24. MAJ 2018
DSTH FORÅRSMØDE
AALBORG KONGRES- OG KULTURCENTER | 9000 AALBORG

PATOFYSIOLOGIEN BAG TRAUME-INDUCERET KOAGULOPATI

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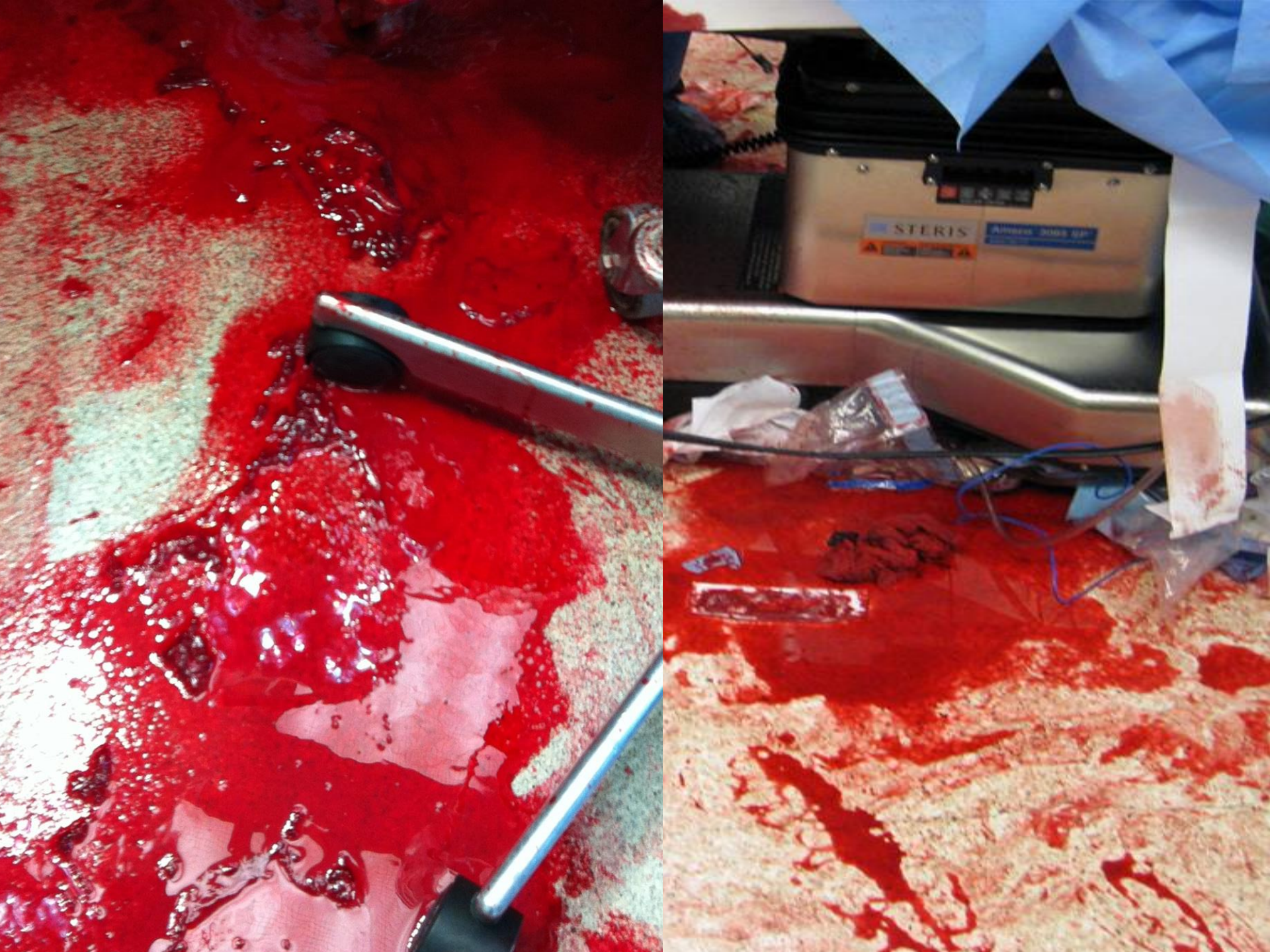
COI: None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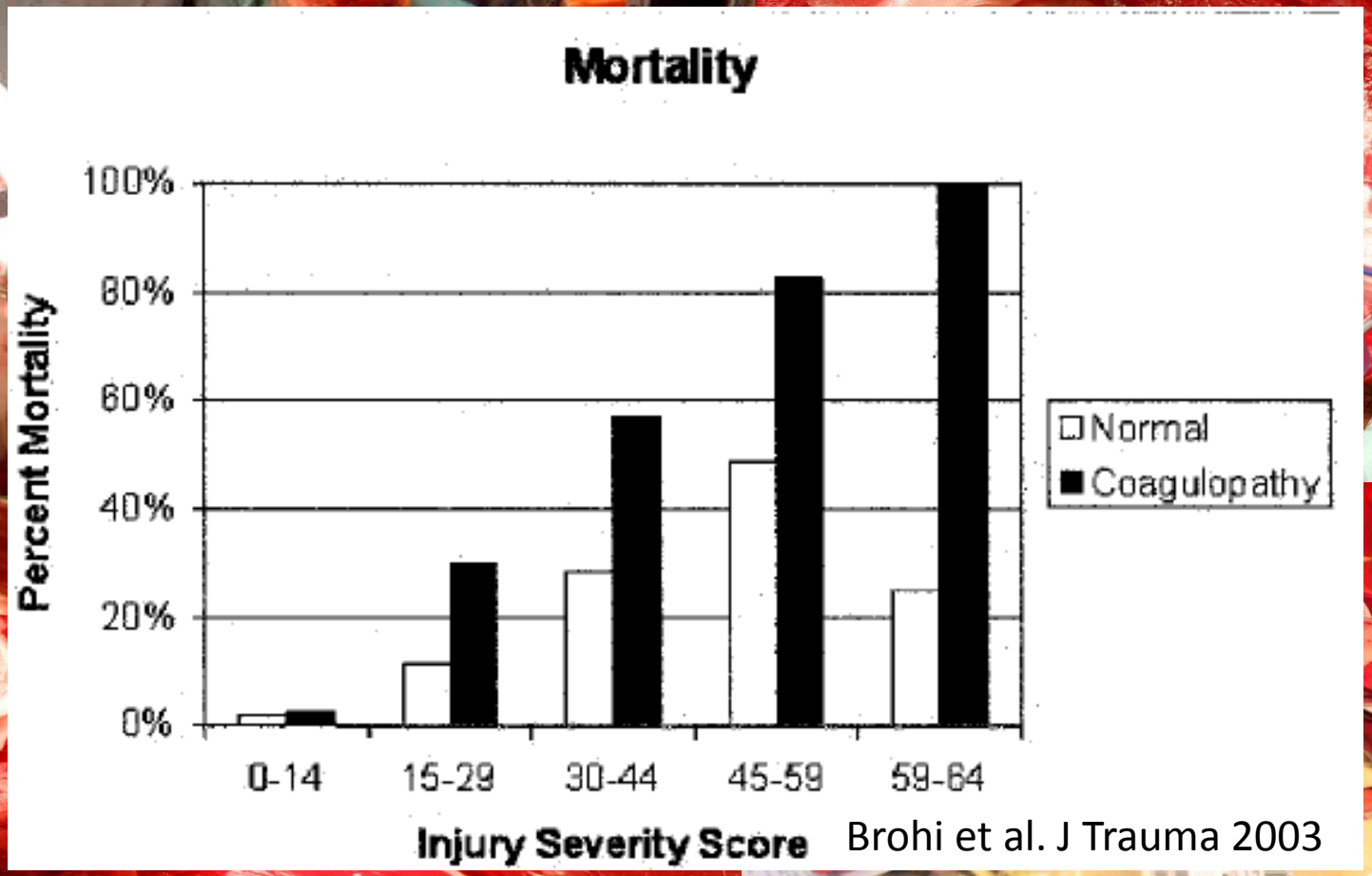
TRAUME-INDUCERET KOAGULOPATI



Brohi et al. J Trauma 2003

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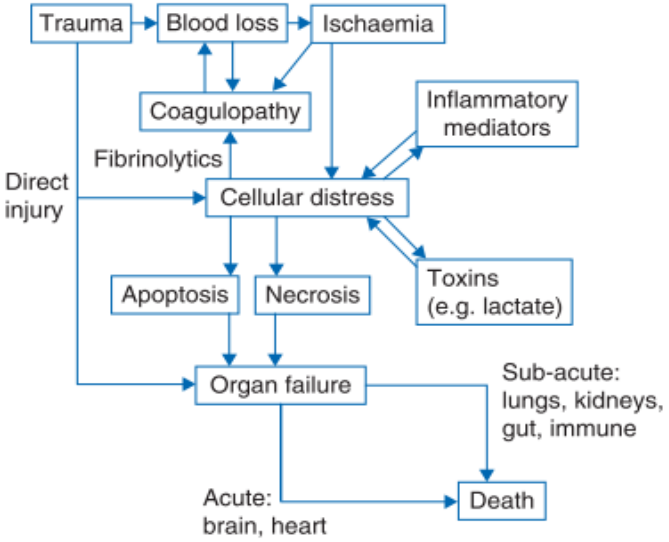

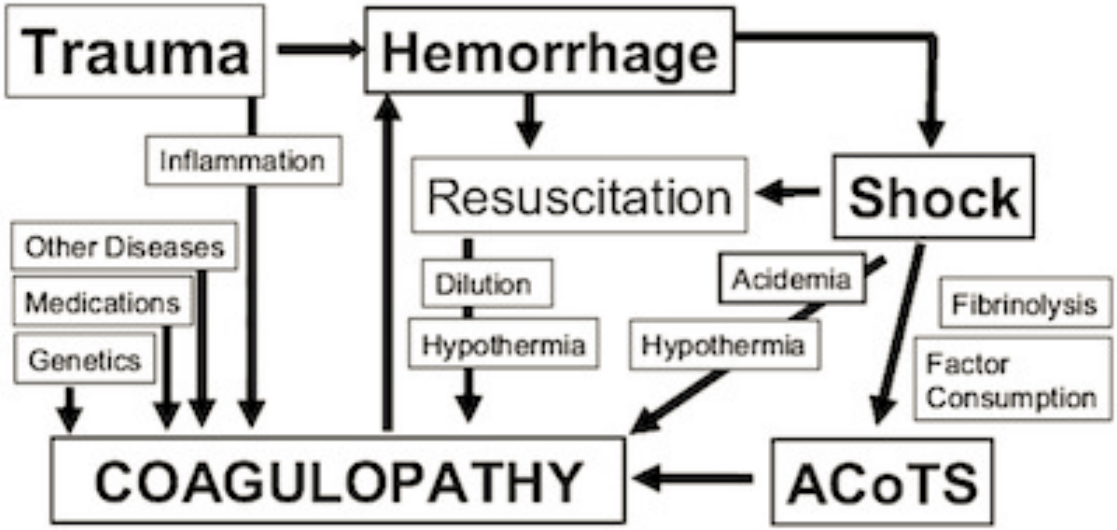

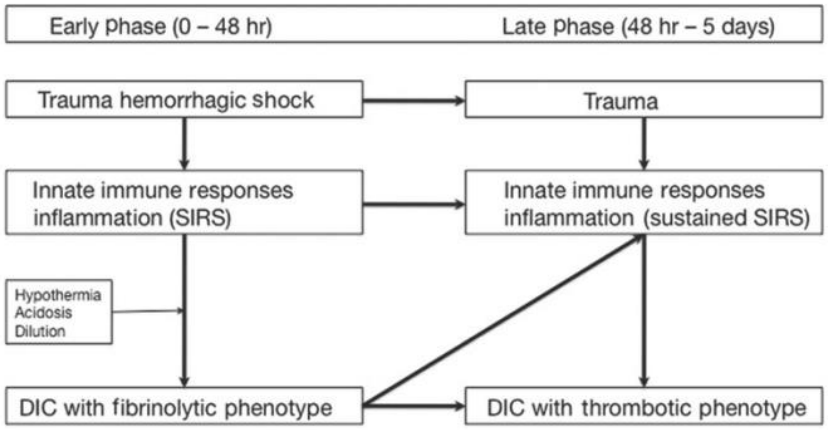

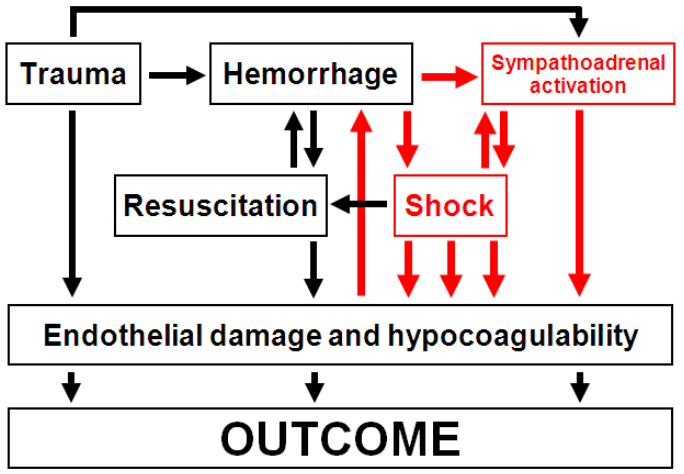

Dutton et al. J Trauma 2010; Hess et al. J Trauma 2008; Gando et al. Annals of Surg 2011; Johansson et al. J Trauma 2012

