

SOCIÉTÉ ALGÉRIENNE D'ANESTHÉSIE, DE RÉANIMATION,
DES SOINS INTENSIFS ET DES URGENCES

CONGRÈS NATIONAL

**Arrêt cardiaque réfractaire
Quelle prise en charge?
Pr R.MEHYAOUÏ**



SAARSIU

DU 30 JANVIER AU
01^{ER} FÉVRIER 2020

Mercure

HÔTEL MERCURE
BAB EZZOUAR ALGER

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- Les hémorragies
- Sécurité au bloc opératoire
- Les urgences cérébro-méningées
- Conférences d'actualisation
- Communications orales
- E-posters
- Ateliers
- Symposium satellite

SAARSIU

SOCIÉTÉ ALGÉRIENNE D'ANESTHÉSIE,
DE RÉANIMATION, DES SOINS INTENSIFS
ET DES URGENCES

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RECEVEZ VOUS
GRATUITEMENT
SUR NOTRE SITE

ACR

200 000 morts par an aux USA

50 000 en France

75 à 80% de causes cardiaques

**Sans prise en charge spécialisée la survie
est de l'ordre de 1 à 2%**

En Algérie ????

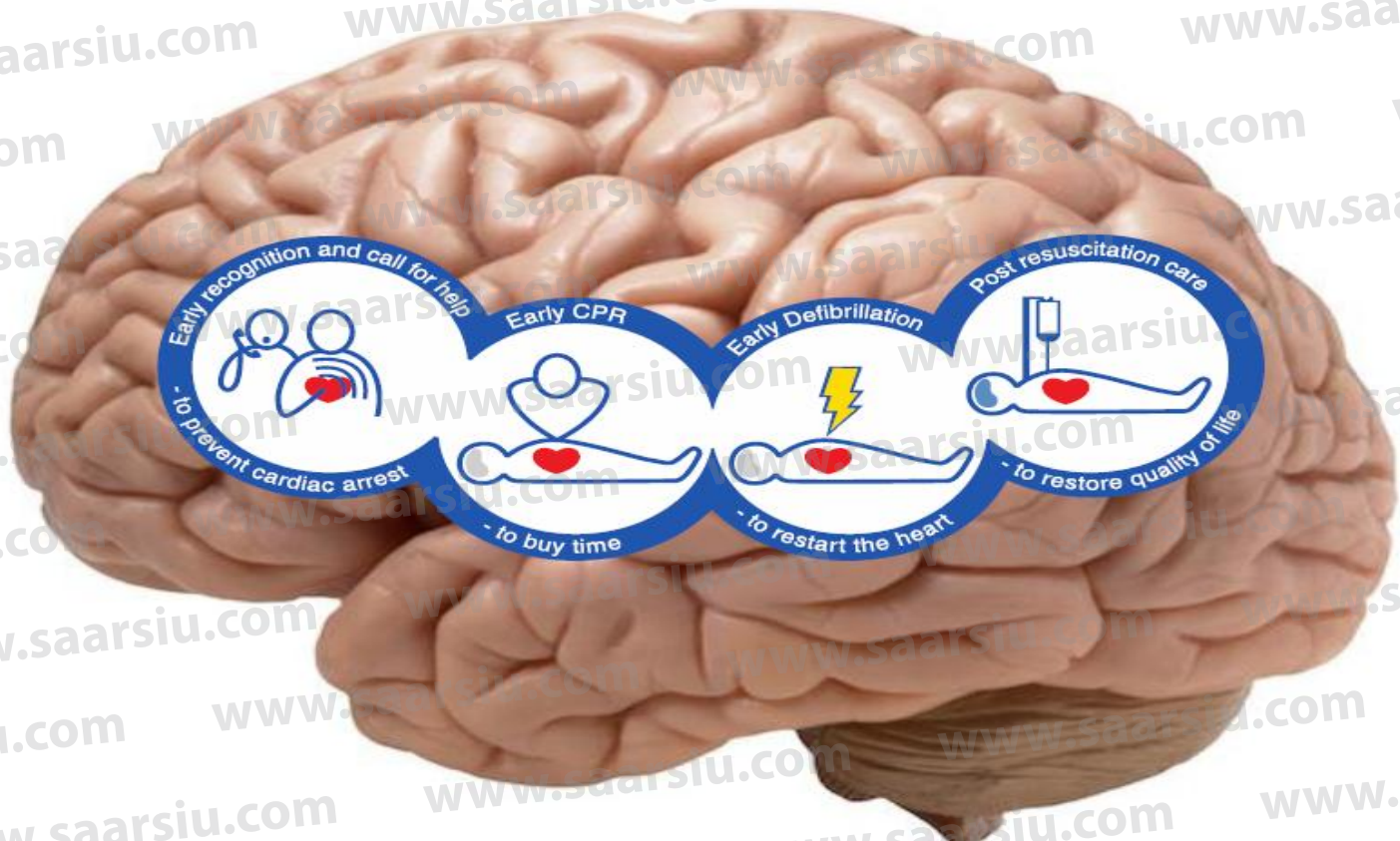
Discussion SAARSIU/ SAC



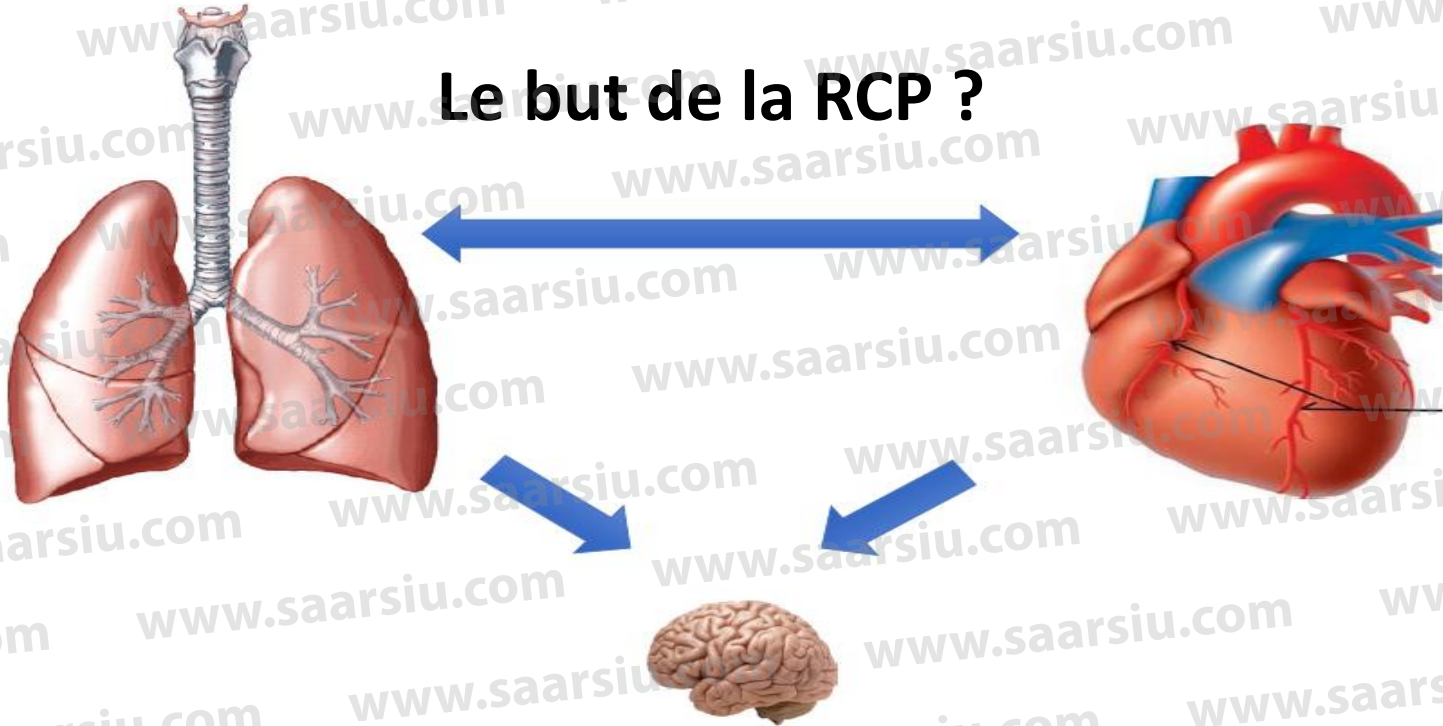
Arrêt cardiaque ...



