Società Italiana
Interdisciplinare
NeuroVascolare

XXVI CONGRESSO NAZIONALE SINV:
SINERGIE INTERDISCIPLINARI NEL PAZIENTE NEUROLOGICO CRITICO
Lecce, 1-2 dicembre 2017

Raccomandazioni sulla gestione del trauma cranico

Maurizio Chiaranda

P.O. di Anestesiologia
Università degli Studi dell'Insubria - Varese

Conflicts of interest

I declare

NO conflicts of interest

[I’m sorry for this...!]


In 30 minuti …

Raccomandazioni sulla gestione del trauma cranico

NELL'ADULTO

- Advanced Trauma Life Support (ATLS) course / European Trauma Course (ETC).
- International Trauma Life Support (ITLS) course.
- Pre-hospital Trauma Life Support (PHTLS) course.
- Advanced Trauma Nurse Course (ATNC).
- Trauma Nursing Core Course (TNCC).
- Joint Royal Colleges Ambulance Service Liaison Committee (JRCALC) Clinical Practice Guidelines for Head Trauma.

IN ETA' PEDIATRICA

- Advanced Paediatric Life Support (APLS) / European Paediatric Life Support (EPLS) course.
- Pre-hospital Paediatric Life Support (PHPLS) course.
- Paediatric Education for Pre-hospital Professionals (PEPP) course.

LE EVIDENZE

- Ampi studi clinici randomizzati non sono di semplice esecuzione
- Difficile è evidenziare l'effetto di determinati interventi su una mortalità legata spesso a cause multifattoriali
- Spesso le iniziative "di buon senso" diventano standard di cura anche senza prove scientifiche
- Ciò che sembra valido in ospedale viene esportato nell'extraospedaliero

PHBTC: Airway and cervical spine

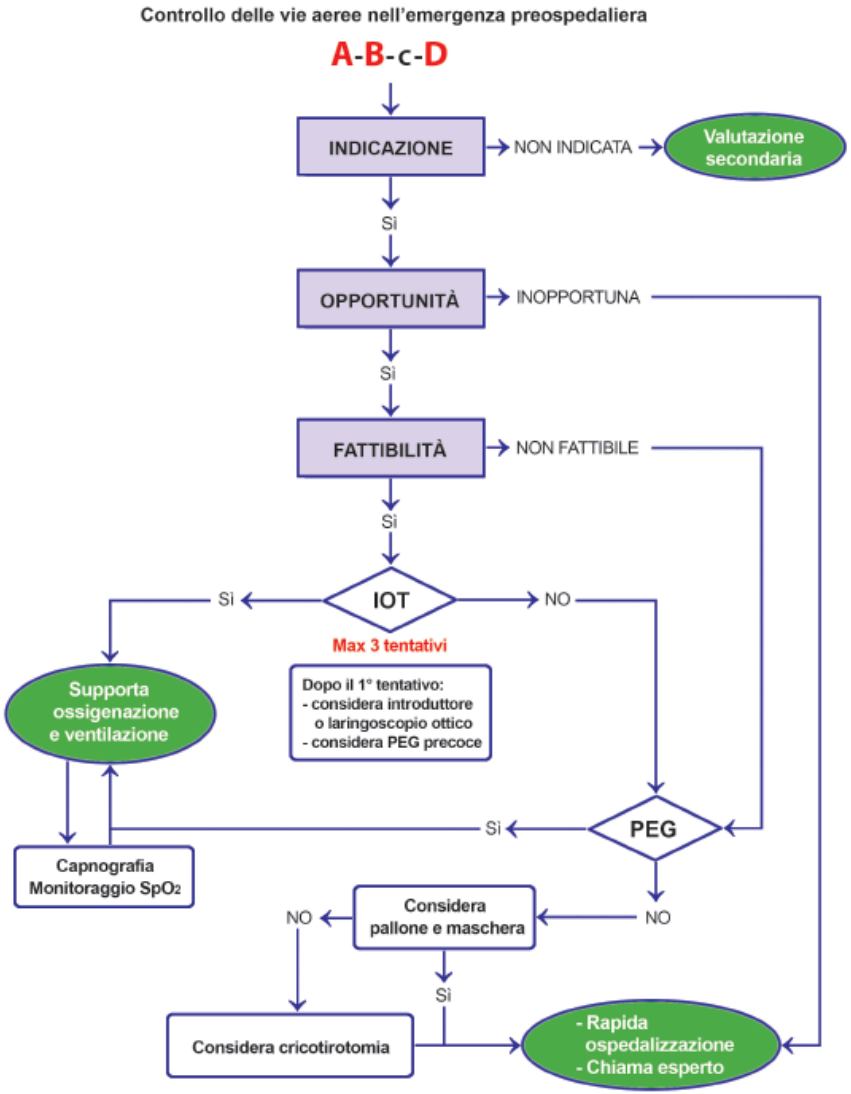
1.2.3 - Aim to perform **RSI** as soon as possible and ***within 45 minutes*** of the initial call to the emergency services, ***preferably at the scene of the incident***.

If RSI cannot be performed at the scene:

- consider using a **supraglottic device** if the patient's airway reflexes are absent
- use basic airway manoeuvres and adjuncts if the patient's airway reflexes are present or supraglottic device placement is not possible,
- ***transport*** the patient to a major trauma centre for RSI ***provided the journey time is 60 minutes or less,***
- ***only divert to a trauma unit*** for RSI before onward transfer if a patent airway cannot be maintained or the journey time to a major trauma centre *is* ***more than 60 minutes***.

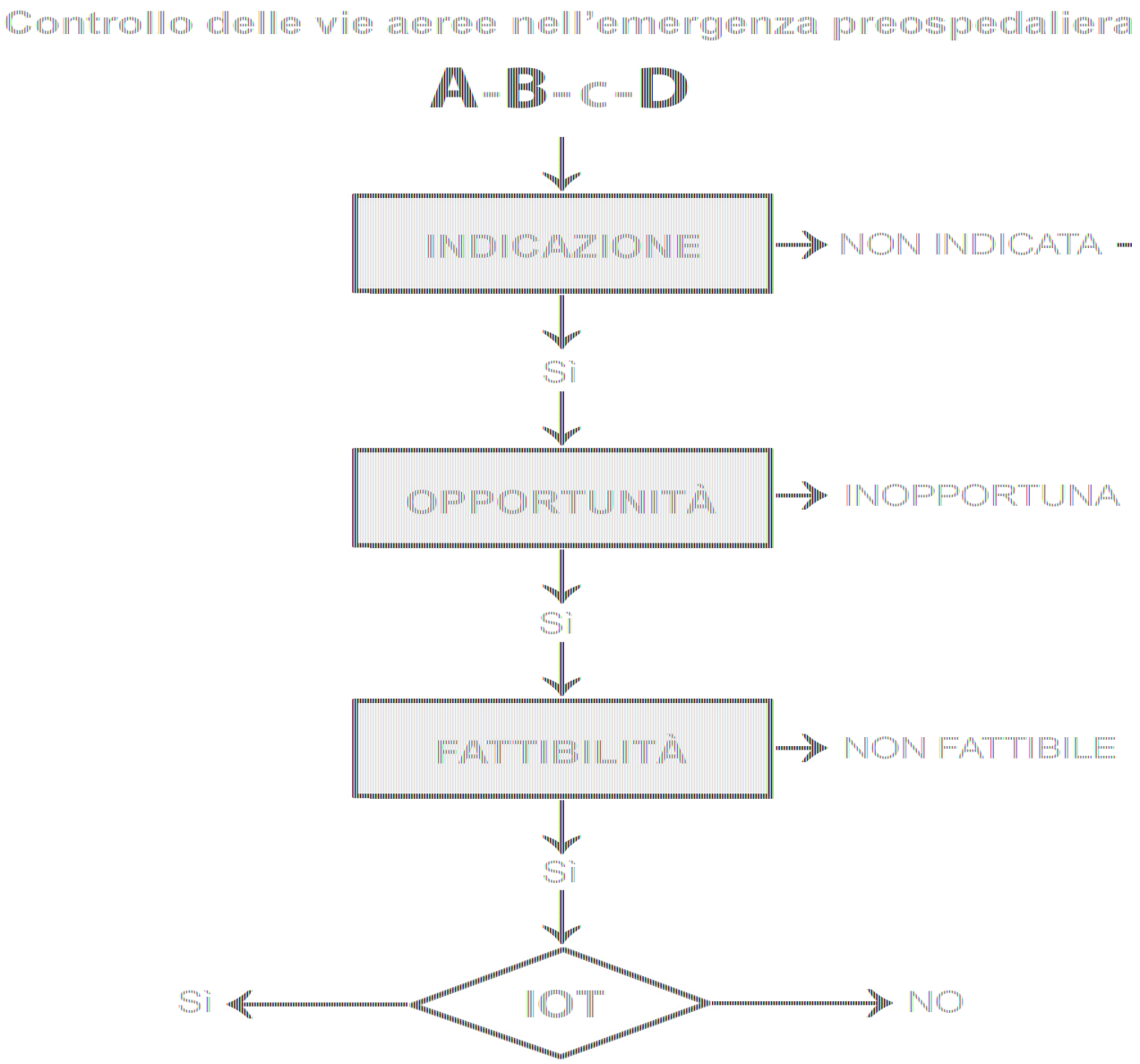
Major trauma: assessment and initial management.
NICE guideline . Published: 17 February 2016 - nice.org.uk/guidance/ng39

