



Printemps d'Urg'Ara

ENS LYON

Jeudi 11 mai 2023

# Arrêt cardiaque traumatique chez l'adulte

Dr Axel Benhamed  
Urgences-SAMU 69  
Hôpital Edouard Herriot, HCL



Hospices Civils de Lyon



Lyon 1

2 questions



1) L'arrêt cardiaque traumatique vs médical: du pareil au même ?

2) Doit-on encore réanimer un ACT en 2023 ?

- Qui réanimer ?
- Faut-il abandonner le massage cardiaque externe ?
- Avez-vous raison d'envoyer un médecin ?
- La thoraco: au doigt ou à l'aiguille ?
- Thoracotomie/REBOA: l'avenir ou déjà trop tard ?



## Littérature très hétérogène = comment comparer

« l'incomparable »

- Définition de l'ACT standardisée mais ...
- Critères d'exclusion : patients décédés en pré-hospitalier / ISS ≤ 16 ...
- Base de données: ACR vs trauma data base ; nationale/locale ?
- Et si la cause était finalement médicale ?
- Système de santé très différents

♦ Définition « Ustein style » (1990, Norvège, révision 2004)

electric shocks, or lightning strikes were also excluded

[20]. The causes of cardiac arrest were traumatic or medical. The causes of cardiac arrest were traumatic or medical. EMS providers and cardiac arrest was de

### Methods

#### Study design

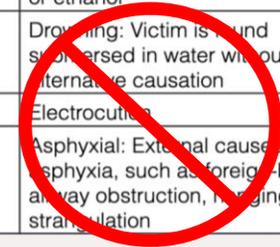
An interrupted time series analysis of cardiac arrest in the Victorian Ambulance Cardiac Arrest Registry. Patients who were attended by EMS between January 2007 and December 2010 were included. Patients who died of cardiac arrest by EMS personnel were excluded from the Monash University Human Re

**Patient selection.** The patient flow chart is shown in Fig. 1. Exclusion criteria were: no resuscitation, ALS performed by a physician (i.e., bias from another ALS procedure such as blood transfusion, insertion of chest tube, thoracotomy, resuscitative endovascular occlusion of the aorta, etc.), unknown adrenaline use, CPR duration time < 1 min, CPR duration time > 30 min (i.e., unsurvivable long time), and prehospital return of spontaneous circulation (ROSC) within 10 min from CPR (i.e., bias caused by inclusion of patients successfully resuscitated prior to epinephrine administration).

### ILCOR CONSENSUS STATEMENT

## Cardiac Arrest and Cardiopulmonary Resuscitation Outcome Reports: Update of the Utstein Resuscitation Registry Templates for Out-of-Hospital Cardiac Arrest

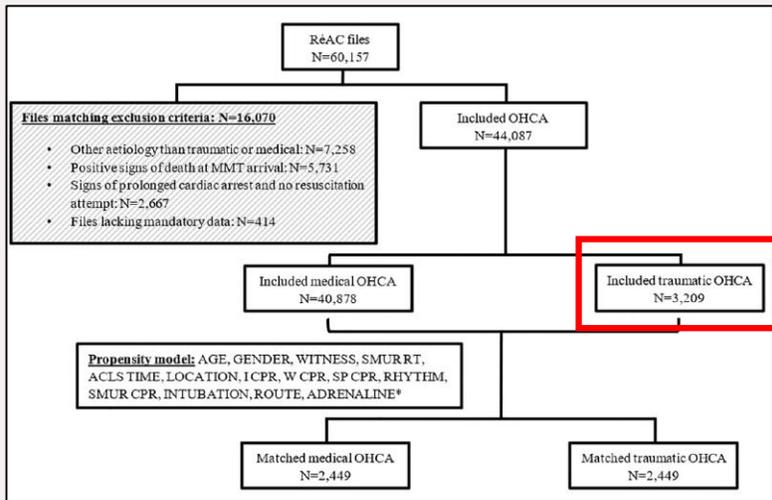
Pathogenesis	The most likely primary cause of the cardiac arrest.	Medical/traumatic cause/drug overdose/drowning/electrocution/asphyxial/not recorded. (Note this variable does not include the unknown option as unknown causes should be assigned as medical causes.)
	Medical: Includes cases in which the cause of the cardiac arrest is presumed to be cardiac, other medical cause (eg, anaphylaxis, asthma, GI bleed), and in which there is no obvious cause of the cardiac arrest	
	Traumatic: Cardiac arrest directly caused by blunt, penetrating, or burn injury	
	Drug overdose: Evidence that the cardiac arrest was caused by deliberate or accidental overdose of prescribed medications, recreational drugs, or ethanol	
	Drowning: Victim is found submerged in water without an alternative causation	
	Electrocution	
	Asphyxial: External causes of asphyxia, such as foreign-body airway obstruction, hanging, or strangulation	



A red balloon is positioned at the top center of the frame, floating above a horizontal line of white balloons. The background is a solid teal color. The text is centered over the white balloons.

ACM vs ACT:  
du pareil au même ?

Escutnaire et al, 2018  
Resuscitation



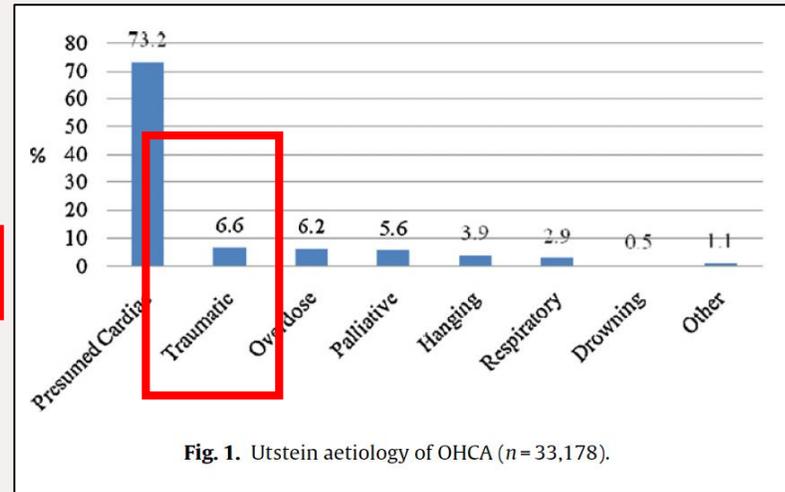
2011-2017

7.2%

Registre électronique des arrêts cardiaques

N= 44,087

Deasy et al, 2012  
Resuscitation



2000-2009

6.6%

Victorian Ambulance Cardiac Arrest Registry

N= 33,178

Djarv et al, 2018  
Scandinavian J Trauma

Djarv et al. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* (2018) 26:30  
<https://doi.org/10.1186/s13049-018-0500-7>

Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine

ORIGINAL RESEARCH Open Access

**Traumatic cardiac arrest in Sweden 1990-2016 - a population-based national cohort study**

T. Djarv<sup>1,2\*</sup>, C. Axelsson<sup>3</sup>, J. Herlitz<sup>2,3</sup>, A. Stromsoe<sup>4</sup>, J. Israelsson<sup>5,6,7</sup> and A. Claesson<sup>2,3</sup>



1990-2016

2.4%

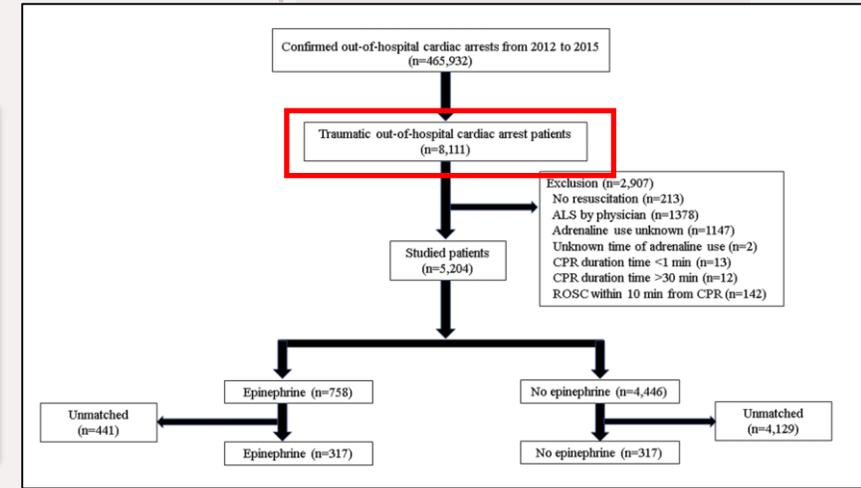
Nationwide, prospective population-based Swedish Registry for Cardiopulmonary Resuscitation

N= 74, 321

Grasner et al, 2016  
Resuscitation

Aoki et al, 2019  
Scientific report

Jun et al, 2020  
Clin Exp Emerg Med



**Prognostic factors related with outcomes in traumatic out-of-hospital cardiac arrest patients without prehospital return of spontaneous circulation: a nationwide observational study**

Gwang Soo Jun<sup>1</sup>, Jae Guk Kim<sup>1,2</sup>, Hyun Young Choi<sup>1</sup>, Gu Hyun Kang<sup>1</sup>, Wonhee Kim<sup>1</sup>, Yong Soo Jang<sup>1</sup>, Hyun Tae Kim<sup>1</sup>  
<sup>1</sup>Department of Emergency Medicine, Kangnam Sacred Heart Hospital, Hallym University College of Medicine, Seoul, Korea  
<sup>2</sup>Department of Emergency Medicine, Kangwon National University Graduate School of Medicine, Chuncheon, Korea

**Table 2**  
Selected summary findings from all countries. Results are presented as overall mean value or percentage. Calculations are based on all cases where CPR was started by EMS or bystander.

	No. of countries	No. of cases	Overall average
Cases with CPR attempted	27	7146	264.7
Mean age (years)	27	6826	66.5
Male gender (%)	27	7004	66.3
Medical/cardiac cause <sup>a</sup> (%)	27	7146 <sup>a</sup>	91.4
Traumatic cause (%)	27	7146 <sup>a</sup>	4.1
Location: residence (%)	27	7052	69.4
Telephone CPR (%)	21	3439	29.9
Collapse witnessed (%)	27	6815	66.1
Bystander CPR (%)	27	6619	47.4
Shockable rhythm (%)	26	6533	22.2
ROSC (%)	27	6963	28.6

<sup>a</sup> Missing or unknown values were considered as medical/cardiac.



2014  
4.1%

Cohorte prospective, internationale (27 pays), 1 mois  
N= 10, 682



2012-2016  
5.9%

Out-of-Hospital Cardiac Arrest Surveillance  
N= 142,095



2012-2015  
1.7%

All-Japan Utstein Registry  
N= 465,932

Faible incidence = **médecin peu exposé**

Plutôt des hommes, jeunes

→ TRAUMA plus que ACR ?

