



## PRINCIPY LÉČBY POLYTRAUMAT V LÉKAŘSKÉM SYSTÉMU: STAY & PLAY NEBO SCOOP & RUN?

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Windsor, 9. března 1997



Paříž, 31. srpna 1997







The SAMU team spent nearly an hour, until 1:30 a.m. treating Diana in the tunnel. Then the ambulance drove her at a snail's pace to Piete-Salpetriere hospital, 6.15 kilometers away. At that time of night, it would normally take five or 10 minutes to do that drive along the riverfront expressway. But Diana's driver, applying standard French emergency procedures, drove extremely slowly so as not to subject the fragile patient to shocks and bumps. As a result, it took them some 40 minutes to make the drive, and the ambulance stopped within a few hundred yards of the hospital to treat a sharp drop in blood pressure.

By the time Diana reached the emergency room, it was nearly an hour and 45 minutes after the crash.



## Přednemocniční čas: smrtící nepřítel

- **Lepší klinický výsledek při příjezdu do TC během 60 minut**

Cowley RA et al. An economical and proved helicopter program for transporting the emergency critically ill and injured patient. J Trauma 1973

- **Advanced care necessarily extends on-scene interval**

Smith J et al. Prehospital stabilization of critically injured patients: a failed concept. Trauma 1985

- **On-scene and dispatch times associated with increased mortality**

Pham H et al. Faster on-scene times associated with decreased mortality in HEMS transported trauma patients. Trauma Surg Acute Care Open 2017

- **Time is the enemy: Critical nature of prehospital time in patients with non-compressible torso hemorrhage**


- **Efforts should be directed toward the development of therapies to increase the window of survival in the prehospital environment**

Alarhayem AQ et al. Mortality in trauma patients with hemorrhage from torso injury occurs long before the "golden hour". Am J Surg 2016



X A B C D E

H H T T





# Hypoxie: intubovat nebo neintubovat?

Fevang et al. *Critical Care* (2017) 21:192  
DOI 10.1186/s13054-017-1787-x

Critical Care

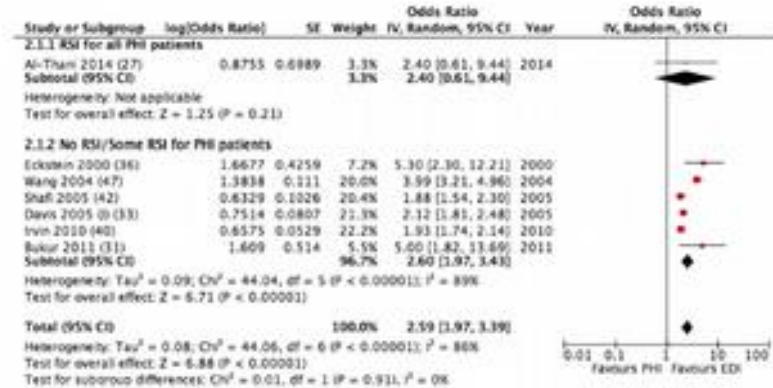
RESEARCH

Open Access



A systematic review and meta-analysis comparing mortality in pre-hospital tracheal intubation to emergency department intubation in trauma patients

Espen Fevang<sup>1,2\*</sup>, Zane Perkins<sup>3,4</sup>, David Lockey<sup>3,4,5</sup>, Elisabeth Jeppesen<sup>1,5</sup> and Hans Morten Lossius<sup>1,5</sup>



- 21 studií | 35 838 pacientů | letalita ETI v PNP 48 % vs. ETI na UP 29 %
- 2,59x vyšší riziko úmrtí při ETI v přednemocniční péči
- Hypoxémie, přetlaková ventilace při hypovolémii, kardiovaskulární kolaps





## Hypoxie: intubovat nebo neintubovat?

- Riziko přednemocniční indukce celkové anestézie
- Pacienti s  $TK_{sys} < 90$  mmHg a GCS 13–15

Hypotenze	Přednemocniční ETI	ETI neprovedena
Pacienti	101	135
Letalita	15 (14,9 %)	6 (4,9 %)

