Traumatisé grave en pré-hospitalier
..... les fondamentaux

K Tazarourte
Pôle S.M.U.R. Melun 77
DAR CHU Le Kremlin Bicêtre 94
DAR HIA Percy 92
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Les causes de décès

1997–2008

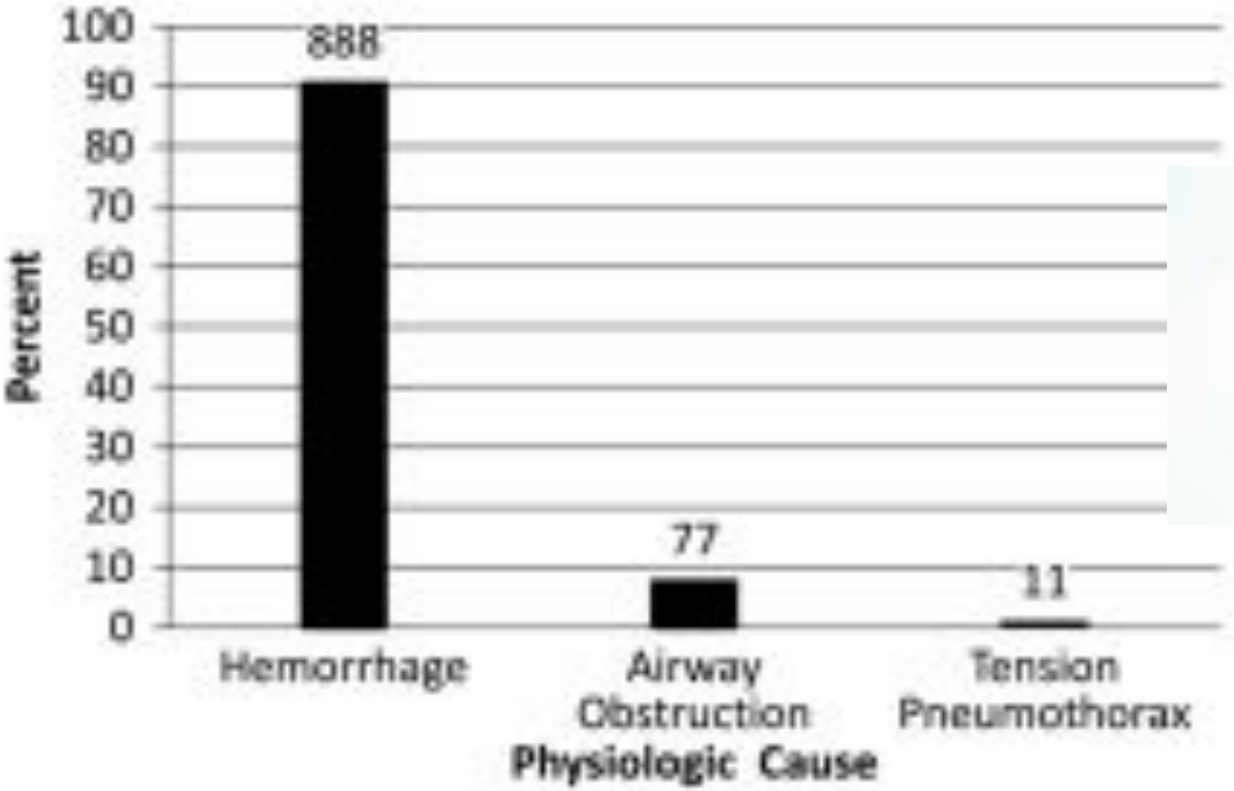
Dutton RP J Trauma 2010

Traumatisme crânien grave	52% (H24)
Hémorragie non contrôlée	30 % (H2)
Airway	10%
SDMV	10 % (J15)

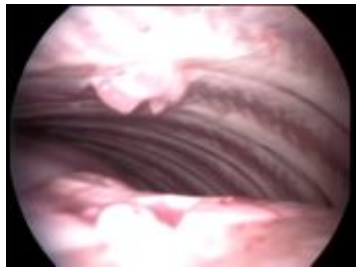
Preventables deaths

Brian J. Eastridge, J Trauma Acute Care Surg. 2012

Military study

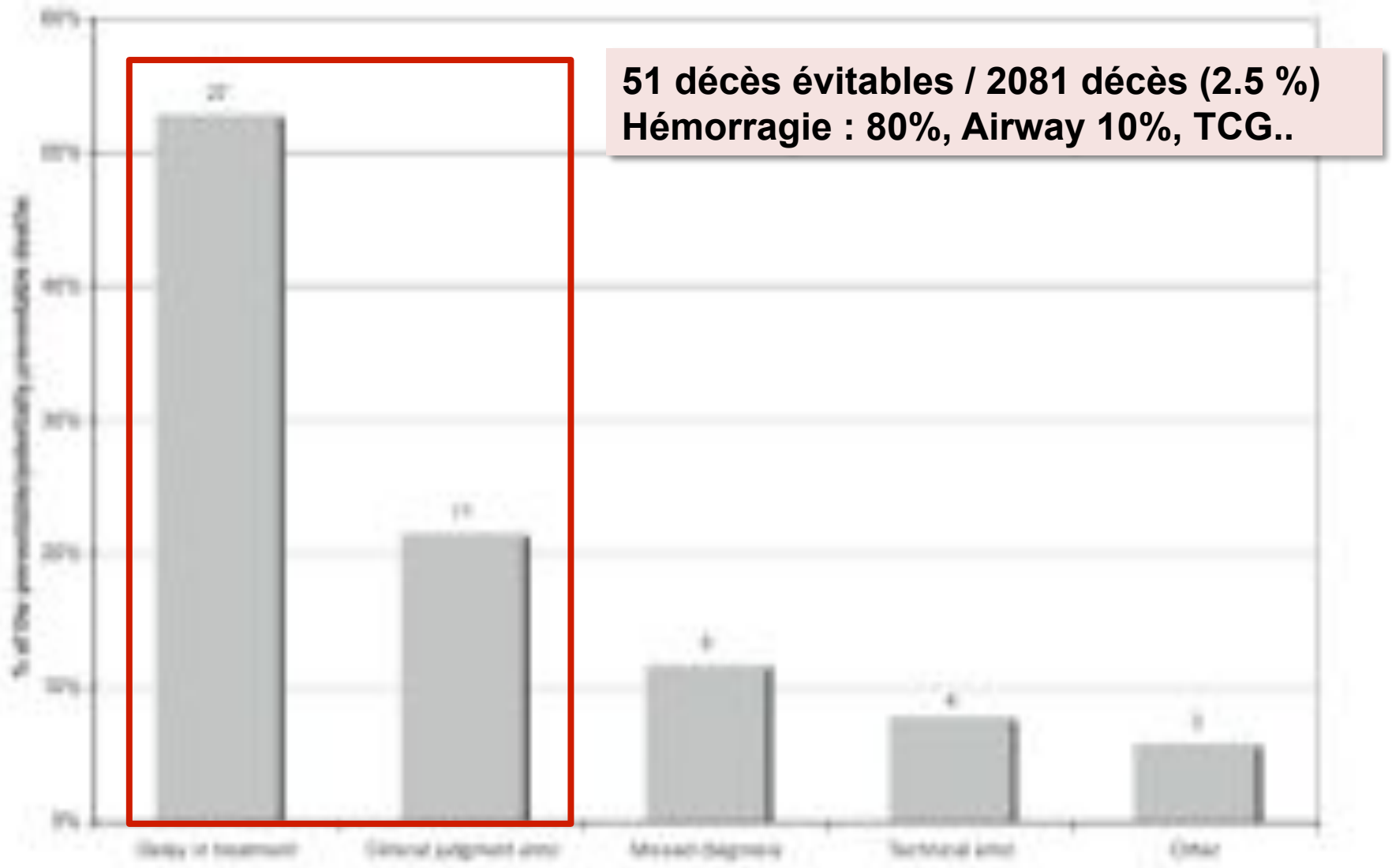


Tourniquet



Les décès évitables

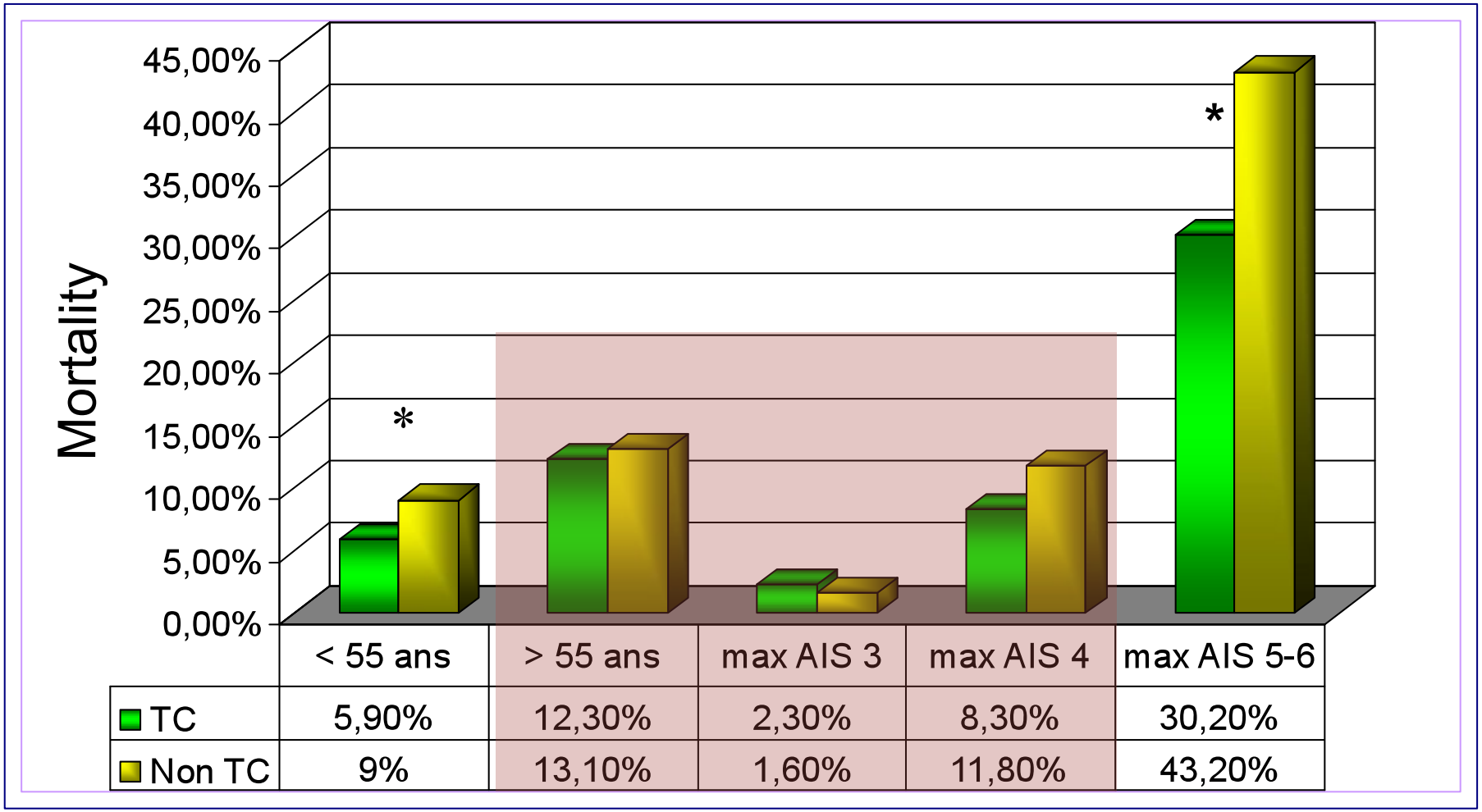
Texeira J Trauma 2007



51 décès évitables / 2081 décès (2.5 %)
Hémorragie : 80%, Airway 10%, TCG..

