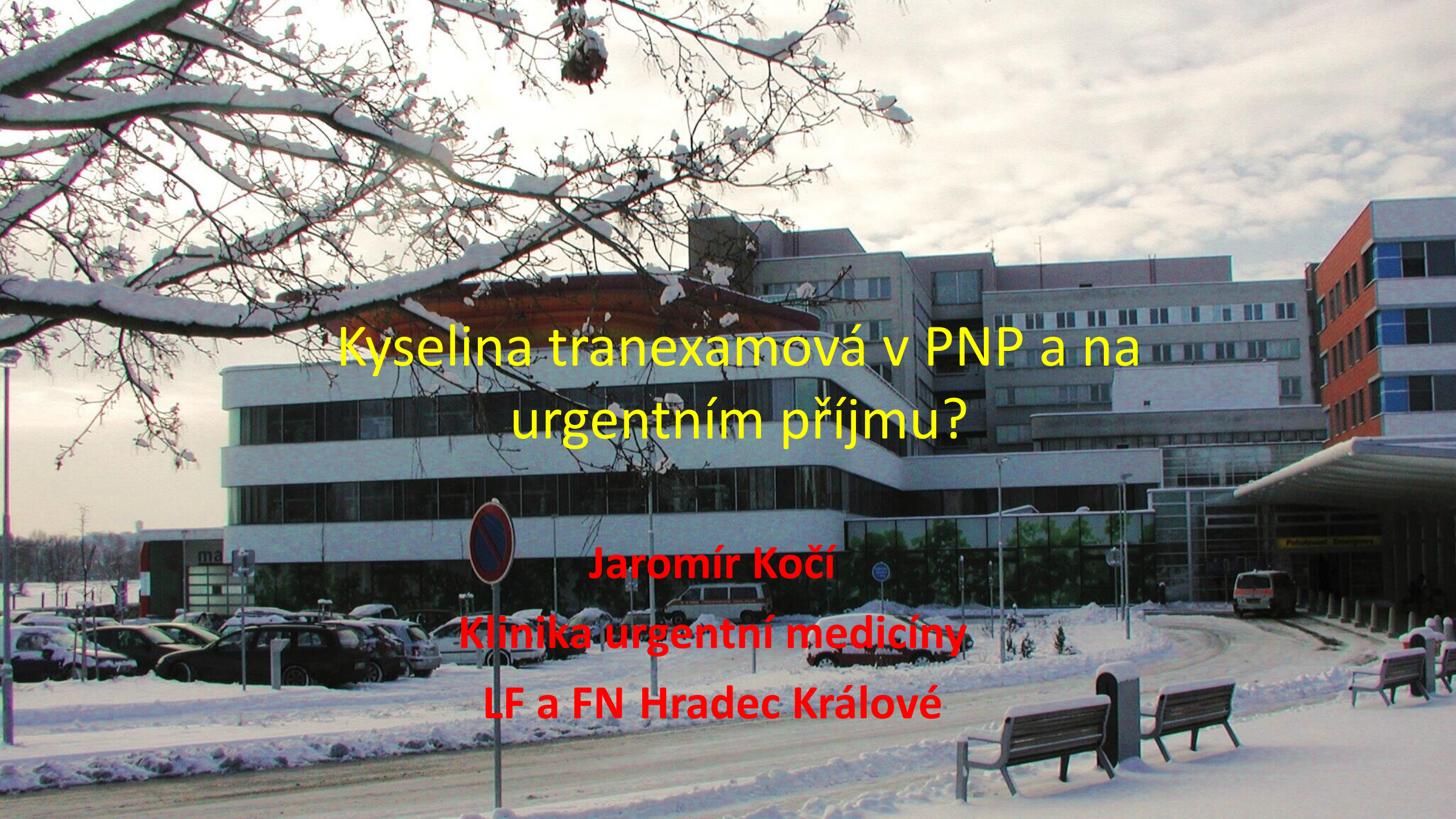


Kyselina tranexamová v PNP a na urgentním příjmu?

Jaromír Kočí

Klinika urgentní medicíny

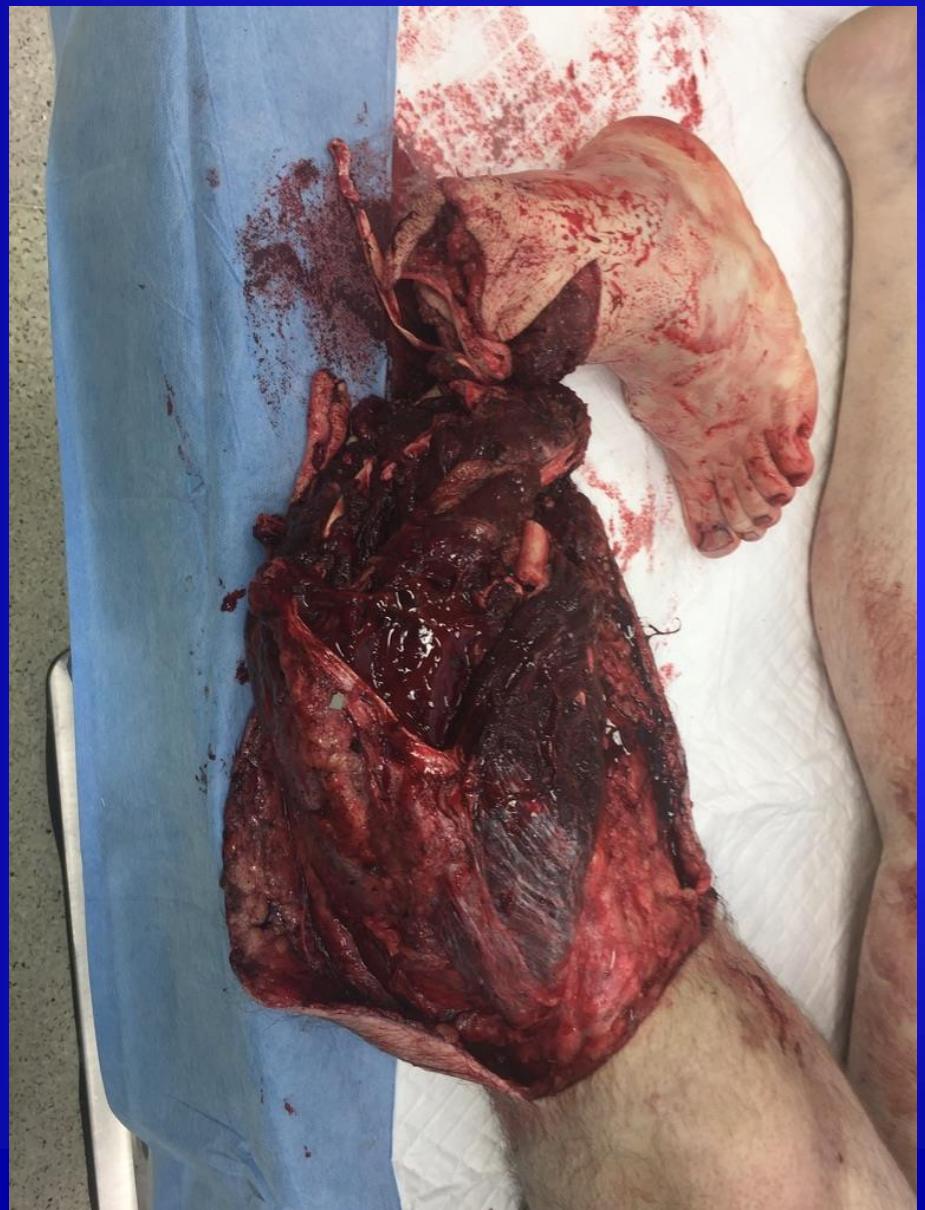
LF a FN Hradec Králové

Střet zájmů

- Žádný

- Exacyl jsem nikdy nepodal (bez znalosti ROTEM!)

Dostal tento pacient TXA?




Jestli ten Exacyl nedáš, tak si u mě mrtvej Homolka!!!

Exacyl podán....