Original article

 OPEN ACCESS

Prehospital determinants of successful resuscitation after traumatic and non-traumatic out-of-hospital cardiac arrest

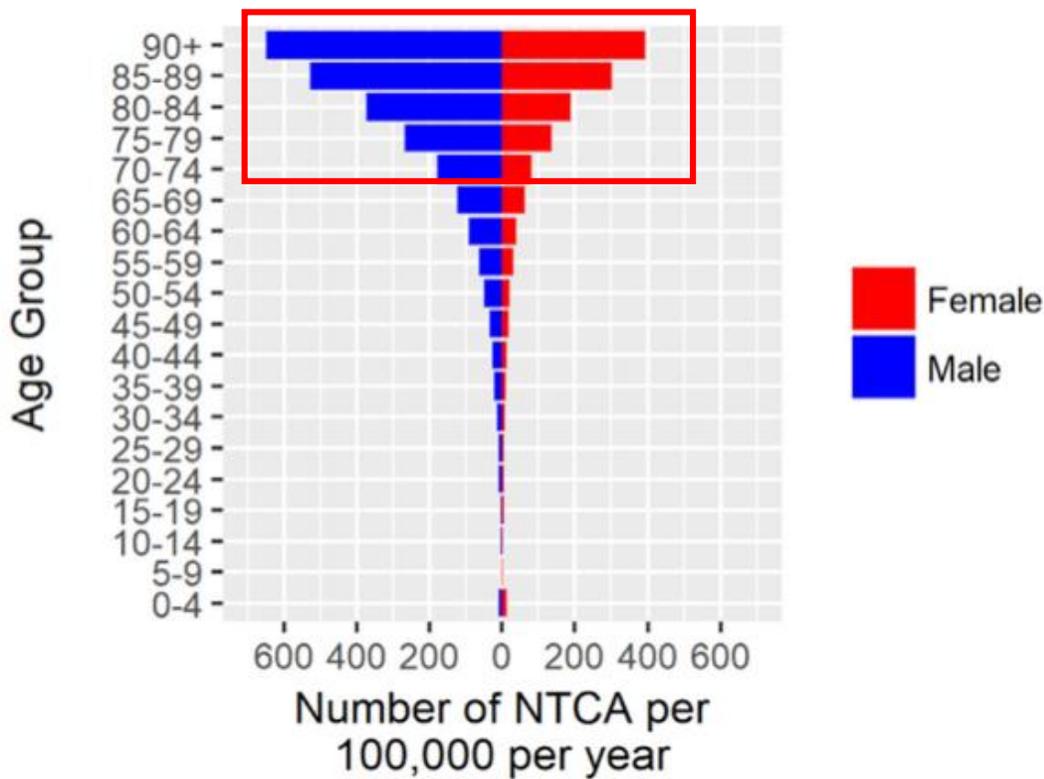
Ed B G Barnard,<sup>1,2</sup> Daniel D Sandbach,<sup>1</sup> Tracy L Nicholls,<sup>3</sup> Alastair W Wilson,<sup>1</sup> Ari Ercole<sup>1,4</sup>



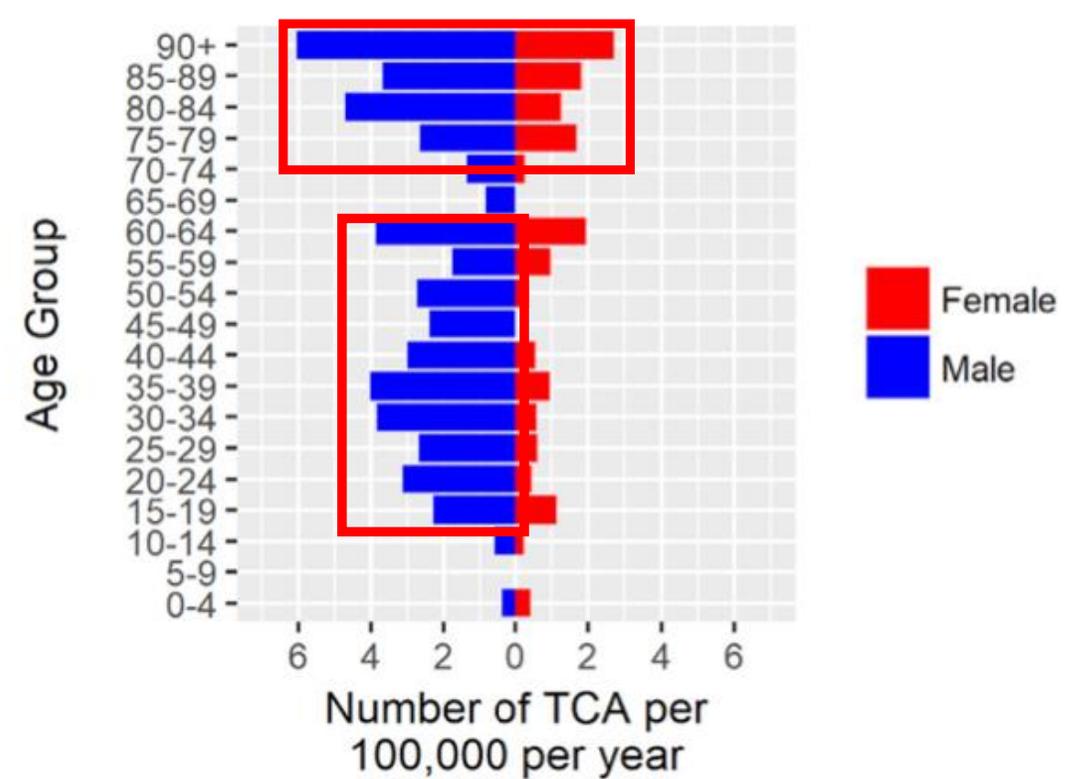
2015-2017

N= 9,109

3.3%



MEDICAL



TRAUMATIQUE

**Table 1**  
Modified Utstein template describing characteristics of 26,471 OHCA in Melbourne (2000–2009) according to 'traumatic' and 'presumed cardiac' aetiologies.

Utstein element	OHCA aetiology		P value
	Traumatic	Presumed cardiac	
Absence of signs of circulation and/or considered for resuscitation	2187	24,284	

**ACT = très peu de rythme choquable**

**Table 1**  
Non-adjusted populations comparison on main criteria.

Out of hospital cardiac arrests  
N = 44,087

		Traumatic OHCA N = 3209	Medical OHCA N = 40,878	P
<b>Population</b>	Age; M[Q1;Q3] (years)	46 [29;64]	71 [58;82]	< 0.001
	Gender: Male; n(%)	2407 (75.0)	26,211 (64.1)	< 0.001
<b>Location of OHCA</b>	Home; n(%)	776 (24.2)	30,030 (74.9)	< 0.001
	Public way; n(%)	1996 (62.3)	3874 (9.2)	
	Public place; n(%)	44 (1.4)	1146 (2.9)	
	Health facility/nursing home; n(%)			
	Workplace; n(%)			
	Airport; n(%)			
	Station; n(%)			
	Other; n(%)			
<b>Witness(es)</b>	No witness; n(%)			
	Bystander; n(%)			
	Fire brigade or MMT; n(%)			
<b>BLS</b>	Immediate CPR; n(%)			
	Bystander CPR; n(%)			
	Fireman CPR; n(%)			
<b>First recorded rhythm</b>	Asystole; n(%)			
	Pulseless electrical activity; n(%)			
	VF/PulselessVT; n(%)			
	Spontaneous activity; n(%)			
<b>ACLS</b>	MMT CPR; n(%)			
	MMT response time; M[Q1;Q3] (minutes)			
<b>Intubation</b>	Intubation; n(%)			
<b>Injection route</b>	Intraosseous; n(%)			
	Peripheral venous access ; n(%)			
	Central venous access; n(%)			
	Endotracheal; n(%)			
	No injection route implemented; n(%)			
<b>Epinephrine</b>	Epinephrine injection; n(%)			
<b>ACLS duration</b>	ACLS duration ; M[Q1;Q3] (minutes)			

**Table 1** Characteristics of 72,547 medical out-of-hospital cardiac arrests (OHCA) compared to 1774 traumatic cardiac arrests (TCA) in the Swedish Registry of Cardiopulmonary Resuscitation between 1990 and 2016

	TCA Number (%) 1774 (100)	Medical OHCA Number (%) 72,547 (100)	P-value*
<b>Sex</b>			
Male	1385 (78)	49,940 (69)	< 0.01
Missing	45 (3)	1543 (2)	
<b>Age</b>			
Years, mean (SD)	51 (23)	70 (16)	< 0.01
Missing	281 (16)	2177 (3)	
<b>Witnessed by</b>			
Crew	253 (14)	10,277 (14)	0.34
Bystander	735 (41)	38,863 (54)	< 0.01
None	642 (36)	20,931 (29)	< 0.01
Missing for "None"	144 (8)	2476 (3)	< 0.01
<b>CPR before arrival of EMS</b>			
Yes	770 (56 <sup>a</sup> )	31,563 (53 <sup>a</sup> )	0.01
Missing	31 (2)	1142 (2)	
<b>Initial rhythm</b>			
Shockable	165 (9)	20,361 (28)	< 0.01
Missing	179 (10)	5924 (8)	< 0.01

First monitored rhythm n (%)  
Shockable  
Non Shockable  
Asystole  
PEA



ELSEVIER

Contents lists available at ScienceDirect

Resuscitation

journal homepage: [www.elsevier.com/locate/resuscitation](http://www.elsevier.com/locate/resuscitation)

Clinical paper

**Traumatic cardiac arrest is associated with lower survival rate vs. medical cardiac arrest – Results from the French national registry<sup>☆</sup>**

Joséphine Escutnaire<sup>a,b,\*</sup>, Michael Genin<sup>a,b</sup>, Evgényia Babykina<sup>a,b</sup>, Cyrielle Dumont<sup>a,b</sup>, François Javaudin<sup>c,d</sup>, Valentine Baert<sup>a,b</sup>, Pierre Mols<sup>e</sup>, Jan-Thorsten Gräsner<sup>f</sup>, Eric Wiel<sup>a,b,g</sup>, Pierre-Yves Gueugniaud<sup>b,h</sup>, Karim Tazarourte<sup>b,h</sup>, Hervé Hubert<sup>a,b</sup>, on behalf GR-RéAC<sup>b</sup>

**Table 2**

Survival on non-adjusted and adjusted populations.

	Traumatic OHCA	Medical OHCA	p	Odds-ratio
<b>Survival at D0: Before matching; n(%)</b>	449 (14.0)	8341 (20.4)	< 0.001	0.456 [0.353;0.558]
<b>Survival at D30: Before matching; n(%)</b>	49 (1.5)	2415 (5.9)	< 0.001	0.240 [0.186;0.329]
<b>Survival at D0: After matching; n(%)</b>	348 (14.2)	718 (29.3)	< 0.001	0.416 [0.359;0.482]
<b>Survival at D30: After matching; n(%)</b>	39 (1.6)	220 (9.0)	< 0.001	0.168 [0.117;0.241]

OHCA: out of hospital cardiac arrest.



**2 ARRETS oui**

...

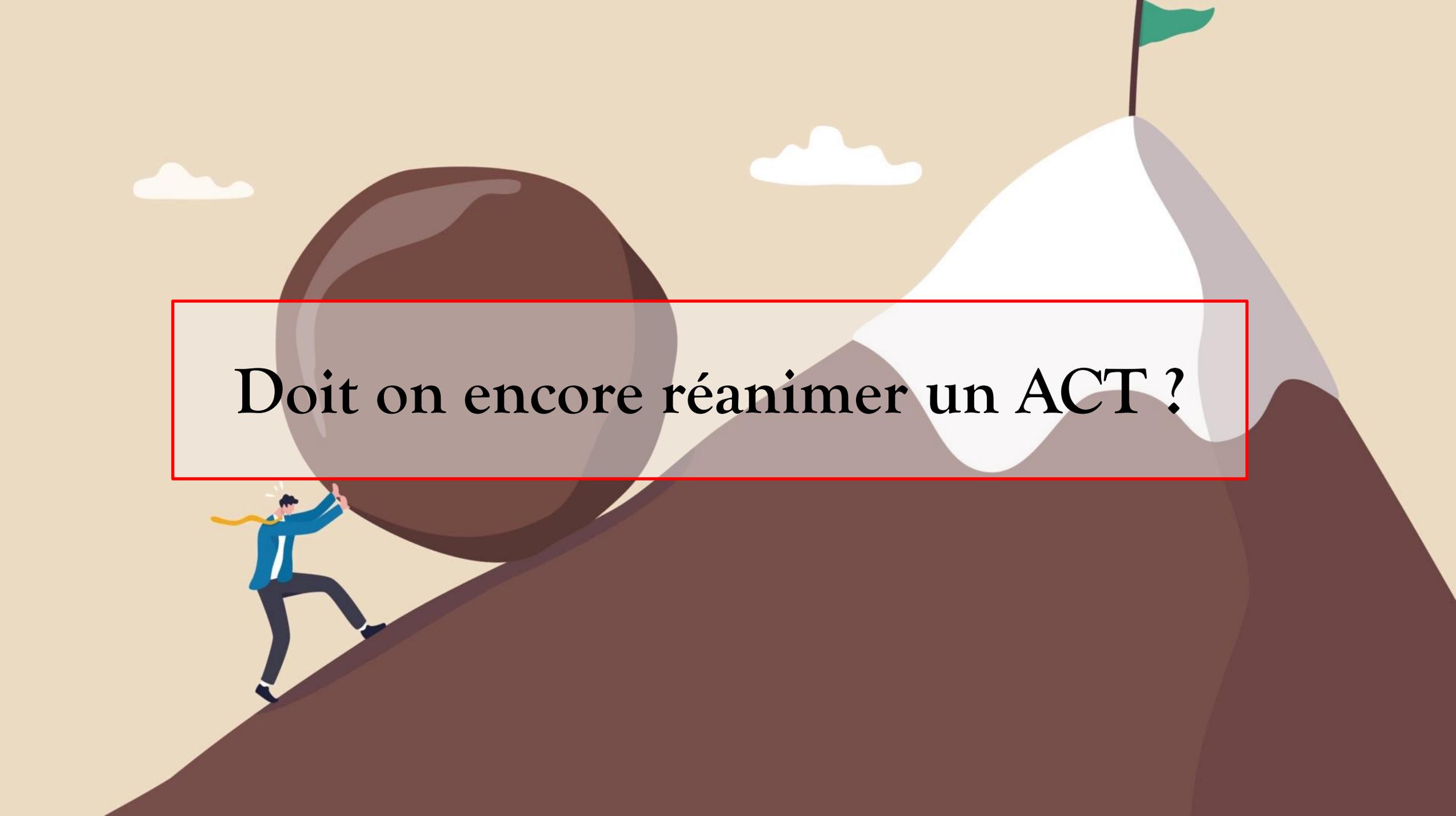
**mais 2 REALITES**

**EPIDEMIOLOGIE**

**PRISE EN CHARGE**

**PRONOSTIC**

**MECANISMES**

An illustration depicting a man in a blue suit and yellow tie pushing a large, dark brown sphere up a dark brown hill. In the background, a mountain peak is covered in white snow and topped with a green flag. The sky is a light beige color with a few white clouds. A red rectangular border frames the central text.

