7. kongres

Anestézie a intenzivní péče
za mimořádných podmínek
12. – 13. října 2017

trauma, krvácení a koagulopatie: časná terapie

ivana zýková

Krajská nemocnice Liberec, a.s.
Liberec a Turnov

disclaimer

- přednášková aktivita CSL Behring

Rossaint et al. Critical Care (2016) 20:100
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Critical Care

RESEARCH Open Access

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

Rolf Rossaint[1], Bertil Bouillon[2], Vladimir Cerny[3,4,5,6], Timothy J. Coats[7], Jacques Duranteau[8], Enrique Fernández-Mondéjar[9], Daniela Filipescu[10], Beverley J. Hunt[11], Radko Komadina[12], Giuseppe Nardi[13], Edmund A. M. Neugebauer[14], Yves Ozier[15], Louis Riddez[16], Arthur Schultz[17], Jean-Louis Vincent[18] and Donat R. Spahn[19*]

Hb

Haemoglobin

Recommendation 10 We recommend that a low initial Hb be considered an indicator for severe bleeding associated with coagulopathy. (Grade 1B)

We recommend the use of repeated Hb measurements as a laboratory marker for bleeding, as an initial Hb value in the normal range may mask bleeding. (Grade 1B)

Coagulation monitoring

Recommendation 12 W

practice include t

coagulati latory

det), activated

11) platelet counts

A) and/or a viscoelastic

A/NEBO

V. Management krvácení a koagulace

Antifibrinolytic agents

Recommendation 24

We recommend that tranexami

possible to the traum

significant hem **over 10**

minute **1 g over 8 h.**

acid be administered to the

within 3 h after injury. (Grade 1B)

W **protocols for the management of bleeding**

p **consider administration of the first dose of tranexamic**

acid en route to the hospital. (Grade 2C)

tranexamová kyselina

CRASH-2
Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage

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

More than 20.000 patients were randomized to receive either tranexamic acid or placebo
10.060 patients received 1g tranexamic acid, initially followed by an infusion of 1g over 8 hours. 10.067 received placebo.

	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

CRASH-2
Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage

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

A further analysis of the CRASH-2 data [323] showed that early treatment (≤1 h from injury) significantly reduced the risk of death due to bleeding [198/3747 (5.3%) events TXA vs. 286/3704 (7.7%) placebo; relative risk (RR) 0.68, 95% CI 0.57-0.82; P<0.0001].

tranexamová kyselina

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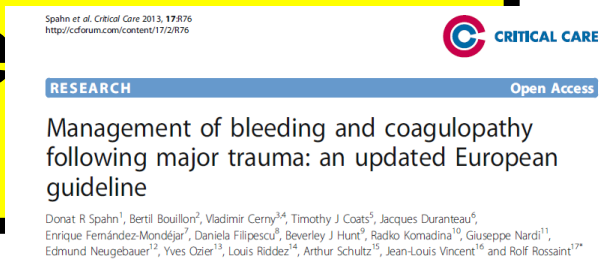
Guidelines on the management of severe perioperative bleeding

Sibylle A. Kozek-Langenecker[1], Arash Afshari[2], Pierre Albaladejo[3], Cesar Aldecoa Alvarez Santullano[4], Edoardo De Robertis[5], Daniela C. Filipescu[6], Dietmar Fries[7], Klaus Görlinger[8], Thorsten Haas[9], Georgina Imberger[10], Matthias Jacob[11], Marcus Lancé[12], Juan Llau[13], Sue Mallett[14], Jens Meier[15], Niels Rahe-Meyer[16], Charles Marc Samama[17], Andrew Smith[18], Cristina Solomon[19], Philippe Van der Linden[20], Anne Juul Wikkelsø[21], Patrick Wouters[22], Piet Wyffels[22]

dávka 20-25 mg/kg

dávka 1 g bolus a 1 g kontinuálně



Spahn *et al. Critical Care* 2013, **17**:R76
http://ccforum.com/content/17/2/R76

CRITICAL CARE

RESEARCH Open Access

Management of bleeding and coagulopathy following major trauma: an updated European guideline

Donat R Spahn[1], Bertil Bouillon[2], Vladimir Cerny[3,4], Timothy J Coats[5], Jacques Duranteau[6], Enrique Fernández-Mondéjar[7], Daniela Filipescu[8], Beverley J Hunt[9], Radko Komadina[10], Giuseppe Nardi[11], Edmund Neugebauer[12], Yves Ozier[13], Louis Riddez[14], Arthur Schultz[15], Jean-Louis Vincent[16] and Rolf Rossaint[17*]