- …a co hemostáza?
- …a co tepelný komfort?
- …a co rychlý transport?


www.miramax.com

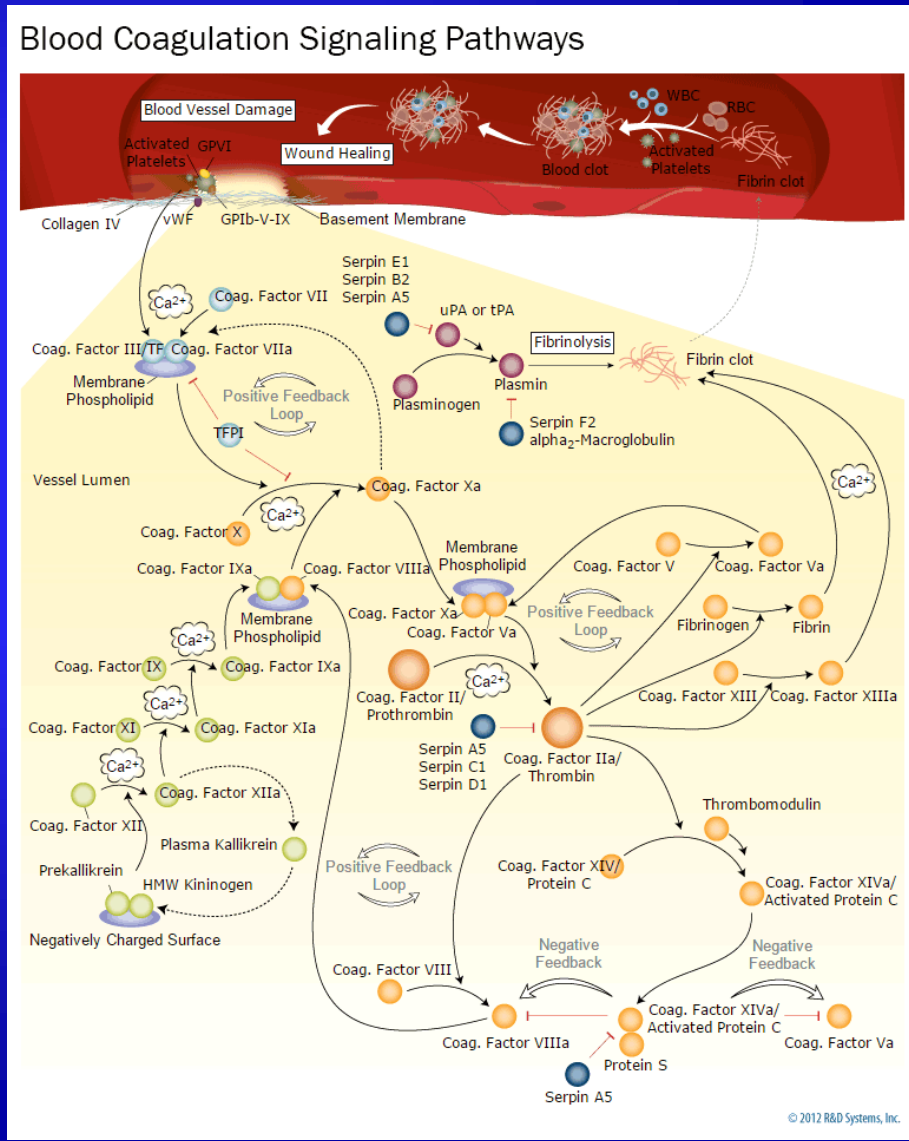

I'm Winston EXACYL I solve problems
www.miramax.com

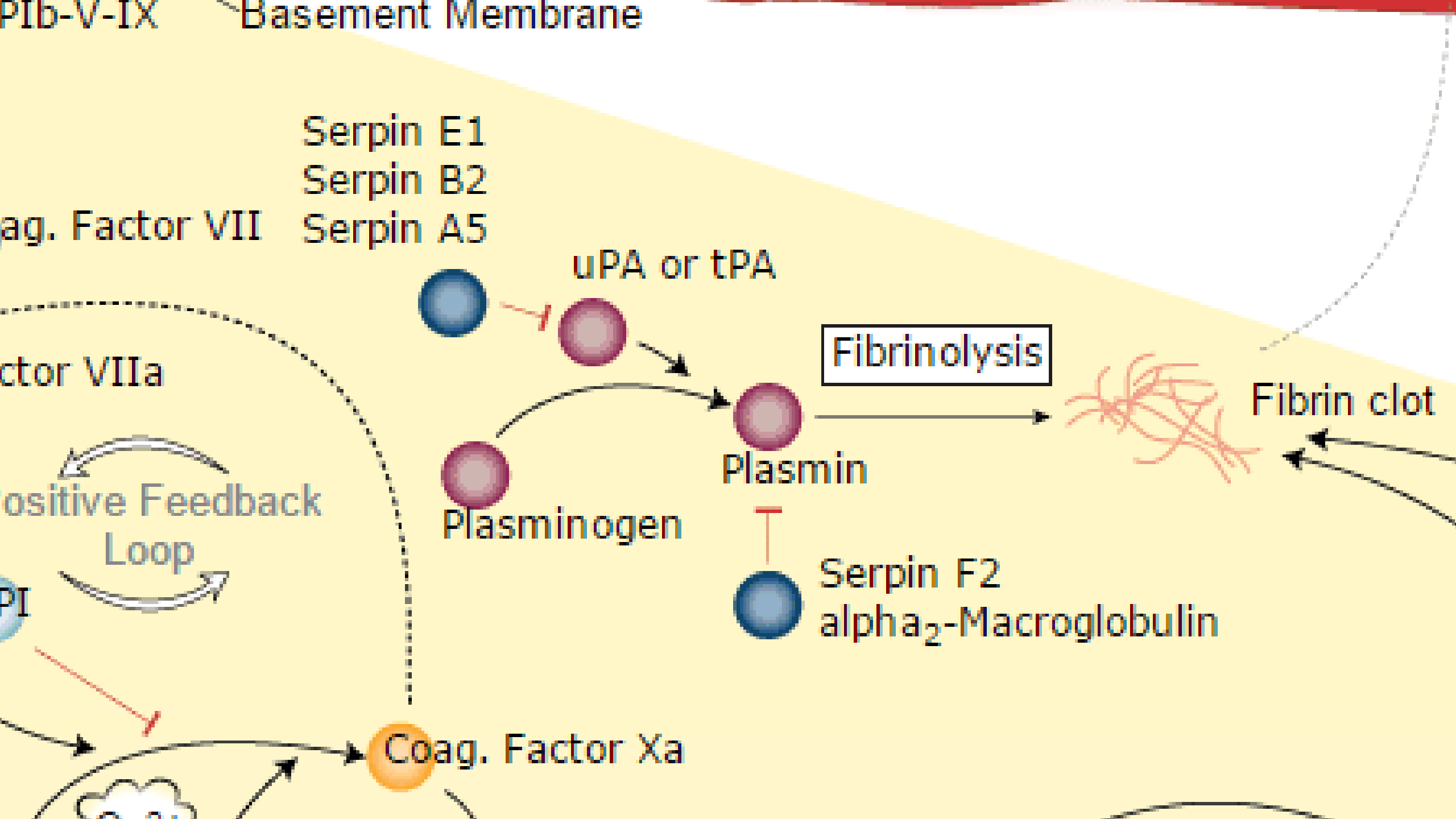
Exacyl – TXA

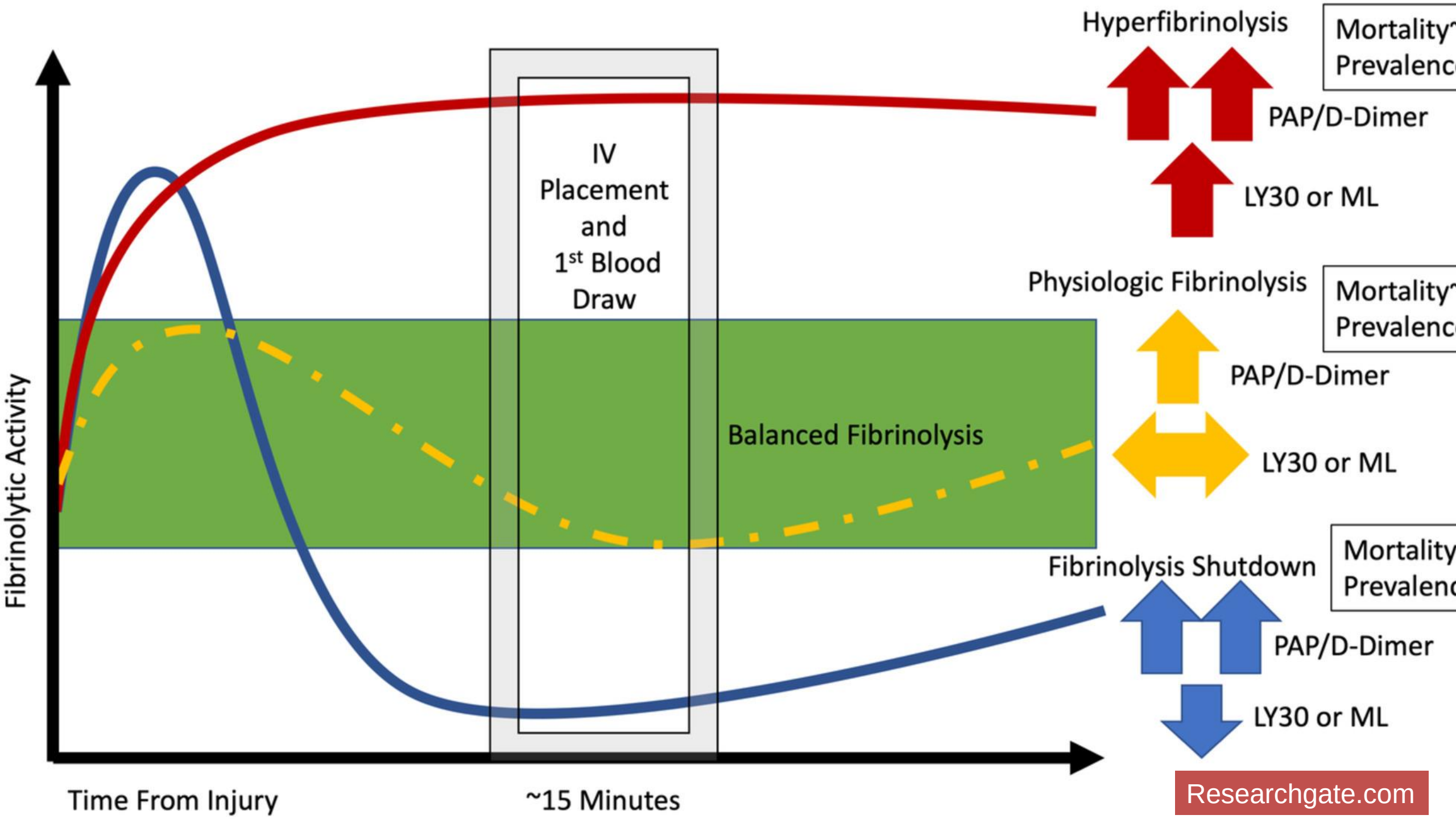
- Antifibrinolytikum
- **Neřeší problémy = nezastavuje krvácení!**
- Snižuje fibrinolýzu