**Doit on encore réanimer un ACT ?**

> [J Trauma](#). 1993 Sep;35(3):468-73; discussion 473-4.

## Prehospital traumatic cardiac arrest: the cost of futility

[A S Rosemurgy](#) <sup>1</sup>, [P A Norr](#)

[Affiliations](#) + [expand](#)

PMID: 8371308

> [Injury](#). 2006 May;37(5):448-54. doi: 10.1016/j.injury.2005.11.011. Epub 2006 Jan 20.

## Cardiopulmonary resuscitation after traumatic cardiac arrest is not always futile

[Cameron D Willis](#) <sup>1</sup>, [Peter A Ca](#)

[Affiliations](#) + [expand](#)

PMID: 16427640 DOI: [10.1016](#)

[Randomized Controlled Trial](#)

> [Crit Care Med](#). 2007 Oct;35(10):2251-5.

doi: 10.1097/01.ccm.00000281859.61545.22.

## Does the prognosis of cardiac arrest differ in trauma patients?

[Jean-Stephane David](#) <sup>1</sup>, [Pierre-Yves Gueugniaud](#), [Bruno Riou](#), [Emmanuel Pham](#),  
[Pierre-Yves Dubien](#), [Patrick Goldstein](#), [Marc Freysz](#), [Paul Petit](#)

## Survival and neurologic outcome after traumatic out-of-hospital cardiopulmonary arrest in a pediatric and adult population: a systematic review

Jörn Zwingmann\*, Alexander T Mehlhorn, Thorsten Hammer, Jörg Bayer, Norbert P Südkamp and Peter C Strohm

### Abstract

**Introduction:** This systematic review is focused on the in-hospital mortality and neurological outcome of survivors after prehospital resuscitation following trauma. Data were analyzed for adults/pediatric patients and for blunt/penetrating trauma.

**Methods:** A systematic review was performed using the data available in Ovid Medline. 476 articles from 1/1964 - 5/2011 were identified by two independent investigators and 47 studies fulfilled the requirements (admission to hospital after prehospital resuscitation following trauma). Neurological outcome was evaluated using the Glasgow outcome scale.

**Results:** 34 studies/5391 patients with a potentially mixed population (no information was found in most studies if and how many children were included) and 13 paediatric studies/1243 children (age  $\leq$  18 years) were investigated. The overall mortality was 92.8% (mixed population: 238 survivors, lethality 96.7%; paediatric group: 237 survivors, lethality 86.4% =  $p < 0.001$ ). Penetrating trauma was found in 19 studies/1891 patients in the mixed population (69 survivors, lethality: 96.4%) and in 3 pediatric studies/91 children (2 survivors lethality 97.8%).

44.3% of the survivors in the mixed population and 38.3% in the group of children had a good neurological recovery. A moderate disability could be evaluated in 13.1% in the mixed population and in 12.8% in children. A severe disability was found in 29.5% of the survivors in the mixed patients and in 38.3% in the group of children. A persistent vegetative state was the neurological status in 9.8% in the mixed population and in 10.6% in children. For each year prior to 2010, the estimated log-odds for survival decreased by 0.022 (95%-CI: [0.038;0.006]). When jointly analyzing the studies on adults and children, the proportion of survivors for children is estimated to be 17.8% (95%-CI: [15.1%;20.8%]). The difference of the paediatric compared to the adult proportion is significant ( $p < 0.001$ ).

**Conclusions:** Children have a higher chance of survival after resuscitation of an out-of-hospital traumatic cardiac arrest compared to adults but tend to have a poorer neurological outcome at discharge.

## Organ donation in trauma victims: A systematic review and meta-analysis

Adam Cameron, MD, Mete Erdogan, PhD, MHI, Sara Lanteigne, MBA, Alexandra Hetherington, MSc, and Robert S. Green, MD, Halifax, Nova Scotia, Canada

## Prehospital predictors for return of spontaneous circulation in traumatic cardiac arrest

Benhamed, Axel M.Sc<sup>1,2,3,4</sup>; Canon, Valentine PhD<sup>5,6</sup>; Mercier, Eric M.Sc<sup>2,3</sup>; Heidet, Matthieu PhD<sup>7</sup>; Gossio, Amaury<sup>1</sup>; Savary, Dominique PhD<sup>8</sup>; El Khoury, Carlos PhD<sup>4,9,10</sup>; Gueugniaud, Pierre-Yves PhD<sup>1,5</sup>; Hubert, Hervé PhD<sup>5,6</sup>; Tazarourte, Karim PhD<sup>1,4,5</sup>

Author Information 

Journal of Trauma and Acute Care Surgery: November 17, 2021 - Volume - Issue -  
doi: 10.1097/TA.0000000000003474

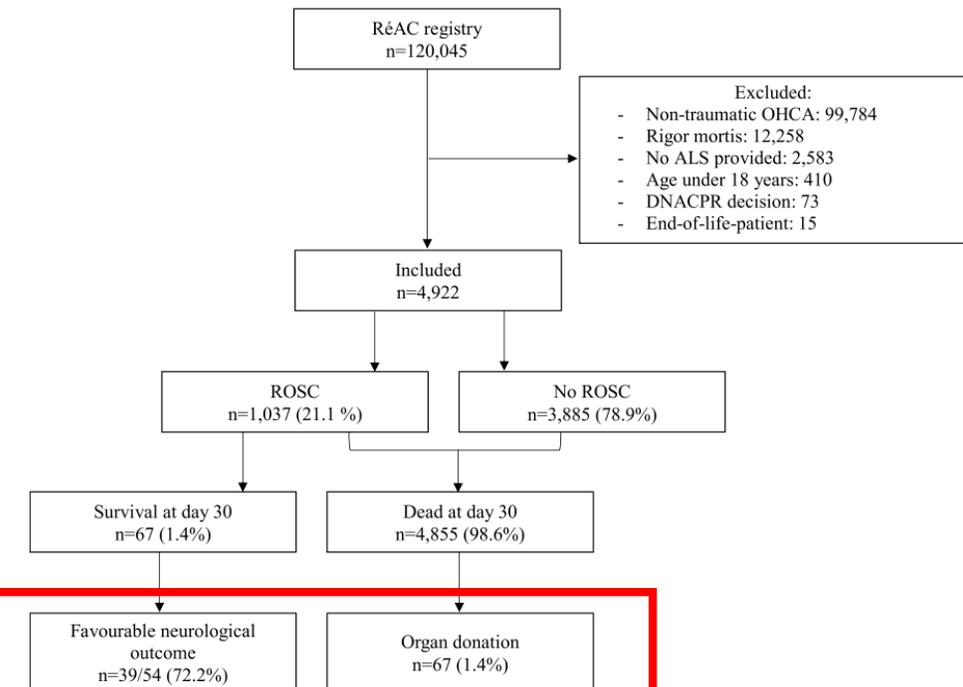


Figure 1. DNACPR dot-not-attempt-cardiopulmonary-resuscitation.

Pre-arrest and intra-arrest prognostic factors associated with survival following traumatic out-of-hospital cardiac arrest – A systematic review and meta-analysis

Alexandre Tran · Shannon M. Fernando · Bram Rochweg · ... Christopher Hicks · Elliott R. Haut · Jeffrey J. Perry · Show all authors

Published: June 09, 2020 · DOI: <https://doi.org/10.1016/j.resuscitation.2020.05.052> · Check for updates

**Long-Term Neurological Outcomes**

We identified 11 studies describing long-term survival with neurological outcome [3, 5, 41, 48, 50-52, 54, 62-64], the findings for which are summarized in the *Supplement*. Utilizing the Glasgow Outcome Scale [18], there were 131 (3.7%) long-term survivors of which 73 had a good neurological recovery (55.7% of survivors).

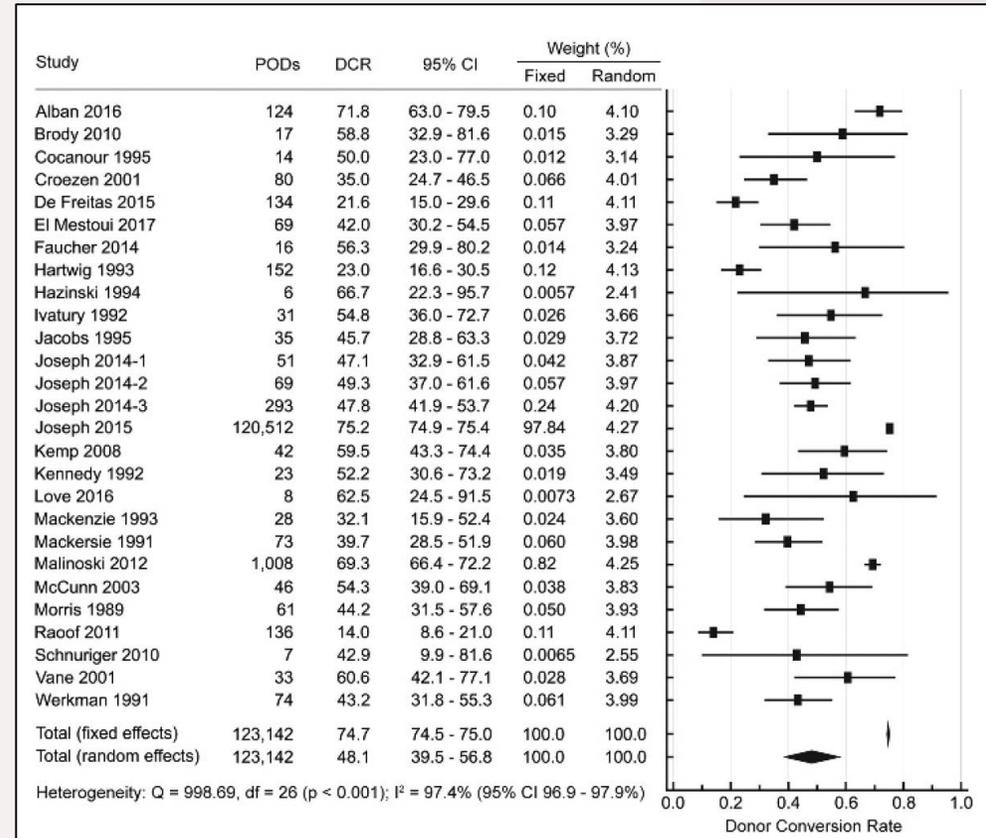
27 articles with a total of 123,142 participants.

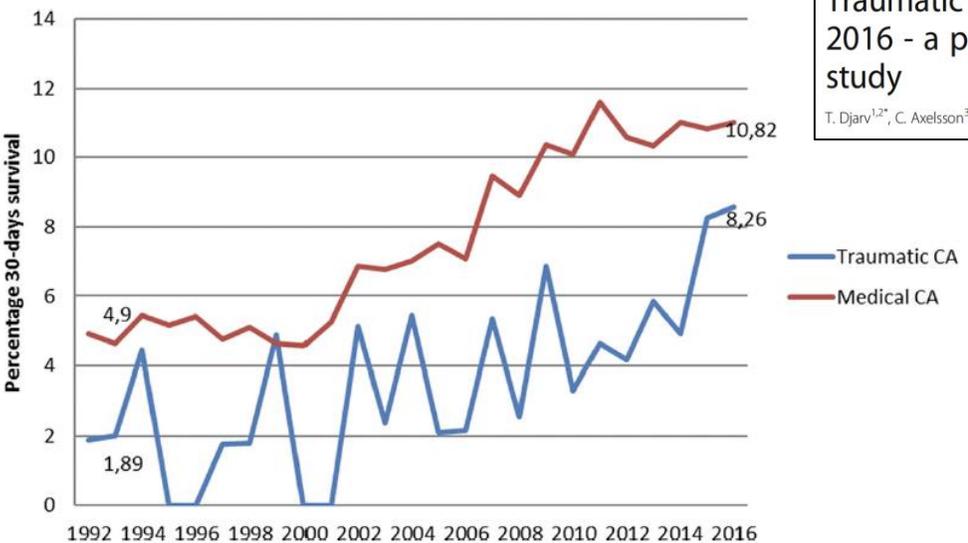
Conversion rates ranged from 14.0% to 75.2% (median, 49.3%).