Volumoth - koloidy

these conflicting results, a recent in vitro study using blood from healthy volunteers demonstrated that coagulation and platelet function are impaired by all HES and gelatin solutions [251]. However, gelatin-induced coagulopathy was reversible with the administration of fibrinogen,

FFP nebo fibrinogen

Initial coagulation resuscitation

Recommendation 24 In the initial management of patients with expected massive haemorrhage, we recommend one of the two following strategies:

- Plasma (FFP or pathogen-inactivated plasma) in a plasma–RBC ratio of at least 1:2 as needed. (Grade 1B)
- Fibrinogen concentrate and RBC according to Hb level. (Grade 1C)

Iniciální resuscitace

We define "initial resuscitation" as the period between arrival in the emergency department and availability of results from coagulation monitoring (coagulation screen, fibrinogen level and/or viscoelastic monitoring and platelet count). There are still conflicting opinions about use of plasma as the initial strategy to support coagulation, and several authors, mainly in Europe, strongly disagree with the initial transfusion of patients based on an empirical ratio rather than guided by concurrent laboratory data (goal-directed therapy) [388]. In the absence of rapid point-of-care coagulation testing to facilitate goal-directed therapy, initial treatment with blood components in a fixed ratio may constitute a reasonable approach. If concurrent coagulation results are available, they should be used to guide therapy.

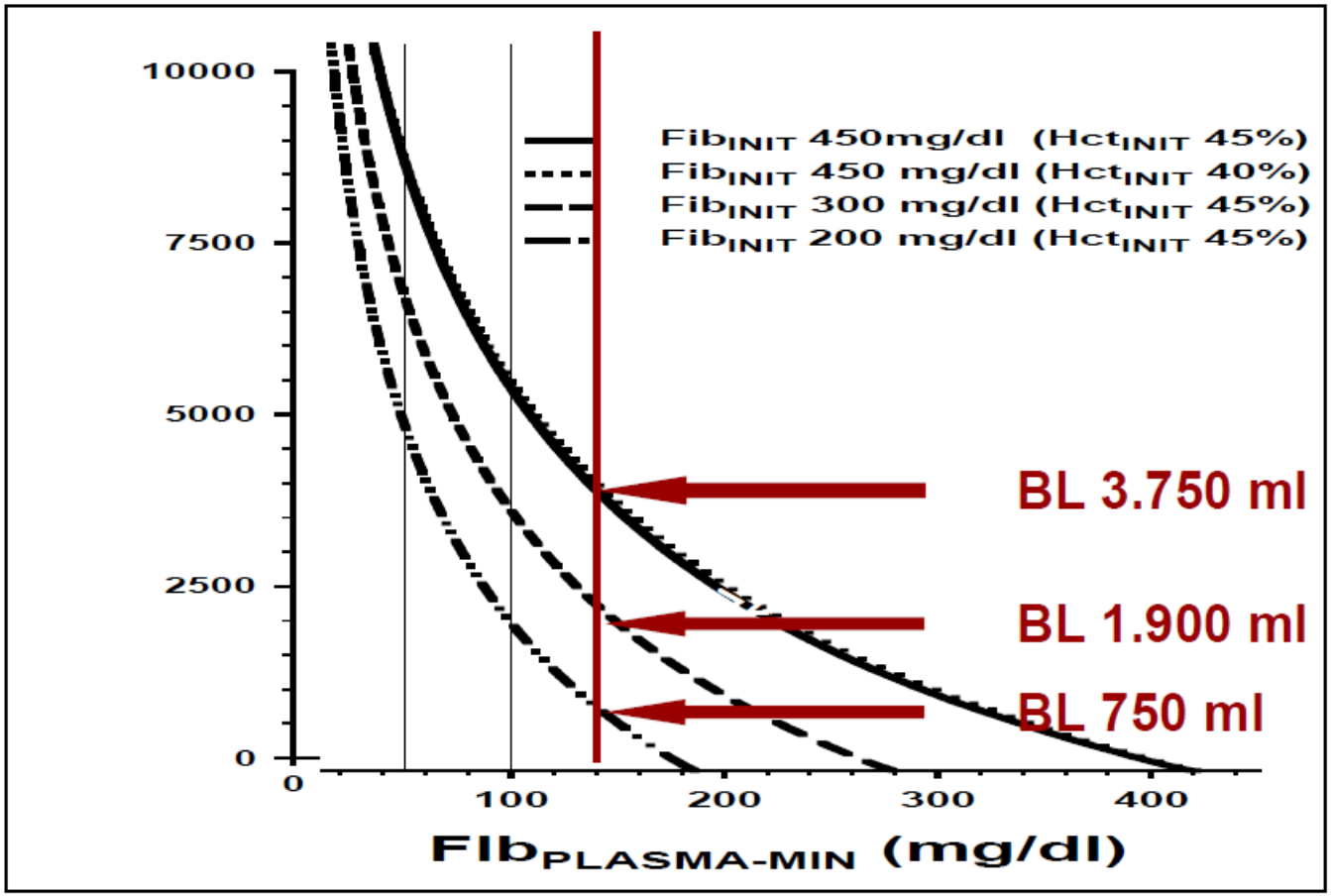
Administration of plasma to bleeding patients may stabilise fibrinogen levels, avoiding a further decrease, but plasma transfusions cannot contribute to a significant increase in fibrinogen level unless very high volumes are infused [406]. The Activation of Coagulation and Inflammation in Trauma (ACIT) study [396] confirmed these findings, showing that the percentage of coagulopathic patients increased with a standard near 1:1 FFP:RBC transfusion protocol. Similar results were recently reported by Khan et al. [15]. Again, a 1:1 FFP:RBC transfusion protocol did not alleviate coagulopathy; the percentage of coagulopathic patients even increased the longer this treatment lasted. Interestingly, in the same study it was shown that only high-dose fibrinogen administration resulted in improved coagulation and a reduction in coagulopathy. Furthermore, both FFP and