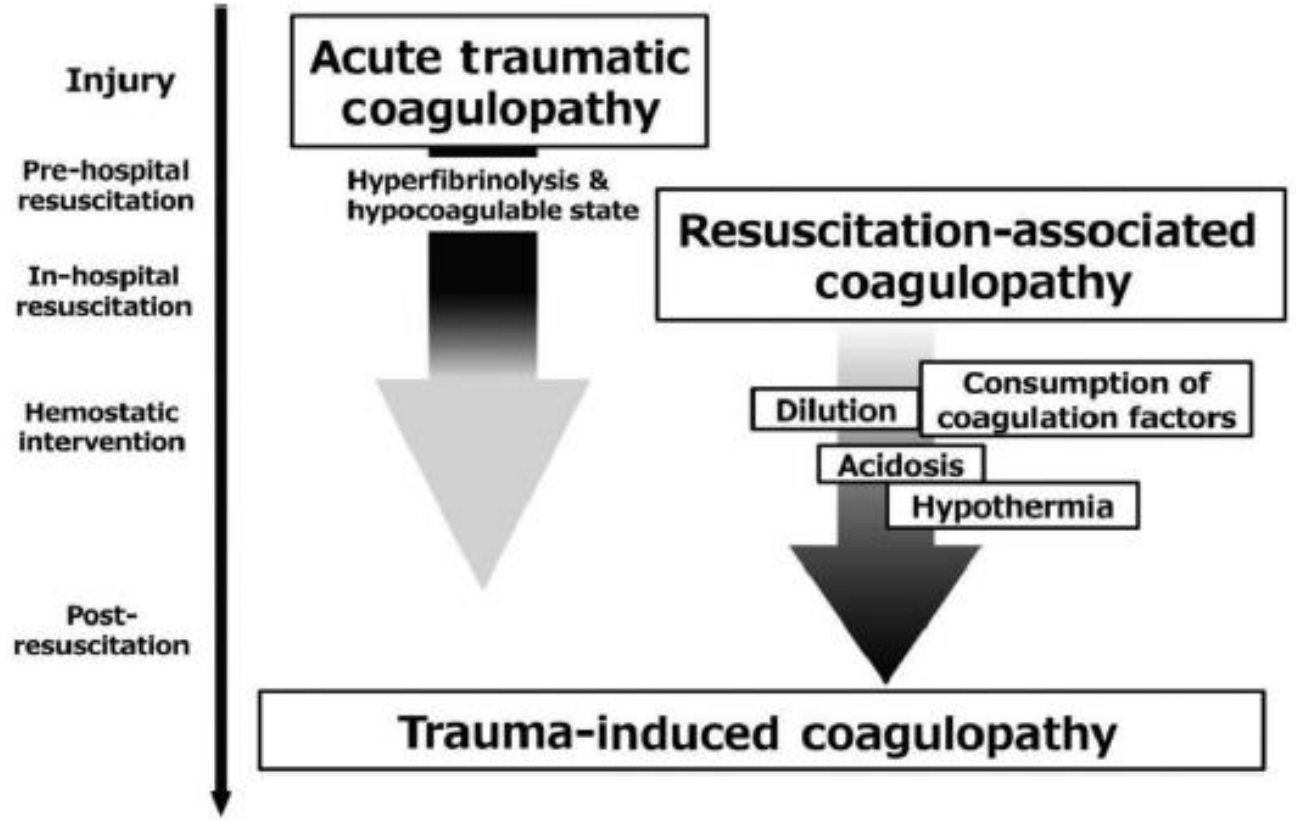
Fibrinolýza

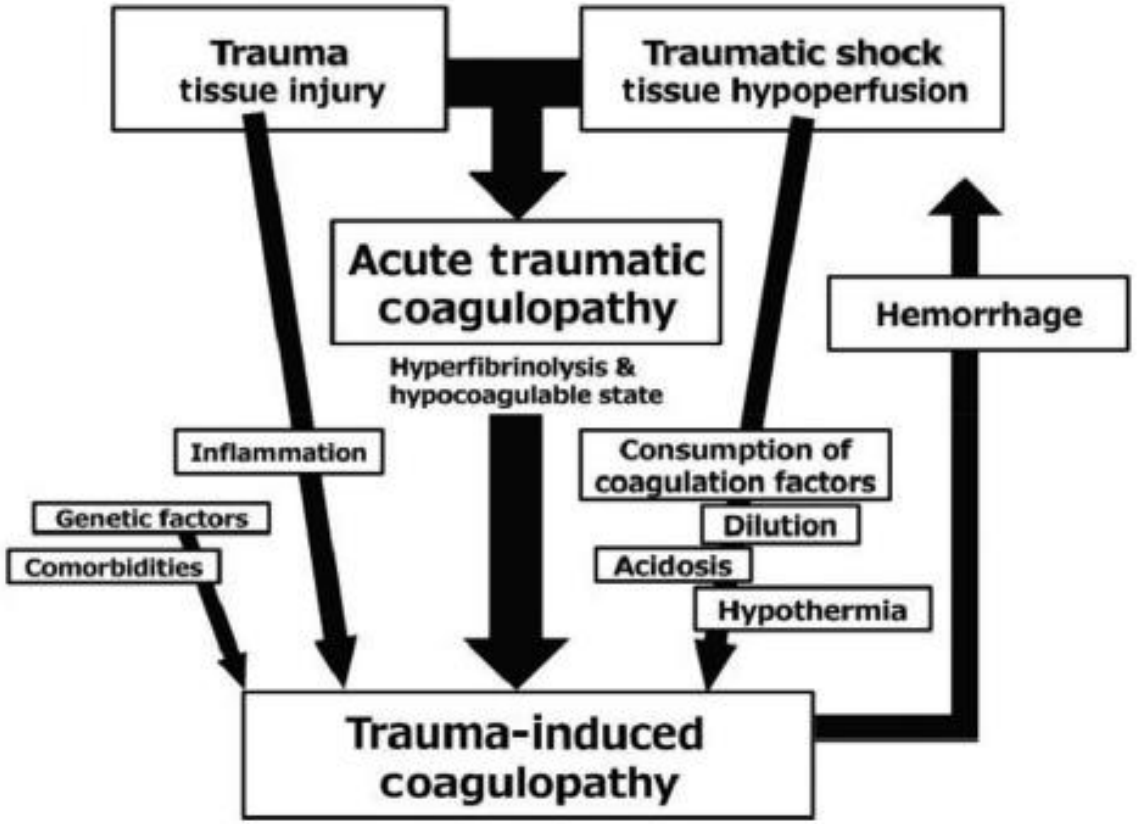
- Fyziologický děj
- Ochrana organizmu
- Startuje ihned po traumatu




PIb-V-IX
Basement Membrane
Serpin E1
Serpin B2
Serpin A5
ag. Factor VII
uPA or tPA
ctor VIIa
Fibrinolysis
Fibrin clot
ositive Feedback
Loop
Plasminogen
Plasmin
PI
Serpin F2
alpha2-Macroglobulin
Coag. Factor Xa

