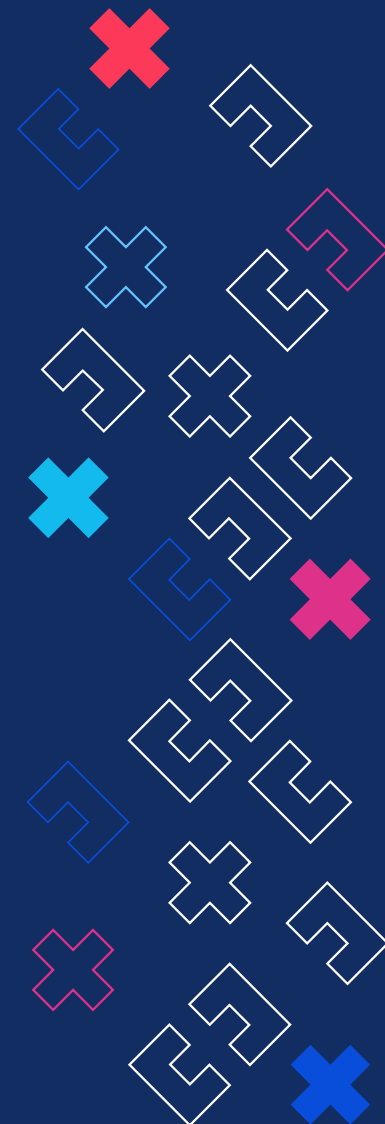


KOAGULOPATIE V NEUROINTENZIVNÍ PÉČI - SOUČASNÝ POHLED

MUDr. Kamil Vrbica, Ph.D.

Klinika anesteziologie, resuscitace a intenzivní medicíny FN Brno a LF MU

17.9.2026

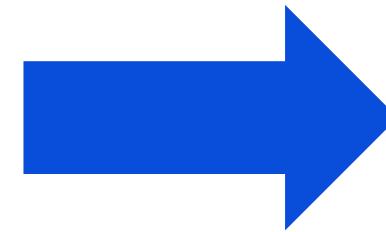


Koagulopatie v neurointenzivní péči

- Proč by nás vůbec měla trápit?
- Jak zjistíme, že je přítomna?
- A co s tím tedy budeme dělat?

Proč by nás vůbec měla trápit?

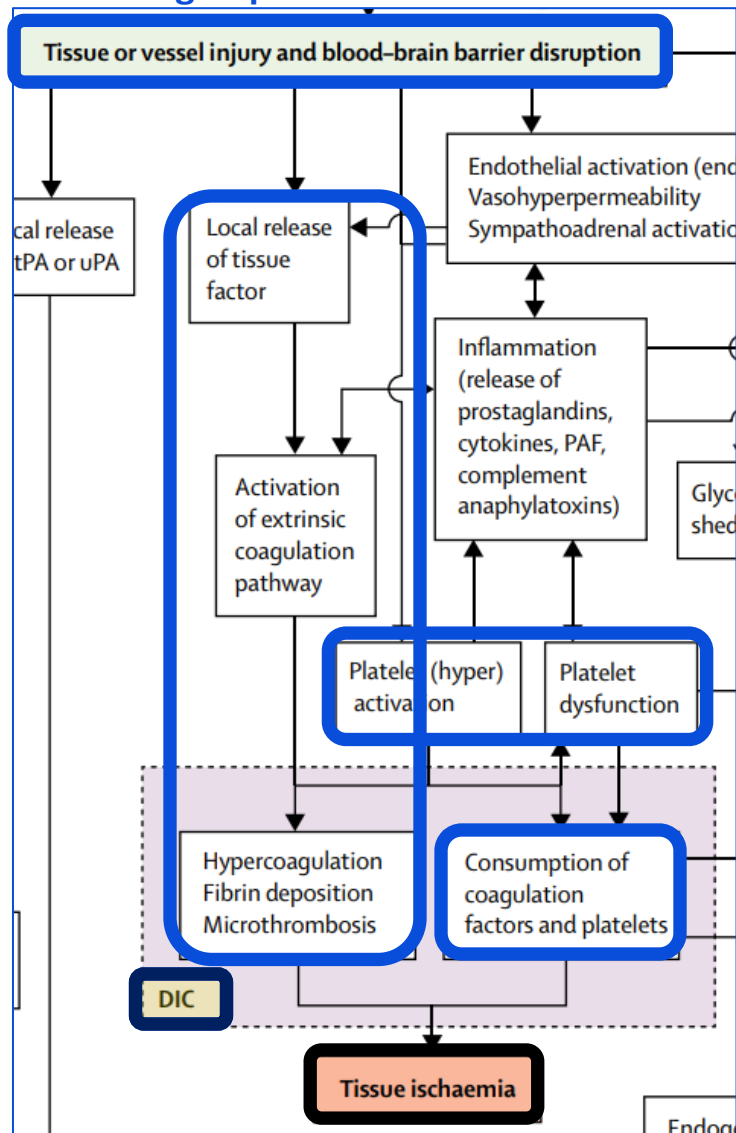
- Příčina příjmu na neurointenzivní lůžko
 - Krvácivý stav
 - ICH, SAK, TBI
 - Antikoagulační / Antiagregační léčba
 - Trombotický stav
 - iCMP, trombóza splavů a žil
- Komplikace pobytu na neurointenzivním lůžku
 - Sekundární poškození CNS
 - Trombembolická nemoc



