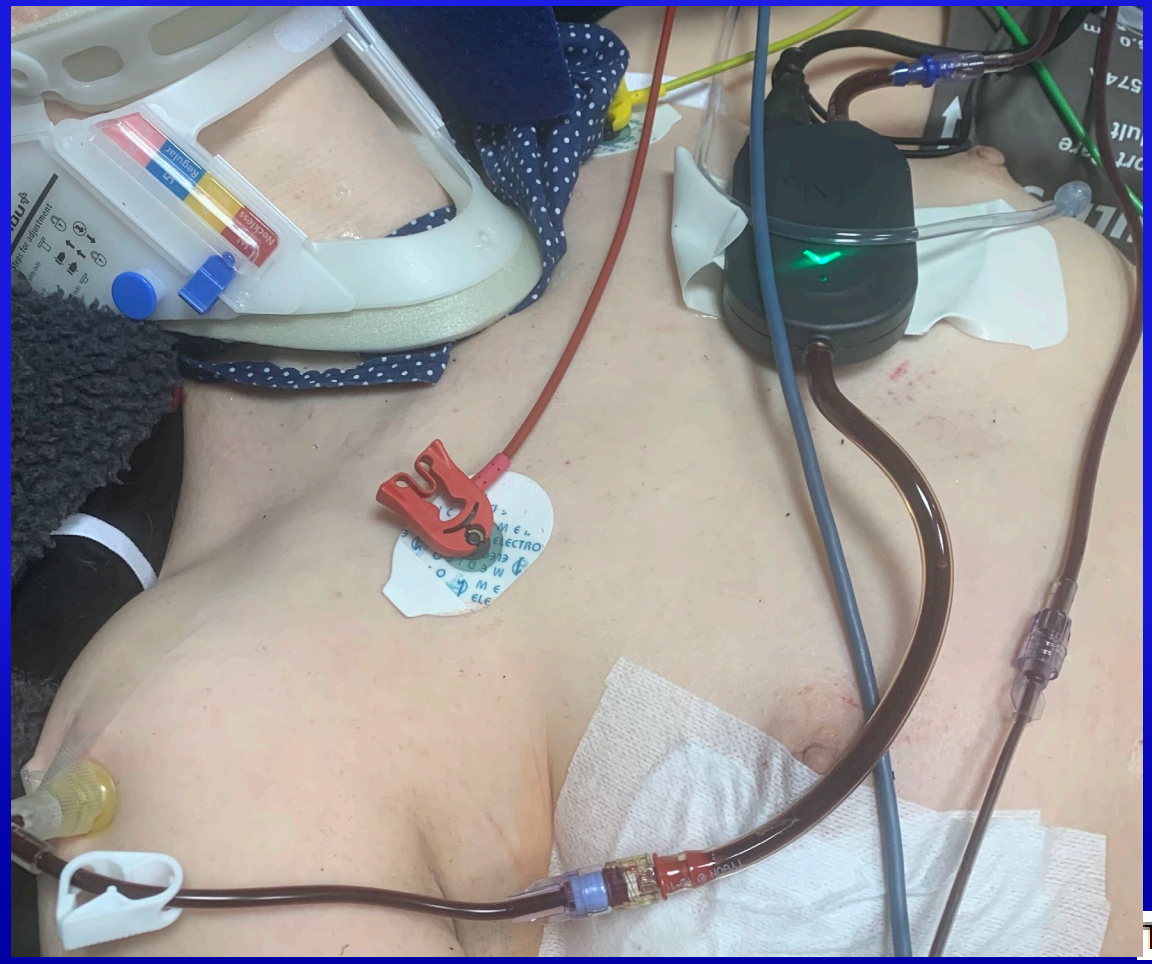
Použití plné krve u traumat

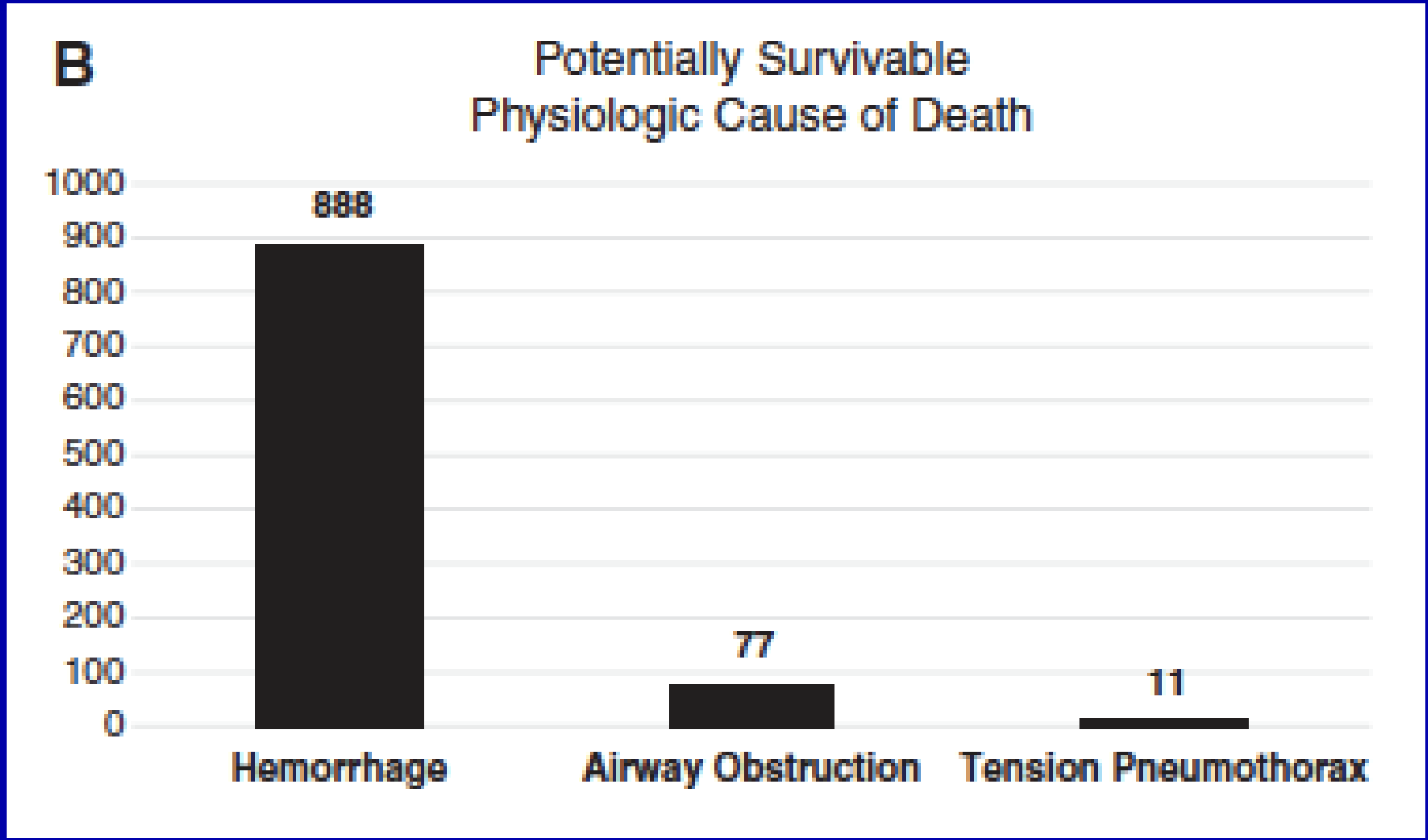
Jaromír Kočí

Klinika urgentní medicíny

LF a FN Hradec Králové

Get ready: whole blood is back and it's good for patients




B
Potentially Survivable
Physiologic Cause of Death
1000
900
800
700
600
500
400
300
200
100
0
888
77
11
Hemorrhage
Airway Obstruction
Tension Pneumothorax

Tekutinová resuscitace krvácejících pacientů

- Po každé válce se došlo k poznatku, že nejlepší tekutinou je krev!

- Po každé válce se na to zapomnělo ☹

Historie je učitelkou života?

and the viscosity of the stagnant blood lessened. In such cases, however, the degree of acidosis had not been determined, and injection of physiologic sodium chlorid solution or Ringer's solution makes no provision against such critical turns as have been encountered during operation or shortly thereafter in consequence of increased acidosis.[7] Not only does ordinary salt solution fail to combat acidosis, it actually *increases* an already existent acidosis. Milroy[8] has

