

Arrêt cardiaque traumatique

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Pas de conflits d'intérêts



Caporal R... 23 ans..

- Militaire engagé au combat.
- 12 h20 : reçoit deux projectiles dans le thorax et le souffle d'un IED.
- 12 h21 : son binôme constate qu'il est inconscient avec gasps et que les membres inférieurs sont touchés avec perte de sang ++
- 12 h 25 : Alerte medics et MCE
- 12 h 27 : MCE, adrénaline sous-cutanée,
- 12 h 30 : O2, MCE, décompression thoracique bilatérale
- 12 h 40 : Arrivée « medevacs » hélico. **Asystole** (19 minutes de low-flow)
- 12 h42 ; IO + sang, O2, MCE, départ à 12 h45. **Rythme sans pouls H + 23 minutes**
- **Probabilité de survie de R... ???**

**Withholding and termination of resuscitation of adult
cardiopulmonary arrest secondary to trauma:
*Emergency Services Prehospital of the American
College of Surgeons' Committee on Trauma
(ACSCOT) GUIDELINE 2012***

Resuscitative efforts may be withheld for a penetrating trauma patient who, on arrival of EMS personnel, is found to be pulseless and apneic and there are no other signs of life, including spontaneous movement, electrocardiographic activity, and pupillary response.

J Trauma Acute Care Surg 2013

Si R était un soldat américain...il n'aurait pas été réanimé.

Outcomes following military traumatic cardiorespiratory arrest: A prospective observational study

Tarmey MT Resuscitation 2011

					survivors
Time intervals ^c					
Arrest to ROSC	Median (range) in mins	9 (2–24)	n/a	9 (2–24)	8 (5–24)
Initial ECG during arrest ^d					
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 ^e					
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%)

Table 2

Characteristics of TCRA by category of outcome.

		All Patients (N = 52)	No ROSC (N = 38)	ROSC (N = 14)	Survivors (N = 4)
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

Arrêt cardiaque traumatique réanimation futile ?

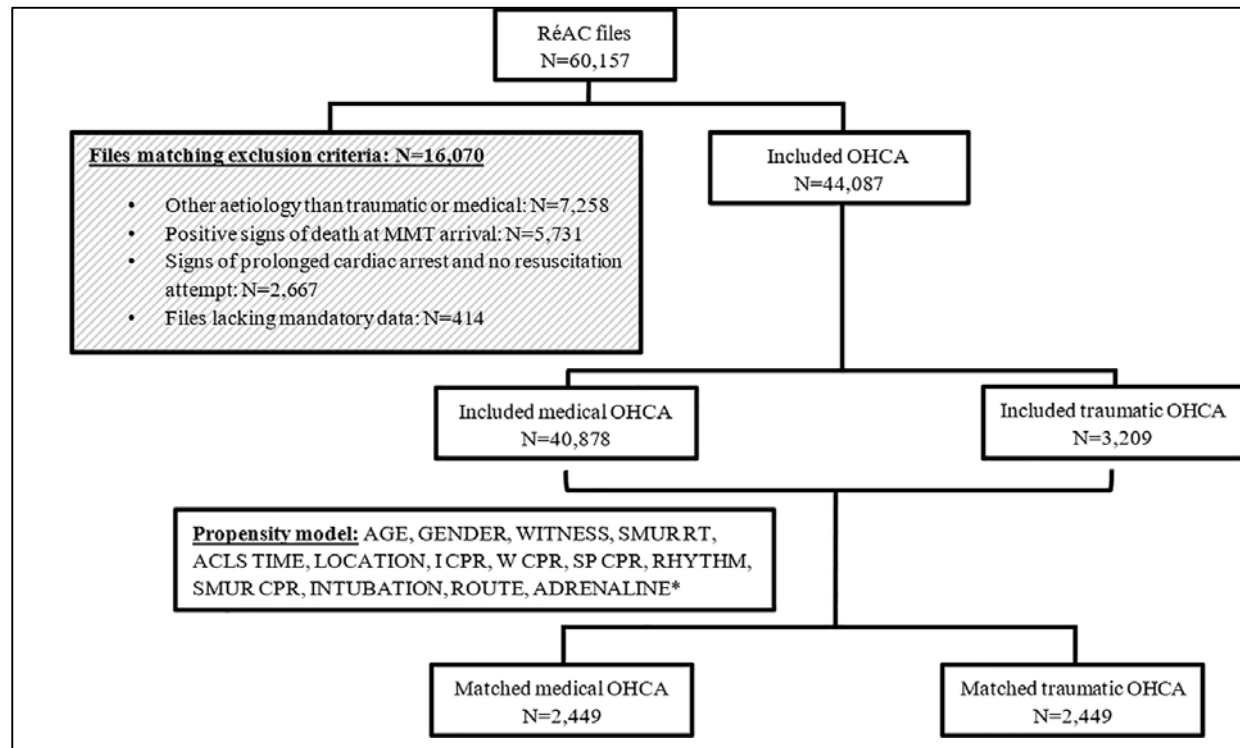
Des systèmes et des étiologies différents, une prise en charge et un pronostic variables



Clinical paper

Traumatic cardiac arrest is associated with lower survival rate vs. medical cardiac arrest – Results from the French national registry[☆]

Joséphine Escutnaire^{a,b,*}, Michael Genin^{a,b}, Evgénia Babykina^{a,b}, Cyrielle Dumont^{a,b}, François Javaudin^{c,d}, Valentine Baert^{a,b}, Pierre Mols^e, Jan-Thorsten Gräsner^f, Eric Wiel^{a,b,g}, Pierre-Yves Gueugniaud^{b,h}, Karim Tazarourte^{b,h}, Hervé Hubert^{a,b}, on behalf GR-RéAC^b



Out of hospital cardiac arrests N = 44,087			
		Traumatic OHCA N = 3209	Medical OHCA N = 40,878
			P

First recorded rhythm	Asystole; n(%)	2544 (87.5)	30,835 (79.9)	< 0.001
	Pulseless electrical activity; n(%)	172 (5.9)	2169 (5.6)	
	VF/PulselessVT; n(%)	44 (1.5)	3152 (8.2)	
	Spontaneous activity; n(%)	146 (4.5)	2421 (6.3)	