- **Trauma indukovanou koagulopatii rozvíjí ¼ až ½ všech pacientů s traumatem**

- **V případě masivní krevní ztráty, dosahuje hladina fibrinogenu kritických hodnot dříve než ostatní prokoagulační faktory nebo trombocyty.**

Brohi K, Singh J, Heron M, Coats T: **Acute traumatic coagulopathy.** *J Trauma* 2003, **54(6)**:1127-1130.
Maegele M, Lefering R, Yucel N, Tjardes T, Rixen D, Paffrath T, Simanski C, Neugebauer E, Bouillon B: **Early coagulopathy in multiple injury: an analysis from the German Trauma Registry on 8724 patients.** *Injury* 2007, **38(3)**:298-304.

Critical blood loss - fibrinogen baseline concentration
Singbartl K et al. Anest&Analg 2003



FI ≥ 150 mg/dL: 750 ml or 3.750 ml

Critical FI levels may be reached before the need of RBC‘s!!!

Fibrinogen & cryoprecipitate

Recommendation 27

We recommend treatm

continuing

ompanied by

deficit or a plasma fibrinogen

itial fibrinogen concentrate dose of 3-4 g or 50 mg/kg of

cr ate, which is approximately equivalent to 15-20 singe donor units in a 70 kg adult. Repeat doses may be guided by viscoelastic monitoring and laboratory assessment of fibrinogen levels. (Grade 2C)

Fibrinogen iniciálně 3-4 g dále dle viskoelastických metod

Podání již při podezření na deficit fibrinogenu

European Society of Anaesthesiology ESA | EJA European Journal of Anaesthesiology | European Society of Anaesthesiology ESA

Guidelines on the management of severe perioperative bleeding

Sibylle A. Kozek-Langenecker[1], Arash Afshari[2], Pierre Albaladejo[3], Cesar Aldecoa Alvarez Santullano[4], Edoardo De Robertis[5], Daniela C. Filipescu[6], Dietmar Fries[7], Klaus Görlinger[8], Thorsten Haas[9], Georgina Imberger[10], Matthias Jacob[11], Marcus Lancé[12], Juan Llau[13], Sue Mallett[14], Jens Meier[15], Niels Rahe-Meyer[16], Charles Marc Samama[17], Andrew Smith[18], Cristina Solomon[19], Philippe Van der Linden[20], Anne Juul Wikkelsø[21], Patrick Wouters[22], Piet Wyffels[22]

Kritických hodnot fibrinogenu může být dosaženo dříve než je nutné podávat PRBC

4 g fibrinogenu ...vzestup o 1g/l fibrinogenu

4 g fibrinogenu nebo 16 x FFP

Další resuscitace koagulace

VI. Further resuscitation

Goal-directed therapy

Recommendation 26 We recommend that resuscitation measures be continued using a goal-directed strategy guided by standard laboratory coagulation values and/or viscoelastic tests. (Grade 1C)

PCC

Prothrombin complex concentrate

Recommendation 33 We recommend the early use of prothrombin complex concentrate (PCC) for the emergency reversal of vitamin K-dependent oral anticoagulants. (Grade 1A)

We suggest the administration of PCC to mitigate life-threatening post-traumatic bleeding in patients treated with novel oral anticoagulants. (Grade 2C)