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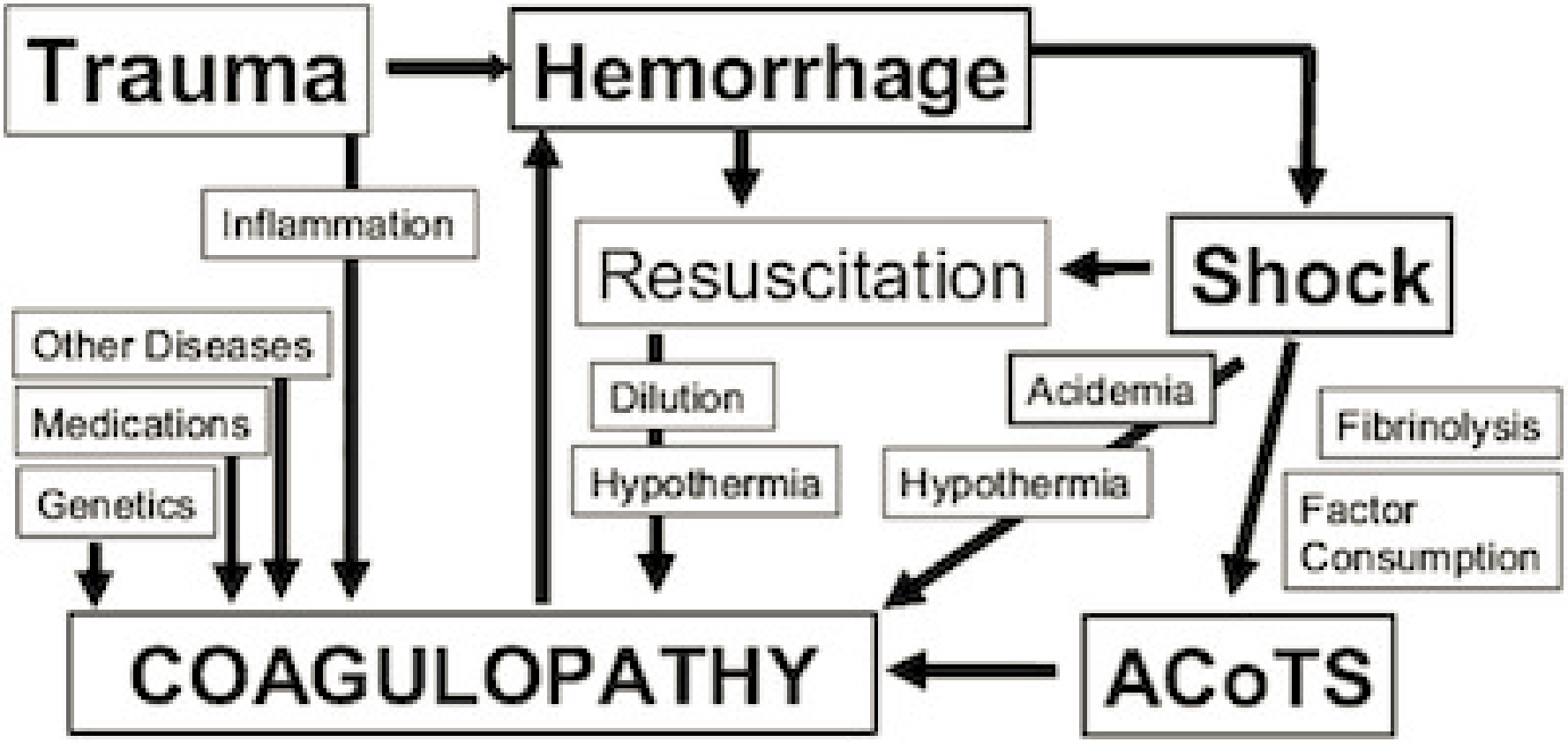

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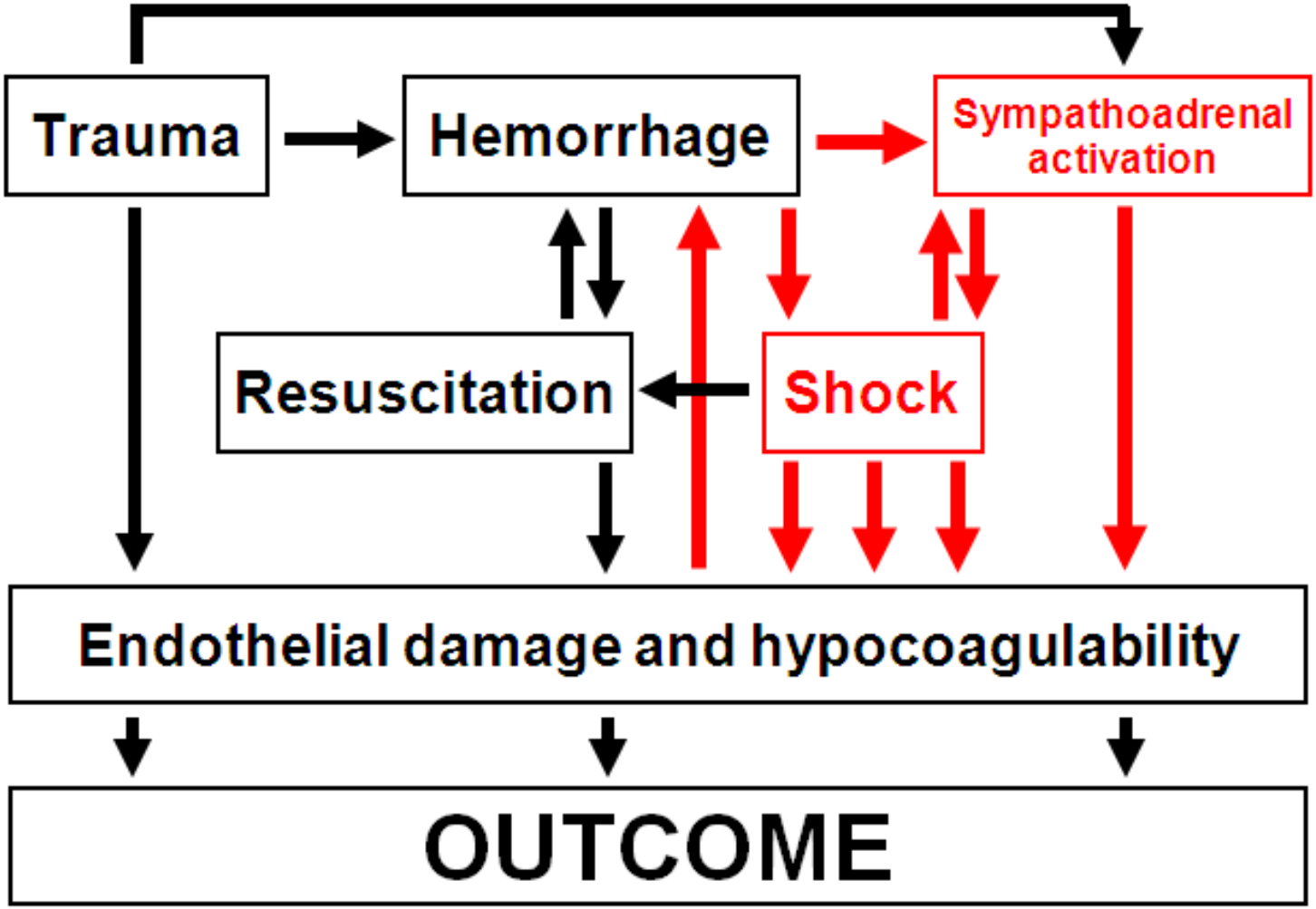
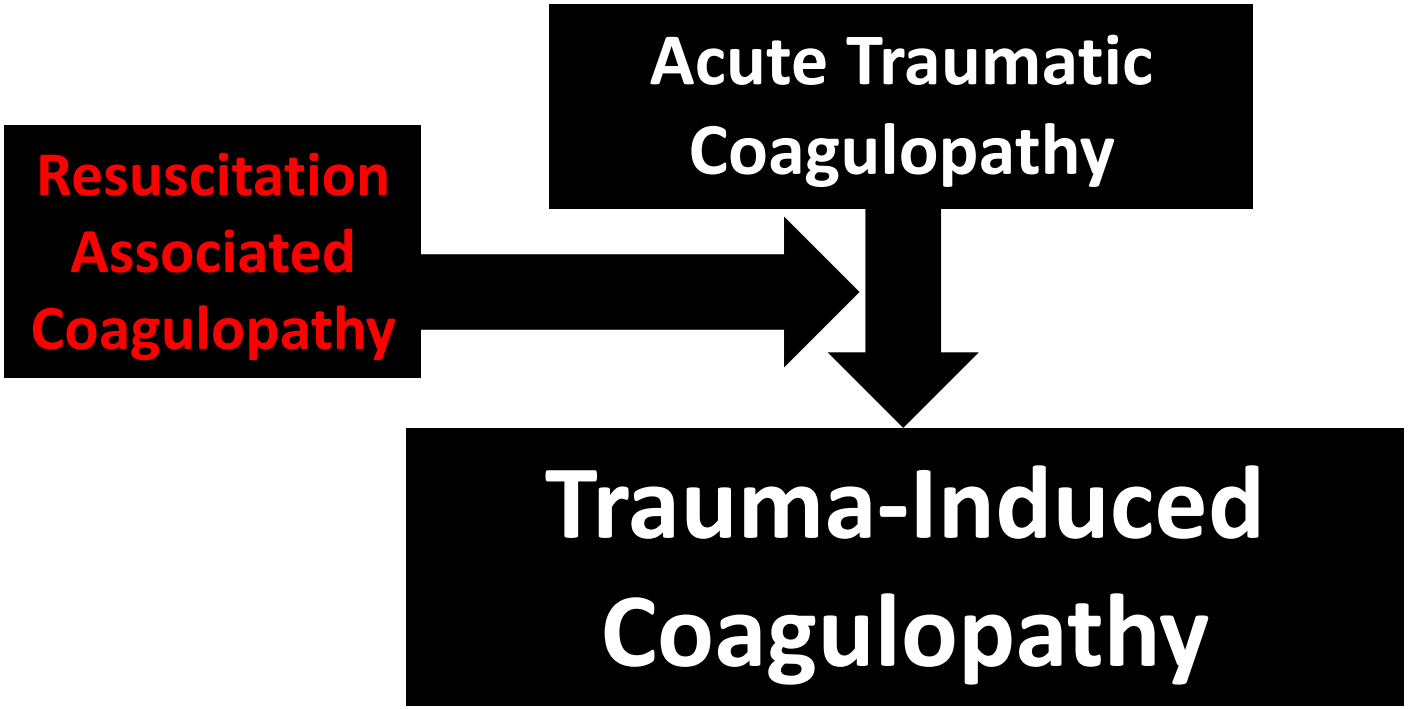
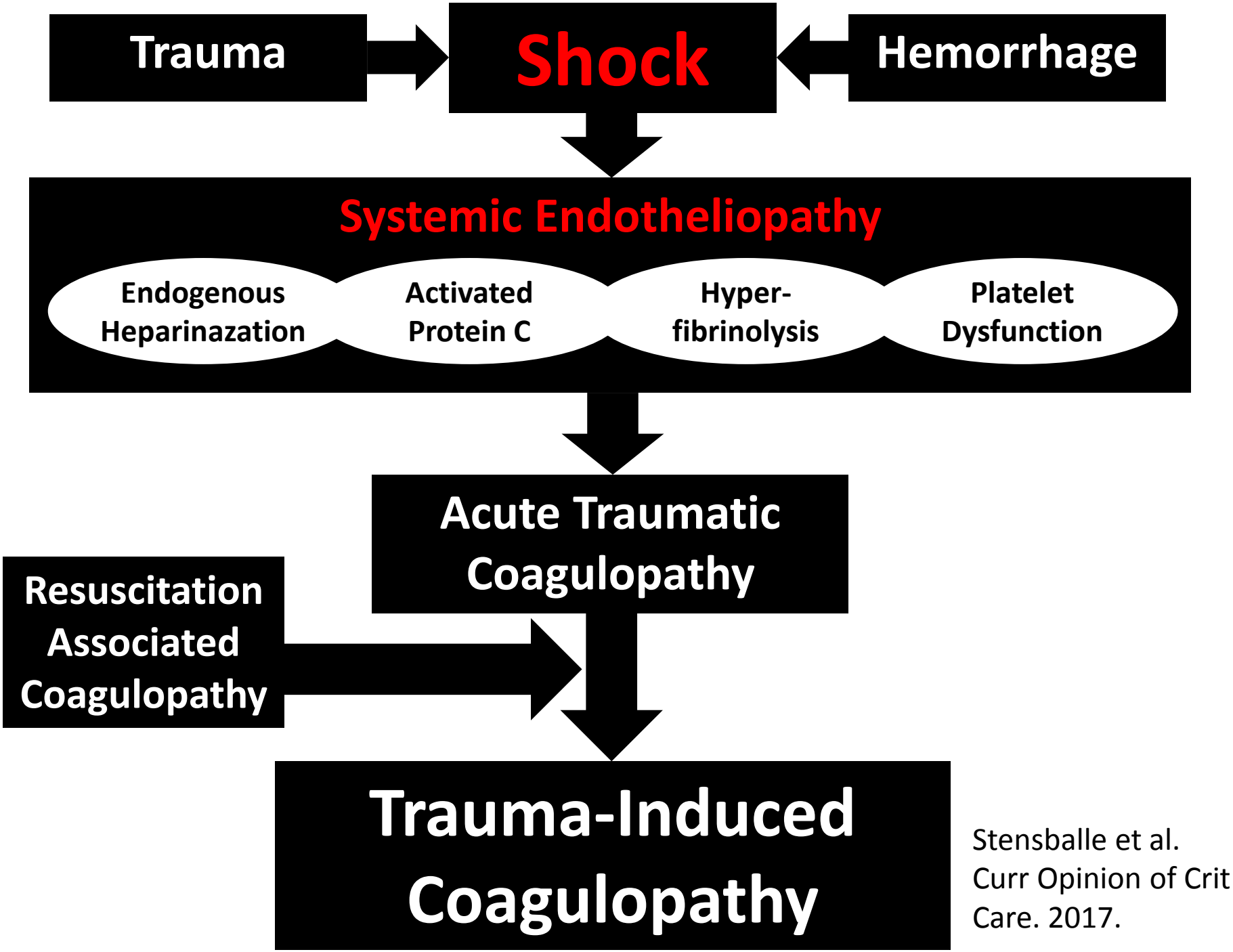