OR adj. 3,07

Přednemocniční ETI	Hypovolémie	Normovolémie
Pacienti	58	43
Letalita	14 (24 %)	1 (2 %)

OR adj. 9,99



GUIDELINE

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# Best practice advice on pre-hospital emergency anaesthesia & advanced airway management

Kate Crewdson<sup>\*</sup>, David Lockey, Wolfgang Voelckel, Peter Temesvari, Hans Morten Lossius and EHAC Medical Working Group

- Min. 12 měsíců praxe v anesteziologii a 12 měsíců v urgentní medicíně
- Formální check-list, přístup 360 st., preoxygenace >3 min, ketamin...

REVIEW

CNS Neuroscience & Therapeutics

## The Emerging Use of Ketamine for Anesthesia and Sedation in Traumatic Brain Injuries

Lee C. Chang,<sup>1</sup> Sally R. Raty,<sup>1</sup> Jaime Ortiz,<sup>1</sup> Neil S. Ballard<sup>1</sup> & Sanjay J. Mathew<sup>2,3</sup>

<sup>1</sup> Department of Anesthesiology, Baylor College of Medicine, Houston, TX, USA

<sup>2</sup> Staff Physician, Michael E. DeBakey VA Medical Center, Houston, TX, USA

<sup>3</sup> Menninger Department of Psychiatry & Behavioral Sciences, Baylor College of Medicine, Houston, TX, USA



## Spinal motion restriction

- Poranění Cp u 2–5 % tupých poranění (10–30 % pokud GCS  $\leq$  8)

### SPINAL MOTION RESTRICTION IN THE TRAUMA PATIENT – A JOINT POSITION STATEMENT

Peter E. Fischer, MD, MS, Debra G. Perina, MD, Theodore R. Delbridge, MD, MPH,  
Mary E. Fallat, MD, Jeffrey P. Salomone, MD, Jimm Dodd, MS, MA, Eileen M. Bulger, MD,  
Mark L. Gestring, MD

There is no role for SMR in penetrating trauma

- . Indications for SMR following blunt trauma include:
  - i. Acutely altered level of consciousness (e.g., GCS  $<$ 15, evidence of intoxication)
  - ii. Midline neck or back pain and/or tenderness
  - iii. Focal neurologic signs and/or symptoms (e.g., numbness or motor weakness)
  - iv. Anatomic deformity of the spine
  - v. Distracting circumstances or injury (e.g., long bone fracture, degloving, or crush injuries, large burns, emotional distress, communication barrier, etc.) or any similar injury that impairs the patient's ability to contribute to a reliable examination



## Hypovolémie: zástava zevního krvácení



Amputační poranění. Boston, USA, 15. dubna 2013



Poranění krčních tepen. LZS Hradec Králové, 2018



## Hypovolémie: zástava vnitřního krvácení (?)





# Hypovolémie: současné možnosti léčby





## London's Air Ambulance, Velká Británie





# Přednemocniční aplikace erytrocytů

## Pre-Trauma Center Red Blood Cell Transfusion Is Associated with Improved Early Outcomes in Air Medical Trauma Patients

Joshua B Brown, MD, Jason L Sperry, MD, MPH, FACS, Anisleidy Fombona, BS,  
Timothy R Billiar, MD, FACS, Andrew B Peitzman, MD, FACS, Francis X Guyette, MD, MPH