PHBTC: Airway and cervical spine

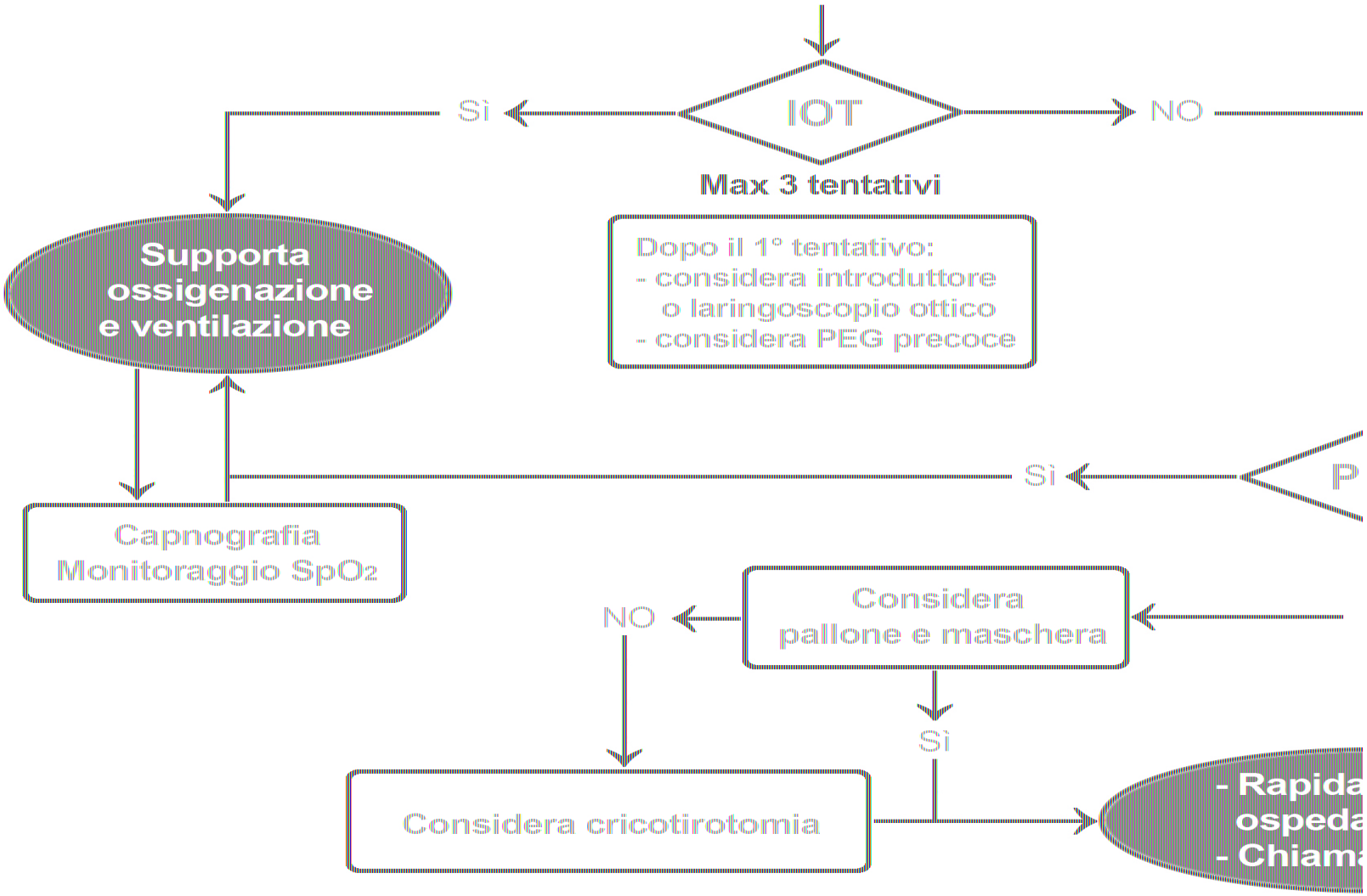


Algoritmo elaborato nel 2010 dalla Società Italiana di Anestesia, Analgesia, Rianimazione e Terapia Intensiva (SIAARTI) unitamente alla Prehospital Airway Management Italian Association (PAMIA)

PHBTC: Airway and cervical spine



PHBTC: Airway and cervical spine



Algoritmo elaborato nel 2010 dalla Società Italiana di Anestesia, Analgesia, Rianimazione e Terapia Intensiva (SIAARTI) unitamente alla Prehospital Airway Management Italian Association (PAMIA)

JOURNAL OF NEUROTRAUMA 31:531–540 (March 15, 2014)

DOI: 10.1089/neu.2013.3094

Review

Prehospital Use of Cervical Collars in Trauma Patients: A Critical Review

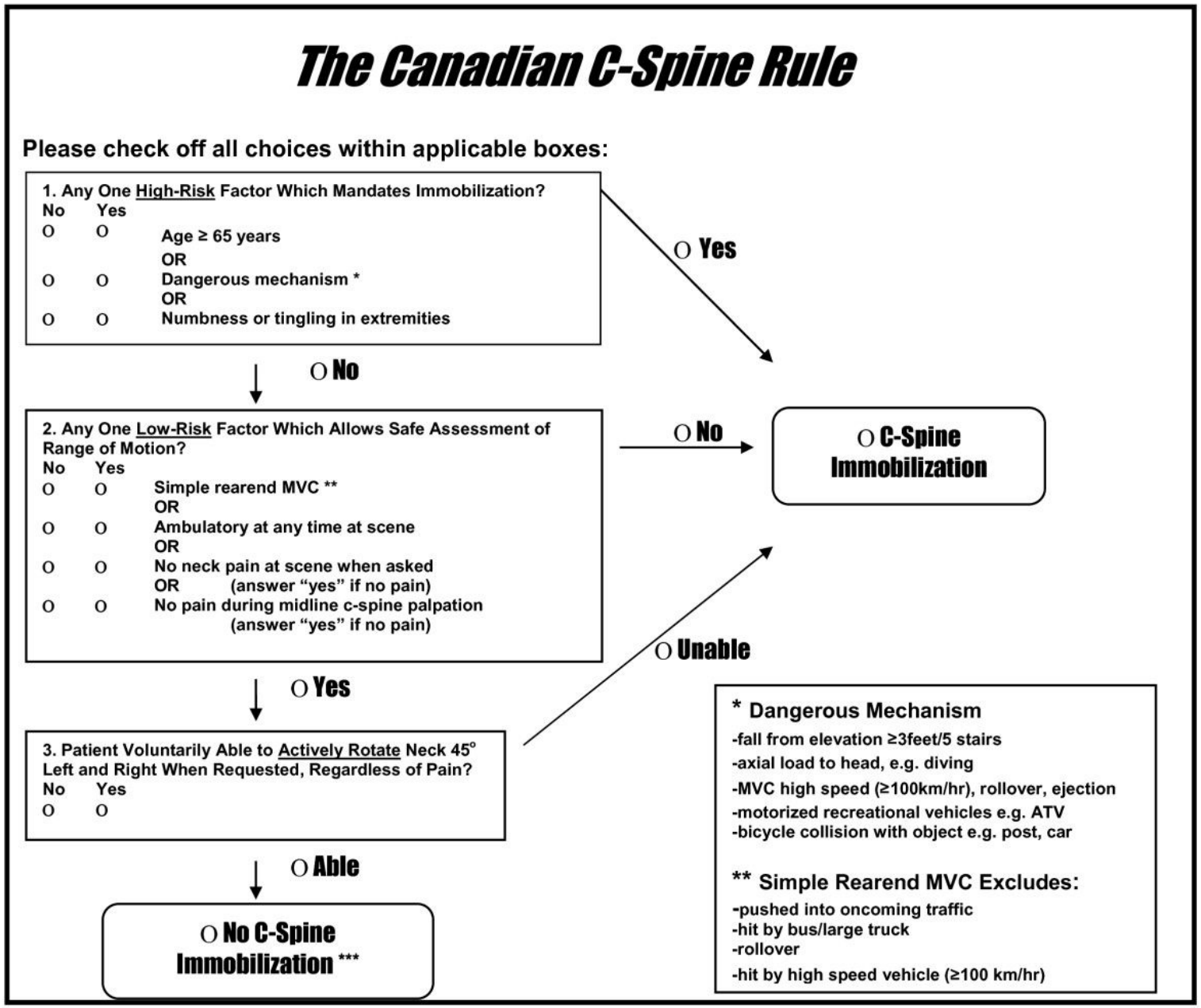
Terje Sundstrøm,[1–3] Helge Asbjørnsen,[4,5] Samer Habiba,[3] Geir Arne Sunde,[4–6] and Knut Wester[2,3]

Abstract

The cervical collar has been routinely used for trauma patients for more than 30 years and is a hallmark of state-of-the-art prehospital trauma care. However, the existing evidence for this practice is limited: Randomized, controlled trials are largely missing, and there are uncertain effects on mortality, neurological injury, and spinal stability. Even more concerning, there is a growing body of evidence and opinion against the use of collars. It has been argued that collars cause more harm than good, and that we should simply stop using them. In this critical review, we discuss the pros and cons of collar use in trauma patients and reflect on how we can move our clinical practice forward. Conclusively, we propose a safe, effective strategy for prehospital spinal immobilization that does not include routine use of collars.

Key words: cervical collar; cervical injury; cervical spine; prehospital; trauma

PHBTC: Airway and cervical spine



PHBTC: Breathing

TABELLA 28-2 Episodi di ipotensione e/o ipossia prima del ricovero in rapporto con l'outcome in un gruppo di pazienti con trauma cranico

INSULTO SECONDARIO	NUMERO PAZIENTI (%)	NESSUNA O MODERATA DISABILITÀ	GRAVE DISABILITÀ PVS	DECESSO
Nessuno	456 (*65*)	51%	22%	27%
Ipossia (PaO_2 <60 mmHg)	78 (*11*)	45%	2%	33%
Ipotensione (PAs <90 mmHg)	113 (*16*)	26%	14%	60%
Entrambe	52 (*8*)	6%	19%	75%
Casi totali	699 (*100*)	43%	20%	37%

Da Chesnut RM, Marshall LF, *J Trauma* 1993.

La capnografia è indispensabile per:

- Confermare l'intubazione tracheale
- Una RCP *di qualità*
- La ventilazione con $PaCO_2$ 35-40 mmHg

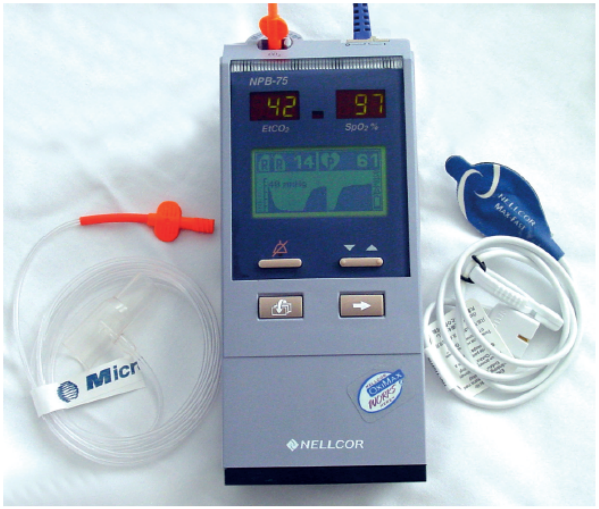


FIGURA 41-3 Strumento portatile per capnografia e pulsossimetria con visualizzazione dei relativi tracciati: la soluzione ottimale per l'emergenza extraospedaliera.