ACLS	MMT CPR; n(%)	2273 (70.8)	29,982 (73.4)	0.002
	MMT response time; M[Q1;Q3] (minutes)	17 [11;25]	19 [12;27]	< 0.001
Intubation	Intubation; n(%)	2128 (66.3)	27, 643 (67.6)	0.002

ACLS duration	ACLS duration ; M[Q1;Q3] (minutes)	14 [1;30]	19 [8;32]	< 0.001
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Traumatic vs medical CA

Survival D0	14,2	vs 29,3 %	0.416 [0.359;0.482]
Survival D30	1,6	vs 9%	0.168 [0.117;0.241]

Long-term prognosis after out-of-hospital resuscitation of cardiac arrest in trauma patients: prehospital trauma-associated cardiac arrest

François-Xavier Duchateau,¹ Sophie Hamada,² Mathieu Raux,³ Matthieu Gay,¹ Jean Mantz,⁴ Catherine Paugam Burtz,^{4,5} Tobias Gauss,⁴ Traumabase Group

Emerg Med J 2017

88 patients, 10 patients (11%; CI 95% 6% to 19%) survived to discharge
9 patients displayed a GCS of 15 and Cerebral Performance Categories (CPC) 1–2

	Survivors to discharge (N=10)	Deceased patients (N=78)	p Value
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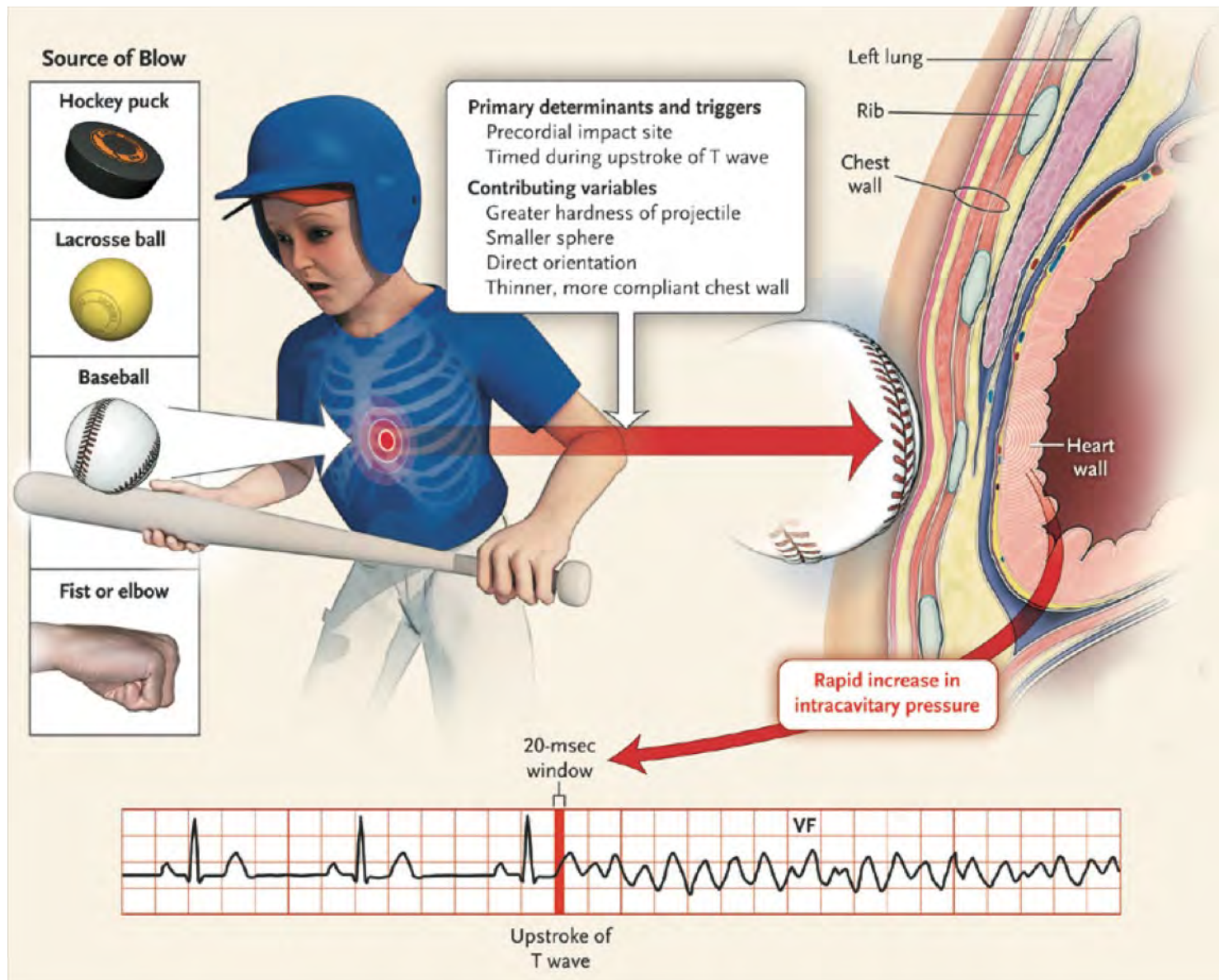
Suspected cause of arrest			
Hypoxia	4 (40%)	5 (6%)	0.008
Haemorrhage	3 (30%)	31 (40%)	
Traumatic brain injury	2 (20%)	24 (31%)	
Comotio cordis	1 (10%)	0	
Penetrating trauma	1 (10%)	10 (13%)	1.0

Un Arrêt cardiaque traumatique par hypoxie : faut se battre !