- 
- BACKGROUND:** Hemorrhage is the leading cause of survivable death in trauma and resuscitation strategies including early RBC transfusion have reduced this. Pre-trauma center (PTC) RBC transfusion is growing and preliminary evidence suggests improved outcomes. The study objective was to evaluate the association of PTC RBC transfusion with outcomes in air medical trauma patients.
- STUDY DESIGN:** We conducted a retrospective cohort study of trauma patients transported by helicopter to a Level I trauma center from 2007 to 2012. Patients receiving PTC RBC transfusion were matched to control patients (receiving no PTC RBC transfusion during transport) in a 1:2 ratio using a propensity score based on prehospital variables. Conditional logistic regression and mixed-effects linear regression were used to determine the association of PTC RBC transfusion with outcomes. Subgroup analysis was performed for scene transport patients.
- RESULTS:** Two-hundred and forty treatment patients were matched to 480 control patients receiving no PTC RBC transfusion. Pre-trauma center RBC transfusion was associated with increased odds of 24-hour survival (adjusted odds ratio [AOR] = 4.92; 95% CI, 1.51–16.04;  $p = 0.01$ ), lower odds of shock (AOR = 0.28; 95% CI, 0.09–0.85;  $p = 0.03$ ), and lower 24-hour RBC requirement (Coefficient –3.6 RBC units; 95% CI, –7.0 to –0.2;  $p = 0.04$ ). Among matched scene patients, PTC RBC was also associated with increased odds of 24-hour survival (AOR = 6.31; 95% CI, 1.88–21.14;  $p < 0.01$ ), lower odds of shock (AOR = 0.24; 95% CI, 0.07–0.80;  $p = 0.02$ ), and lower 24-hour RBC requirement (Coefficient –4.5 RBC units; 95% CI, –8.3 to –0.7;  $p = 0.02$ ).
- CONCLUSIONS:** Pre-trauma center RBC was associated with an increased probability of 24-hour survival, decreased risk of shock, and lower 24-hour RBC requirement. Pre-trauma center RBC appears beneficial in severely injured air medical trauma patients and prospective study is warranted as PTC RBC transfusion becomes more readily available. (J Am Coll Surg 2015; 220:797–808. © 2015 by the American College of Surgeons)





# Přednemocniční aplikace plazmy

## Plasma-first resuscitation to treat haemorrhagic shock during emergency ground transportation in an urban area: a randomised trial



*Hunter B Moore, Ernest E Moore, Michal P Chapman, Kevin McVane, Gary Bryskiewicz, Robert Blechar, Theresa Chin, Clay Cothren Burlew, Fredric Pieracci, F Bernadette West, Courtney D Fleming, Arsen Ghasabyan, James Chandler, Christopher C Silliman, Anirban Banerjee, Angela Sauaia*

Moore HB et al. The Lancet 19 July 2018

## Prehospital Plasma during Air Medical Transport in Trauma Patients at Risk for Hemorrhagic Shock

*J.L. Sperry, F.X. Guyette, J.B. Brown, M.H. Yazer, D.J. Triulzi, B.J. Early-Young, P.W. Adams, B.J. Daley, R.S. Miller, B.G. Harbrecht, J.A. Claridge, H.A. Phelan, W.R. Witham, A.T. Putnam, T.M. Duane, L.H. Alarcon, C.W. Callaway, B.S. Zuckerbraun, M.D. Neal, M.R. Rosengart, R.M. Forsythe, T.R. Billiar, D.M. Yealy, A.B. Peitzman, and M.S. Zenati, for the PAMPer Study Group\**

Sperry JL et al. NEJM 26 July 2018



# Přednemocniční aplikace plazmy

## COMBAT | Control of Major Bleeding After Trauma Trial

- Use of prehospital plasma was **NOT** associated with survival benefit BUT most patients in trauma centre within 30 min of injury

Moore HB et al. The Lancet 19 July 2018

## PAMPer trail | Prehospital Air Medical Plasma

- Prehospital administration of thawed plasma was safe and resulted in a robust 30-day mortality benefit and a lower median prothrombintime ratio than standard-care resuscitation
- Mortality: plasma 23,2 % vs. control 33,9 % ( $p=0,03$ )

Sperry JL et al. NEJM 26 July 2018



## Přednemocniční aplikace plazmy

A survival benefit associated with prehospital plasma at 24 hours and 28 days exists primarily in blunt injured patients with no benefit shown in penetrating trauma patients. No detrimental effects attributable to plasma are demonstrated in penetrating injury. These results have important relevance to military and civilian trauma systems. (*J Trauma Acute Care Surg.* 2020;88: 33–41. Copyright © 2019 American Association for the Surgery of Trauma.)