National evaluation of the effect of trauma-center care on mortality

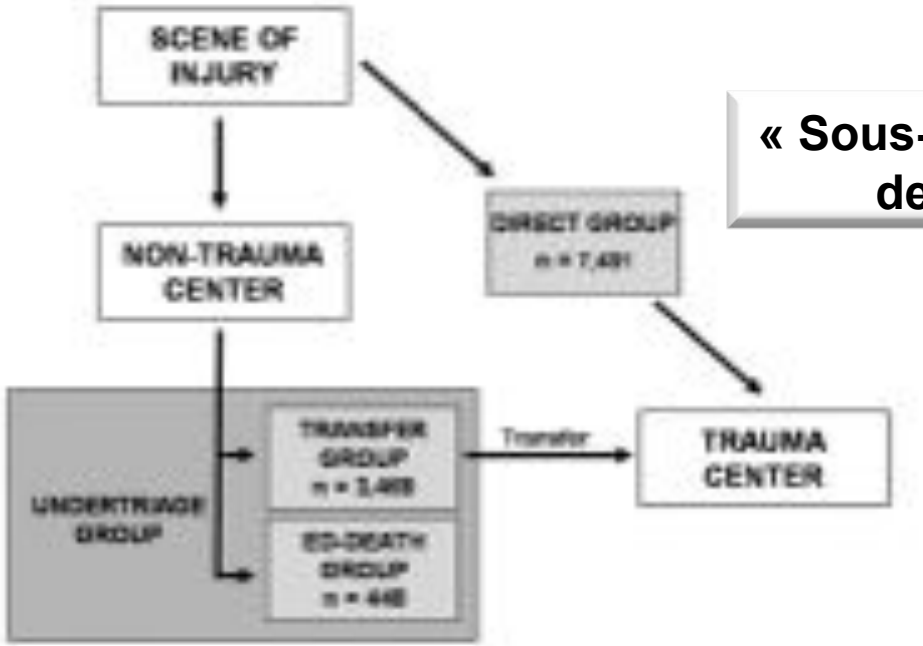
MacKenzie EJ N Eng J Med 2006



	< 55 ans	> 55 ans	max AIS 3	max AIS 4	max AIS 5-6
TC	5,90%	12,30%	2,30%	8,30%	30,20%
Non TC	9%	13,10%	1,60%	11,80%	43,20%

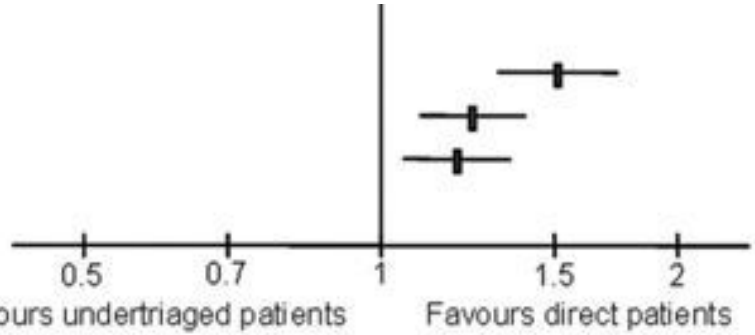
Survival of the Fittest: The Hidden Cost of Undertriage of Major Trauma

Barbara Haas J Am Coll Surg 2010



« Sous-triage » : majoration de la mortalité de 25% dans le groupe Transfert

Population-based analyses	
All patients (unadjusted mortality)	1.51 [1.37, 1.67]
All patients (risk-adjusted mortality)	1.24 [1.10, 1.40]
1h survivors (risk-adjusted mortality)	1.20 [1.06, 1.35]



Predictive Factors for Undertriage

Nakahara S J Trauma 2010

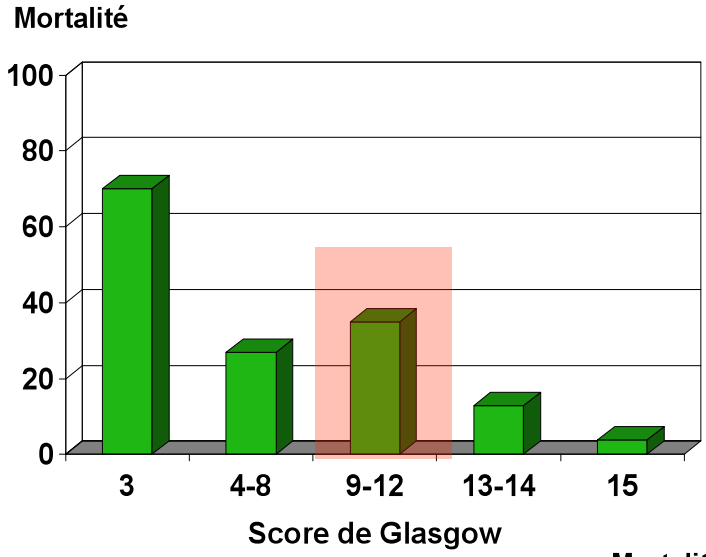
- **Age of 45 years to 54 years** (odds ratio [OR], 6.76)
- **Injury Severity Score of 16** (OR 3.67)
- **Glasgow coma scale score of 13 to 15** (OR 4.79)
- **Nighttime** (OR 2.31)
- **Pelvic injuries** (OR 14.2)

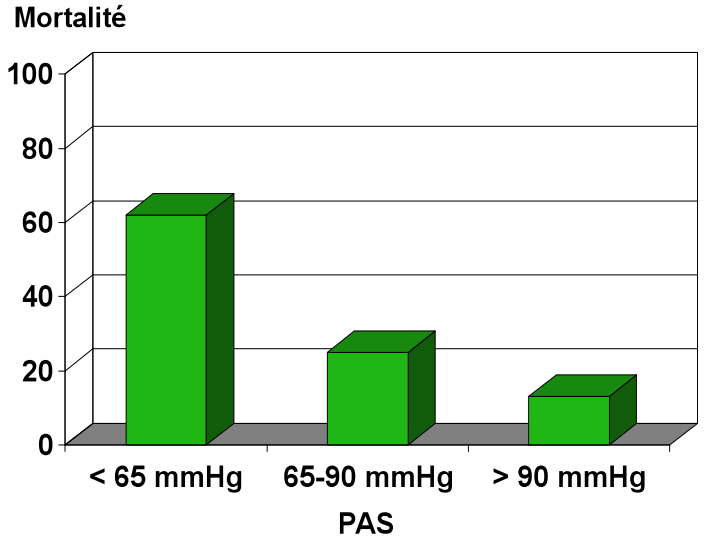
Evaluation initiale des traumatisés graves

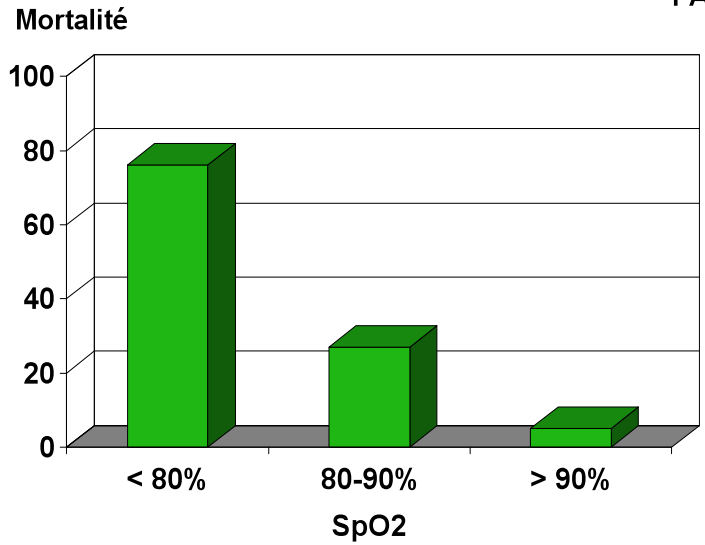
- Détecter des lésions occultes
- Prévoir des gestes urgents
- Prédire la mortalité *et le pronostic fonctionnel*

- Variables physiologiques
- Autres…(biologie, imagerie)
- Scores….
- Algorithme…
- Expertise clinique

Les éléments de l'évaluation physiologique







Riou et al. Anesthesiology 2001

Prehospital Hypotension is a Predictor of the Need For an Emergent, Therapeutic Operation in Trauma Patients With Normal Systolic Blood Pressure in the Emergency Department

Lipsky AM J Trauma 2006

	All Patients N = 1,028	Hypotensive in Field N = 71	Normotensive in Field N = 957	
Age, years, median (IQR)	28 (18–39)	30 (22–44)	27 (18–39)	$p = 0.01$
Male, N (%)	784 (76)	54 (76)	730 (76)	OR 1.0 (95% CI 0.6–1.7)
Blunt mechanism, N (%)	746 (73)	41 (58)	705 (74)	OR 0.5 (95% CI 0.3–0.8)
ISS, median (IQR)*	4 (1–10)	9 (4–19)	4 (1–10)	$p < 0.0001$
Prehospital i.v. fluid, ml, median (IQR)†	100 (0–300)	400 (100–700)	100 (0–300)	$p < 0.0001$
Underwent surgery				
Any surgery, N (%)	285 (28)	38 (54)	247 (26)	OR 3.3 (95% CI 2.0–5.4)
Within 6 h, N (%)	168 (16)	27 (38)	141 (15)	OR 3.6 (95% CI 2.1–5.9)
Therapeutic, N (%)	135 (13)	26 (37)	109 (11)	OR 4.5 (95% CI 2.7–7.6)
Mortality, N (%)‡	27 (3)	4 (6)	24 (3)	OR 2.3 (95% CI 0.8–6.9)

Hypotension ≠ hypovolémie

Cardiogénique :

- contusion myocardique

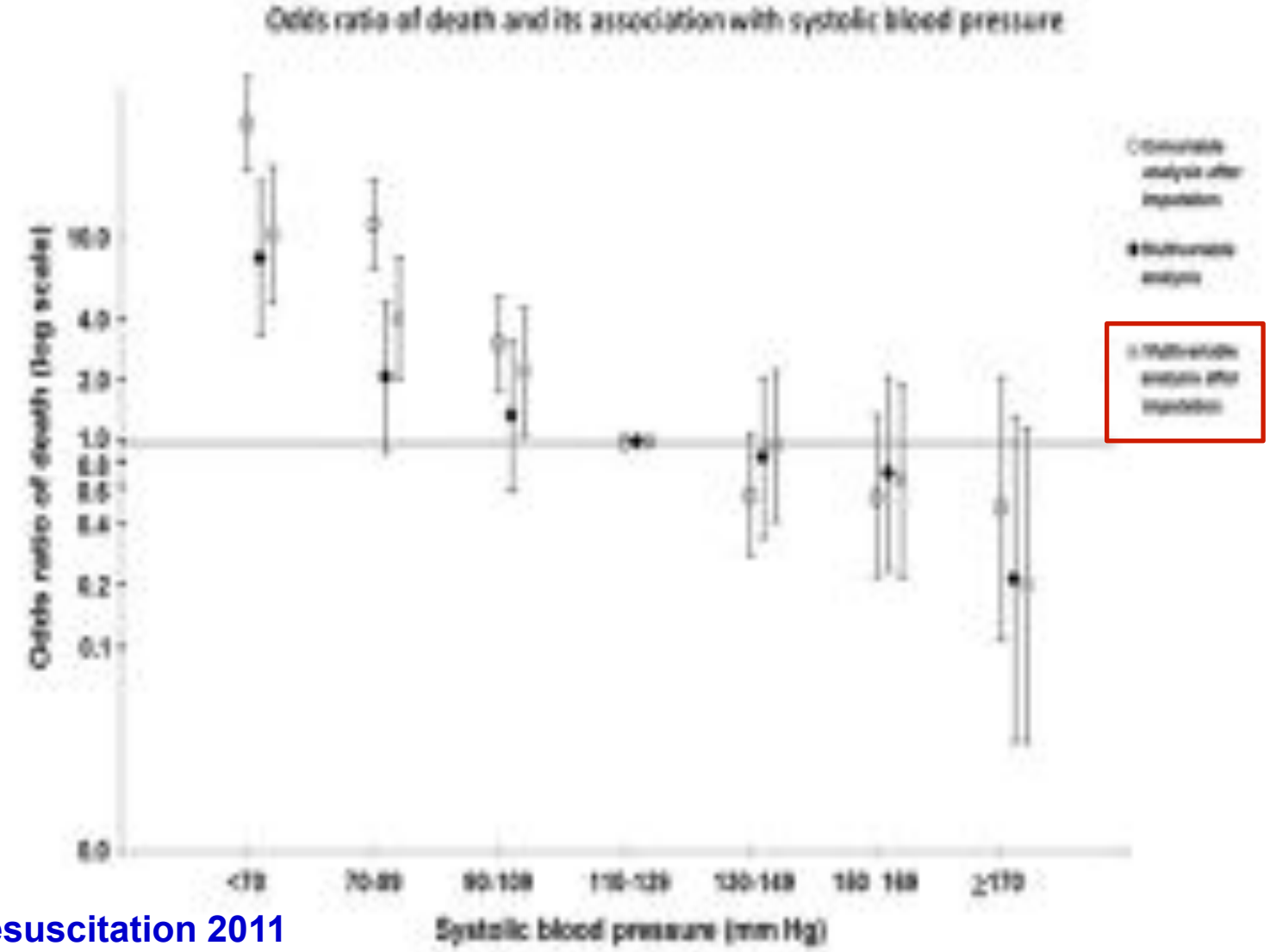
Restrictif :