Etiologies

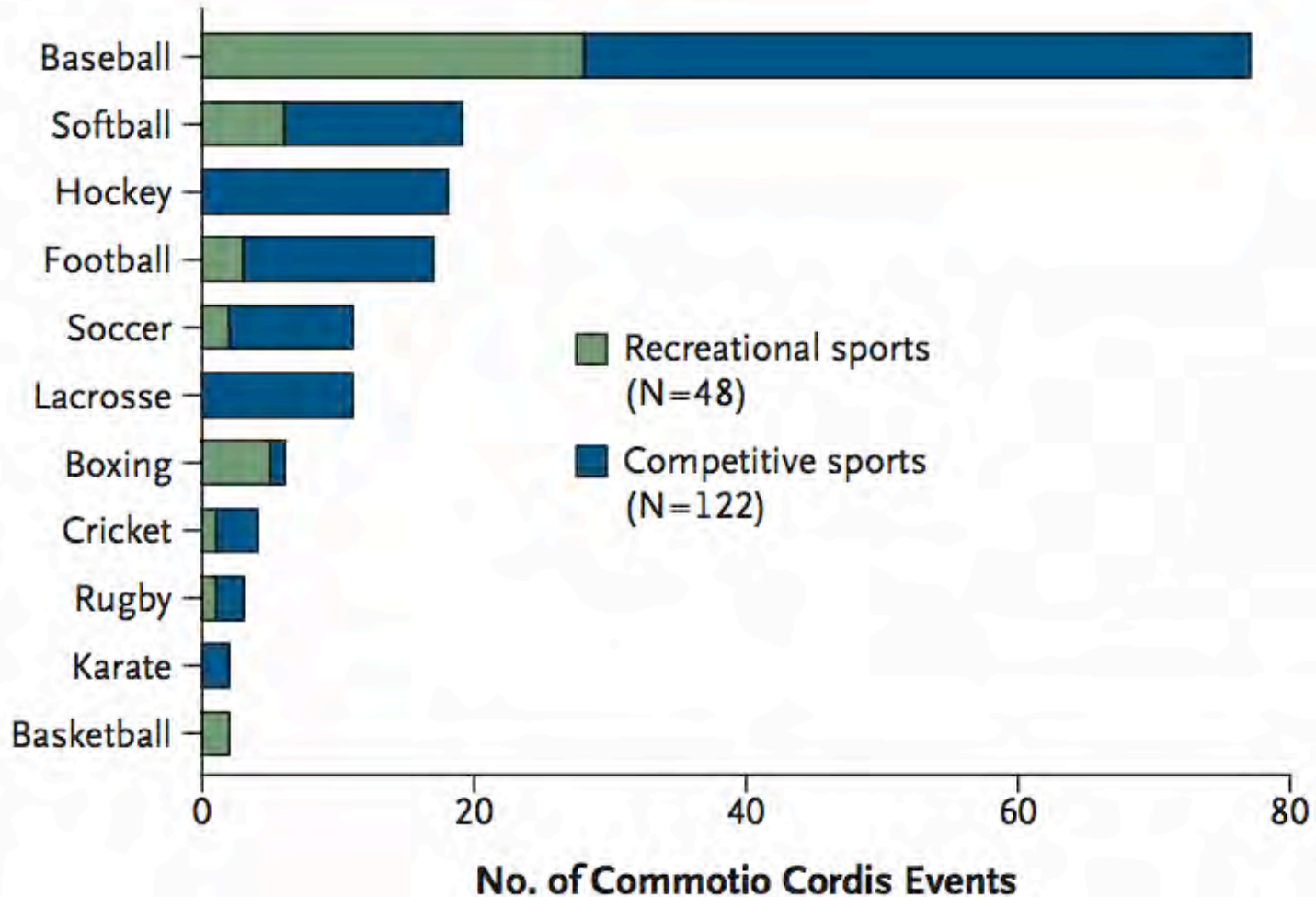
Commotio cordis

Maron, NEJM 2010



Etiologies

Commotio cordis



Etiologies

Commotio cordis

- 224 cas répertoriés
- Mauvais pronostic si absence de défibrillation
- 15 à 25 % de survie malgré cœur sain



Maron, NEJM 2010

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

2018

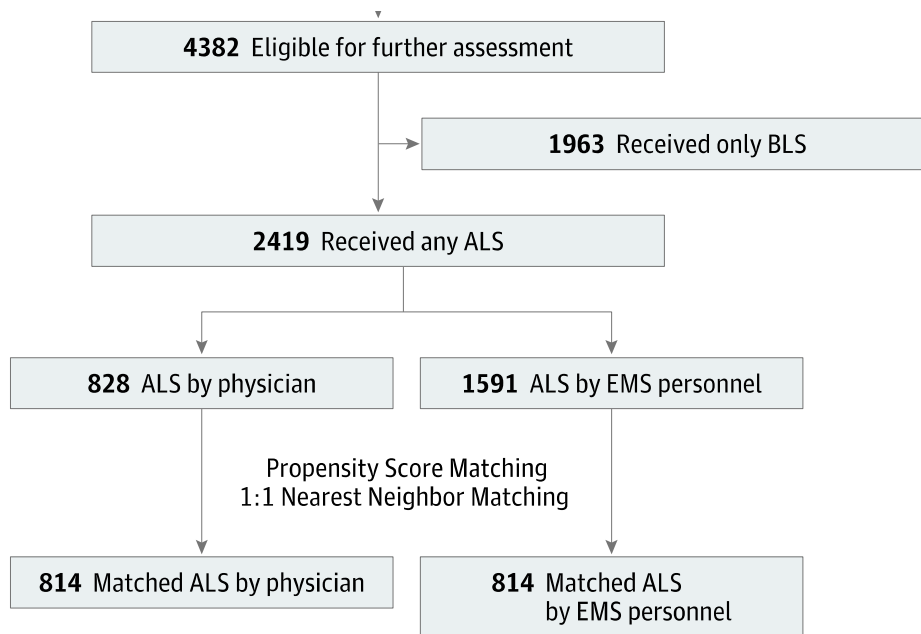


Table 2. Outcomes of Patients With Traumatic OHCA by the Type of Prehospital Care in the Total Cohort^a

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)	0.90 (0.39-2.04)
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)	0.47 (0.13-1.35)
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)	1.77 (0.66-4.45)

Table 4. Outcomes of Patients With Traumatic OHCA by the Type of ALS Professional in the Propensity Score-Matched Cohort

Outcome	Favorable Outcomes, No. (%)		RR (95% CI)	P Value
	ALS by Physician (n = 814)	ALS by EMS Personnel (n = 814)		
Prehospital ROSC	87 (10.7)	57 (7.0)	1.53 (1.11-2.10)	.009
1-mo Overall survival	24 (3.0)	12 (1.5)	2.00 (1.01-3.97)	.04
Neurologic outcome (CPC 1 or 2)	7 (0.9)	0	NA	.008
CPC 1	5 (0.6)	0	NA	NA
CPC 2	2 (0.3)	0	NA	NA
CPC 3	6 (0.7)	3 (0.4)	NA	NA
CPC 4	10 (1.2)	8 (1.0)	NA	NA
CPC 5	791 (97.2)	803 (98.6)	NA	NA