Meta-Analysis > J Trauma Acute Care Surg. 2018 Jun;84(6):994-1002.  
doi: 10.1097/TA.0000000000001886.

**Organ donation in trauma victims: A systematic review and meta-analysis**

Adam Cameron <sup>1</sup>, Mete Erdogan, Sara Lanteigne, Alexandra Hetherington, Robert S Green

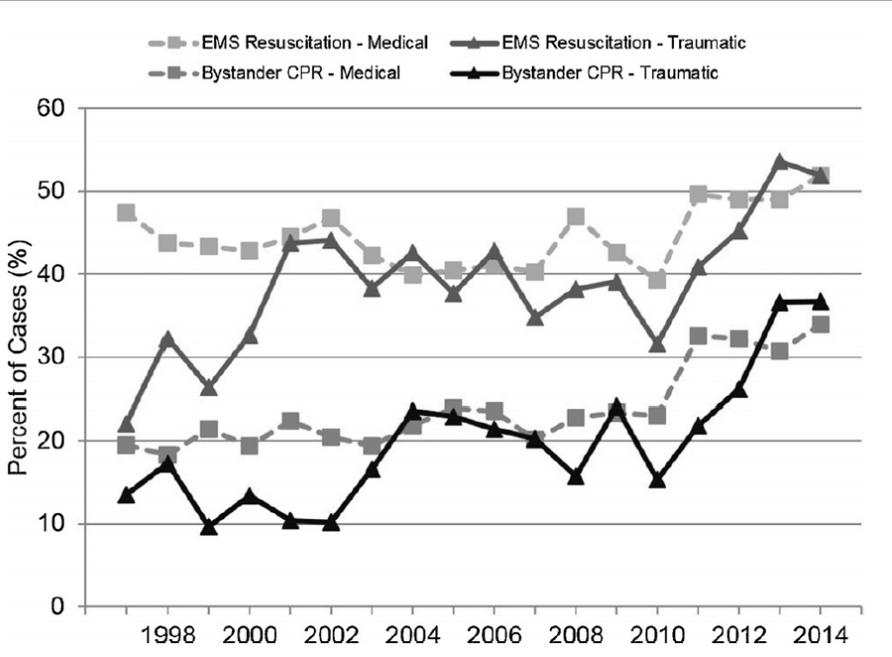




**Traumatic cardiac arrest in Sweden 1990-2016 - a population-based national cohort study**  
 T. Djarv<sup>1,2\*</sup>, C. Axelsson<sup>3</sup>, J. Herlitz<sup>2,3</sup>, A. Stromsoe<sup>4</sup>, J. Israelsson<sup>5,6,7</sup> and A. Claesson<sup>2,3</sup>

**Doit on réanimer un ACT ? OUI**

- Il y a des survivants, même en asystolie
- Pronostic neurologique favorable
- Dons d'organe
- Survie en augmentation (?)



**Fig. 3.** Temporal trends in the percentage of cases with bystander CPR and paramedic resuscitation segregated by medical and traumatic aetiologies. This data includes paramedic-witnessed arrests.

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**Resuscitation**

ELSEVIER journal homepage: [www.elsevier.com/locate/resuscitation](http://www.elsevier.com/locate/resuscitation)

EUROPEAN RESUSCITATION COUNCIL

Clinical paper

**Trends in traumatic out-of-hospital cardiac arrest in Perth, Western Australia from 1997 to 2014<sup>†</sup>**

Ben Beck<sup>a,\*</sup>, Hideo Tohira<sup>b</sup>, Janet E Bray<sup>a,b</sup>, Lahn Straney<sup>a</sup>, Elizabeth Brown<sup>b,c</sup>, Madoka Inoue<sup>b</sup>, Teresa A. Williams<sup>b,c</sup>, Nicole McKenzie<sup>b</sup>, Antonio Celenza<sup>d</sup>, Paul Bailey<sup>b,c</sup>, Judith Finn<sup>a,b,c</sup>

**Table 3**  
 Multivariable analysis on paramedic decision to resuscitate non EMS witnessed non shockable traumatic OHCA and 'presumed cardiac' cardiac arrest.

Covariate	Traumatic OHCA OR (95% CI)	Presumed cardiac OR (95% CI)
Year		
2000-2006	1	1
2007	0.96 (0.58-1.57)	1.21 (1.08-1.36)
2008	1.60 (1.00-2.52)	0.87 (0.77-0.98)
2009	1.99 (1.25-3.19)	0.83 (0.74-0.94)



QUI réanimer ?



## Revisiting traumatic cardiac arrest: should CPR be initiated?

Katie L. Konesky<sup>1</sup> · Weidun Alan Guo<sup>1</sup>

Received: 26 July 2017 / Accepted: 4 November 2017  
© Springer-Verlag GmbH Germany, part of Springer Nature 2017

## Traumatic Cardiac Arrest: Who Are the Survivors?

David Lockey, FRCA, FIMC,  
RCS(Ed)

Kate Croudson, MB, BS, BSc  
Gareth Davies, FFAEM, FRCP

# Trauma Patients Receiving CPR: Predictors of Survival

*John J. Pickens, MD, Michael K. Copass,*

REVIEW | VOLUME 153, P119-135, AUGUST 01, 2020

Pre-arrest and intra-arrest prognostic factors associated with survival following traumatic out-of-hospital cardiac arrest – A systematic review and meta-analysis

Alexandre Tran   • Shannon M. Fernando • Bram Rochweg • ... Christopher Hicks • Elliott R. Haut • Jeffrey J. Perry • [Show all authors](#)

Published: June 09, 2020 • DOI: <https://doi.org/10.1016/j.resuscitation.2020.05.052> •



# Les causes dites réversibles/curables

♦ **TRAQUER +++**

♦ Pour TRAITER en PRIORITE

4H

Hypovolémie

Hypoxie

Hypothermie

Hypo/hyperK<sup>+</sup>

4T

Tension

Tamponnade

Toxique

Thrombose

Pre-arrest and intra-arrest prognostic factors associated with survival following traumatic out-of-hospital cardiac arrest – A systematic review and meta-analysis

Alexandre Tran • Shannon M. Fernando • Bram Rochweg • ... Christopher Hicks • Elliott R. Haut • Jeffrey J. Perry • Show all authors

Published: June 09, 2020 • DOI: <https://doi.org/10.1016/j.resuscitation.2020.05.052> • Check for updates

**Conclusion:** This review provides very low to moderate certainty evidence that pre- and intra-arrest prognostic factors following penetrating or blunt traumatic OHCA predict ROSC and survival. This evidence is primarily based on unadjusted data. Further well-designed studies with larger cohorts are warranted to test the adjusted prognostic ability of pre- and intra-arrest factors and guide therapeutic decision-making.

Predictors of ROSC

Predictors of survival

- Sex (male)

- Cardiac motion
- Shockable rhythm
- Witnessed arrest
- Epinephrine

- Penetrating trauma 0.97 [0.51-1.85]
- Bystander resuscitation 1.04 [0.81-1.34]

**Study Characteristics**

*Table 1* presents the characteristics of included studies. Of the 53 included studies, there were 24 (45.3%) from North America, 15 (28.3%) from Europe, 11 (20.8%) from Asia and 3 (5.7%) from Australia. All studies used observational designs, 48 (90.6%) of which were retrospective. There were 29 (54.7%) studies with multi-institutional involvement. There were 48 (90.6%) studies including a mixed mechanism population and 5 (9.4%) studies including only blunt mechanism.

- 4-0.88]
- 3-0.93]

- 87-613.42]
- 9-10.44]
- 9-2.60]
- 9-2.79]

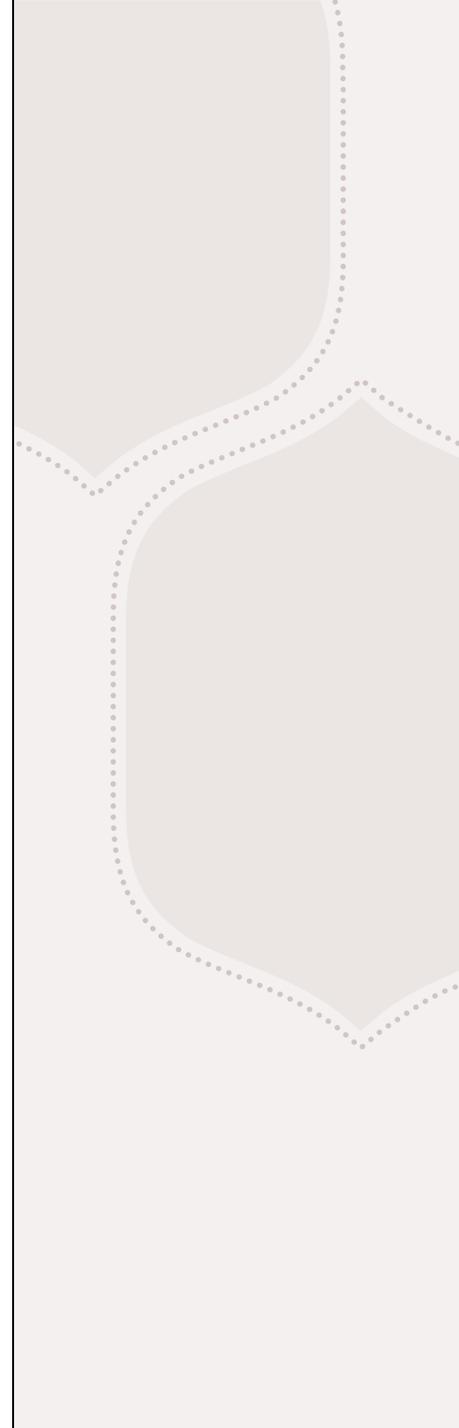
- Penetrating trauma 1.40 [0.79-2.48]
- Sex (male) 1.19 [0.89-1.59]



**Pneumothorax compressif:  
décompression  
à l'aiguille ou au doigt ?**

VOUS VOULEZ UN WHISKY ?

JUSTE UN DOIGT



> Injury. 2012 Jan;43(1):42-5. doi: 10.1016/j.injury.2010.11.022. Epub 2010 Dec 24.

## Determination of the appropriate catheter length for needle thoracostomy by using computed tomography scans of trauma patients in Japan

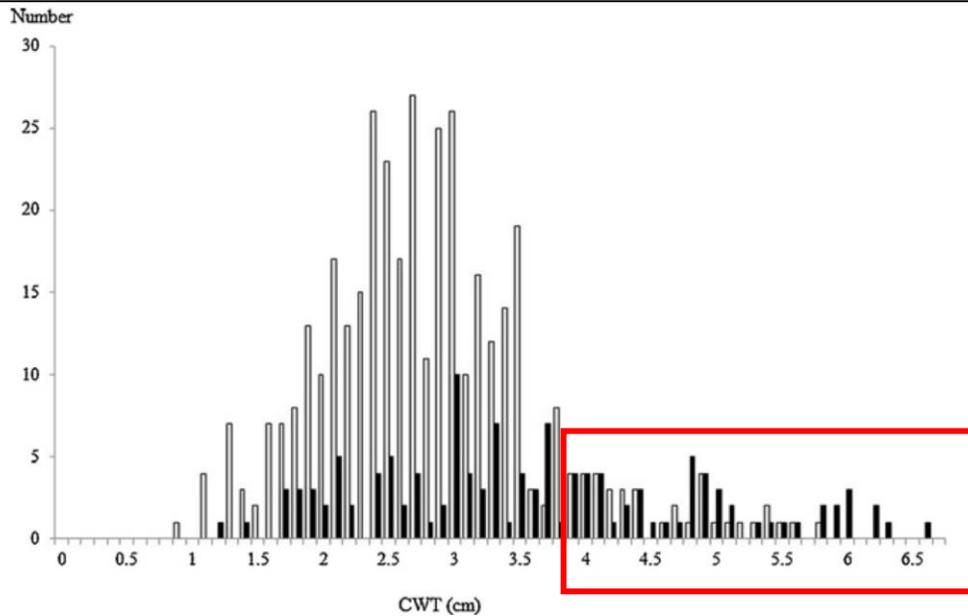
Takeshi Yamagiwa<sup>1</sup>, Seiji Morita, Rie Yamamoto, Tomoko Seki, Katsuhiko Sugimoto, Sadaki Inokuchi

## Chest wall thickness and decompression failure: A systematic review and meta-analysis comparing anatomic locations in needle thoracostomy

Daniel V. Laan ✉ • Trang Diem N. Vu ✉ • Cornelius A. Thiels ✉ • ... Henry J. Schiller ✉ •

M. Hassan Murad<sup>1</sup> ✉ • Johnathon M. Aho<sup>1</sup> ✉ • Show all authors • Show footnotes

Published: December 13, 2015 • DOI: <https://doi.org/10.1016/j.injury.2015.11.045> •  Check for updates



**Fig. 1.** Histogram of CWT in males and females. CWT: chest wall thickness. The grey and black bars indicate males and females, respectively. CWT ranged from a minimum of 0.96 cm to a maximum 6.68 cm.