- **pneumothorax compressif (+++)**
- tamponade
- ventilation artificielle

Vasoplégie

- traumatisme crânien
- **atteinte médullaire**
- anesthésie

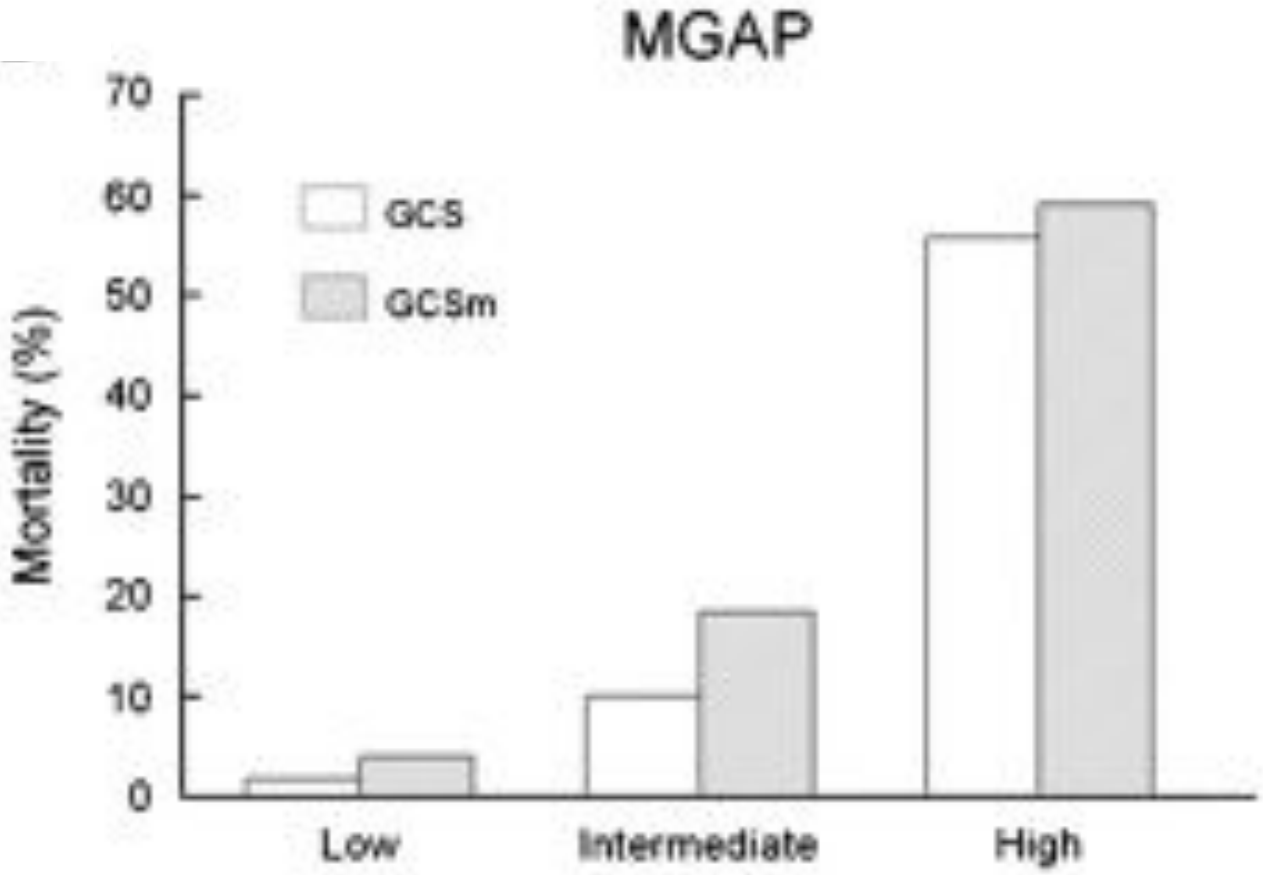
Systolic blood pressure below 110 mmHg is associated with increased mortality in penetrating major trauma patients: Multicentre cohort study (n=3444;2000-2009)



Hasler Resuscitation 2011

GCS ou score M seul ?

Vivien B Am J Emerg Med 2011



La surveillance des pupilles

- Mydriase non détectée durant le transport.
- Osmothérapie peu réalisée

41 % des patients non traités par osmothérapie Tazarourte et al.
0% Pays de Loire Bouhours et al. 2008

Mechanism, Glasgow Coma Scale, Age, and Arterial Pressure (MGAP): A new simple prehospital triage score to predict mortality in trauma patients*

Danielle Sartorius, MD; Yannick Le Manach, MD; Jean-Stéphane David, MD, PhD; Elisabeth Rancurel, MD; Nadia Smail, MD; Michel Thicoïpé, MD; Eric Wiel, MD, PhD; Agnès Ricard-Hibon, MD, PhD; Frédéric Berthier, MD; Pierre-Yves Gueugniaud, MD, PhD; Bruno Riou, MD, PhD

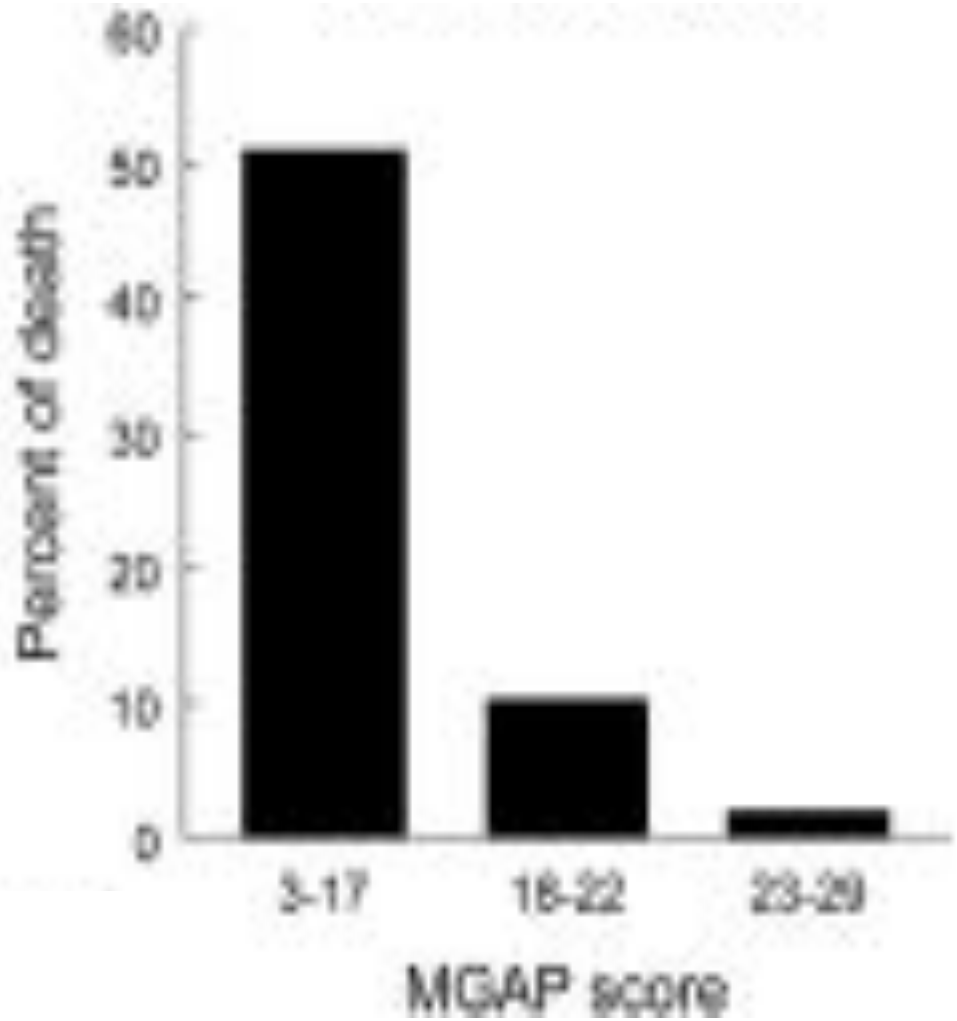
Critical Care Med 2010

Multivariate analysis of prehospital predictors of in-hospital death

	Odds Ratio [95% CI]	Points of the MGAP Score
Glasgow Coma Scale by point increase	0.71 [0.68–0.74]	GCS value
Systolic arterial blood pressure		
>120 mm Hg	1	+5
60–120 mm Hg	2.7 [2.0–3.6]	+3
<60 mm Hg	5.4 [4.1–7.3]	0
Blunt trauma (vs. penetrating)	0.24 [0.13–0.45]*	+4
Age	0.21 [0.13–0.35]*	+5
<60 yrs		
		Total: 3 to 29

Mechanism, Glasgow Coma Scale, Age, and Arterial Pressure (MGAP): A new simple prehospital triage score to predict mortality in trauma patients*

Sartorius D Crit Care Med 2010



Eviter le sous-triage

Sartorius D Crit Care Med 2010

Score	MGAP	T-RTS	RTS	TRISS
Threshold	<23	<12	<7.5	<0.91
Sensitivity	0.95 [0.91–0.97]	0.96 [0.93–0.98]	0.95 [0.92–0.97]	0.96 [0.92–0.97]
Specificity	0.70 [0.67–0.73]	0.42 [0.39–0.45]*	0.38 [0.35–0.41]*	0.74 [0.71–0.76]*
Positive predictive value	0.47 [0.43–0.52]	0.27 [0.24–0.30]*	0.26 [0.23–0.29]*	0.45 [0.41–0.50]
Negative predictive value	0.98 [0.96–0.99]	0.98 [0.96–0.99]	0.97 [0.95–0.98]	0.99 [0.98–0.99]
Accuracy	0.45 [0.43–0.48]	0.35 [0.32–0.38]*	0.32 [0.30–0.35]*	0.61 [0.59–0.64]*
Positive diagnostic likelihood ratio	3.13 [2.82–3.48]	1.65 [1.56–1.75]*	1.54 [1.46–1.63]*	3.68 [3.32–4.08]*
Negative diagnostic likelihood ratio	0.07 [0.04–0.13]	0.09 [0.05–0.18]	0.12 [0.07–0.22]	0.06 [0.03–0.11]

Le score MGAP prédit une mortalité mais pas le besoin de gestes urgents…

Expertise médicale en préhospitalier

- 504 TCG étudiés pendant 22 mois
  - **25% admis en centres non spécialisés**

Homme 51±24 ans
Chute
GCS 5
Pas de lésions associées

Pronostic fonctionnel favorable 10%

The MRC CRASH. BMJ 2008

self-fulfilling prophecy

Claire J. Creutzfeldt, Crit Care Med 2011

Such pessimism may drive medical decisions not to attempt resuscitation in patients in whom a favorable outcome may have been possible,……

Les éléments de prédiction d'une procédure urgente à l'accueil hospitalier

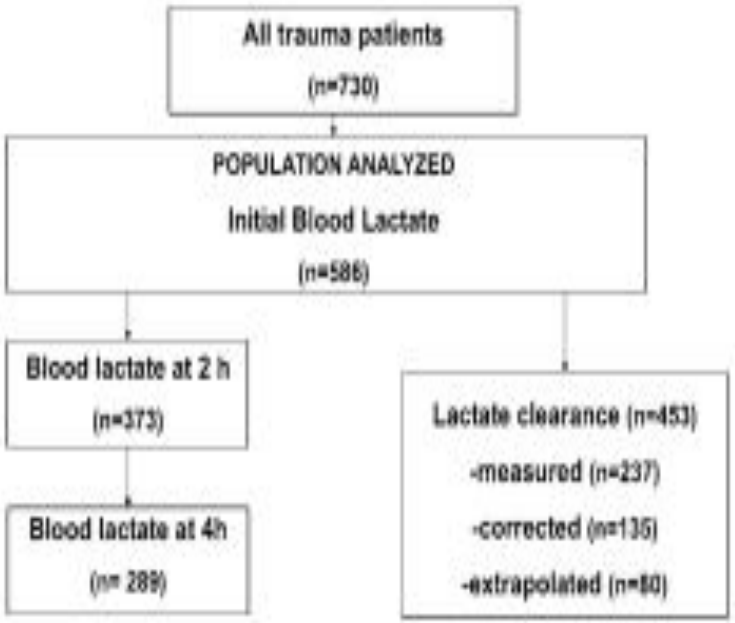
Raux M J Trauma 2011

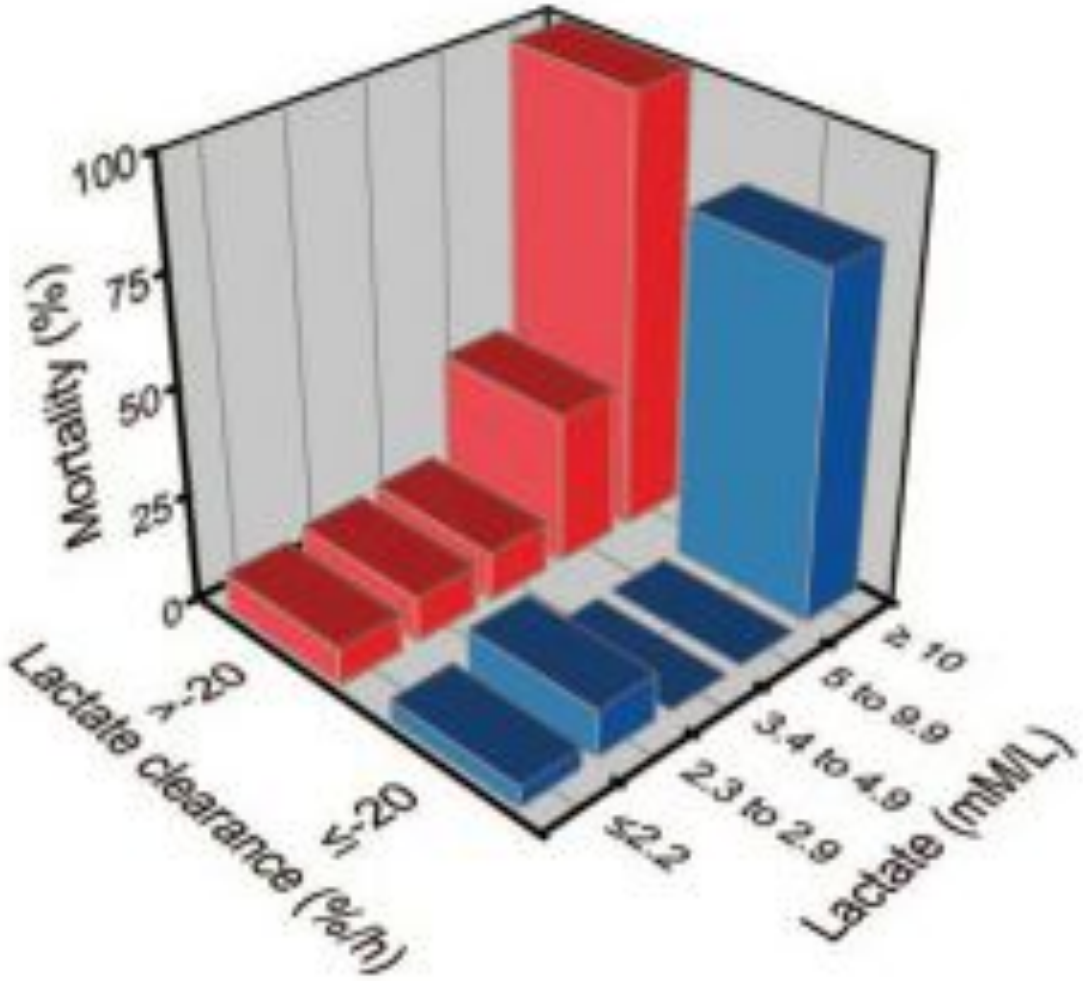
Variables	Odds Ratio (95% CI)	*p*
Penetrating trauma	2.46 (1.61–3.67)	<0.001
Intravenous administration of colloids >750 mL	2.20 (1.68–2.88)	<0.001
Systolic arterial blood pressure <100 mm Hg	1.42 (1.10–1.84)	0.006
Heart rate ≥100 bpm	1.42 (1.12–1.79)	0.004