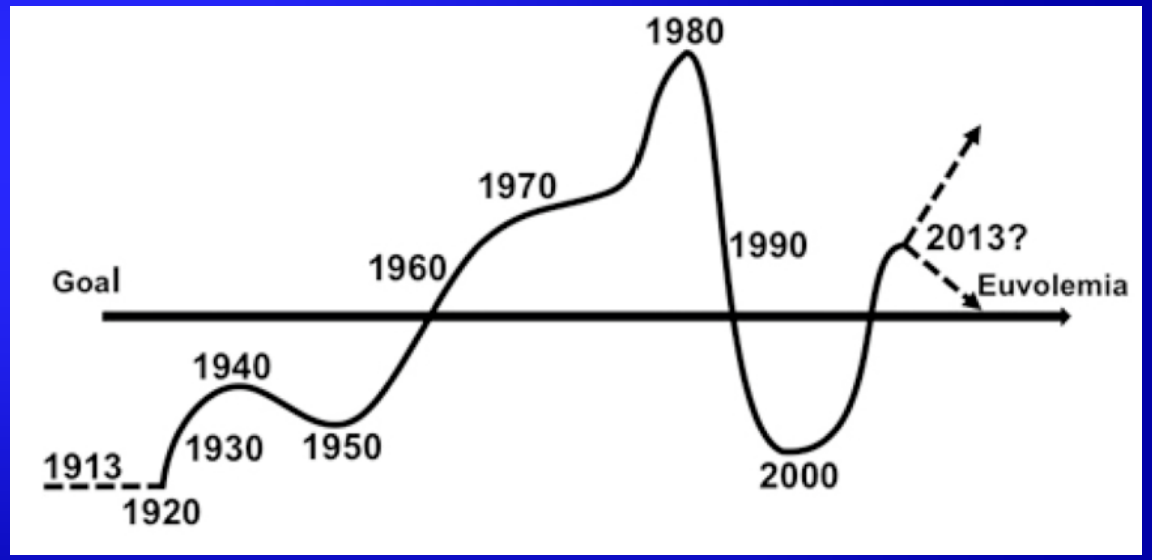
A CONSIDERATION OF THE NATURE OF WOUND SHOCK

W. B. CANNON, M.D. (BOSTON)
Captain, M. R. C., U. S. Army
FRANCE

JAMA 1918

Historie tekutinové resuscitace

- Navyšování objemů náhradních roztoků
- Redukce s počátkem tisíciletí
- Využití výsledků válečných konfliktů



A Century of Evolution in Trauma Resuscitation

Ronald V Maier, MD, FACS

Kdy začal odklon od plné krve?

CRITICAL CARE MEDICINE

Vol. 4, No. 2
Printed in U.S.A.

Fluid resuscitation following injury: rationale for the use of balanced salt solutions

CHARLES J. CARRICO, MD; PETER C. CANIZARO, MD; G. TOM SHIRES, MD

Kdy začal odklon od plné krve?

Carico 1972, CCM

- Chování intesticia během krvácení
- Vnitřní shift tekutin
- Možno zabránit aplikací 1 - 2 000 ml krystaloidního roztoku
- POUZE jako bridging terapie

Shoemaker 1976, CCM

- Apel na dodržování transfuzí
- Škodlivost náhradních roztoků
- Varování před zneužitím záběrů práce Carica a spol.

CRITICAL CARE MEDICINE

Vol. 4, No. 2
Printed in U.S.A.

Comparison of the relative effectiveness of whole blood transfusions and various types of fluid therapy in resuscitation

WILLIAM C. SHOEMAKER, MD

major objective is to achieve hemodynamic stability by volume therapy that will achieve to optimal values for blood volume, blood flow, and oxygen consumption. As soon as the patient's hemodynamic state becomes stabilized, it is desirable to keep the patient "on the dry side" to avoid pulmonary problems

Co dělat ?

- Tamponáda
- Turniket

Co dělat v PNP?