PHBTC: Circulation

Somministrazione di liquidi e farmaci?

1.5.15 - For circulatory access in patients with major trauma in pre-hospital settings:

- use peripheral intravenous access, or
- if peripheral intravenous access fails, consider intra-osseous access.

1.5.16 - For circulatory access in children (under 16s) with major trauma, consider intra-osseous access as first-line access if peripheral access is anticipated to be difficult.

Major trauma: assessment and initial management.
NICE guideline . Published: 17 February 2016 - nice.org.uk/guidance/ng39

PHBTC: Circulation

Quale endpoint di PA nel politrauma?

RESEARCH ARTICLE

PLOS ONE | DOI:10.1371/journal.pone.0148844 February 12, 2016

Mortality Patterns in Patients with Multiple Trauma: A Systematic Review of Autopsy Studies

Roman Pfeifer[1]*, Michel Teuben[1], Hagen Andruszkow[1], Bilal M. Barkatali[2], Hans-Christoph Pape[1]

References	Pattern of mortality	Causes of deaths
(Baker et al., 1980)[7]	ND	BI ; TI ; HS
(Pories et al., 1989)[19]	ND	BI, HS ; Other
(Shackford et al., 1989)[20]	ND	BI ; HS ; TI
(Sahdev et al., 1994)[9]	Four peaks	BI, HS ; BI+HS
(Sauaia et al., 1995)[18]	Bimodal	BI ; HS ; MOF
(Meislin et al., 1997)[17]	Bimodal	BI ; HS ; BI+HS
(Hodgson et al., 2000)[21]	Bimodal	BI ; Sepsis ; HS
(Marson et al., 2001)[22]	Unimodal	BI; HS; BI+HS
(Chiara et al., 2002)[14]	Unimodal	BI+HS ; HS ; BI
(Stewart et al., 2003)[23]	Unimodal	BI ; HS ; BI+HS
(Tien et al., 2007)[24]	ND	BI ; HS ; BI+HS
(Søreide et al., 2007)[11]	Model-dependent	BI ; HS ; MOF
(Pang et al., 2008)[25]	Unimodal	BI; HS; BI+HS
(Evans et al., 2010)[15]	Unimodal	BI; HS; BI+HS
(Kleber et al. 2012)[26]	Bimodal	PT; BI; HS

PHBTC: Circulation

Quale endpoint di PA nel politrauma?

Injury, Int. J. Care Injured 45 (2014) 612–617

Contents lists available at ScienceDirect

Injury

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

The association between admission systolic blood pressure and mortality in significant traumatic brain injury: A multi-centre cohort study

Gordon Fuller [a,1,*], Rebecca M. Hasler [b,1], Nicole Mealing [c], Thomas Lawrence [a], Maralyn Woodford [a], Peter Juni [c], Fiona Lecky [d]

[a] Trauma Audit and Research Network, Health Sciences Research Group, Manchester Academic Health Sciences Centre, Mayo Building, Salford Royal Hospital,

PHBTC: Circulation

Quale endpoint di PA nel politrauma?

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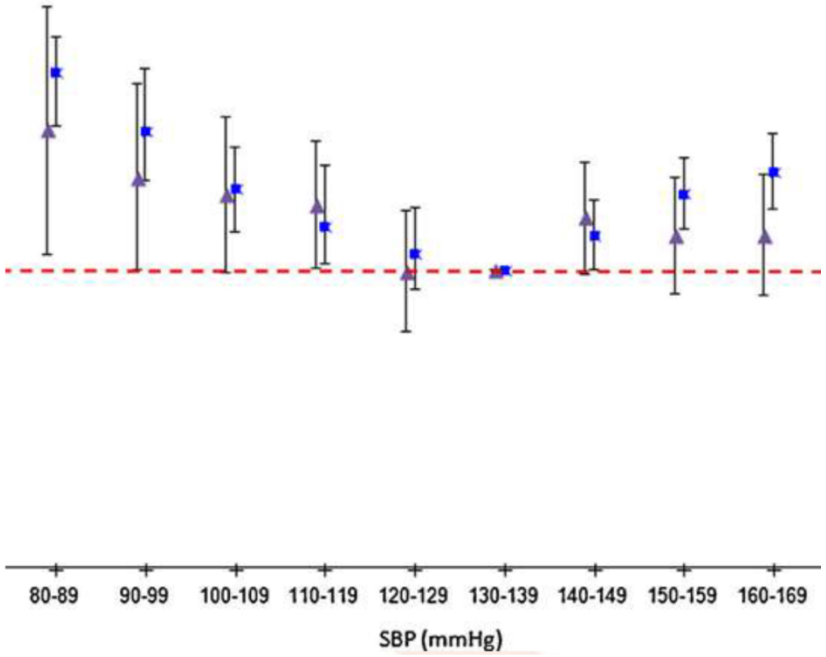
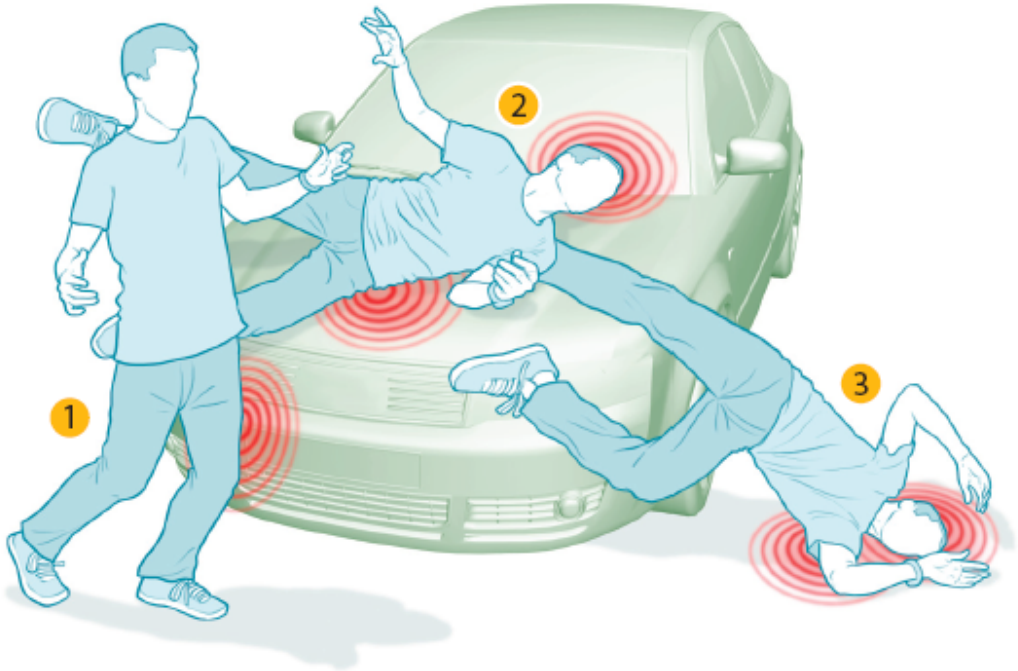


Case-mix adjusted odds of death were:

- 1.5 times grater at <120 mmHg
- ***Doubled*** at <100 mmHg
- ***Tripled*** at <90 mmHg
- ***Six times greater*** at SBP <70 mmHg (*p* <0.01)

PHBTC: Circulation

Quale endpoint di PA nel politrauma?



1.5.21 - For patients who have haemorrhagic shock and a traumatic brain injury:

- if haemorrhagic shock is the dominant condition, continue restrictive volume resuscitation, *or*
- if traumatic brain injury is the dominant condition, use a less restrictive volume resuscitation approach to maintain cerebral perfusion.

Major trauma: assessment and initial management.
NICE guideline . Published: 17 February 2016 - nice.org.uk/guidance/ng39

PHBTC: Circulation

Quale endpoint di PA nel politrauma?

Rossaint *et al. Critical Care* (2016) 20:100
DOI 10.1186/s13054-016-1265-x

Critical Care

RESEARCH Open Access

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

Recommendation 13 **We recommend a target systolic blood pressure of 80–90 mmHg until major bleeding has been stopped in the initial phase following trauma without brain injury. (Grade 1C)**

In patients with severe TBI (GCS ≤8), we recommend that a mean arterial pressure ≥80 mmHg be maintained. (Grade 1C)

PHBTC: Circulation

Quale endpoint di PA nel politrauma?