Valeurs de l'Hémocue et cinétique

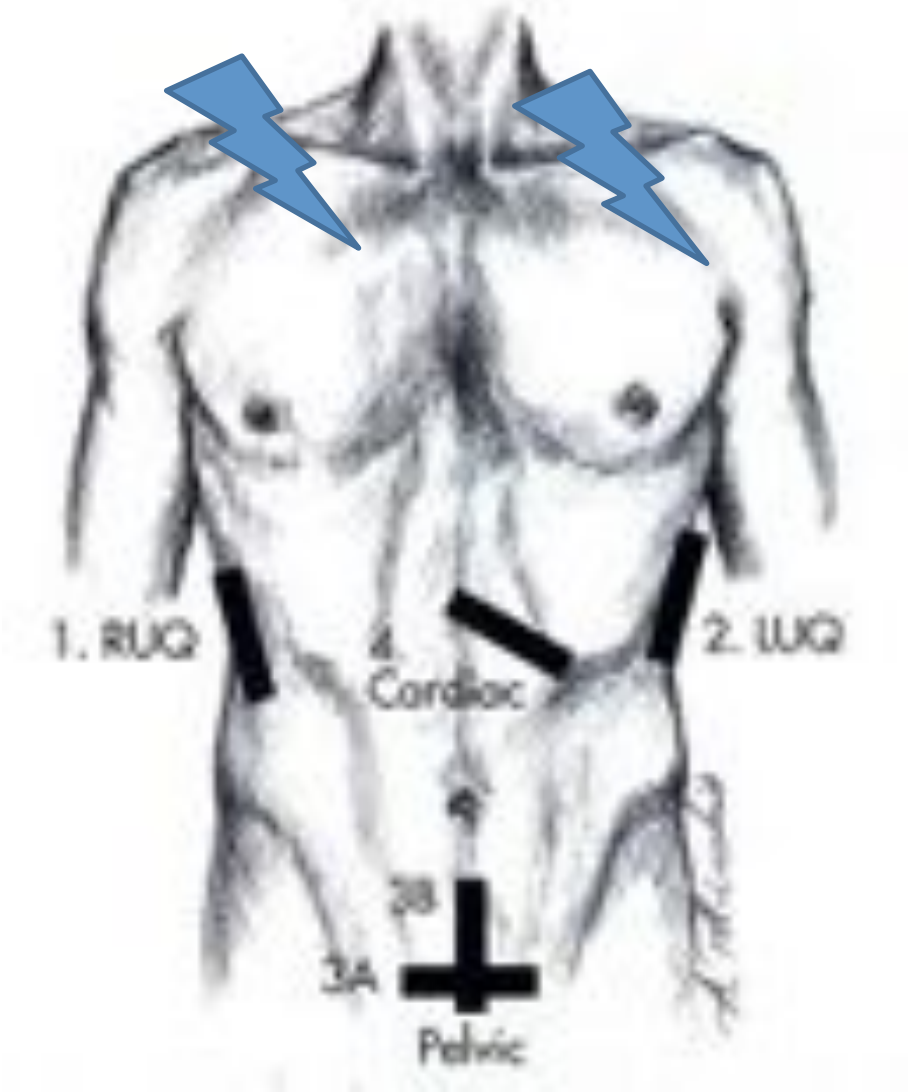
Prognostic Significance of Blood Lactate and Lactate Clearance in Trauma Patients

Régnier MA Anesthesiology 2012





Echographie préhospitalière en aide au diagnostic et triage



FAST

Focused Abdominal Sonography for Trauma

Lapostolle Am J Emerg Med 2005

Comparative Effectiveness of Inhospital Trauma Resuscitation at a French Trauma Center and Matched Patients Treated in the United States

Adil H. Haider, MD, MPH, FACS, Jean-Stephane David, MD, PhD,†‡ Syed Nabeel Zafar, MBBS, MPH,‡‡ Pierre-Yves Gueugniaud, MD, PhD,§ David T. Efron, MD,* Bernard Floccard, MD,¶ Ellen J. MacKenzie, PhD,|| and Eric Voiglio, MD, PhD, FACS, FRCS**††*

Ann Surg 2013

	Mortality Rate			
	Lyon	**NTDB**	**OR**	**95% CI**
All	13.7%	13.5%	1.0	0.77–1.39
Blunt injury	14.5%	14.4%	1.0	0.75–1.37
Penetrating injury	5.3%	4.2%	1.9	0.41–8.59
GCS 3–8	47.4%	43.8%	1.4	0.91–2.07
GCS 9–15	3.9%	4.8%	0.7	0.47–1.19

The london attacks-response Prehospital and Hospital Care

Rapidly assembled at each bombing scene was a team of doctors who were experienced in delivering prehospital care. They fulfilled two roles:

- Care of the individual patients with serious injuries (“bronze doctors”)
- Management of the scene to evacuate large numbers of casualties to surrounding hospitals (“silver doctors”).

Redhead N Engl J Med 2005

Advanced life support versus basic life support in the pre-hospital setting: A meta-analysis☆

G. Bakalos*, M. Mamali, C. Komninos, E. Koukou, A. Tsantilas, S. Tzima, T. Rosenberg

Resuscitation 2011

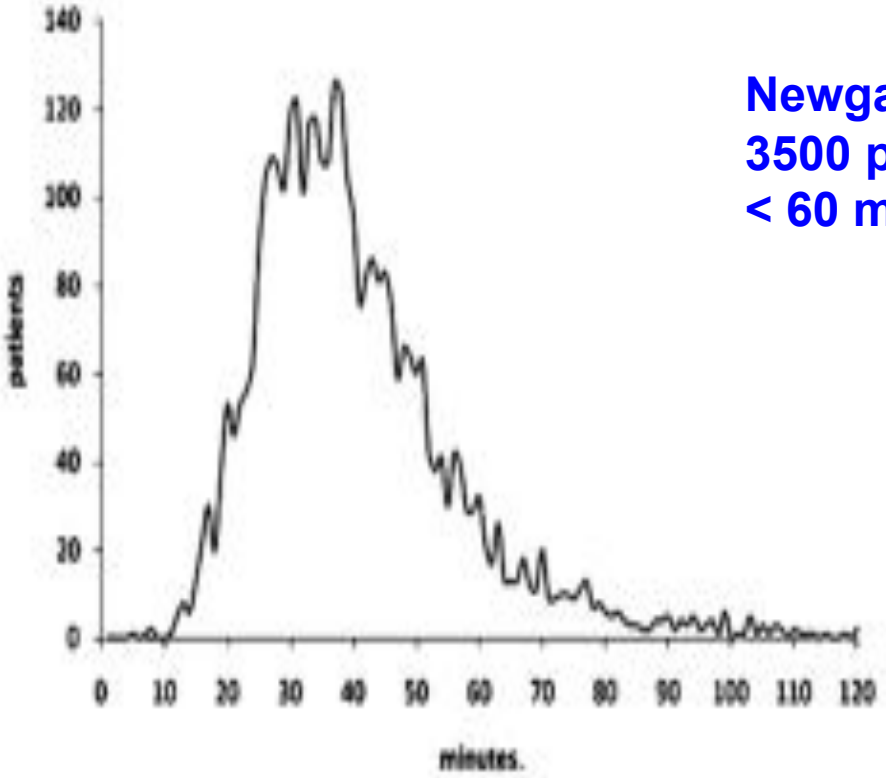
18 articles comparing ALS versus BLS in the pre-hospital setting
9 articles in patients with trauma (16,857 trauma victims)

(pooled OR 0.892, 95% CI, 0.775–1.026)

How can advanced life support be harmful?

Prehospital time and mortality

- 112 min décédés vs 115 minutes vivants (ns) TCG
- 70 [55–95] min deaths vs 63 [45–90] alive (penetrating trauma) p< 0,02 (MGAP study)



Newgard CD Ann Emerg Med 2010
3500 patients USA
< 60 minutes vs > 60 minutes
ns mortalité

Pré-Bilan et demande de renfort (hélicoptère..)

Temps	Médiane (25ème – 75ème perc.) en minutes
Arrivée du SMUR sur place	20 (12-40)
Arrivée SMUR- transmission du bilan	34 (22-46)
Transmission bilan - notification de destination	14 (8-23)
Notification de destination - arrivée au 1er hôpital	41 (22-64)
Total (SAMU - Arrivée au 1er hôpital)	115 (85-149)

Tazarourte et al. Paris TBI study.

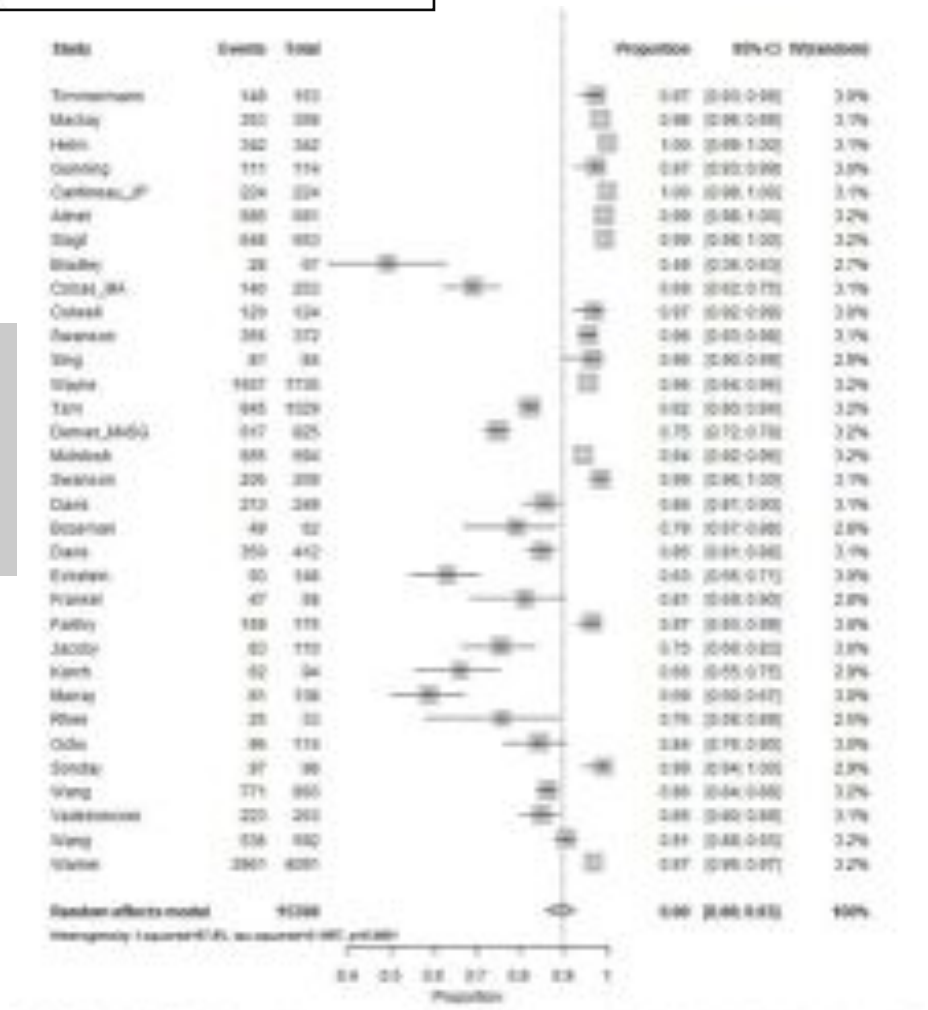
Patient safety in pre-hospital emergency tracheal intubation: a comprehensive meta-analysis of the intubation success rates of EMS providers

Critical Care 2012, **16**:R24 doi:10.1186/cc11189

Hans Morten Lossius (hans.morten.lossius@snla.no)
Jo Roislien (jo.roislien@medisin.uio.no)
David J Lockey (david.lockey@nbt.nhs.uk)

- Meta-analysis of 33 studies

EMS-physicians have ETI success rates close to 100% and significantly higher than non-physicians even if they used muscle paralytic agent.