**ZHORŠENÍ
NEUROSTATU**

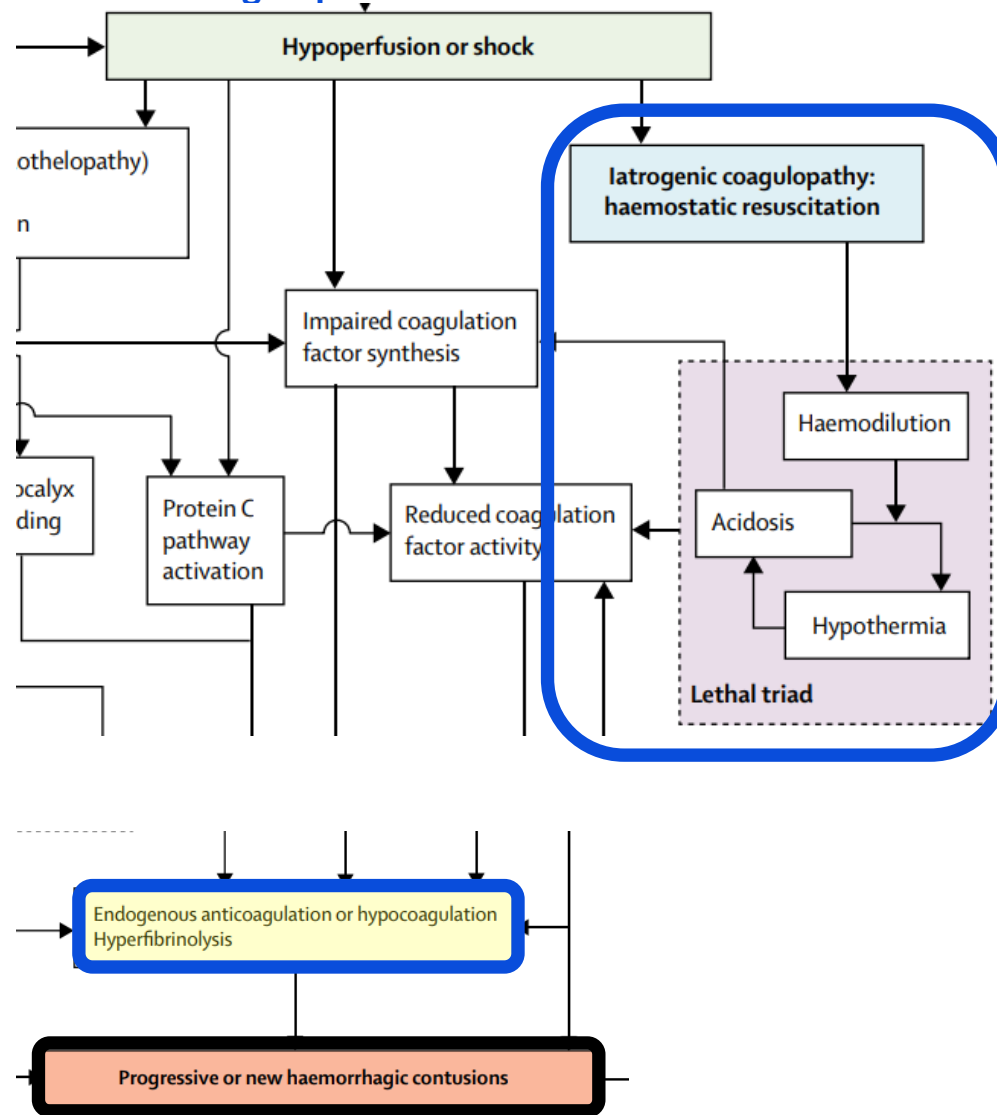
Patofyziologie koagulopatie při TBI

Koagulopatie vázaná na TBI



Koagulopatie vázaná na šok

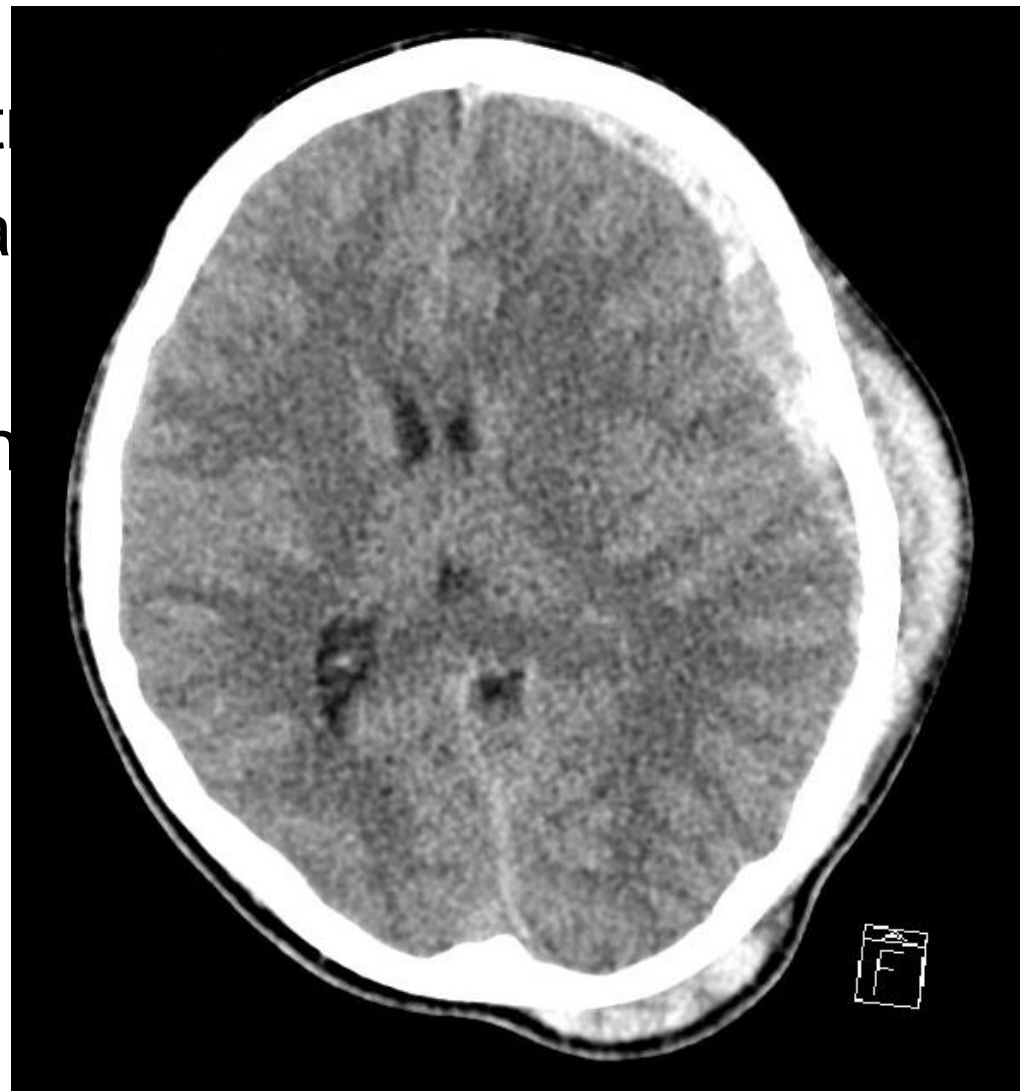
Endotheliopathy, inflammation, and glycocalyx shedding Protein C pathway activation