Provided that fibrinogen levels are normal, we suggest that PCC or plasma be administered in the bleeding patient based on evidence of delayed coagulation initiation using viscoelastic monitoring. (Grade 2C)

Functional definition and characterization of acute traumatic coagulopathy

Crit Care Med 2011 Vol. 39, No. 12

Ross Davenport, BSc, MD, MRCS; Joanna Manson, MD, MRCS; Henry De'Ath, MD, MRCS; Sean Platton, MSc, CSci, FIBMS; Amy Coates, BSc; Shubha Allard, MD, FRCP, FRCPath; Daniel Hart, MD; Rupert Pearse, MD, FRCA; K. John Pasi, PhD, FRCP, FRCPath, FRCPCH; Peter MacCallum, MD, FRCP, FRCPath; Simon Stanworth, DPhil, MRCP, FRCPath; Karim Brohi, FRCA, FRCS

Acute traumatic coagulopathy is functional characterized by a reduction in clot strength. With a threshold of clot amplitude at 5 mins of ≤ 35 mm, rotational thromboelastometry can identify acute traumatic coagulopathy at 5 mins and predict the need for massive transfusion.

BJA Advance Access published September 8, 2014

British Journal of Anaesthesia Page 1 of 8
doi:10.1093/bja/aeu303

BJA

Usefulness of standard plasma coagulation tests in the management of perioperative coagulopathic bleeding: is there any evidence?

T. Haas[1]*, D. Fries[2], K. A. Tanaka[3], L. Asmis[4], N. S. Curry[5] and

habits. In general, SL
used, but th
studie

ard tests. Thus, it seems questionable how long physicians are willing to continue using (late) results of SLTs as marker of coagulopathy or guidance for bleeding management. But as always, old and even bad habits die hard.

s, where
s, such as visco-
re quickly and provide a
the whole coagulation process.

Život ohrožující krvácení u traumat

- **Ztráta objemu**
- **Rozvoj koagulopatie**
- **Zhoršení dodávky 02**

Ztráta objemu

- **Stěžejní je co nejdříve ji zastavit!!**
- **Zástava krvácení:**
  - **zástava zevního krvácení**
  - **pánevní pás, fixace dlouhých kostí**
  - **REBOA ?**
  - **co nejkratší čas do definitivní zástavy krvácení**

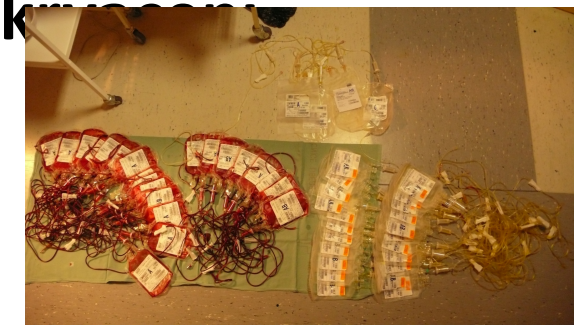
Ztráta objemu

- **Volumoterapie:**
  - **krystaloidy, koloidy ……co nejméně**
  - **Albumin ??**

Rozvoj koagulopatie

- kyselina tranexamová

- fibrinogen (první faktor, který se spotřebovává)
  …… cca 10 minut na podání 4 gramů
  (výhodné skladování, malý objem, rychlé podání)
- PCC
- FFP: iniciálně při těžkém šokovém stavu refrakterním na terapii dle typu k[illegible]
- trombocyty



FIBTIC

Fibrinogen in Trauma induced coagulopathy

25 % pacientů zařazeno bez ŽOK

Antikoagulační terapie: warfarin a DOAC

Pacientů přibývá……

PCC ????