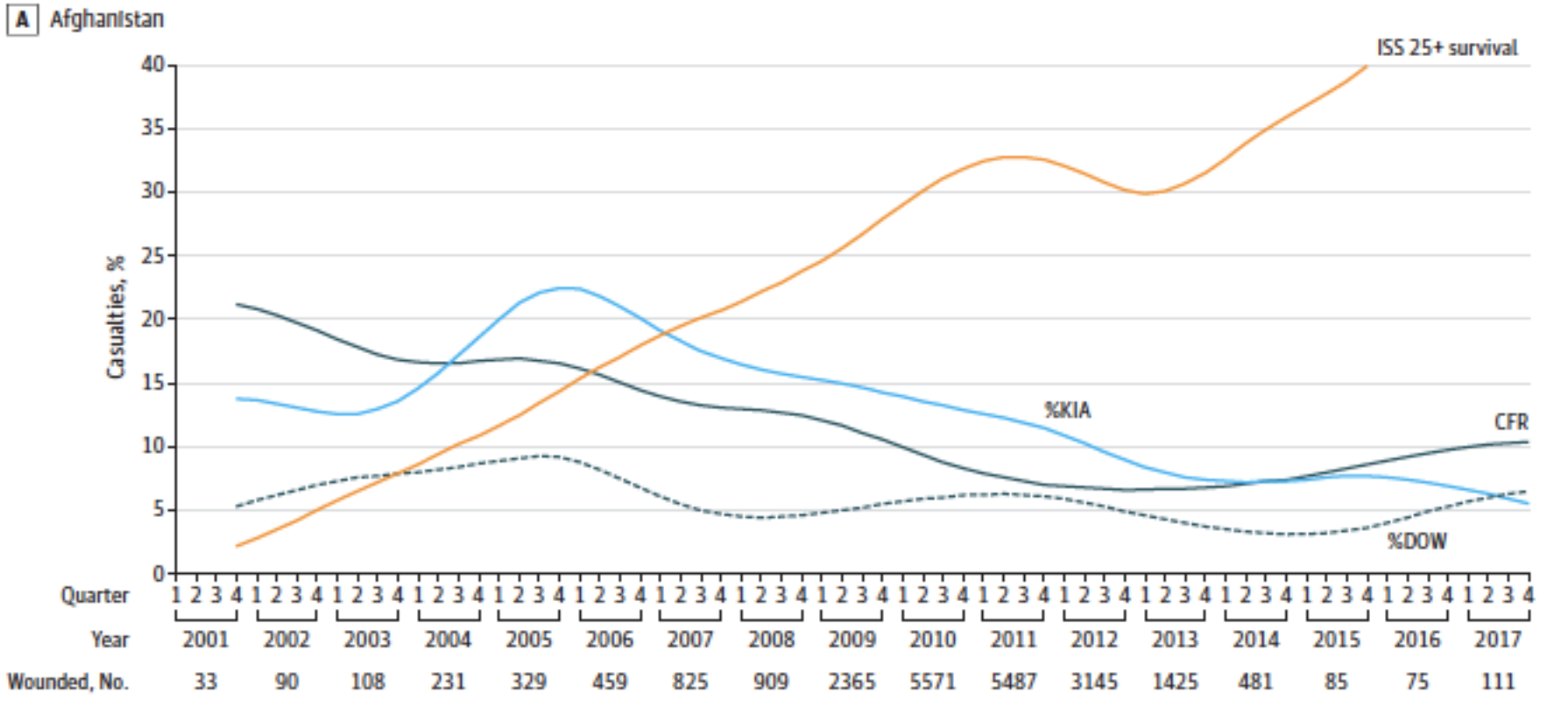
- Rychlý transport
- Pokud možno nepodávat náhradní roztoky u penetrujících traumat
- Krev s výhodou…..ALE?

JAMA Surgery | Original Investigation

Use of Combat Casualty Care Data to Assess the US Military Trauma System During the Afghanistan and Iraq Conflicts, 2001-2017

Jeffrey T. Howard, PhD; Russ S. Kotwal, MD, MPH; Caryn A. Stern, DrPH; Jud C. Janak, PhD; Edward L. Mazuchowski, MD, PhD; Frank K. Butler, MD; Zsolt T. Stockinger, MD; Barbara R. Raquel C. Bono, MD; David J. Smith, MD

higher at the outset of each conflict. Increased use of tourniquets, increased use of blood transfusion, and rapid prehospital trans-