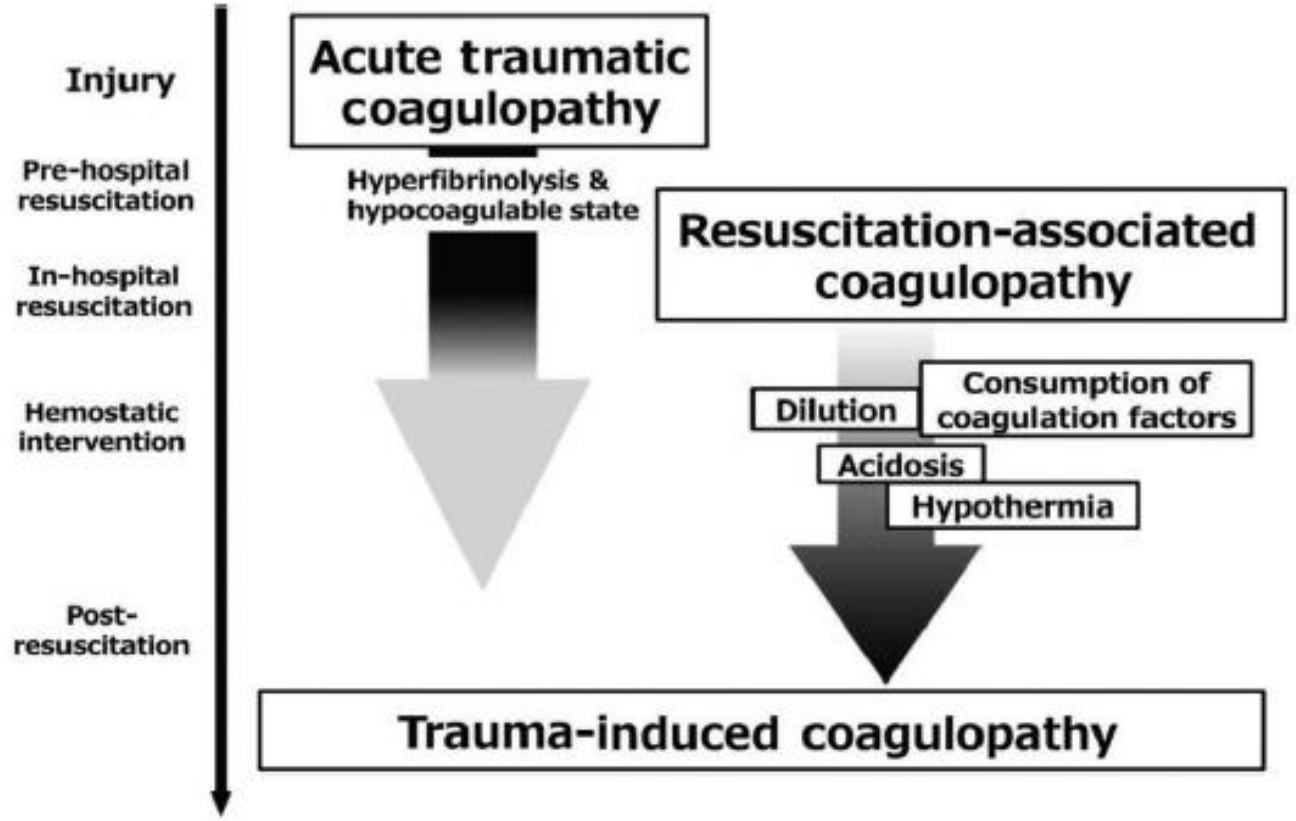



Injury
Pre-hospital resuscitation
In-hospital resuscitation
Hemostatic intervention
Post-resuscitation
Acute traumatic coagulopathy
Hyperfibrinolysis & hypocoagulable state
Resuscitation-associated coagulopathy
Dilution
Consumption of coagulation factors
Acidosis
Hypothermia
Trauma-induced coagulopathy


Trauma tissue injury
Traumatic shock tissue hypoperfusion
Acute traumatic coagulopathy
Hyperfibrinolysis & hypocoagulable state
Hemorrhage
Inflammation
Genetic factors
Comorbidities
Consumption of coagulation factors
Dilution
Acidosis
Hypothermia
Trauma-induced coagulopathy

Acute traumatic coagulopathy

Hyperfibrinolysis & hypocoagulable state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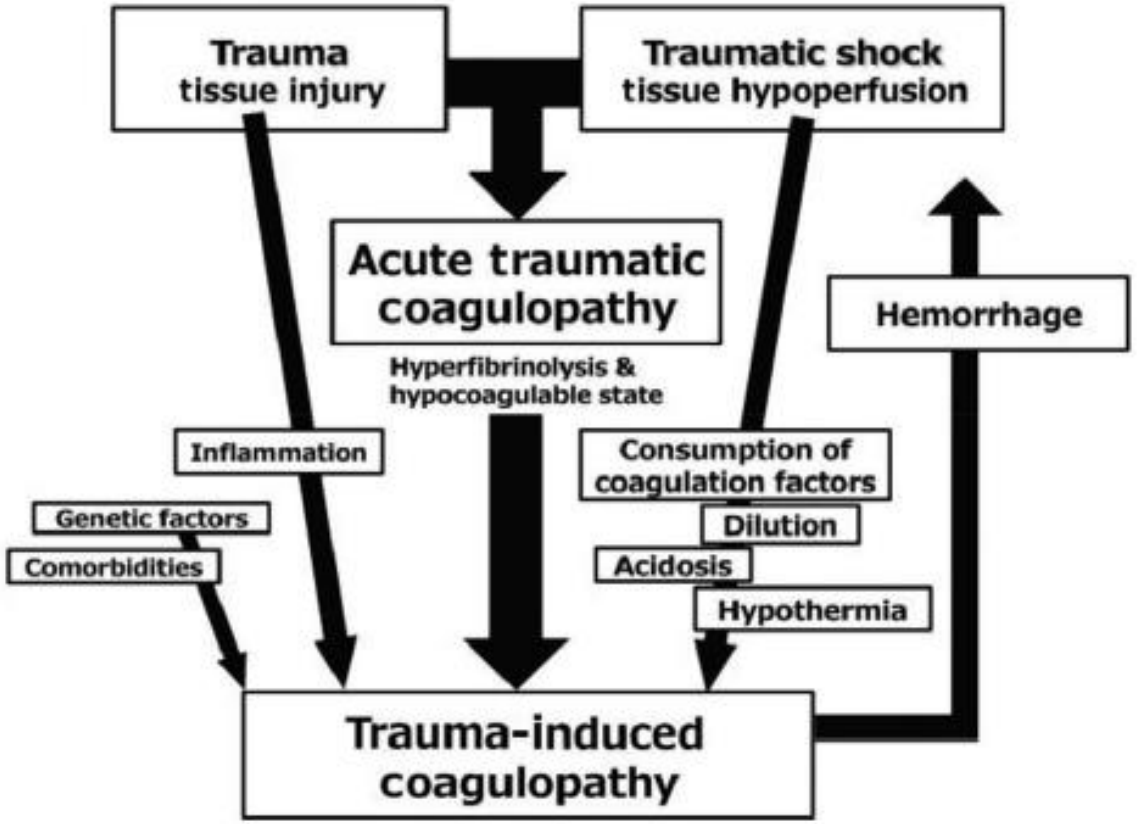
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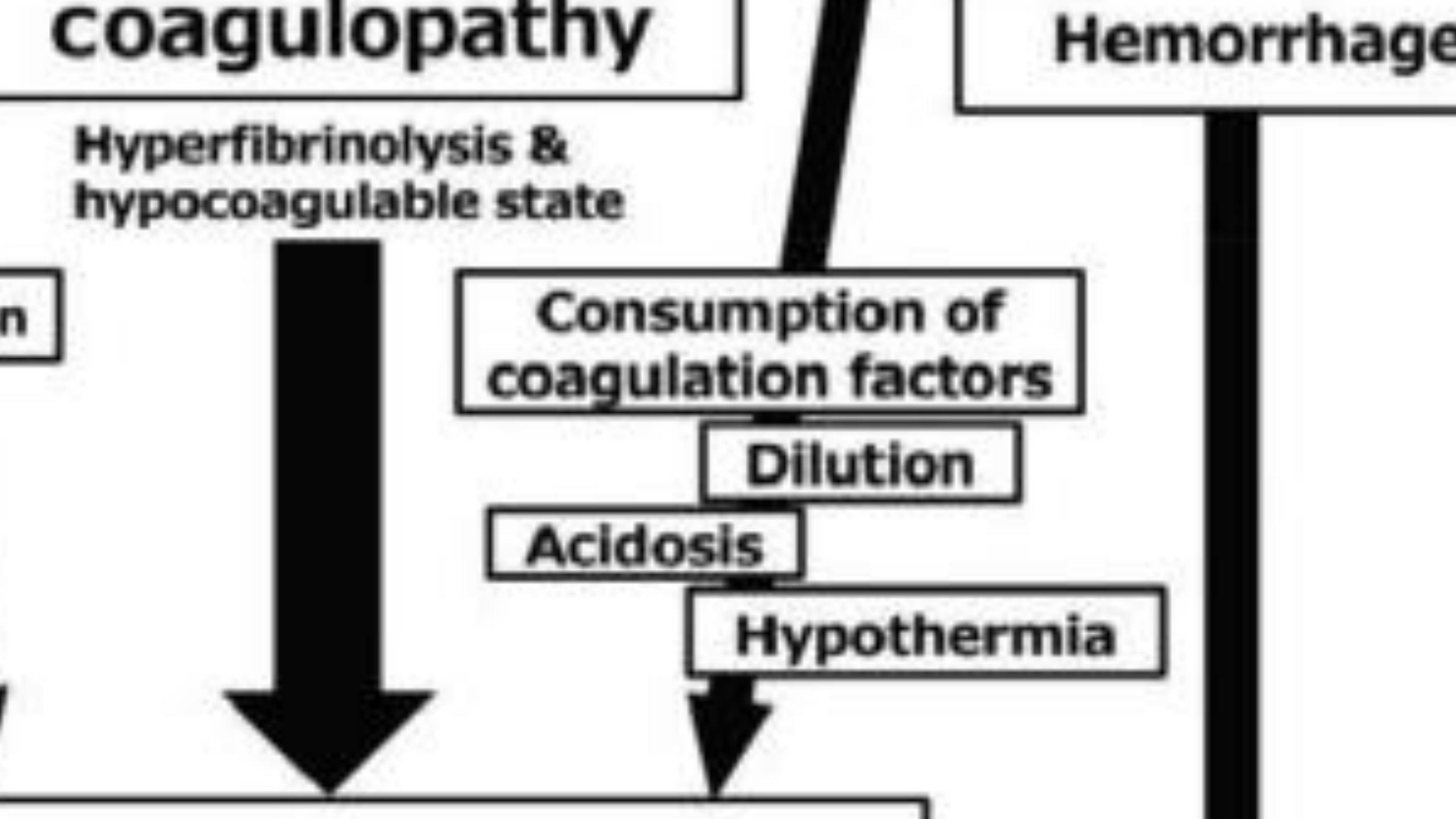
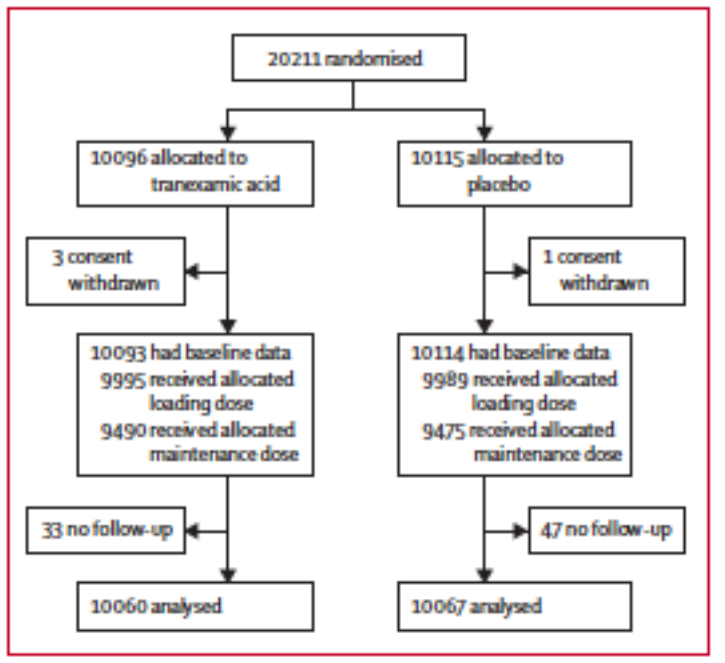