Reitz K et al. *J Trauma Acute Care Surg* 2019

## Přednemocniční aplikace fibrinogenu

### FlinTIC | Efficacy of pre-hospital Fibrinogen Concentrate (Clottafact)

- Časně podání proveditelné a snižuje riziko časně deplece
- Nízký počet pacientů (n=53 za období 2011–15), extrémní dávky koloidů, trend ke zvýšení spotřeby TP (zejména FFP) v nemocnici

Ziegler B et al. Nepublikované výsledky na papers.ssrn.com 2019



## LZS Hradec Králové, Česká republika

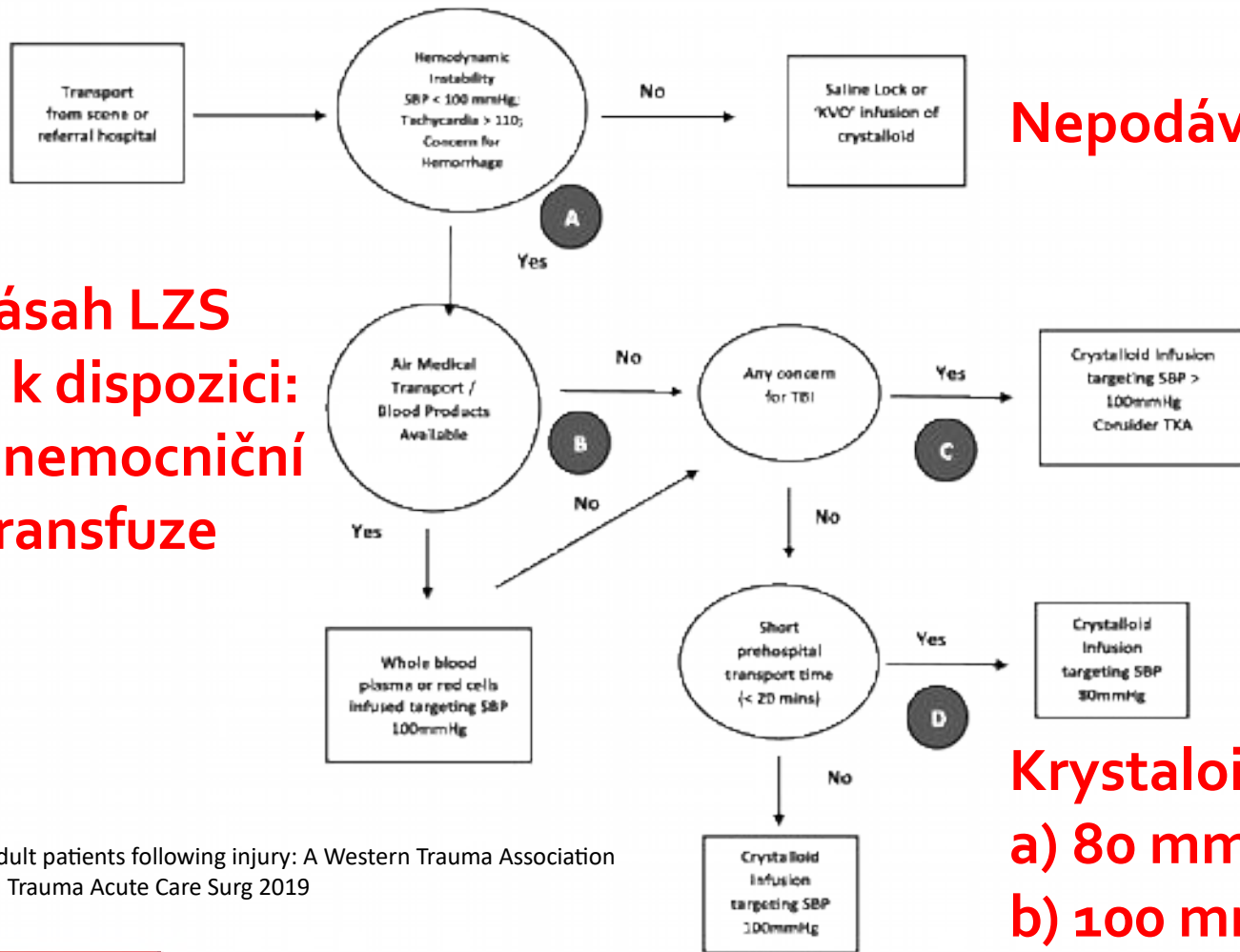




Fotografie: LZS Hradec Králové 2018–19



## Zásah LZS a TP k dispozici: přednemocniční transfuze



**Nepodávat nic!**

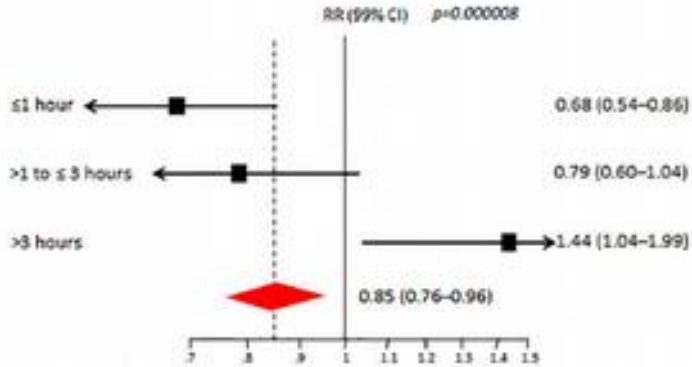
**Krystaloidy**  
**a) 80 mmHg**  
**b) 100 mmHg**



# Prehospital tranexamic acid: what is the current evidence?

Lena M Napolitano

- Significant limitations of CRASH-2
- Difficulty to translate results into large civilian trauma centres and trauma systems of care



**Figure 1** CRASH-2 trial results; RR all-cause in-hospital mortality based on timing of TXA administration. Early TXA ( $\leq 1$  hour from injury) is associated with survival benefit. From Shakur *et al.