Un seul objectif : Le cerveau



Le but de la RCP ?



ABC → ACB → Circulation AB

Élément fondamental = MCE en continu !!!!

Lésions d'ischémie/reperfusion

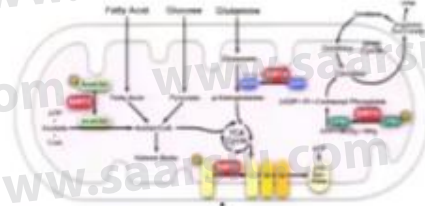
**Lésions
d'ischémie**



AC

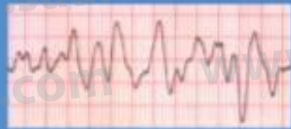
No Flow

Lésions d'ischémie/reperfusion



**Lésions
d'ischémie**

**Lésions
d'ischémie
de reperfusion**

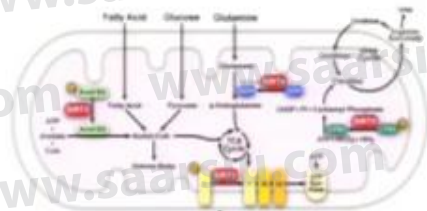


AC
No Flow



RCP de haute qualité
Low Flow

Lésions d'ischémie/reperfusion



**Lésions
d'ischémie**

**Lésions
d'ischémie
de reperfusion**

**Lésions
de reperfusion**



AC
No Flow



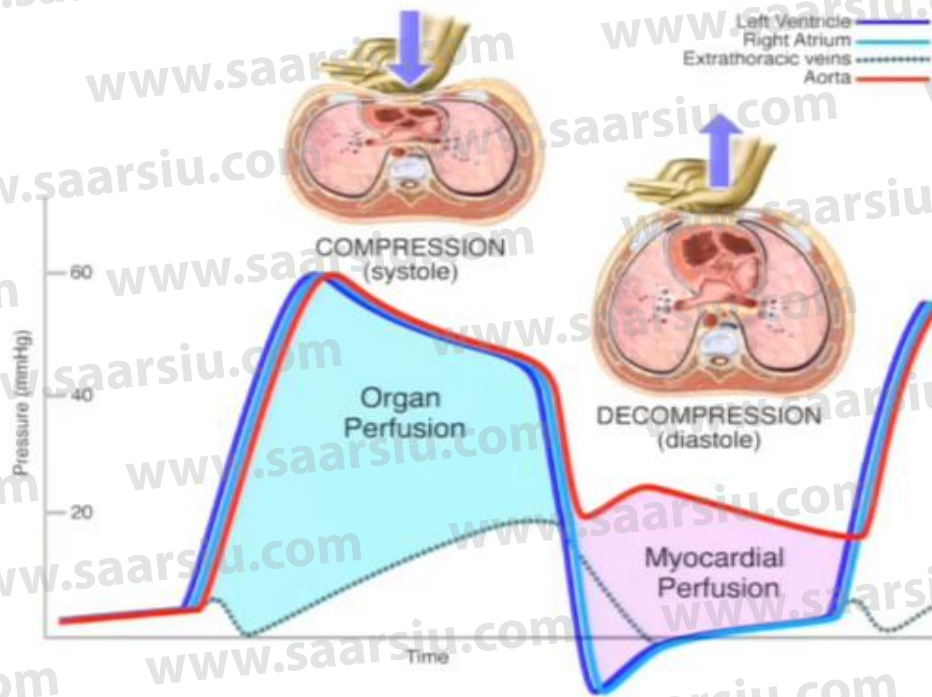
RCP de haute qualité
Low Flow



RACS

Pendant la RCP

Le plus important est de limiter les lésions de reperfusion avec une RCP de haute qualité



Harris AW, Kudenchuk PJ. *Heart* 2018;0:1-6. doi:10.1136/heartjnl-2017-312696

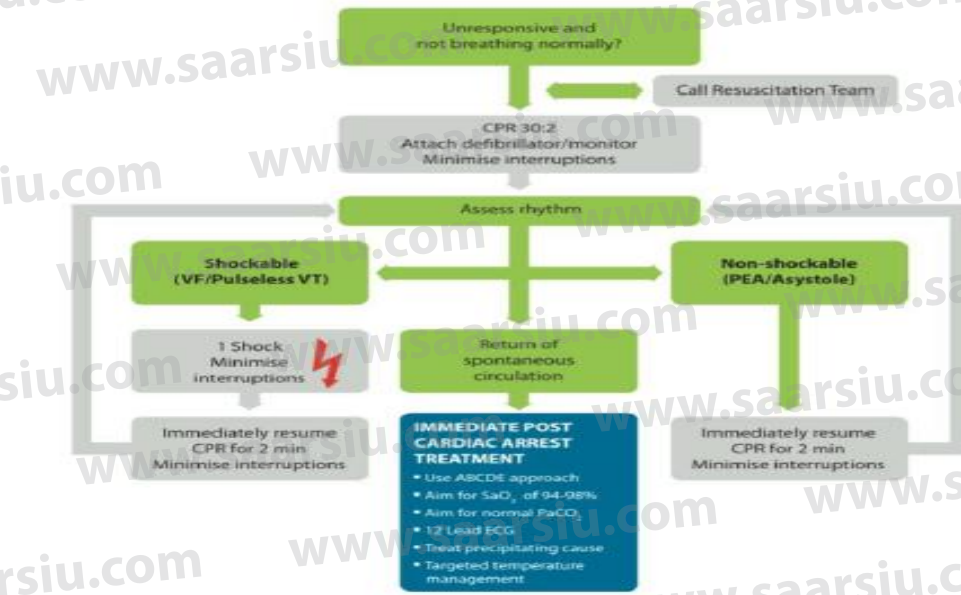


Prise en charge de l'arrêt cardiaque en 2018

Romain Jouffroy ¹, Sarah Berger ¹, Pierre Carli ¹, Benoît Vivien ¹

brutale de la circulation et de la ventilation. L'ILCOR (*International Liaison Committee on Resuscitation*), regroupement des sociétés scientifiques s'intéressant à l'AC, établit tous les 5 ans un consensus scientifique international, dont la dernière version disponible en ligne est celle de 2015 [1]. Ces recommandations de l'ILCOR sont adaptées par les sociétés savantes