Treat whole blood loss with whole blood

Dodávka 02

- **1 PRBC…….Hb o 10 g/l**
- **2 PRBC…….Hb o 20 g/l**

Monitorace krvácení: při příjezdu do nemocnice

zhodnocení oběhu a krevní ztráty, detekce zdroje krvácení

Hbmetr - hned

INR - hned

Trombelastometrie – 5-10 minut

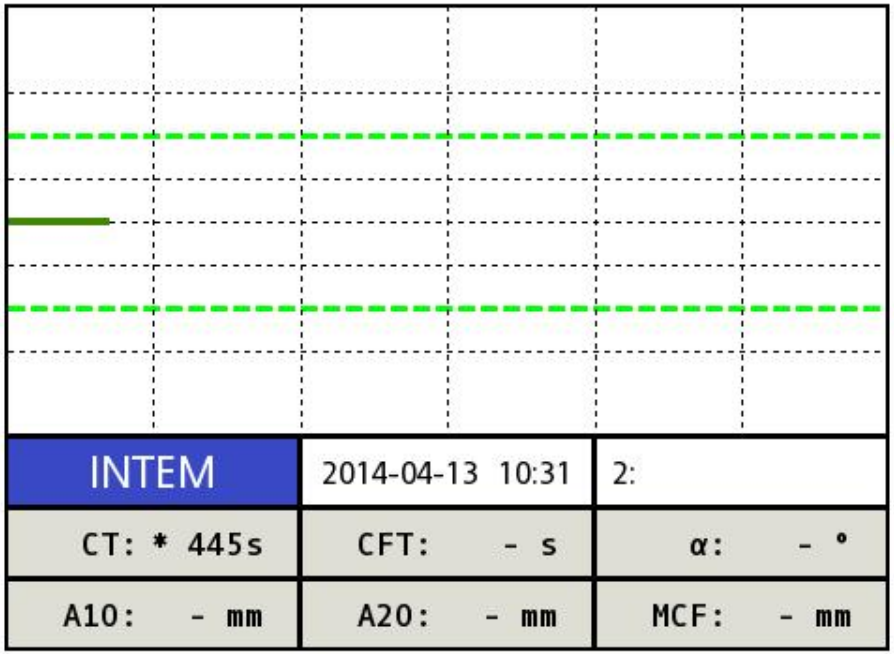
aKP POCT – laktát

Hb

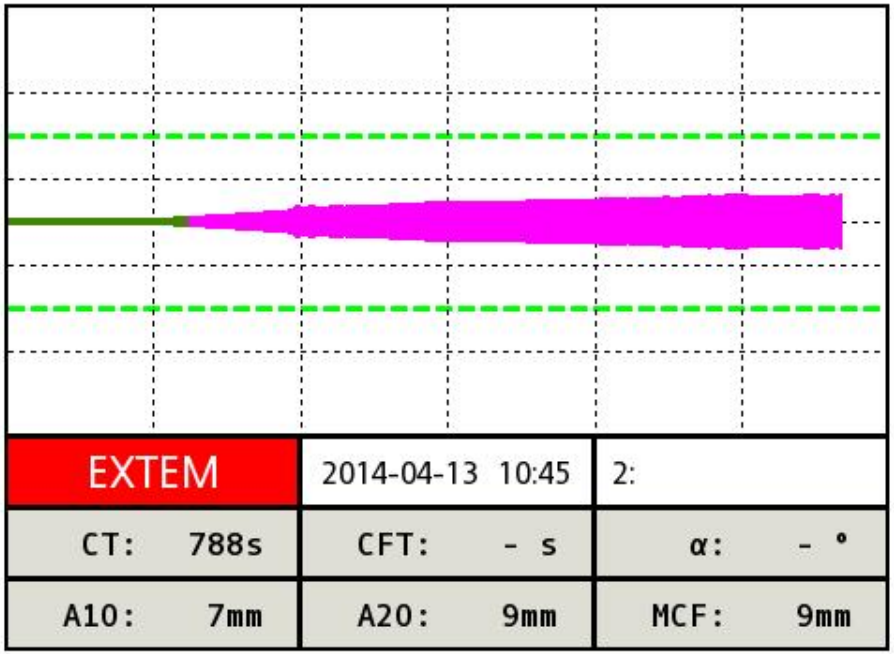
- **Normální hodnota nic neznamená**
- **Nízká hodnota signifikantní**
- **Seriové odběry**