Rossaint *et al. Critical Care* (2016) 20:100
DOI 10.1186/s13054-016-1265-x

Critical Care

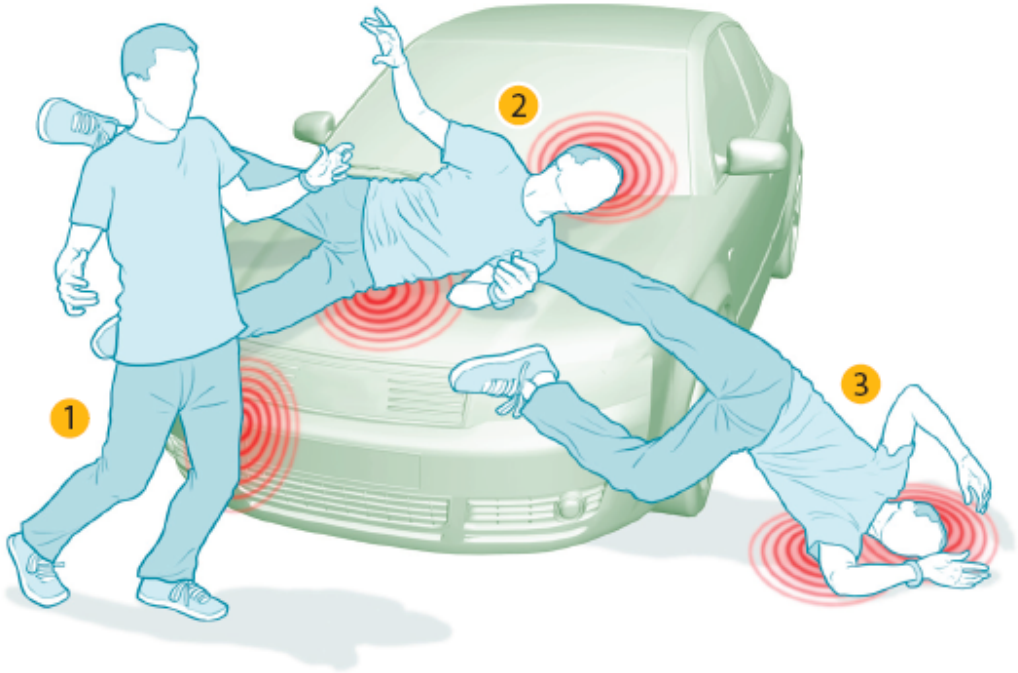
RESEARCH Open Access

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

It should be noted that a damage control resuscitation strategy using restrictive volume replacement is contra-indicated in patients with TBI and spinal injuries, because an adequate perfusion pressure is crucial to ensure tissue oxygenation of the injured central nervous system [229]. Rapid bleeding control is of particular importance in these patients. In addition, the concept of permissive hypotension should be carefully considered in the elderly patient, and may be contraindicated if the patient suffers from chronic arterial hypertension [230].

PHBTC: Circulation

→ Stop the bleeding!



1.5.2 - In patients with major limb trauma use a tourniquet if direct pressure has failed to control life-threatening haemorrhage.

1.5.3 - If active bleeding is suspected from a pelvic fracture after blunt high-energy trauma: apply a purpose-made pelvic binder or consider an improvised pelvic binder.

1.5.4 - Use intravenous tranexamic acid as soon as possible in patients with major trauma and active or suspected active bleeding.

Major trauma: assessment and initial management.
NICE guideline . Published: 17 February 2016 - nice.org.uk/guidance/ng39

PHBTC: Circulation

→ Stop the bleeding!

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PHBTC: Circulation

→ Stop the bleeding!

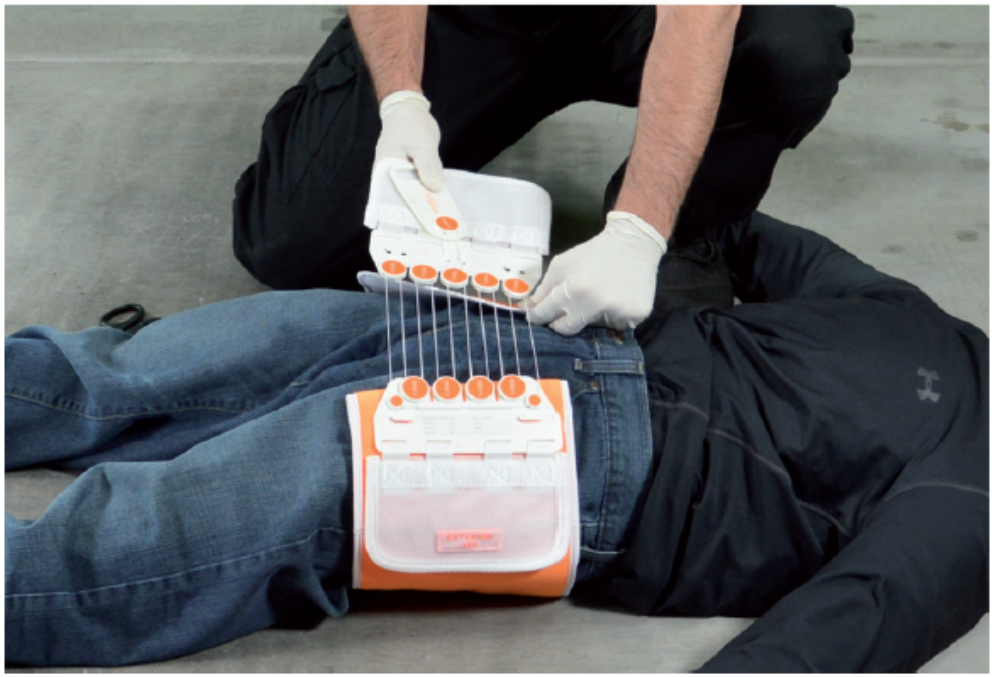

FIGURA 33-3 Dispositivo di stabilizzazione della pelvi.

1.5.2 - In patients with major limb trauma use a tourniquet if direct pressure has failed to control life-threatening haemorrhage.

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Major trauma: assessment and initial management.
NICE guideline . Published: 17 February 2016 - nice.org.uk/guidance/ng39

PHBTC: Circulation

→ Stop the bleeding!

2010

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Major trauma: assessment and initial management.
NICE guideline . Published: 17 February 2016 - nice.org.uk/guidance/ng39

PHBTC: Circulation

→ Stop the bleeding!

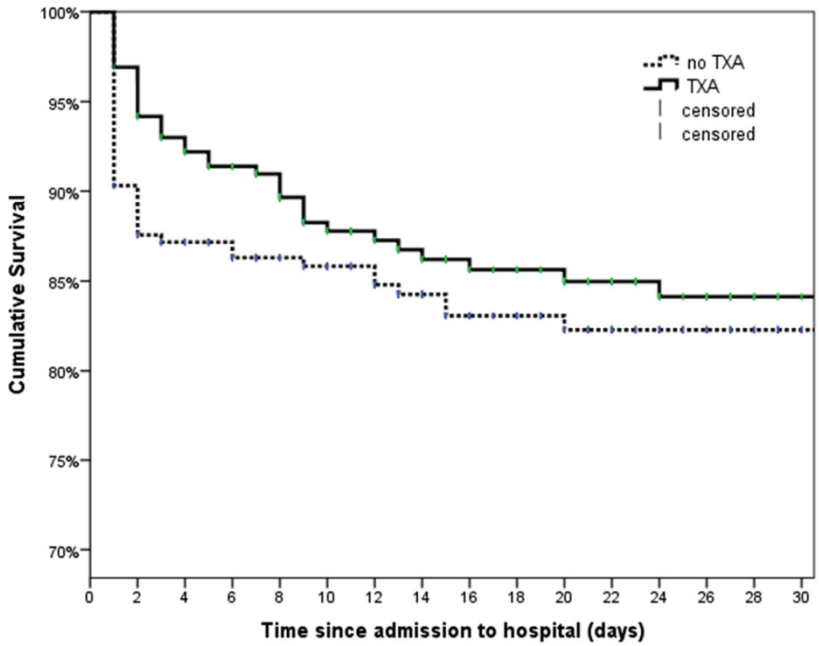
Wafaisade *et al. Critical Care* (2016) 20:143
DOI 10.1186/s13054-016-1322-5

Critical Care

RESEARCH Open Access

Prehospital administration of tranexamic acid in trauma patients

Arasch Wafaisade[1*], Rolf Lefering[2], Bertil Bouillon[1], Andreas B. Böhmer[3], Michael Gäßler[4], Matthias Ruppert[4] and TraumaRegister DGU



Prehospital German database of the ADAC: 258 Tranex vs. 258 No Tranex

Early mortality was significantly lower in the TXA group (e.g., 24-h mortality 5.8% [TXA] vs. 12.4% [control]; p = 0,01)

PHBTC: Circulation

→ Stop the bleeding!

Wafaisade *et al. Critical Care* (2016) 20:143
DOI 10.1186/s13054-016-1322-5

Critical Care

RESEARCH Open Access

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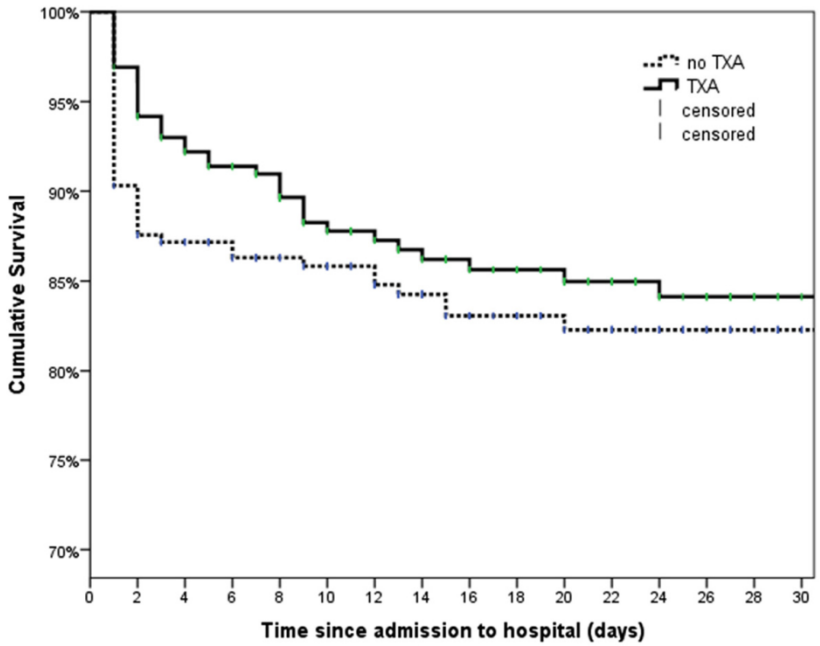


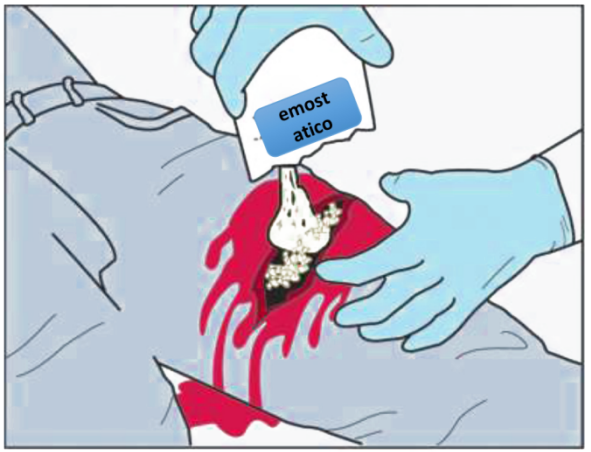
Dose carico: 1 g (2 fl) ***entro 3 h*** dal trauma.