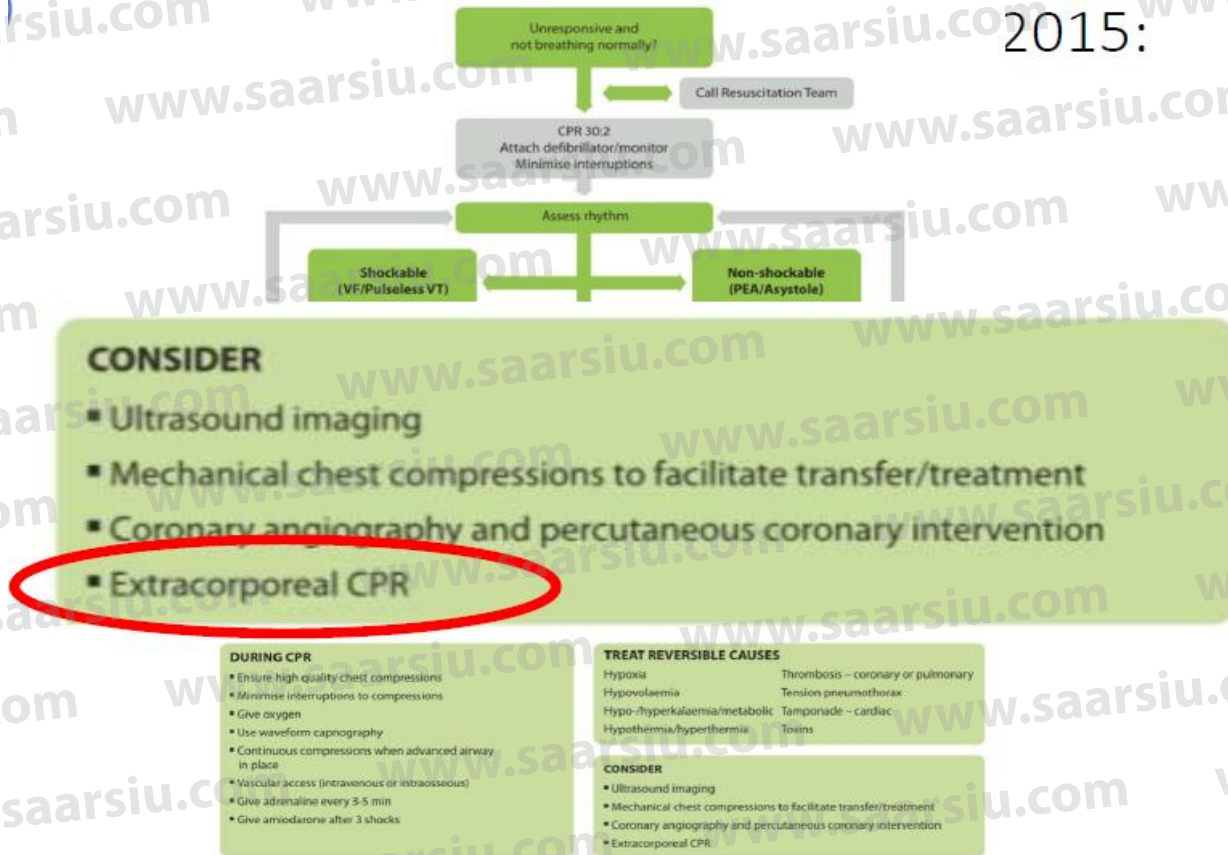
2015:ALS



- DURING CPR**
- Ensure high quality chest compressions
 - Minimise interruptions to compressions
 - Give oxygen
 - Use waveform capnography
 - Continuous compressions when advanced airway in place
 - Vascular access (Intravenous or intraosseous)
 - Give adrenaline every 3-5 min
 - Give amiodarone after 3 shocks

- TREAT REVERSIBLE CAUSES**
- | | |
|-------------------------------|------------------------------------|
| Hypoxia | Thrombosis – coronary or pulmonary |
| Hypovolaemia | Tension pneumothorax |
| Hypo-/hyperkalaemia/metabolic | Tamponade – cardiac |
| Hypothermia/hyperthermia | Toxins |
- CONSIDER**
- Ultrasound imaging
 - Mechanical chest compressions to facilitate transfer/treatment
 - Coronary angiography and percutaneous coronary intervention
 - Extracorporeal CPR

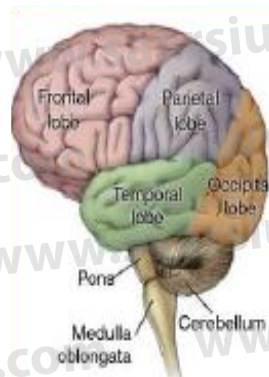
2015:



Pourquoi l'ECPR dans l'ACR



Etiologies : SCA ...

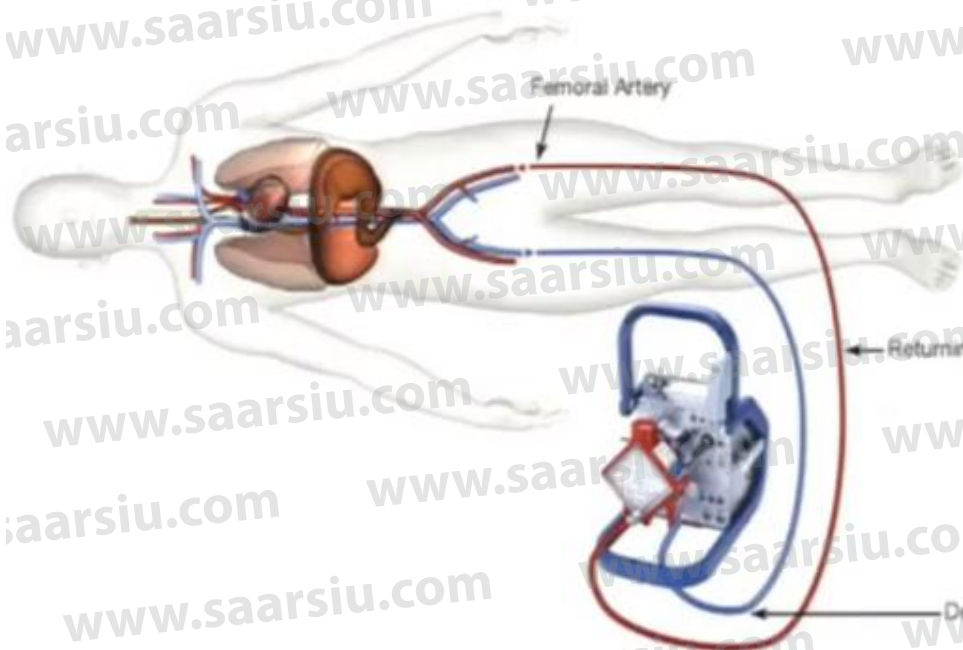


Pronostic: Neurologique

Le temps du traitement étiologique et de l'évaluation neurologique

ECPR – ECLS – ECMO

V-A ECMO



Circulation extracorporelle permettant de
suppléer
les fonctions cardiaques (pompe)
et respiratoires (membrane)
du patient.