The search resulted in 34,652 studies

- 15 were included for CWT analysis
- 13 for NT effectiveness.
- Mean CWT was:
  - 43 mm at the 2nd intercostal space on the midclavicular line (MCL)
  - 40 mm at the 4th/5th ICS mid axillary line (MAL)
  - **34 mm at the 4th/5th ICS at the anterior axillary line (AAL)**
- Mean failure rate was
  - 38% (95% CI, 24-54) at 2nd ICS-MCL
  - 31% (95% CI, 10-64) at MAL
  - **13% (95% CI, 8-22) at the 4th/5th ICS at the anterior axillary line**

Matériel adapté  
Attention aux aiguilles trop courtes et qui  
courbent

A photograph of a person lying on a massage table, receiving a massage. The person's hands are resting on their back. The background is a blurred indoor setting. A red-bordered box is overlaid on the image, containing the text.

**Faut il abandonner le massage ?**

# Outcomes following military traumatic cardiorespiratory arrest: A prospective observational study

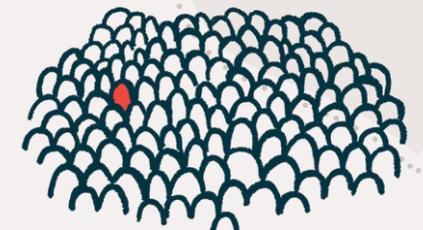
Nicholas T. Tarmey   • Claire L. Park   • Oliver J. Bartels   • Thomas C. Konig    
 Peter F. Mahoney   • Adrian J. Mellor  

Published: May 30, 2011 • DOI: <https://doi.org/10.1016/j.resuscitation.2011.04.018>

**Table 2**  
 Characteristics of TCRA by category of outcome.

		All Patients (N = 52)	No ROSC (N = 38)	ROSC (N = 14)	Survivors (N = 4)
Age <sup>a</sup>					
Age	Mean (range) in yrs	24.5 (18–36)	24.6 (19–36)	24.1 (18–35)	24.5 (20–35)
Mechanism of injury					
IED	Number (%)	34 (65%)	24 (63%)	10 (71%)	4 (100%)
GSW	Number (%)	17 (33%)	13 (34%)	4 (29%)	0
Grenade	Number (%)	1 (2%)	1 (3%)	0	0
Injury severity scores <sup>b</sup>					
ISS (2005)	Median (range)	33 (9–75)	41 (9–75)	20 (13–59)	16.5 (13–24)
NISS (2005)	Median (range)	50 (16–75)	57 (9–75)	38.5 (17–66)	31.5 (17–41)
Cause of arrest					
Exsanguination	Number (%)	42 (81%)	30 (79%)	12 (86%)	3 (75%)
Brain injury	Number (%)	7 (13%)	6 (16%)	1 (7%)	0
Airway obstruction	Number (%)	1 (2%)	1 (3%)	0	0
Cardiac tamponade	Number (%)	1 (2%)	0	1 (7%)	1 (25%)
C-Spine injury	Number (%)	1 (2%)	1 (3%)	0	0
Location of arrest					
Ground	Number (%)	29 (56%)	24 (63%)	5 (36%)	0
Transfer to hospital	Number (%)	16 (31%)	13 (34%)	3 (21%)	1 (25%)
Field hospital	Number (%)	7 (13%)	1 (3%)	6 (43%)	3 (75%)
Time intervals <sup>c</sup>					
Arrest to ROSC	Median (range) in mins	9 (2–24)	n/a	9 (2–24)	8 (5–24)
Initial ECG during arrest <sup>d</sup>					
Asystole	Number (%)	29 (63%)	28 (82%)	1 (8%)	0
Sinus-based > 40bpm	Number (%)	13 (28%)	4 (12%)	9 (75%)	3 (75%)
Agonal	Number (%)	4 (9%)	2 (6%)	2 (17%)	1 (25%)
VF/VT	Number (%)	0	0	0	0
Cardiac activity on ultrasound <sup>e</sup>					
No activity	Number (%)	18 (75%)	18 (100%)	0	0
Activity	Number (%)	6 (25%)	0	6 (100%)	2 (100%)
Resuscitative thoracotomy					
RT done	Number (%)	12 (23%)	3 (8%)	9 (64%)	4 (100%)

**Don't pump an empty heart**



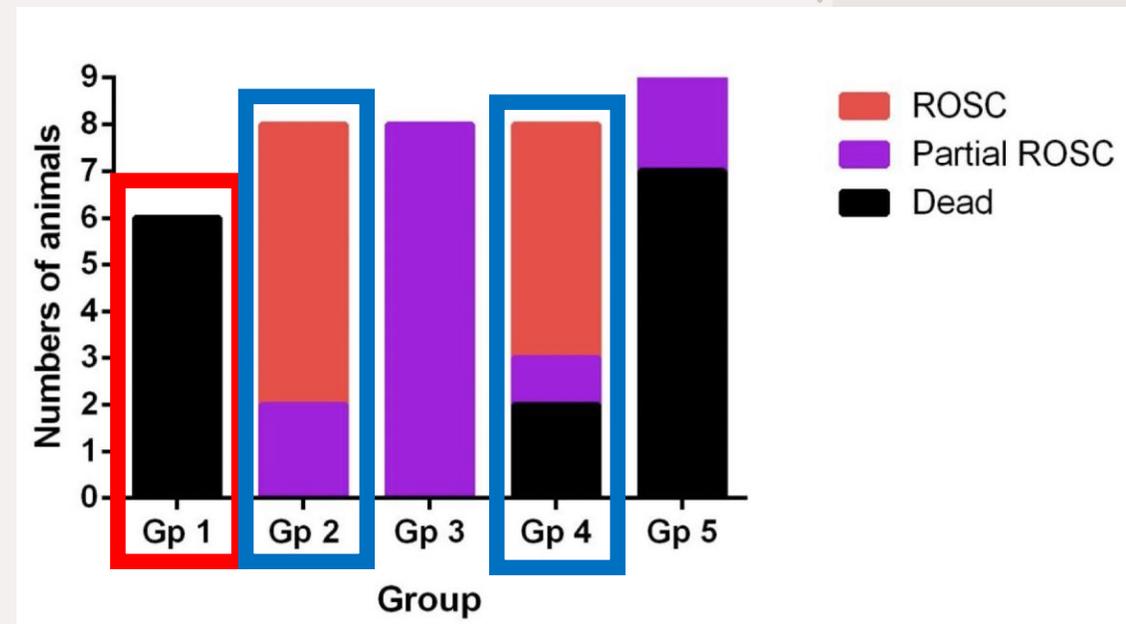


Animals underwent captive bolt injury to the right thigh and controlled haemorrhage (30% blood volume).  
 60 minutes later there was a further haemorrhage to a MAP of 20 mmHg.

Le massage oui mais n'est pas la priorité !!  
 « Don't pump an empty heart »  
 D'abord traquer et traiter les causes curables !!!

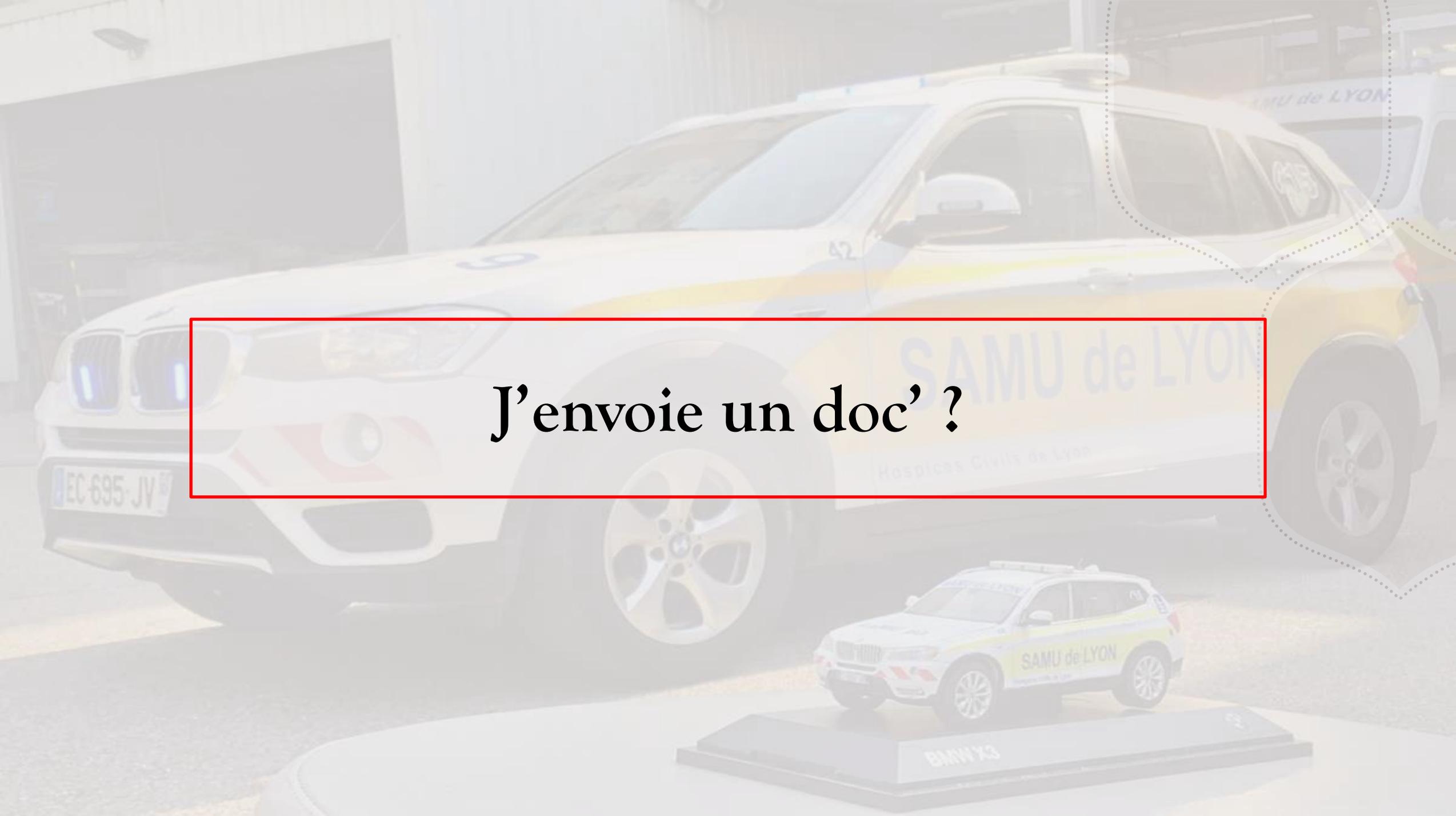
The randomised resuscitation protocol was initiated within 5 min:

- Group 1: CCC
- Group 2: IV whole blood
- Group 3: IV 0.9% saline
- Group 4: IV whole blood + CCC
- Group 5: IV saline + CCC



- Primary outcome was attainment of ROSC at Study End (15min post-resuscitation)
  - Gp 2 vs Gp 4: p=0.44
  - Gp 3 vs 5: p=0.0023

J'envoie un doc' ?