Characteristic	Total Cohort, No. (%)			Prehospital ALS Cohort, No. (%)		
	BLS (n = 1963)	ALS (n = 2419)	P Value	By EMS Personnel (n = 1591)	By Physician (n = 828)	P Value

First rhythm						
VF	52 (2.6)	51 (2.1)		39 (2.5)	12 (1.4)	
VT	1 (0.1)	5 (0.2)		4 (0.3)	1 (0.1)	
PEA	698 (35.6)	897 (37.1)	.001	591 (37.1)	306 (37.0)	.02
Asystole	1039 (52.9)	1325 (54.8)		881 (55.4)	444 (53.6)	
Other	173 (8.8)	141 (5.8)		76 (4.8)	65 (7.9)	

Response time from emergency call to contact with patient, min						
Median (IQR)	8 (6-11)	9 (7-13)	<.001	9 (7-12)	9 (7-14)	.01

Total time from emergency call to hospital arrival, min						
Median (IQR)	31 (24-42)	38 (29-51)	<.001	36 (28-48)	43 (30-59)	<.001

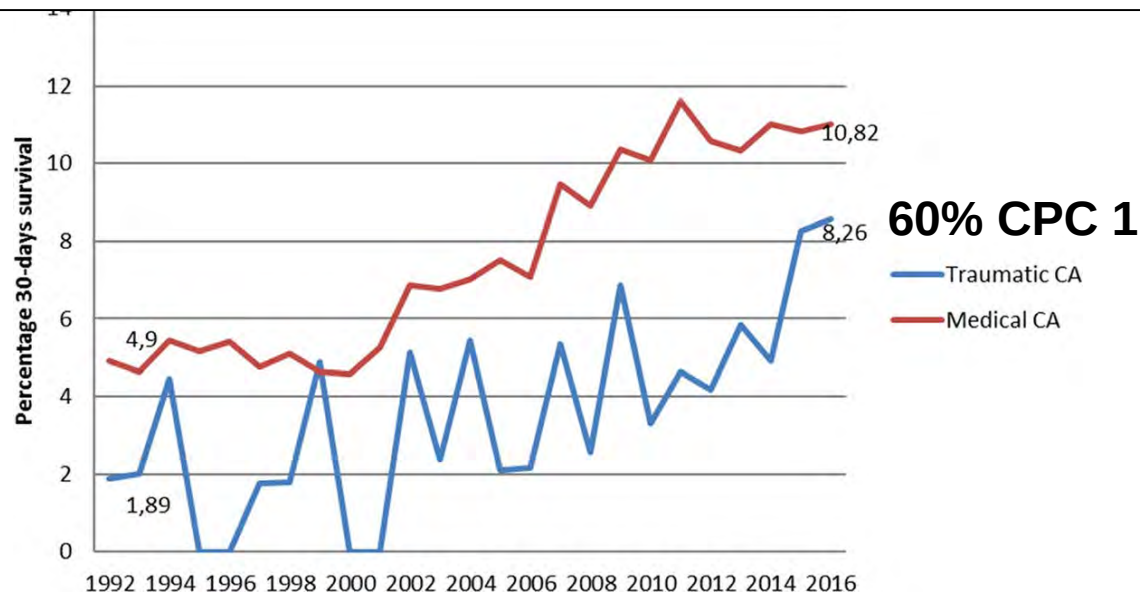


Traumatic cardiac arrest in Sweden 1990-2016 - a population-based national cohort study

T. Djarv^{1,2*}, C. Axelsson³, J. Herlitz^{2,3}, A. Stromsoe⁴, J. Israelsson^{5,6,7} and A. Claesson^{2,3}

2018

Between 1990 and 2016,
1774 (2.4%) cases had a TCA and 72,547 had a medical CA.
Overall 30-day survival gradually increased over the years,
3.7% for TCAs compared to 8.2% following a medical CA ($p < 0.01$).





Clinical paper

Table 2 – Interventions provided by the ground ambulance crew and by the HEMS team on scene for patients with a TCA (n = 262) stratified by patient outcome.

	Total group (n = 262)	Sustained ROSC (n = 51)	No ROSC (n = 211)	Missing	p
Patients with one or more HEMS specific interventions	227 (86.3)	40 (76.9)	187 (88.6)		0.007
RSI	43 (16.3)	19 (36.5)	24 (11.4)		<0.001
Blood products	113 (42.9)	32 (61.5)	81 (38.4)		0.005
Thoracostomies	221 (84.0)	36 (69.2)	185 (87.7)		0.001
Release of blood or air	152 (57.8)	27 (52.9)	125 (59.2)		0.38
Thoracotomy	8 (3.0)	2 (3.8)	6 (2.8)		0.98
Surgical airway	2 (0.8)	2 (3.8)	0 (0)		0.015
Other interventions					
CPR	181 (68.8)	36 (69.2)	145 (68.7)		0.79
Airway adjuncts	218 (82.9)	42 (80.8)	176 (83.4)		0.76
Supraglottic airway	38 (18.0)	7 (13.7)	44 (20.8)		0.91
ETT without medication	172 (65.4)	29 (55.8)	143 (67.8)	1	0.17
Oxygen administration	260 (99.2)	51 (100)	209 (99.1)		0.78
BVM ventilation	120 (45.6)	35 (67.3)	85 (40.3)		0.002
Needle chest decompression	102 (38.8)	17 (32.7)	85 (40.3)		0.48
Pneumofix chest decompression	23 (8.7)	3 (5.8)	20 (9.5)		0.68
IV access	168 (63.9)	46 (88.5)	122 (57.8)	1	0.002
IO access	157 (59.7)	27 (51.9)	130 (61.6)	1	0.56
Pelvic binder	127 (48.3)	24 (46.2)	103 (48.8)	1	0.87
Kendrick traction splint	26 (9.9)	6 (11.5)	20 (9.5)	1	0.96
Non-blood IV fluids	164 (62.6)	34 (66.6)	130 (61.6)	1	0.52

L'intensité de soins thérapeutique

Lockey D Resuscitation 2013

Hémorragie

Oxygénation

Tamponnade

Péricardique

Pneumothorax

J Trauma Acute Care Surg. 2016

Open chest cardiac massage offers no benefit over closed chest compressions in patients with traumatic cardiac arrest