Premier succès rapporté dans le NEJM en 1972: 75h d'assistance, survie sans séquelles

ECPR dans l'AC réfractaire



**Bien
choisir**

Problème d'indication

N'agoniser pas, Organiser



Problème d'organisation



Former

Problème de formation



Problème médico-économique

ECPR dans l'AC réfractaire

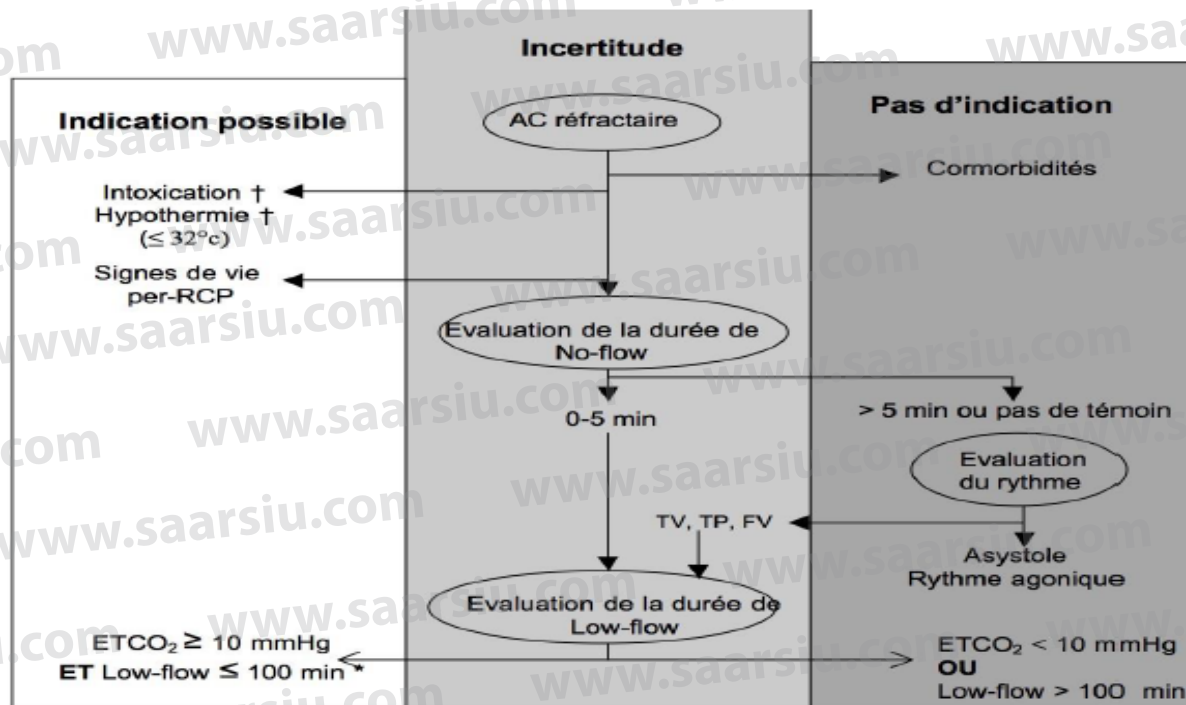


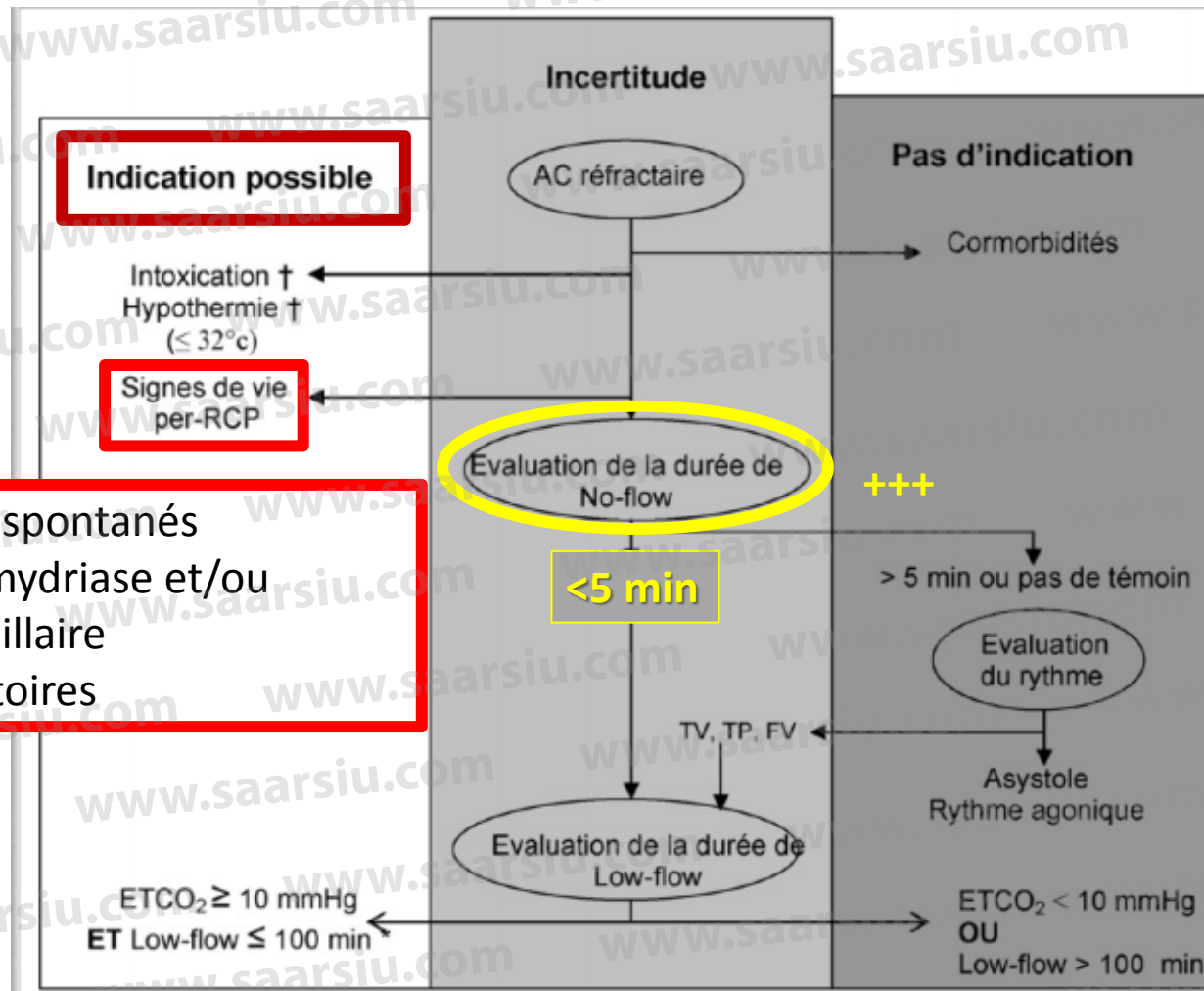
**Bien
choisir**

Problème d'indication

« Recommandations sur les indications de l'assistance circulatoire dans le traitement des arrêts cardiaques réfractaires »