# Association of Prehospital Advanced Life Support by Physician With Survival After Out-of-Hospital Cardiac Arrest With Blunt Trauma Following Traffic Collisions

## Japanese Registry-Based Study

Tatsuma Fukuda, MD, PhD; Naoko Ohashi-Fukuda, MD; Yutaka Kondo, MD, PhD; Kei Hayashida, MD, PhD; Ichiro Kukita, MD, PhD

- P Patients who experienced traumatic OHCA following a traffic collision (2013-2014)
- I Advanced life support by physician
- C ALS by EMS personnel, or BLS only
- O 1-month survival / prehospital ROSC/ favorable neurologic outcomes

828 (18.9%) = prehospital ALS by physician  
 1591 (36.3%) = prehospital ALS by EMS personnel  
 1963 (44.8%) = BLS only

### Survival:

3.1%  
 1.6%  
 2.3%

**Table 2. Outcomes of Patients With Traumatic OHCA by the Type of Prehospital Care in the Total Cohort<sup>a</sup>**

Group	Prehospital ROSC		One-Month Survival		Neurologic Outcome (CPC 1 or 2)	
	Events, No. (%)	Adjusted OR (95% CI)	Events, No. (%)	Adjusted OR (95% CI)	Events, No. (%)	Adjusted OR (95% CI)
BLS (n = 1963)	95 (4.8)	1 [Reference]	45 (2.3)	1 [Reference]	14 (0.7)	1 [Reference]
ALS (n = 2419)	204 (8.4)	1.87 (1.43-2.46)	51 (2.1)	1.24 (0.81-1.91)	12 (0.5)	0.9 (0.5-1.5)
By EMS personnel (n = 1591)	110 (6.9)	1.60 (1.19-2.16)	25 (1.6)	0.91 (0.54-1.51)	4 (0.3)	0.4 (0.1-1.1)
By physician (n = 828)	94 (11.4)	2.41 (1.74-3.35)	26 (3.1)	1.94 (1.14-3.25)	8 (1.0)	1.1 (0.3-3.8)

**Table. Outcomes of traumatic OHCA patients in ALS by physician vs ALS by EMS personnel**

Group	Prehospital ROSC		One-month survival		Neurologic outcome (CPC 1 or 2)	
	No. (%) of Events	Adjusted OR (95%CI)	No. (%) of Events	Adjusted OR (95%CI)	No. (%) of Events	Adjusted OR (95%CI)
ALS n = 2419	204 (8.4)		51 (2.1)		12 (0.5)	
by EMS personnel n = 1591	110 (6.9)	Reference	25 (1.6)	Reference	4 (0.3)	Reference
by physician n = 828	94 (11.4)	1.51 (1.11-2.06)	26 (3.1)	2.13 (1.20-3.78)	8 (1.0)	3.76 (1.14-14.51)

**CONCLUSIONS AND RELEVANCE** In traumatic OHCA, ALS by physician was associated with increased chance of 1-month survival compared with both ALS by EMS personnel and BLS.



## Impact of the 2015 European guidelines for resuscitation on traumatic cardiac arrest outcomes and prehospital management: A French nationwide interrupted time-series analysis

Axel Benhamed<sup>a,b,\*</sup>, Eric Mercier<sup>b</sup>, Julie Freyssenge<sup>c,d</sup>, Mathieu Heidet<sup>e</sup>, Tobias Gauss<sup>f</sup>, Valentine Canon<sup>g</sup>, Clement Claustre<sup>c</sup>, Karim Tazarourte<sup>a,d</sup>,  
On behalf of the RéAC investigator<sup>1</sup>

**Table 2 – Prehospital MMT management and outcomes.**

	Overall n = 4,980	Pre-publication period n = 2,145	Post-publication period n = 2,739	p value	Missing
Endotracheal intubation, n (%)	4,678 (93.9)	2,033 (94.8)	2,554 (93.2)	<b>0.03</b>	0
Injection route, n (%)					
Peripheral intravenous catheter	4,132 (83.0)	1,835 (85.5)	2,217 (80.9)	<b>&lt;0.001</b>	
Intraosseous catheter	823 (16.5)	279 (13.0)	525 (19.2)	<b>&lt;0.001</b>	
Central venous catheter	84 (1.7)	63 (2.9)	20 (0.7)	<b>&lt;0.001</b>	
Endotracheal	49 (1.0)	40 (1.9)	9 (0.3)	<b>&lt;0.001</b>	
Intravenous fluid resuscitation <sup>b</sup> , n (%)	2,023 (40.6)	1,006 (46.9)	980 (35.8)	<b>&lt;0.001</b>	0
Median volume (mL)	1000 [500;1000]	1000 [500;1000]	1000 [500;1000]	<b>&lt;0.001</b>	1,723 (34.6)
Bolus of adrenaline	4,584 (92.1)	1,953 (91.1)	2,547 (93.0)	<b>0.017</b>	3 (0.06)
Continuous infusion of catecholamine, n (%)	610 (12.2)	301 (14.0)	291 (10.6)	<b>&lt;0.001</b>	0
External haemorrhage control <sup>a</sup> , n (%)	426 (34.9)	210 (23.9)	208 (64.8)	<b>&lt;0.001</b>	0
Needle chest decompression, n (%)	293 (5.9)	141 (6.6)	150 (5.5)	0.12	0
Bilateral chest decompression, n (%)	753 (15.1)	294 (13.7)	451 (16.5)	<b>0.009</b>	0
Packed red cells transfusion, n (%)	239 (4.8)	58 (2.7)	178 (6.5)	<b>&lt;0.001</b>	0
Outcomes, n (%)					
Prehospital ROSC	1,060 (21.3)	480 (22.4)	553 (20.2)	0.067	1 (0.02)
30-day survival <sup>c</sup>	71 (1.4)	31 (1.4)	37 (1.4)	0.87	1 (0.02)
CPC 1–2 at day 30	39 (68.4)	20 (71.4)	18 (66.7)	0.93	14 (19.7)
Organ donation	68 (1.5)	33 (1.6)	34 (1.3)	0.50	297 (6.0)

CPC: cerebral performance category; ROSC: return of spontaneous circulation.

<sup>a</sup> Among patients where an external haemorrhage has been identified by the physician in charge (n = 1,221).

<sup>b</sup> Includes crystalloids and colloids.

<sup>c</sup> Survival according to initial rhythm was 0.7% (n = 28), 2.2% (n = 9), 8.2% (n = 21) and 8.5% (n = 8) among patients in asystole, pulseless electrical activity, spontaneous electrical activity, and ventricular fibrillation/ventricular tachycardia respectively.



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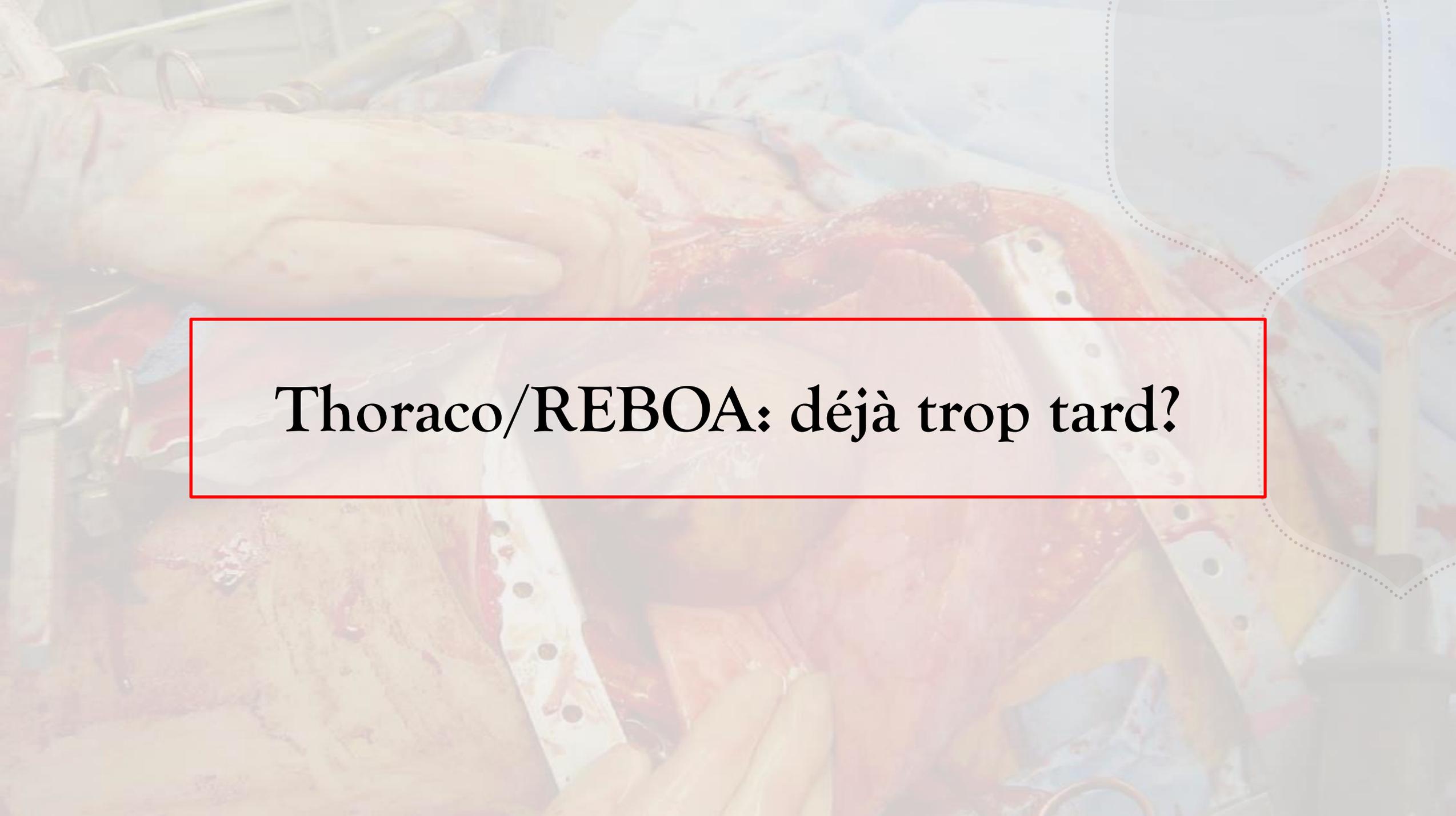
## Clinical paper

**Impact of the 2015 European guidelines for resuscitation on traumatic cardiac arrest outcomes and prehospital management: A French nationwide interrupted time-series analysis***Axel Benhamed<sup>a,b,\*</sup>, Eric Mercier<sup>b</sup>, Julie Freyssenge<sup>c,d</sup>, Mathieu Heidet<sup>e</sup>, Tobias Gauss<sup>f</sup>, Valentine Canon<sup>g</sup>, Clement Claustre<sup>c</sup>, Karim Tazarourte<sup>a,d</sup>, On behalf of the RéAC investigator<sup>1</sup>***Table 3b – Unadjusted and adjusted interruptive time series analyses, changes in outcomes trend (long term impact).**

Outcome	Unadjusted		Adjusted	
	OR [95% CI]	p value	aOR [95% CI]	p value
Prehospital ROSC	0.89 [0.79, 1.01]	0.06	0.88 [0.77, 1.00]	0.05
30-day survival	1.28 [0.83, 1.97]	0.27	1.34 [0.83, 2.17]	0.23
CPC 1–2 at day 30	1.52 [0.86, 2.69]	0.15	1.57 [0.82, 3.05]	0.17
Organ donation	1.05 [0.69, 1.57]	0.83	1.06 [0.71, 1.60]	0.77
Endotracheal intubation	0.89 [0.71, 1.11]	0.29	0.90 [0.72, 1.12]	0.35
Packed red cells transfusion	0.59 [0.43, 0.80]	<b>&lt;0.001</b>	0.59 [0.43, 0.80]	<b>&lt;0.001</b>
Needle chest decompression	1.24 [1.02, 1.52]	<b>0.03</b>	1.25 [1.02, 1.54]	<b>0.03</b>
Bilateral chest decompression	1.21 [1.05, 1.39]	<b>0.008</b>	1.20 [1.04, 1.39]	<b>0.01</b>
External haemorrhage control <sup>a</sup>	0.84 [0.67, 1.06]	0.14	0.77 [0.60, 0.98]	<b>0.04</b>

CPC: cerebral performance category; ROSC: return of spontaneous circulation.

<sup>a</sup> Among patients with external haemorrhage that was identified by the physician in charge.

A photograph of a thoracic surgical procedure. The image shows a patient's chest with a large incision, and a surgeon's gloved hands are visible. A red-bordered text box is overlaid on the image, containing the text "Thoraco/REBOA: déjà trop tard?".