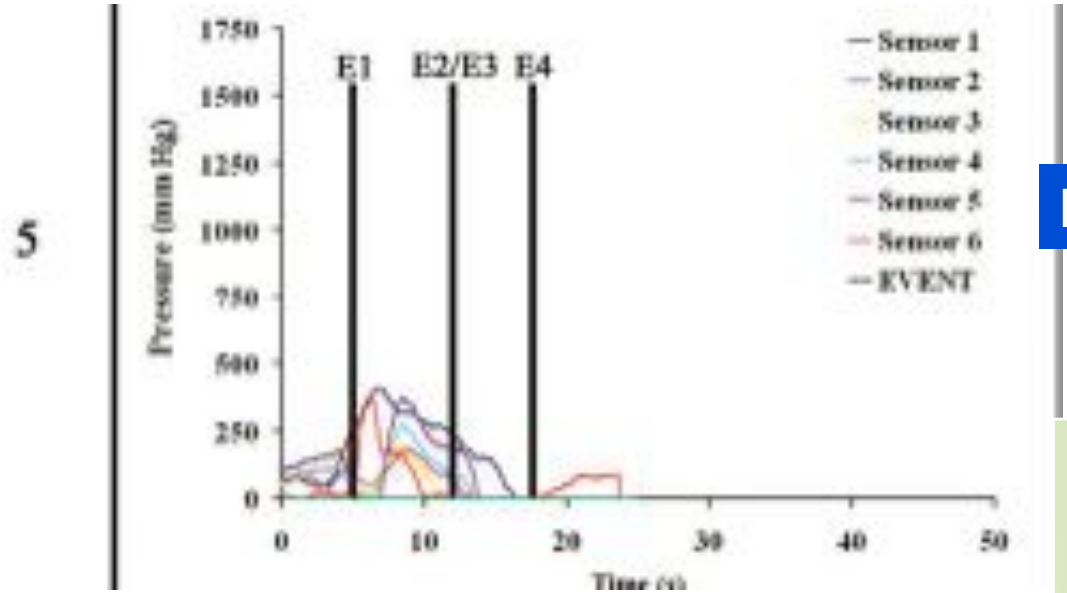
Prehospital Rapid Sequence Intubation Improves Functional Outcome for Patients With Severe Traumatic Brain Injury : *A Randomized Controlled Trial*

Bernard SA Ann Surg 2010

	Rapid Sequence Intubation Group (n = 157)	Hospital Intubation Group (n = 142)	P*
Primary outcome measure			
GOSe 1 (dead)	53	55	
GOSe 2 (vegetative state)	1	3	
GOSe 3 (severe disability-lower end)	19	20	
GOSe 4 (severe disability-upper end)	4	8	
GOSe 5 (moderate disability-lower end)	32	18	
GOSe 6 (moderate disability-upper end)	21	14	
GOSe 7 (good)	20	12	
GOSe 8 (normal)	7	12	
Median GOSe (IQR)	5 (1–6)	3 (1–6)	0.28
Secondary outcome measures			
Good neurologic outcome (GOSe 5–8)	80/157 (51%)	56/142 (39%)	0.046
Age ≤60 yr and GOSe 5–8	75/121 (62%)	54/105 (51%)	0.094
Age >60 yr and GOSe 5–8	5/35 (14%)	2/35 (6%)	0.23
Transport time ≥20 min and GOSe 5–8	48/97 (50%)	33/87 (38%)	0.12

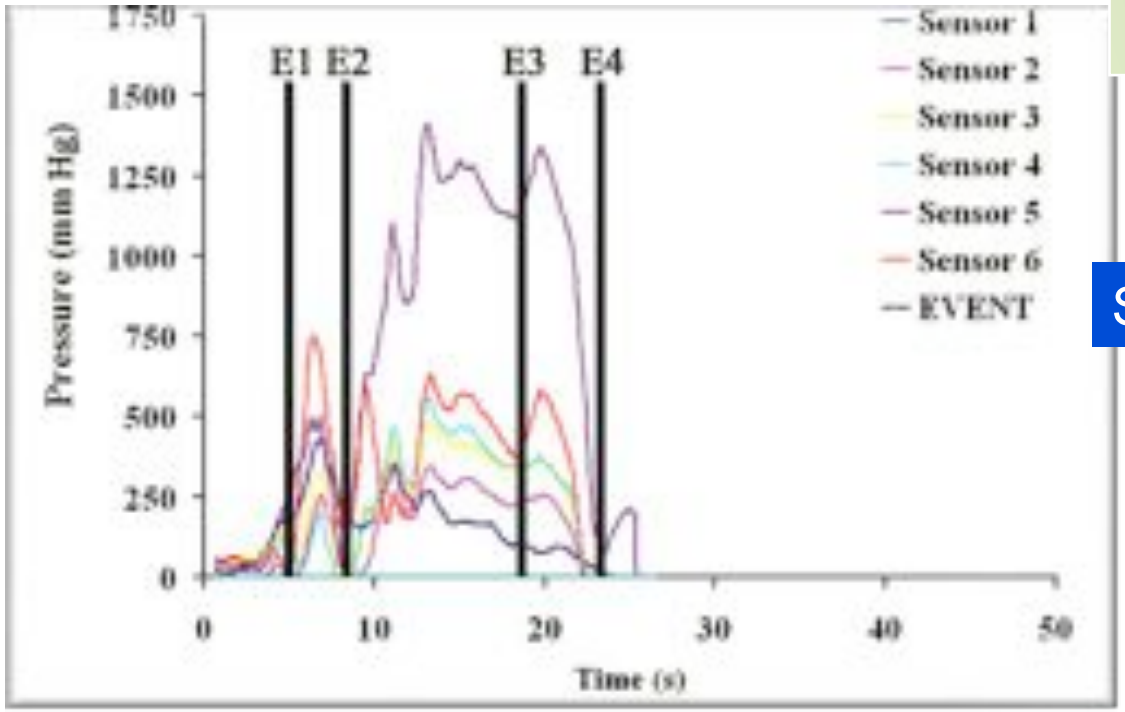
Guidelines for initial management of spinal injury
British Trauma Society 2002

Santoni BD Anesthesiology 2009



Pas de stabilisation

E 1 : début intubation
E2 : epiglotte vue
E3 : vue glottique avant IT
E4 : IT



Stabilisation par MILS

Use of the Airtraq laryngoscope for emergency intubation in the prehospital setting: A randomized control trial*

Trimmel Crit Care Med 2011

- Succès d'intubation Airtraq vs laryngoscopie

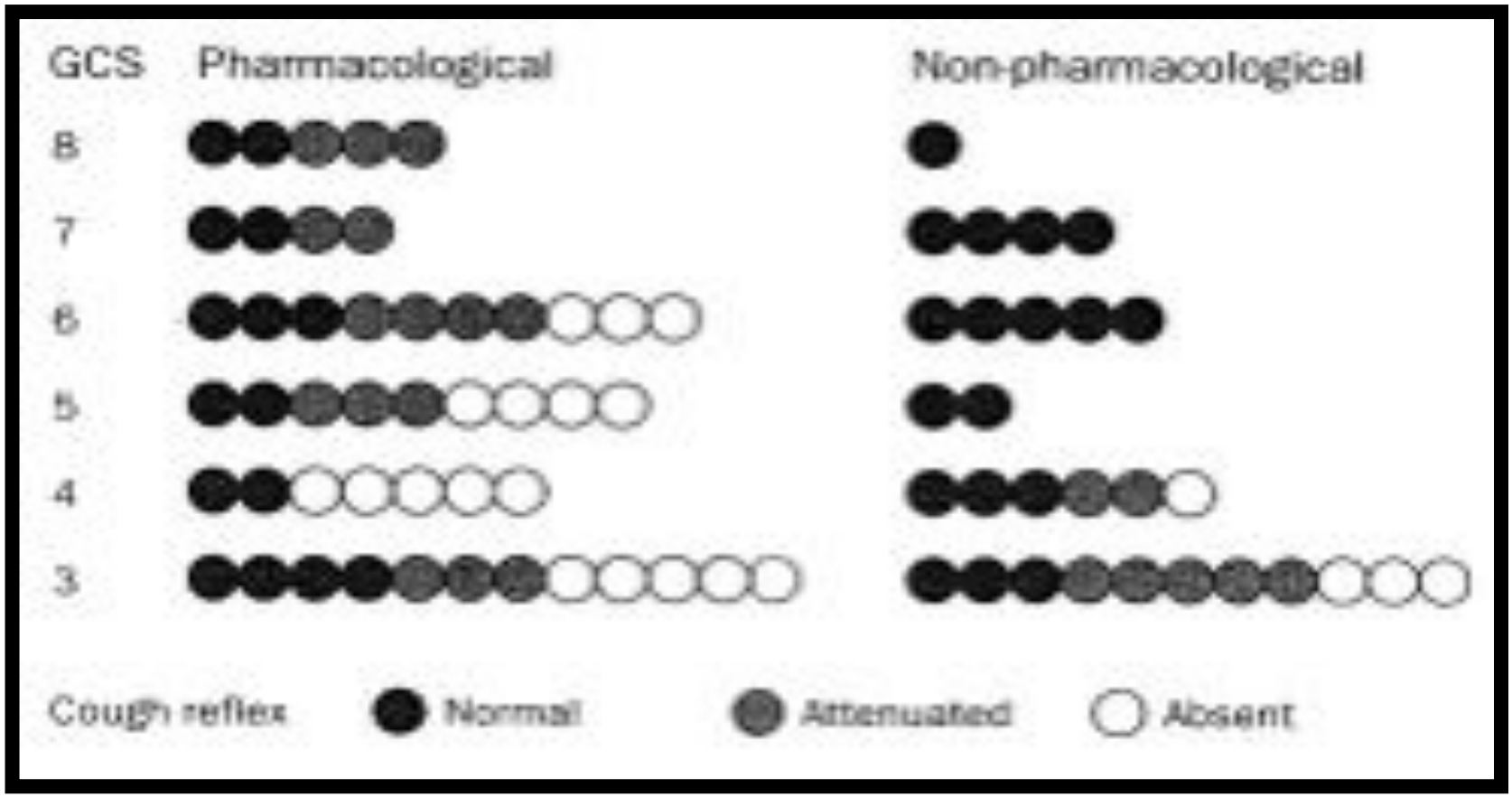
47 vs 99 % (p<0,001)

En préhospitalier la laryngoscopie directe reste la méthode de référence

Reasons for failed endotracheal intubation while employing the Airtraq	n = 56
Cuff damage noticed after successful endotracheal tube placement	10
Light source defect (continuous flashing)	2
Impaired sight and visibility due to vomitus, blood, or food bolus	0
Impaired mouth opening—Airtraq difficult to insert	5
Poor visibility due to environmental exposure (snow field, ambient light)	5
Esophageal intubation despite optimal view	3
Airtraq handling mistakes	3
Laryngospasm and hiccup	1
Airtraq and subsequent direct laryngoscopy failed	3
Missing information	15

Relation between GCS and cough reflex

Moulton C Lancet 1994

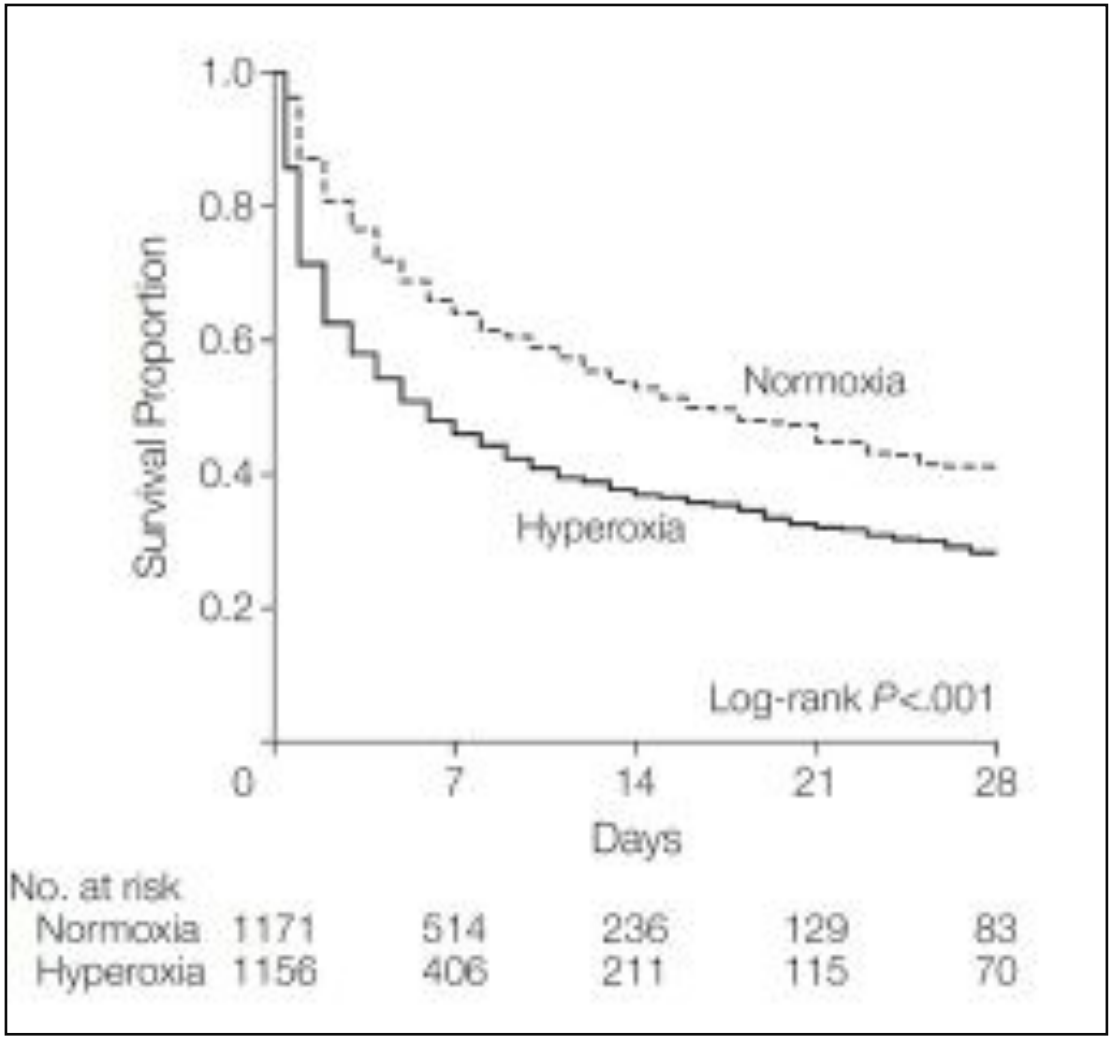


Pendant le MCE
« O2 mais pas trop »