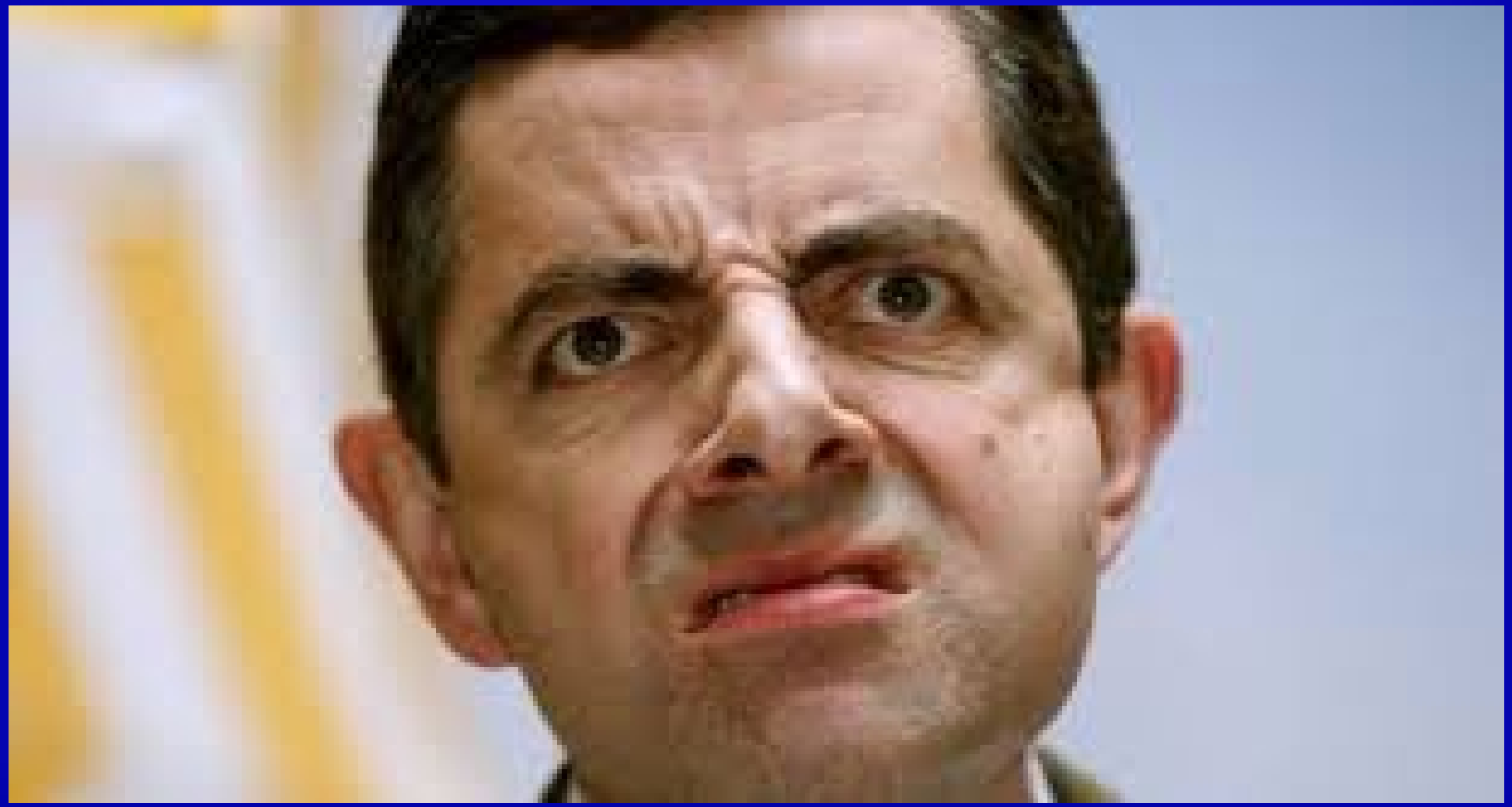


Zjištění rozsahu krevní ztráty

- Po prvotním vyšetření správná predikce krevní ztráty

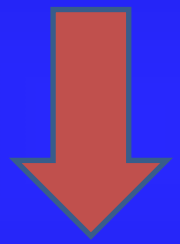
- Zlomenina žebra= 150-200 ml
- Zlomenina stehenní kosti= 1000-1500 ml
- Zlomenina pánve= až 2000 ml
- Skalp + nasopharynx= až 1000 ml

Opravdu to jde bez krve?



Typ objemové náhrady

Stabilní pacient s krevní ztrátou do 1000 ml bez známek pokračujícího krvácení



Podání krystaloidů dle diurézy, roztoky vždy ohřáté

Duchesne J Trauma 2010

Ztráta 1000-2000ml krve

- Podání erytrocytů dle hodnot krevního obrazu a oběhové stability pacienta
- Pokud je prodloužení koagulačních parametrů, zvážit podání plazmy
- Základem je vždy zastavené resp. nepokračující krvácení!

Ztráta poloviny objemu krve

- Snaha o malé objemy náhradních roztoků, ale nezaměňovat permisivní hypotenzi za nedostatečnou resuscitaci !!!!!!
- Katecholaminy ?
- Indikace k podání plné krve

Major venous injury and large volume crystalloid resuscitation: A limb threatening combination

Elizabeth Dauer [a, *], Seiji Yamaguchi [a], Daohai Yu [a], Xiaoning Lu [a], Kathyrn Kelley [a], John Sharpe [b], Nathan Manley [b], John A. Harvin [c], Ethan A. Taub [c], Anna Goldenberg-Sandau [d], Krishan Patel [d], Ellen Omi [e], Hassan Mashbari [e], Jennifer Hartwell [f], Jason Brocker [g]

Conclusion: Patients with MVI who receive LVCR, have combined arterial/venous injuries and have associated fractures are more likely to require amputation. MT was not associated with delayed amputation.

Kdo aktivuje podání plné krve?