Dose mantenimento: 1 g (2 fl) entro 8 ore dal trauma.

PHBTC: Circulation

→ Stop the bleeding!

Garze/polveri compressive ed emostatiche



Indicazioni

- Zone non comprimibili con Tourniquet
- Emostasi difficile
- Ferite penetranti/destruenti
- Ambito militare> civile

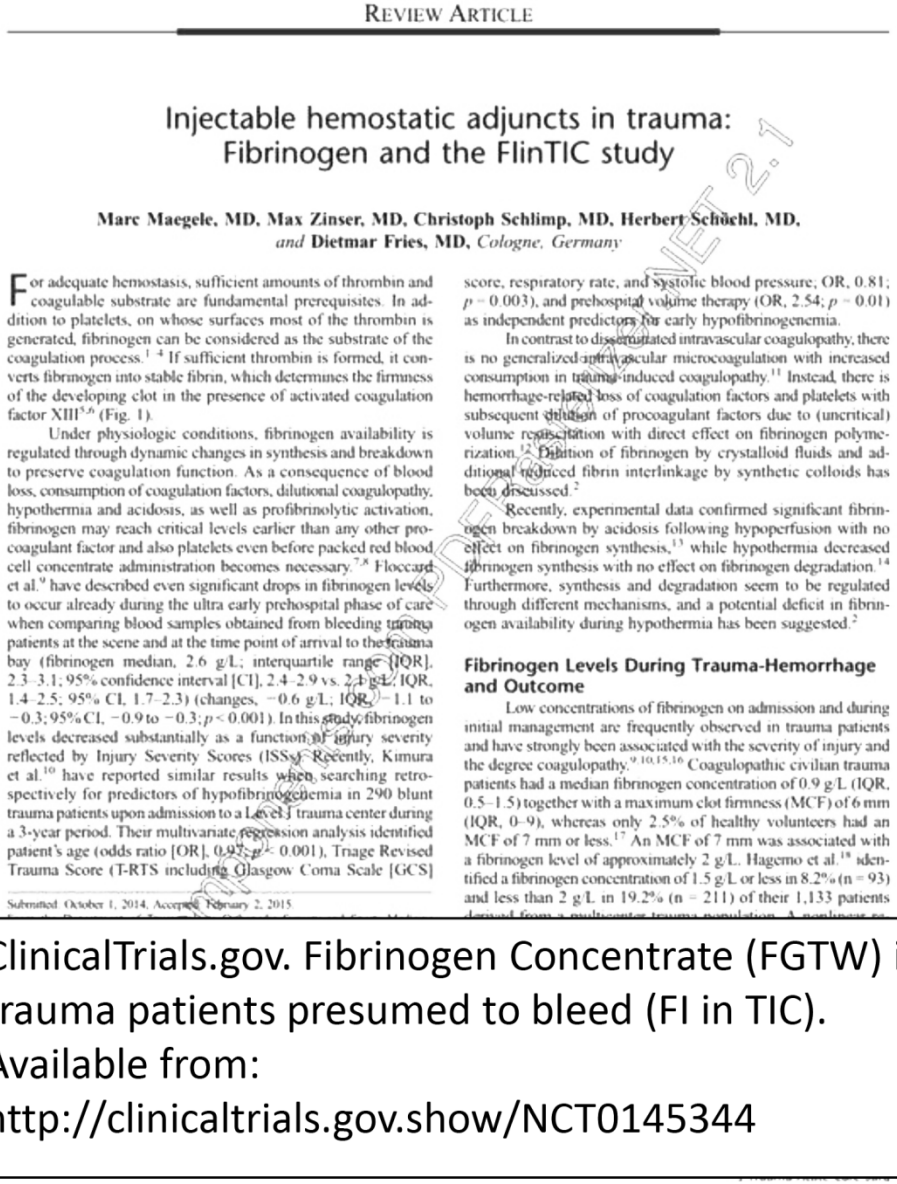
Azione

- Concentrati di fibrina
- Concentrati procoagulanti (chitosano)
- Adsorbenti e concentratori di piastrine e fattori locali

- Necessità di ulteriori studi

PHBTC: Circulation

→ Stop the bleeding!



REVIEW ARTICLE

Injectable hemostatic adjuncts in trauma: Fibrinogen and the FIinTIC study

Marc Maegele, MD, Max Zinser, MD, Christoph Schlimp, MD, Herbert Schöchl, MD, *and* **Dietmar Fries, MD,** *Cologne, Germany*

For adequate hemostasis, sufficient amounts of thrombin and coagulable substrate are fundamental prerequisites. In addition to platelets, on whose surfaces most of the thrombin is generated, fibrinogen can be considered as the substrate of the coagulation process.[1-4] If sufficient thrombin is formed, it converts fibrinogen into stable fibrin, which determines the firmness of the developing clot in the presence of activated coagulation factor XIII[5,6] (Fig. 1).

Under physiologic conditions, fibrinogen availability is regulated through dynamic changes in synthesis and breakdown to preserve coagulation function. As a consequence of blood loss, consumption of coagulation factors, dilutional coagulopathy, hypothermia and acidosis, as well as profibrinolytic activation, fibrinogen may reach critical levels earlier than any other procoagulant factor and also platelets even before packed red blood cell concentrate administration becomes necessary.[7,8] Floccard et al.[9] have described even significant drops in fibrinogen levels to occur already during the ultra early prehospital phase of care when comparing blood samples obtained from bleeding trauma patients at the scene and at the time point of arrival to the trauma bay (fibrinogen median, 2.6 g/L; interquartile range [IQR], 2.3–3.1; 95% confidence interval [CI], 2.4–2.9 vs. 2.1 g/L; IQR, 1.4–2.5; 95% CI, 1.7–2.3) (changes, −0.6 g/L; IQR, −1.1 to −0.3; 95% CI, −0.9 to −0.3; $p < 0.001$). In this study, fibrinogen levels decreased substantially as a function of injury severity reflected by Injury Severity Scores (ISSs). Recently, Kimura et al.[10] have reported similar results when searching retrospectively for predictors of hypofibrinogenemia in 290 blunt trauma patients upon admission to a Level I trauma center during a 3-year period. Their multivariate regression analysis identified patient's age (odds ratio [OR], 0.97; $p = 0.001$), Triage Revised Trauma Score (T-RTS including Glasgow Coma Scale [GCS] score, respiratory rate, and systolic blood pressure; OR, 0.81; $p = 0.003$), and prehospital volume therapy (OR, 2.54; $p = 0.01$) as independent predictors for early hypofibrinogenemia.

In contrast to disseminated intravascular coagulopathy, there is no generalized intravascular microcoagulation with increased consumption in trauma-induced coagulopathy.[11] Instead, there is hemorrhage-related loss of coagulation factors and platelets with subsequent dilution of procoagulant factors due to (uncritical) volume resuscitation with direct effect on fibrinogen polymerization.[12] Dilution of fibrinogen by crystalloid fluids and additional reduced fibrin interlinkage by synthetic colloids has been discussed.[2]

Recently, experimental data confirmed significant fibrinogen breakdown by acidosis following hypoperfusion with no effect on fibrinogen synthesis,[13] while hypothermia decreased fibrinogen synthesis with no effect on fibrinogen degradation.[14] Furthermore, synthesis and degradation seem to be regulated through different mechanisms, and a potential deficit in fibrinogen availability during hypothermia has been suggested.[2]

Fibrinogen Levels During Trauma-Hemorrhage and Outcome

Low concentrations of fibrinogen on admission and during initial management are frequently observed in trauma patients and have strongly been associated with the severity of injury and the degree coagulopathy.[9,10,15,16] Coagulopathic civilian trauma patients had a median fibrinogen concentration of 0.9 g/L (IQR, 0.5–1.5) together with a maximum clot firmness (MCF) of 6 mm (IQR, 0–9), whereas only 2.5% of healthy volunteers had an MCF of 7 mm or less.[17] An MCF of 7 mm was associated with a fibrinogen level of approximately 2 g/L. Hagemo et al.[18] identified a fibrinogen concentration of 1.5 g/L or less in 8.2% (n = 93) and less than 2 g/L in 19.2% (n = 211) of their 1,133 patients

Submitted October 1, 2014, Accepted February 2, 2015

ClinicalTrials.gov. Fibrinogen Concentrate (FGTW) in trauma patients presumed to bleed (FI in TIC). Available from: http://clinicaltrials.gov.show/NCT0145344

Fibrinogeno in preH: FI in TIC Study

Studio prospettico multicentrico in corso (Austria, Germania, Rep Ceca)

Pazienti emorragici in preH
30 pz Fibrinogeno 30mg/kg Vs
30 pz **Placebo**

Outcome:

- 1° Effetto sulla coagulazione : MCF al FIBTEM
- 2°
  - richieste trasfusionali
  - emorragia
  - Compl. Tromboemboliche
  - LOS in ICU
  - mortalità

PHBTC: Circulation

→ Stop the bleeding!
Emoderivati nel preospedaliero?