*<sup>1</sup>

## V. Initial management of bleeding and coagulopathy

### *Antifibrinolytic agents*

**Recommendation 22** We recommend that TXA be administered to the trauma patient who is bleeding or at risk of significant haemorrhage as soon as possible and within 3 h after injury at a loading dose of 1 g infused over 10 min, followed by an i.v. infusion of 1 g over 8 h. (Grade 1A)

We recommend that protocols for the management of bleeding patients consider administration of the first dose of TXA en route to the hospital. (Grade 1C)



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## World's first pre-hospital REBOA performed

Monday 16th June 2014

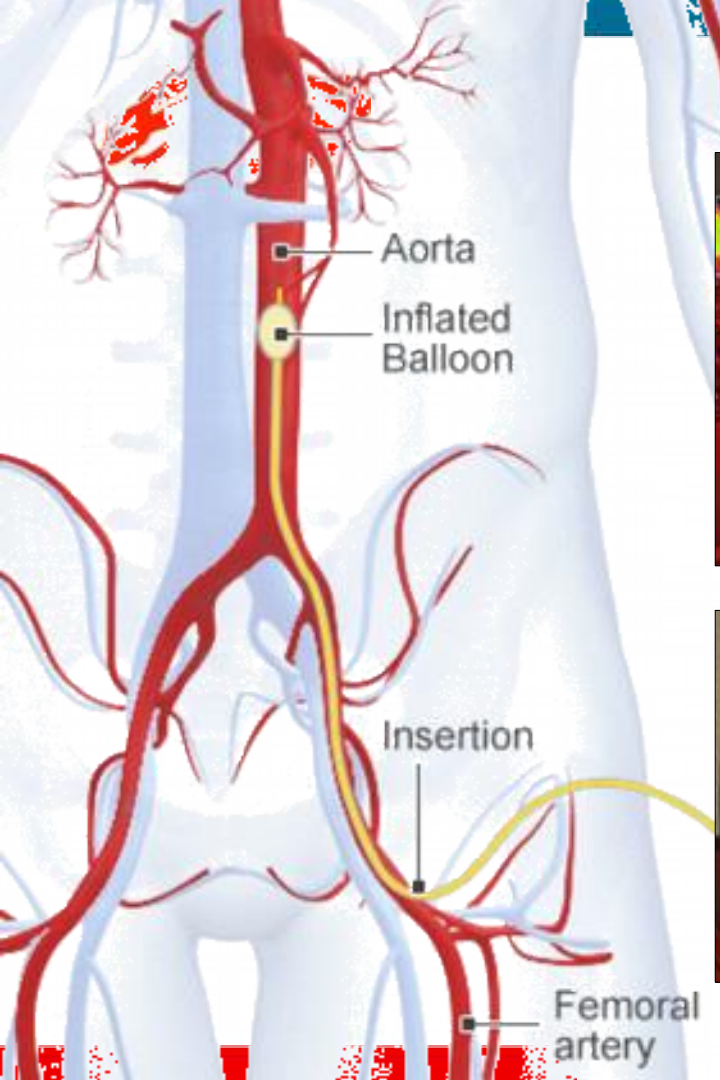
- World's first pre-hospital REBOA carried out by London's Air Ambulance
- Pioneering new technique to prevent trauma patients bleeding to death
- Control of severe pelvic haemorrhage, an injury most commonly associated with cycling incidents and falls from height
- 2 years of development with The Royal London Hospital
- Boris, "stunning advances in medical care are helping people survive serious injury in London"



