (kPa) | ≥400 (53.3) | <400 (53.3) | <300 (40) | <200 (26.7) with respiratory support | <100 (13.3) with respiratory support |
| Coagulation | | | | | |
| Platelets, $\times 10^3/\mu L$ | ≥150 | <150 | <100 | <50 | <20 |
| Liver | | | | | |
| Bilirubin, mg/dL (μmol/L) | <1.2 (20) | 1.2-1.9 (20-32) | 2.0-5.9 (33-101) | 6.0-11.9 (102-204) | >12.0 (204) |
| Cardiovascular | MAP ≥70 mm Hg | MAP <70 mm Hg | Dopamine <5 or dobutamine (any dose)[b] | Dopamine 5.1-15 or epinephrine ≤0.1 or norepinephrine ≤0.1[b] | Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1[b] |
| Central nervous system | | | | | |
| Glasgow Coma Scale score[c] | 15 | 13-14 | 10-12 | 6-9 | <6 |
| Renal | | | | | |
| Creatinine, mg/dL (μmol/L) | <1.2 (110) | 1.2-1.9 (110-170) | 2.0-3.4 (171-299) | 3.5-4.9 (300-440) | >5.0 (440) |
| Urine output, mL/d | | | | <500 | <200 |

Abbreviations: $Fio_2$, fraction of inspired oxygen; MAP, mean arterial pressure; $Pao_2$, partial pressure of oxygen.

[a] Adapted from Vincent et al.[27]

[b] Catecholamine doses are given as μg/kg/min for at least 1 hour.

[c] Glasgow Coma Scale scores range from 3-15; higher score indicates better neurological function.