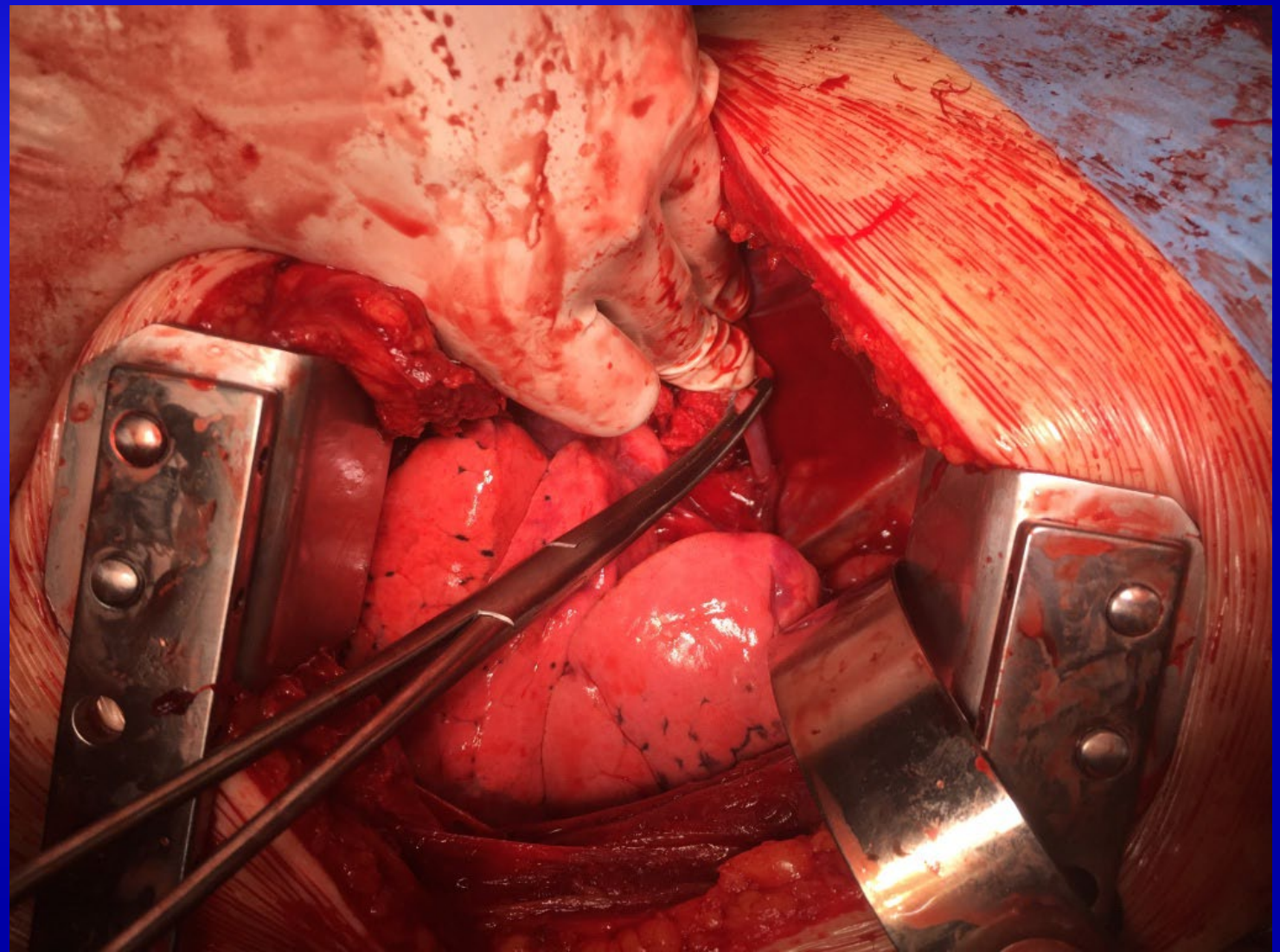
Konzultant při přítomnosti závažného krvácení či jeho předpokladu

Duchesne J Trauma 2008, 2010

Pomocná kritéria k podání plné krve/MTP

- Akce srdeční nad 110/min
- Systolický tlak pod 100 Torr
- Hemoglobin pod 90 g/l
- pH pod 7,25
- INR nad 1,5
- Tělesná teplota pod 35 st.

Duchesne J Trauma 2010



The prehospital use of younger age whole blood is associated with an improved arrival coagulation profile

Thomas Clements, MD, Cameron McCoy, MD, Scott Assen, MD, Jessica Cardenas, PhD, Charles Wade, PhD, David Meyer, MD, *and* **Bryan A. Cotton, MD, MPH**, *Houston, Texas*

J Trauma Acute Care Surg. 2021;90: 607–614.