Kilgannon JAMA 2010

- **Libération des VAS**
- **IOT non prioritaire**

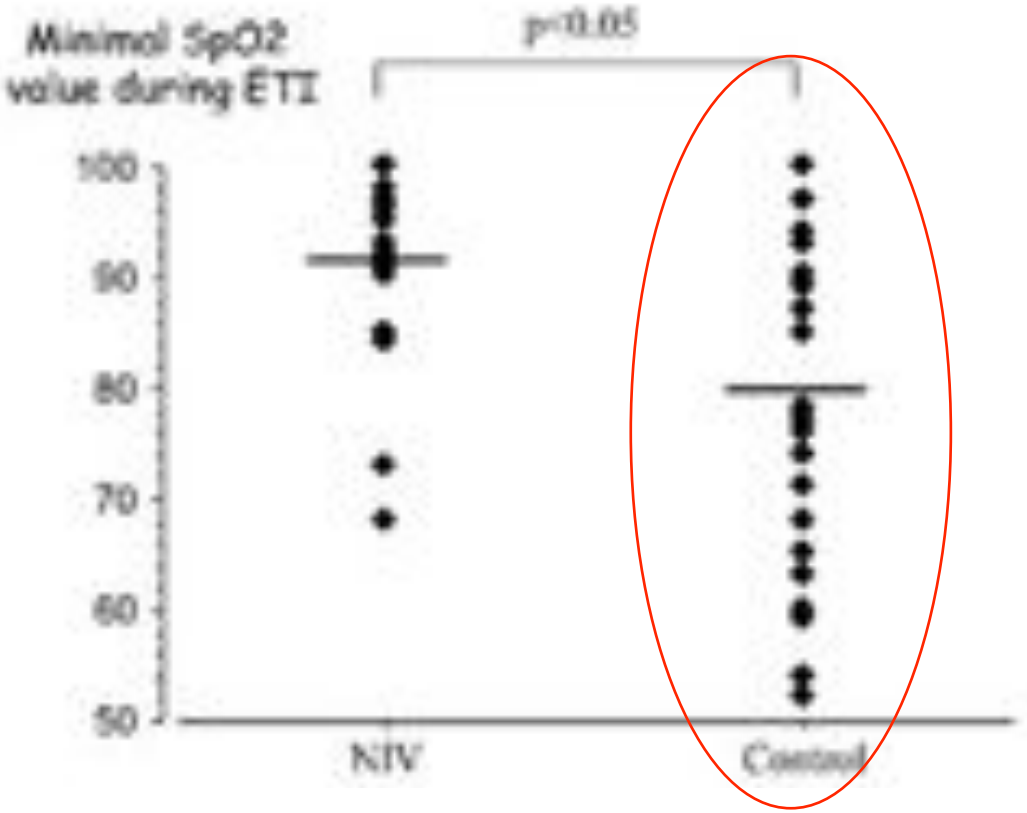
FI02 0,5
Objectif SpO2 90-95%



Noninvasive Ventilation Improves Preoxygenation before Intubation of Hypoxic Patients

Christophe Baillard, Jean-Philippe Fosse, Mustapha Sebbane, Gérald Chanques, François Vincent, Patricia Courouble, Yves Cohen, Jean-Jacques Eledjam, Frédéric Adnet, and Samir Jaber

Am J Respir Crit Care Med Vol 174. pp 171–177, 2006



La prise en charge médicale génère des épisodes d'hypotension artérielle

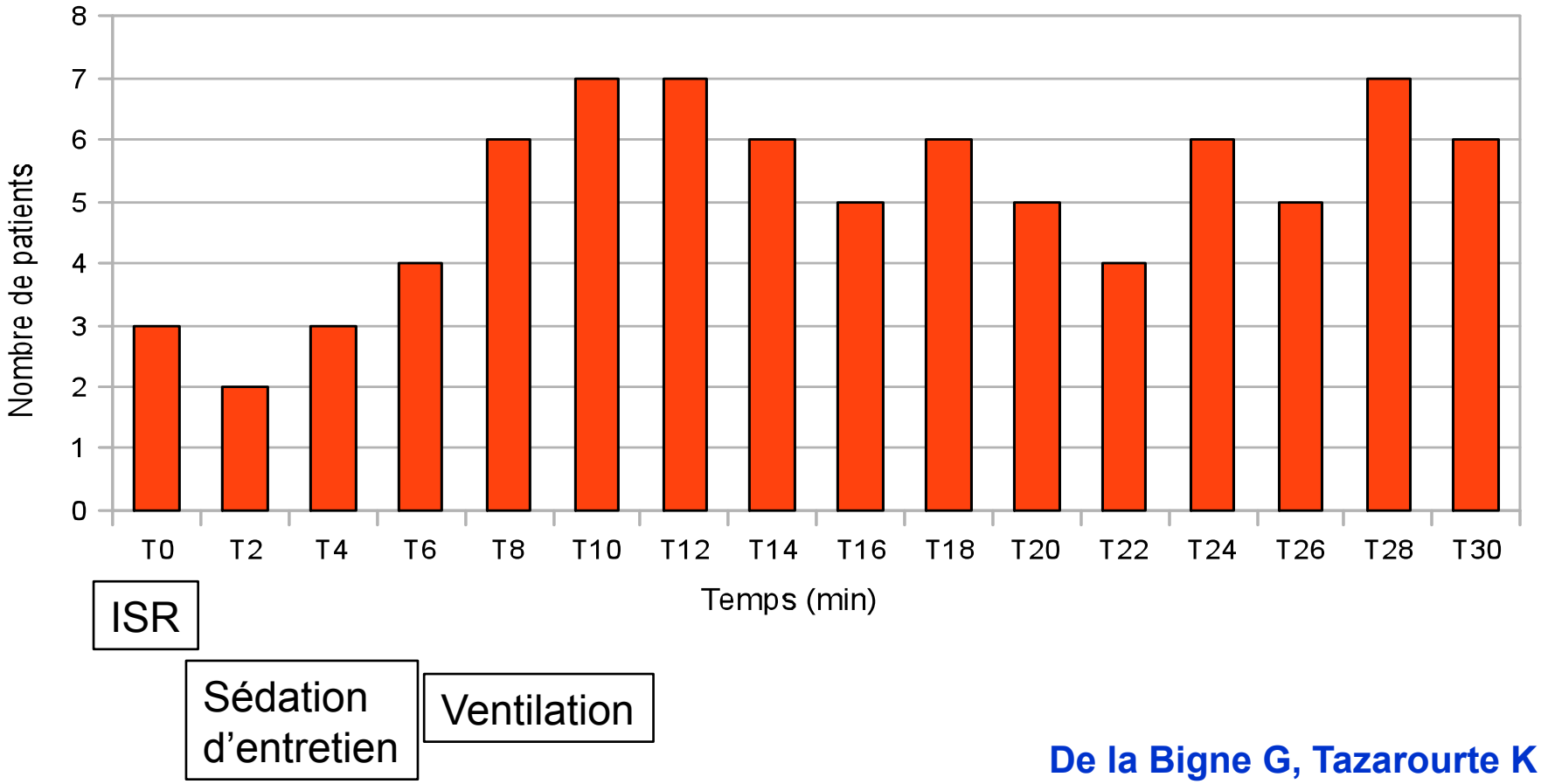
Tazarourte et al.

n=504	Patients	Décès 30 J n (%)	P.value
Jamais d'HypoTA	386 (76.6%)	141 (36.5%)	-
PAS<90 mmHg avant PEC	41 (8.1%)	**36 (87.8%)**	
3 HypoTA (P1-P2-P3)	4	4 (100%)	
2 HypoTA (P1- P2)	9	9 (100%)	
1 (P1-P3)	16	13 (81.2%)	
1 HypoTA (P1)	12	10 (83.3%)	
PAS<90 mmHg après PEC	106 (21%)		
2 HypoTA (P2 et P3)	14	**80 (75.5%)** 11 (78.6%)	**<0.001***
1 HypoTA (P2)	17	15 (88.2%)	
1 HypoTA (P3)	75	54 (72%)	

avant prise en charge médicale (**P1**), juste après (**P2**), avant l'admission à l'hôpital (**P3**).

Nombre d'épisodes d'hypotension artérielle pendant les 30 minutes suivant l'intubation trachéale

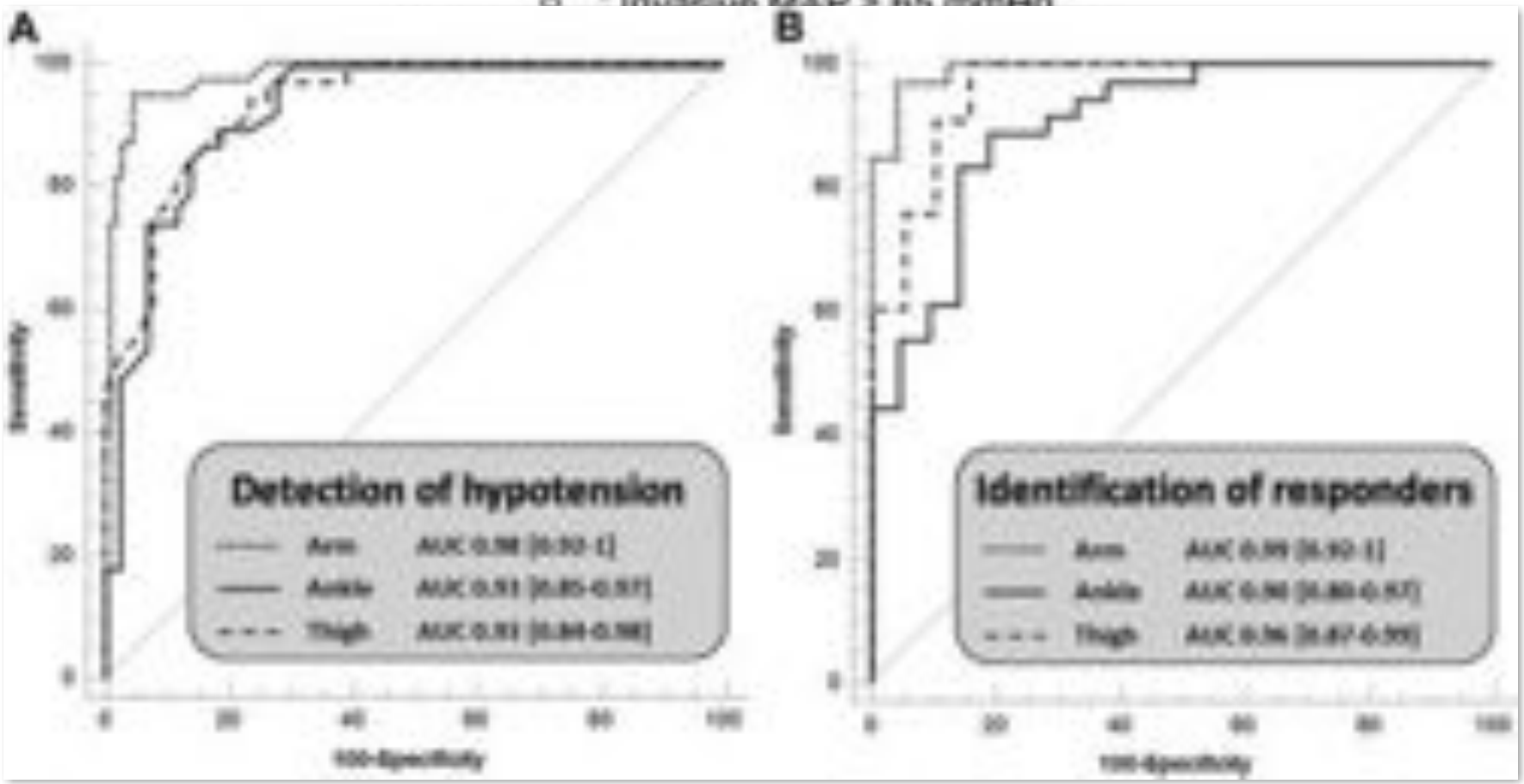
N = 38 patients



De la Bigne G, Tazarourte K
Med Emergency 2013

Tracking Hypotension and Dynamic Changes in Arterial Blood Pressure with Brachial Cuff Measurements