**Thoraco/REBOA: déjà trop tard?**

## Survival after emergency department thoracotomy: review of published data from the past 25 years<sup>2 2</sup>

Peter M Rhee MD, MPH (FACS)<sup>a, b, c</sup>, Jose Acosta MD (FACS)<sup>a, b</sup>, Amy Bridgeman RN, BSN<sup>b</sup>, Dennis Wang MD (FACS)<sup>a, b</sup>, Marion Jordan MD (FACS)<sup>a, b</sup>, Norman Rich MD (FACS)<sup>a</sup>

Objective: Determine the main factors that most influence survival after EDT

24 studies (4,620 cases)

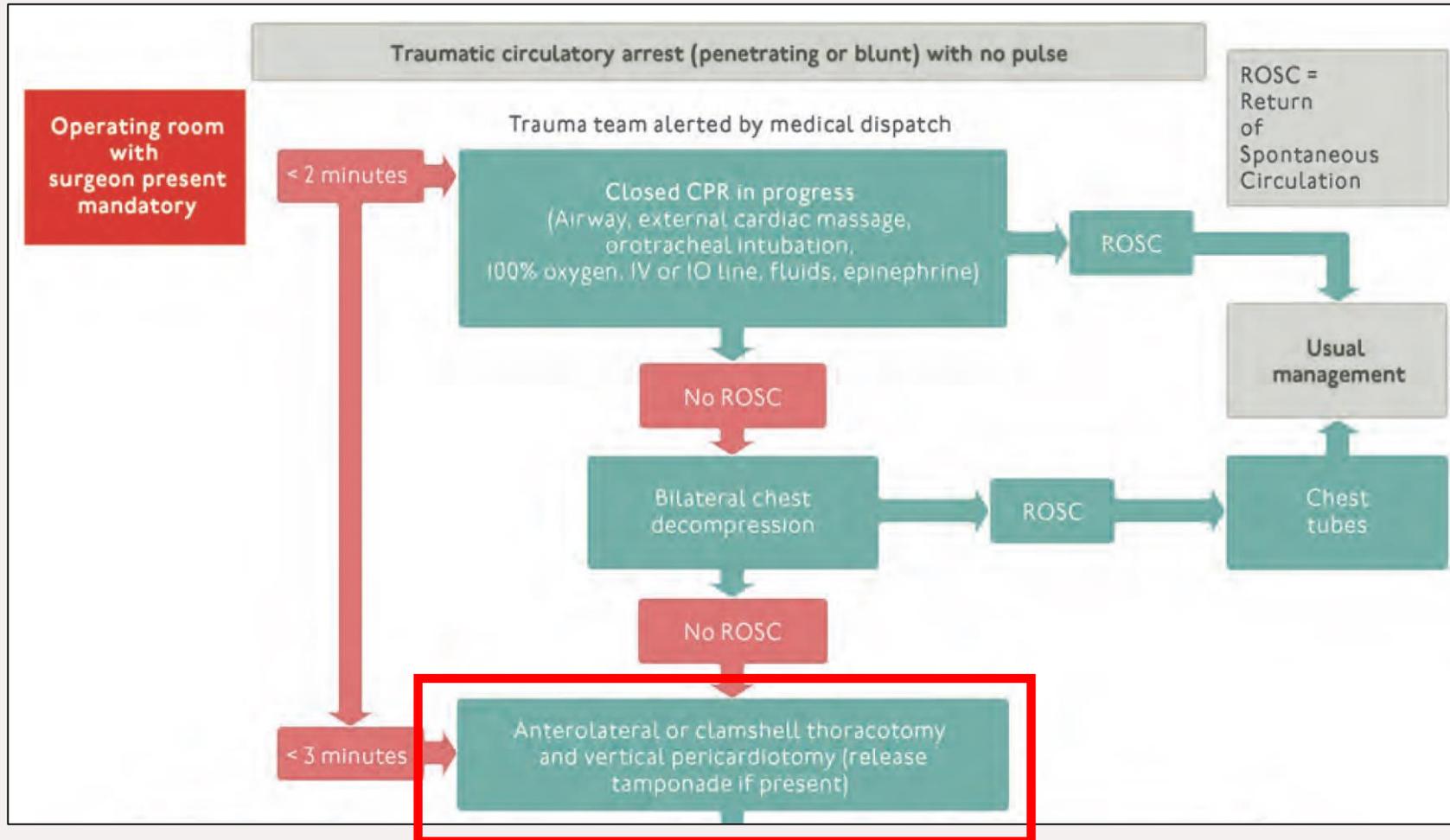
Overall survival = 7.4%

Normal neurologic outcomes = 92.4% (of survivors)

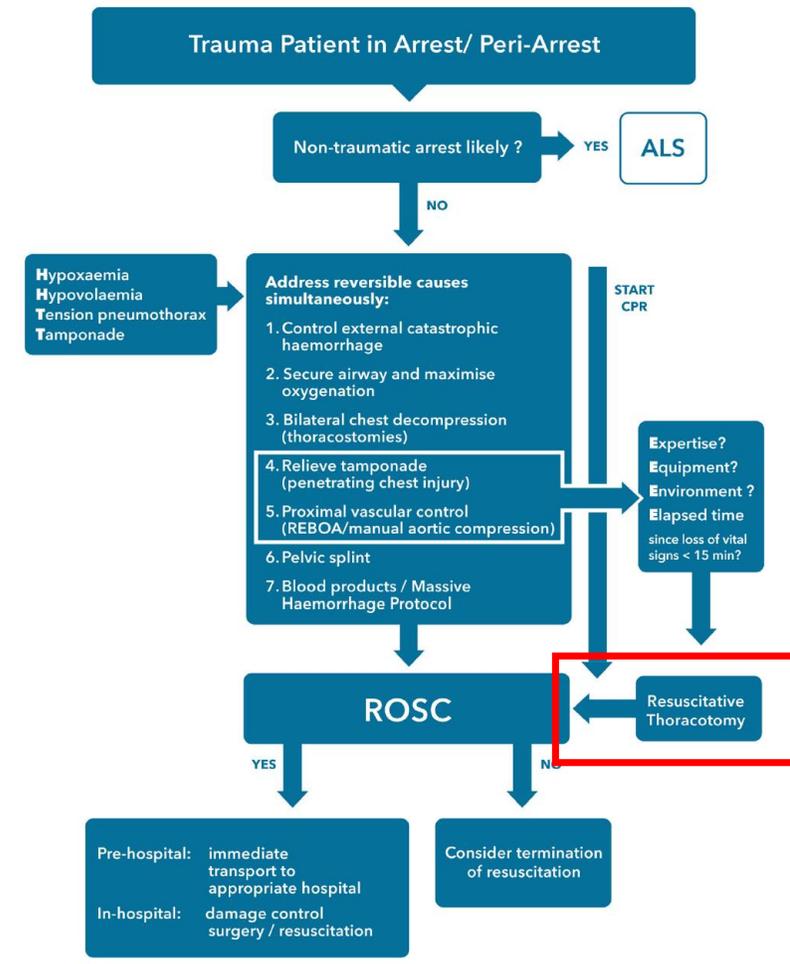
### Factors reported as influencing survival were:

- **Mechanism of injury**
  - 8.8% for **penetrating injuries** vs 1.4% for blunt injuries
  - **16.8% for stab wounds** vs 4.3% for gunshot injuries
- **Location of major injury**
  - 10.7% for **thoracic injuries** vs 4.5% for abdominal injuries and 0.7% for multiple injuries
  - **19.4% for heart injuries**
- **Signs of life (SOL)**
  - **SOL+ on arrival at the hospital:** 11.5% ; during transport: 8.9% ; none during transport 2.6%; none in the field 1.2%

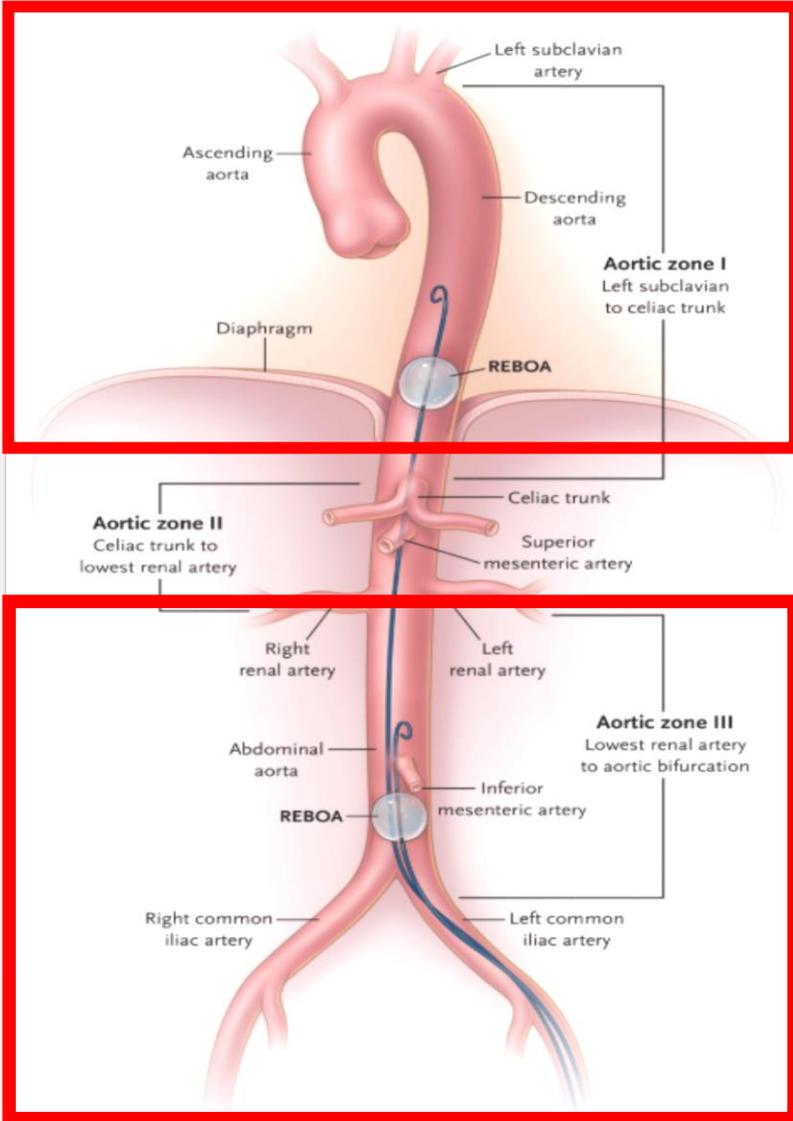
The best survival results are seen in patients who undergo EDT for **thoracic stab injuries and who arrive with SOL** in the emergency department.



**TRAUMATIC CARDIAC ARREST/ PERI-ARREST ALGORITHM**

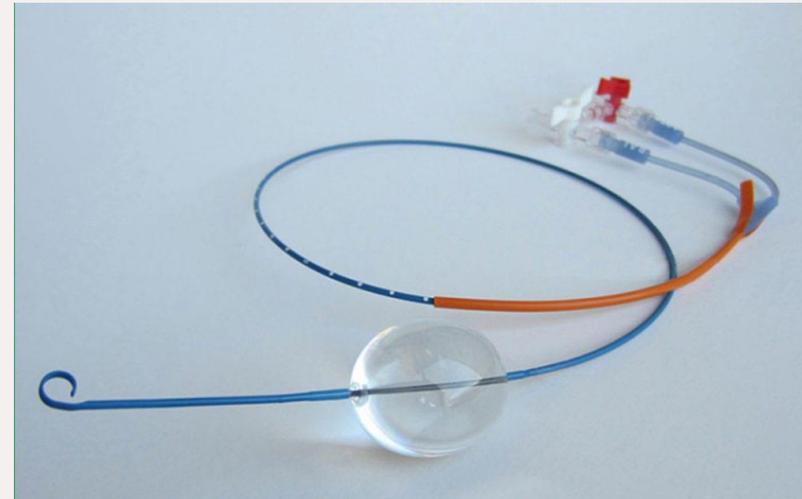


REBOA is a **minimally invasive alternative** to emergency department **thoracotomy** with **aortic cross-clamp** to **temporize noncompressible torso hemorrhage** and **obtain proximal control** in both traumatic and nontraumatic causes of hemorrhage



- Zone 1 (distal thoracic aorta)

- Intra-abdominal or retroperitoneal hemorrhage.
- Should not be used if cannot proceed to definitive hemorrhage control < 15 minutes.
- Total aortic occlusion times >30 min are associated with increased ischemic complications and risk of mortality



- Zone 3 (distal abdominal aorta)

- Isolated pelvic, junctional, or proximal lower extremity hemorrhage not amenable to tourniquet use.
- Should target ischemia time of less than 30 minutes, but no greater than 60 minutes

USE OF RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA IN A HIGHLY LETHAL MODEL OF NONCOMPRESSIBLE TORSO HEMORRHAGE

Jonathan J. Morrison,<sup>\*,††</sup> James D. Ross,<sup>§</sup> Robert Houston IV,<sup>‡¶</sup> J. Devin B. Watson,<sup>‡¶</sup> Kyle K. Sokol,<sup>‡§</sup> and Todd E. Rasmussen<sup>‡§¶</sup>

**No significant difference between REBOA and open procedures in :**

- Time to aortic occlusion:  $6.6 \pm 5.6$  min vs  $7.2 \pm 15.1$ ;  $p = 0.842$
- Survival: 28.2% vs 16.1%;  $p = 0.120$

- Des **résultats enthousiasmants chez l'animal**
- Sur la reperfusion (pression artérielle systolique)
- + Baisse de la mortalité

