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ACTUALITÉS EN RÉANIMATION

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AER
ACTUALITÉS EN RÉANIMATION

UNIVERSITÉ DE LYON
Université Claude Bernard Lyon 1

ACTUALITES TRAUMA 2019

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HCL
HOSPICES CIVILS DE LYON

INTRODUCTION

- **WERFEN (ROTEM) : 2 topos en 2019**

EPIDEMIOLOGIE

EPIDEMIOLOGIE

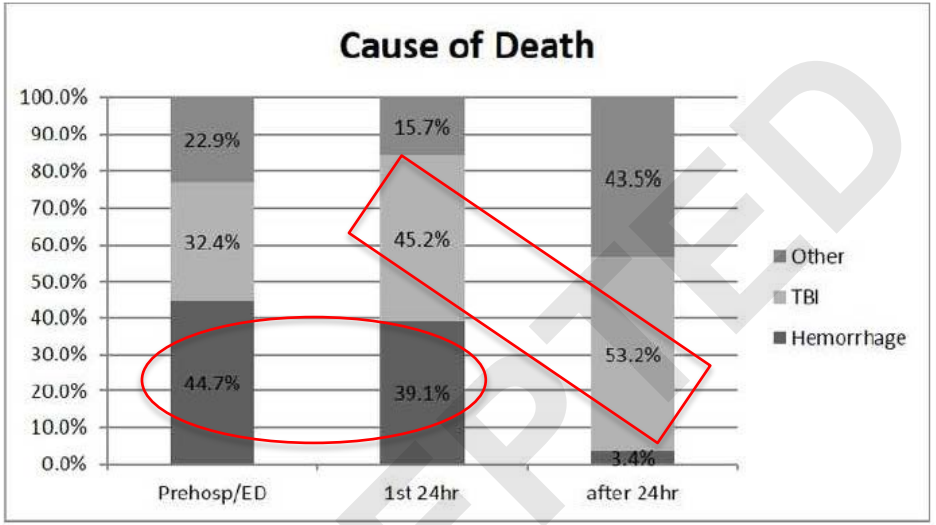
- **Epidémiologie**
  - De quoi meurt les patients actuellement ?
  - **En 1995**, 39 % des décès en relation avec un choc hémorragique (Sauia A et al. J Trauma 1995)
  - **Choc hémorragique : principale cause de mort évitable …**

Journal of Trauma and Acute Care Surgery, Publish Ahead of Print
DOI: 10.1097/TA.0000000000002205

"The Why & How Our Trauma Patients Die: A Prospective Multicenter Western Trauma Association Study."

Rachael A. Callcut, MD, MSPH[1], Lucy Z. Kornblith, MD[1], Amanda S. Conroy, BSN[1], Anamaria J.

18 Trauma Center
Prospectif Observationnel
1536 patients DCD donc 412 Tr Pénétrant



Overall: TBI (45%) and exsanguination (23%)

PREHOSPITAL CARE / TIME - TRANSPORT

PREHOSPITAL CARE : TRANSPORT

Research

JAMA Surgery | Original Investigation

Association of Prehospital Mode of Transport With Mortality in Penetrating Trauma

A Trauma System–Level Assessment of Private Vehicle Transportation vs Ground Emergency Medical Services

Michael W. Wandling, MD, MS; Avery B. Nathens, MD, PhD; Michael B. Shapiro, MD; Elliott R. Haut, MD, PhD

IMPORTANCE Time to definitive care following injury is important to the outcomes of trauma patients. Prehospital trauma care is provided based on policies developed by individual trauma systems and is an important component of the care of injured patients. Given a paucity of systems-level trauma research, considerable variability exists in prehospital care policies across trauma systems, potentially affecting patient outcomes.

OBJECTIVE To evaluate whether private vehicle prehospital transport confers a survival advantage vs ground emergency medical services (EMS) transport following penetrating injuries in urban trauma systems.

DESIGN, SETTING, AND PARTICIPANTS Retrospective cohort study of data included in the National Trauma Data Bank from January 1, 2010, through December 31, 2012, comprising 298 level 1 and level 2 trauma centers that contribute data to the National Trauma Data Bank that are located within the 100 most populous metropolitan areas in the United States. Of 2 329 446 patients assessed for eligibility, 103 029 were included in this study. All patients were 16 years or older, had a gunshot wound or stab wound, and were transported by ground EMS or private vehicle.

MAIN OUTCOME AND MEASURE In-hospital mortality.

RESULTS Of the 2 329 446 records assessed for eligibility, 103 029 individuals at 298 urban level 1 and level 2 trauma centers were included in the analysis. The study population was predominantly male (87.6%), with a mean age of 32.3 years. Among those included, 47.9% were black, 26.3% were white, and 18.4% were Hispanic. Following risk adjustment, individuals with penetrating injuries transported by private vehicle were less likely to die than patients transported by ground EMS (odds ratio [OR], 0.38; 95% CI, 0.31-0.47). This association remained statistically significant on stratified analysis of the gunshot wound (OR, 0.45; 95% CI, 0.36-0.56) and stab wound (OR, 0.32; 95% CI, 0.20-0.52) subgroups.

CONCLUSIONS AND RELEVANCE Private vehicle transport is associated with a significantly lower likelihood of death when compared with ground EMS transport for individuals with gunshot wounds and stab wounds in urban US trauma systems. System-level evidence such as this can be a valuable tool for those responsible for developing and implementing policies at the trauma system level.

Supplemental content

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Published online September 20, 2017.

- **Trauma Pénétrant / US**
- Paramedic vs. Police : NS (J Trauma 2016)
- **Comparaison mode de transport : Mortalité Hosp**
  - **Paramedic vs. Private vehicle / Urbain – Suburbain**
  - National Trauma Data Bank (2010-2012)

Table 1. Sample Population Characteristics by Mode of Prehospital Transportation

Characteristic	No. (%) All Patients	Ground EMS	Private Vehicle	*P* Value
Population size	103 029 (100)	86 097 (83.6)	16 932 (16.4)	
Injury mechanism				
GSW	53 052 (51.5)	45 582 (52.9)	7470 (44.1)	<.001
Stab wound	49 977 (48.5)	40 515 (47.1)	9462 (55.9)	
HR, bpm				
Mean (SD)	91.5 (30.2)	90.6 (31.1)	96.3 (24.6)	<.001
Median	94.0	94.0	96.0	<.001
SBP, mm Hg				
Mean (SD)	125.3 (39.7)	123.6 (41.2)	134.0 (29.3)	<.001
Median	132.0	131.0	136.0	<.001
GCS motor score[a]				<.001
Mean (SD)	5.4 (1.5)	5.4 (1.6)	5.9 (0.8)	<.001
% GCS motor <6	14.1	15.9	5.9	<.001
ISS[b]				
Mean (SD)	9.3 (12.0)	10.1 (12.5)	5.5 (7.8)	<.001
Median	5.0	8.0	2.0	<.001

PREHOSPITAL CARE : TRANSPORT

Research

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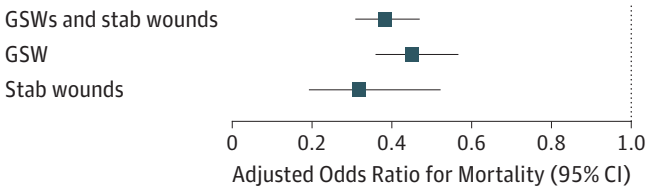
Table 2. Unadjusted Overall Mortality for All Penetrating Injuries, GSWs, and Stab Wounds by Mode of Prehospital Transportation

	No. (%)			
Overall Mortality	All Patients	Ground EMS	Private Vehicle	*P* Value
All GSWs and stab wounds (n = 103 029)	10 364 (10.1)	9986 (11.6)	378 (2.2)	<.001
GSWs only (n = 53 052)	9146 (17.2)	8807 (19.3)	339 (4.5)	<.001
Stab wounds only (n = 49 977)	1218 (2.4)	1179 (2.9)	39 (0.2)	<.001

Figure 2. Risk-Adjusted Odds Ratios For Mortality For Private Vehicle Transport When Compared With Ground Emergency Medical Services Transport



GSW indicates gunshot wound.

Key Points

Question Does ground emergency medical services transport confer a survival advantage vs private vehicle transport for patients with penetrating injuries?

Findings In this cohort study of 103 029 patients included in the National Trauma Data Bank, individuals transported by private vehicle were significantly less likely to die than similarly injured patients transported by ground emergency medical services, even when controlling for injury severity.

Meaning Ground emergency medical services transport is not associated with improved survival compared with private vehicle transport among patients with penetrating injuries in urban trauma systems, suggesting prehospital trauma care may have a limited role in this subset of patients.

PREHOSPITAL CARE : TIME IS LIFE

Research

JAMA Surgery | Original Investigation

Association of Prehospital Time to In-Hospital Trauma Mortality in a Physician-Staffed Emergency Medicine System

Tobias Gauss, MD; François-Xavier Ageron, MD, PhD; Marie-Laure Devaud, MD; Guillaume Debaty, MD, PhD; Stéphane Travers, MD; Delphine Garrigue, MD; Mathieu Raux, MD, PhD; Anatole Harrois, MD, PhD; Pierre Bouzat, MD, PhD; for the French Trauma Research Initiative

IMPORTANCE The association between total prehospital time and mortality in physician-staffed trauma systems remains uncertain.

OBJECTIVE To describe the association of total prehospital time and in-hospital mortality in prehospital, physician-staffed trauma systems in France, with the hypothesis that total prehospital time is associated with increased mortality.

DESIGN, SETTING, AND PARTICIPANTS This cohort study was conducted from January 2009 to December 2016. Data for this study were derived from 2 distinct regional trauma registries in France (1 urban and 1 rural) that both have a physician-staffed emergency medical service. Consecutive adult trauma patients admitted to either of the regional trauma referral centers during the study period were included. Data analysis took place from March 2018 to September 2018.

MAIN OUTCOMES AND MEASURES The association between death and prehospital time was assessed with a multivariable model adjusted with confounders. Total prehospital time was the primary exposure variable, recorded as the time from the arrival of the physician-led prehospital care team on scene to the arrival at the hospital. The main outcome of interest was all-cause in-hospital mortality.

RESULTS A total of 10 216 patients were included (mean [SD] age, 41 [18] years; 7937 men [78.3%]) affected by predominantly nonpenetrating injuries (9265 [91.5%]), with a mean (SD) Injury Severity Score of 17 (14) points. Of the patients, 6737 (66.5%) had at least 1 body region with an Abbreviated Injury Scale score of 3 or more. A total of 1259 patients (12.4%) presented in shock (with systolic pressure <90 mm Hg) and 2724 (26.9%) with severe head injury (Abbreviated Injury Scale score ≥3 points). On unadjusted analysis, increasing prehospital times (in 30-minute categories) were associated with a markedly and constant increase in the risk of in-hospital death. The odds of death increased by 9% for each 10-minute increase in prehospital time (odds ratio, 1.09 [95% CI, 1.07-1.11]) and after adjustment by 4% (odds ratio, 1.04 [95% CI, 1.01-1.07]).