Lakhal K Anesth Analg 2009
Lakhal K Critical Care Med 2012



Tension pneumothorax : eyes may be more diagnostic than ears

Leight- Smith S Emerg Med J 2003

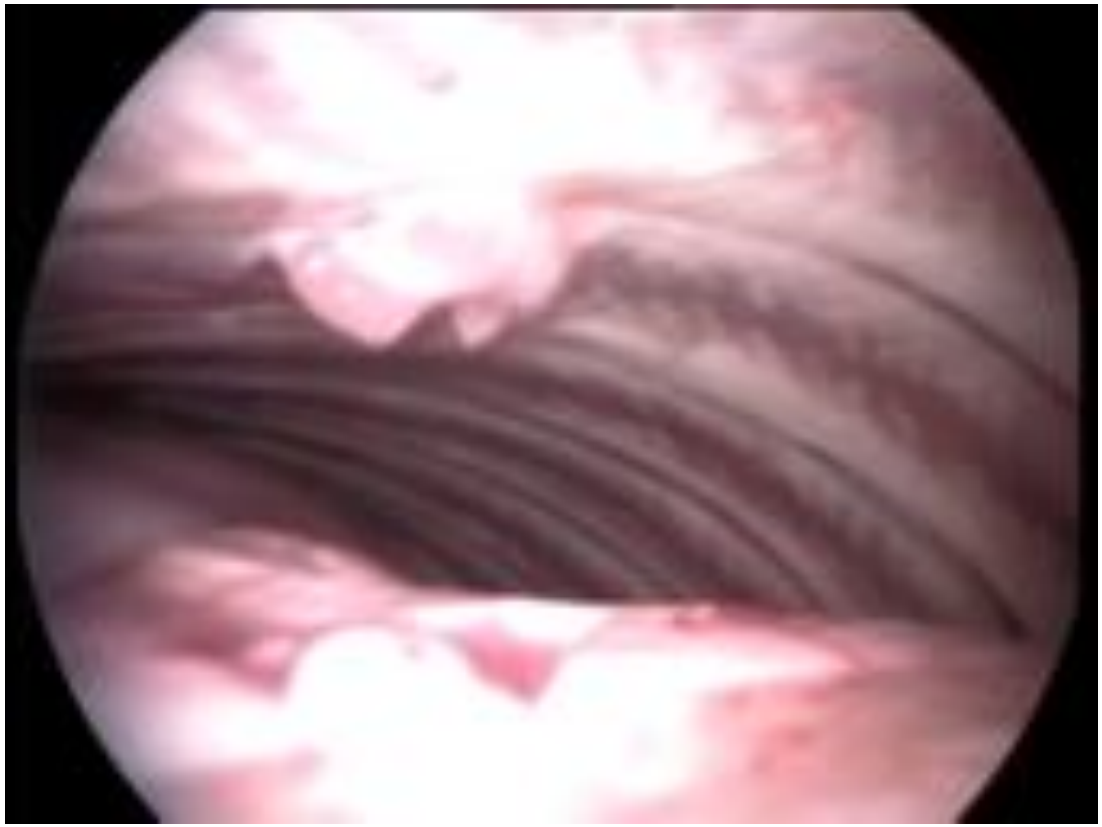
Inadequate Needle Thoracostomy Rate in the Prehospital Setting for Presumed Pneumothorax

An Ultrasound Study

Blaivas M J Ultrasound 2010

- 26% de décompression à l'aiguille sans rapport avec un pneumothorax

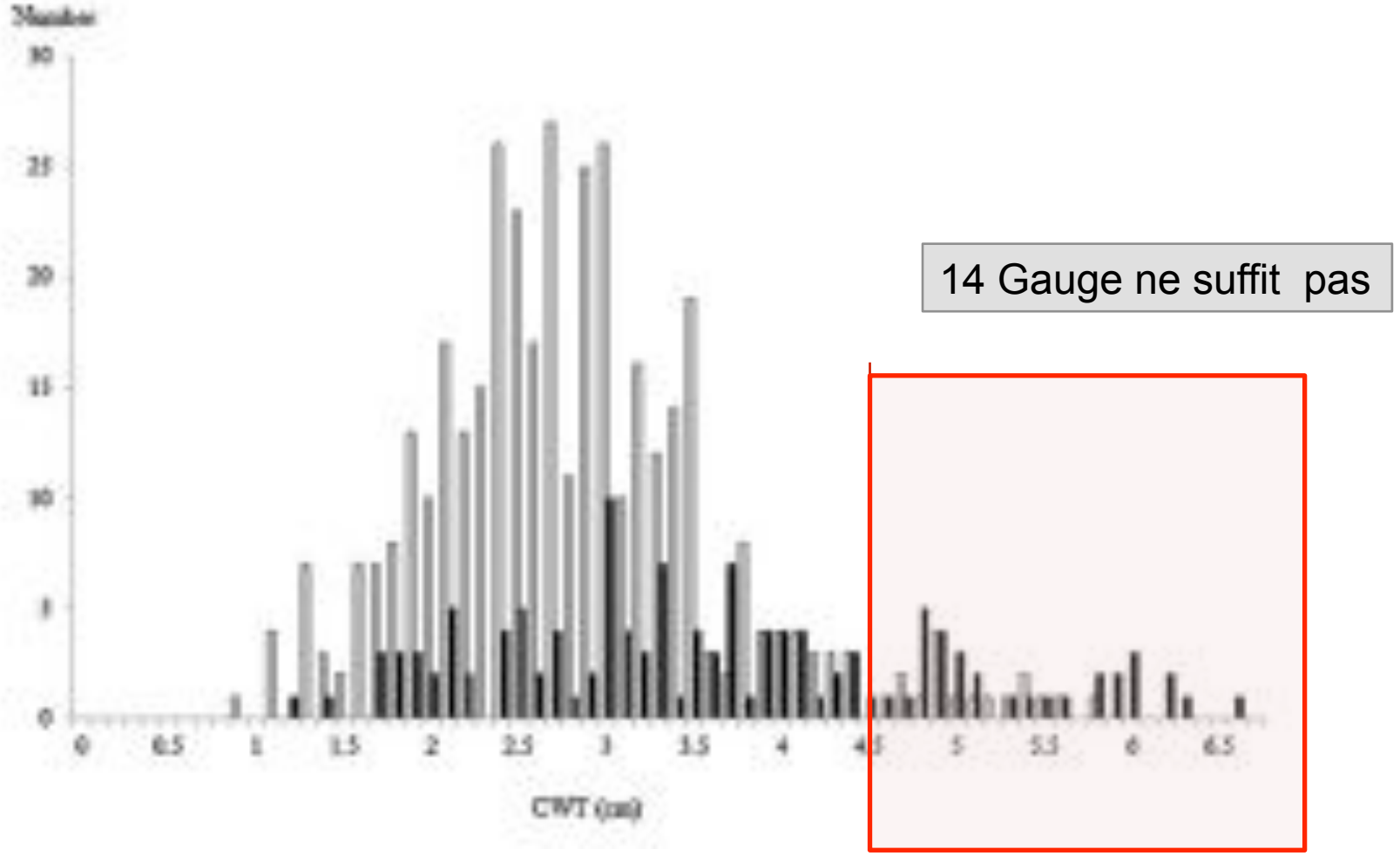
Décompression
Le doigt si échec avec cathlon !!!!



Needle Decompression for Tension Pneumothorax in Tactical Combat Casualty Care: Do Catheters Placed in the Midaxillary Line Kink More Often Than Those in the Midclavicular Line?

Attention à l'épaisseur du « chest wall »

Yamagiwa T Injury 2012



14 Gauge ne suffit pas

La jeune femme de 33 ans….

Survival trends and predictors of mortality in severe pelvic trauma: Estimates from the German Pelvic Trauma Registry Initiative

Pohleman T Injury 2011

Damage Control Resuscitation: The New Face of Damage Control

Maintenir un Ta02 minimal

Tourtier JP Ann Fr Anesth Réanim 2013
Tazarourte K Ann Fr Anesth Réanim 2013

- Hypotension artérielle permissive
  - PAM 60 mmhg ou 50 mmHg ? **Morrison C J Trauma 2011**
  - Si TCG ….. Adapter avec DTC
- Remplissage vasculaire modéré et adapté…**Mapstone 2003**
- Introduction **précoce** de catécholamines associée à un remplissage vasculaire ?

  Poloujadoff MP,Anesthesiology 2007
- Politique transfusionnelle

  Theusinger OM Curr Opin Crit Care 2012
- Exacyl en Préhospitalier

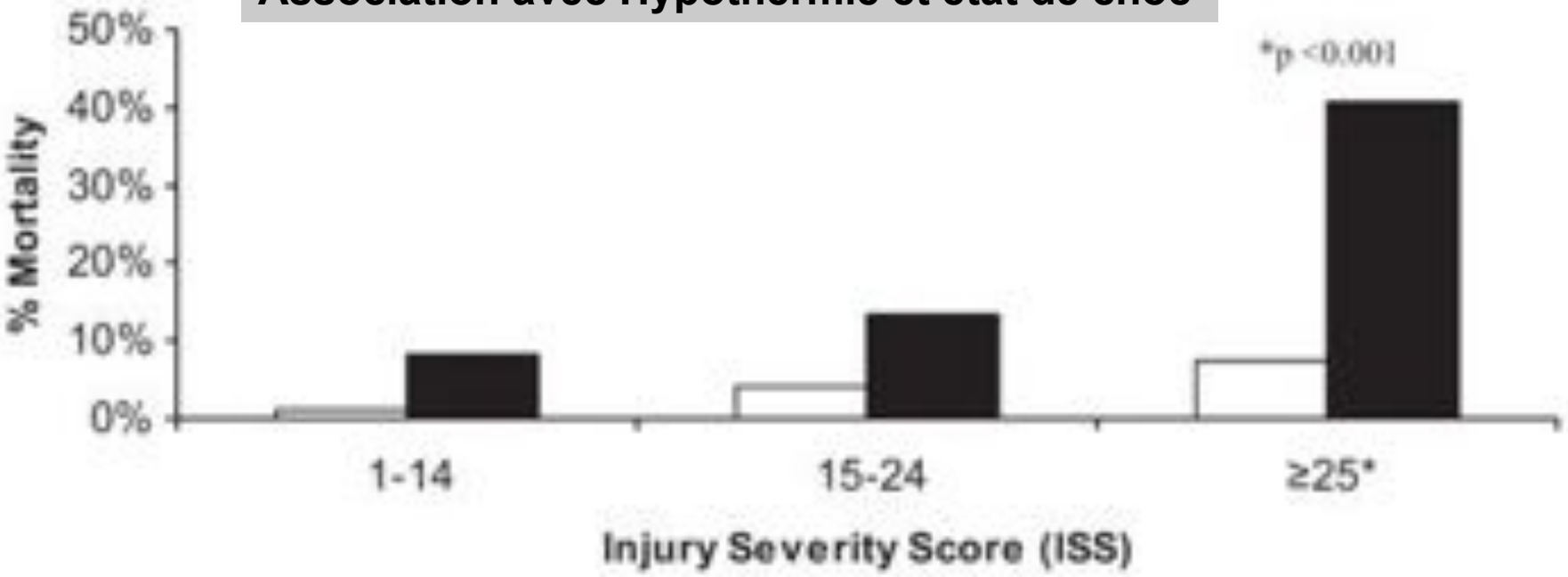
Mortalité et troubles de l'hémostase

Brohi K J Trauma 2008

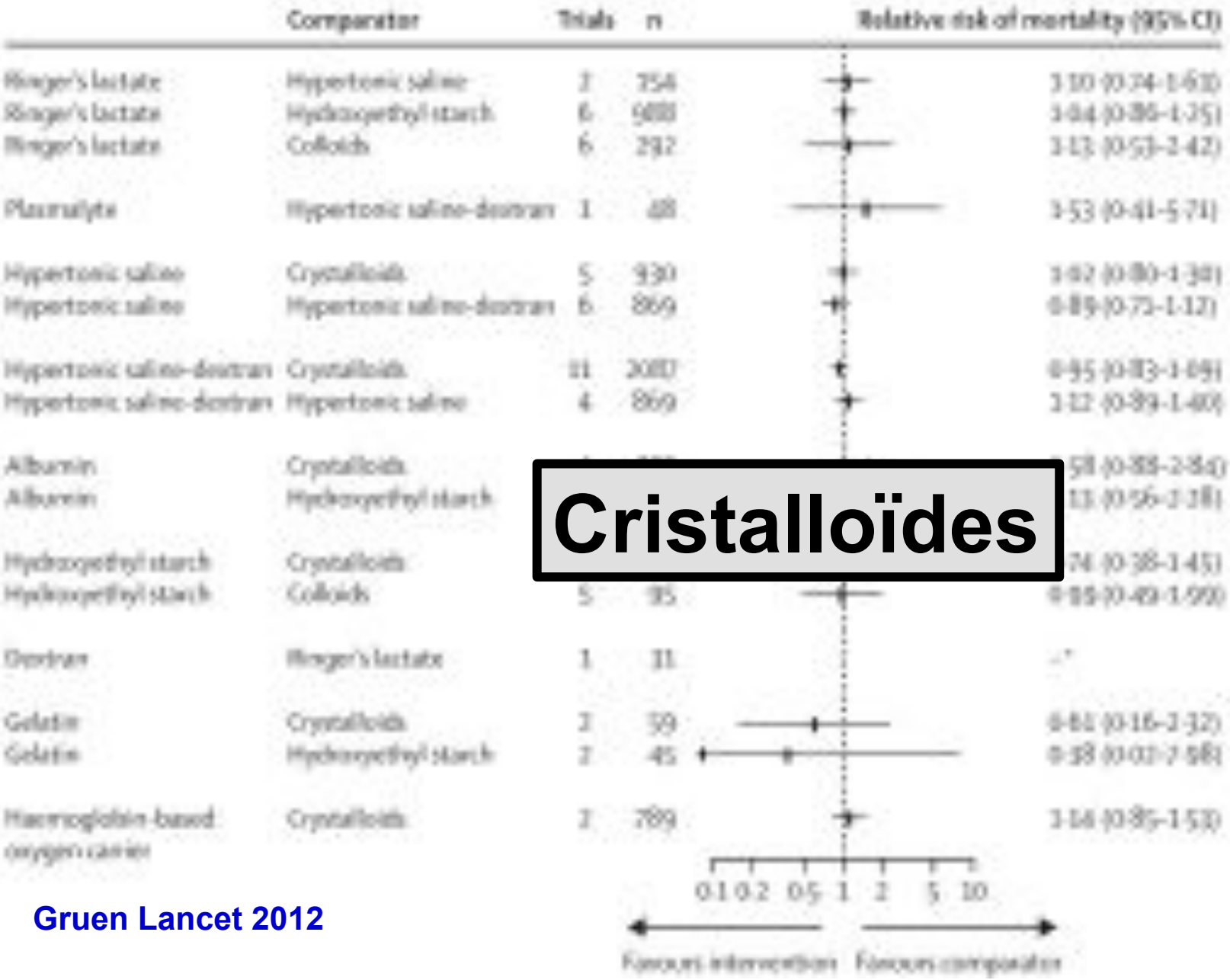
Niles SE J Trauma 2008

391 patients

Association avec Hypothermie et état de choc



Quel produit de remplissage vasculaire ?