B.Riou et assoc SFAR 2008



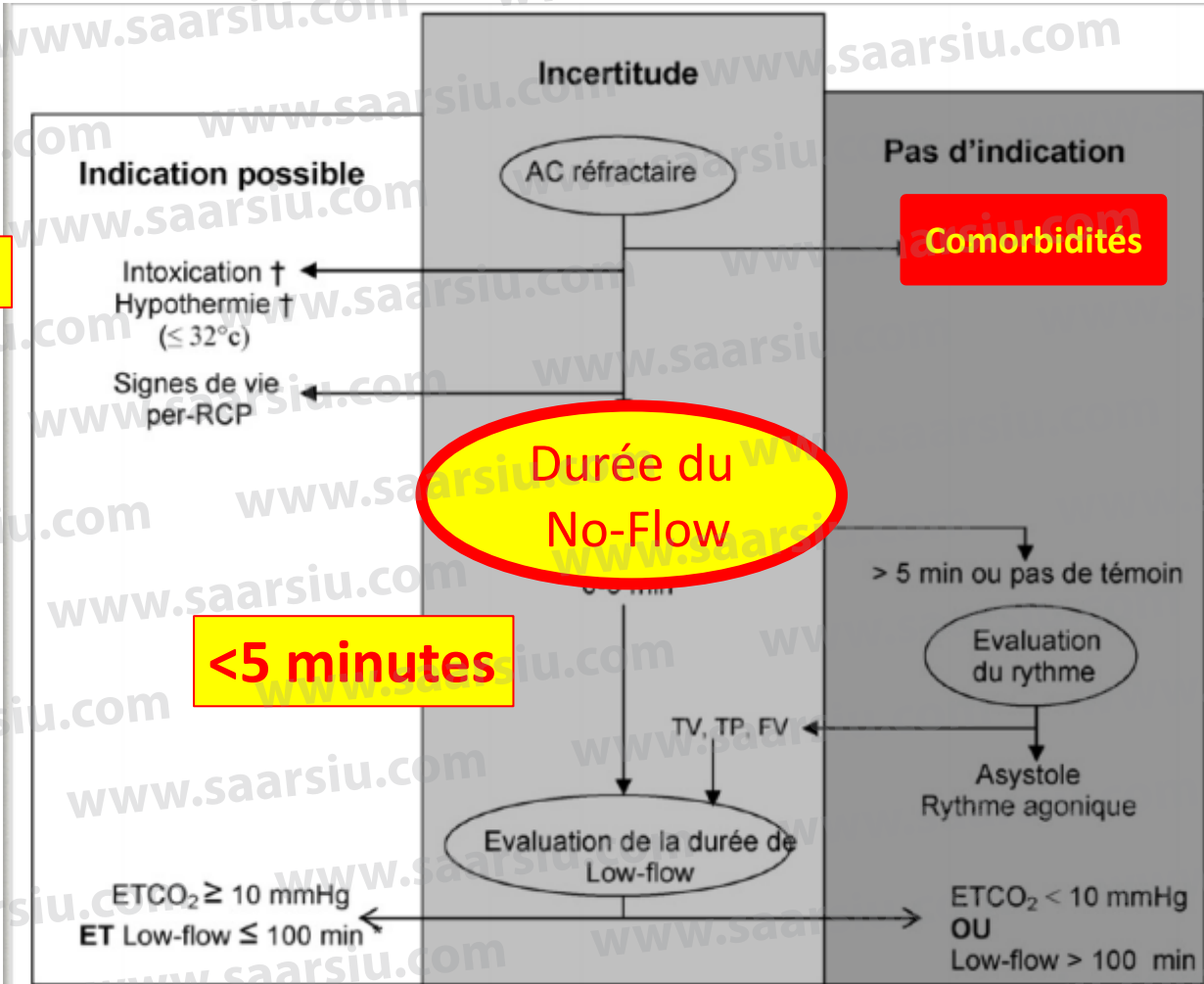


- Mouvements spontanés
- Absence de mydriase et/ou réactivité pupillaire
- Gaspes inspiratoires

Riou B. et al.
Annales
Françaises
d'Anesthésie et de
Réanimation 28
(2009) 182–186

Age < 75 ans

IMC < 30 kg/m²

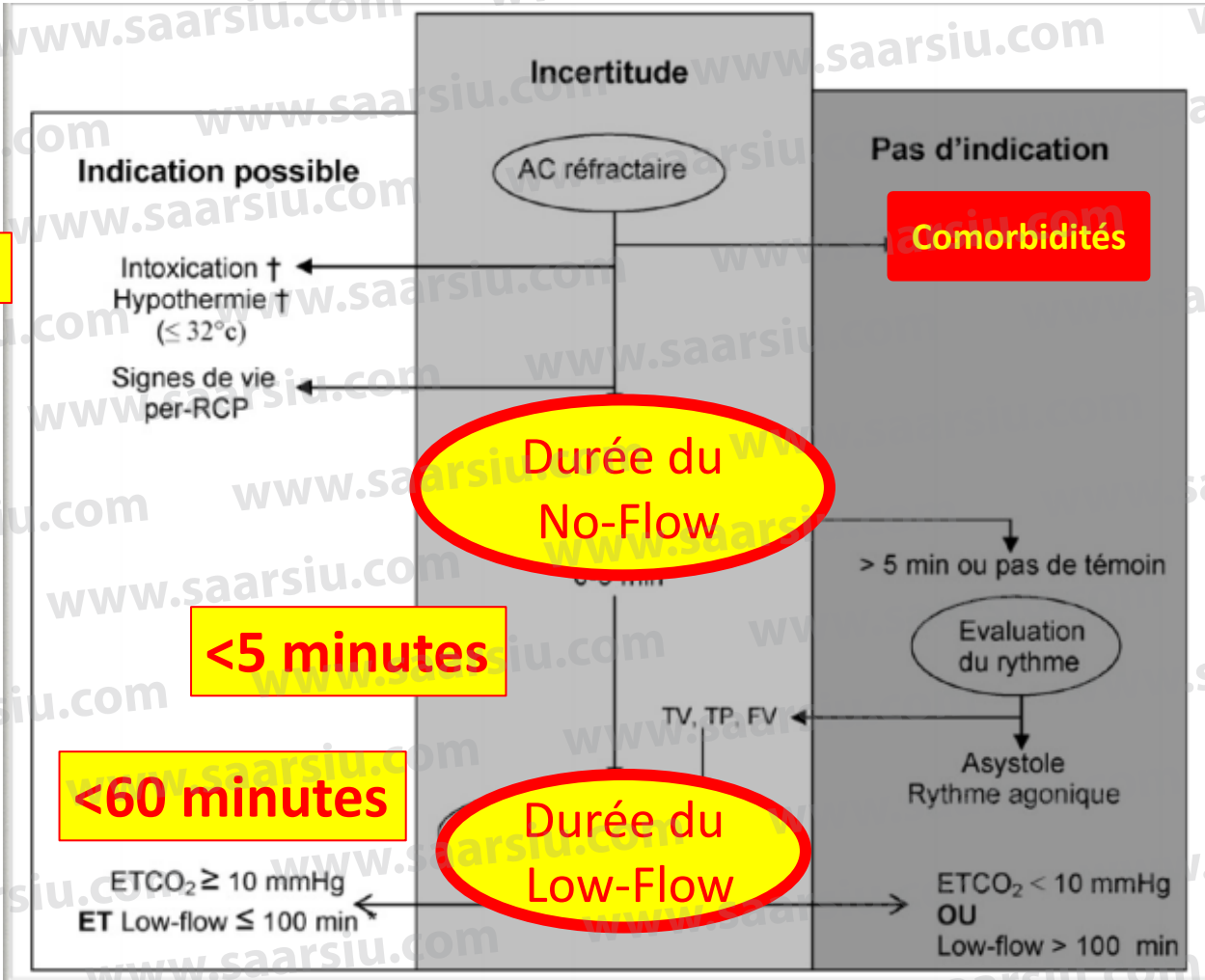


< 5 minutes

Riou B. et al.
Annales
Françaises
d'Anesthésie et de
Réanimation 28
(2009) 182–186