Johansson, Stensballe et al. J Trauma 2012



Stensballe et al. Curr Opinion of Crit Care. 2017.



Stensballe et al. Curr Opinion of Crit Care. 2017.

TRAUME-INDUCERET KOAGULOPATI

Johansson, Stensballe et al. SJTREM 2009; Johansson & Ostrowski. Medical Hypotheses 2010

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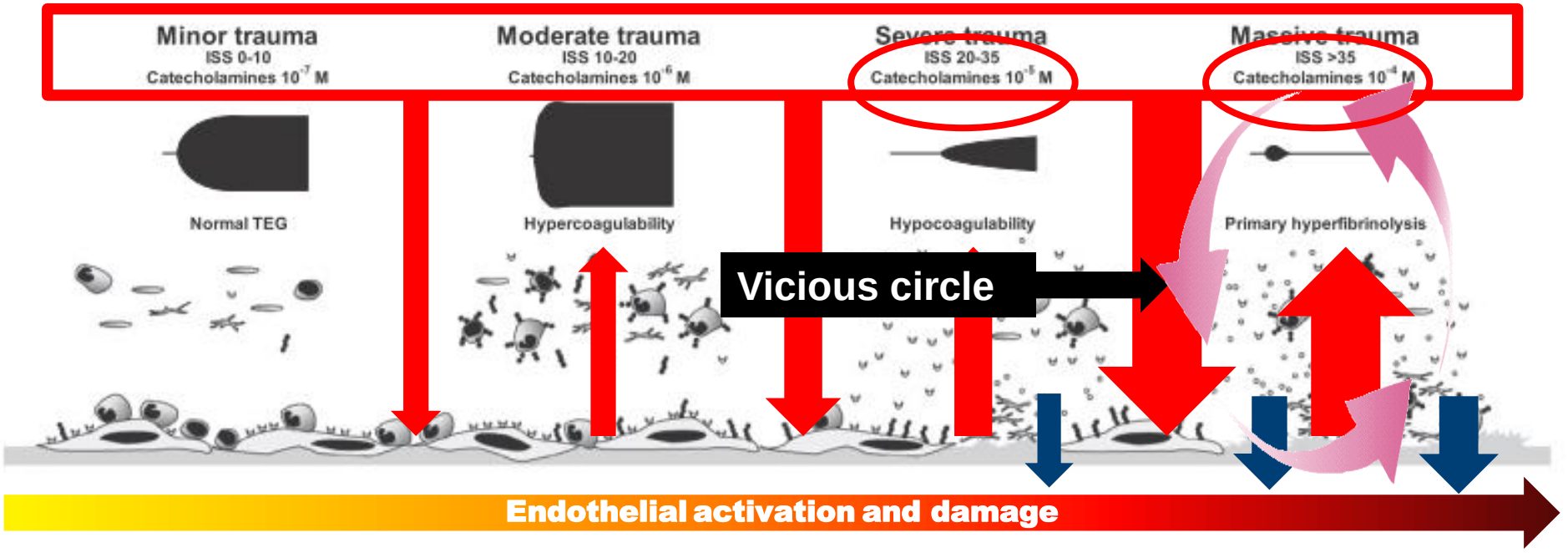
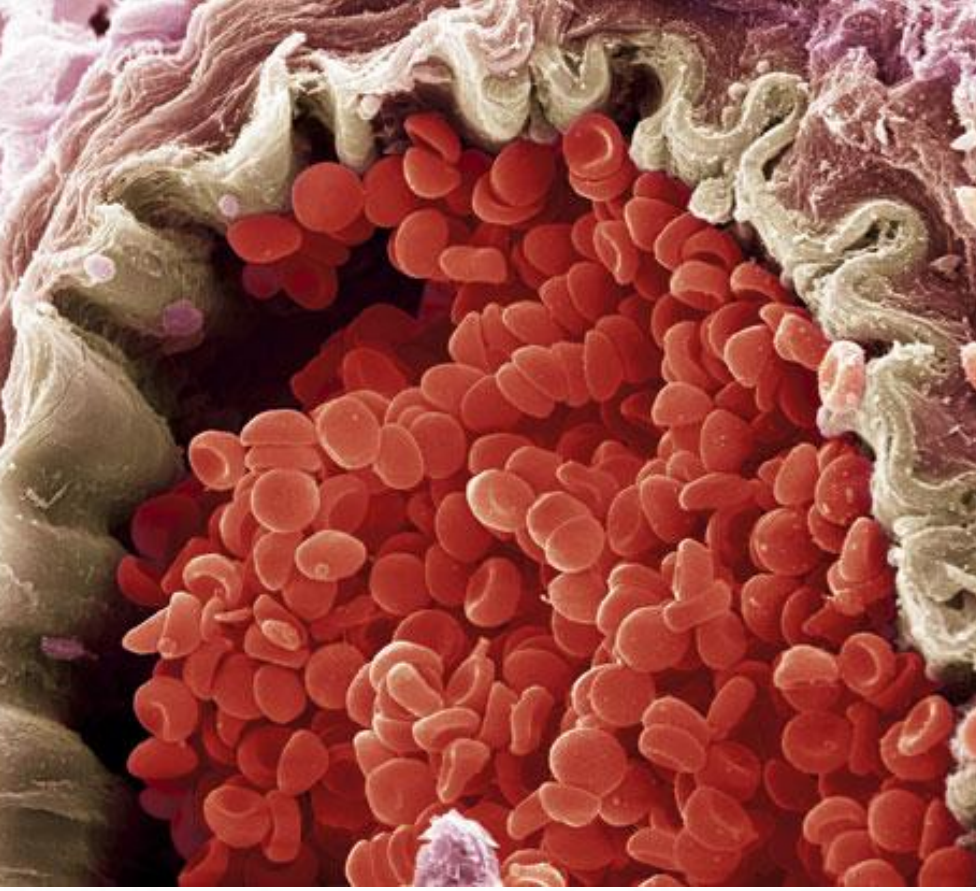
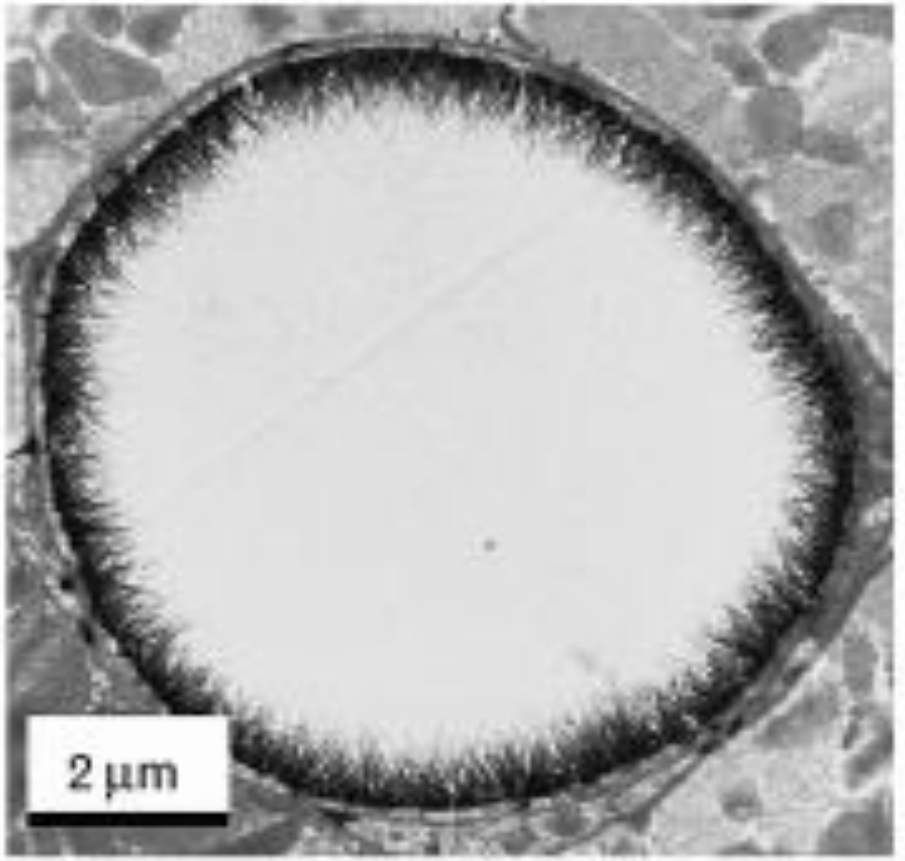


Oxygen versus hæmostase

Johansson, Stensballe et al. SJTREM 2009; Johansson & Ostrowski. Medical Hypotheses 2010