CONCLUSIONS AND RELEVANCE In this study, an increase in total prehospital time was associated with increasing in-hospital all-cause mortality in trauma patients at a physician-staffed emergency medical system, after adjustment for case complexity. Prehospital time is a management objective in analogy to physiological targets. These findings plead for a further streamlining of prehospital trauma care and the need to define the optimal intervention-to-time ratio.

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Invited Commentary
Supplemental content

Author Affiliations: Author affiliations are listed at the end of this article.

Group Information: The French Trauma Research Initiative members appear at the end of the article.

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- **Question : Relation timing préhospitalier et mortalité**
- **Etude Française :**
  - 2009-2016
  - Données issues de 2 trauma Data bank (Trauma Base / TRENAU)
  - Timing « Contact Médical jusqu'à arrivée hôpital »
  - Modèle ajusté sur Age, Sexe, ISS, SBP, GCS

Table 1. Patient Characteristics According to Regional Database

Characteristic	No. (%)		
	Total	Paris, Île-de-France (TraumaBase)	Northern French Alps (TRENAU)
No.	10 126	5067	5059
Prehospital systolic blood pressure, mm Hg			
Mean (SD)	117 (32)	109 (34)	126 (2.5)
<90 mm Hg	1259 (12.4)	946 (18.7)	313 (6.2)
Prehospital Glasgow Coma Scale score			
3-8	1518 (15.0)	889 (17.5)	629 (12.4)
9-13	963 (9.5)	517 (10.2)	446 (8.8)
13-15	7453 (73.6)	3648 (72.0)	3805 (75.2)
Injury Severity Score			
Mean (SD)	17 (14)	18 (15)	17 (13)
In-hospital mortality	968 (9.6)	566 (11.2)	402 (7.9)

PREHOSPITAL CARE : TIME IS LIFE

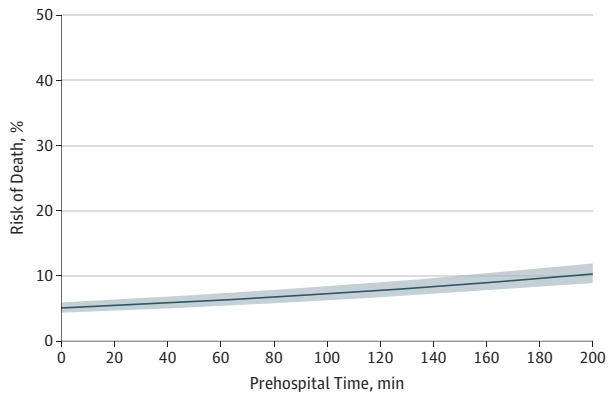
Research

JAMA Surgery | Original Investigation

Association of Prehospital Time to In-Hospital Trauma Mortality in a Physician-Staffed Emergency Medicine System

Tobias Gauss, MD; François-Xavier Ageron, MD, PhD; Marie-Laure Devaud, MD; Guillaume Debaty, MD, PhD; Stéphane Travers, MD; Delphine Garrigue, MD; Mathieu Raux, MD, PhD; Anatole Harrois, MD, PhD; Pierre Bouzat, MD, PhD; for the French Trauma Research Initiative

Figure 2. Adjusted Association Between Death and Prehospital Time



Multivariable generalized linear mixed model representing the risk of death from all causes according to prehospital time, adjusted for individual confounder as logarithmic function (age, systolic blood pressure, Glasgow Coma Score scale, and Injury Severity Score): area under the curve, 0.96 (95% CI, 0.95-0.96); internal overall calibration (expected over observed), 1.00 (95% CI, 0.96-1.04); and calibration slope, 1.00 (95% CI, 0.94-1.06). The full model is presented in eTable 5 in the Supplement. The shaded area represents the 95% CIs.

Table 3. Association Between Outcome and Prehospital Time[a]

Death by Type	Odds Ratio by Generalized Linear Mixed Model (95% CI)[b]	*P* Value
Univariable Analysis		
Overall death	1.09 (1.07-1.11)	<.001
Death attributable to head injury	1.09 (1.06-1.11)	<.001
Death attributable to bleeding	1.04 (1.00-1.09)	.04
Multivariable Analysis		
Overall death	1.04 (1.01-1.07)	.002
Death attributable to head injury	1.03 (1.00-1.07)	.15
Death attributable to bleeding	1.00 (0.99-1.02)	.24

[a] Generalized linear model with random effect by registry and emergency medical system; adjustment for individual confounders as logarithmic function (prehospital time, age, systolic blood pressure, Injury Severity Score, and Glasgow Coma Scale score).

[b] Odds ratio for increase of 10 minutes in prehospital time.

Findings The results of this cohort study from 2 French trauma registries demonstrate a linear association between total prehospital time and in-hospital all-cause mortality. The odds of death increased by 8% for each 10-minute increase in prehospital time.

TRANSFUSION / COAGULOPATHIE

AER ACTUALITÉS EN RÉANIMATION

TRANSFUSION PREHOSPITALIERE

HCL HOSPICES CIVILS DE LYON

Articles

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

Hunter B Moore, Ernest E Moore, Michael P Chapman, Kevin McVaney, 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

Summary

Background Plasma is integral to haemostatic resuscitation after injury, but the timing of administration remains controversial. Anticipating approval of lyophilised plasma by the US Food and Drug Administration, the US Department of Defense funded trials of prehospital plasma resuscitation. We investigated use of prehospital plasma during rapid ground rescue of patients with haemorrhagic shock before arrival at an urban level 1 trauma centre.

Methods The Control of Major Bleeding After Trauma Trial was a pragmatic, randomised, single-centre trial done at the Denver Health Medical Center (DHMC), which houses the paramedic division for Denver city. Consecutive trauma patients in haemorrhagic shock (defined as systolic blood pressure [SBP] ≤70 mm Hg or 71–90 mm Hg plus heart rate ≥108 beats per min) were assessed for eligibility at the scene of the injury by trained paramedics. Eligible patients were randomly assigned to receive plasma or normal saline (control). Randomisation was achieved by preloading all ambulances with sealed coolers at the start of each shift. Coolers were randomly assigned to groups 1:1 in blocks of 20 according to a schedule generated by the research coordinators. If the coolers contained two units of frozen plasma, they were defrosted in the ambulance and the infusion started. If the coolers contained a dummy load of frozen water, this indicated allocation to the control group and saline was infused. The primary endpoint was mortality within 28 days of injury. Analyses were done in the as-treated population and by intention to treat. This trial is registered with ClinicalTrials.gov, number NCT01838863.

Findings From April 1, 2014, to March 31, 2017, paramedics randomly assigned 144 patients to study groups. The as-treated analysis included 125 eligible patients, 65 received plasma and 60 received saline. Median age was 33 years (IQR 25–47) and median New Injury Severity Score was 27 (10–38). 70 (56%) patients required blood transfusions within 6 h of injury. The groups were similar at baseline and had similar transport times (plasma group median 19 min [IQR 16–23] *vs* control 16 min [14–22]). The groups did not differ in mortality at 28 days (15% in the plasma group *vs* 10% in the control group, p=0·37). In the intention-to-treat analysis, we saw no significant differences between the groups in safety outcomes and adverse events. Due to the consistent lack of differences in the analyses, the study was stopped for futility after 144 of 150 planned enrolments.

Interpretation During rapid ground rescue to an urban level 1 trauma centre, use of prehospital plasma was not associated with survival benefit. Blood products might be beneficial in settings with longer transport times, but the financial burden would not be justified in an urban environment with short distances to mature trauma centres.

Funding US Department of Defense.

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Introduction

For more than 50 years, impaired coagulation has been associated with severe injury, and crystalloid resuscitation has been the standard.[1] In civilian settings, the first pre-emptive plasma resuscitation after injury was proposed in the late 1970s in Denver, CO, USA.[2] The rationale was that coagulopathy would be lessened and progression to the "bloody vicious cycle", in which coagulopathy coupled with acidosis and hypothermia (called the lethal triad) result in uncontrolled bleeding, would be prevented.[3] Benefits of early plasma resuscitation, however, were not highlighted until the military reported increased survival with high ratios of plasma to red blood cells in US combat support hospitals in Iraq in 2003 and 2005.[4] This experience prompted several retrospective civilian studies[5,6] followed by a multicentre prospective study that seemed to indicate a survival benefit with early plasma administration.[7] The retrospective studies, though, were plagued by survivor bias (ie, patients had to survive long enough to receive plasma). Indeed randomised clinical trials have shown no survival benefit.[8,9] A 2016 systematic review concluded that, although transfusion of blood products before reaching hospital is a plausible therapeutic approach, the evidence at the time was of poor quality, did not show outcome improvements, and recommended assessment in randomised controlled trials.[10]

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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*

ABSTRACT

BACKGROUND

After a person has been injured, prehospital administration of plasma in addition to the initiation of standard resuscitation procedures in the prehospital environment may reduce the risk of downstream complications from hemorrhage and shock. Data from large clinical trials are lacking to show either the efficacy or the risks associated with plasma transfusion in the prehospital setting.

METHODS

To determine the efficacy and safety of prehospital administration of thawed plasma in injured patients who are at risk for hemorrhagic shock, we conducted a pragmatic, multicenter, cluster-randomized, phase 3 superiority trial that compared the administration of thawed plasma with standard-care resuscitation during air medical transport. The primary outcome was mortality at 30 days.

RESULTS

A total of 501 patients were evaluated: 230 patients received plasma (plasma group) and 271 received standard-care resuscitation (standard-care group). Mortality at 30 days was significantly lower in the plasma group than in the standard-care group (23.2% vs. 33.0%; difference, −9.8 percentage points; 95% confidence interval, −18.6 to −1.0%; P=0.03). A similar treatment effect was observed across nine prespecified subgroups (heterogeneity chi-square test, 12.21; P=0.79). Kaplan–Meier curves showed an early separation of the two treatment groups that began 3 hours after randomization and persisted until 30 days after randomization (log-rank chi-square test, 5.70; P=0.02). The median prothrombin-time ratio was lower in the plasma group than in the standard-care group (1.2 [interquartile range, 1.1 to 1.4] vs. 1.3 [interquartile range, 1.1 to 1.6], P<0.001) after the patients' arrival at the trauma center. No significant differences between the two groups were noted with respect to multiorgan failure, acute lung injury–acute respiratory distress syndrome, nosocomial infections, or allergic or transfusion-related reactions.