POINT OF CARE

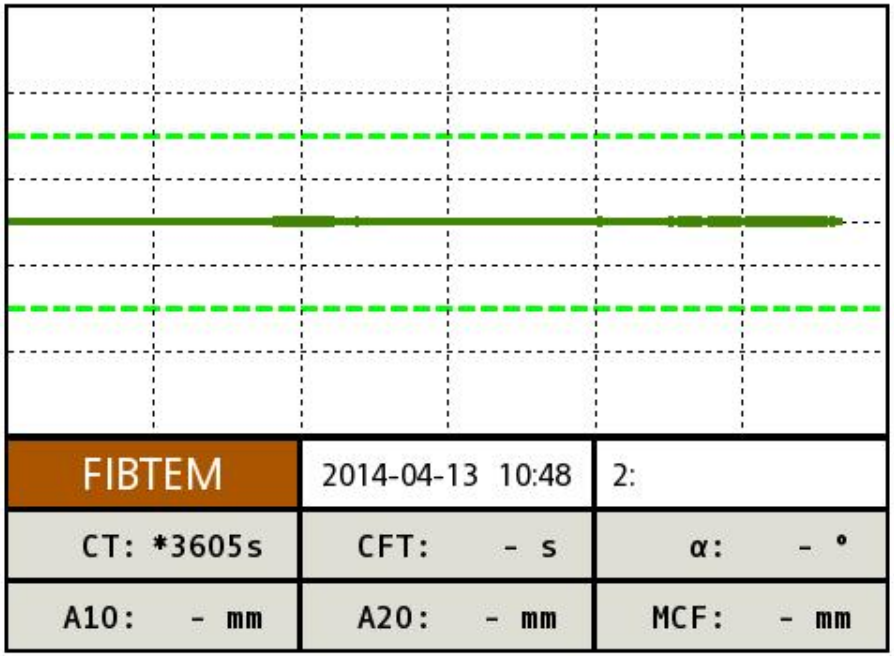
melkova 1



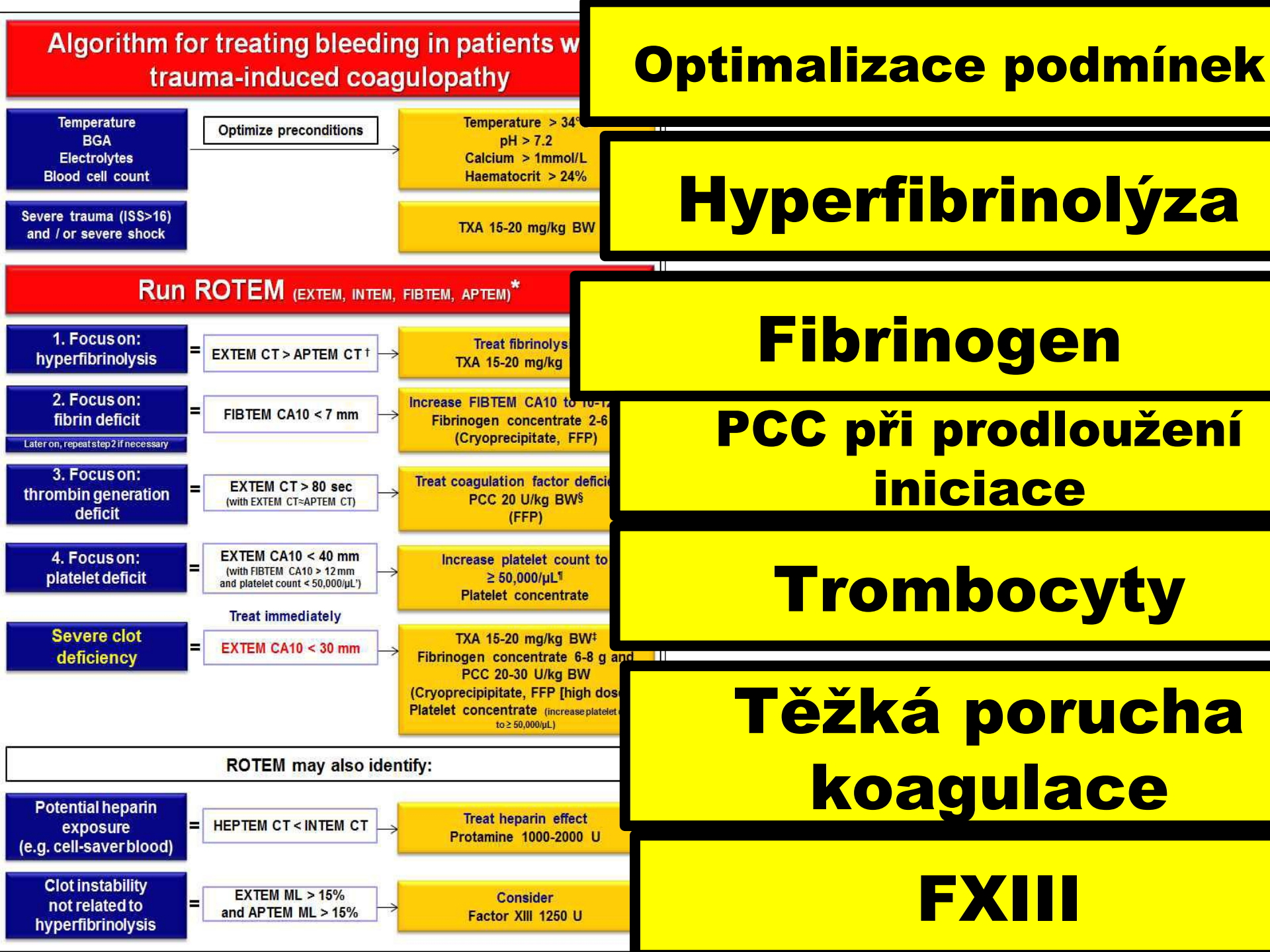
INTEM	2014-04-13 10:31	2:
CT: * 445s	CFT: - s	α: - °
A10: - mm	A20: - mm	MCF: - mm