We have performed the world's first roadside balloon surgery to control internal bleeding. Use of pre-hospital Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA), a technique used first in the UK at The Royal London Hospital, to control haemorrhage in trauma patients is a ground breaking move by London's Air Ambulance.

On average the charity is called five times a day to deliver its life-saving medical interventions to people seriously injured in the Capital. Many of these patients are suffering from catastrophic bleeding. Tragically some die at the scene as a result of their severe blood loss and never make it to hospital. London's Air Ambulance can now perform





REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta)



## REBOA: alternativa resuscitační torakostomie?

- 19 pacientů ISS 34 se život ohrožujícím pánevním krvácením
- 13 úspěšných vs. 6 neúspěšných zavedení
- Pre-REBOA TK<sub>sys</sub> 57 vs. Post- REBOA TK<sub>sys</sub> 114 (P < 0,001)
- Nižší riziko vzniku přednemocniční NZO: 0 % vs. 50 % (P = 0,021)
- Nižší riziko úmrtí z vykrvácení: 0 % vs. 67 % (P = 0,004)
- Lepší výsledky přežití: REBOA 62 % vs. no REBOA 33 % (P = 0,350)
- Distální arteriální uzávěr vyžadující troembektomii 10/13 (77 %)

## Tenzní pneumothorax



Four years of pre-hospital simple thoracostomy performed by a physician-paramedic HEMS team **236**  
**torakostomií u 110 pacientů: žádné komplikace**



## Tamponáda: (hyper-)invazivní metody léčby



Pravidlo „4P“: prodleva do 10 minut od vzniku NZO, praxe, pomůcky, prostředí  
**Přínos přednemocniční torakotomie u tupých poranění neprokázán!**

## Thirteen Survivors of Prehospital Thoracotomy for Penetrating Trauma: A Prehospital Physician-Performed Resuscitation Procedure That Can Yield Good Results

Gareth E. Davies, FRCP, FFAEM, and David J. Lockett, FRCA, FIMC, RCS(Ed)

*The Journal of TRAUMA*<sup>®</sup> Injury, Infection, and Critical Care • Volume 70, Number 5, May 2011

Foto: Rehn M, London's Air Ambulance



and 13 survivors of traumatic cardiac arrest survived who might not have been resuscitated had these guidelines been followed. Eight of these unexpected survivors had pre-hospital thoracotomies.