CONCLUSIONS

In injured patients at risk for hemorrhagic shock, the prehospital administration of thawed plasma was safe and resulted in lower 30-day mortality and a lower median prothrombin-time ratio than standard-care resuscitation. (Funded by the U.S. Army Medical Research and Materiel Command; PAMPer ClinicalTrials.gov number, NCT01818427.)

The authors' full names, academic degrees, and affiliations are listed in the Appendix. Address reprint requests to Dr. Sperry at the University of Pittsburgh, Department of Surgery and Critical Care Medicine, 200 Lothrop St., Pittsburgh, PA, 15213, or at sperryjl@upmc.edu.

*A complete list of the members of the PAMPer Study Group is provided in the Supplementary Appendix, available at NEJM.org.

Drs. Sperry and Guyette contributed equally to this article.

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TRANSFUSION PREHOSPITALIERE

EDITORIAL Open Access

Pre-hospital plasma transfusion: a valuable coagulation support or an expensive fluid therapy?

Christian Fenger-Eriksen[1], Dietmar Fries[2], Jean-Stephane David[3], Pierre Bouzat[4], Marcus Daniel Lance[5], Oliver Grottke[6], Donat R. Spahn[7], Herbert Schoechl[8,9] and Marc Maegele[10*]

Fenger-Eriksen et al. Critical Care (2019) 23:238
https://doi.org/10.1186/s13054-019-2524-4

Critical Care

Table 1 Basic characteristics of both trials

	COMBAT		PAMPer	
	FFP	Standard	FFP	Standard
Setting	US ground EMS transport (Denver) single-centre		US air EMS transport multicentre	
Randomisation	Individual randomisation by content of cooling boxes; staff non-blinded		Cluster randomisation at monthly intervals; staff non-blinded	
Inclusion criteria	BP < 70 mmHg or BP 71–90 mmHg + HR > 108/min		BP < 70 mmHg or BP < 90 mmHg and HR > 108/min	
Patients included (n)	65 vs 60		230 vs 271	
Age median (IQR)	33 (25–51)	33 (25–42)	44 (31–59)	46 (28–60)
Male (%)	80	85	71	74
Blunt injury (%)	46	53	81	73
Injury severity Score median (IQR)*	27 (10–41)	27 (11–36)	22 (14–33)	21 (12–29)
Prothrombin time ratio or INR on hospital arrival	1.3	1.2	1.2	1.3
Pre-hospital management				
Pre-hospital intubation (%)	Not provided	Not provided	50	50
Pre-hospital RBCs (%)	Not provided	Not provided	26	42
Pre-hospital crystalloids (mls) median (IQR)	150 (0–300)	250 (100–500)	500 (0–1250)	900 (0–1500)
Tranexamic acid within 6 h (%)	9	13	Not provided	Not provided
Intervention	2 U pre-thawed FFP up to 5d old FFP vs standard		2 U apheresis FFP (approx. 500 ml) vs standard	
Median Transportation time median (IQR)	28 (22–34) min	24 (19–31) min	42 (34–53) min	40 (33–41) min
Outcome				
Primary endpoint	Mortality 28 days		Mortality 30 days	
Mortality 28/30d (%)	15	10	23	33
Mortality 24 h (%)	12	10	14	22

*Combat trial New Injury Severity Score was used

NS

0.03

TRANSFUSION PREHOSPITALIERE

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

Hunter B Moore, Ernest E Moore, Michael P Chapman, Kevin McVaney, 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

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Introduction

For more than 50 years, impaired coagulation has been associated with severe injury, and crystalloid resuscitation has been the standard.[1] In civilian settings, the first pre-emptive plasma resuscitation after injury was proposed in the late 1970s in Denver, CO, USA.[2] The rationale was that coagulopathy would be lessened and progression to the "bloody vicious cycle", in which coagulopathy coupled with acidosis and hypothermia (called the lethal triad) result in uncontrolled bleeding, would be prevented.[3] Benefits of early plasma resuscitation, however, were not highlighted until the military reported increased survival with high ratios of plasma to red blood cells in US combat support hospitals in Iraq in 2003 and 2005.[4] This experience prompted several retrospective civilian studies[5,6] followed by a multicentre prospective study that seemed to indicate a survival benefit with early plasma administration.[7] The retrospective studies, though, were plagued by survivor bias (ie, patients had to survive long enough to receive plasma). Indeed randomised clinical trials have shown no survival benefit.[8,9] A 2016 systematic review concluded that, although transfusion of blood products before reaching hospital is a plausible therapeutic approach, the evidence at the time was of poor quality, did not show outcome improvements, and recommended assessment in randomised controlled trials.[10]

	Plasma group (n=65)	Control group (n=60)	Effect size (95% CI)*	p value
Physiology and shock				
SBP on arrival (mm Hg)	96 (80 to 110)	90 (72 to 111)	5·00 (–6·00 to 15·00)	0·38
Heart rate on arrival (bpm)	105 (76 to 124)	111 (92 to 128)	–6·00 (–17·00 to 4·00)	0·23
Haemoglobin concentration on arrival (g/dL)	12·6 (11·3 to 14·7)	13·5 (11·9 to 14·7)	–0·30 (–1·10 to 0·50)	0·50
Lowest haemoglobin concentration in 1–6 h (g/dL)	11·3 (9·6 to 12·6)	11·0 (9·1 to 12·8)	0·20 (–0·70 to 1·00)	0·67
Haemoglobin concentration <70 g/L in 1–6 h	3 (5%)	2 (3%)	0·41 (0·24 to 8·13)	1·00
Base deficit on arrival (mEq/L)‡	9·0 (5·5 to 13·0)	8·8 (6·0 to 13·0)	0 (–2·70 to 2·00)	0·80
Base deficit >10 mEq/L	21/51 (41%)	22/50 (44%)	0·94 (0·59–1·47)	0·77
Lactic acid concentration on arrival (mg/dL)‡	5·5 (3·9 to 8·5)	4·9 (3·2 to 7·0)	0·60 (–0·60 to 1·80)	0·30
Coagulation (on arrival at hospital)				
INR on arrival†	1·27 (1·11 to 1·40)	1·15 (1·08 to 1·29)	0·60 (–0·01 to 0·14)	0·10
INR>1·3	28/63 (44%)	14/58 (24%)	1·84 (1·08 to 3·14)	0·02
Rapid thromboelastography				
G (dynes/cm²)‡	7·7 (6·2 to 8·9)	7·1 (5·4 to 9·7)	0·30 (–0·90 to 1·40)	0·66
Activated clotting time (s)	128 (113 to 136)	121 (113 to 136)	0 (–7·00 to 8·00)	0·76
Maximum amplitude (mm)	60·5 (55·5 to 64·0)	58·5 (52·0 to 66·0)	1·00 (–2·50 to 4·50)	0·67
Angle (°)	70·9 (66·1 to 76·1)	69·3 (63·2 to 74·4)	2·20 (–0·80 to 5·40)	0·16
LY30 (%)	1·3 (0·3 to 2·6)	1·6 (0·7 to 3·1)	–0·20 (–0·90 to 0·30)	0·32
Hyperfibrinolysis (LY30 >3·0%)	14/56 (23%)	13/51 (25%)	0·91 (0·47 to 1·78)	0·78

Pas d'acide Tranexamique !

TRANSFUSION PREHOSPITALIERE

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JULY 26, 2018 VOL. 379 NO. 4

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*

Mortalité J30 : 23,2 vs. 33%, p= 0.03

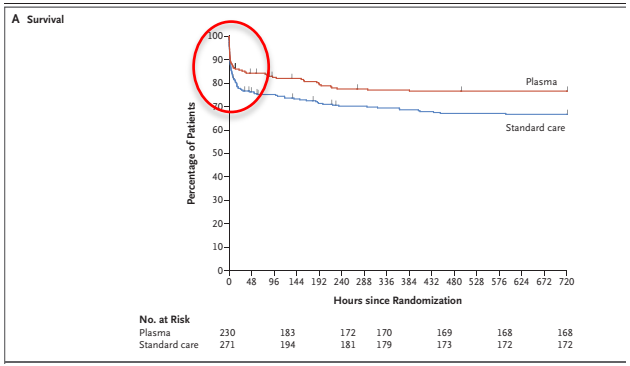

Table 2. Secondary Trial Outcomes.*

Outcome	Standard-Care Group (N=271)	Plasma Group (N=230)	Difference (95% CI)†	Observed P Value‡	Adjusted P Value§
24-hr mortality — no. (%)	60 (22.1)	32 (13.9)	−8.2 (−14.9 to −1.6)	0.02	0.55
In-hospital mortality — no. (%)	88 (32.5)	51 (22.2)	−10.3 (−18.0 to −2.6)	0.01	0.33

NON !

- TXA ? Pas enregistré …
- Cryoprecipité ? Pas enregistré …
- Anticoagulant / TIH …
- Balance Level 1 vs. 2/3 ?
- Mortalité 33% avec ISS < 25 ??

CORRESPONDENCE

Prehospital Plasma during Air Medical Transport in Trauma Patients

TO THE EDITOR: Sperry and colleagues (July 26 issue)[1] suggested that prehospital transfusion of thawed plasma could improve survival in a heterogeneous group of injured patients, including patients who were taking anticoagulants or were referred from another hospital. We have some concerns about the trial.

First, there is no mention of the use of tranexamic acid or cryoprecipitate. However, international guidelines suggest the use of tranexamic acid within the first 3 hours after injury and the maintenance of fibrinogen levels above 1.5 g per liter.[2] The administration of either of these treatments may have influenced the results and should be reported.

Second, mortality was higher among patients in the standard-care group than has been reported in the literature for patients with more severe injuries.[3-5] For example, in a recent trial examining the role of prehospital administration of thawed plasma in a similar context,[3] mortality at 24 hours in the control group was 10%, as compared with 22% in the trial by Sperry et al., whereas mortality in the plasma group was similar to that in previously published studies. This discrepancy may suggest a possible bias in the conduct of the study.

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Dr. David and Dr. Bouzat report having received lecture fees and consulting fees from LFB. No other potential conflict of interest relevant to this letter was reported.