coagulopathy
Hemorrhage
Hyperfibrinolysis &
hypocoagulable state
Consumption of
coagulation factors
Dilution
Acidosis
Hypothermia

CRASH-2 trial

Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

Lancet 2010; 376: 23-32



Adult trauma patients with significant haemorrhage (systolic blood pressure <90 mm Hg or heart rate >110 beats per min, or both), or who were considered to be at risk of significant haemorrhage, and who were within 8 h of injury, were eligible for the trial. Patients

CRASH-2 trial

	Tranexamic acid (n=10 060)	Placebo (n=10 067)	RR (95% CI)	p value (two-sided)
Any cause of death	1463 (14·5%)	1613 (16·0%)	0·91 (0·85–0·97)	0·0035
Bleeding	489 (4·9%)	574 (5·7%)	0·85 (0·76–0·96)	0·0077
Vascular occlusion*	33 (0·3%)	48 (0·5%)	0·69 (0·44–1·07)	0·096
Multiorgan failure	209 (2·1%)	233 (2·3%)	0·90 (0·75–1·08)	0·25
Head injury	603 (6·0%)	621 (6·2%)	0·97 (0·87–1·08)	0·60
Other causes	129 (1·3%)	137 (1·4%)	0·94 (0·74–1·20)	0·63

Data are number (%), unless otherwise indicated. RR=relative risk. * Includes myocardial infarction, stroke, and pulmonary embolism.

Table 2: Death by cause

admission. Finally, fewer deaths occurred in patients allocated to tranexamic acid than to placebo, and the patients who survived as a result of tranexamic acid administration would have had a greater opportunity to receive a blood transfusion (competing risks).

CRASH-2 trial

- ALE…..
  - Pouze 50 % pacientů vyžadovalo operaci
  - Pouze 50 % pacientů vyžadovalo transfúzi
  - Dávkové schéma neodpovídající SPC
  - Pod dohledem FDA by byla zastavena po 1000 pacientech

JAMA Surgery | Original Investigation

Tranexamic Acid During Prehospital Transport in Patients at Risk for Hemorrhage After Injury

A Double-blind, Placebo-Controlled, Randomized Clinical Trial

Francis X. Guyette, MD, MPH; Joshua B. Brown, MD, MSc; Mazen S. Zenati, MD, PhD; Barbara J. Early-Young, BSN; Peter W. Adams, BS; Brian J. Eastridge, MD; Raminder Nirula, MD, MPH; Gary A. Vercruysse, MD; Terence O'Keeffe, MD; Bellal Joseph, MD; Louis H. Alarcon, MD; Clifton W. Callaway, MD, PhD; Brian S. Zuckerbraun, MD; Matthew D. Neal, MD; Raquel M. Forsythe, MD; Matthew R. Rosengart, MD, MPH; Timothy R. Billiar, MD; Donald M. Yealy, MD; Andrew B. Peitzman, MD; Jason L. Sperry, MD, MPH; and the STAAMP Study Group

JAMA Surg. 2021;156(1):11-20. doi:10.1001/jamasurg.2020.4350
Published online October 5, 2020. Corrected on December 2, 2020.

CONCLUSIONS AND RELEVANCE In injured patients at risk for hemorrhage, tranexamic acid administered before hospitalization did not result in significantly lower 30-day mortality. The

An association with decreased mortality was found in the subgroup of patients who had the highest shock severity based on qualifying prehospital vital sign inclusion criteria. Al-

ORIGINAL ARTICLE

ONLINE FIRST

Military Application of Tranexamic Acid in Trauma Emergency Resuscitation (MATTERs) Study

Jonathan J. Morrison, MB ChB, MRCS; Joseph J. Dubose, MD; Todd E. Rasmussen, MD; Mark J. Midwinter, BMedSci, MD, FRCS

Arch Surg. 2012;147(2):113-119. Published online October 17, 2011. doi:10.1001/archsurg.2011.287

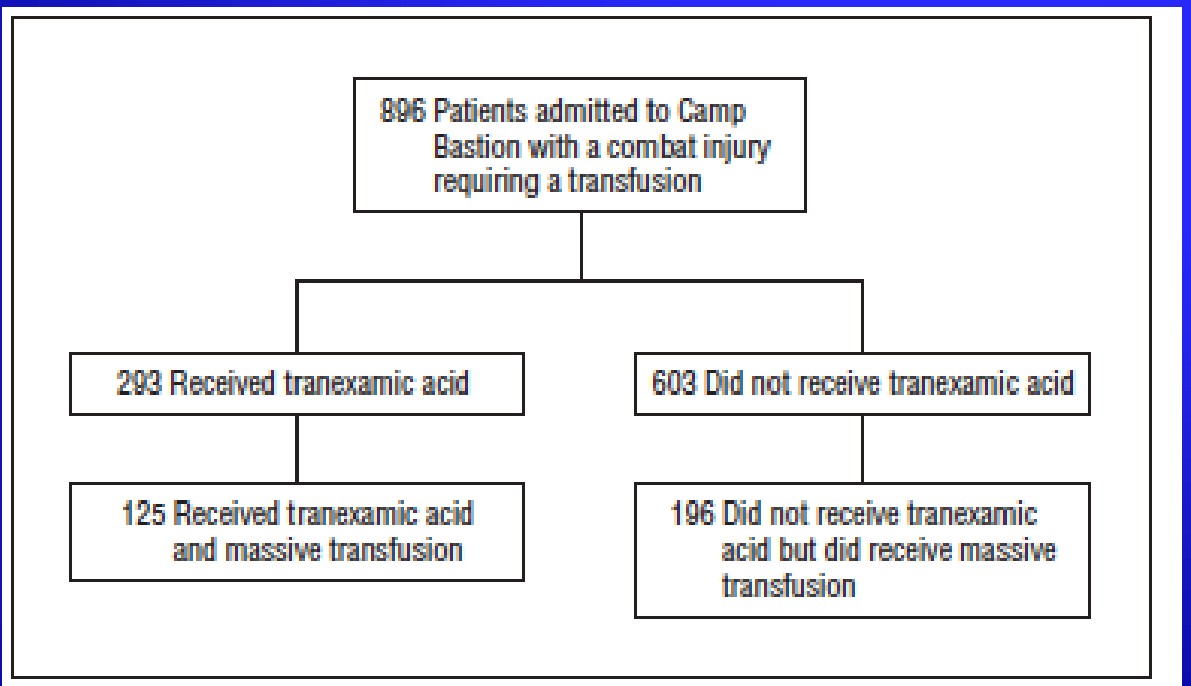
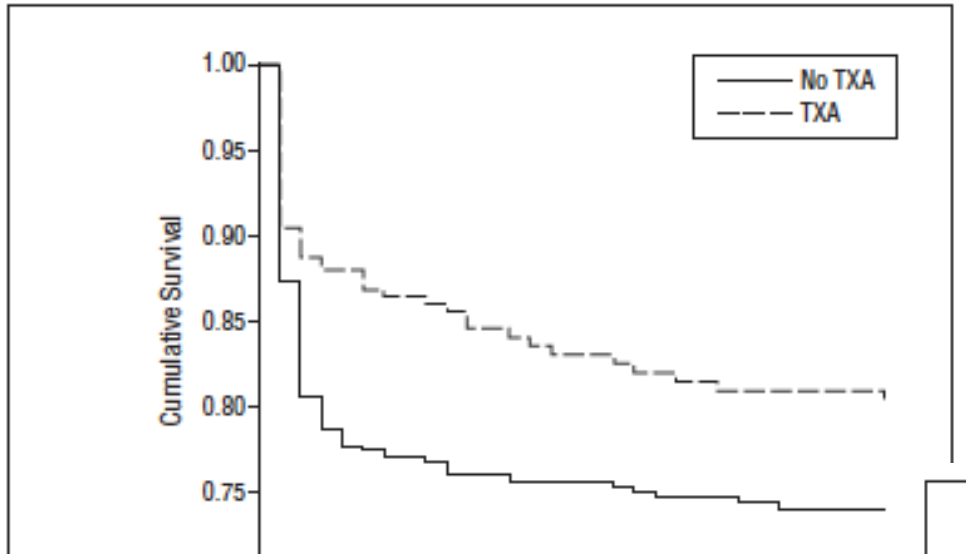


Figure 1. Study profile illustrating the overall cohort and study groups.