SHOCK, Vol. 46, No. 1, pp. 3–16, 2016

Review Article

PREHOSPITAL BLOOD PRODUCT RESUSCITATION FOR TRAUMA: A SYSTEMATIC REVIEW

Iain M. Smith,[*†‡] Robert H. James,[§‖¶] Janine Dretzke,[**] and Mark J. Midwinter[*†]

[*]NIHR Surgical Reconstruction and Microbiology Research Centre, University of Birmingham; [†]Academic Department of Military Surgery and Trauma, Royal Centre for Defence Medicine, ICT Centre, Edgbaston, Birmingham; [‡]205 (Scottish) Field Hospital, Govan, Glasgow; [§]Academic Department of Military Emergency Medicine, Royal Centre for Defence Medicine, ICT Centre, Edgbaston, Birmingham; [‖]East Anglian Air Ambulance, Gambling Close, Norwich; [¶]Ministry of Defence Hospital Unit Derriford, Derriford Hospital, Plymouth, United Kingdom; and [**]Institute of Applied Health Research, University of Birmingham, Edgbaston, Birmingham, United Kingdom

Received 6 Nov 2015; first review completed 16 Nov 2015; accepted in final form 12 Jan 2016

- Evidenze di bassa qualità
- Nessuna associazione fra PHBPR e sopravvivenza
- Nessun consistente beneficio sul piano clinico o bioumorale

PHBTC: Circulation

In definitiva …

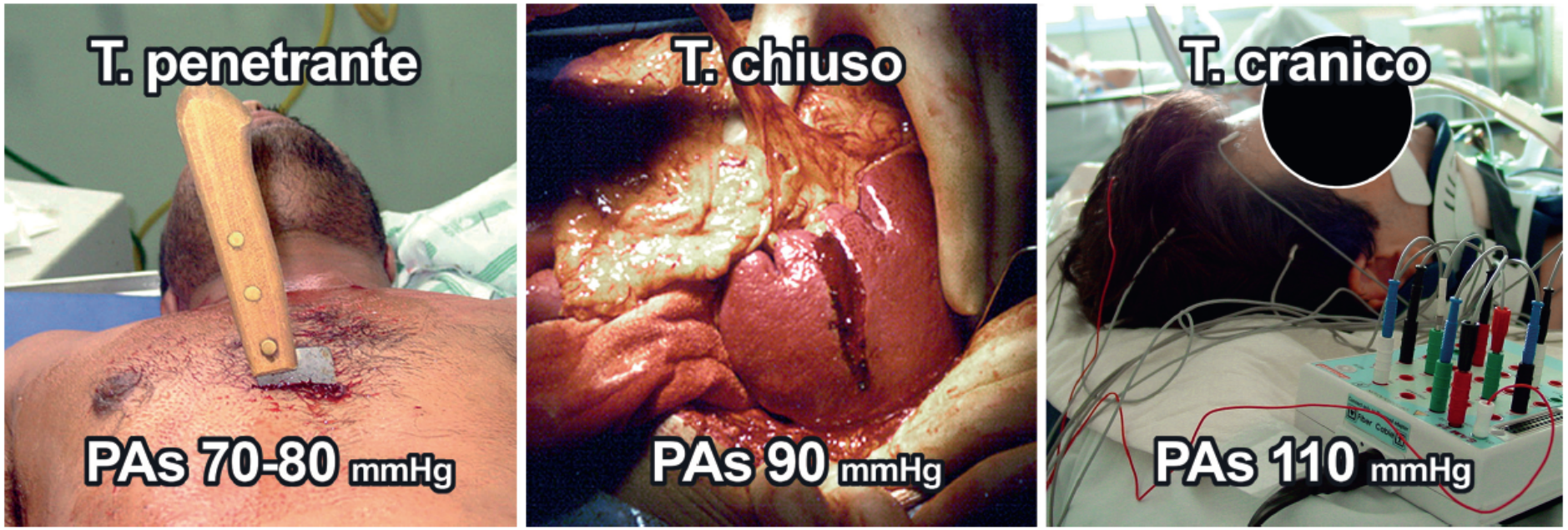
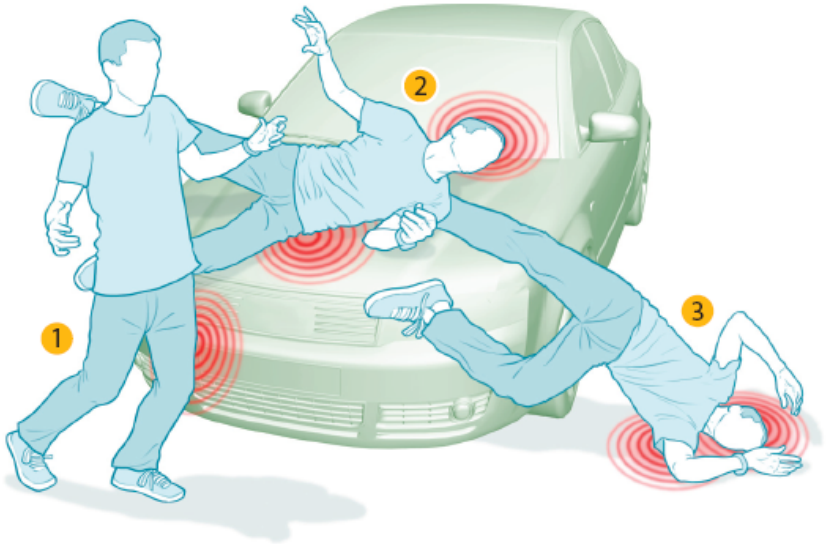


FIGURA 27-8 Valori indicativi del minimo di pressione arteriosa sistolica (PAs) accettabile in rapporto con la tipologia del trauma; in realtà l'obiettivo non è tanto quello di raggiungere un determinato valore di PA, quanto quello di garantire la perfusione degli organi.

PHBTC: Circulation

In definitiva …



Il "fluido" migliore in pre-ospedaliero (G. Nardi)

→Trasporto **Fast & Clean** verso l'Ospedale Giusto … Non il più vicino

In-Hospital Brain Trauma Care (IHBTC)

PRIORITÀ DI PRIMO LIVELLO

➤ Sono costituite dalla valutazione primaria con stabilizzazione delle funzioni vitali. La sequenza dei passi ABCDE è quella illustrata nella fase preospedaliera

PRIORITÀ DI SECONDO LIVELLO

➤ Nel paziente con stabilità emodinamica l'ordine di priorità è il seguente:

- 1° – trattamento delle lesioni espansive o compressive del sistema nervoso centrale;
- 2° – correzione delle lesioni viscerali non sanguinanti;
- 3° – stabilizzazione delle fratture scheletriche.

In caso di instabilità emodinamica, invece:

- 1° – trattamento delle lesioni (viscerali o scheletriche) causa di instabilità cardiocircolatoria;
- 2° – trattamento delle lesioni espansive o compressive del sistema nervoso centrale;
- 3° – correzione delle lesioni viscerali non sanguinanti;
- 4° – stabilizzazione delle fratture scheletriche.

In-Hospital Brain Trauma Care (IHBTC)

The Hybrid OR is the future of surgery

A single surgical workspace that combines imaging equipment with a multifunctional surgical table. It allows clinicians to diagnose and treat in a single location, reducing risk and delays, improving patient safety, and ultimately reducing costs. The surgical table top not only meets the needs of multiple surgical disciplines but also balances the need for panning when used for advanced imaging.

See the future becoming reality!

Improving care across surgical disciplines

Once limited to cardiovascular procedures in the Cath Lab, image-guided surgery has expanded to include nearly all surgical disciplines.

In the modern Hybrid OR, this segregation is a thing of the past. Cardiovascular, neurosurgery, oncology, orthopedic surgeries, urology and traumatology procedures can benefit from real-time diagnostic imaging. By integrating X-rays, ultrasound, MR and CT into the OR, all procedures can be performed in the same surgical suite — minimally invasive and conventional alike. Getinge surgical tables can be configured to meet the needs of any surgical discipline, with radiolucent tabletops that minimize or eliminate imaging artifacts for clear visualization.

In-Hospital Brain Trauma Care (IHBTC)

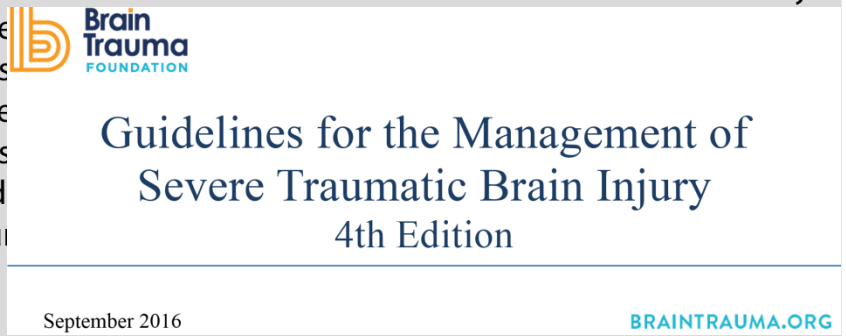
BRAIN TRAUMA FOUNDATION TBI GUIDELINES

Nancy Carney, PhD*
Annette M. Totten, PhD*
Cindy O'Reilly, BS*
Jamie S. Ullman, MD‡
Gregory W.J. Hawryluk, MD, PhD§
Michael J. Bell, MD¶
Susan L. Bratton, MD§
Randall Chesnut, MD||
Odette A. Harris, MD, MPH#
Niranjan Kissoon, MD**
Andres M. Rubiano, MD‡‡§§
Lori Shutter, MD¶
Robert C. Tasker, MBBS, MD¶¶
Monica S. Vavilala, MD||
Jack Wilberger, MD|||
David W. Wright, MD##
Jamshid Ghajar, MD, PhD#

*Oregon Health & Science University, Portland, Oregon; ‡Hofstra North Shore-LIJ School of Medicine, Hempstead, New York; §University of Utah, Salt Lake City, Utah; ¶University of Pittsburgh, Pitts-

Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition

The scope and purpose of this work is 2-fold: to synthesize the available evidence and to translate it into recommendations. This document provides recommendations only when there is evidence to support them. As such, they do not constitute a complete protocol for clinical use. Our intention is that these recommendations be used by others to develop treatment protocols, which necessarily need to incorporate consensus and clinical judgment in areas where current evidence is lacking or insufficient. We think it is important to have evidence-based recommendations to clarify what aspects of practice curre
encourage use of evidence-bas
in treatment and research in are
neurosurgery and neuro-intens
evidence-based medicine and
guideline document, which su
and supplemental appendices
org/coma/guidelines.



KEY WORDS: Severe traumatic brain injury, Adults, Critical care, Evidence-based medicine, Guidelines, Systematic review

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1. Decompressive Craniectomy

RECOMMENDATIONS

Level I

- There was insufficient evidence to support a Level I recommendation for this topic.