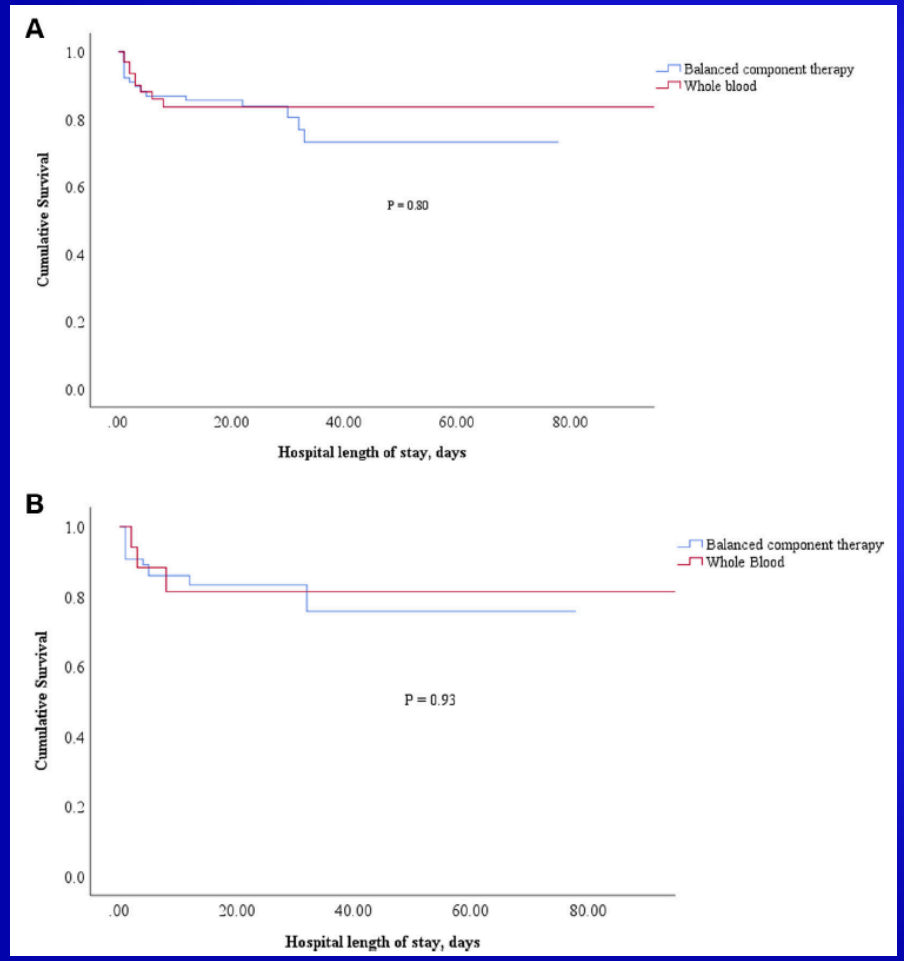
Previous in vitro data have suggested deterioration of platelet function in cold-stored WB after 14 days. The current study demonstrated decreased global hemostasis by clinically available laboratory tests, in older WB. This was most notable

Single Institution Trial Comparing Whole Blood vs Balanced Component Therapy: 50 Years Later

Juan Duchesne, MD, FACS, Alison Smith, MD, PhD, Shaun Lawicki, MBBS, John Hunt, MD, MPH, August Houghton, BS, MPH, Sharven Taghavi, MD, FACS, Rebecca Schroll, MD, FACS, Olan Jackson-Weaver, PhD, Chrissy Guidry, DO, Danielle Tatum, PhD

J Am Coll Surg 2021;232:433–442.

- Prospektivní observační studie
- 180 komponentní terapie/73 WB



- N.s. pro přežití
- Rychlejší hemostáza
- Nižší ARDS, ICU LOS, méně tranfuzí

- Čtyřletý soubor
- Level I TC Houston
- WB/komponentní terapie
- 840/537 pacientů

Impact of Incorporating Whole Blood into Hemorrhagic Shock Resuscitation: Analysis of 1,377 Consecutive Trauma Patients Receiving Emergency-Release Uncrossmatched Blood Products

Jason B Brill, MD, Brian Tang, BS, Gabrielle Hatton, MD, Krislynn M Mueck, MD, C Cameron McCoy, MD, Lillian S Kao, MD, MS, FACS, Bryan A Cotton, MD, MPH, FACS

J Am Coll Surg 2022;234:408–418

30-day survival	Odds ratio (95% CI)	p Value
WB group	4.10 (2.22-7.45)	<0.001
Age, per year	0.97 (0.96-0.98)	0.001
Male sex	0.46 (0.24-0.87)	0.018
ISS, per point	0.93 (0.92-0.95)	<0.001
Scene SBP, per mmHg	1.00 (0.99-1.01)	0.286
Arrival lactate, per mmol/L	0.82 (0.76-0.88)	<0.001

24-hour blood product use	Rate ratio (95% CI)	p Value
Whole blood group	0.38 (0.21-0.70)	0.002
Age, per year	1.00 (0.99-1.02)	0.602
Male sex	1.80 (0.98-3.26)	0.055
ISS, per point	1.07 (1.04-1.09)	<0.001
Scene SBP, per mmHg	0.99 (0.99-1.01)	0.639
Arrival lactate, per mmol/L	1.12 (1.02-1.25)	0.019