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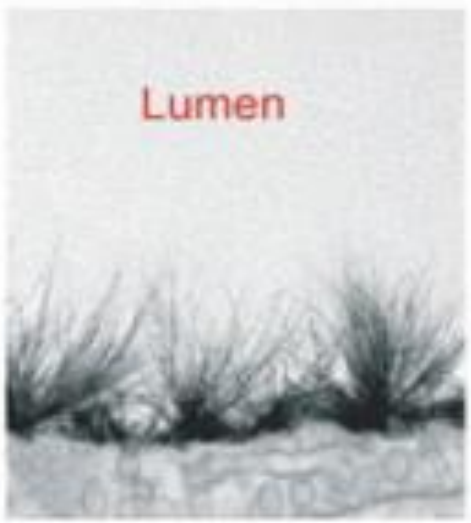
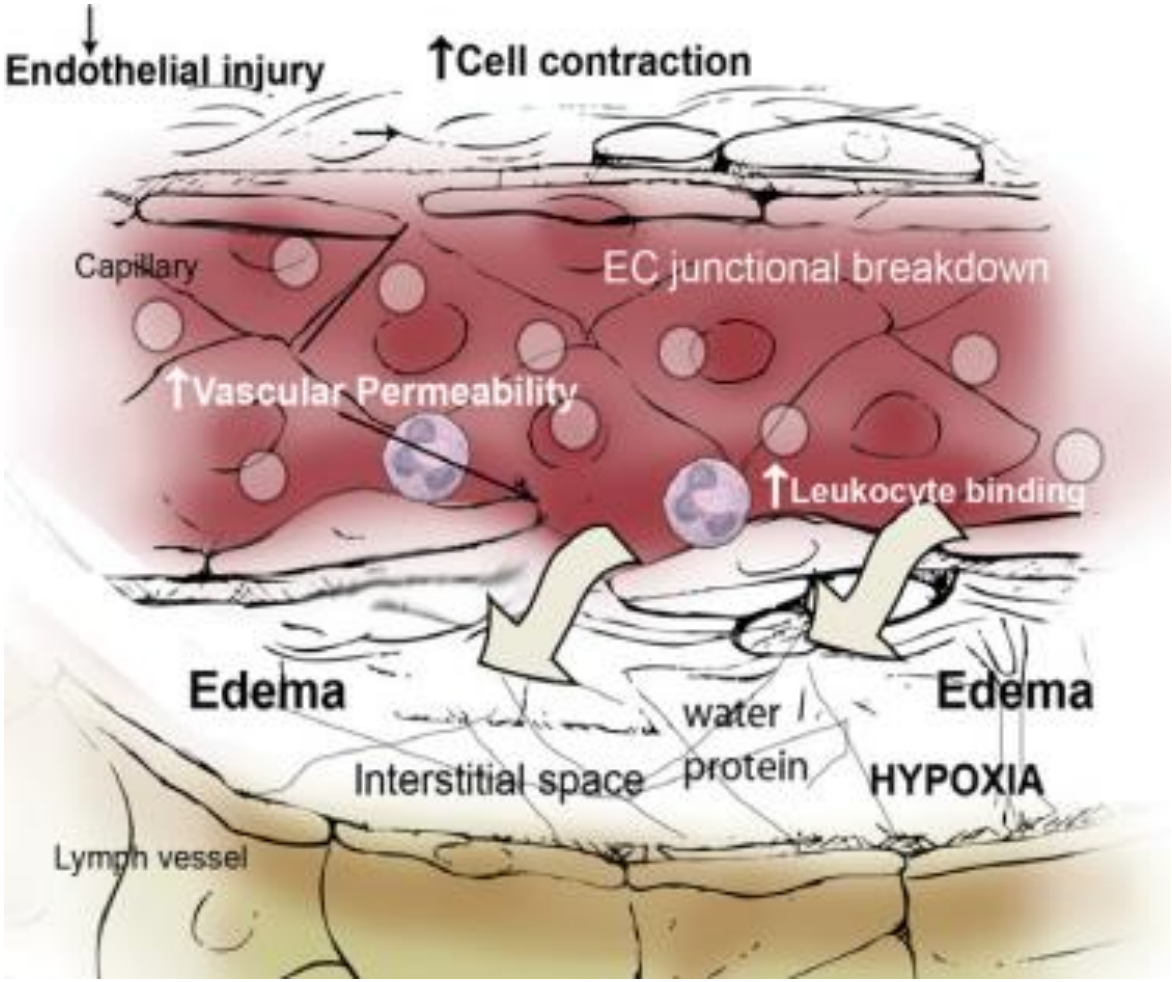
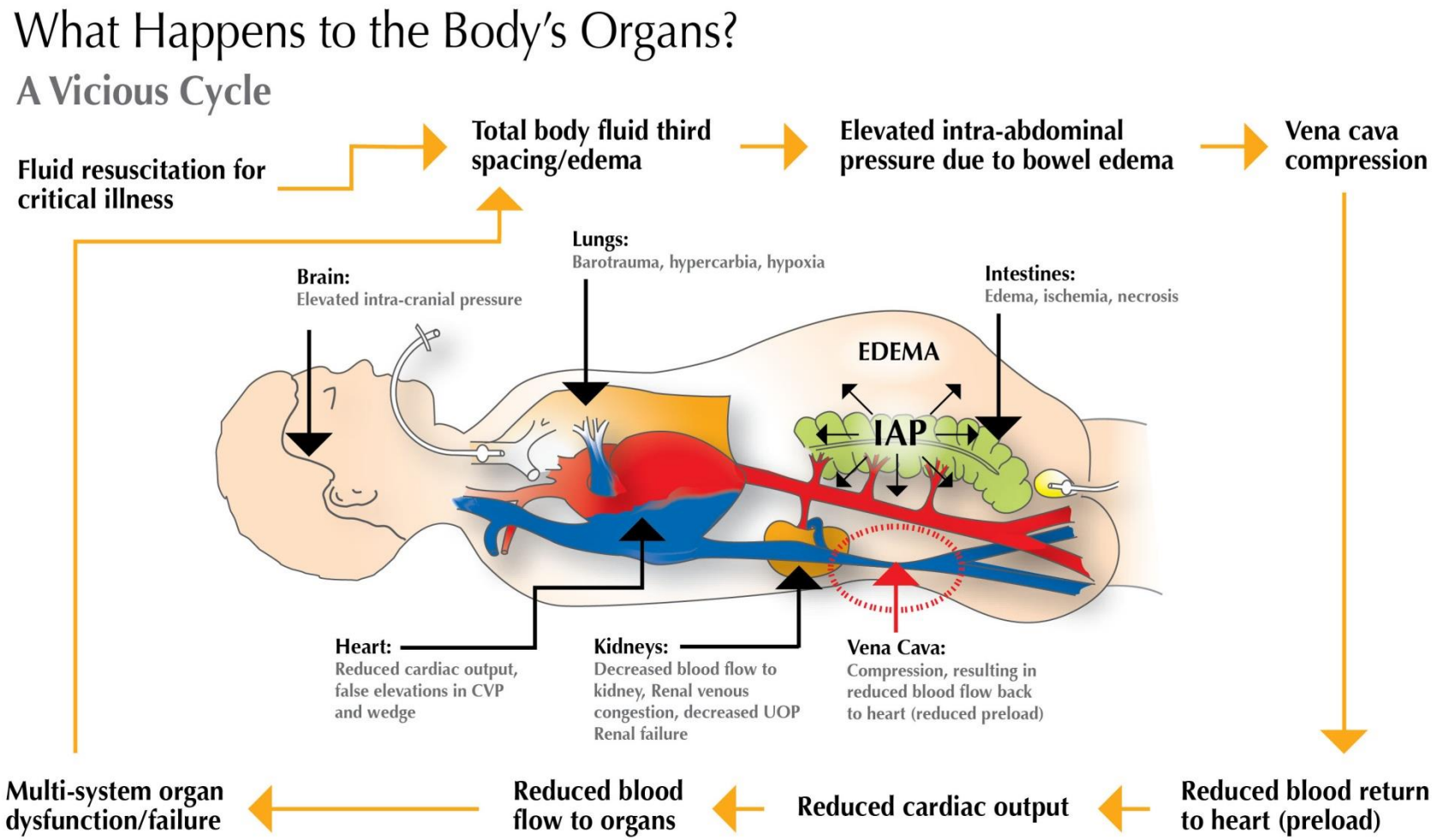

Lumen

Skade på karbarriere



Wataha et al. Transfusioin 2013

Kapillærlækage Syndrom



High circulating adrenaline levels at admission predict increased mortality after trauma

Pär Ingemar Johansson, MD, DMSc, MPA, Jakob Stensballe, MD, PhD, Lars Simon Rasmussen, MD, PhD, DMSc, *and* **Sisse Rye Ostrowski, MD, PhD, DMSc,**
Copenhagen, Denmark

J Trauma
Volume 72, Number 2

TABLE 4. Univariate and Multivariate Logistic Regression Models With 30-d Mortality as Main Endpoint in Trauma Patients

	Univariate (n = 69)			Multivariate (n = 69)		
	OR (95% CI)	χ^2	*p*	**OR (95% CI)**	χ^2	*p*
ISS	1.1 (1.0–1.1)	10	**0.001**	—		
Age (yr)	1.1 (1.0–1.1)	13	**<0.001**	1.1 (1.0–1.2)	10	**0.001**
Adrenaline (ng/mL)	3.6 (1.6–8.4)	9	**0.003**	5.5 (1.2–26.2)	5	**0.031**
APTT (s)	1.1 (1.0–1.2)	8	**0.005**	1.1 (1.0–1.3)	5	**0.026**
Lactate (mmol/L)	1.7 (1.2–2.3)	11	**0.001**	—		
Hemoglobin (mmol/L)	0.6 (0.4–0.9)	6	**0.015**	—		

Odds ratios with 95% CI and *p* values are shown for all variables, with *p* values in bold for variables with $p < 0.05$. OR (95% CI) associated with one unit increase in ISS, age, adrenaline, APTT, lactate, or hemoglobin. The univariate and multivariate models are based on the same 69 patients, i.e., those with complete data.

J Trauma. 2011

A High Admission Syndecan-1 Level, A Marker of Endothelial Glycocalyx Degradation, Is Associated With Inflammation, Protein C Depletion, Fibrinolysis, and Increased Mortality in Trauma Patients

Pär I. Johansson, MD, DMSc, MPA, Jakob Stensballe, MD, PhD,† Lars S. Rasmussen, MD, PhD, DMSc,† and Sisse R. Ostrowski, MD, PhD, DMSc**