**The AAST prospective Aortic Occlusion for Resuscitation in Trauma and Acute Care Surgery (AORTA) registry**



Data on contemporary utilization and outcomes of aortic occlusion and resuscitative balloon occlusion of the aorta (REBOA)

Journal of Trauma and Acute Care Surgery: September 2016 - Volume 81 - Issue 3 - p 409-419  
doi: 10.1097/TA.0000000000001079

Original Investigation | Pacific Coast Surgical Association

FREE

February 2018

**Use of Resuscitative Endovascular Balloon Occlusion of the Aorta for Proximal Aortic Control in Patients With Severe Hemorrhage and Arrest**



Megan Brenner, MD, MS<sup>1</sup>; William Teeter, MD, MS<sup>1</sup>; Melanie Hoehn, MD<sup>1</sup>; et al

> Author Affiliations | Article Information

JAMA Surg. 2018;153(2):130-135. doi:10.1001/jamasurg.2017.3549

- 29 severe traumatic hemorrhage → 39% mortality
- 50 trauma arrest → 90% mortality
- 11 nontraumatic hemorrhage → 36% mortality

Trauma base 2004-2011

452 patients (1.0%) received REBOA

- Matching: vital signs, age, sex, anatomic and physiologic injury severity
- **Survival by REBOA treatment was OR: 0.30 (95% CI, 0.23-0.40)**

**Survival of severe blunt trauma patients treated with resuscitative endovascular balloon occlusion of the aorta compared with propensity score-adjusted untreated patients**

Norii, Tatsuya MD; Crandall, Cameron MD; Terasaka, Yusuke MD

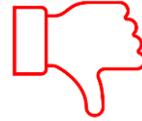
Author Information ☺

Journal of Trauma and Acute Care Surgery: April 2015 - Volume 78 - Issue 4 - p 721-728  
doi: 10.1097/TA.0000000000000578



# 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



JAMA Surg. 2019;154(6):500-508. doi:10.1001/jamasurg.2019.0096  
Published online March 20, 2019.

140 patients (0.03%) received REBOA

Design: 1:2 Propensity score matching: demographics, vital signs, mechanism, ISS, each body region AIS, pelvic fractures, lower extremity vascular injuries and fractures, and number and grades of intraabdominal solid organ injuries

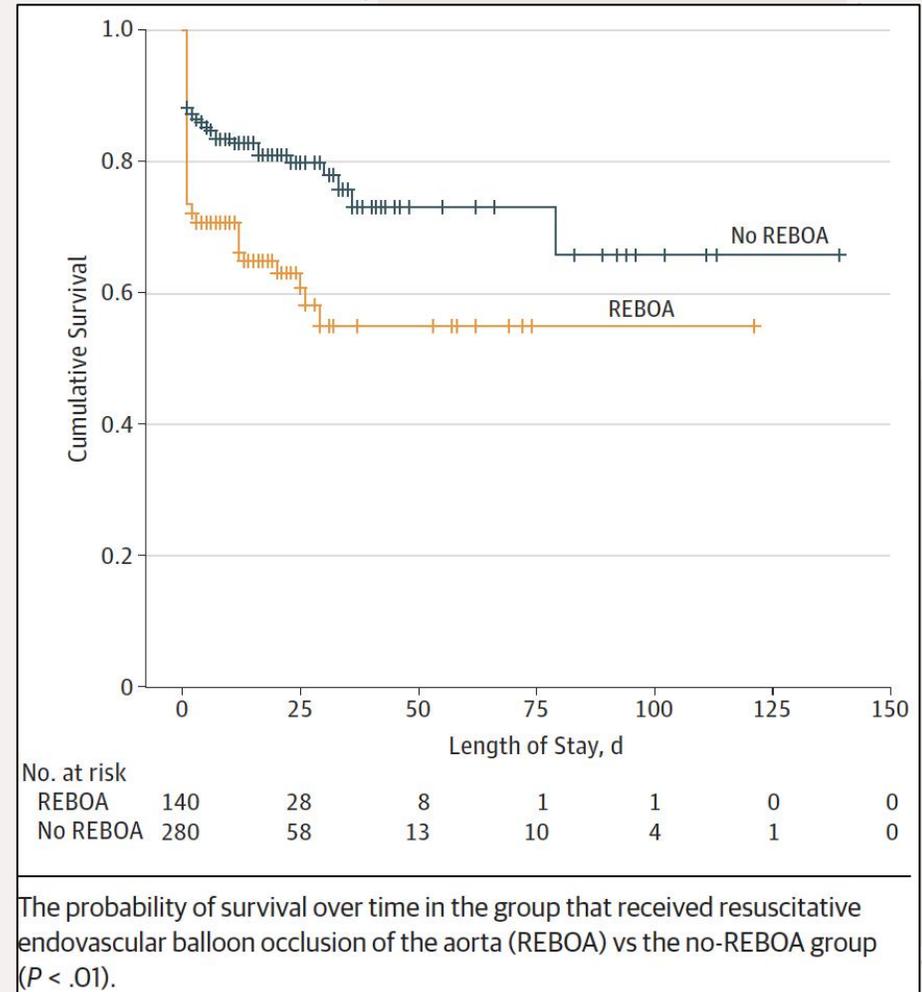
- **Mortality: 35.7% REBOA vs 18.9% non REBOA ; p =0 .01**



- **Acute kidney injury (15 [10.7%] vs 9 [3.2%]; P = .02)**
- **Lower extremity amputation (5 [3.6%] vs 2 [0.7%]; P = .04)**

- No difference in requirements for blood products at 4h - 24h after the injury.

**CONCLUSIONS AND RELEVANCE** Placement of REBOA in severely injured trauma patients was associated with a higher mortality rate compared with a similar cohort of patients with no placement of REBOA. Patients in the REBOA group also had higher rates of acute kidney injury and lower leg amputations. There is a need for a concerted effort to clearly define when and in which patient population REBOA has benefit.



## Original Investigation

December 21, 2022

# Zone 1 Endovascular Balloon Occlusion of the Aorta vs Resuscitative Thoracotomy for Patient Resuscitation After Severe Hemorrhagic Shock

Alexis L. Cralley, MD<sup>1</sup>; Navin Vigneshwar, MD, MPH<sup>1</sup>; Ernest E. Moore, MD<sup>1,2</sup>; [et al](#)

» [Author Affiliations](#)

*JAMA Surg.* 2023;158(2):140-150. doi:10.1001/jamasurg.2022.6393

REBOA zone1 was associated with a statistically significant lower mortality compared with RT

**78.6% [44] vs 92.9% [52];  $P = .03$**

REVIEW

Open Access



Resuscitative endovascular balloon occlusion of the aorta (REBOA) in patients with major trauma and uncontrolled haemorrhagic shock: a systematic review with meta-analysis

- 11 studies (5,866 participants)
- **REBOA vs RT: lower mortality** aOR 0.38; 95% CI 0.20–0.74
- **REBOA vs no-REBOA: no difference** aOR 1.40; 95% CI 0.79–2.46
- Variability in indications and patient characteristics !

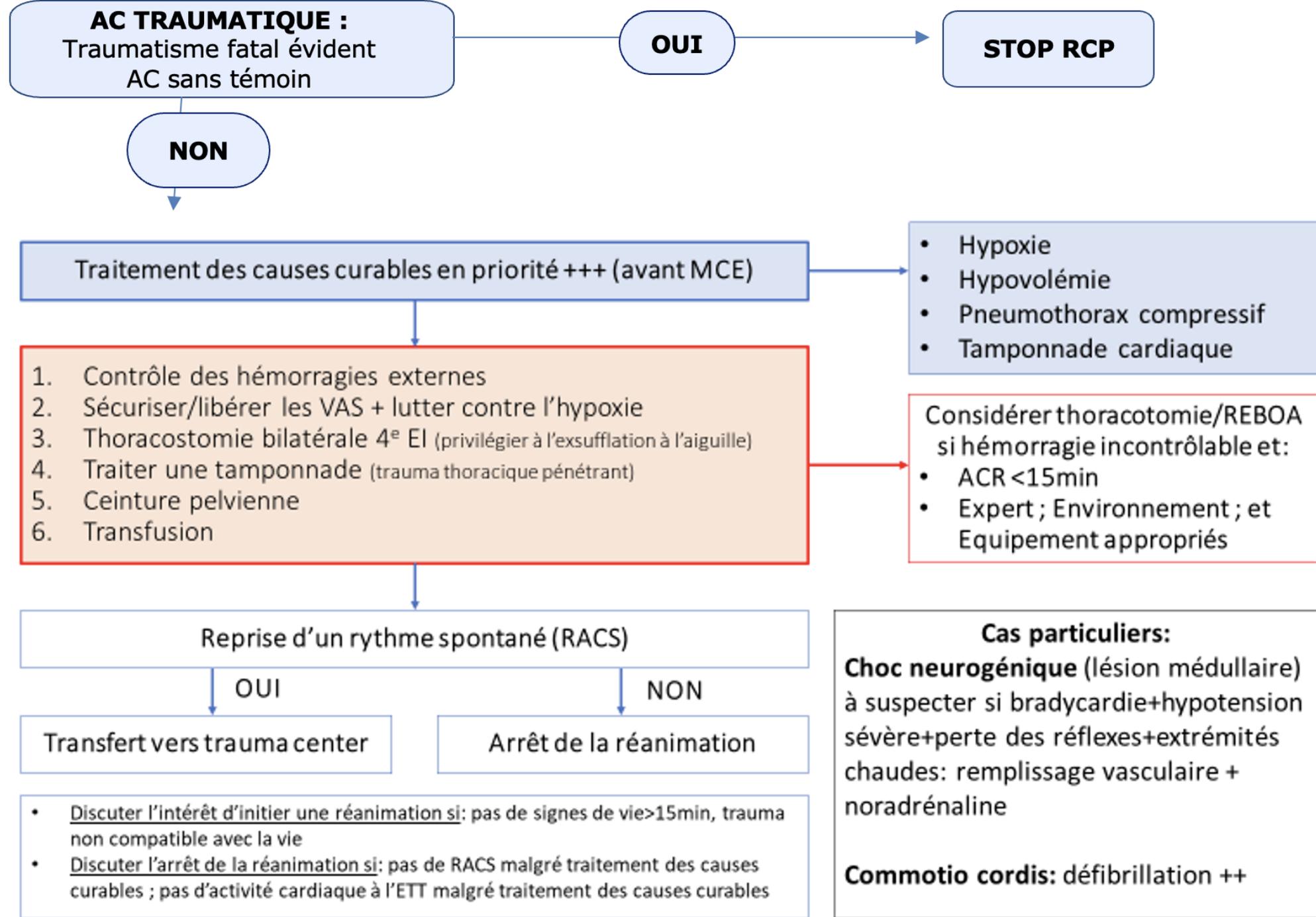
REBOA: why not ? Mais ...

- Manque encore d'étude à haut niveau de preuve
- Les bons patients: ACT pénétrant - aire cardiaque ?
- Le bon timing: en pré arrêt ?
- Médecins à former : règles des 4<sup>E</sup> (environnement/expertise ++)

Invited Commentary

# The Need to Better Define the Who, What, and Where of Resuscitative Endovascular Balloon Occlusion of the Aorta

Gilbert R. Upchurch Jr, MD; R. Stephen Smith, MD, RDMS



**AC TRAUMATIQUE :**

Traumatisme fatal évident  
AC sans témoin

**OUI**

**STOP RCP**

**NON**

Traitement des causes curables en priorité +++ (avant MCE)

- Hypoxie
- Hypovolémie
- Pneumothorax compressif
- Tamponnade cardiaque

1. Contrôle des hémorragies externes
2. Sécuriser/libérer les VAS + lutter contre l'hypoxie
3. Thoracostomie bilatérale 4<sup>e</sup> EI (privilégier à l'exsufflation à l'aiguille)
4. Traiter une tamponnade (trauma thoracique pénétrant)
5. Ceinture pelvienne
6. Transfusion

Considérer thoracotomie/REBOA si hémorragie incontrôlable et:

- ACR < 15min
- Expert ; Environnement ; et Equipement appropriés

Reprise d'un rythme spontané (RACS)

OUI

NON

Transfert vers trauma center

Arrêt de la réanimation

- Discuter l'intérêt d'initier une réanimation si: pas de signes de vie > 15min, trauma non compatible avec la vie
- Discuter l'arrêt de la réanimation si: pas de RACS malgré traitement des causes curables ; pas d'activité cardiaque à l'ETT malgré traitement des causes curables

**Cas particuliers:**  
**Choc neurogénique** (lésion médullaire) à suspecter si bradycardie+hypotension sévère+perte des réflexes+extrémités chaudes: remplissage vasculaire + noradrénaline  
**Comotio cordis:** défibrillation ++