Matthew J. Bradley, MD, Brandon W. Bonds, MD, Luke Chang, Shiming Yang, PhD,
 Peter Hu, PhD, Hsiao-chi Li, MS, Megan L. Brenner, MD,
 Thomas M. Scalea, MD, and Deborah M. Stein, MD, MPH, Baltimore, Maryland

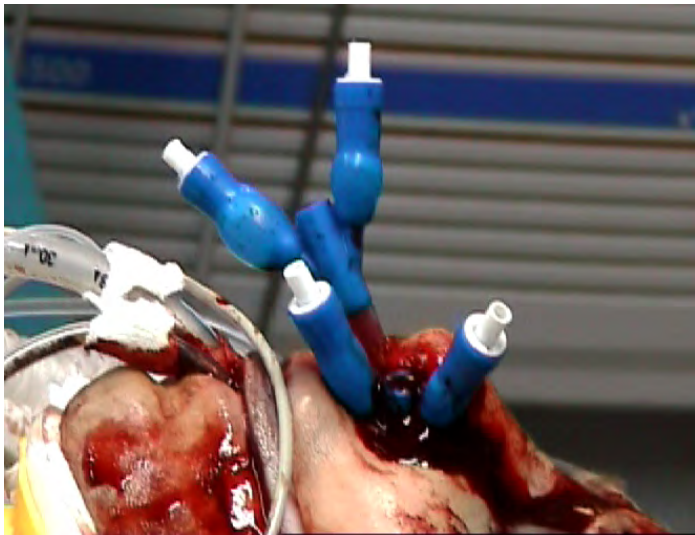
	CCC Only (n = 17)	OCCM (n = 16)	p
Sex (M/F)	15/2	16/0	0.49
Age: $\pm$ SD, y	42.5 $\pm$ 18.8	31.4 $\pm$ 12.7	0.08
Witnessed arrest (yes/no/unspecified)	9/8/0	7/8/1	0.54
Mortality (percent)	15 (88.2%)	16 (100%)	0.49
Mechanism of injury			
Penetrating	8 (47.1%)	13 (81.3%)	0.05
Stab	1	3	
Gunshot wound	7	10	
Blunt	8 (47.1%)	2 (12.5%)	0.04



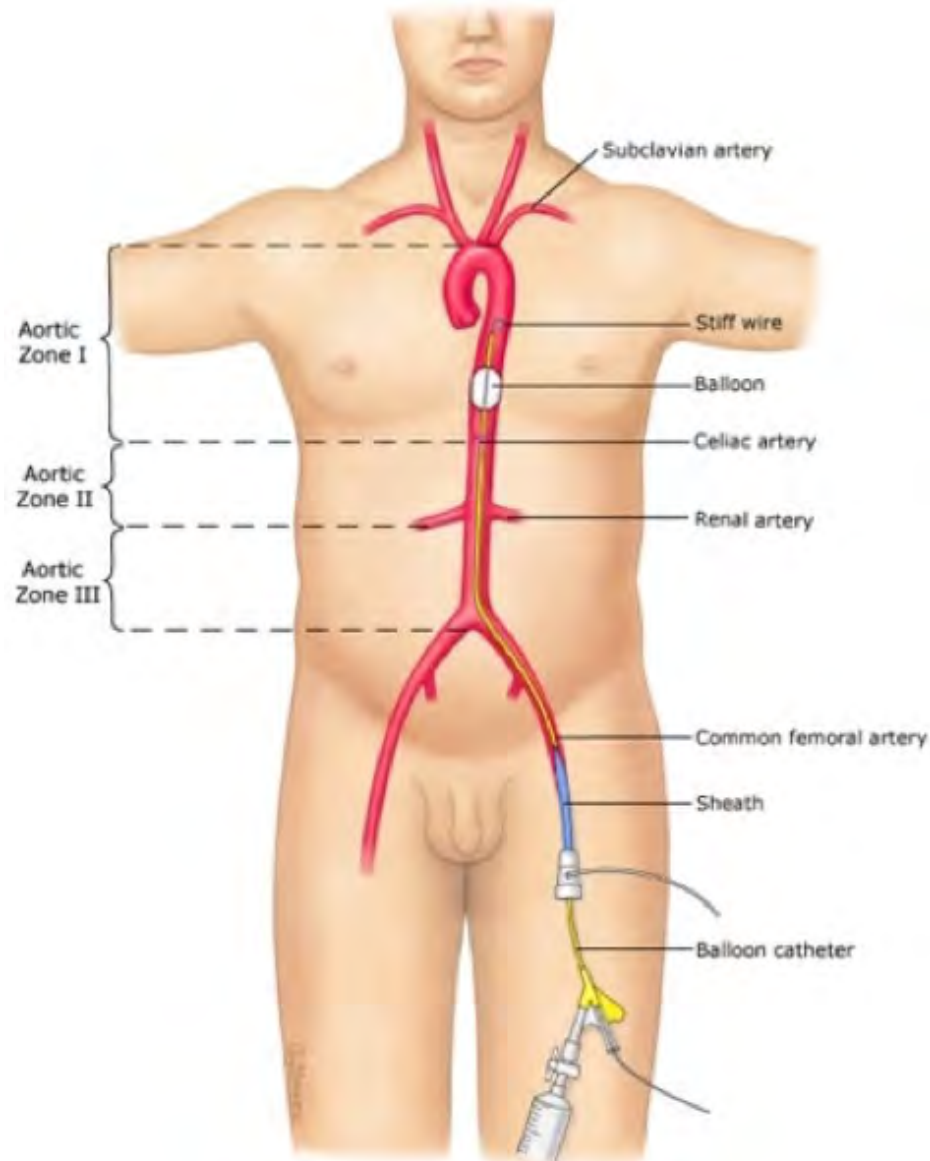
ROSC CCC 38.9% vs. OCCM 23.5% p = 0.53
 ETCO₂ CCC 6.8 $\pm$ 6.8 vs OCCM 12.6 $\pm$ 8.4; p=0.94



Damage control Resuscitation



Les techniques d'exception



Resuscitative Endovascular Balloon Occlusion of the Aorta Improves Cardiac Compression Fraction Versus Resuscitative Thoracotomy in Patients in Traumatic Arrest