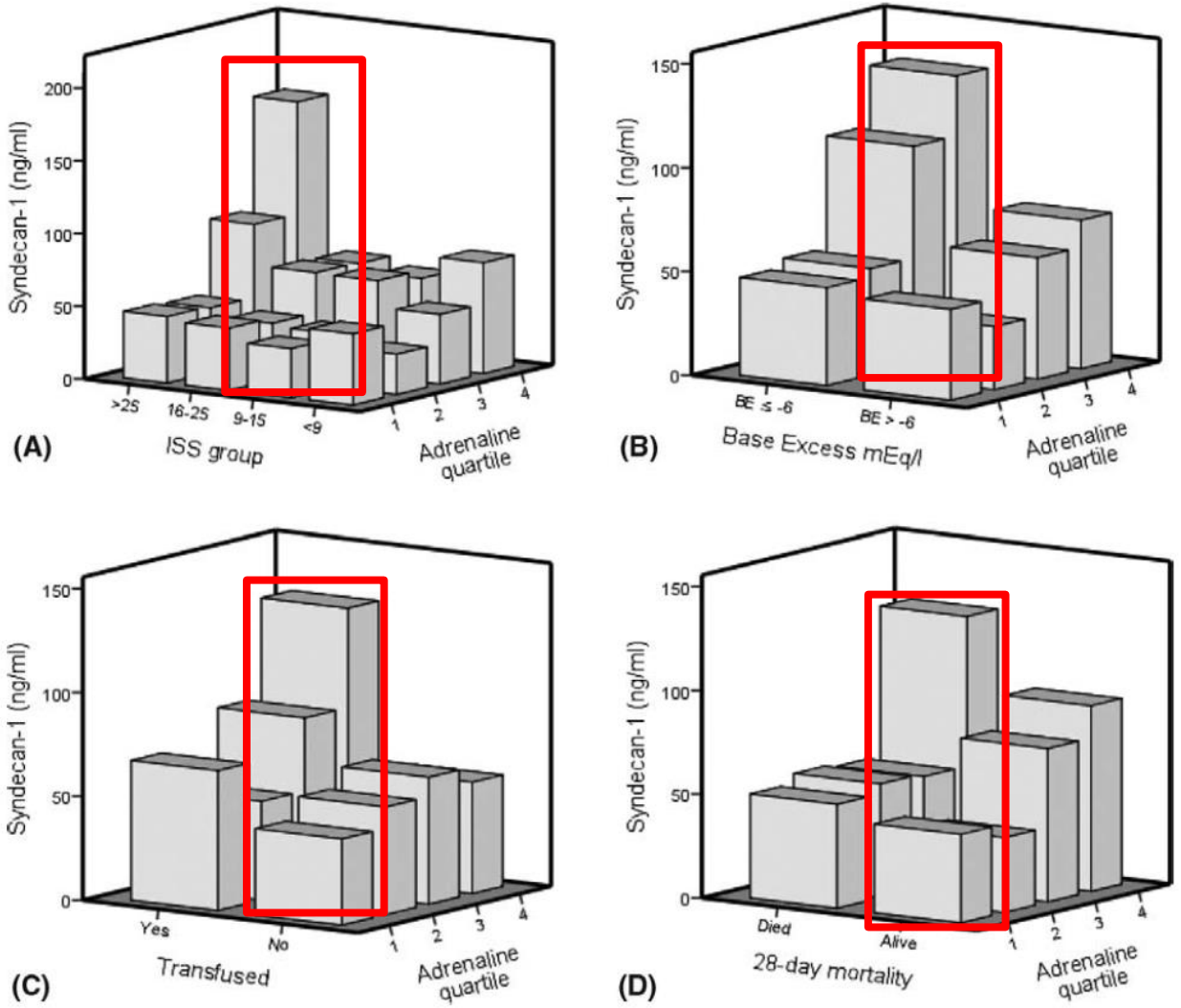
TABLE 2. Univariate and Multivariate Logistic Regression Models with 30-day Mortality as Main Endpoint in 75 Trauma Patients

	Univariate			Multivariate		
	OR (95% CI)*	**χ^2**	***P***	**OR (95% CI)[1]**	**χ^2**	***P***
Age (years)†	1.07 (1.03-1.11)	12	**<0.001**	1.09 (1.04-1.14)	12	**<0.001**
ISS scores‡	1.06 (1.03–1.10)	12	**<0.001**	1.08 (1.03-1.13)	10	**0.002**
Syndecan-1 (ng/mL)§	1.01 (1.01–1.02)	11	**0.001**	1.01 (1.00-1.02)	4	**0.043**

*Odds ratios with 95% confidence intervals (OR [95% CI]) and *P* values are shown, with *P* values in bold for variables with $P < 0.05$.
†One year older.
‡One unit increase in ISS.
§One ng/mL higher plasma concentration.

Traumatic Endotheliopathy: A Prospective Observational Study of 424 Severely Injured Patients

Pär I. Johansson, MD, DMSc, MPA,† Hanne H. Henriksen, BSc,* Jakob Stensballe, MD, PhD,*‡ Mikkel Gybel-Brask, MD,* Jessica C. Cardenas, PhD,† Lisa A. Baer, BSc,† Bryan A. Cotton, MD, MPH,† John B. Holcomb, MD,† Charles E. Wade, PhD,† and Sisse R. Ostrowski, MD, PhD, DMSc**



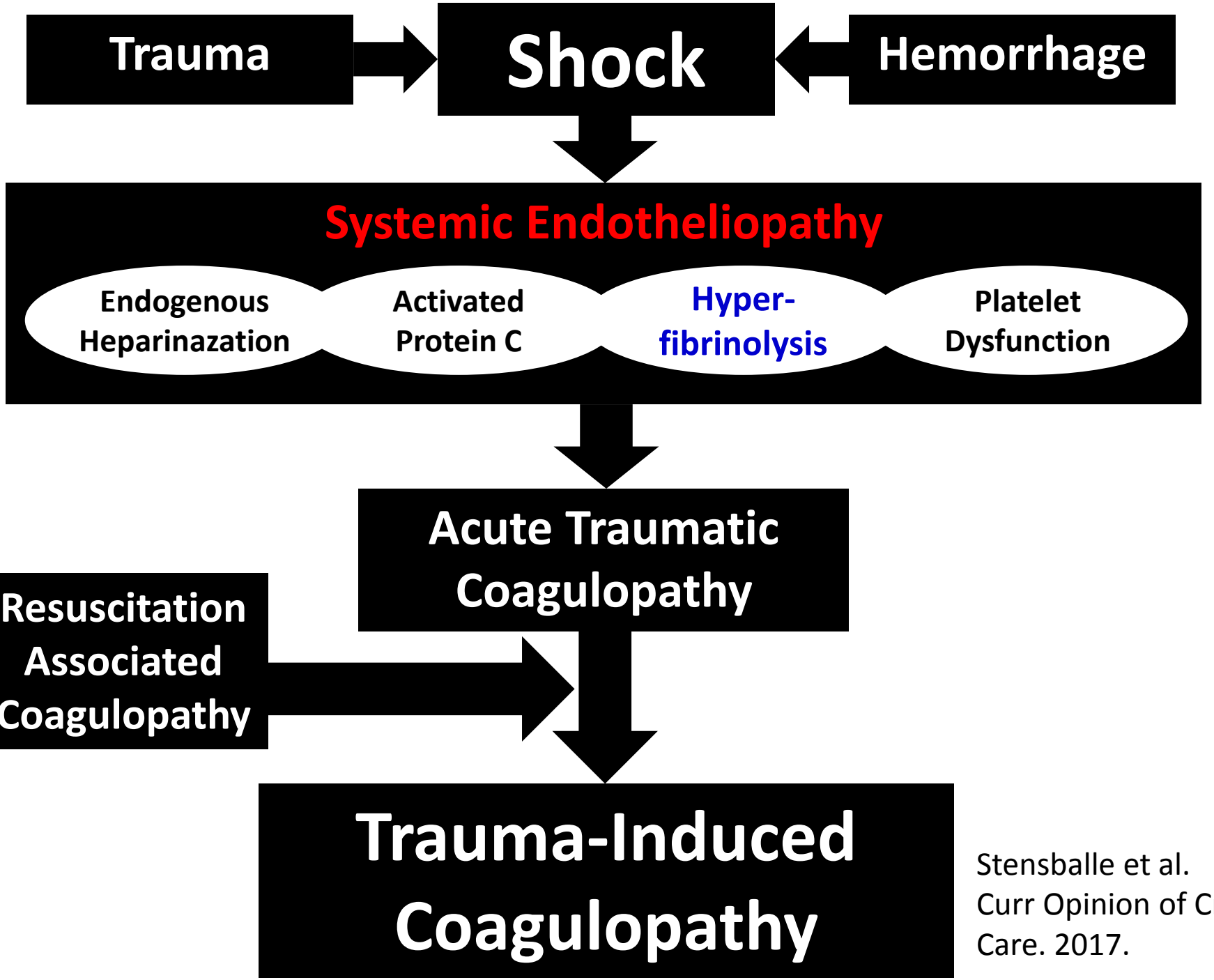
Syndecan-1: A Quantitative Marker for the Endotheliopathy of Trauma

Erika Gonzalez Rodriguez, MD, Sisse R Ostrowski, MD, DMSc, Jessica C Cardenas, PhD, Lisa A Baer, BSc, Jeffrey S Tomasek, MD, Hanne H Henriksen, BSc, Jakob Stensballe, MD, PhD, Bryan A Cotton, MD, MPH, FACS, John B Holcomb, MD, FACS, Pär I Johansson, MD, DMSc, Charles E Wade, PhD

Table 2. Blood Products and Crystalloid Use, Outcomes, and Mortality Comparisons Between Endotheliopathy of Trauma-Positive and Endotheliopathy of Trauma-Negative Patients

Variable	Total	EoT−*	EoT+†	p Value
n	410	272	138	
Transfusion				
Transfused, n (%)	198 (48.3)	99 (36.4)	99 (71.7)	<0.001
RBC, U, median (IQR)	0 (0–2)	0 (0–1)	2 (0–6)	<0.001
Plasma, U, median (IQR)	0 (0–2)	0 (0–1)	2 (0–6)	<0.001
Platelets, U, median (IQR)	0 (0)	0 (0)	0 (0–2)	<0.001
24-h total blood,‡ U, median (IQR)	0 (0–6)	0 (0–2)	4 (0–16)	<0.001
24-h total crystalloid volume, mL, median (IQR)	1,600 (0–3,700)	0 (0–2,600)	3,100 (300–5,800)	<0.001
Outcomes				
Hospital-free days, median (IQR)	21 (4–27)	23 (10–28)	13 (0–25)	<0.001
ICU-free days, median (IQR)	28 (16–30)	28 (21–30)	23 (0–29)	<0.001
Ventilator-free days, median (IQR)	29 (20–30)	29 (26–30)	28 (0–30)	<0.001
24-h mortality, n (%)	39 (9.5)	16 (5.9)	23 (16.7)	0.001
30-d in-hospital mortality, n (%)	67 (16.3)	33 (12.1)	34 (24.6)	0.001

Ann Surg. 2018

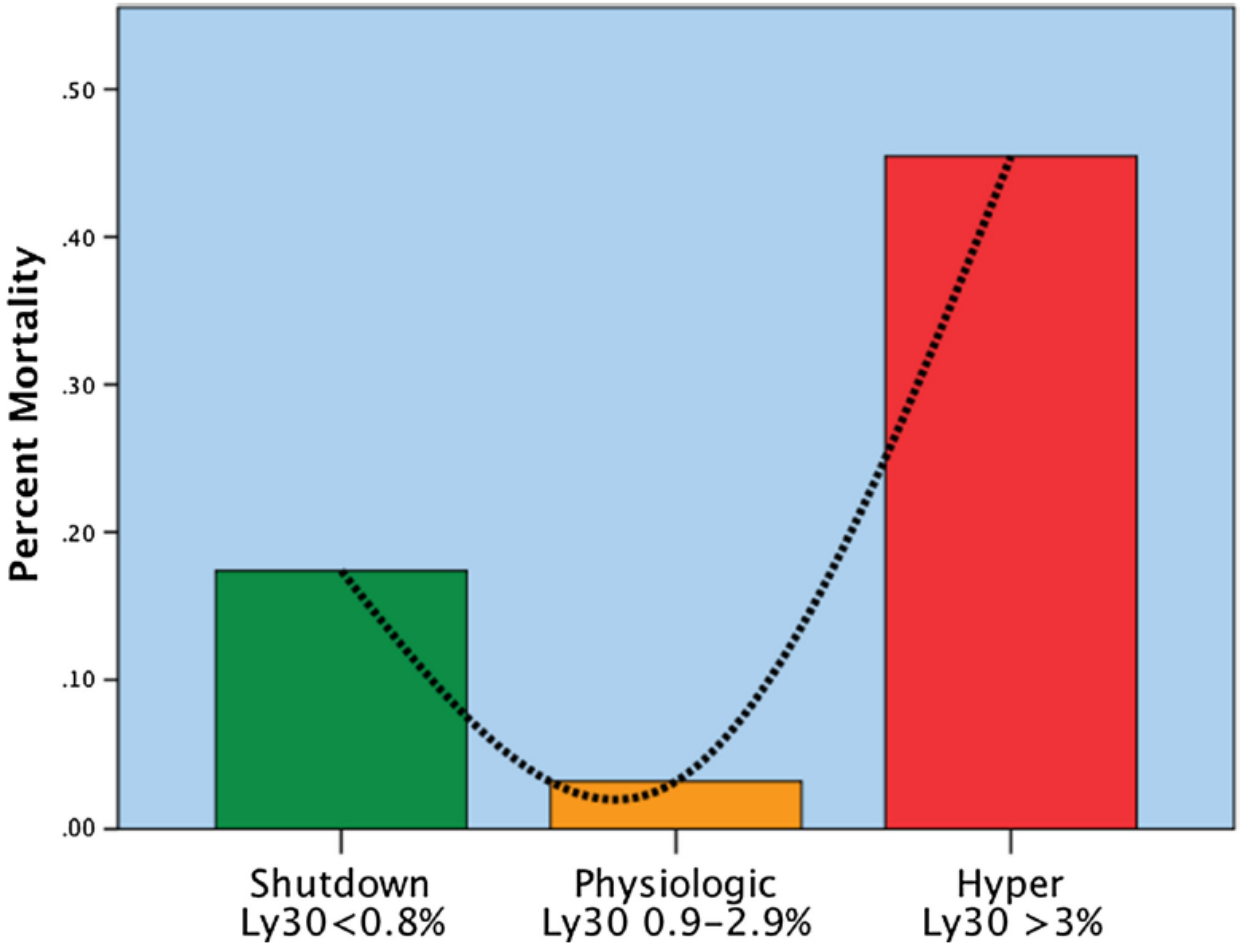


Stensballe et al. Curr Opinion of Crit Care. 2017.