Age < 75 ans

IMC < 30 kg/m²



<5 minutes

<60 minutes

Ortega-Deballon I
et al.
Resuscitation
2016; 101: 12–20.

Debaty G et al.
Resuscitation
2017; 112: 1–10.

Arrêt cardiaque réfractaire ?

- Pas de recommandations claires sur la durée de RCP avant AC réfractaire

- Guidelines 2015 :

- "Asystole for more than 20 min despite ongoing ALS, in the absence of a reversible cause."

The ethics of resuscitation and end-of-life decisions. Resuscitation. 2015;95:302-11.

- AC réfractaire pas toujours défini dans les études sur ECPR, la plupart du temps = 30 min

Crit Care. 2015;19:268.

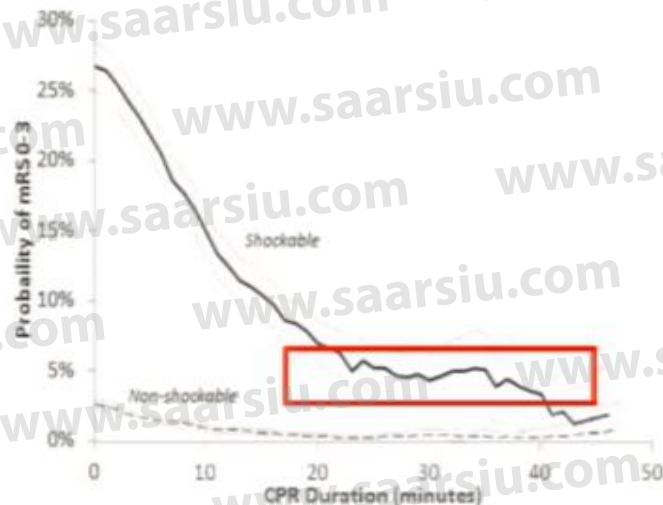
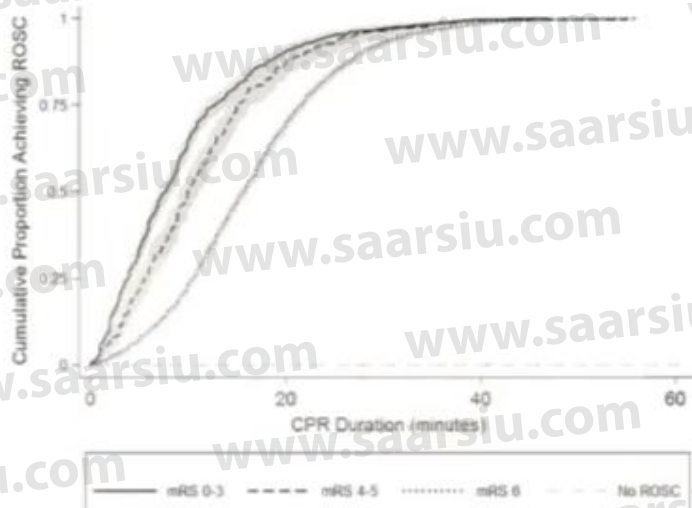
ECPR pour l'AC réfractaire

The Association Between Duration of Resuscitation and Favorable Outcome After Out-of-Hospital Cardiac Arrest: Implications for Prolonging or Terminating Resuscitation

Joshua C. Reynolds, MD, MS 1; Brian E. Grunau, MD 2; Jon C. Rittenberger, MD, MS 3;
Kelly N. Sawyer, MD, MS 4; Michael C. Kurz, MD, MS 5; Clifton W. Callaway, MD, PhD 3



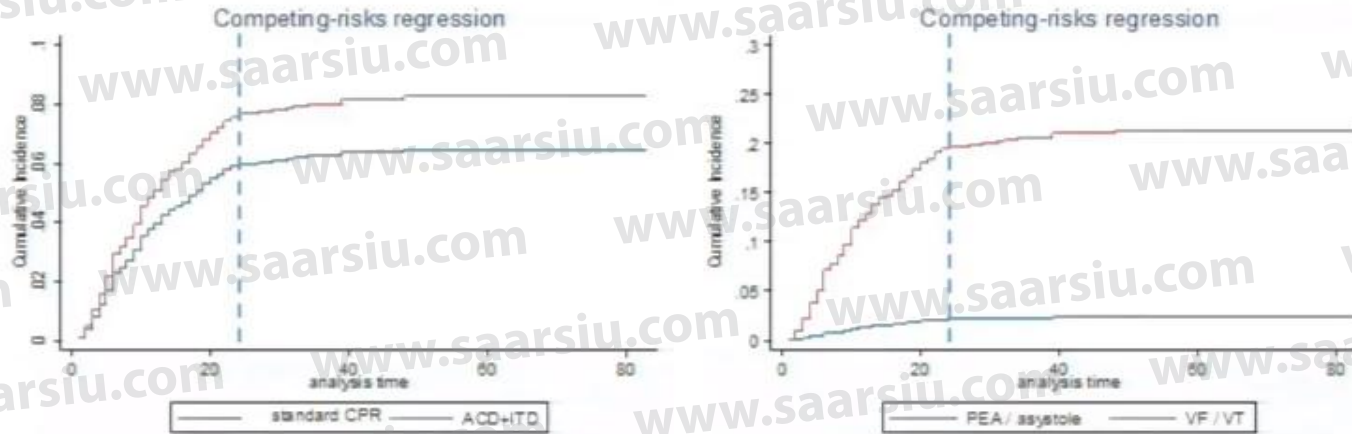
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choisir**



Circulation. 2016;134:2084-2094

Un problème lié au temps d'intervention

Post-hoc analysis of the ResqTrial Database (n = 2447)
Probability of survival with mRs ≤ 3 according to CPR duration



A. ACD+ITD CPR and Standard CPR, B. First recorded rhythm - Survival analysis of CPR duration for modified Rankin scale ≤ 3 using the method of Fine and Gray for accounting competing risks (ending CPR with death)

Defining the beginning of the metabolic phase after cardiac arrest in human –
Circulation. 2018;136:A20385

Facteurs pronostiques

Délétères



Asystolie

+

Absence de signe de vie

VPP décès

100 %

IC₉₅ [90;100]

AC réfractaire hypothermique

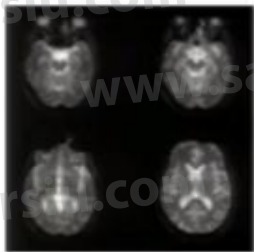


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Neurologic Recovery From Profound Accidental Hypothermia After 5 Hours of Cardiopulmonary Resuscitation

Yvonnick Boue, MD^{1,2,3}; Julien Lavolaine, MD¹; Pierre Bouzat, MD, PhD^{1,2,3}; Sophie Matraxia, MD,
Olivier Chavanon, MD, PhD⁵; Jean-François Payen, MD, PhD^{1,2,3}

Crit Care Med. 2014;42:e167-70.