Koagulopatie vázaná s TBI

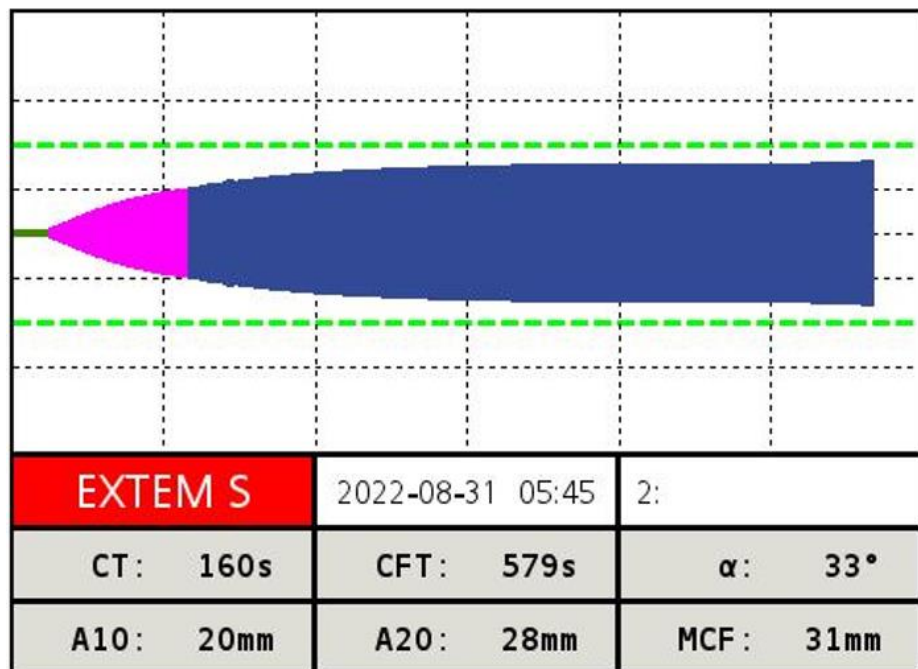


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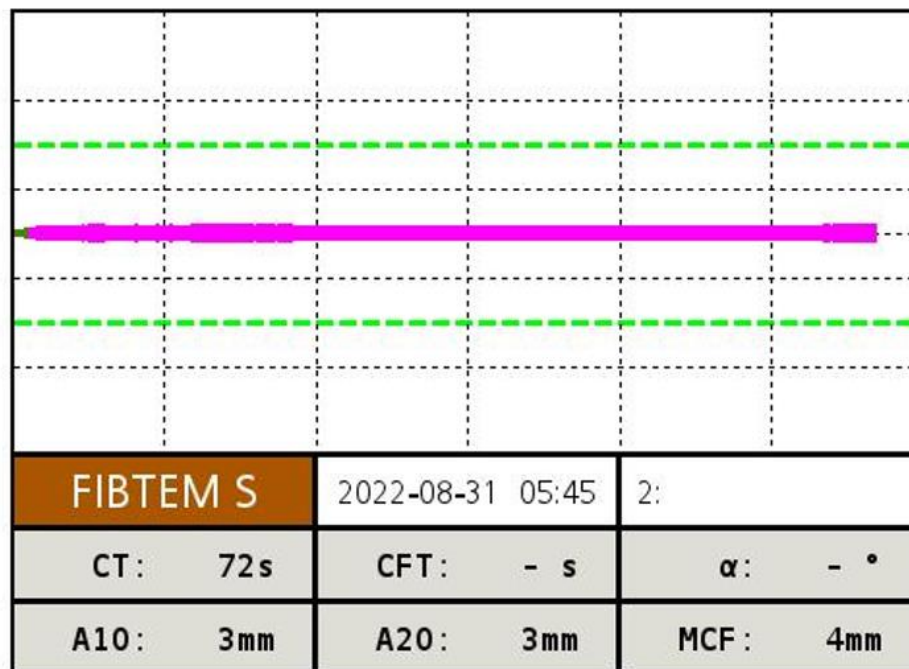
Datum a čas odběru: 31.08.2022 07:02 Te

Vyšetření	Hodn.	Výsl.	Jedn.	Meze/koment.
Leukocyty	<VH>	15.630	$10^9/l$	(4 - 10)
Erytrocyty	<. >	4.40	$10^{12}/l$	(4 - 5.8)
Hemoglobin	<VL>	130.0	g/l	(135 - 175)
Hematokrit	<VL>	0.360	l/l	(0.4 - 0.5)
Střední objem ERY	<VL>	81.6	fL	(84 - 96)
Trombocyty	<. >	184.0	$10^9/l$	(150 - 400)
Množství HGB v ERY	<. >	29.5	pg	(28 - 34)
Koncentr. HGB v ERY	<VH>	362.0	g/l	(320 - 360)
Střední objem trombo	<. >	10.70	fL	(7.8 - 11)
Šíře distribuce ERY	<. >	12.6	%	(10 - 15.2)
Normoblasty	<. >	0.00	$10^9/l$	(0 - 0)
Normoblasty/100WBC	<. >	0.00	/100WBC	(0 - 0)



Datum a čas odběru: 31.08.2022 07:08

Vyšetření	Hodn.	Výsl.	Jedn.	Meze/koment.
Protrombin.čas	<H >	1.51	INR	(0.8 - 1.2)
Protrombin.čas	<VH>	20.5	s	(11 - 17)
Protrombin.čas	<VH>	1.51	R	(0.8 - 1.2)
Fibrinogen	<VL>	1.42	g/l	(1.8 - 4.2)
aPTT -ratio	<VH>	1.31	R	(0.8 - 1.2)
aPTT s	<VH>	42.00	s	(26 - 40)
Trombinový čas	<VH>	1.13	R	(0.8 - 1.1)
Trombinový čas	<VH>	20.1	s	(14 - 19)



Jak zjistíme, že je koagulopatie u TBI přítomna?

Rossaint et al. Critical Care (2023) 27:80
<https://doi.org/10.1186/s13054-023-04327-7>

Critical Care

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



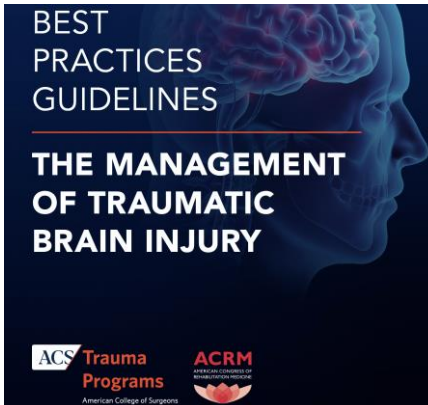
R11 Coagulation monitoring

Early, repeated haemostasis monitoring, including laboratory measurements (PT/INR, fibrinogen, platelets, fibrinogen) and/or point-of-care PT/INR and/or viscoelastic methods, should be employed.

Hematology Monitoring

Hematology monitoring is essential in patients with TBI. Although recommendations for hemoglobin transfusion thresholds vary somewhat, the current literature and expert consensus suggest a transfusion threshold of ≥ 7 g/dL.^{3,4}

Early evaluation for coagulopathy is important for patients with TBI. Assessment of direct and indirect coagulation cascades using INR is essential (a target INR ≤ 1.4 is appropriate in most cases). Utilization of thromboelastography (TEG), rotational thromboelastometry (ROTEM), and platelet function assays may provide additional information regarding the need for targeted therapy to reverse coagulopathy.



Jak zjistíme, že je koagulopatie u TBI přítomna?



> J Neurotrauma. 2011 Oct;28(10):2033-41. doi: 10.1089/neu.2010.1744. Epub 2011 Sep 23.

Thromboelastometric (ROTEM) findings in patients suffering from isolated severe traumatic brain injury

Herbert Schöchl¹, Cristina Solomon, Stefan Traininger, Ulrike Nienaber, Astrid Tacacs-Tolnai, Christian Windhofer, Soheyl Bahrami, Wolfgang Voelckel

results. Thirty-two patients were included in the study. Complete adherence to the algorithm was observed in 20 out of 32 cases. The availability of thromboelastometric results after hospital admission was reported significantly earlier than conventional coagulation tests (median (IQR [range]) 33 (20-40 [14-250]) min vs. 71 (51-101 [32-290]) min; $p = 0.037$). Although only 5 out of 32 patients had abnormalities of conventional coagulation tests 21 out of 32 patients had a coagulopathic baseline thromboelastometric trace. Implementing a thromboelastometric-guided algorithm for the

Výhody VET:

- přesnější popis reálné hemostázy
- rychlejší výsledky

Multicenter Study > Anaesthesia. 2019 Jul;74(7):883-890. doi: 10.1111/anae.14670. Epub 2019 Apr 29.

Protocolised thromboelastometric-guided haemostatic management in patients with traumatic brain injury: a pilot study

J Gratz¹, H Güting², S Thorn³, A Brazinova⁴, K Görlinger^{5,6}, N Schäfer², H Schöchl^{7,8},

Comparison of two viscoelastic devices in patients with severe trauma: a prospective observational study

[Kamil Vrbica](#), [Ondrej Hrdy](#) , [Katerina Vanickova](#), [Martin Dolecek](#), [Radka Stepanova](#),
[Rostislav Mahel](#) & [Roman Gal](#)

[Scientific Reports](#) **16**, Article number: 18562 (2026) | [Cite this article](#)

Conclusions

On the basis of 108 paired measurements with ROTEM® and ClotPro® devices in patients with severe trauma, we demonstrated that clot firmness in the extrinsic-specific assay can be used interchangeably between devices. However, the remaining parameters in both the extrinsic and fibrinogen-specific assays showed differences between devices. ClotPro® consistently yielded higher clot firmness values in the fibrinogen-specific assay. A significant difference was also observed in the number of measurements falling outside the manufacturer-specified limits for the devices. These findings provide evidence that the two viscoelastic devices cannot be used interchangeably in applying the algorithm for managing haemorrhage and coagulopathy. This complex issue will require further research to develop device-specific algorithms.

	Min–Max	3–25	0–28	– 7 to 12		
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A co tedy s tím TBI?

- Udržovat trombocyty nad $100 \times 10^9/L$
- Fibrinogen substituovat při známkách hypofibrinogenémie na VET nebo při hladině pod 1,5 g/L

A není to pozdě?