Hyperfibrinolysis, physiologic fibrinolysis, and fibrinolysis shutdown: The spectrum of postinjury fibrinolysis and relevance to antifibrinolytic therapy

Hunter B. Moore, MD, Ernest E. Moore, MD, Eduardo Gonzalez, MD, Michael P. Chapman, MD, Theresa L. Chin, MD, Christopher C. Silliman, MD, PhD, Anirban Banerjee, PhD, *and* Angela Sauaia, MD, PhD, *Denver, Colorado*

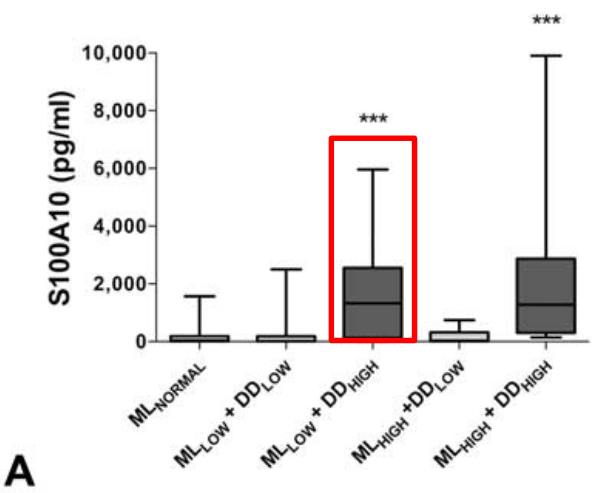
J Trauma Acute Care Surg 2014



The S100A10 Pathway Mediates an Occult Hyperfibrinolytic Subtype in Trauma Patients

Lewis S. Gall, MD, Paul Vulliamy, MD,* Scarlett Gillespie, PhD,* Timothy F. Jones, MD,* Rochelle S. J. Pierre,* Sabine E. Breukers,* Christine Gaarder, MD, PhD,† Nicole P. Juffermans, MD, PhD,‡ Marc Maegele, MD,§ Jakob Stensballe, MD,¶‖** Pär I. Johansson, MD, DMSc, MPA,¶‖** Ross A. Davenport, MD, PhD,* and Karim Brohi, MD*, Targeted Action for Curing Trauma-Induced Coagulopathy (TACTIC) partners*

Ann Surg 2018



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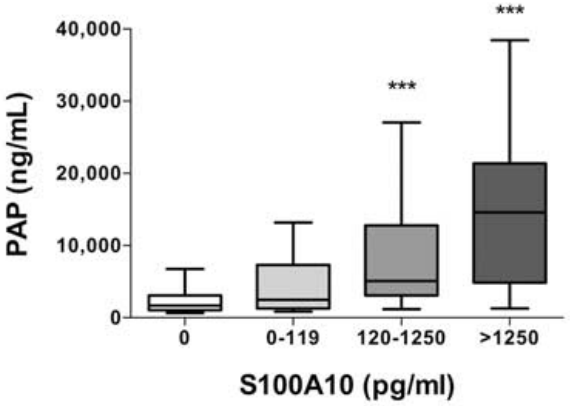

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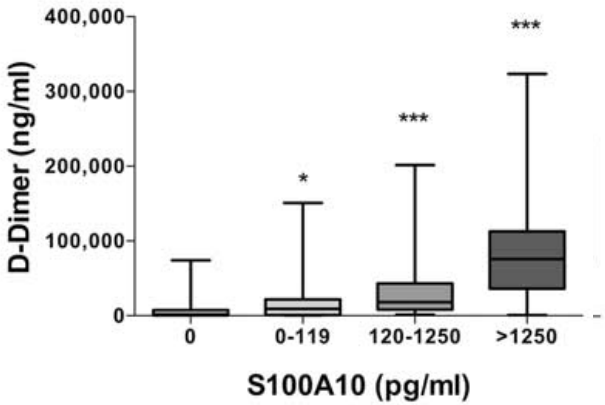

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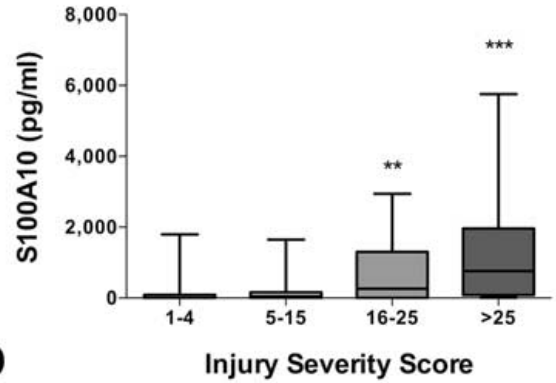

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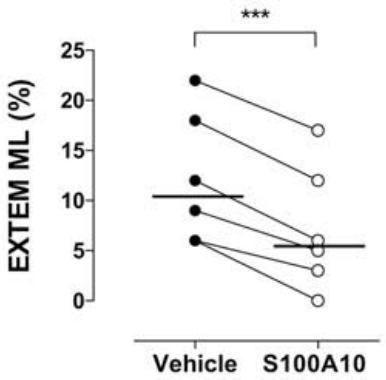

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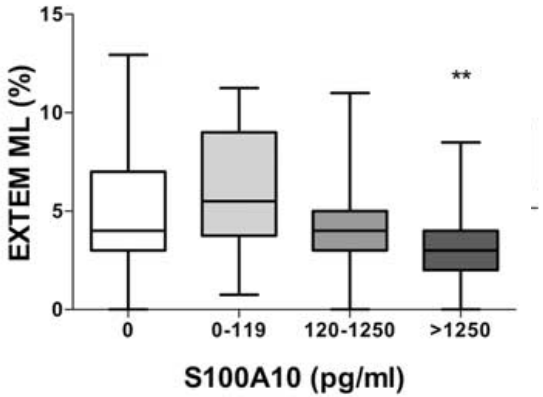

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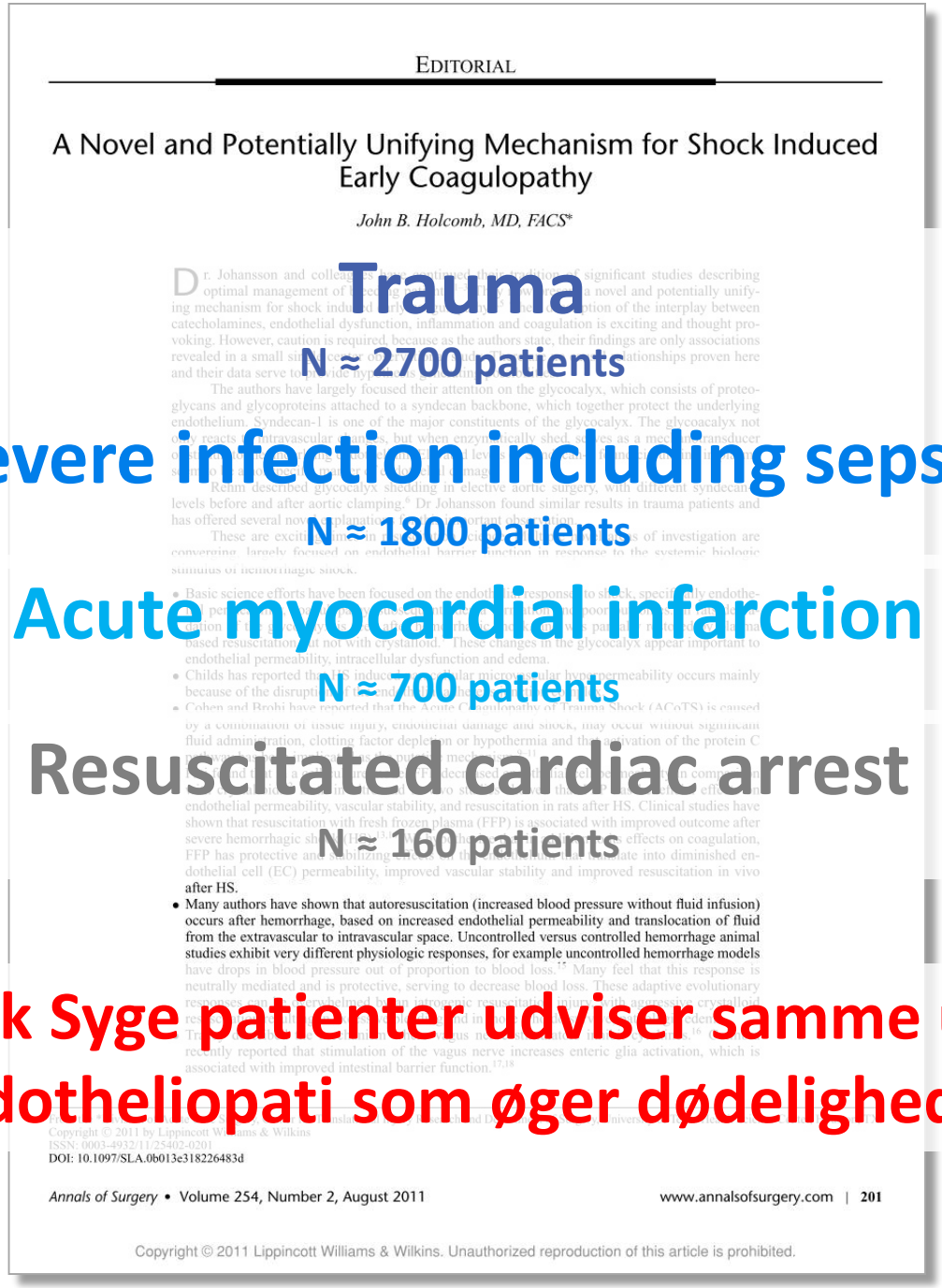


EDITORIAL

A Novel and Potentially Unifying Mechanism for Shock Induced Early Coagulopathy

*John B. Holcomb, MD, FACS**

Trauma

N ≈ 2700 patients

Severe infection including sepsis

N ≈ 1800 patients

Acute myocardial infarction

N ≈ 700 patients

Resuscitated cardiac arrest

N ≈ 160 patients

after HS.

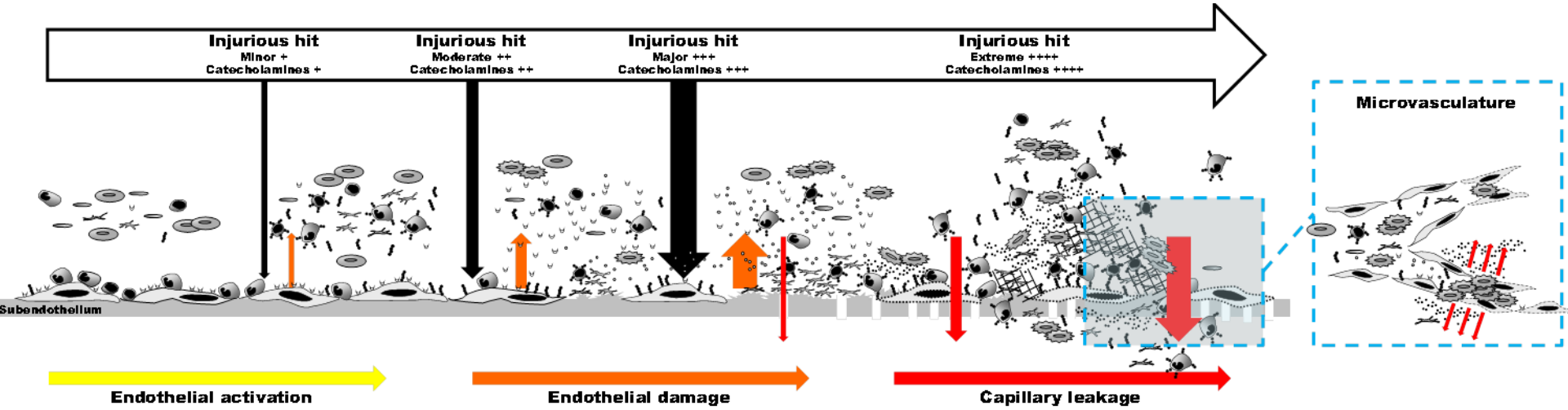
- Many authors have shown that autoresuscitation (increased blood pressure without fluid infusion) occurs after hemorrhage, based on increased endothelial permeability and translocation of fluid from the extravascular to intravascular space. Uncontrolled versus controlled hemorrhage animal studies exhibit very different physiologic responses, for example uncontrolled hemorrhage models have drops in blood pressure out of proportion to blood loss.