Penetrující trauma hrudníku, crush končetin

log-rank test.

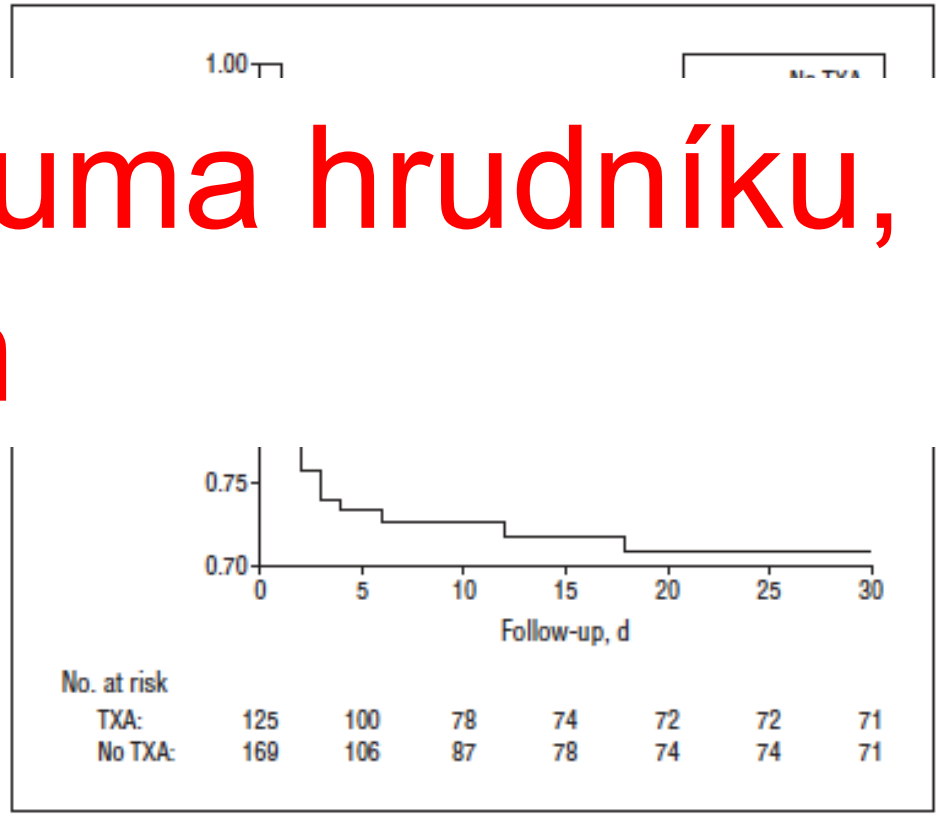
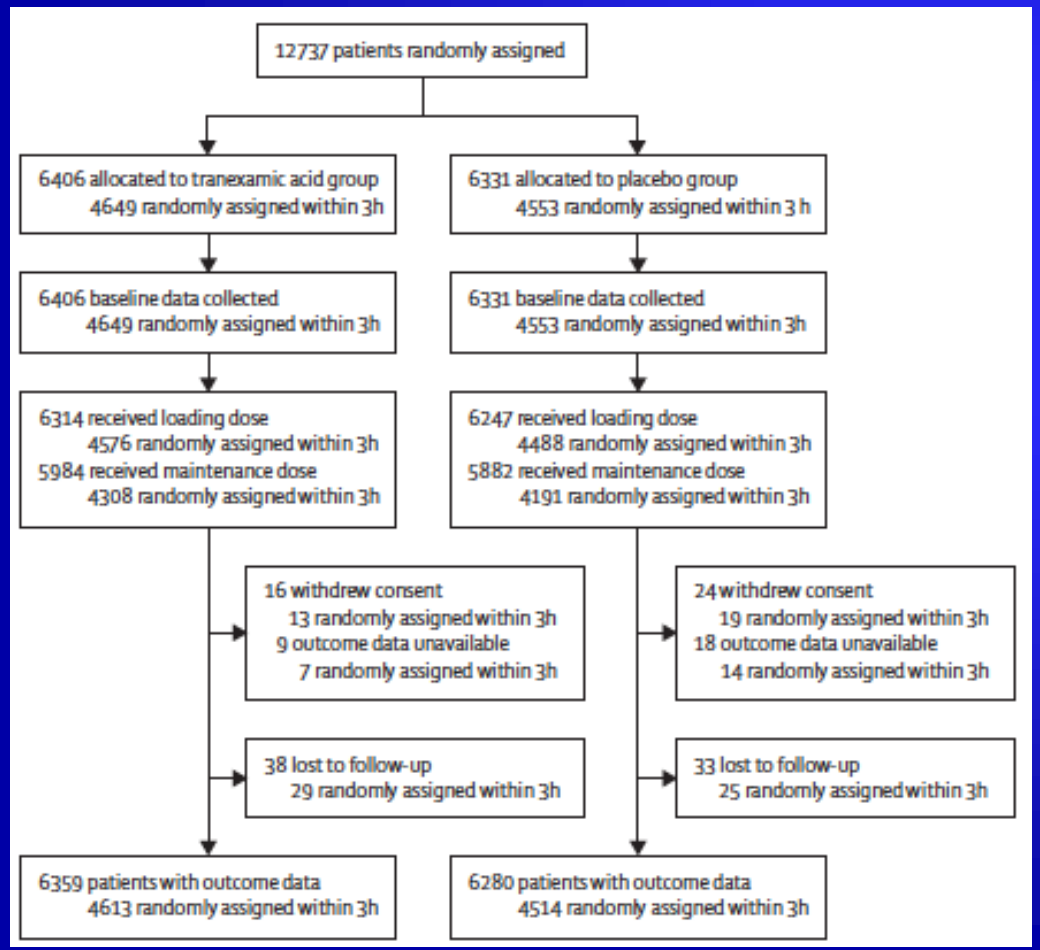


Figure 4. Kaplan-Meier survival curve of the massive transfusion group receiving tranexamic acid (TXA) or no TXA. *P*=.004, Mantel-Cox log-rank test.

Effects of tranexamic acid on death, disability, vascular occlusive events and other morbidities in patients with acute traumatic brain injury (CRASH-3): a randomised, placebo-controlled trial

Lancet 2019; 394: 1713–23



GCS 9-12!

This trial provides evidence that the administration of tranexamic acid to patients with TBI within 3 h of injury reduces head injury-related death, with no evidence of adverse effects or complications. We found

JAMA | Original Investigation

Effect of Out-of-Hospital Tranexamic Acid vs Placebo on 6-Month Functional Neurologic Outcomes in Patients With Moderate or Severe Traumatic Brain Injury

Susan E. Rowell, MD, MBA; Eric N. Meier, MS; Barbara McKnight, PhD; Delores Kannas, RN, MS, MHA; Susanne May, PhD; Kellie Sheehan, RN; Eileen M. Bulger, MD; Ahamed H. Idris, MD; Jim Christenson, MD; Laurie J. Morrison, MD; Ralph J. Frascone, MD; Patrick L. Bosarge, MD; M. Riccardo Colella, DO, MPH; Jay Johannigman, MD; Bryan A. Cotton, MD; Jeannie Callum, MD; Jason McMullan, MD; David J. Dries, MD; Brian Tibbs, MD; Neal J. Richmond, MD; Myron L. Weisfeldt, MD; John M. Tallon, MD, MSc; John S. Garrett, MD; Martin D. Zielinski, MD; Tom P. Aufderheide, MD; Rajesh R. Gandhi, MD, PhD; Rob Schlamp; Bryce R. H. Robinson, MD; Jonathan Jui, MD, MPH; Lauren Klein, MD, MS; Sandro Rizoli, MD; Mark Gamber, DO; Michael Fleming, BA; Jun Hwang, MS; Laura E. Vincent, RN; Carolyn Williams, RN; Audrey Hendrickson, MPH; Robert Simonson, DO; Patricia Klotz, RN; George Sopko, MD; William Witham, MD; Michael Ferrara, MS; Martin A. Schreiber, MD

TRIAL REGISTRATION ClinicalTrials.gov Identifier: NCT01990768
JAMA. 2020;324(10):961-974. doi:10.1001/jama.2020.8958
Corrected on October 27, 2020.

Conclusions

Among patients with moderate or severe TBI, out-of-hospital tranexamic acid administration within 2 hours of injury did not improve 6-month neurologic outcome as measured by the GOSE.

Do all trauma patients benefit from tranexamic acid?