Rossaint et al. Critical Care (2023) 27:80
https://doi.org/10.1186/s13054-023-04327-7 Critical Care

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



Rossaint et al. Critical Care (2023) 27:80
https://doi.org/10.1186/s13054-023-04327-7 Critical Care

GUIDELINES **Open Access**

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

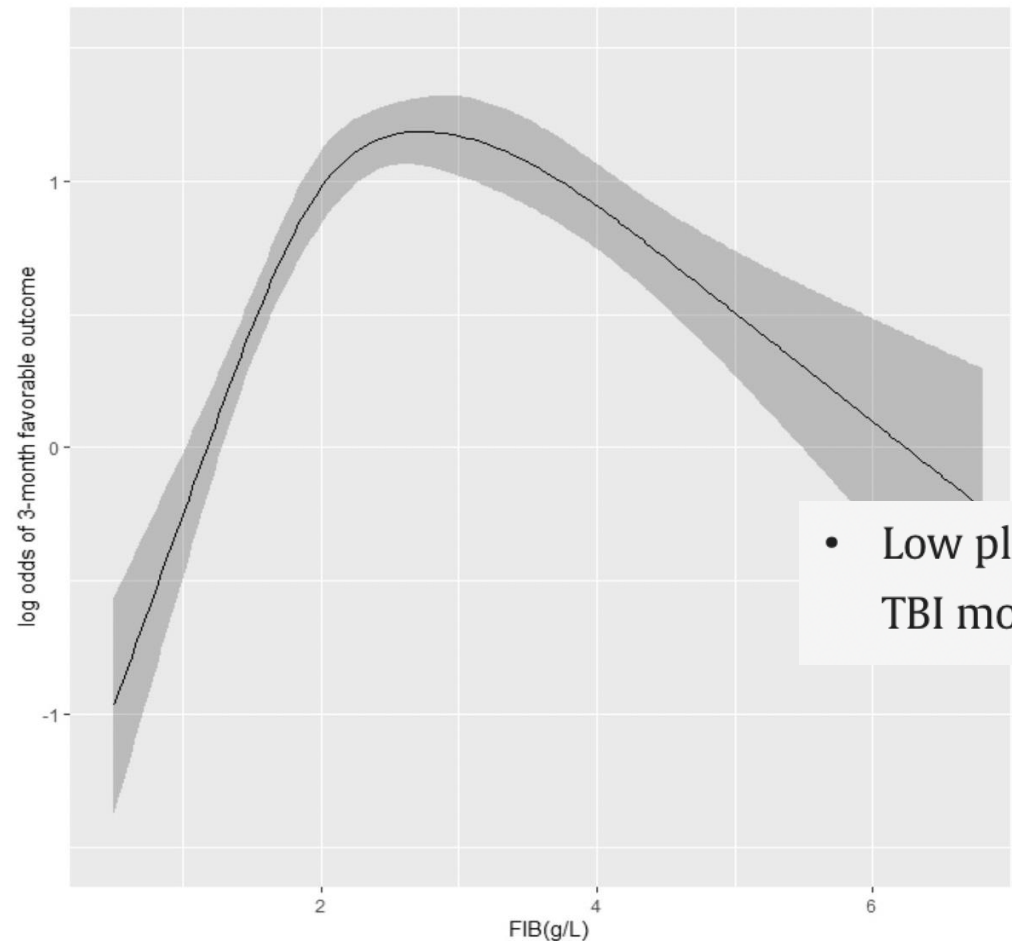


RESEARCH ARTICLE

Open Access

Impact of fibrinogen level on the prognosis of patients with traumatic brain injury: a single-center analysis of 2570 patients

Ke Lv[†], Qiang Yuan[†], Pengfei Fu, Gang Wu, Xing Wu, Zhuoying Du, Jian Yu, Zhiqi Li and Jin Hu^{*}



- Low platelet and fibrinogen levels increase PHI risk, requiring close TBI monitoring.

Clinical Neurology and Neurosurgery 249 (2025) 108699



Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineneuro



Review Article

Coagulopathy at admission in traumatic brain injury and its association with hematoma progression: A systematic review and meta-analysis of 2411 patients

Ibrahim Mohammadzadeh^{a,b,*}, Behnaz Niroomand^{a,b,*}, Amin Tajerian^{c,3}, Zahra Shahnazian^{d,4}, Zahra Nouri^{d,5}, Ali Mortezaei^{e,6}



Fig. 2 The shape of the relationship between the fibrinogen level at admission and the probability of 3-month favorable outcome. When the fibrinogen levels were < 2.5 g/L, the likelihood of favorable outcomes increased in association with fibrinogen level. This positive association was not seen in patients with fibrinogen levels between 2.5 and 3.0 g/L. Further elevation of fibrinogen to levels > 3.0 g/L revealed a decrease in favorable outcomes in association with increases in the levels

A co tedy s tím TBI?

- Udržovat trombocyty nad $100 \times 10^9/L$
- Fibrinogen substituovat při známkách hypofibrinogenémie na VET nebo při hladině pod 1,5 nebo 2 g/L?
- INR do 1,4 nebo normalizace CT u vnější cesty VET

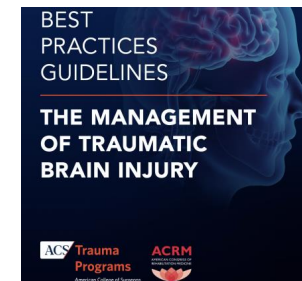
Rossaint et al. Critical Care (2020) 27:80
<https://doi.org/10.1186/s13054-020-04327-7>

Critical Care

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



Rossaint et al. Critical Care (2020) 27:80
<https://doi.org/10.1186/s13054-020-04327-7>

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R28 Coagulation factor concentrate-based management

Factor concentrates should be administered based on standard laboratory coagulation parameters and/or viscoelastic evidence of a functional coagulation factor deficiency. If fibrinogen levels are normal, PCC may be administered based on viscoelastic evidence of delayed coagulation initiation. FXIII monitoring may be included in coagulation support algorithms and FXIII supplemented in bleeding patients with a functional FXIII deficiency.

R27 Fresh frozen plasma-based management

Further use of FFP should be guided by standard laboratory coagulation parameters (PT and/or APTT >1.5 times normal and/or viscoelastic evidence of a coagulation factor deficiency). FFP use should be avoided for the correction of hypofibrinogenaemia if fibrinogen concentrate and/or cryoprecipitate are available.

Rossaint et al. Critical Care (2020) 27:80
<https://doi.org/10.1186/s13054-020-04327-7>

Critical Care

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



NARRATIVE REVIEW



Management of moderate to severe traumatic brain injury: an update for the intensivist

Geert Meyfroidt^{1*}, Pierre Bouzat², Michael P. Casaer¹, Randall Chesnut³, Sophie Rym Hamada⁴

the first 3 h. In isolated TBI, the CRASH3 trial showed a reduction in TBI-related death when tranexamic acid (TXA) was administered in the subgroup of patients with mild-to-moderate TBI (Glasgow Coma Score (GCS) 9–15) within the first 3 h [91], but not in

TBI. Moreover, a systematic review of 9 RCTs (including CRASH3) in 14,747 isolated TBI patients [92] did not find such mortality benefit of TXA in

a reduction in hematoma expansion in severe isolated TBI, but can be considered in moderate TBI, when administered within the first 3 h [93].