Level II A

- Bifrontal DC is not recommended to improve outcomes as measured by the Glasgow Outcome Scale–Extended (GOS-E) score at 6 months post-injury in severe TBI patients with diffuse injury (without mass lesions), and with ICP elevation to values >20 mm Hg for more than 15 minutes within a 1-hour period that are refractory to first-tier therapies. However, this procedure has been demonstrated to reduce ICP and to minimize days in the intensive care unit (ICU).
- A large frontotemporoparietal DC (not less than 12 x 15 cm or 15 cm diameter) is recommended over a small frontotemporoparietal DC for reduced mortality and improved neurologic outcomes in patients with severe TBI.

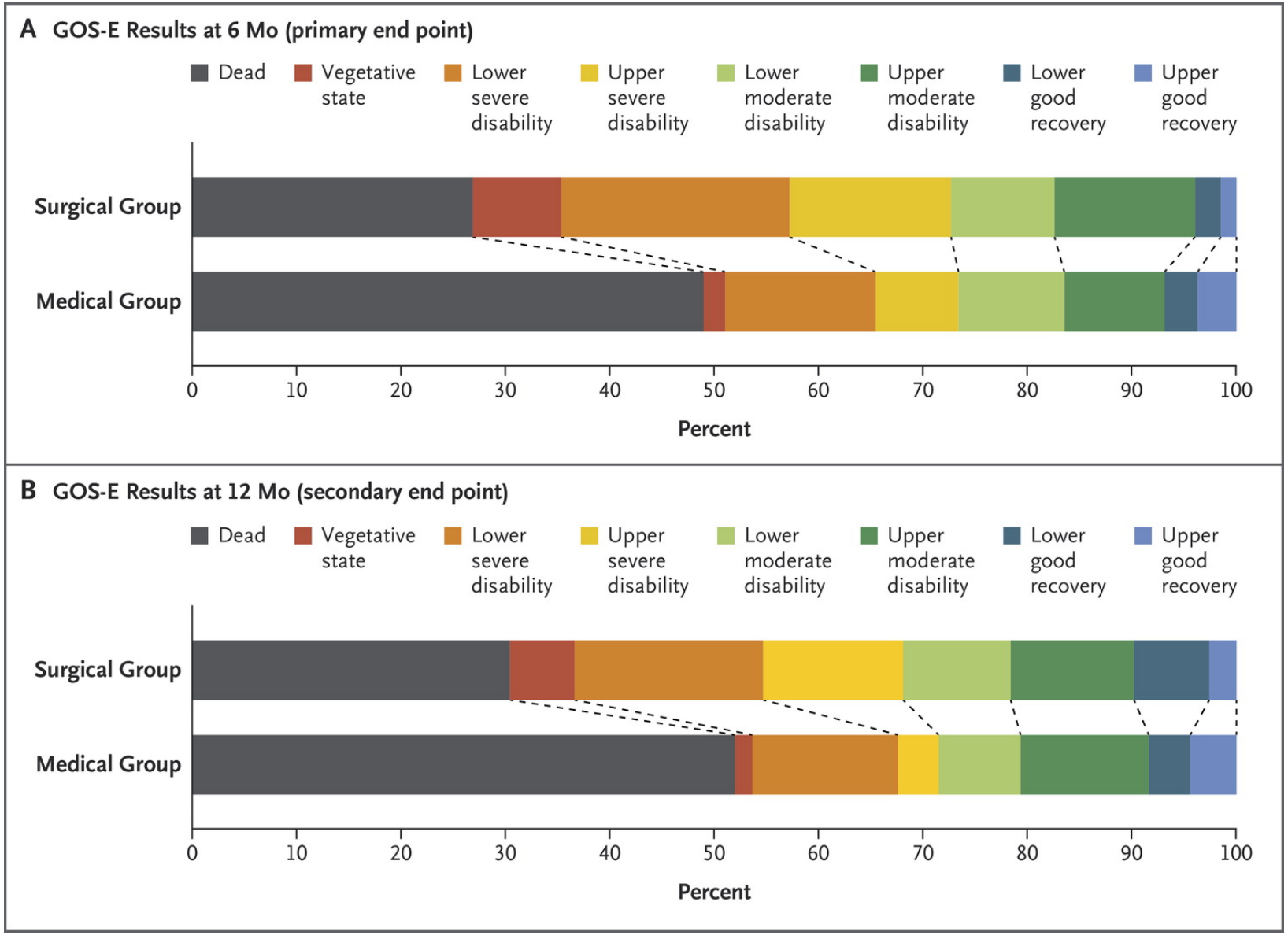
1. Decompressive Craniectomy

*The committee is aware that the results of the RESCUEicp trial[13] may be released soon after the publication of these Guidelines. The results of this trial may affect these recommendations and may need to be considered by treating physicians and other users of these Guidelines. We intend to update these recommendations after the results are published if needed.

Trial of Decompressive Craniectomy for Traumatic Intracranial Hypertension

The NEW ENGLAND JOURNAL of MEDICINE

September 2016



2. Prophylactic Hypothermia

RECOMMENDATIONS

Level I and II A

- There was insufficient evidence to support a Level I or II A recommendation for this topic.

Level II B

- Early (within 2.5 hours), short-term (48 hours post-injury) prophylactic hypothermia is not recommended to improve outcomes in patients with diffuse injury.

3. Hyperosmolar Therapy

RECOMMENDATIONS

Level I, II, and III

- Although hyperosmolar therapy may lower intracranial pressure, there was insufficient evidence about effects on clinical outcomes to support a specific recommendation, or to support use of any specific hyperosmolar agent, for patients with severe traumatic brain injury.

4. Cerebrospinal Fluid Drainage

RECOMMENDATIONS

Level I and II

- There was insufficient evidence to support a Level I or II recommendation for this topic.

Level III

- An EVD system zeroed at the midbrain with continuous drainage of CSF may be considered to lower ICP burden more effectively than intermittent use.
- Use of CSF drainage to lower ICP in patients with an initial Glasgow Coma Scale (GCS) <6 during the first 12 hours after injury may be considered.

5. Ventilation Therapies

RECOMMENDATIONS

Level I and II A

- There was insufficient evidence to support a Level I or II A recommendation for this topic.

Level II B

- Prolonged prophylactic hyperventilation with partial pressure of carbon dioxide in arterial blood ($PaCO_2$) of 25 mm Hg or less is not recommended.

6. Anesthetics, Analgesics, and Sedatives

RECOMMENDATIONS

Level I and II A

- There was insufficient evidence to support a Level I or Level IIA recommendation for this topic.

Level II B

- Administration of barbiturates to induce burst suppression measured by EEG as prophylaxis against the development of intracranial hypertension is not recommended.
- High-dose barbiturate administration is recommended to control elevated ICP refractory to maximum standard medical and surgical treatment. Hemodynamic stability is essential before and during barbiturate therapy.
- Although propofol is recommended for the control of ICP, it is not recommended for improvement in mortality or 6-month outcomes. Caution is required as high-dose propofol can produce significant morbidity.[7,8]

7. Steroids

RECOMMENDATIONS

Level I

- The use of steroids is not recommended for improving outcome or reducing ICP. In patients with severe TBI, high-dose methylprednisolone was associated with increased mortality and is contraindicated.

11. Seizure Prophylaxis

RECOMMENDATIONS

Level I

- There was insufficient evidence to support a Level I recommendation for this topic.

Level II A

- Prophylactic use of phenytoin or valproate is not recommended for preventing late PTS.
- Phenytoin is recommended to decrease the incidence of early PTS (within 7 days of injury), when the overall benefit is felt to outweigh the complications associated with such treatment. However, early PTS have not been associated with worse outcomes.

At the present time there is insufficient evidence to recommend levetiracetam over phenytoin regarding efficacy in preventing early post-traumatic seizures and toxicity.

12. Intracranial Pressure Monitoring

Brain Trauma FOUNDATION

RECOMMENDATIONS

Level I and II A

- There was insufficient evidence to support a Level I or II A recommendation for this topic.

Level II B

- Management of severe TBI patients using information from ICP monitoring is recommended to reduce in-hospital and 2-week post-injury mortality.

13. Cerebral Perfusion Pressure Monitoring

RECOMMENDATIONS

Level I

- There was insufficient evidence to support a Level I recommendation for this topic.

Level II B

- Management of severe TBI patients using guidelines-based recommendations for CPP monitoring is recommended to decrease 2-week mortality.

14. Advanced Cerebral Monitoring

RECOMMENDATIONS

Level I and II

- There was insufficient evidence to support a Level I or II recommendation for this topic.

(Although patients with desaturations identified with advanced cerebral monitoring have poorer outcomes, Level II evidence showed no improvement in outcomes for monitored patients.)

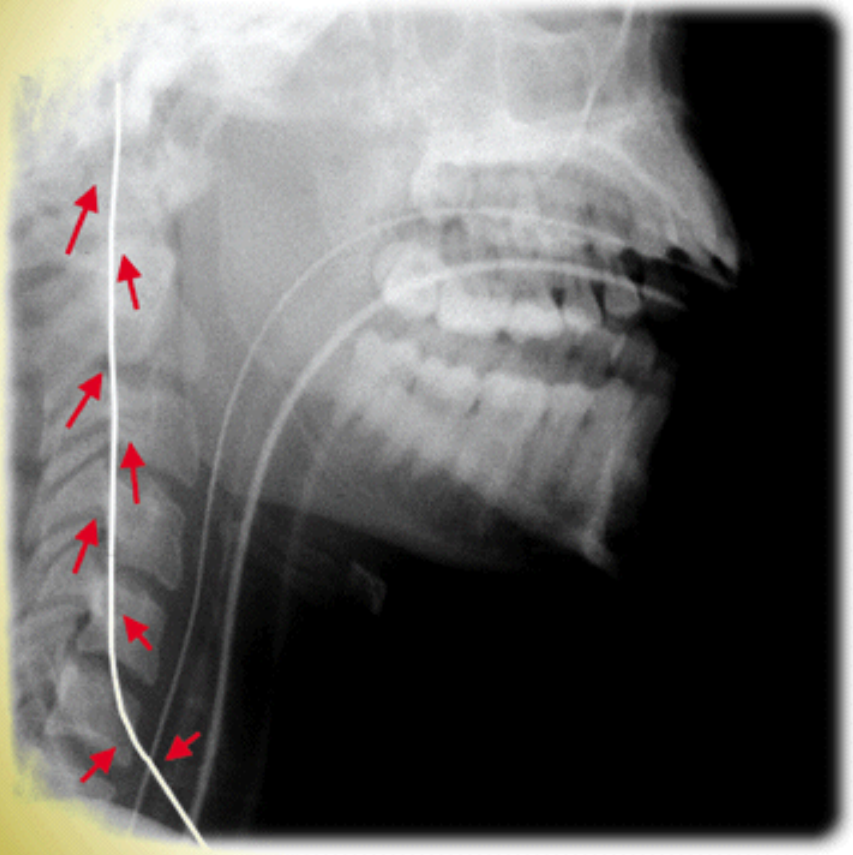
Level III

- Jugular bulb monitoring of arteriovenous oxygen content difference ($AVDO_2$), as a source of information for management decisions, may be considered to reduce mortality and improve outcomes at 3 and 6 months post-injury.