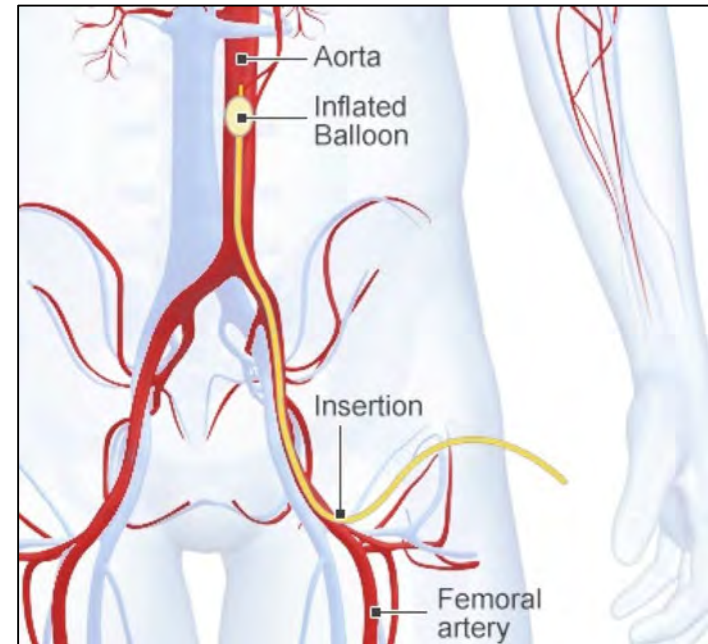
Ann Emerg Med 2018

William Teeter, MD, MS*; Anna Romagnoli, MD; Philip Wasicek, MD; Peter Hu, PhD; Shiming Yang, PhD; Deborah Stein, MD, MPH; Thomas Scalea, MD; Megan Brenner, MD, MS

Characteristics	REBOA (n=22)	RT (n=28)
Age, median (IQR), y	27.1 (24.4-50.7)	34.1 (25.3-40.8)
Men, %	77.3	92.9
Blunt injury, %	72.7	10.7
ISS, median (IQR)	34 (18-41)	22.5 (12-42)

RT, Resuscitative thoracotomy; ISS, Injury Severity Score.

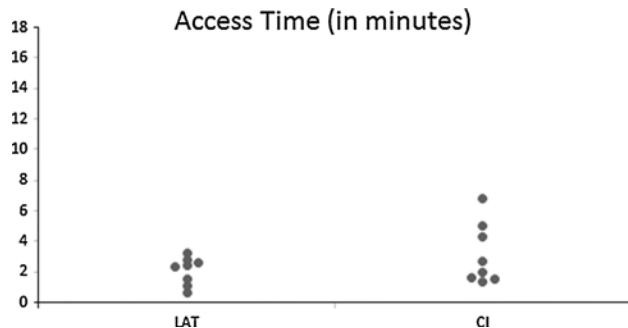
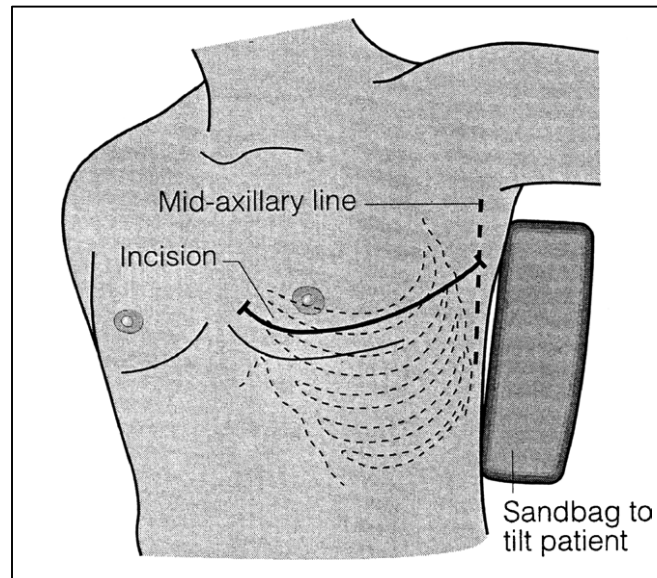
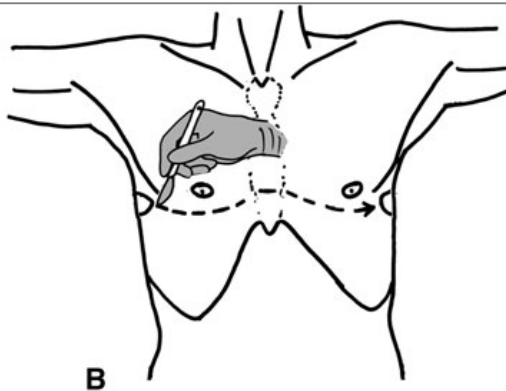
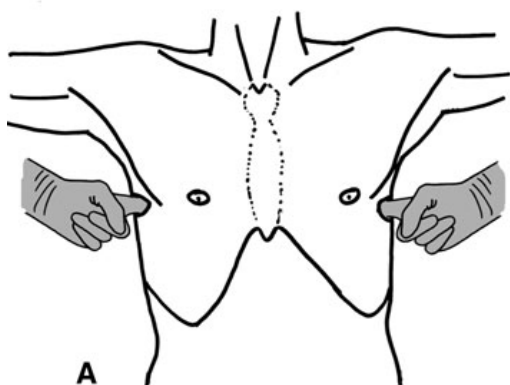
Résultats ambigus...