The effects of timing of prehospital tranexamic acid on outcomes after traumatic brain injury: Subanalysis of a randomized controlled trial

Brito, Alexandra M.P.; Schreiber, Martin A. MD; El Haddi, James MD; Meier, Eric N. MD; Rowell, Susan E. MD

Author Information

Journal of Trauma and Acute Care Surgery 04(1):95–102, January 2022. | DOI: 10.1007/s12009-022-00275-7

RESULTS

Six hundred forty-nine patients met inclusion criteria (354 early and 259 late). Twenty-eight-day and 6-month mortalities, 6-month Glasgow Outcome Scale–Extended, and disability rating scale scores were not different between early and late administration. Late administration was associated with higher rates of deep venous thrombosis (0.8 vs. 3.4%, $p = 0.02$), cerebral vasospasm (0% vs. 2%, $p = 0.01$), as well as prolonged EMS transport and need for a prehospital airway ($p < 0.01$).

CONCLUSION

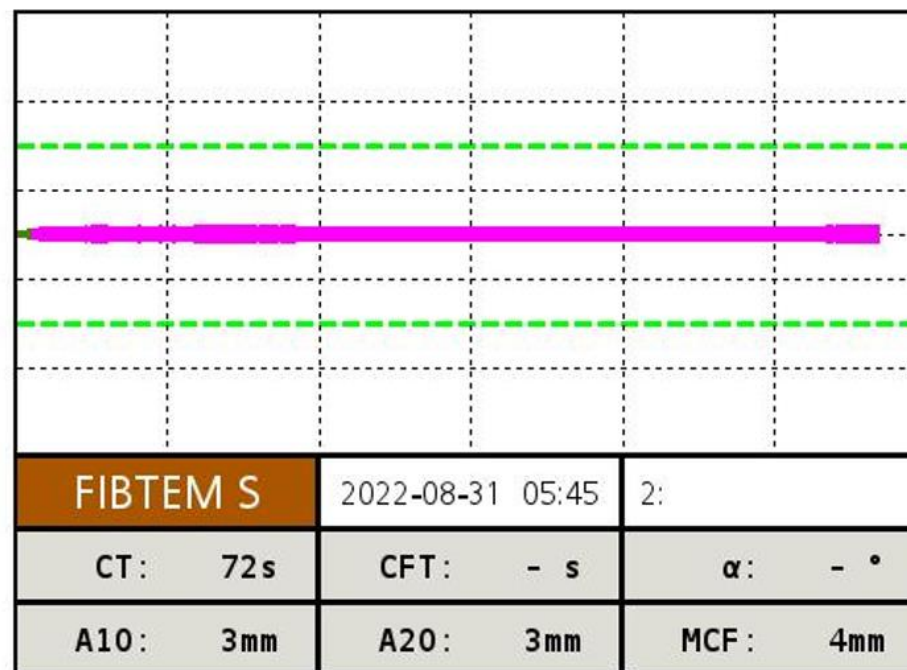
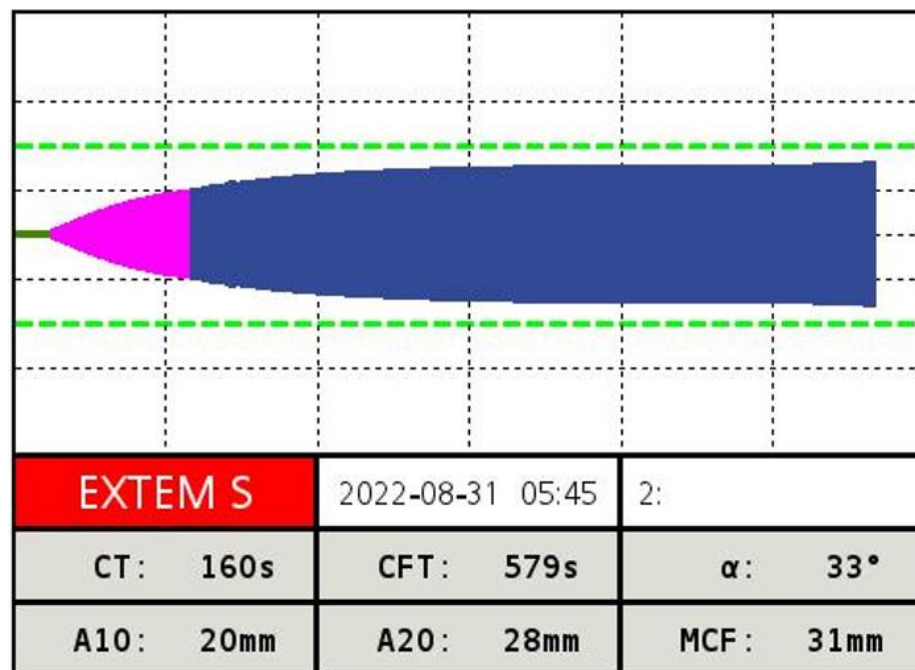
In patients with moderate or severe TBI who received TXA within 2 hours of injury, no mortality benefit was observed in those who received treatment within 45 minutes of injury, although lower rates of select complications were seen. These results support protocols that recommend TXA administration within 45 minutes of injury for patients with suspected TBI.

Datum a čas odběru: 31.08.2022 07:02 Te

Vyšetření	Hodn.	Výsl.	Jedn.	Meze/koment.
Leukocyty	<VH>	15.630	$10^9/l$	(4 - 10)
Erytrocyty	< . >	4.40	$10^{12}/l$	(4 - 5.8)
Hemoglobin	<VL>	130.0	g/l	(135 - 175)
Hematokrit	<VL>	0.360	l/l	(0.4 - 0.5)
Střední objem ERY	<VL>	81.6	fL	(84 - 96)
Trombocyty	< . >	184.0	$10^9/l$	(150 - 400)
Množství HGB v ERY	< . >	29.5	pg	(28 - 34)
Koncentr. HGB v ERY	<VH>	362.0	g/l	(320 - 360)
Střední objem trombo	< . >	10.70	fL	(7.8 - 11)
Šíře distribuce ERY	< . >	12.6	%	(10 - 15.2)
Normoblasty	< . >	0.00	$10^9/l$	(0 - 0)
Normoblasty/100WBC	< . >	0.00	/100WBC	(0 - 0)

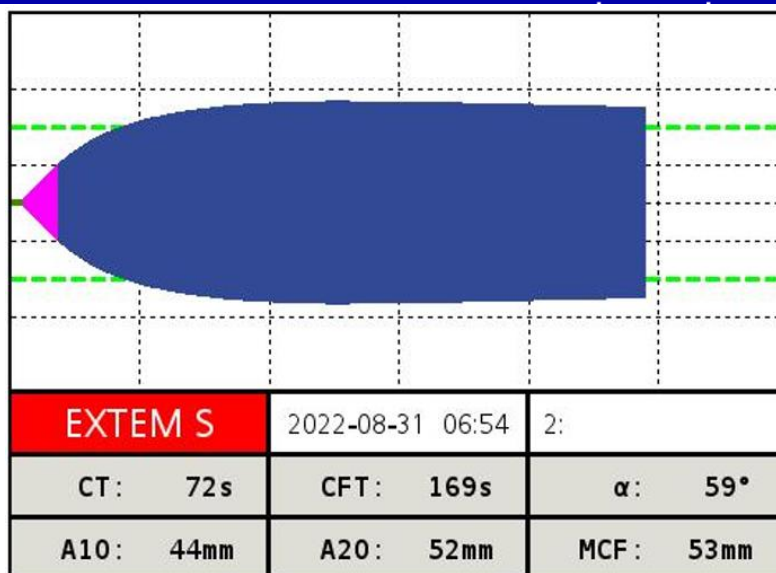
Datum a čas odběru: 31.08.2022 07:08

Vyšetření	Hodn.	Výsl.	Jedn.	Meze/koment.
Protrombin.čas	<H >	1.51	INR	(0.8 - 1.2)
Protrombin.čas	<VH>	20.5	s	(11 - 17)
Protrombin.čas	<VH>	1.51	R	(0.8 - 1.2)
Fibrinogen	<VL>	1.42	g/l	(1.8 - 4.2)
aPTT -ratio	<VH>	1.31	R	(0.8 - 1.2)
aPTT s	<VH>	42.00	s	(26 - 40)
Trombinový čas	<VH>	1.13	R	(0.8 - 1.1)
Trombinový čas	<VH>	20.1	s	(14 - 19)