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4. Gonzalez E, Moore EE, Moore HB, et al. Goal-directed hemostatic resuscitation of trauma-induced coagulopathy: a pragmatic randomized clinical trial comparing a viscoelastic assay to conventional coagulation assays. Ann Surg 2016;263:1051-9.
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DOI: 10.1056/NEJMc1811315

THE AUTHORS REPLY: The Prehospital Air Medical Plasma (PAMPer) trial was a pragmatic, multicenter trial comparing the prehospital infusion of plasma with standard care in injured patients who were at risk for hemorrhagic shock.[1] Because this intervention was initiated in the prehospital phase of care, we did not alter any other aspect of treatment during transport or after the patient's arrival at a definitive trauma center. Participating trauma centers used tranexamic acid and cryoprecipitate after arrival at the hospital in accordance with their own respective standard-care guidelines. In the trial, we did not regulate or monitor the use of tranexamic acid or levels of fibrinogen.

Previous literature on traumatic injury shows a range of mortality rates, as a result of differences in the nature and severity of injuries and in the inclusion criteria used in the studies.[2,3] The recent trial of prehospital plasma by Moore et al.[4] focused on ground transport and involved short prehospital times and a high proportion of penetrating traumatic injury. As evidenced by the overall differences in mortality rates between that trial and our trial, irrespective of whether they were in the plasma group or the standard-care group, the cohorts differed and represented unique injured populations with different responses to the prehospital infusion of plasma.

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Since publication of their article, the authors report no further potential conflict of interest.

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4. Moore HB, Moore EE, Chapman MP, et al. Plasma-first resuscitation to treat haemorrhagic shock during emergency ground transportation in an urban area: a randomised trial. Lancet 2018;392:283-91.

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TRANSFUSION PREHOSPITALIERE

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COMMENTARY

Prehospital fresh frozen plasma: Universal life saver or treatment in search of a target population?

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EDITORIAL Open Access

Pre-hospital plasma transfusion: a valuable coagulation support or an expensive fluid therapy?

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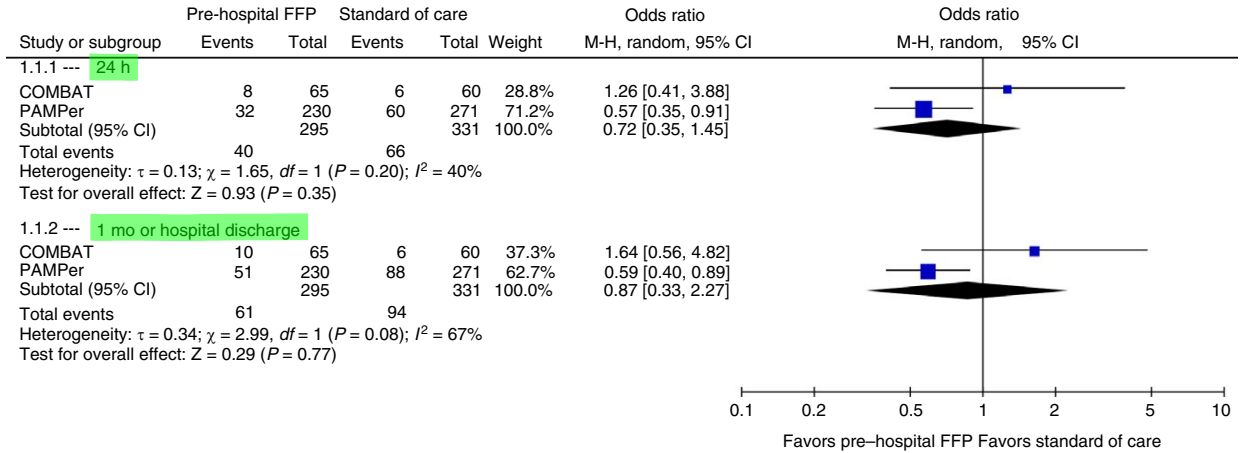

FIGURE 1 Random effect meta-analysis of mortality data from the PAMPer and COMBAT trials. CI, confidence interval; COMBAT, Control of Major Bleeding After Trauma Trial; PAMPer, Prehospital Air Medical Plasma trial

SMUR ?
Etre capable de transfuser les plus graves et/ou temps de transport long …
CGR / PLYO / Fibrinogène

COAGULOPATHIE : ROTEM / TEG ?

Traiter la coagulopathie à l'aveugle ou guidé par BS vs. ROTEM/TEG ?

Etudes Avant / Après Bundle of Care :

- DC Surgery (2006)
- TXA (2011)
- ROTEM (2011)

Anaesthesia 2017 doi:10.1111/anae.13920

Original Article

Change of transfusion and treatment paradigm in major trauma patients

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Summary

Trauma promotes trauma-induced coagulopathy, which requires urgent treatment with fixed-ratio transfusions of red blood cells, fresh frozen plasma and platelet concentrates, or goal-directed administration of coagulation factors based on viscoelastic testing. This retrospective observational study compared two time periods before (2005–2007) and after (2012–2014) the implementation of changes in trauma management protocols which included: use of goal-directed coagulation management; admission of patients to designated trauma centres; whole-body computed tomography scanning on admission; damage control surgery; permissive hypotension; restrictive fluid resuscitation; and administration of tranexamic acid. The incidence of massive transfusion (≥ 10 units of red blood cells from emergency department arrival until intensive care unit admission) was compared with the predicted incidence according to the trauma associated severe haemorrhage score. All adult (≥ 16 years) trauma patients primarily admitted to the University Hospital Zürich with an injury severity score ≥ 16 were included. In 2005–2007, the observed and trauma associated severe haemorrhage score that predicted the incidence of massive transfusion were identical, whereas in 2012–2014 the observed incidence was less than half that predicted (3.7% vs. 7.5%). Compared to 2005–2007, the proportion of patients transfused with red blood cells and fresh frozen plasma was significantly lower in 2012–2014 in both the emergency department (43% vs. 17%; 31% vs. 6%, respectively), and after 24 h (53% vs. 27%; 37% vs. 16%, respectively). The use of tranexamic acid and coagulation factor XIII also increased significantly in the 2012–2014 time period. Implementation of a revised trauma management strategy, which included goal-directed coagulation management, was associated with a reduced incidence of massive transfusion and a reduction in the transfusion of red blood cells and fresh frozen plasma.

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Accepted: 3 April 2017
Keywords: anaemia and coagulation; FFP indications; transfusion mortality: causes

Introduction

Trauma is a leading cause of death worldwide [1, 2]. Severe trauma frequently results in trauma-induced coagulopathy [3], which may increase mortality four-fold [4] and therefore requires urgent treatment [3, 5]. This treatment may consist of administration of red blood cells (RBC), fresh frozen plasma (FFP) and platelet concentrates at a fixed-ratio [6], or administration of

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Anaesth Crit Care Pain Med 38 (2019) 469–476

Original Article

Effects of modification of trauma bleeding management: A before and after study

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ABSTRACT

Objective: We hypothesised that the association of tranexamic acid (TXA) administration and thromboelastometry-guided haemostatic therapy (TGHT) with implementation of Damage Control Resuscitation (DCR) reduced blood products (BP) use and massive transfusion (MT).
Methods: Retrospective comparison of 2 cohorts of trauma patients admitted in a university hospital, before (Period 1) and after implementation of DCR, TXA (first 3-hours) and TGHT (Period 2). Patients were included if they received at least 1 BP (RBC, FFP or platelet) or coagulation factor concentrates (fibrinogen or prothrombin complex) during the first 24-hours following the admission.
Results: 380 patients were included. Patients in Period 2 (*n* = 182) received less frequently a MT (8% vs. 33%, $P < 0.01$), significantly less BP (RBC: 2 units [1–5] vs. 6 [3–11]; FFP: 0 units [0–2] vs. 4 [2–8]) but more fibrinogen concentrates (3.0 g [1.5–4.5] vs. 0.0 g [0.0–3.0], $P < 0.01$). Multivariate logistic regression analysis identified Period 1 as being associated with an increased risk of receiving MT (OR: 26.1, 95% CI: 9.7–70.2) and decreased survival at 28 days (OR: 2.0, 95% CI: 1.0–3.9). After propensity matching, the same results were observed but there was no difference for survival and a significant decrease for the cost of BP (2370 ± 2126 vs. 3284 ± 3812 €, *P*: 0.036).
Conclusion: Following the implementation of a bundle of care including DCR, TGHT and administration of TXA, we observed a decrease to the use of blood products, need for MT and an improvement of survival.
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1. Introduction

In order to improve the outcome of injured patients, Damage Control strategies have been implemented throughout the world during the last 15-years. Damage Control *Resuscitation* (DCR) seeks to minimise blood loss until definitive haemostasis is achieved. It includes permissive hypotension with restrictive fluid administration and early correction of the three components of the lethal triad: hypothermia, acidosis and the Trauma induced coagulopathy (TIC) [1]. TIC is a frequent phenomenon observed in 20 to 30 % of the injured patients [2], it reflects the severity of injury and bleeding, increases the requirement for blood and directly impacts outcome [2]. Treatment of TIC may involve administration of blood products (BP) at a fixed-ratio or the administration of BP combined with coagulation factors concentrates (CFC) according to an individualised goal-directed algorithm based on viscoelastic techniques, such as rotational thromboelastometry (ROTEM®, TEM international, Munich, Germany) [3–5]. Whereas several studies have found that the use of thromboelastometry-guided haemostatic therapy (TGHT) decreases the administration of BP and the rate of massive transfusion (MT) [6–8], only one study has suggested that the use of thromboelastography improves the outcome [9].

Together with implementation of DCR, it is now recommended, since the publication of the Crash-2 study in 2010, to give tranexamic acid (TXA) in the first three hours following the injury in order to reduce the bleeding and improve the outcome [10].

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COAGULOPATHIE : ROTEM / TEG ?

Score de Propension

Table 1
Demographic and injury characteristics at hospital admission.

	Period 1		Period 2	
	Unmatched	Matched	Unmatched	Matched
n	190	102	182	102
Demographic characteristics and vital signs at admission				
Age (years)	35 [22-54]	37 [24–54]	39 [25–53]	38 [25–53]
Sex male	144 (76)	76 (75)	129 (71)	71 (70)
SBP (mmHg)	105 [85-120]	109 [85-126]	106 [84–125]	107 [90–120]
GCS	13 [3–15]	13 [3–15]	11 [3–15]	13 [3–15]
GCS < 9	47 (26)	42 (41)	78 (43)*	39 (38)
Injury characteristics				
Injury severity Score	28 [18–38]	28 [18–38]	30 [24–45]*	29 [22–38]
Blunt trauma	170 (89)	95 (93)	169 (93)	94 (92)
Trauma mechanism				
MVC	102 (54)	57 (56)	86 (47)	55 (54)
Pedestrian	14 (7)	8 (8)	23 (13)	8 (8)
Fall from a Height	44 (23)	24 (24)	48 (26)	28 (27)
Other	10 (5)	6 (6)	12 (7)	3 (3)
GSSW	12 (6)	4 (4)	11 (6)	6 (6)
Other penetrating	8 (4)	3 (3)	2 (1)	2 (2)

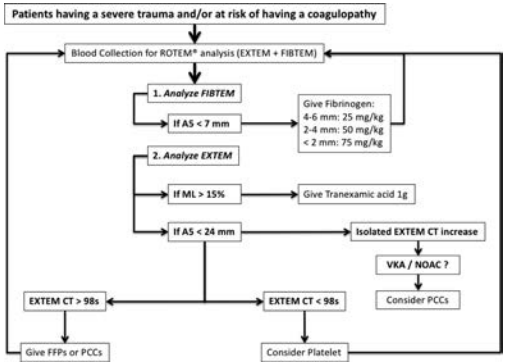


Table 2
Laboratory analyses and blood product administration at 24 hours following admission.