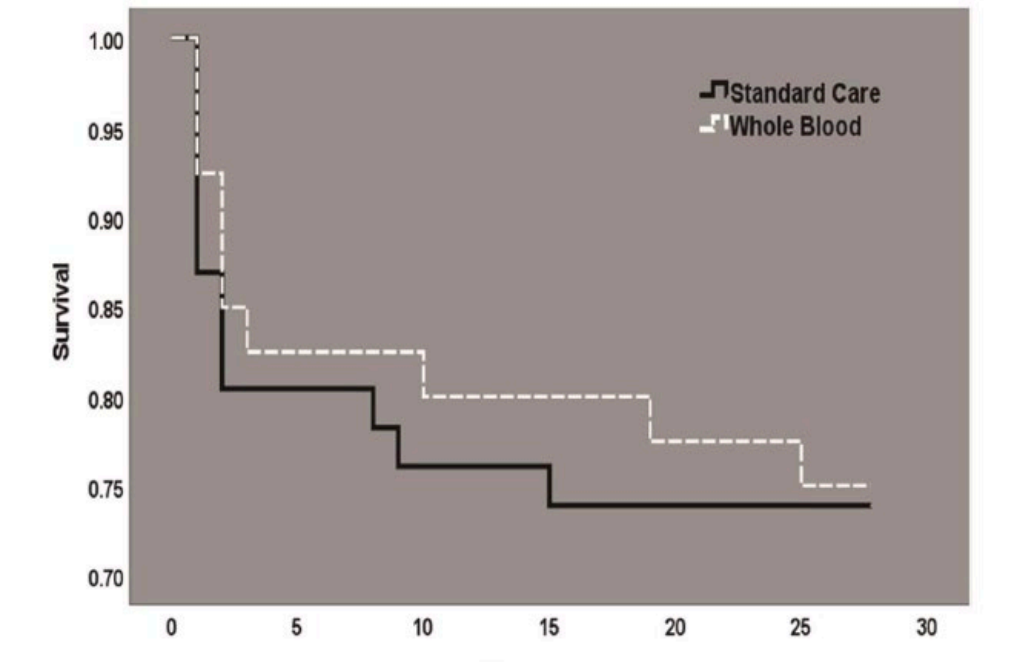
WB transfusion to resuscitate patients in hemorrhagic shock from major trauma is associated with a survival benefit that extends to 30 days in a large cohort. These patients

later in the resuscitation. Transfusion after trauma should return to the basic approach proven in 2 World Wars, Korea, Vietnam, and more recently Iraq and Afghanistan. Patients bleeding out whole blood should be provided whole blood while hemostasis is achieved. Further mul-

Prehospital low titer group O whole blood is feasible and safe: Results of a prospective randomized pilot trial

Frank X. Guyette, MD, MPH, Mazen Zenati, MD, PhD, Darrell J. Triulzi, MD, Mark H. Yazer, MD, Hunter Skroczky, BS, Barbara J. Early, BSN, Peter W. Adams, BS, Joshua B. Brown, MD, MCS, Louis Alarcon, MD, Matthew D. Neal, MD, Raquel M. Forsythe, MD, Brian S. Zuckerbraun, MD, Andrew B. Peitzman, MD, Timothy R. Billiar, MD, *and* Jason L. Sperry, MD, MPH, *Pittsburgh, Pennsylvania*

J Trauma Acute Care Surg. 2022;92: 839–847.



In conclusion, prehospital through in-hospital LTOWB resuscitation is safe and may possibly associated with hemostatic benefits. A large-scale prehospital clinical trial is feasible with

Whole blood: back to the future

- Plná krev deleukotizovaná k univerzálnímu použití (PKDU)
- Čerstvá, max 14 dní, nízký titr protilátek
- Pouze chlazená
- Aktivní trombocyty

Další výhody?

- Hlavně logistika – vše v jednom bez počítání
- Odpadá lidová tvořivost ☺

Rizika?

Safety profile and impact of low-titer group O whole blood for emergency use in trauma

Despite WB patients presenting with more evidence of shock upon arrival to the ED, there was no difference in overall mortality. We found less evidence of hemolysis in patients receiving WB and no difference in transfusion reactions between the two groups. Moreover, when controlling for degree of shock and injury severity, LTO-WB use was associated with a greater than 50% reduction in post-ED transfusions and twofold increase in survival. This suggests, at the very least, that reconstituting WB

J Trauma Acute Care Surg
Volume 88, Number 1

Aplikace plné krve u traumat

- Bezpečná
- Fungující
- Efektivní
- Zachraňuje životy….

Vy nepoužíváte plnou krev u traumatu?

A jaký máte důvod?