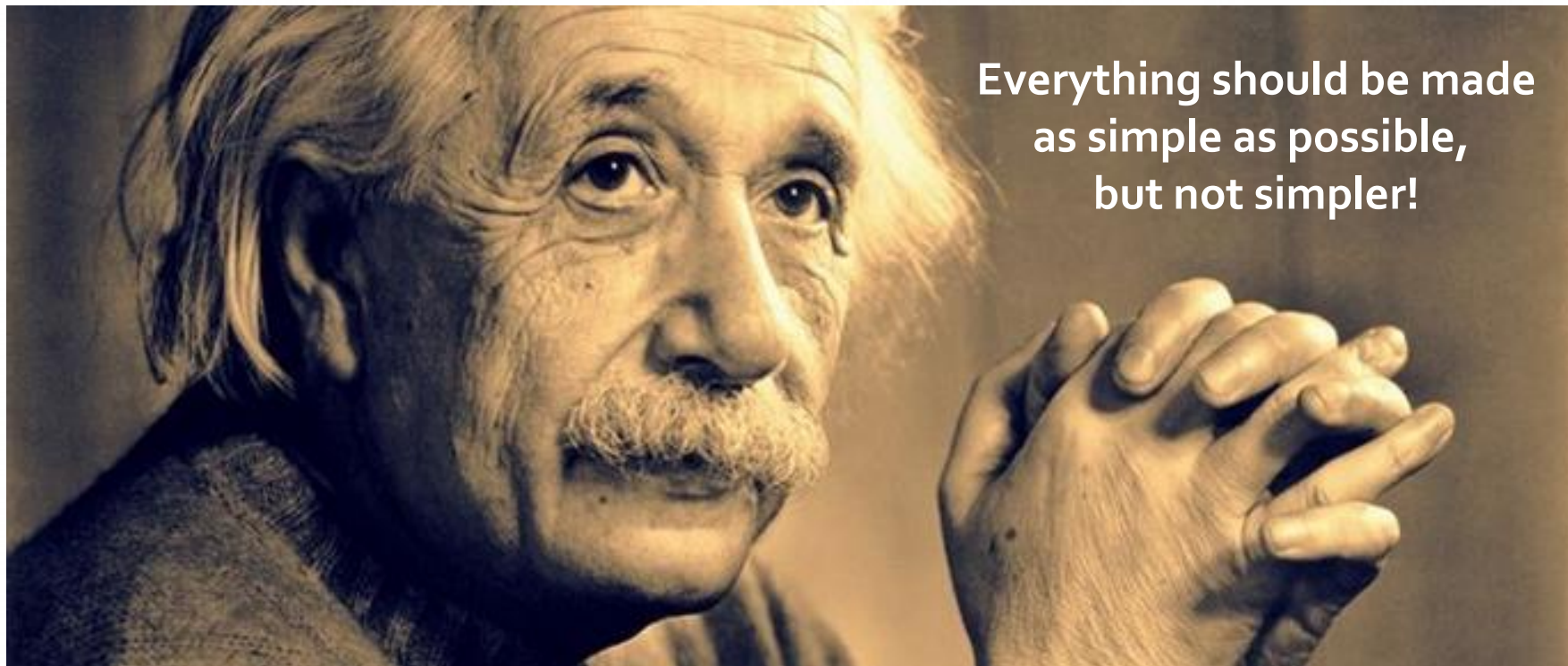
Which EMS systems should consider introducing this intervention into routine practice? Those with high rates of penetrating trauma and physicians working in the pre-hospital environment

are likely to be most suitable. A system that has the same elements required for other complex pre-hospital interventions such as pre-hospital anaesthesia is essential.<sup>13</sup> These include a system of audit and quality assurance and adequate training and resource. When contemplating introduction of pre-hospital thoracotomy pre-hospital services will need to develop firm links with their receiving intensive care units and

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## Stay and play nebo scoop and run?



Albert Einstein, Roger Sessions, New York Times, 8 Jan 1950



H H H T T





Rozhodujeme o osudu mnoha lidí...

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NA CESTĚ K NOVÝM GUIDELINES

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*Informace a on-line registrace na [www.resuscitace.cz](http://www.resuscitace.cz)*

*Vzdělávací akce je pořádána dle Stavovského předpisu ČLK č.16.*