Evan J. Valle, MD, Casey J. Allen, MD, Robert M. Van Haren, MD, MSPH, Jassin M. Jouria, MD, Hua Li, MD, PhD, Alan S. Livingstone, MD, Nicholas Namias, MD, MBA, Carl I. Schulman, MD, PhD, *and* **Kenneth G. Proctor, PhD,** *Miami, Florida*

TABLE 1. Comparison of Study Populations

	CRASH-2[1]	Present Study
n	20,211	300
Age	**35 ± 14**	**43 ± 20**
% male	84%	86%
Time since injury, h	**2.8–2.9**	**<1 (est)**
% penetrating	**32%**	**54%**
SBP< 75 mm Hg	**16%**	**35%**
SBP, 76–89 mm Hg	16%	16%
SBP > 90 mm Hg	**68%**	**48%**
Heart rate (HR) < 77 beats/min	**9%**	**24%**
HR, 77–91 beats/min	17%	15%
HR, 92–107 beats/min	25%	19%
HR > 107 beats/min	48%	42%
GCS score, 3–8	**18%**	**32%**
GCS score, 9–12	**13%**	**8%**
GCS score, 13–15	**68%**	**59%**
Mortality	**15%**	**27%**
Blood product transfusion	**50%**	**97%**
Surgical intervention	**48%**	**78%**

TABLE 3. Fluid Requirements and Other Outcomes

	No TXA (n = 150)	TXA (n = 150)	*p*
Emergency resuscitation area			
pRBC, mL	1,000 (1,000)	1,000 (750)	0.284
FFP, mL	920 ± 463	824 (593)	0.340
Crystalloid, mL	1,600 (1,950)	1,125 (1,531)	0.083
Total Fluid, mL	**2,675 (3,505)**	**2,250 (2,275)**	**0.025**
Operating room			
pRBC, mL	**1,500 (1,750)**	**2,250 (3,450)**	**0.002**
FFP, mL	**1,125 (1,250)**	**1,750 (2,500)**	**0.005**
Crystalloid, mL	4,500 (3,025)	4,000 (3,600)	0.605
Total fluid , mL	6,450 (5,100)	7,050 (8,859)	0.092
Estimated blood loss, mL	1,500 (2,413)	1,500 (3,350)	0.582
24-h totals			
pRBC, mL	**1,999 (2,000)**	**2,250 (4,188)**	**0.009**
FFP, mL	1,218 (1,060)	1,684 (2,996)	0.197
Crystalloid, mL	7,663 (5,701)	7,600 (6,137)	0.985
Total fluid, mL	10,675 (8,108)	12,102 (11,663)	0.890
Estimated blood loss, mL	1,450 (3,300)	1,528 (3,883)	0.173
Outcomes			
ICU, d	4 (14)	5 (18)	0.968
LOS, d	13 (28)	13 (24)	0.745
Mortality	23%	31%	0.091
Mortality (excluding DOA)	**17%**	**27%**	**0.024**

Crystalloid, lactated Ringer's or saline.

The impact of tranexamic acid on mortality in injured patients with hyperfibrinolysis

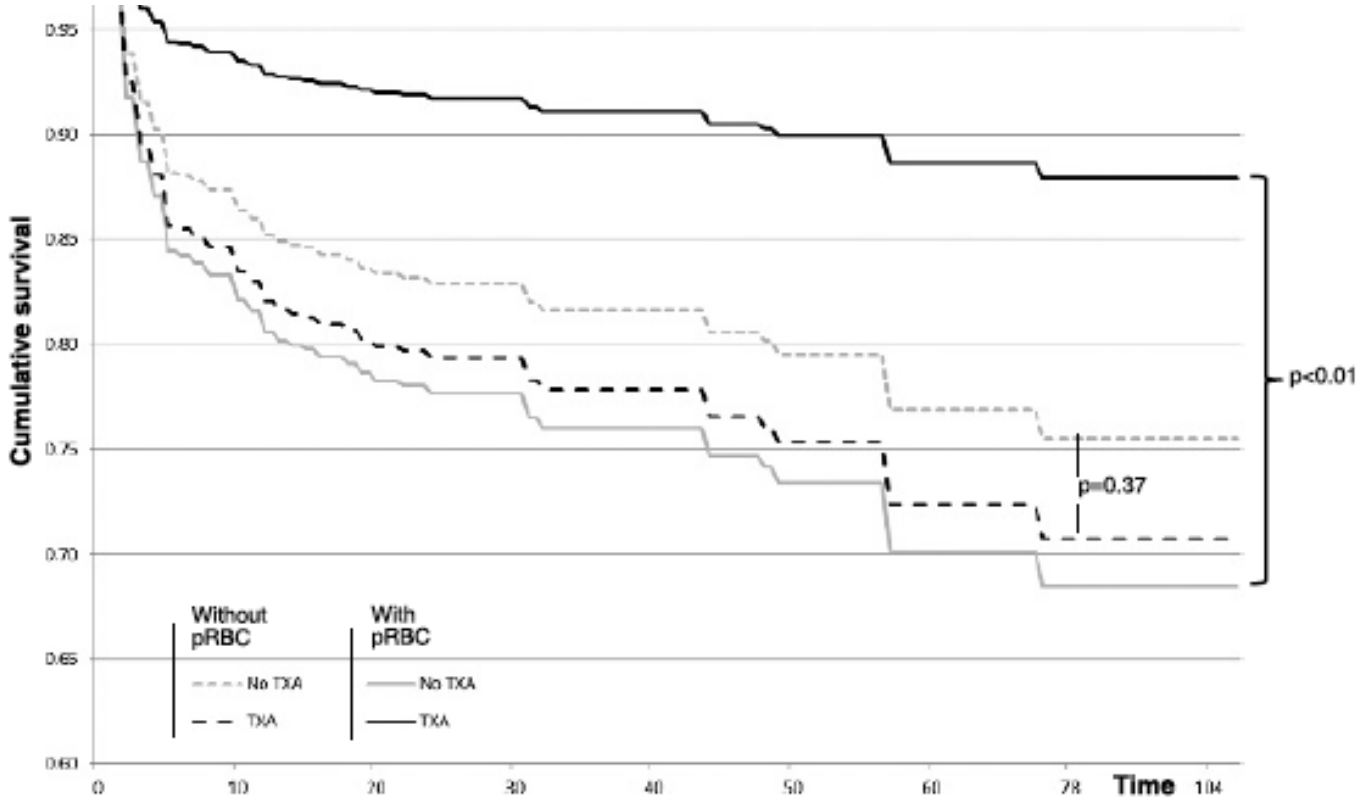
John A. Harvin, MD, Charles A. Peirce, Mark M. Mims, Jessica A. Hudson, MD, Jeanette M. Podbielski, RN, Charles E. Wade, PhD, John B. Holcomb, MD, *and* Bryan A. Cotton, MD, MPH, *Houston, Texas*

CONCLUSION

The administration of TXA in trauma patients with known HF was associated with increased 24-hour morality but no difference in in-hospital mortality after adjusting for severity of injury, age, and sex. While far from a definitive study,

Tranexamic acid in severe trauma patients managed in a mature trauma care system

Mathieu Boutonnet, MD, Paer Abback, MD, Frédéric Le Saché, MD, Anatole Harrois, MD, PhD, Arnaud Follin, MD, Nicolas Imbert, MD, Andrew P. Cap, MD, PhD, Julie Trichereau, Msc, Sylvain Ausset, MD, *and* **the Traumabase Group**, *Clamart Cedex, France*



Tranexamic acid administration is associated with an increased risk of posttraumatic venous thromboembolism

Sara P. Myers, MD, Matthew E. Kutcher, MD, Matthew R. Rosengart, MD, Jason L. Sperry, MD, Andrew B. Peitzman, MD, Joshua B. Brown, MD, *and* **Matthew D. Neal, MD,** *Pittsburgh, PA*

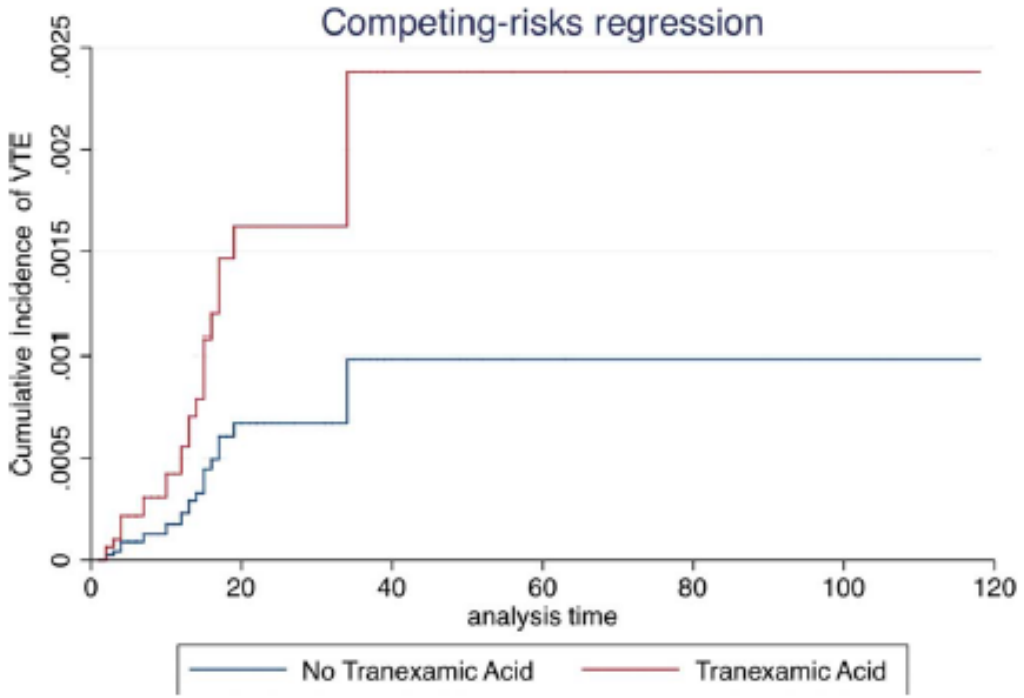


Figure 3. Cumulative incidence of venous thromboembolic events among patients who received TXA compared with those who did not using a competing-risks regression model.