	Period 1		Period 2	
	Unmatched	Matched	Unmatched	Matched
n	190	102	182	102
Laboratory analyses				
BD (mEq/L^{-1})	6.2 [3.7–11.7]	6.6 [3.9–12.1]	8.0 [4.9–13.4]	7.4 [5.2–11.7]
Lactate (mmol/L^{-1})	3.1 [2.1–6.6]	3.3 [2.1–6.8]	3.3 [2.1–5.9]	3.2 [2.0–5.0]
PT_{ratio}	1.3 [1.1–1.7]	1.3 [1.1–1.7]	1.4 [1.2–1.6]	1.3 [1.2–1.6]
Fibrinogen (g/L^{-1})	1.6 [0.9–2.2]	1.6 [0.9–2.2]	1.5 [0.9–1.8]*	1.6 [1.1–2.0]
Hemoglobin (g/dL^{-1})	10.6 [8.6–12.3]	10.6 [8.5–12.3]	10.1 [8.7–12.3]	11.0 [9.1–12.6]
Platelet (10^{9}/L^{-1})	176 [123-233]	169 [130-225]	188 [146-227]	197 [151-241]‡
Blood products administered				
RBC (U)	6 [3–12]	6 [2–12]	[illegible][b]	2 [0–4][a]
n (%)	181 (95)	96 (94)	137 (75)[b]	72 (71)[a]
FFP (U)	4 [2–9]	5 [2–9]	[illegible]	0 [0–2][a]
n (%)	163 (86)	84 (82)	60 (33)[b]	28 (27)[a]
Platelets (U)	0 [0–4]	0 [0–4]	0 [0–0][b]	0 [0–0][a]
n (%)	76 (40)	39 (38)	33 (18)[b]	17 (17)[a]
FibCon (g)	0 [0–3]	0 [0–3]	[illegible]	3 [2–5][a]
n (%)	76 (40)	46 (45)	153 (84)[b]	85 (83)[a]
Total Fibrinogen (g)	2.4 [1.2–5.7]	2.9 [1.2–6.5]	3.0 [1.5–6.0]	3.0 [1.5–4.5]
n (%)	168 (88)	86 (84)	158 (87)	88 (86)
PCCs (UI)	1000 [900–1500]	1000 [875–1125]	2000 [1500–2000][b]	2000 [1500–2000][a]
n (%)	10 (5)	6 (6)	37 (20)[b]	16 (16)[a]
FFP:RBC ratio	0.8 [0.5–1.0]	0.9 [0.6–1.0]	0.7 [0.5–1.0]	0.8 [0.6–1.0]
n (%)	155 (82)	78 (76)	55 (30)[b]	26 (25)[a]
FIB:RBC ratio	0.3 [0.2–0.5]	0.3 [0.2–0.5]	1.1 [0.8–1.5][b]	1.1 [0.8–1.5][a]
n (%)	74 (39)	45 (44)	109 (60)[b]	55 (54)
Total FIB:RBC ratio	0.4 [0.3–0.7]	0.5 [0.4–0.8]	1.3 [0.9–1.6][b]	1.4 [0.9–1.5][a]
n (%)	159 (84)	80 (78)	113 (62)	58 (57)[a]

COAGULOPATHIE : ROTEM / TEG ?

Table 3
Stepwise regression analysis for massive transfusion.

TM : 3,5 vs. 35 %

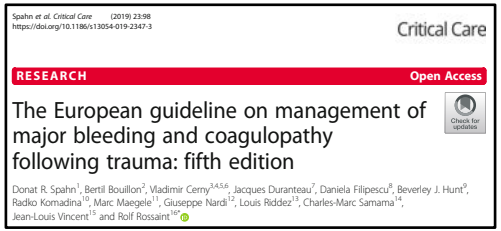
	OR	95% CI	AUC	*P*		OR	95% CI	*P*
Univariate analysis					Multivariate analysis			
Period 1 (yes)	5.39	2.93-9.92	0.686	< 0.001	Period 1 (yes)	25.92	9.66–69.51	< 0.001
Injury severity score	1.06	1.04-1.08	0.723	< 0.001	Injury severity Score	1.06	1.03–1.10	< 0.001
Base deficit	0.88	0.84-0.92	0.732	< 0.001	Base deficit	0.88	0.83–0.94	< 0.001
Hemoglobin	0.98	0.97-0.99	0.662	< 0.001	Hemoglobin	0.97	0.96–0.99	< 0.001
SBP < 90 mmHg (yes)	3.27	1.94-5.51	0.634	< 0.001	–			
PT_{ratio} > 1.2 (yes)	4.17	2.16-8.07	0.641	< 0.001	–			

The parameters that were significantly associated with massive transfusion are shown in the univariate analysis. For the multivariate regression analysis, calibration was assessed by the *Hosmer and Lemeshow* test (*P*: 0.18), AUC was 0.903 and the percentage of patients correctly classified was 87 %. OR: odds ratio. SBP (systolic blood pressure) and PT_{ratio} were not included in the final model.

Table 4
Univariate and multivariate stepwise regression analysis to predict death at day 28.

	OR	95% CI	AUC	P		OR	95% CI	*P*
Univariate Analysis					Multivariate analysis			
Period 1 (yes)	0.79	0.52-1.22	0.529	0.196	Period 1 (yes)	2.12	1.06-4.24	0.033
Age	1.02	1.00-1.03	0.574	0.004	Age	1.04	1.02-1.08	< 0.001
GCS < 9	12.67	7.50-21.39	0.775	< 0.001	GCS < 9 (yes)	14.48	6.92-30.30	< 0.001
Injury severity score	1.10	1.07-1.12	0.806	< 0.001	Injury severity Score	1.05	1.02-1.08	0.002
Base deficit	0.85	0.82-0.89	0.741	< 0.001	Base deficit	0.86	0.81-0.91	< 0.001
SBP < 90 mmHg (yes)	2.63	1.65-4.18	0.604	< 0.001	-			

Après appariement, cout période 2 < période 1 : 2370 ± 2126 euro vs. 3284 ± 3812 euro, P: 0.036

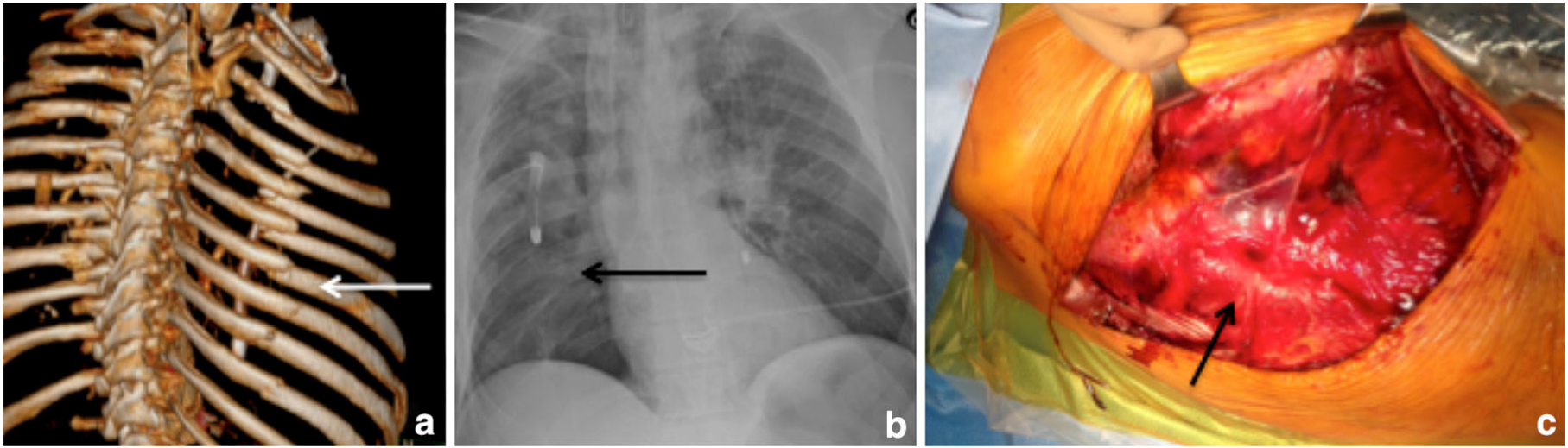


Coagulation monitoring

Recommendation 10 We recommend that routine practice include the early and repeated monitoring of haemostasis, using either a combined traditional laboratory determination [prothrombin time (PT), platelet counts and Clauss fibrinogen level] and/or point-of-care (POC) PT/international normalised ratio (INR) and/or a viscoelastic method (VEM) (Grade 1C)

Etude randomisée à construire : Mortalité / Morbidité !

PNEUMOTHORAX / SYNTHESE COTES



PNEUMOTHORAX / QUI DRAINER ?

AAST 2018 PODIUM PAPER

Observing pneumothoraces: The 35-millimeter rule is safe for both blunt and penetrating chest trauma

Savo Bou Zein Eddine, MD, Kelly A. Boyle, MD, Christopher M. Dodgion, MD, MSPH, MBA, Christopher S. Davis, MD, MPH, Travis P. Webb, MD, MHPE, Jeremy S. Juern, MD, David J. Milia, MD, Thomas W. Carver, MD, Marshall A. Beckman, MD, Panna A. Codner, MD, Colleen Trevino, PhD, *and* **Marc A. de Moya, MD**, *Milwaukee, Wisconsin*

J Trauma Acute Care Surg
Volume 86, Number 4

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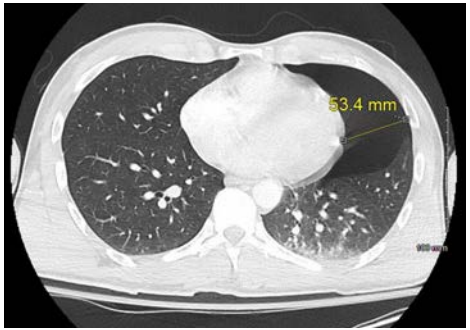


- ***Hypothèse*** : Seuil 35 mm Safe ?
- Etude rétrospective US.
- 1767 trauma thorax / 257 patients inclus.
- VPP : 91 % pour prédire le succès du non drainage (observation).
- AMV : Le seuil de 35 mm est associé avec le succès de l'observation.