ISSN: 0003-4932/11/25402-0201
DOI: 10.1097/SLA.0b013e318226483d

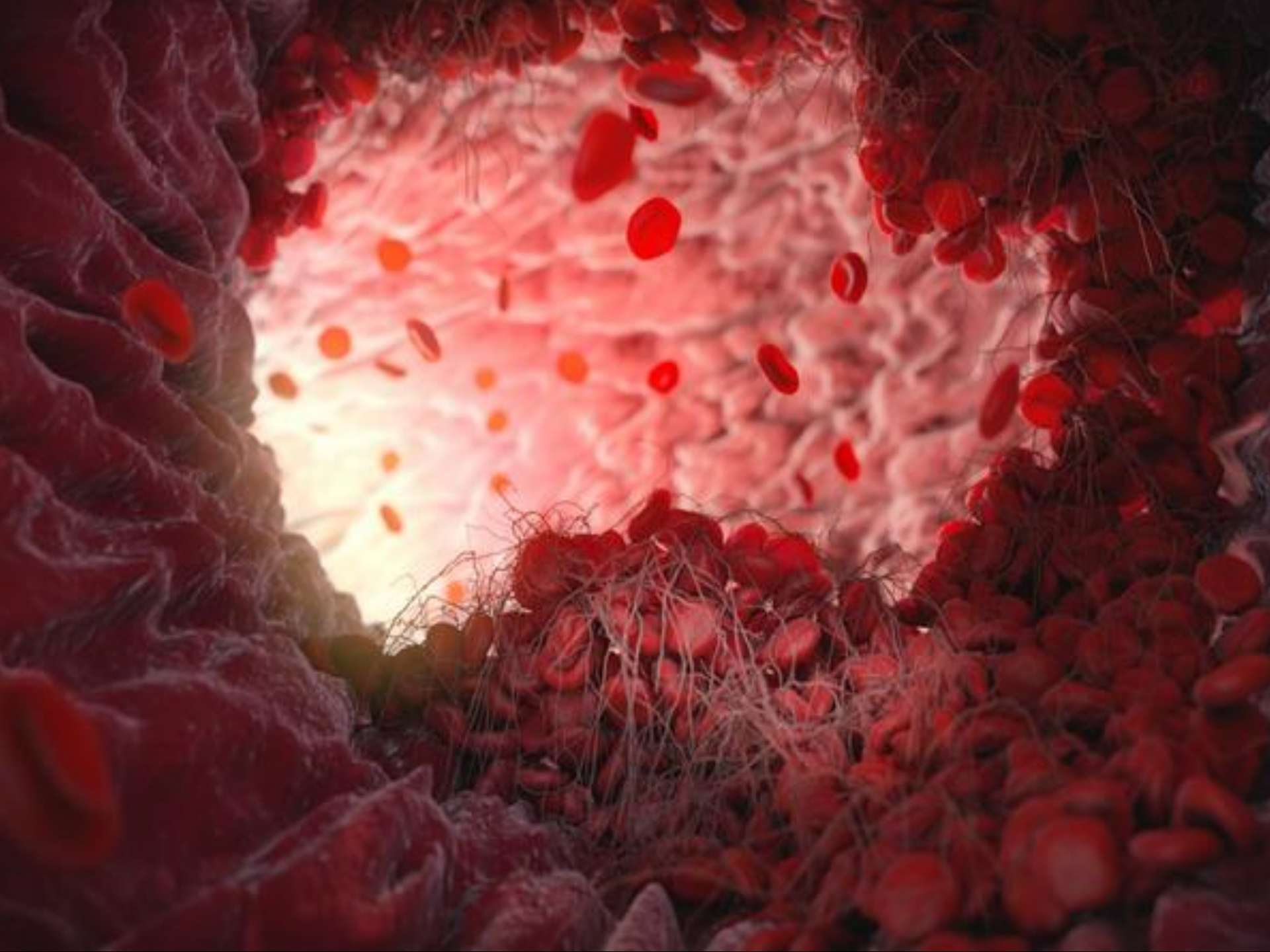
Akut Kritisk Syge patienter udviser samme unike type endotheliopati som øger dødeligheden

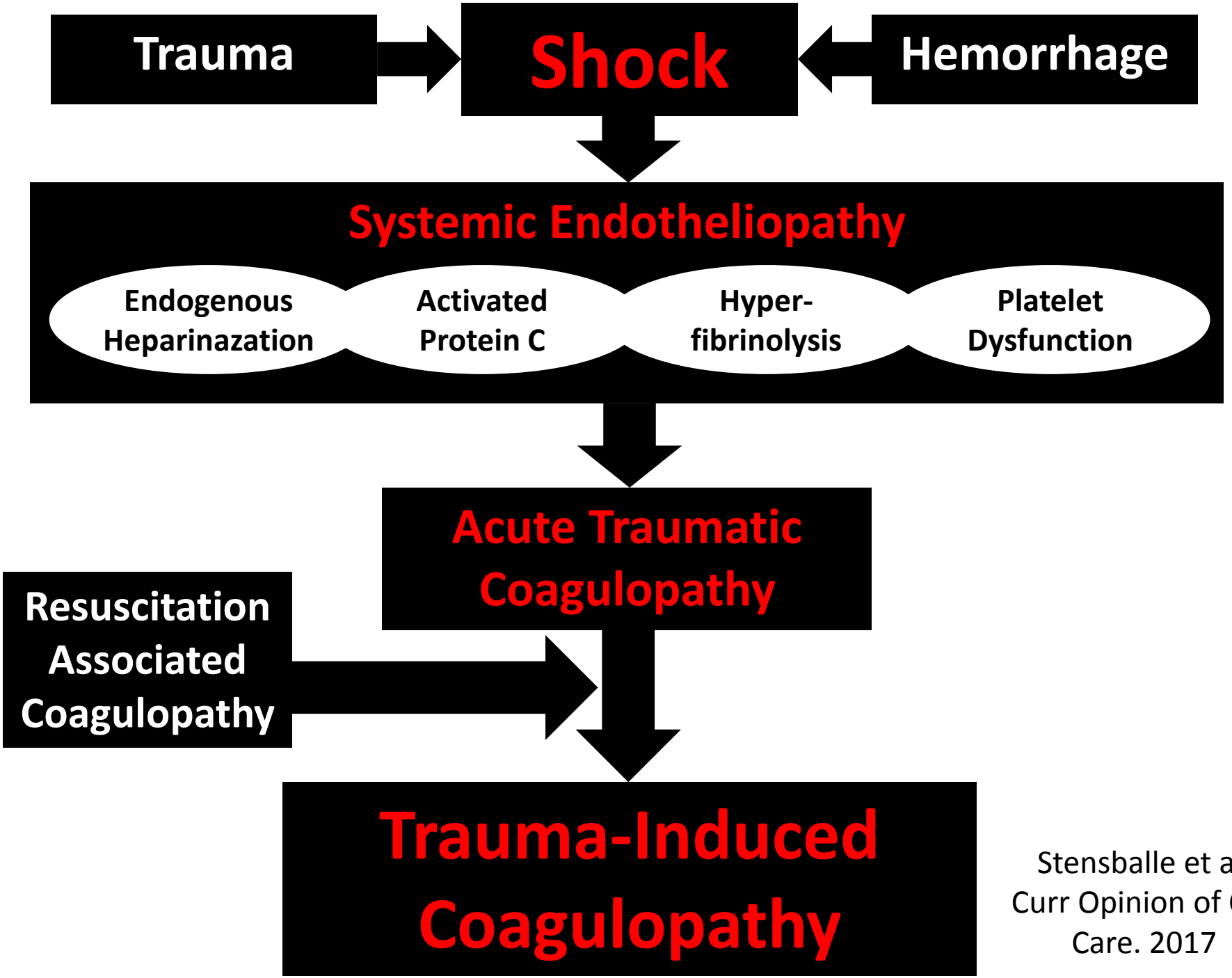
SHock-INduced Endotheliopathy

SHINE



Johansson, Stensballe & Ostrowski. Crit Care. 2017



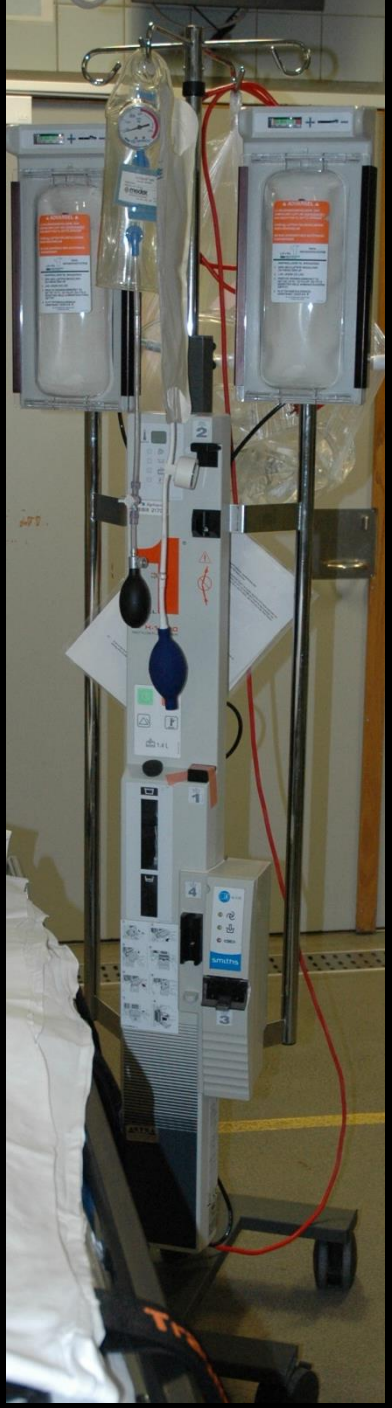


Stensballe et al.
Curr Opinion of Crit Care. 2017

Livstruende
blødning

1:1:1

3:3:1-4:4:2

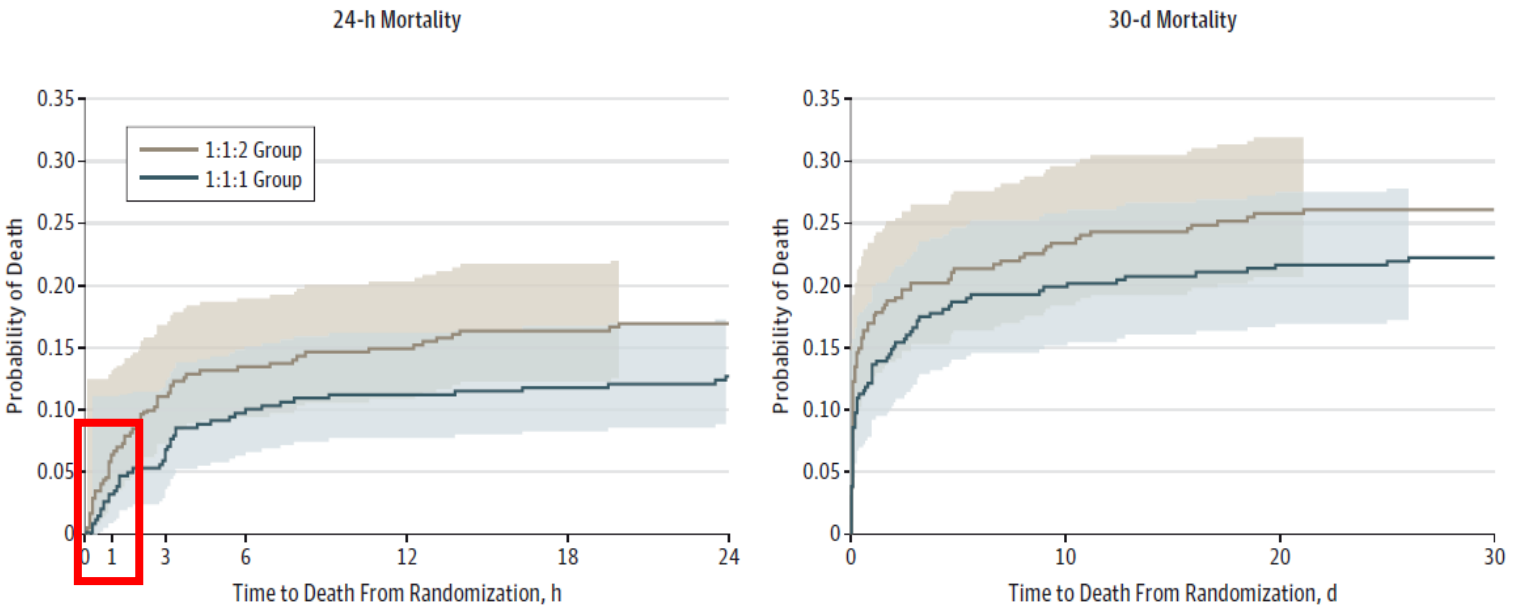


Original Investigation

Transfusion of Plasma, Platelets, and Red Blood Cells in a 1:1:1 vs a 1:1:2 Ratio and Mortality in Patients With Severe Trauma