Femme 55 ans, épuisement dans la tempête en montagne.

Risque avalanche ++

Arrivée des secours : signes de vie puis AC en FV

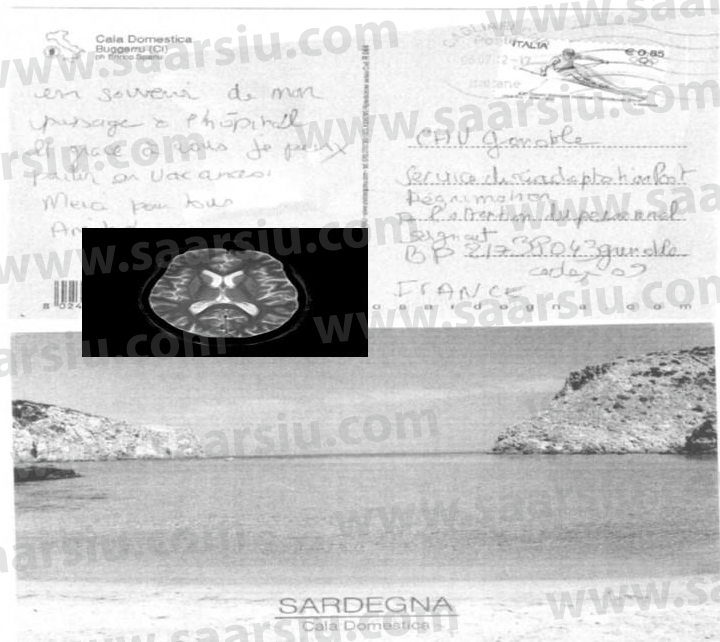
CEE / Adrénaline (IO)

Alternance RCP (1 min) / No flow pour descente (1 min)
jusqu'à l'ambulance

Total no flow 12 - 13 min

Neurologic Recovery From Profound Accidental Hypothermia After 5 Hours of Cardiopulmonary Resuscitation

Yvonnick Boue, MD^{1,2,3}; Julien Lavolaine, MD¹; Pierre Bouzat, MD, PhD^{1,2,3}; Sophie Matraxia, MD⁴; Olivier Chavanon, MD, PhD⁵; Jean-François Payen, MD, PhD^{1,2,3}



Prise en charge préhospitalière (2)

- IOT
- MCE + MC automatisé
- T° : 16,7° c
- EtCO₂ : 19 mmHg
- 3 h de route jusqu'au CHU, Intermittent CPR :
- **Total low flow 5 h**

Prise en charge hospitalière :

- ECMO (AV)
- T° centrale : 16,3° C
- K⁺ : 5.8 mmol/l
- Pas de trauma
- 2 mois en réanimation
- 3 mois en centre de rééducation neurologique

Pas de limite de durée de Low Flow si Hypothermie accidentelle à l'origine d'un AC

AC réfractaire d'origine toxique



**Bien
choisir**

Table 1. Comparison of extracorporeal life support (ECLS) management and outcome according to the cause of the refractory cardiac arrest (SAPS II Simplified Acute Physiology Score II, SOFA Sequential Organ Failure Assessment)

	Toxic cardiac arrest (n = 12)	Nontoxic cardiac arrest (n = 5)	p
Age (years)	49 (33–59)	29 (20–49)	0.02
SAPS II value on admission	79 (38–94)	83 (53–94)	0.9
Maximal SOFA score	18.5 (15.8–20.3)	18.0 (17.0–20.0)	0.9
Place of cardiac arrest occurrence (out-of vs. intrahospital)	8/4	1/4	0.1
Duration of continuous external cardiac massage (min)	120 (45–180)	135 (120–185)	0.2
Plasma lactate concentration (mmol/l)	17.3 (5.3–39.3)	22.5 (10.5–29.6)	0.8
Serum creatinine concentration (μmol/l)	141 (83–369)	128 (92–173)	0.6
PaO ₂ /FIO ₂ ratio (mmHg)	271 (41–557)	76 (71–358)	0.3
ECLS success (%)	83	80	0.9
ECLS duration (h)	56 (5–108)	14 (5–129)	0.5
24-h survival (%)	50	20	0.3
Hospital discharge (%)	25	0	0.5

Megarbane B et al. Emergency feasibility in medical intensive care unit of extracorporeal life support for refractory cardiac arrest. *Intensive Care Med.* 2007;33(5):758–64.

AC réfractaire indication



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choisir**



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Contents lists available at ScienceDirect

Resuscitation

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



EUROPEAN
RESUSCITATION
COUNCIL

Review article

Prognostic factors for extracorporeal cardiopulmonary resuscitation recipients following out-of-hospital refractory cardiac arrest. A systematic review and meta-analysis^a

Guillaume Debaty^{a,b,*}, Valentin Babaz^b, Michel Durand^c, Lucie Gaide-Chevronnay^c, Emmanuel Fournel^c, Marc Blancher^d, Hélène Bouvaist^d, Olivier Chavanon^{e,f}, Maxime Maignan^{b,f}, Pierre Bouzat^{c,d}, Pierre Albaladejo^{a,c}, José Labarère^{d,h}



Facteurs pronostics significatifs :

- **Durée de low-flow**
- **Rythme initial**
- **pH et Lactate à l'admission**

Facteurs pronostics non significatifs :

- **Durée de no-flow**
- **Age**
- **Sexe**

Diminuer le Low-Flow

- 2 approches:

- Poser sur place

Lamhaut L et al. Resuscitation. 2017 Aug;117:109-117.

- Rapprochement rapide « Load and go »

Poppe M. et al. Resuscitation. 2015 Jun;91:131-6.