TABLE 3. Multivariant Logistic Regression With Failure of Observation as an Outcome, N = 289

Variable	*p*	OR [95% CI]
PTX measurement (≤35 mm as reference)	0.001	0.142 (0.047–0.428]
GCS	0.065	6.632 (0.889–49.483)
No. rib fractures	0.098	1.300 (0.953–1.774)

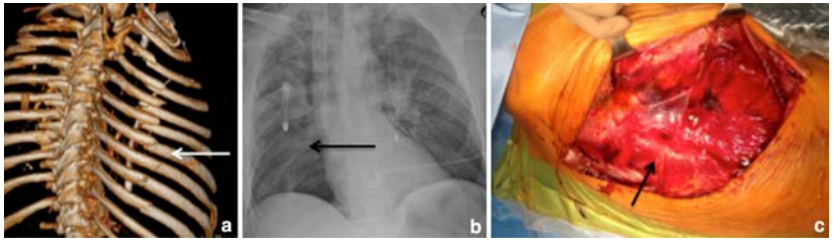
RIB FRACTURE FIXATION ?

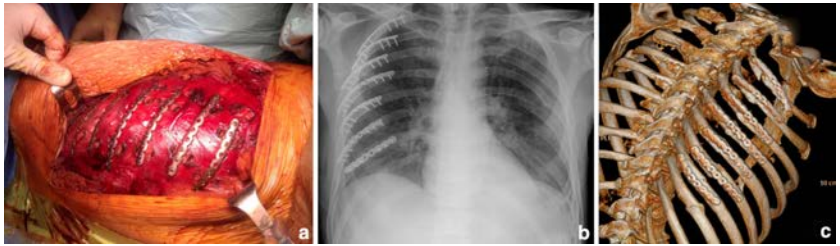
Intensive Care Med (2015) 41:1483–1484
DOI 10.1007/s00134-015-3684-6

IMAGING IN INTENSIVE CARE MEDICINE

Jean-Michel Maury
Gaëtane Roquet
Guillaume Marcotte
Jean-Stephane David

Surgical fixation of rib fractures in chest wall trauma





1: Multicentre prospective cohort study of nonoperative versus operative treatment for flail chest and multiple rib fractures after blunt thoracic trauma: study protocol. Beks RB, et al. BMJ Open 2019. PubMed PMID: 31462458.
2: A Randomized Controlled Trial of Surgical Rib Fixation in Polytrauma Patients With Flail Chest. Liu T, et al. J Surg Res 2019. PubMed PMID: 31100568.
3: **Effect of surgical rib fixation for rib fracture on mortality: A multicenter, propensity score matching analysis. Shibahashi K, et al. J Trauma Acute Care Surg 2019. PubMed PMID: 31045734.**
4: Systematic review of systematic reviews for effectiveness of internal fixation for flail chest and rib fractures in adults. Ingoe HM, et al. BMJ Open 2019. PubMed PMID: 30940753. PubMed Central PMCID: PMC6500198.
5: Epidemiology of adult rib fracture and factors associated with surgical fixation: Analysis of a chest wall injury dataset from England and Wales. Ingoe HM, et al. Injury 2019. PubMed PMID: 31690496.

CHU de Poitiers

EMVOLS

NEWSLETTER DECEMBRE 2018

1ères inclusion le 11/11/2015	Fin du recrutement théorique **Avril 2019**
16 centres ouverts	Objectif **310** patients
Recrutement actuel : **277** patients inclus	

OBJECTIF ATTEINT A : **89,35%**

RIB FRACTURE FIXATION ?

ORIGINAL ARTICLE

Effect of surgical rib fixation for rib fracture on mortality:
A multicenter, propensity score matching analysis

Keita Shibahashi, MD, Kazuhiro Sugiyama, MD, Yoshihiro Okura, MD, *and* **Yuichi Hamabe, MD**, *Tokyo, Japan*

- ***Hypothèse*** : L'ostéosynthèse costal améliore t'elle le pronostic ?
- *Japan Trauma Data Bank*
- Critère jugement 1 : Mortalité Hospitalière
- Score de Propension 1:4
- 147 synthèse costale vs. 588 contrôles
- **Mortalité Intra-Hospitalière** :
  - 4,8 (synthèse) vs. 16,2% (contrôle)
  - Différence : -11,4 (95% CI : -14,8 to -8,0%)
- ARF : 1,4 vs. 3,5%*
- PNP : 7,5 vs. 7,1%, NS
- Atélectasie : 12,2 vs. 5,4%*

Subgroups	Number of patients surgery/control	Absolute difference (%) in mortality [95% CI]	*P* for interaction
Overall	588/588	-11.4 [-14.8, -8.0]	
Sex			
Men	424/430	-12.7 [-16.7, -8.8]	0.089
Women	164/158	-7.9 [-14.7, -1.0]	
Age			
<65 years	336/316	-10.0 [-14.3, -5.8]	0.660
≥65 years	252/272	-12.8 [-18.3, -7.2]	
AIS head			
<3	468/483	-12.1 [-15.6, -8.7]	0.010
≥3	120/105	- 9.5 [-19.6, 0.6]	
AIS abdomen			
<3	544/523	-11.6 [-15.1. -8.2]	0.023
≥3	44/65	-4.9 [-20.2, 10.4]	
Sternum fracture			
No	552/550	-11.1 [-14.7, -7.5]	0.982
Yes	36/38	-15.8 [-27.4, -4.2]	
Flail chest			
No	364/367	-8.1 [-12.1, -4.1]	0.289
Yes	224/221	-16.8 [-23.0, -10.6]	
Hemothorax and/or pneumothorax			
No	216/221	-16.7 [-22.1, -11.3]	0.008
Yes	372/367	-8.3 [-12.7, -3.9]	

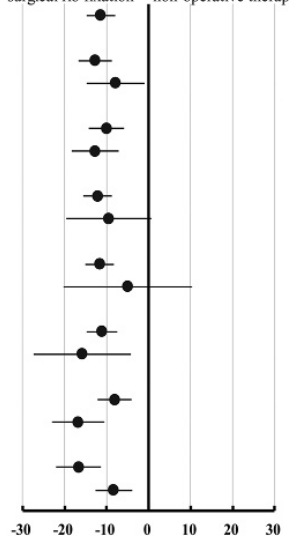
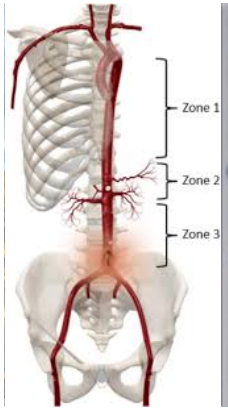


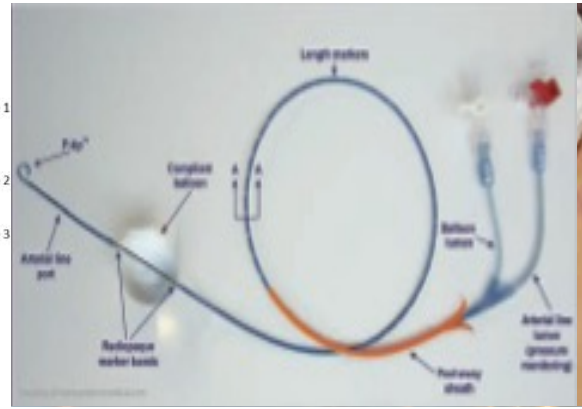
Figure 2. Subgroup analysis of the mean differences in in-hospital mortality associated with SRF.

Améliore peut être l'outcome, à l'exclusion patient avec TCG et/ou Abdomen sévère

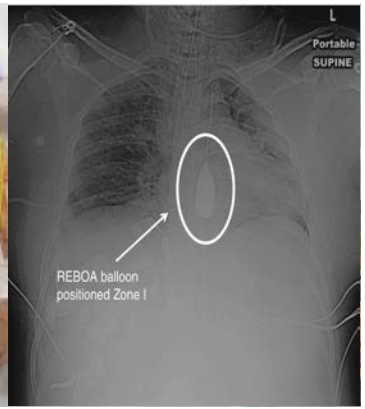
Attendre résultats EMVOLS !

REBOA … OR NOT ?


Zone 1
Zone 2
Zone 3




REBOA

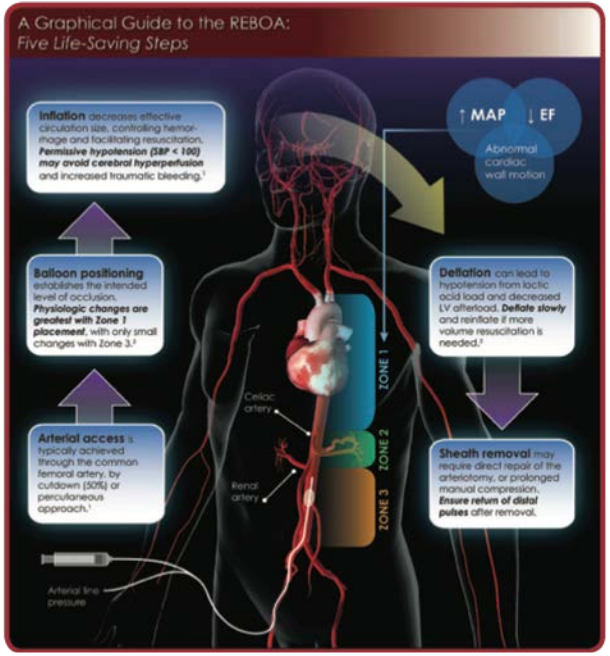

L
Portable
SUPINE
REBOA balloon
positioned Zone I

AORTIC BALLOON OCCLUSION

AER ACTUALITÉS EN RÉANIMATION

HCL HOSPICES CIVILS DE LYON

ANESTHESIA & ANALGESIA *Infographic*



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Published Online: 17 May 2001
Cardiovasc Intervent Radiol (2001) 24:274–276
DOI: 10.1007/s00270-001-0003-0

TECHNICAL NOTES

Temporary Percutaneous Aortic Balloon Occlusion to Enhance Fluid Resuscitation Prior to Definitive Embolization of Post-Traumatic Liver Hemorrhage

Shin Matsuoka, Katsuhiro Uchiyama, Hideki Shima, Sonomi Ohishi, Yoko Nojiri, Hitoshi Ogata