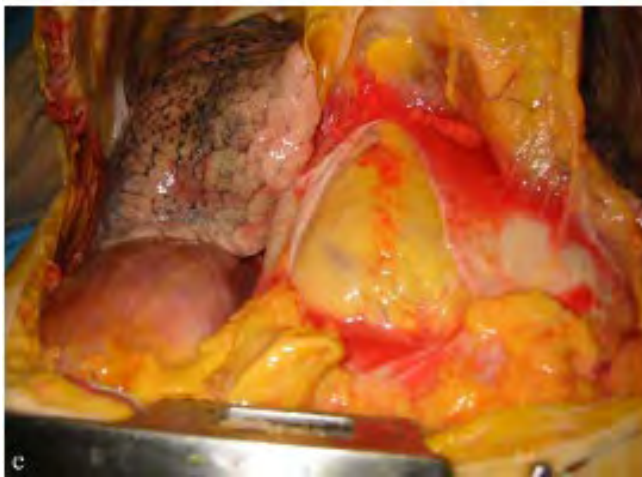


Clamshell Incision Versus Left Anterolateral Thoracotomy. Which One is Faster When Performing a Resuscitative Thoracotomy? The Tortoise and the Hare Revisited

Alexandros N. Flaris · Eric R. Simms ·
Nicolas Prat · Florian Reynard · Jean-Louis Caillot ·
Eric J. Voiglio

Inexperienced surgical trainees
Cadaver study





Voiglio E
Lyon 2016

L'impact « social »...



An evidence-based approach to patient selection for emergency department thoracotomy: A practice management guideline from the Eastern Association for the Surgery of Trauma

Mark J. Seamon, MD, Elliott R. Haut, MD, PhD, Kyle Van Arendonk, MD, Ronald R. Barbosa, MD, William C. Chiu, MD, Christopher J. Dente, MD, Nicole Fox, MD, Randeep S. Jawa, MD, Kosar Khwaja, MD, J. Kayle Lee, MD, Louis J. Magnotti, MD, Julie A. Mayglothling, MD, Amy A. McDonald, MD, Susan Rowell, MD, MCR, Kathleen B. To, MD, Yngve Falck-Ytter, MD, and Peter Rhee, MD, MPH, Philadelphia, Pennsylvania

J Trauma Acute Care Surg. 2015

Recommendation

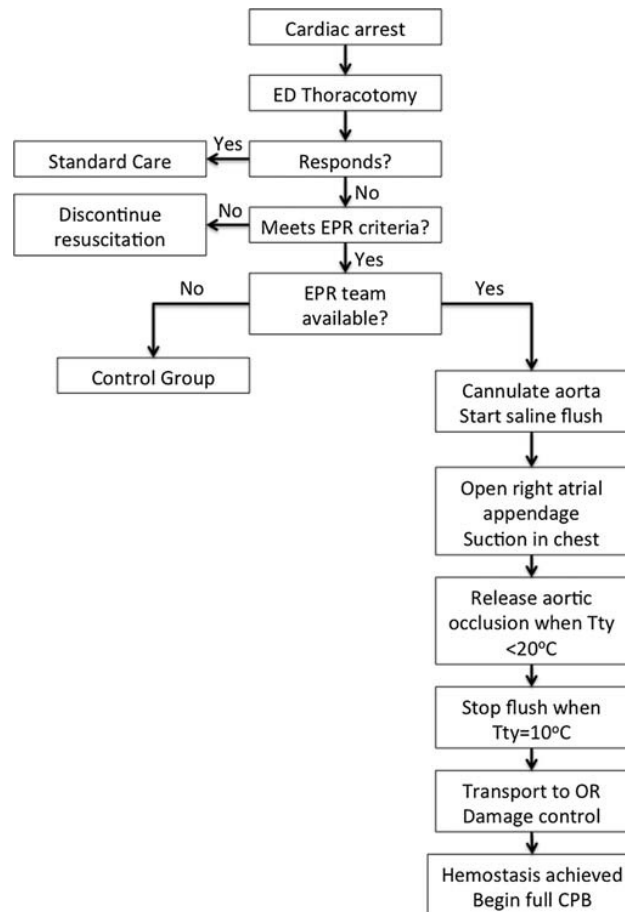
In patients who present pulseless to the Emergency Department with signs of life after penetrating thoracic injury, we **strongly recommend** resuscitative Emergency Department thoracotomy. **Strong Recommendation**

2017

Development of the emergency preservation and resuscitation for cardiac arrest from trauma clinical trial

Samuel A. Tisherman, MD, Hasan B. Alam, MD, Peter M. Rhee, MD, Thomas M. Scalea, MD, Tomas Drabek, MD, Raquel M. Forsythe, MD, and Patrick M. Kochanek, MD, Baltimore, Maryland

Emergency Preservation and Resuscitation (EPR) was developed to utilize hypothermia to buy time to obtain hemostasis before irreversible organ damage occurs



Tamponnade: le pneumothorax compressif



EMERGENCY MEDICAL SERVICES SIMPLE THORACOSTOMY FOR TRAUMATIC CARDIAC ARREST: POSTIMPLEMENTATION EXPERIENCE IN A GROUND-BASED SUBURBAN/RURAL EMERGENCY MEDICAL SERVICES AGENCY

Robert L. Dickson, MD, FACEP, FACEM,* Guy Gleisberg, MBA, NREMT-B,† Michael Aiken, NREMT-P,‡
Kevin Crocker, NREMT-P,‡ Casey Patrick, MD, FAAEM, FACEP,‡ Tyler Nichols, MS-3,* Christopher Mason, MS-3,*
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*Baylor College of Medicine, Baylor University, †Houston Fire Department, and ‡Montgomery County Hospital District Emergency Medical Services, Houston, Texas

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Journal of emergency medicine 2018