EXTEM	2014-04-13 10:45	2:
CT: 788s	CFT: - s	α: - °
A10: 7mm	A20: 9mm	MCF: 9mm



FIBTEM	2014-04-13 10:48	2:
CT: *3605s	CFT: - s	α: - °
A10: - mm	A20: - mm	MCF: - mm


Algorithm for treating bleeding in patients w
trauma-induced coagulopathy
Temperature
BGA
Electrolytes
Blood cell count
Optimize preconditions
Temperature > 34°
pH > 7.2
Calcium > 1mmol/L
Haematocrit > 24%
Severe trauma (ISS>16)
and / or severe shock
TXA 15-20 mg/kg BW
Run ROTEM (EXTEM, INTEM, FIBTEM, APTEM)*
1. Focus on:
hyperfibrinolysis
=
EXTEM CT > APTEM CT†
Treat fibrinolys
TXA 15-20 mg/kg
2. Focus on:
fibrin deficit
Later on, repeat step 2 if necessary
=
FIBTEM CA10 < 7 mm
Increase FIBTEM CA10 to
Fibrinogen concentrate 2-6
(Cryoprecipitate, FFP)
3. Focus on:
thrombin generation
deficit
=
EXTEM CT > 80 sec
(with EXTEM CT≈APTEM CT)
Treat coagulation factor defici
PCC 20 U/kg BW§
(FFP)
4. Focus on:
platelet deficit
=
EXTEM CA10 < 40 mm
(with FIBTEM CA10 > 12 mm
and platelet count < 50,000/µL')
Increase platelet count to
≥ 50,000/µL¶
Platelet concentrate
Treat immediately
Severe clot
deficiency
=
EXTEM CA10 < 30 mm
TXA 15-20 mg/kg BW‡
Fibrinogen concentrate 6-8 g and
PCC 20-30 U/kg BW
(Cryoprecipipitate, FFP [high dos
Platelet concentrate (increase platelet
to ≥ 50,000/µL)
ROTEM may also identify:
Potential heparin
exposure
(e.g. cell-saver blood)
=
HEPTEM CT < INTEM CT
Treat heparin effect
Protamine 1000-2000 U
Clot instability
not related to
hyperfibrinolysis
=
EXTEM ML > 15%
and APTEM ML > 15%
Consider
Factor XIII 1250 U
Optimalizace podmínek
Hyperfibrinolýza
Fibrinogen
PCC při prodloužení
iniciace
Trombocyty
Těžká porucha
koagulace
FXIII