ORIGINAL ARTICLE

A clinical series of resuscitative endovascular balloon occlusion of the aorta for hemorrhage control and resuscitation

Megan L. Brenner, MD, Laura J. Moore, MD, Joseph J. DuBose, MD, George H. Tyson, MD, Michelle K. McNutt, MD, Rondel P. Albarado, MD, John B. Holcomb, MD, Thomas M. Scalea, MD, *and* Todd E. Rasmussen, MD

Research

JAMA Surgery | Original Investigation

First Fixed-Distance Model for Balloon Placement During Fluoroscopy-Free Resuscitative Endovascular Balloon Occlusion of the Aorta in a Civilian Population

Pierre Pezy, MS; Alexandros N. Flaris, MD, MSc; Nicolas J. Prat, MD, PhD; François Cotton, MD, PhD; Peter W. Lundberg, MD; Jean-Louis Caillot, MD, PhD; Jean-Stéphane David, MD, PhD; Eric J. Voiglio, MD, PhD

GUIDELINES

Current opinion on catheter-based hemorrhage control in trauma patients

John B. Holcomb, MD, Erin E. Fox, PhD, Thomas M. Scalea, MD, Lena M. Napolitano, MD, Rondel Albarado, MD, Brijesh Gill, MD, Brian J. Dunkin, MD, Andrew W. Kirkpatrick, MD, Bryan A. Cotton, MD, Kenji Inaba, MD, Joseph J. DuBose, MD, Alan M. Cohen, MD, Ali Azizzadeh, MD, Megan Brenner, MD, Mitchell J. Cohen, MD, Charles E. Wade, PhD, Alan B. Lumsden, MD, Richard Andrassy, MD, Peter M. Rhee, MD, MPH, Barbara L. Bass, MD, Kenneth L. Mattox, MD, L.D. Britt, MD, A. Brent Eastman, MD, David B. Hoyt, MD, Todd E. Rasmussen, MD, *and* the Catheter-Based Hemorrhage Control Study Group, *Houston, Texas*

KEY WORDS: Hemorrhage control; bleeding; injury; trauma; catheter.

Open access Guidelines / Algorithms

Trauma Surgery & Acute Care Open

Clinical use of resuscitative endovascular balloon occlusion of the aorta (REBOA) in civilian trauma systems in the USA, 2019: a joint statement from the American College of Surgeons Committee on Trauma, the American College of Emergency Physicians, the National Association of Emergency Medical Services Physicians and the National Association of Emergency Medical Technicians

Eileen M Bulger,[1] Debra G Perina,[2] Zaffer Qasim,[3] Brian Beldowicz,[4] Megan Brenner,[5] Frances Guyette,[6] Dennis Rowe,[7] Christopher Scott Kang,[8] Jennifer Gurney,[9] Joseph DuBose,[10] Bellal Joseph,[11] Regan Lyon,[12] Krista Kaups,[13] Vidor E Friedman,[14] Brian Eastridge,[15] Ronald Stewart[15]

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Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
EUROPEAN RESUSCITATION COUNCIL

Clinical paper

Pre-hospital Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) for exsanguinating pelvic haemorrhage

Robbie Lendrum[a,b,c,], Zane Perkins[a,b,d], Manik Chana[e], Max Marsden[d,f], Ross Davenport[a,d], Gareth Grier[a,b,e], Samy Sadek[a,b], Gareth Davies[a,b,d]*

Bridge to Surgical Care ?

Suggested by the last *Tactical Combat Casualty Care*

AORTIC BALLOON OCCLUSION

Research

JAMA Surgery | Original Investigation

Nationwide Analysis of Resuscitative Endovascular Balloon Occlusion of the Aorta in Civilian Trauma

Bellal Joseph, MD; Muhammad Zeeshan, MD; Joseph V. Sakran, MD, MPH; Mohammad Hamidi, MD; Narong Kulvatunyou, MD; Muhammad Khan, MD; Terence O'Keeffe, MD; Peter Rhee, MD

Key Points

Question Is there a benefit of placement of resuscitative endovascular balloon occlusion of the aorta for resuscitation of severely injured trauma patients?

Analyse banque de donnée US (ACS-TQIP)
REBOA < 1h après admission
Appariement par score de propension, 1:2

Table 2. Postmatch Demographics and Injury Parameters of the 2 Groups

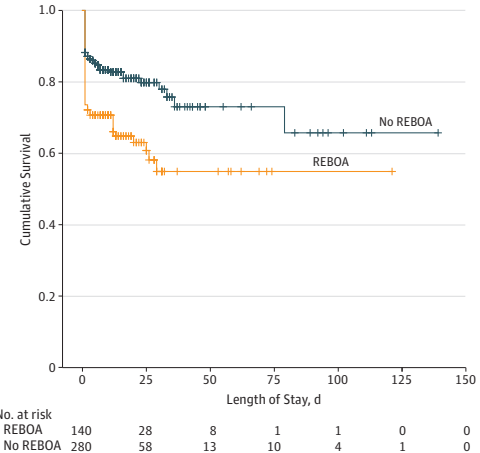
Variables	Patients, No. (%)		*P* Value
	No-REBOA Group (n = 280)	REBOA Group (n = 140)	
Age, mean (SD), y	43 (19)	44 (20)	.88
Male sex	203 (72.5)	104 (74.3)	.76
White race	180 (64.3)	89 (63.6)	.37
Vital signs in the ED			
SBP, mean (SD), mm Hg	106.5 (28.7)	108.8 (32.7)	.65
HR, mean (SD), bpm	104 (27)	102 (30)	.74
GCS score, median (IQR)	13 (3-15)	14 (3-15)	.88
Injury parameters			
Blunt MOI	257 (91.8)	129 (92.1)	.87
ISS, median (IQR)	28 (17-35)	29 (18-38)	.91
h-AIS score, median (IQR)	0 (0-3)	0 (0-3)	.98
Pelvic fractures, total	144 (51.4)	74 (52.9)	.65
With intact posterior arch	45 (16.1)	25 (17.9)	
Incompletely disrupted posterior arch	68 (24.3)	33 (23.6)	
Completely disrupted posterior arch	31 (11.1)	16 (11.4)	
Liver injuries, total	89 (31.8)	43 (30.7)	.79
Grades I-III	76 (27.1)	37 (26.4)	
Grades IV-VI	13 (4.6)	6 (4.3)	
Splenic injuries, total	90 (32.1)	47 (33.6)	.81
Grades I-III	67 (23.9)	36 (25.7)	
Grades IV-V	22 (7.9)	11 (7.9)	
Kidney injuries, total	39 (13.9)	22 (15.7)	.82
Grades I-III	35 (12.5)	19 (13.6)	
Grades IV-V	5 (1.8)	3 (2.1)	
Lower limb fractures, total	78 (27.9)	41 (29.3)	.69
Femur	48 (17.1)	27 (19.3)	
Tibia	45 (16.1)	20 (14.3)	
Fibula	32 (11.4)	21 (15.0)	
Vascular injuries, total	76 (27.1)	41 (29.3)	.11
Iliac	53 (18.9)	29 (20.7)	
Lower extremity	20 (7.1)	11 (7.9)	
Other	11 (3.9)	38 (27.1)	

AORTIC BALLOON OCCLUSION

Table 3. Outcomes of Patients

Variable	Patients, No. (%) No-REBOA Group (n = 280)	REBOA Group (n = 140)	*P* Value
4-h Transfusion, median (IQR), U			
PRBCs	7 (3-9)	6 (3-8)	.14
Platelets	4 (3-8)	4 (3-9)	.13
Plasma	3 (2-6)	3 (2-5)	.17
24-h Transfusion, median (IQR), U			
PRBCs	10 (4-21)	9 (5-20)	.21
Platelets	8 (3-12)	7 (3-13)	.12
Plasma	10 (7-20)	9 (6-20)	.11
Hemorrhage control intervention			
Angioembolization	85 (30.4)	40 (28.6)	.18
Time to angioembolization, median (IQR), min	46 (31-69)	59 (39-78)	.04
Laparotomy	190 (67.9)	96 (68.6)	.33
Time to laparotomy, median (IQR), min	33 (26-62)	45 (35-69)	.04
LOS, median (IQR), d			
Hospital	10 (5-22)	8 (1-20)	.21
ICU	6 (3-15)	5 (2-14)	.19
Complications			
Acute kidney injury	9 (3.2)	15 (10.7)	.02
Amputation of lower limb	2 (0.7)	5 (3.6)	.04
Deep venous thrombosis	14 (5.0)	6 (4.3)	.42
Pulmonary embolism	5 (1.8)	2 (1.4)	.28
Stroke	3 (1.1)	2 (1.4)	.37
Myocardial infarction	1 (0.4)	0	.51
Extremity compartment syndrome	2 (0.7)	1 (0.7)	.39
Overall mortality	53 (18.9)	50 (35.7)	.01
Mortality in the ED	5 (1.8)	4 (2.9)	.35
24-h Mortality	33 (11.8)	37 (26.4)	.01
In-hospital mortality after 24 h	15 (5.4)	9 (6.4)	.21

Figure. Survival Curve Analysis



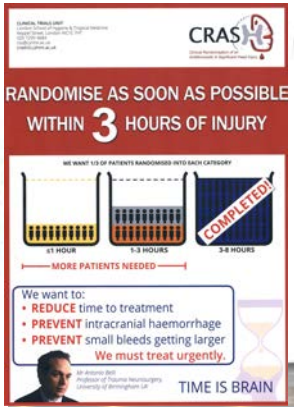
The probability of survival over time in the group that received resuscitative endovascular balloon occlusion of the aorta (REBOA) vs the no-REBOA group ($P < .01$).

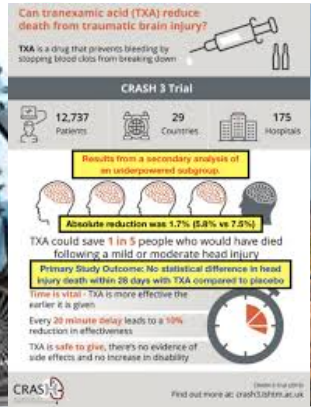
Meaning The use of resuscitative endovascular balloon occlusion of the aorta in severely injured trauma patients may increase the risk of complications and mortality.

Critères Inclusion trop large ?

REBOA may be used for traumatic life-threatening hemorrhage below the diaphragm in patients in hemorrhagic shock who are refractory to resuscitation.

TRANEXAMIC ACID FOR HEAD INJURY ?