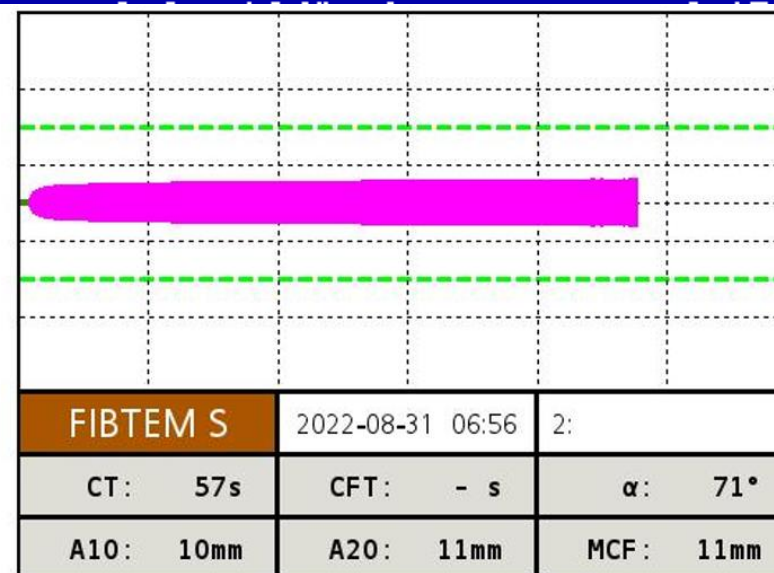


- podán Fibrinogen 6g, PCC 500IU, Exacyl 1g

Datum a čas odběru: 31.08.2022 08:18				
Vyšetření	Hodn.	Výsl.	Jedn.	Meze/koment.
Leukocyty	<VH>	11.410	10 ⁹ /l	(4 - 10)
Erytrocyty	<VL>	3.95	10 ¹² /l	(4 - 5.8)
Hemoglobin	<VL>	115.0	g/l	(135 - 175)
Hematokrit	<VL>	0.320	l/l	(0.4 - 0.5)
Střední objem ERY	<VL>	81.5	fL	(84 - 96)
Trombocyty	< . >	157.0	10 ⁹ /l	(150 - 400)
Množství HGB v ERY	< . >	29.1	pg	(28 - 34)
Koncentr. HGB v ERY	< . >	357.0	g/l	(320 - 360)
Střední objem trombo	< . >	11.00	fL	(7.8 - 11)
Šíře distribuce ERY	< . >	12.6	%	(10 - 15.2)



Datum a čas odběru: 31.08.2022 09:24				
Vyšetření	Hodn.	Výsl.	Jedn.	Meze/koment.
Protrombin.čas	<H >	1.45	INR	(0.8 - 1.2)
Protrombin.čas	<VH>	19.6	s	(11 - 17)
Protrombin.čas	<VH>	1.44	R	(0.8 - 1.2)
Fibrinogen	< . >	2.53	g/l	(1.8 - 4.2)
aPTT -ratio	<VH>	1.25	R	(0.8 - 1.2)
aPTT s	<H >	40.10	s	(26 - 40)
Trombinový čas	<VH>	1.12	R	(0.8 - 1.1)
Trombinový čas	<VH>	19.9	s	(14 - 19)



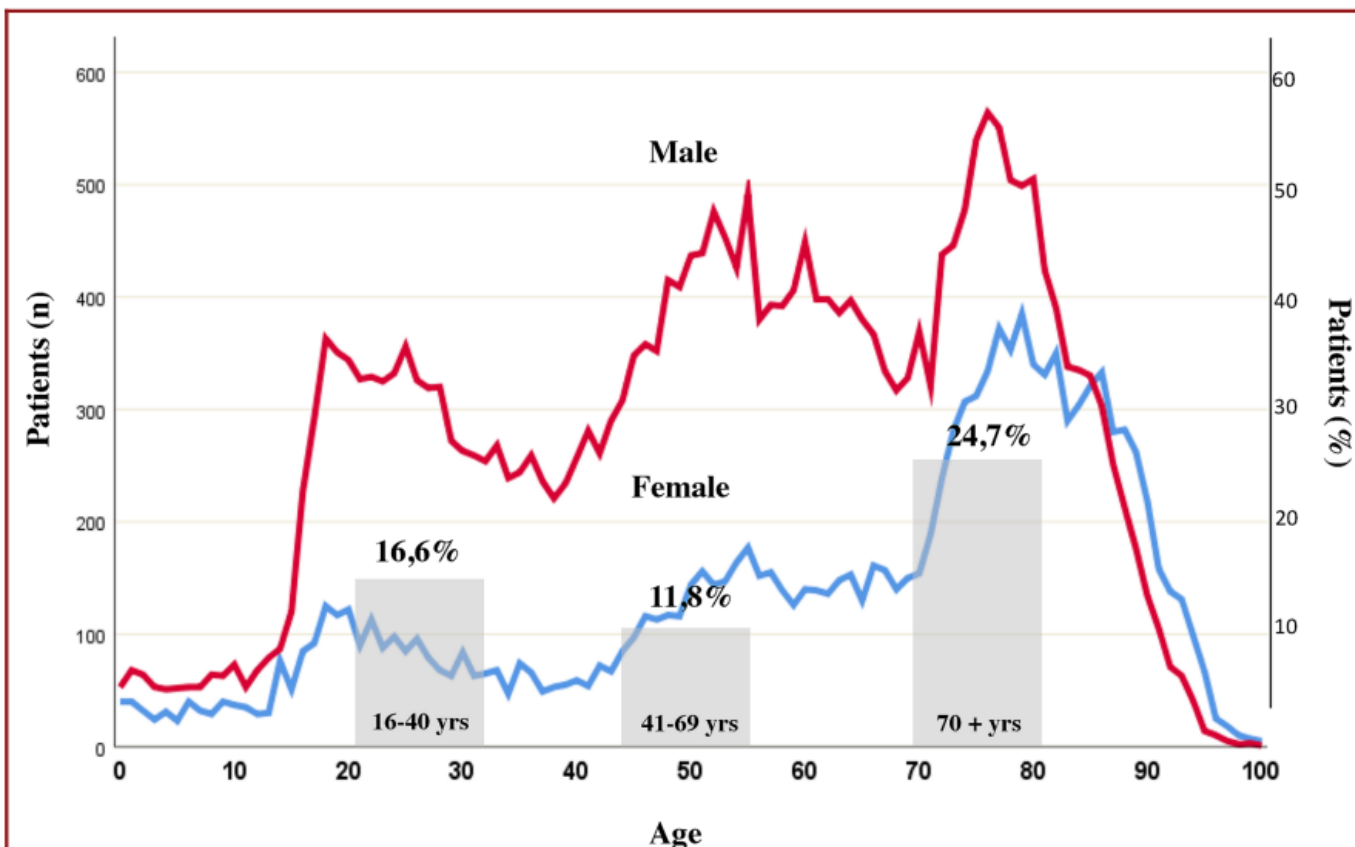


FIGURE 1. Trimodal age distribution of moderate to severe TBI in men and women: first peak: marked difference in incidence between the sexes, starting at puberty and rising until age 18 (driver's license); "testosterone effect" > "young risk-takers"; male > female; second peak: mid-50s ("older risk-takers"; work accidents); third peak: late 70s (incidence in the 2 sexes is now more nearly equal; mainly falls) and frequency of coagulopathy upon admission for 3 age groups according to the Berlin definition of coagulopathy, eg, PTT ≥ 40 s and/or INR ≥ 1.4 . Modified from Maegele et al,⁶ with permission from Deutscher Ärzteverlag GmbH.