Holcomb *Critical Care* 2010, **14**:162
http://ccforum.com/content/14/3/162

CRITICAL CARE

COMMENTARY

Traditional transfusion practices are changing

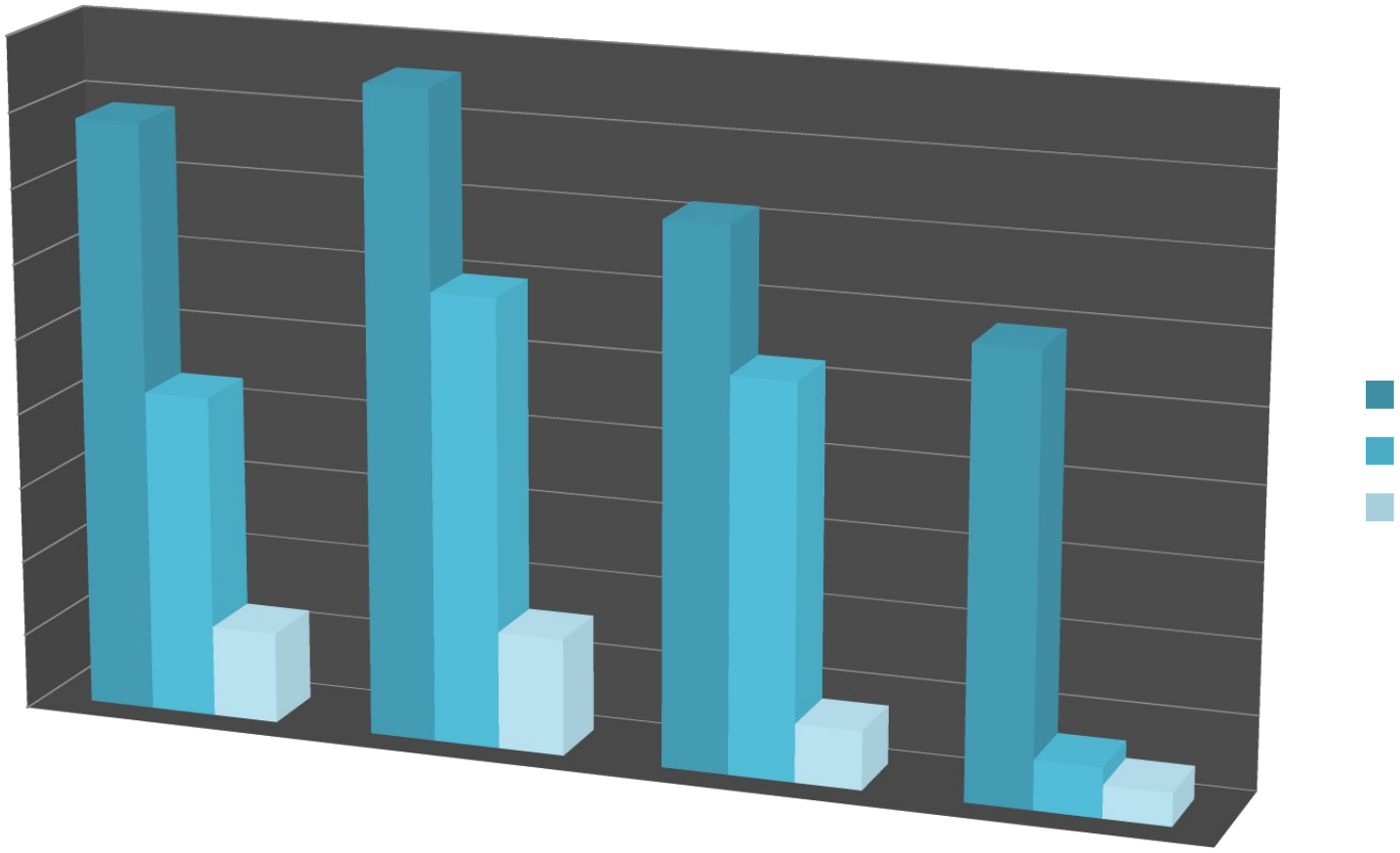
John B Holcomb*

See related research by Schochl *et al.*, http://ccforum.com/content/14/2/R55

It will be nice to **only transfuse what is needed,** based on level I data, finally **balancing risk and benefit** in data-driven fashion **for the benefit of our patients.**

Active, Personalized, and Balanced Coagulation Management Saves Lives in Patients with Massive Bleeding Anesthesiology 2010; 113:1–1

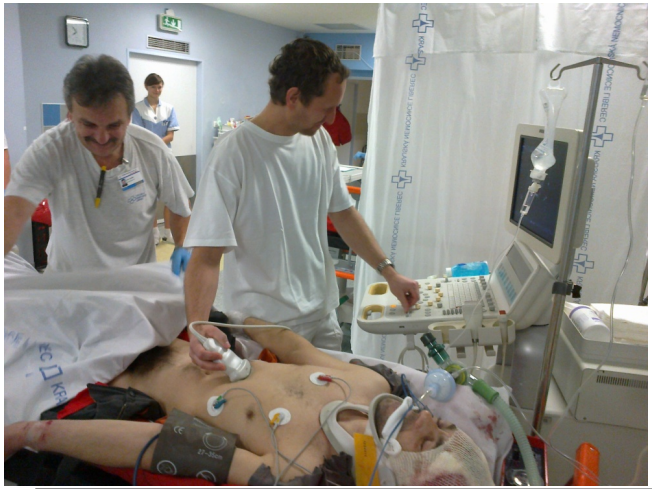
Transfusion requirements



Závěr

- **Dobře fungující systém přednemocniční a časné nemocniční péče**
- **Kyselina tranexamová, fibrinogen ? ?**
- **Albumin ? ?**

Organizace urgentního traumatologického příjmu KNL



Triage pozitivní pacient

Standardní postup
15 minut

Diagnostika a terapie
Vyloučení či vyřešení život ohrožujících stavů

Dýchací cesty
Zdroje velkého krvácení: hemothorax, hemoperitoneum, nestabilní pánev, fraktury dlouhých kostí, zevní krvácení
Tenzní pneumothorax
Tamponáda srdeční

Oběhově stabilní x nestabilní pacient

CT v režimu polytrauma

Další řešení

Analýza časných úmrtí

- **Přednemocniční péče**
- **Časně při příjezdu**
- **Dojezdové časy a délka transportu LZS**
- **Tupá poranění/ penetrující poranění**
- **Využití PRBC na urgentním příjmu**

Děkuji za pozornost

ivana.zykova@nemlib.cz