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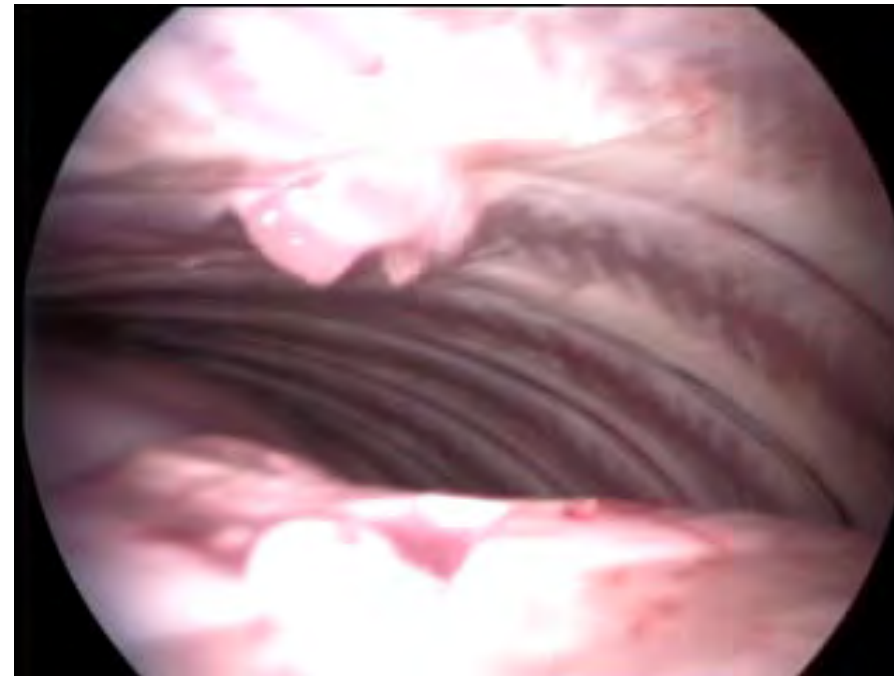
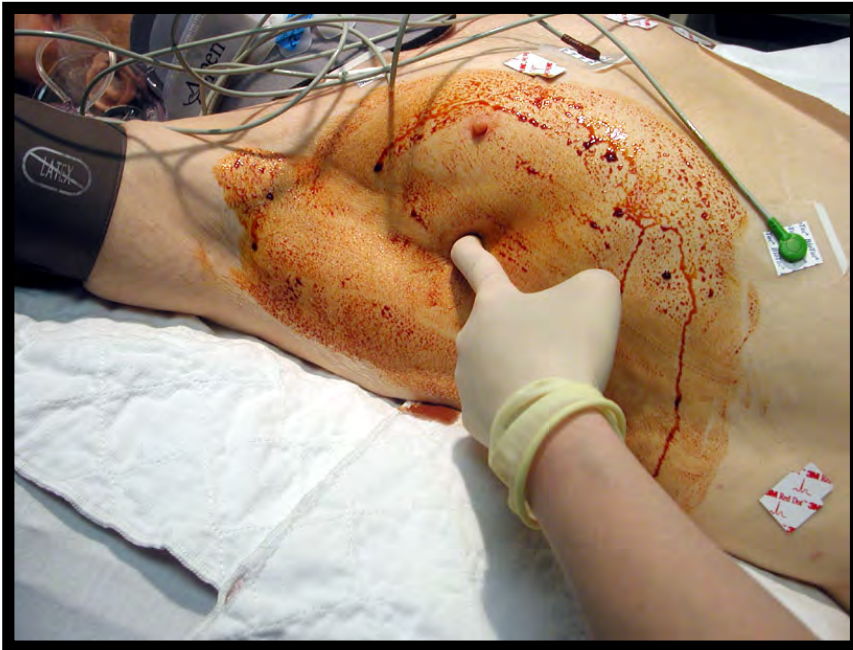
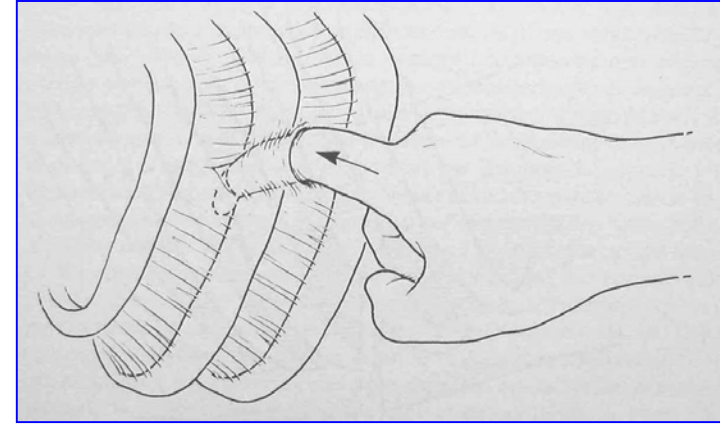
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- Presenting rhythm was pulseless electrical activity 65%, asystole 26%
- **Eighteen of 57 (32%) had air return,**
-
- 14 of 57 (25%) return of spontaneous circulation,
- 6 of 57 (11%) surviving to 24 h
- 4 of 57 (7%) discharged from the hospital neurologically intact.



Thoracostomie



Le rôle de l'échographie dans la gestion de l'AC

- **Détecter et décompresser une tamponnade péricardique, un pneumothorax compressif**
- Apprécier une volémie
- Rôle pronostic
 - **Détecter une activité cardiaque**

ORIGINAL ARTICLE

Out-of-hospital traumatic cardiac arrest: an underrecognized source of organ donors

Anna Faucher,^{1*} Dominique Savary,¹ Jérôme Jund,² Didier Dorez,³ Guillaume Debaty,⁴ Arnaud Gaillard,⁵ Arthur Atchabahian⁶ and Karim Tazarourte⁷

- 11% des patients admis évolueront en mort encéphalique et feront un don d'organes.
- 10 % auront une procédure de dons à cœur non battant.

Les points à retenir

1. Le pronostic de l'arrêt traumatique n'est pas nul
2. RCP de base associée au traitement étiologique
 - H**ypovolémie
 - O**xygénation
 - T**amponnade (pneumothorax, hémopéricarde)
3. Pas de péricardocentèse, transfert rapide au bloc opératoire
4. Le doigt dans le thorax

Algorithme pour AC Traumatique (Reco. RCP - ERC/CFRC/SFMU 2015)

AC / Traumatisé

Rechercher
une cause non traumatique

Probable

Algorithme
RCP-S Standard

Improbable

Evoquer toutes
les causes réversibles

Hypoxie
Pneumothorax sous tension
Tamponnade cardiaque
Hypovolémie

1- Contrôle d'hémorragie extériorisée
2- Contrôle VA et optimisation O₂
3- Décompression thoracique bilatérale

4- Evacuation de tamponnade cardiaque
5- Contrôle chirurgical des hémorragies
ou compression de l'aorte proximale

6- Protocole de remplissage et
de transfusion massive

Faire/Continuer
RCP-S Standard

AC < 10 min ?
Expertise ?
Équipement ?
Contexte ?

Envisager
l'arrêt de la RCP

NON

RACS

OUI

Envisager immédiatement
thoracotomie de sauvetage

Pré-hospitalier:

Intra-hospitalier

- . Se limiter aux gestes de sauvetage. Réanimation du « Damage Contrôle »
- . Transport rapide vers centre adapté, Contrôle définitif de l'hémorragie