- antikoagulační/antiagregační terapie – 20% pacientů

ORIGINAL WORK

Global Characterisation of Coagulopathy in Isolated Traumatic Brain Injury (TBI): A CENTER-TBI Analysis

Julia K. Böhm¹, Helge Güting¹, Sophie Thonn¹, Nadine Schäfer¹, Victoria Rambach¹, Herbert Schöchl^{2,3}, Oliver Grottel⁴, Rolf Rossaint⁵, Simon Stanworth¹, Nicola Curry², Rolf Lellering¹, Marc Maegele^{1,6} and CENTER-TBI Participants and Investigators

- u seniorů 50% pacientů

Impact of Preinjury Antithrombotic Therapy on 30-Day Mortality in Older Patients Hospitalized With Traumatic Brain Injury (TBI)

Pål Rønning¹, Erik Helseth^{1,2}, Ole Skarsaas¹, Cathrine Tverdal^{1,2}, Nade Andelic^{3,4}, Rahul Bhatnagar⁵, Mathias Melberg⁶, Nils Oddvar Skaga⁷, Mads Aarhus⁸, Signe Halvorsen⁴ and Ragnhild Helseth⁹

- zhoršení krvácení a outcome

> Acta Neurochir (Wien). 2016 Jan;158(1):117-23. doi: 10.1007/s00701-015-2645-8. Epub 2015 Nov 27.

High prevalence of pharmacologically induced platelet dysfunction in the acute setting of brain injury

Vincent Prinz¹, Tobias Finger², Simon Bayerl¹, Christoph Rosenthal², Stefan Wolf³

Dnešní hot topic – DOAC a neurointenzivní pacient?

Rossaint et al. *Critical Care* (2023) 27:80
<https://doi.org/10.1186/s13054-023-04327-7>

Critical Care

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

Rolf Rossaint^{1*}, Arash Afshari², Bertil Bouillon³, Vladimir Cerny^{4,5}, Diana Cimpoeu⁶, Nicola Curry^{7,8}, Jacques Duranteau⁹, Daniela Filipescu¹⁰, Oliver Grottke¹, Lars Grønlykke¹¹, Anatole Harrois⁹, Beverley J. Hunt¹², Alexander Kaserer¹³, Radko Komadina¹⁴, Mikkel Herold Madsen², Marc Maegele¹⁵, Lidia Mora¹⁶, Louis Riddez¹⁷, Carolina S. Romero¹⁸, Charles-Marc Samama¹⁹, Jean-Louis Vincent²⁰, Sebastian Wiberg¹¹ and Donat R. Spahn¹³

EJA

Eur J Anaesthesiol 2023; **40**:226–304

GUIDELINES

Management of severe peri-operative bleeding: Guidelines from the European Society of Anaesthesiology and Intensive Care

Second update 2022

Sibylle Kietzbl, Aamer Ahmed, Arash Afshari, Pierre Albaladejo, Cesar Aldecoa, Giedrius Barauskas, Edoardo De Robertis, David Faraoni, Daniela C. Filipescu, Dietmar Fries, Anne Godier, Thorsten Haas, Matthias Jacob, Marcus D. Lancé, Juan V. Llau, Jens Meier, Zsolt Molnar, Lidia Mora, Niels Rahe-Meyer, Charles M. Samama, Ecaterina Scarlatescu, Christoph Schlump, Anne J. Wikkelse and Kai Zacharowski

If bleeding is life-threatening in those receiving dabigatran, we recommend treatment with idarucizumab (i.v. 5 g) (Grade 1C).

If bleeding is life-threatening in the presence of an apixaban or rivaroxaban effect, especially in patients with TBI, we suggest reversal with andexanet alfa (Grade 2C).

If andexanet alfa is not available, or in patients receiving edoxaban, we suggest administration of PCC (25–50 U/kg) (Grade 2C).

We suggest that in severe bleeding, patients treated with dabigatran, a specific antidote (idarucizumab) could be considered. 2C

We suggest the use of PCC (25 IU kg⁻¹ at first) rather than andexanet alpha in bleeding patients treated with anti-Xa agents (rivaroxaban, apixaban and edoxaban). 2C

Jak zjistím, že pacient užívá DOAC?

- ANAMNÉZA !!!
 - Zda pacient užívá DOAC a kdy ho naposledy užil
- Laboratorní testy
 - PT, PT-R, aPTT, TT Fbg, Plt, DD, kreat, anti-Xa UFH
 - Hladina DOAC
 - Dabigatran – dTT, anti-IIa, ECT
 - Xabany – specifické anti-Xa
- Viskoelastické metody
 - Test na vnější cestu, vnitřní cestu a fibrinogen
 - RVV-test, ECA-test (ClotPro®)
- Screeningové testy z moči
 - DOASENSE® - DOAC Dipstick

EJA

Eur J Anaesthesiol 2024; 41:327–350

GUIDELINES

Clinical guideline on reversal of direct oral anticoagulants in patients with life threatening bleeding

Oliver Grottke, Arash Afshari, Aamer Ahmed, Eleni Arnaoutoglou, Daniel Bolliger, Christian Fenger-Eriksen and Christian von Heymann

Terapie – neurointenzivní pacient a Dabigatran

PICO 8

Clinical scenario: Adult patients on dabigatran therapy, who present with severe bleeding in urgent surgical or nonsurgical settings.

Should idarucizumab or PCC, aPCC or rFVIIa be used to manage dabigatran associated bleeding in urgent surgical or nonsurgical settings?

Recommendation

R8.1: We recommend that idarucizumab should be considered in patients under dabigatran therapy presenting with severe bleeding or in urgent surgical or nonsurgical settings. (1C)

R 8.2: In the absence of the availability of idarucizumab, we suggest the use of PCC or aPCC. However, the superiority of one agent over another has not been demonstrated. (2C)

R 8.3: Due to the paucity of clinical data, we are unable to provide any recommendation for the use of rFVIIa. (3)

EJA

Eur J Anaesthesiol 2024; **41**:327–350

GUIDELINES

Clinical guideline on reversal of direct oral anticoagulants in patients with life threatening bleeding

Oliver Grottke, Arash Afshari, Aamer Ahmed, Eleni Arnaoutoglou, Daniel Bolliger, Christian Fenger-Eriksen and Christian von Heymann

Terapie – neurointenzivní pacient a Xabany

PICO 7

Clinical scenario: Adult patients on FXa inhibitor therapy, who present with severe bleeding in urgent surgical or nonsurgical settings.

Should andexanet alfa or PCC, aPCC or rFVIIa be used to manage FXa inhibitor-associated bleeding in urgent surgical or nonsurgical settings?