CREDITS
AIUTO
QUIZ

NEURORIANIMAZIONE - DIAGNOSI E MONITORAGGIO

Saturazione venosa giugulare (SjO_2)



Calcolo e significato della CEO_2

$AVDO_2$ cerebrale =
$(SaO_2-SjvO_2) \times 1.36 \times Hb + (PaO_2-PjvO_2) \times 0.003$

dove:

- SaO_2 = Saturazione arteriosa di O_2
- $SjvO_2$ = Saturazione venosa giugulare di O_2
- Hb = Emoglobina
- PaO_2 = tensione di O_2 arteriosa
- PjO_2 = tensione di O_2 giugulare

$CEO_2 = SaO_2 - SjO_2$ (v.n. = 24 - 42%)

CEO_2 > 42% = oligoemia
CEO_2 < 24% = iperemia
***target* CEO_2 = 32%**

PIC > 20 mmHg e CEO_2 > 42%:
- mannitolo 05-1 g/Kg

PIC > 20 mmHg e CEO_2 < 24%:
- iperventilazione

PIC < 15 mmHg e CEO_2 > 42%:
- riduzione del V/min
- ottimizzazione dell'emodinamica sistemica

➲ Implicazioni terapeutiche

INDICE
SOMMARIO

15. Blood Pressure Thresholds

RECOMMENDATIONS

Level I and II

- There was insufficient evidence to support a Level I or II recommendation for this topic.

Level III

- Maintaining SBP at ≥100 mm Hg for patients 50 to 69 years old or at ≥110 mm Hg or above for patients 15 to 49 or over 70 years old may be considered to decrease mortality and improve outcomes.

16. Intracranial Pressure Thresholds

RECOMMENDATIONS*

Level I and II A

- There was insufficient evidence to support a Level I or II A recommendation for this topic.

Level II B

- Treating ICP above 22 mm Hg is recommended because values above this level are associated with increased mortality.

Level III

- A combination of ICP values and clinical and brain CT findings may be used to make management decisions.

17. Cerebral Perfusion Pressure Thresholds

RECOMMENDATIONS

Level I and II A

- There was insufficient evidence to support a Level I or II A recommendation for this topic.

Level II B

- The recommended target cerebral perfusion pressure (CPP) value for survival and favorable outcomes is between 60 and 70 mm Hg. Whether 60 or 70 mm Hg is the minimum optimal CPP threshold is unclear and may depend upon the patient's autoregulatory status.

Level III

- Avoiding aggressive attempts to maintain CPP above 70 mm Hg with fluids and pressors may be considered because of the risk of adult respiratory failure.

18. Advanced Cerebral Monitoring Thresholds

RECOMMENDATIONS

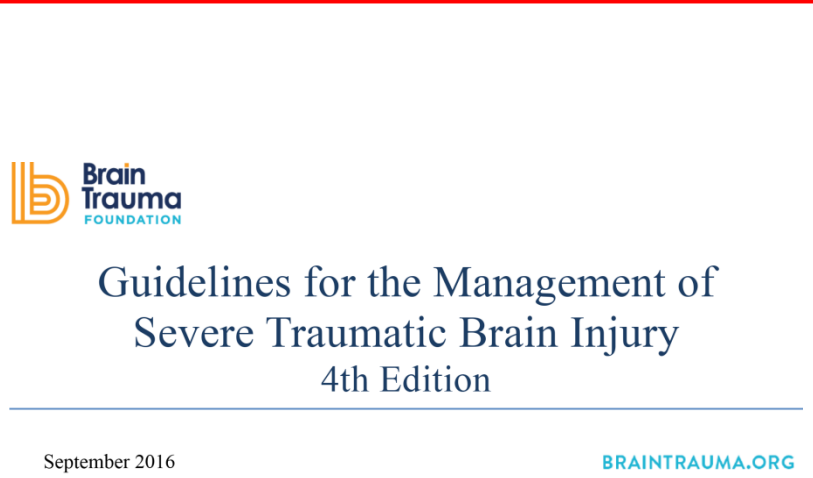
Level I and II

- There was insufficient evidence to support Level I or II recommendation for this topic.

Level III

- Jugular venous saturation of <50% may be a threshold to avoid in order to reduce mortality and improve outcomes.

In-Hospital Brain Trauma Care (IHBTC)



15. BLOOD PRESSU

5. VENTILA

ERAPY

18. ADVANCED CER

RESHOLDS

2. PROPHYLACTIC HYP

S, ANALGESICS, AND SEDATIVES

SION PRESSURE MONITORING

11

XIS

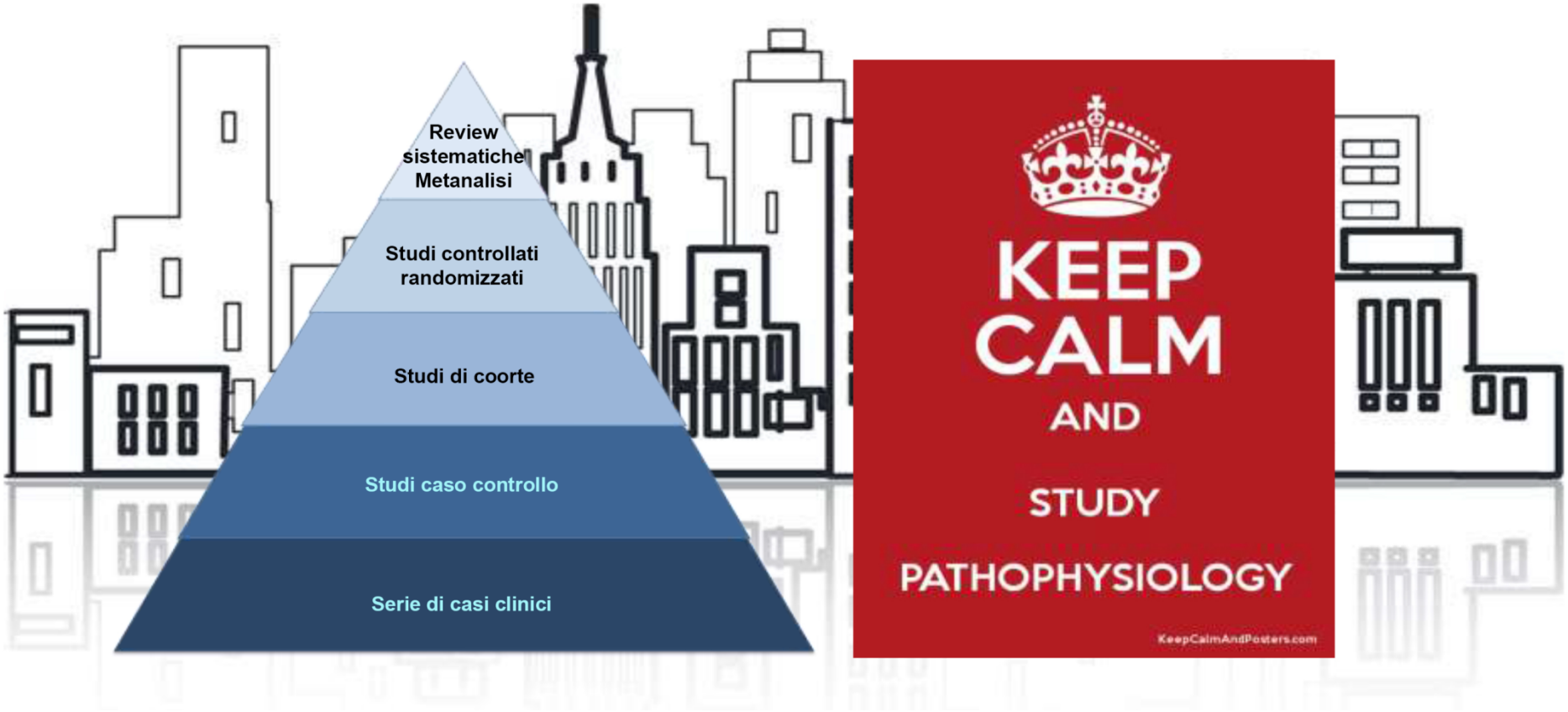
12. INTRACRANIAL PRESSURE MONITORING

ED CEREBRAL MONITORING

Level I

- There was insufficient evidence to support a Level I recommendation for this topic.

In-Hospital Brain Trauma Care (IHBTC)



Recommendations for research

1 Point-of-care coagulation testing

What is the clinical and cost effectiveness of point-of-care coagulation testing using rotational thromboelastometry (ROTEM) or thromboelastography (TEG) to target treatment, compared with standard laboratory coagulation testing?

2 Lactate level for monitoring severity of shock

Is lactate monitoring in patients with major trauma clinically and cost effective?

3 Morphine compared with ketamine for first-line management of pain

Is morphine clinically and cost effective compared with ketamine for first-line pharmacological pain management (in both pre-hospital and hospital settings) in patients with major trauma?

4 Warming in patients with major trauma

Is warming clinically and cost effective in patients with major trauma? If so, which groups of patients will benefit from warming and what is the best method of warming?

Major trauma: assessment and initial management.
NICE guideline . Published: 17 February 2016 - nice.org.uk/guidance/ng39


Grazie per
l'attenzione !

Questions?

Please, don't make questions!