The PROPPR Randomized Clinical Trial

Figure 2. Kaplan-Meier Failure Curves for Mortality at 24 Hours and 30 Days



No. at risk

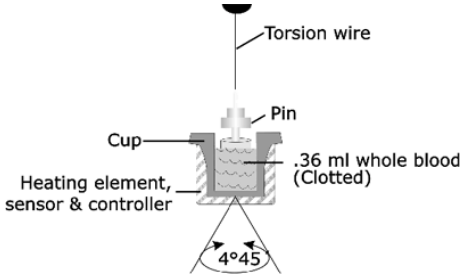
1:1:2	342	322	304	296	291	286	284	342	261	253	252
1:1:1	338	327	318	305	300	297	295	338	269	263	260

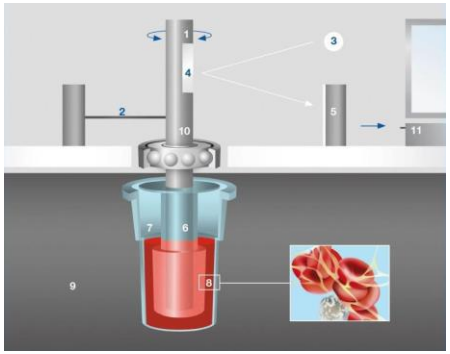
Holcomb et al. JAMA 2015

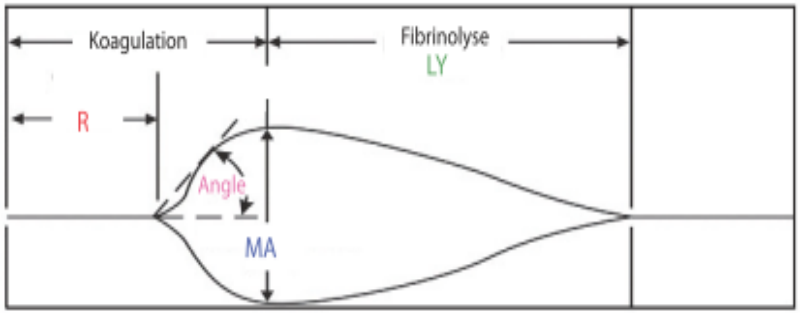
Viscoelastic Haemostatic Assays (VHA)

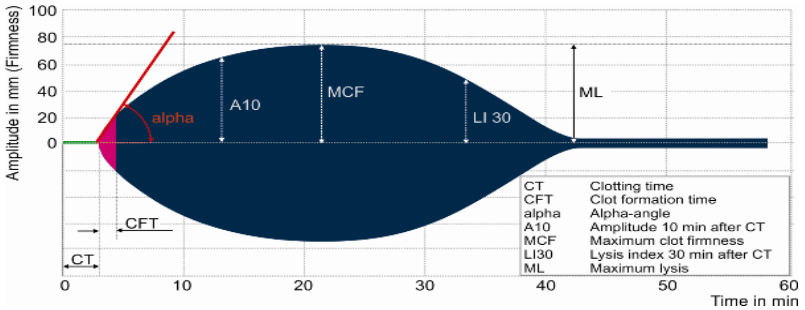
TEG®/ROTEM®

- Whole blood analysis
- Measures the viscoelsatical properties of the clot
- Multiple endpoints reflecting clot formation, strength & degradation
- Real-time (15 min.)









Thromboelastography (TEG) or thromboelastometry (ROTEM) to monitor haemostatic treatment versus usual care in adults or children with bleeding (Review)

Wikkelsø A, Wetterslev J, Møller AM, Afshari A

Cochrane Library

Cochrane Database of Systematic Reviews

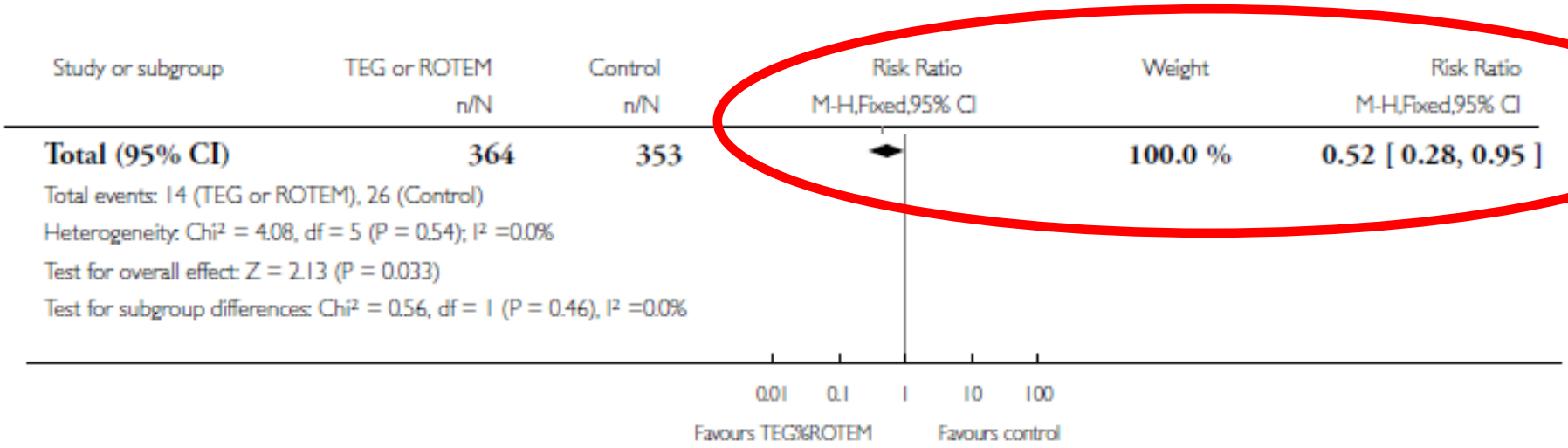
Cochrane Database of Systematic Reviews 2016, Issue 8. Art. No.: CD007871.

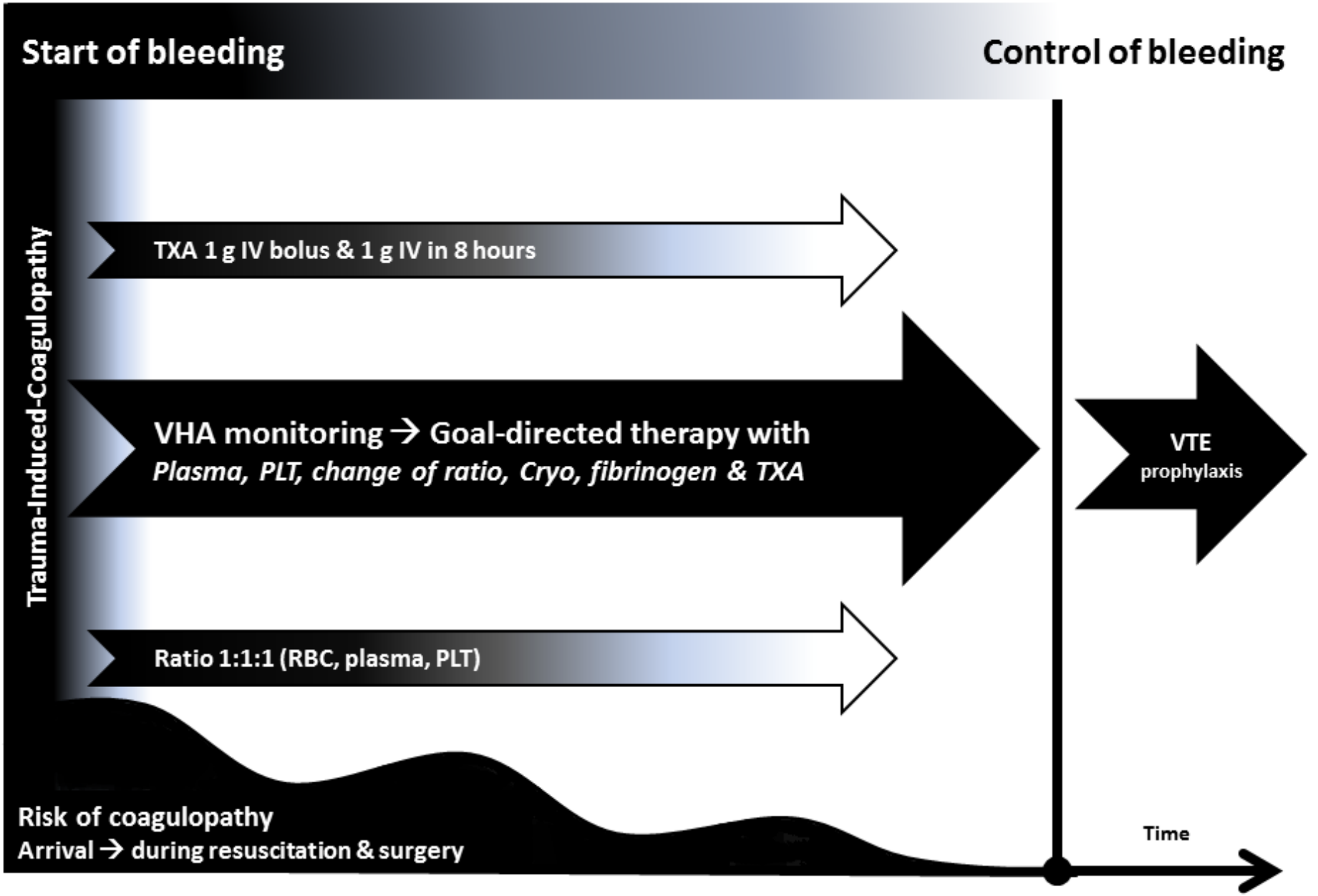
Analysis 1.1. Comparison 1 TEG or ROTEM versus any comparison, Outcome 1 Mortality; grouped by TEG or ROTEM.

Review: Thromboelastography (TEG) or thromboelastometry (ROTEM) to monitor haemostatic treatment versus usual care in adults or children with bleeding

Comparison: 1 TEG or ROTEM versus any comparison

Outcome: 1 Mortality; grouped by TEG or ROTEM





Stensballe et al. Curr Opinion of Crit Care. 2017

TRAUME-INDUCERET KOAGULOPATI

1. Øger dødeligheden, ses hos 30-40%!

2. Aggressiv monitorering & behandling!!

3. Udløses af systemisk endotheliopati (**SHINE**), og fremtidens resuscitation vil fokuserer på genskabelse af normal endothelfunktion