R7.1: We recommend that PCC or andexanet alfa should be considered in patients under FXa inhibitor therapy presenting with severe bleeding. However, the superiority of one agent over another has not been demonstrated. (1C)

R7.2: In the absence of the availability of andexanet alfa and PCC, aPCC may be considered in patients on FXa inhibitor therapy presenting with severe bleeding. (2C)

R7.3: Due to the paucity of clinical data, we are unable to provide any recommendation for the use of rFVIIa in patients on FXa inhibitor therapy presenting with severe bleeding. (3)

EJA

Eur J Anaesthesiol 2024; **41**:327–350

GUIDELINES

Clinical guideline on reversal of direct oral anticoagulants in patients with life threatening bleeding

Oliver Grottke, Arash Afshari, Aamer Ahmed, Eleni Arnaoutoglou, Daniel Bolliger, Christian Fenger-Eriksen and Christian von Heymann

Terapie – neurointenzivní pacient + Xabany

RESULTS

A total of 263 patients were assigned to receive andexanet, and 267 to receive usual care. Efficacy was assessed in an interim analysis that included 452 patients, and safety was analyzed in all 530 enrolled patients. Atrial fibrillation was the most common indication for factor Xa inhibitors. Of the patients receiving usual care, 85.5% received prothrombin complex concentrate. Hemostatic efficacy was achieved in 150 of 224 patients (67.0%) receiving andexanet and in 121 of 228 (53.1%) receiving usual care (adjusted difference, 13.4 percentage points; 95% confidence interval [CI], 4.6 to 22.2; $P=0.003$). The median reduction from baseline to the 1-to-2-hour nadir in anti-factor Xa activity was 94.5% with andexanet and 26.9% with usual care ($P<0.001$). Thrombotic events occurred in 27 of 263 patients (10.3%) receiving andexanet and in 15 of 267 (5.6%) receiving usual care (difference, 4.6 percentage points; 95% CI, 0.1 to 9.2; $P=0.048$); ischemic stroke occurred in 17 patients (6.5%) and 4 patients (1.5%), respectively. There were no appreciable differences between the groups in the score on the modified Rankin scale or in death within 30 days.

czki, D. Toni,
A. Crowther,
Robinson,
v, A. Taylor,
nvestigators*

Terapie – neurointenzivní pacient + Xabany



CONCLUSIONS

Among patients with intracerebral hemorrhage who were receiving factor Xa inhibitors, andexanet resulted in **better control of hematoma expansion** than usual care but was associated with **thrombotic events, including ischemic stroke.** (Funded by Alexion Astra-Zeneca Rare Disease and others; ANNEXA-I ClinicalTrials.gov number, NCT03661528.)

Terapie – neurointenzivní pa

Critical Care Medicine

June 2025 • Volume 53 • Number 6 • Pages e1202–e1213

CLINICAL INVESTIGATION

Reversal of Factor Xa Inhibitor-Related Intracranial Hemorrhage: A Multicenter, Retrospective, Observational Study Comparing the Efficacy and Safety of Andexanet and Prothrombin Complex Concentrates

OBJECTIVE: To determine the effectiveness and safety of andexanet and prothrombin complex concentrates (PCCs) when administered after intracranial hemorrhage (ICrH) associated with direct oral anticoagulants, specifically apixaban or rivaroxaban.

DESIGN: A multicenter, retrospective, observational study of patients with apixaban or rivaroxaban-related ICrH who received andexanet or PCCs between January 1, 2015, and March 31, 2023. A predefined sensitivity analysis excluding patients with an admission Glasgow Coma Scale score of less than 7 was also performed.

SETTING: Forty-two stroke centers in the United States.

PATIENTS: A total of 1133 patients.

INTERVENTIONS: None.

MEASUREMENTS AND MAIN RESULTS: The primary efficacy outcome was the percentage of patients with excellent or good hemostasis as defined by the modified Sarode criteria. The primary safety outcome was the occurrence of a thrombotic event (TE) during their hospital stay. Of the 1133 patients evaluated, 1096 were included. In the full hemostatic efficacy analysis, patients receiving andexanet (87.8%) had higher odds of achieving excellent or good hemostasis (odds ratio [OR] 1.60; 95% CI, 1.00–2.56; $p = 0.048$) compared with PCCs (81.8%). Patients treated with andexanet (7.9%) had higher odds of a TE (OR 1.91; 95% CI, 1.13–3.20; $p = 0.014$) compared to those treated with PCCs (4.2%). No differences in hemostatic or thrombotic outcomes were observed when the sensitivity analysis was applied.

CONCLUSIONS: Despite statistically higher odds of achieving hemostatic efficacy with andexanet, we also observed higher odds of a TE with no difference in discharge outcomes observed between groups. When those with more severe neurologic injuries were excluded, efficacy and safety outcomes were similar between treatments.

Tak teda

- 18.12.2
- 22.12.2
- 23.12.2

ACC SCIENTIFIC STATEMENT

Direct Oral Anticoagulants in Primary and Secondary Prevention of Thrombotic Events: 2026 ACC Scientific Statement

A Report of the American College of Cardiology

t alfa

Osobní pohled: preference PCC

tor Xa Inhibitor-Associated Acute Intracerebral Hemorrhage) trial.²²⁹ This leaves 4-factor prothrombin complex concentrate (4F-PCC) or activated PCC as the primary reversal agent for factor Xa inhibitors. For dabigatran-

associated traumatic ICH (conditional recommendation; very low certainty

evidence).

A co dál po kontrole krvácení při TBI?

Rossaint et al. Critical Care (2023) 27:80
https://doi.org/10.1186/s13054-023-04327-7

Critical Care

GUIDELINES

Open Access



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

Rolf Rossaint^{1*}, Arash Afshari², Bertil Bouillon³, Vladimir Cerny^{4,5}, Diana Cimpoesu⁶, Nicola Curry^{7,8}, Jacques Duranseau⁹, Daniela Filipescu¹⁰, Oliver Grottke¹, Lars Grønlykke¹¹, Anatole Harrois⁹, Beverley J. Hunt¹², Alexander Kaserer¹³, Radko Komadina¹⁴, Mikkel Herold Madsen², Marc Maegele¹⁵, Lidia Mora¹⁶, Louis Riddez¹⁷, Carolina S. Romero¹⁸, Charles-Marc Samama¹⁹, Jean-Louis Vincent²⁰, Sebastian Wiberg¹¹ and Donat R. Spahn¹³

Recommendation 37
mechanical thromboprophylaxis with intermittent pneumatic compression (IPC) is recommended for patients with TBI who are on mechanical ventilation and have a bleeding risk.

We recommend continuing mechanical thromboprophylaxis with IPC until the patient is able to walk and until the bleeding risk is controlled and until the patient is able to take oral medication.

The optimal timing for the initiation of pharmacological thromboprophylaxis remains inadequately investigated, especially after TBI. Retrospective studies looking at TBI show that there are fewer VTE if thromboprophylaxis is started sooner (within 24–72 h of injury) rather than later, without increased bleeding risk [380], but how much earlier thromboprophylaxis can be used with efficacy and safety is the subject of future clinical trials. We suggest that pharmacological VTE prophylaxis be initiated with either LMWH, or low-dose UFH in patients with renal failure, as early as possible, only after a head CT confirms that ICH is stable and in the absence of persistent bleeding.

A co dál po kontrole krvácení při ICH?

Guideline

EUROPEAN
STROKE JOURNAL

European Stroke Organisation (ESO) and European Association of Neurosurgical Societies (EANS) guideline on stroke due to spontaneous intracerebral haemorrhage

European Stroke Journal
2025, Vol. 10(4) 1007–1086
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Expert consensus statement:

Low-molecular-weight heparins (LMWH) prophylaxis after ICH might be used for venous thromboembolism prevention in standard clinical practice if intermittent pneumatic compression is not available or feasible. The use should be limited to immobile patients, as well as patients at high prothrombotic risk (due to comorbidities, or prothrombotic medications).

Vote: 15/15

Take home message

- V neurointenzivní péči musíme umět urgentně vyřešit krvácivý či trombotický stav a poté preventovat trombembolické komplikace a zároveň minimalizovat krvácivé komplikace
- V pátrání po koagulopatii používejte všechny dostupné metody, včetně specifických testů pro DOAC
- V případě koagulopatie vyvolané DOAC u krvácení v CNS, použijte Idarucizumab u Dabigatranu a PCC u Xabanů