Acute Fibrinolysis Shutdown after Injury Occurs Frequently and Increases Mortality: A Multicenter Evaluation of 2,540 Severely Injured Patients

Hunter B Moore, MD, Ernest E Moore, MD, FACS, Ioannis N Liras, MD, Eduardo Gonzalez, MD, John A Harvin, FACS, MD, John B Holcomb, MD, FACS, Angela Sauaia, MD, PhD, Bryan A Cotton, MD, MPH, FACS

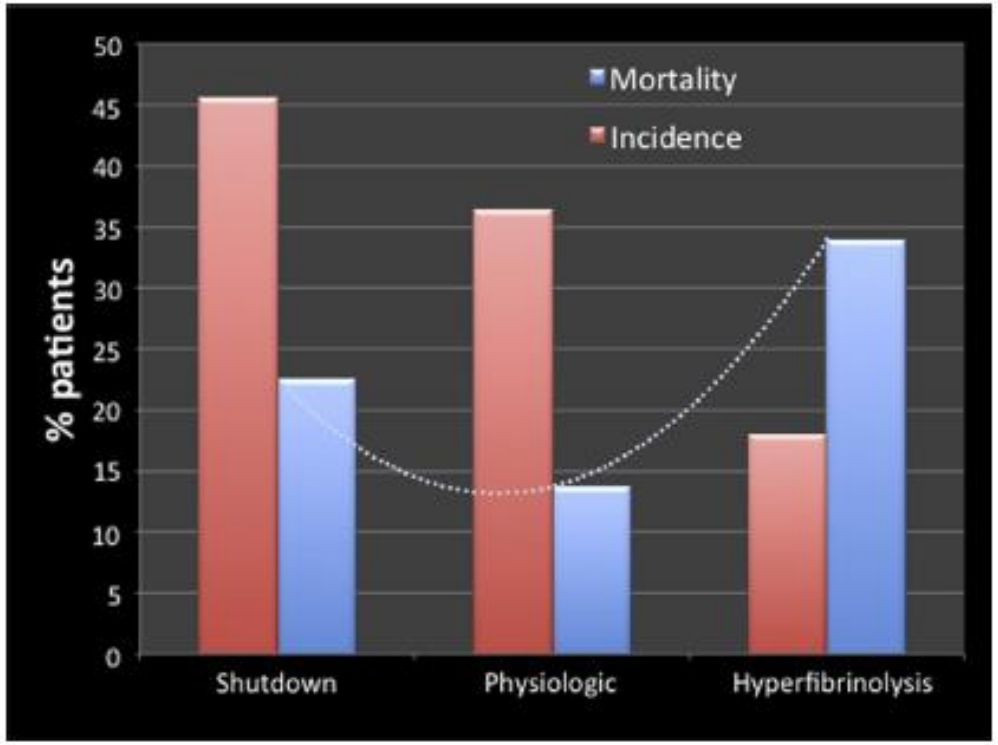


Figure 1. Incidence and mortality of severely injured trauma patients stratified by fibrinolysis phenotype.

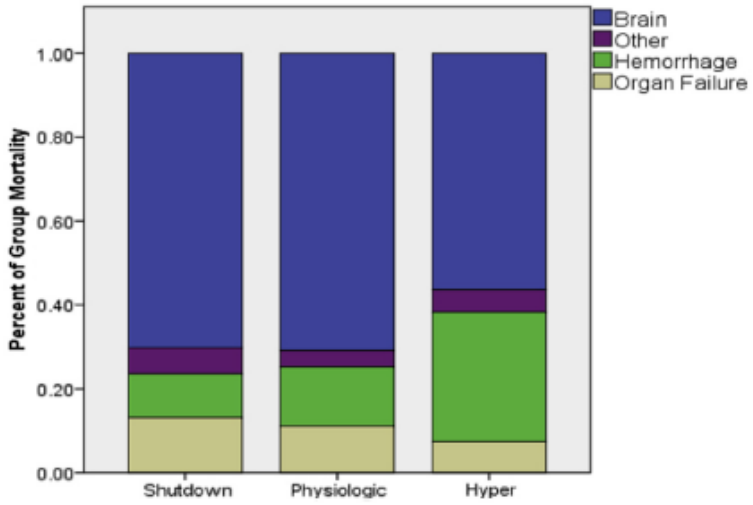
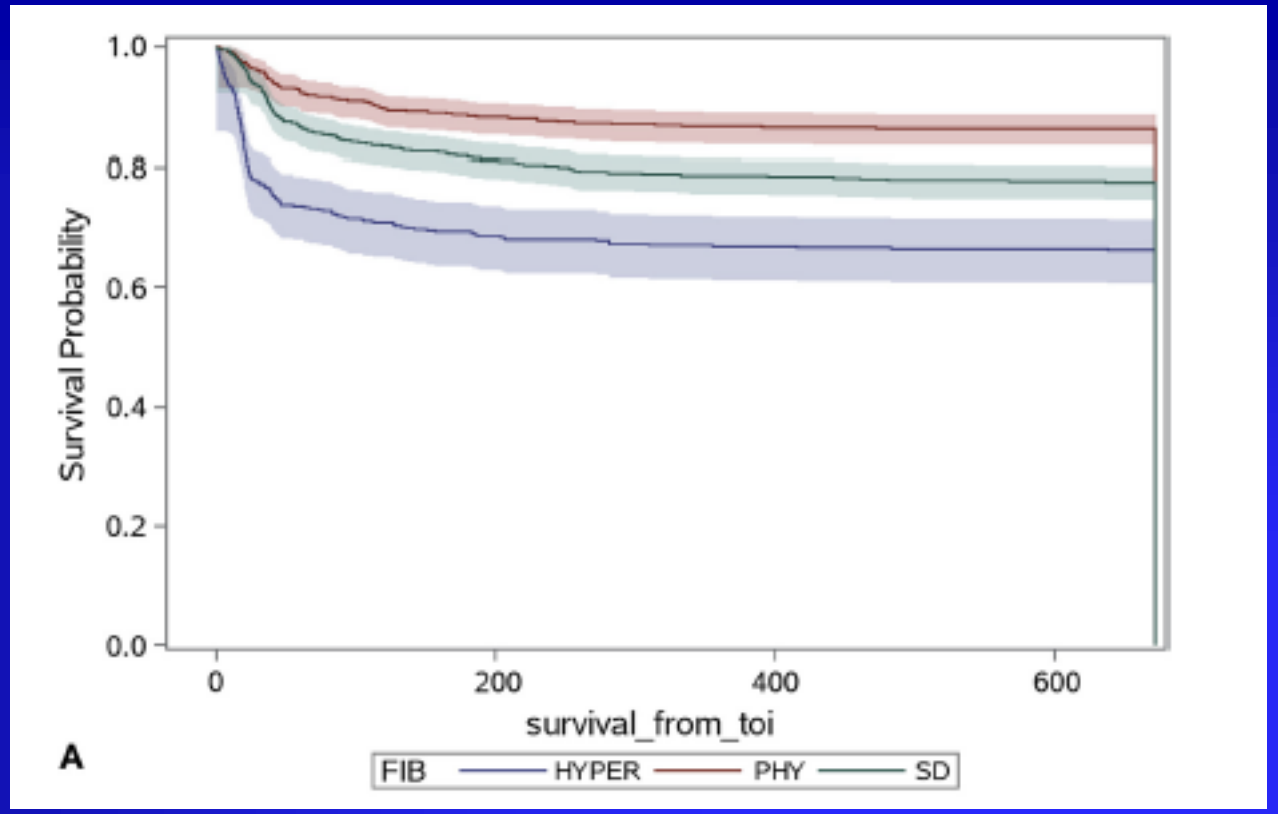


Figure 3. Differences in causes of mortality between phenotypes.



using rapid TEG. Appreciation that fibrinolysis shutdown is the most common phenotype after severe injury warrants careful reconsideration of the empiric use of antifibrinolytics in trauma, and suggests a mechanism for the failure to document improved survival with the use of tranexamic acid in recent studies.

Pro jaké pacienty je tedy TXA vhodná?

Pro jaké pacienty je tedy TXA vhodná?

- Systolický tlak pod 70 mmHg
- Středně těžké TBI (GCS 9-12)
- Těžké zhmoždění měkkých tkání

Pro jaké pacienty je tedy TXA vhodná?

- Vždy TEG/ROTEM ! (jsme v 21. století)
- Do 3 hodin (do 60 minut) po úrazu
- Vždy prokázané krvácení!
- **Adekvátní dávka – tedy 2-3g ve 100ml infúzi**

ALE HLAVNĚ....

jaromir.koci@fnhk.cz