TXA AND BRAIN INJURY

Articles

Effects of tranexamic acid on death, disability, vascular occlusive events and other morbidities in patients with acute traumatic brain injury (CRASH-3): a randomised, placebo-controlled trial

*The CRASH-3 trial collaborators**

Summary

Background Tranexamic acid reduces surgical bleeding and decreases mortality in patients with traumatic extracranial bleeding. Intracranial bleeding is common after traumatic brain injury (TBI) and can cause brain herniation and death. We aimed to assess the effects of tranexamic acid in patients with TBI.

Methods This randomised, placebo-controlled trial was done in 175 hospitals in 29 countries. Adults with TBI who were within 3 h of injury, had a Glasgow Coma Scale (GCS) score of 12 or lower or any intracranial bleeding on CT scan, and no major extracranial bleeding were eligible. The time window for eligibility was originally 8 h but in 2016 the protocol was changed to limit recruitment to patients within 3 h of injury. This change was made blind to the trial data, in response to external evidence suggesting that delayed treatment is unlikely to be effective. We randomly assigned (1:1) patients to receive tranexamic acid (loading dose 1 g over 10 min then infusion of 1 g over 8 h) or matching placebo. Patients were assigned by selecting a numbered treatment pack from a box containing eight packs that were identical apart from the pack number. Patients, caregivers, and those assessing outcomes were masked to allocation. The primary outcome was head injury-related death in hospital within 28 days of injury in patients treated within 3 h of injury. We prespecified a sensitivity analysis that excluded patients with a GCS score of 3 and those with bilateral unreactive pupils at baseline. All analyses were done by intention to treat. This trial was registered with ISRCTN (ISRCTN15088122), ClinicalTrials.gov (NCT01402882), EudraCT (2011-003669-14), and the Pan African Clinical Trial Registry (PACTR201210004412 77).

Results Between July 20, 2012, and Jan 31, 2019, we randomly allocated 12 737 patients with TBI to receive tranexamic acid (6406 [50·3%] or placebo (6331 [49·7%], of whom 9202 (72·2%) patients were treated within 3 h of injury. Among patients treated within 3 h of injury, the risk of head injury-related death was 18·5% in the tranexamic acid group versus 19·8% in the placebo group (855 *vs* 892 events; risk ratio [RR] 0·94 [95% CI 0·86–1·02]). In the prespecified sensitivity analysis that excluded patients with a GCS score of 3 or bilateral unreactive pupils at baseline, the risk of head injury-related death was 12·5% in the tranexamic acid group versus 14·0% in the placebo group (485 *vs* 525 events; RR 0·89 [95% CI 0·80–1·00]). The risk of head injury-related death reduced with tranexamic acid in patients with mild-to-moderate head injury (RR 0·78 [95% CI 0·64–0·95]) but not in patients with severe head injury (0·99 [95% CI 0·91–1·07]; p value for heterogeneity 0·030). Early treatment was more effective than was later treatment in patients with mild and moderate head injury (p=0·005) but time to treatment had no obvious effect in patients with severe head injury (p=0·73). The risk of vascular occlusive events was similar in the tranexamic acid and placebo groups (RR 0·98 (0·74–1·28). The risk of seizures was also similar between groups (1·09 [95% CI 0·90–1·33]).

Interpretation Our results show that tranexamic acid is safe in patients with TBI and that treatment within 3 h of injury reduces head injury-related death. Patients should be treated as soon as possible after injury.

Funding National Institute for Health Research Health Technology Assessment, JP Moulton Charitable Trust, Department of Health and Social Care, Department for International Development, Global Challenges Research Fund, Medical Research Council, and Wellcome Trust (Joint Global Health Trials scheme).

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See **Comment** page 1687

*Members listed at end of paper

For the Arabic translation of the abstract see Online for appendix 1

For the Chinese translation of the abstract see Online for appendix 2

For the French translation of the abstract see Online for appendix 3

For the Hindi translation of the abstract see Online for appendix 4

For the Japanese translation of the abstract see Online for appendix 5

For the Spanish translation of the abstract see Online for appendix 6

For the Urdu translation of the abstract see Online for appendix 7

Correspondence to:
Clinical Trials Unit, London School of Hygiene & Tropical Medicine, London WC1 E7HT, UK
crash@lshtm.ac.uk

FLOW CHART: STUDY OVERVIEW

ELIGIBILITY (data collected on entry form)

- adult with traumatic brain injury
- within 8 hours of injury (for the remainder of the trial we will limit recruitment to patients who are within 3 hours of injury)
- any intracranial bleeding on CT scan **OR** GCS ≤12 if no scan available
- no significant extra cranial bleeding (needing immediate blood transfusion)
- where the responsible clinician is substantially uncertain as to the appropriateness of antifibrinolytic agents in a patient

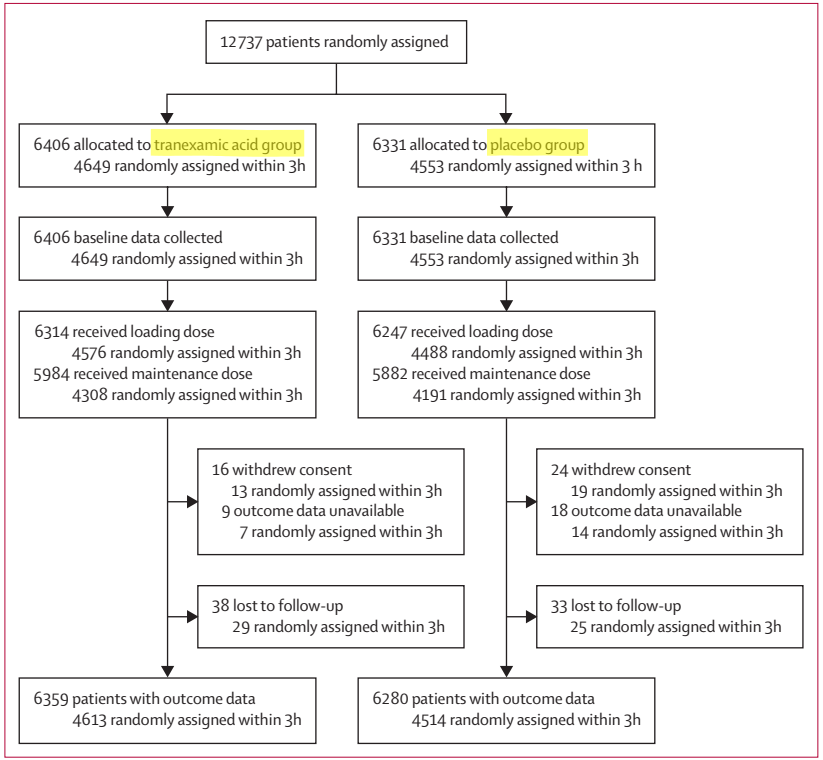
Appropriate **CONSENT PROCESS**
eg relative agreement or waiver

RANDOMISE (tranexamic acid or placebo)
Entry form completed

Give **loading dose** over 10 minutes

Give **maintenance dose** over 8 hours

Complete **outcome form** at discharge, death or day 28 (whichever is earlier)



9202 patient randomisés ds les 3 heures (< 10.000)

CJP : Head related death vs. All Cause death

TXA AND BRAIN INJURY

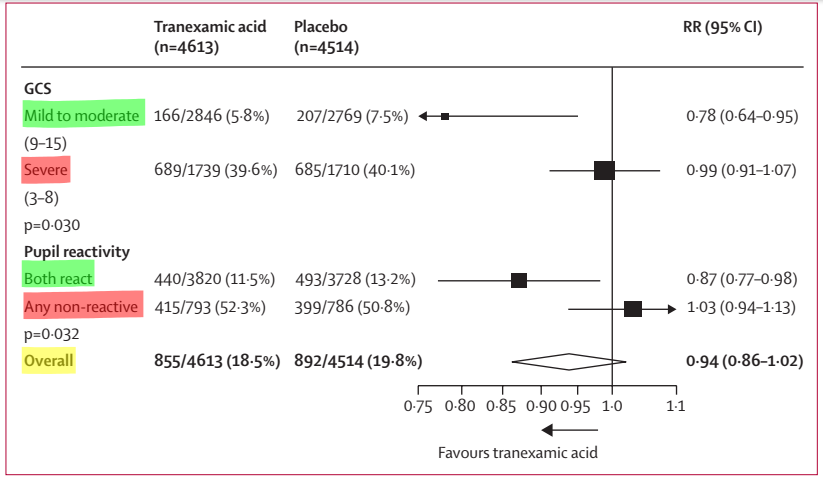
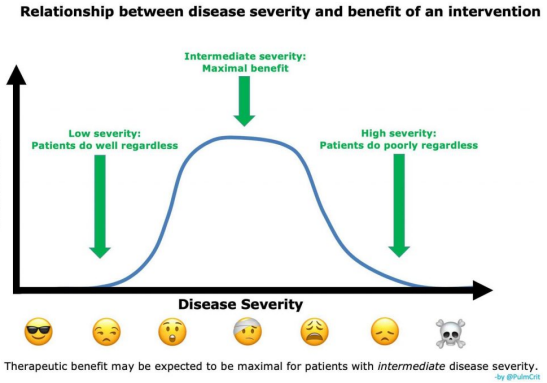


Figure 3: Effect of tranexamic acid on head injury-related death stratified by baseline severity in patients randomised within 3 h of injury



Goldilocks Concept

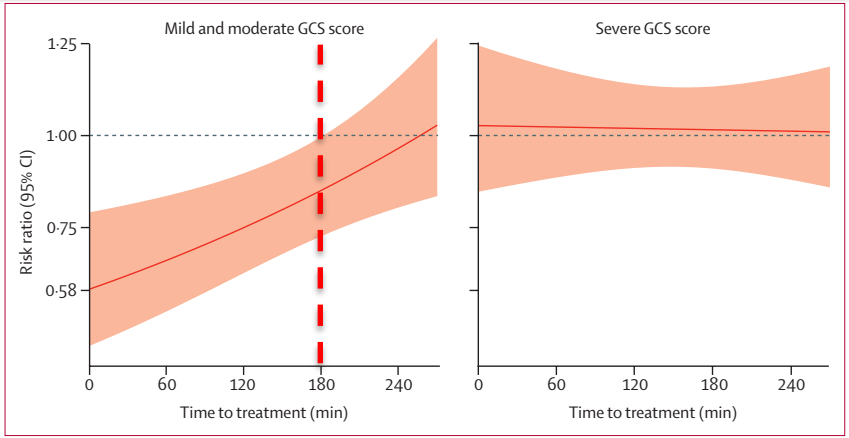


Figure 4: Effect of tranexamic acid on head injury-related death by severity and time to treatment in all patients

All cause mortality (Subgroup GCS 9-15) :

- 6.9% in the TXA group vs. 8.3% in the placebo group
- RR 0.83; 95% CI 0.69-0.99

ENJOY LYON !