Gruen Lancet 2012

The evolving role of lyophilized plasma in remote damage control resuscitation in the French Armed Forces Health Service

Saillol A Transfusion 2013

TABLE 2. In vitro properties of FLYP compared with other French therapeutic plasmas

Parameters	Units	PFC-SD	PFC-IA	PFC-Se	FLYP	Physiological norms
Fibrinogen	g/L	2.8	2.7	2.8	2.4	2-4
Factor V	IU/mL	0.9	1.0	1.0-1.1	0.7	0.7-1.2
Factor VIII	IU/mL	0.7	0.8	0.9-1.1	0.7	0.5-1.5
Factor XI	IU/mL	0.8	0.6	0.9-1.0	0.7	0.5-1.4
Protein C	IU/mL	1.0	0.9	1.1-1.2	0.9	0.7-1.2
Protein S	IU/mL	0.6	1.0	1.3-1.4	0.9	0.7-1.4
Antithrombin III	IU/mL	0.9	1.0	1.0	1.0	0.8-1.2
α2 antiplasmin	IU/mL	0.2	0.8	1.0	0.9	0.8-1.2

PFC-SD = frozen solvent-detergent plasma; PFC-IA = frozen amotosalen/UV-treated plasma; PFC-Se = frozen secured by quarantine plasma; FLYP = lyophilized amotosalen/UV-treated plasma.

Temps de reconstitution < 6 minutes
Stockage en T° ambiante
1100 poches utiliséés depuis 10 ans
Pas encore disponible en pratique civile…

Héli-SMUR

- Améliore le pronostic
  - [OR], 1.16; 95% CI, 1.14-1.17

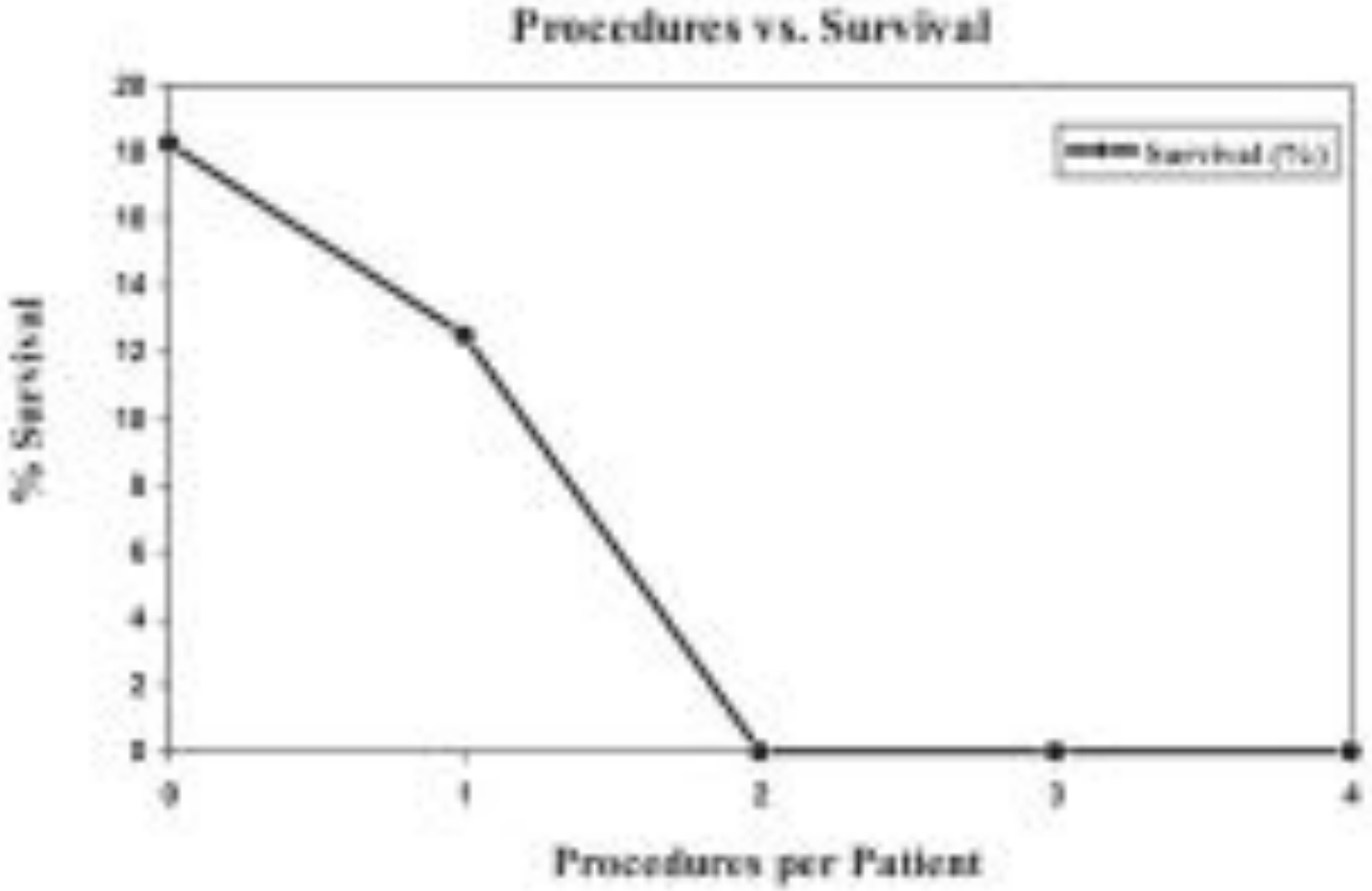
  Galvagno JAMA 2012 (61 000), Desmettre Critical Care 2012 (500 patients)

- N'améliore pas le pronostic

  Bulger J Trauma 2012 (2 500 patients)

- Impact médico-économique à préciser
  - **Galvagno Cochrane 2013**

Prehospital Procedures Before Emergency Department Thoracotomy: “Scoop and Run” Saves Lives



Seamon MJ J Trauma 2007

Take Home Message

- Racourcir les délais
- On peut jeter le pantalon anti choc et acheter un drap..
- Attention aux AC
- Exacyl obligatoire
- Demain les plasmas lyophylisés
- Ultrasons en SMUR
- La pression artérielle
- Hélico = peut être

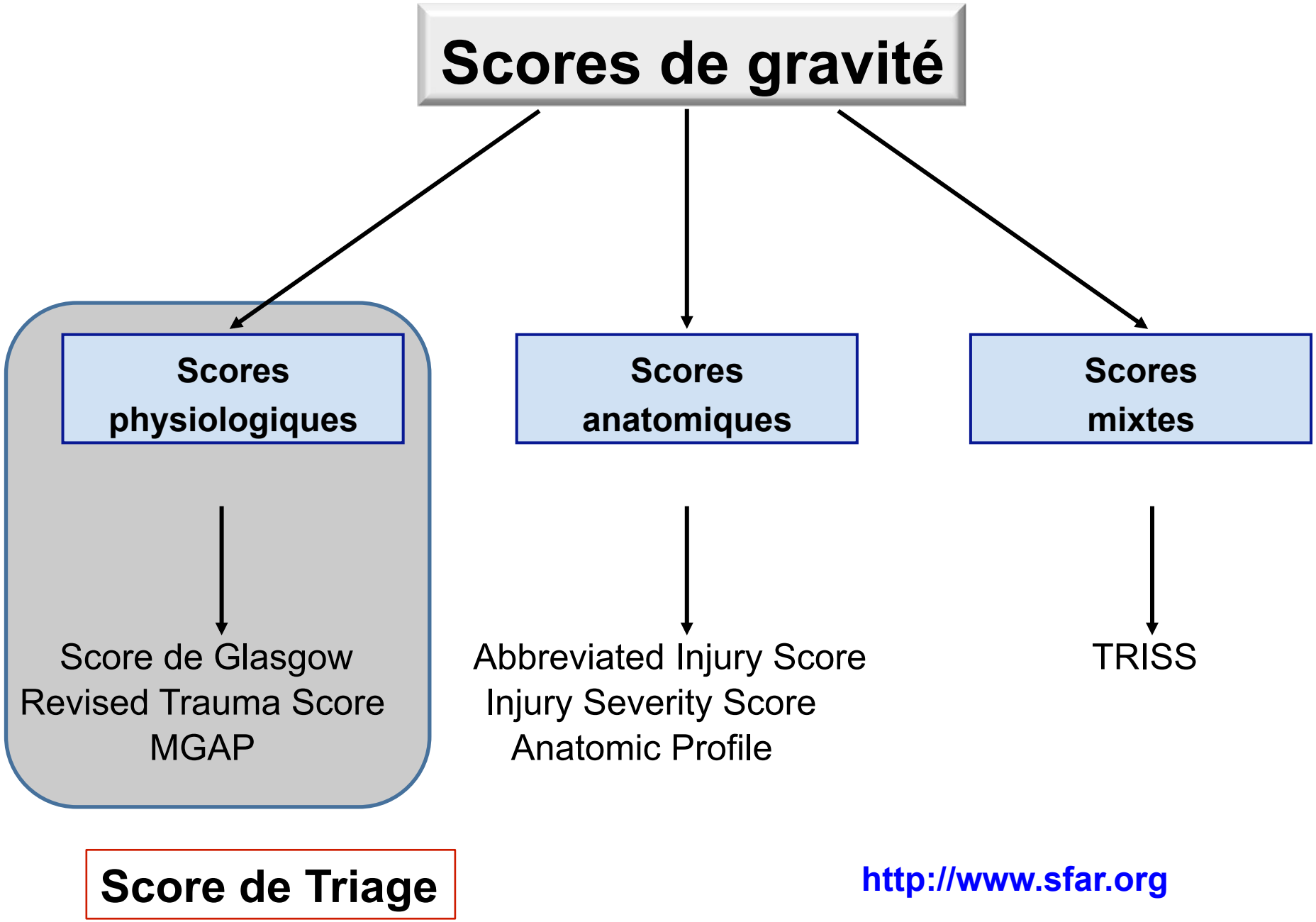
Survival Advantage for Elderly Trauma Patients Treated in a Designated Trauma Center

Le DTC en préhospitalier

Values at arrival in the field and at the hospital for 18 severe traumatic brain injury patients.

	Abnormal TCD ($n = 9$) Group 1		Normal TCD ($n = 9$) Group 2	
	In the field	At the trauma centre	In the field	At the trauma centre
Time from trauma (min)	68 ± 25	143 ± 50	61 ± 14	146 ± 57
Abnormal TCD (n)	9	4	0	0
Systolic velocity (cm/s)	67 ± 21	76 ± 23	79 ± 25	81 ± 17
Mean velocity (cm/s)	28 ± 10†	37 ± 12*,†	48 ± 14†	53 ± 9†
Diastolic velocity (cm/s)	9 ± 7†	18 ± 11*,†	33 ± 10†	38 ± 10†
Pulsatility index	2.2 ± 0.6†	1.7 ± 0.8*,†	0.9 ± 0.3†	0.8 ± 0.3†
MAP (mmHg)	93 ± 25	101 ± 32	72 ± 22	83 ± 19
Haemoglobin (g/dl)	14 ± 1		122	
Areactive mydriasis	4	2	0	0
Norepinephrine (n)	–	2	–	3
Mannitol (n)	–	7	–	0
Emergency neurosurgery (n)	–	3	–	0
48 h mortality (n)	–	6†	–	1†

Tazarourte et al. Acta Anesth Scandinav. 2011


Scores de gravité
Scores physiologiques
Scores anatomiques
Scores mixtes
Score de Glasgow
Revised Trauma Score
MGAP
Abbreviated Injury Score
Injury Severity Score
Anatomic Profile
TRISS
Score de Triage
http://www.sfar.org