Importance de la durée de low flow

Wengemayer et al. Critical Care (2017) 21:157
DOI 10.1186/s13054-017-1744-8

Critical Care

RESEARCH

Open Access



— Influence of low-flow time on survival after extracorporeal cardiopulmonary resuscitation (eCPR)

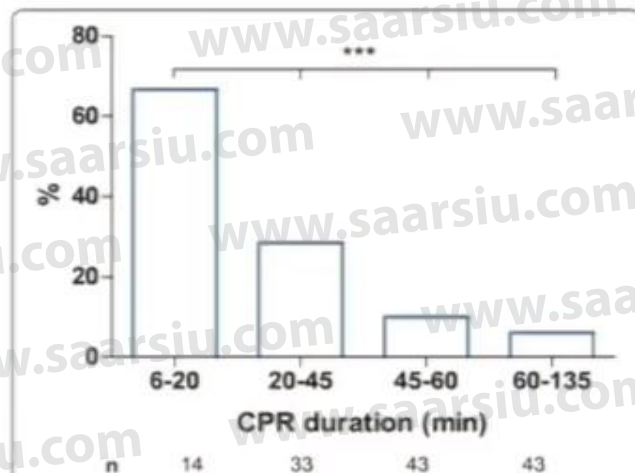


Fig. 4 Mean survival for extracorporeal cardiopulmonary resuscitation patients after 6–20, 20–45, 45–60, and 60–135 minutes of mechanical cardiopulmonary resuscitation (CPR) (** $p = 0.001$)

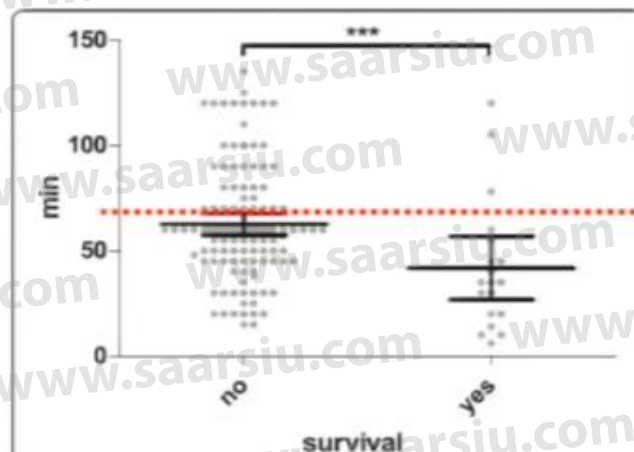
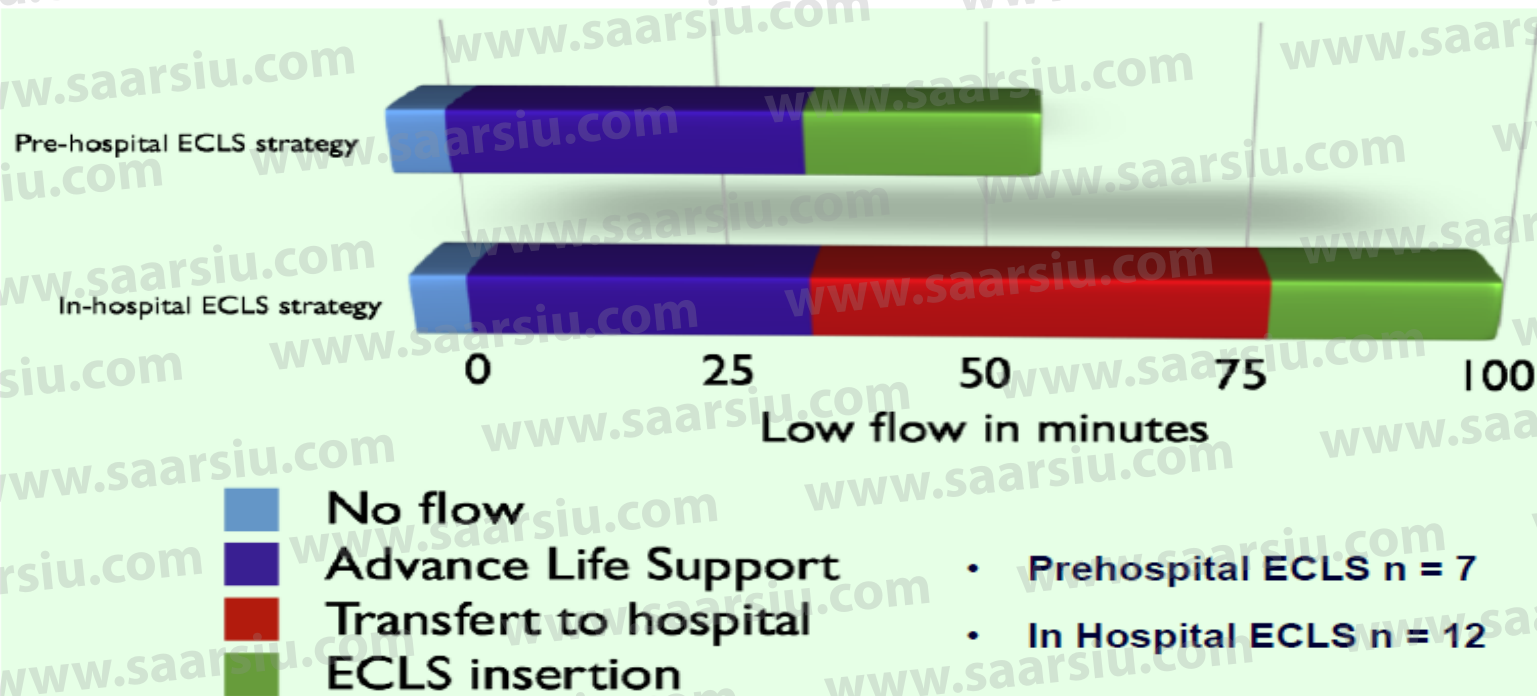


Fig. 2 Scatterplot of low-flow time in survivors and nonsurvivors (** $p = 0.003$). Low-flow time means duration of mechanical cardiopulmonary resuscitation before full extracorporeal membrane oxygenation support



Comparison of prehospital VS in hospital ECLS strategy



Réduire le low flow par ECPR préhospitalier

Resuscitation 117 (2017) 109–117

Contents lists available at ScienceDirect



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Resuscitation

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



Clinical paper

A Pre-Hospital Extracorporeal Cardio Pulmonary Resuscitation (ECPR) strategy for treatment of refractory out hospital cardiac arrest: An observational study and propensity analysis



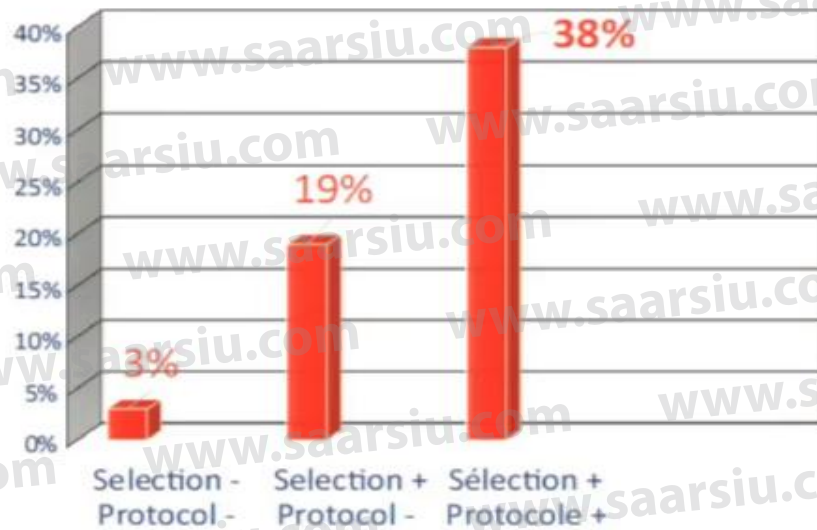
CrossMark

Lionel Lamhaut^{a,b,*}, Alice Hutin^{a,c}, Etienne Puymirat^{d,e}, Jérôme Jouan^a, Jean-Herlé Raphalen^a, Romain Jouffroy^a, Murielle Jaffry^g, Christelle Dagron^a, Kim An^a, Florence Dumas^{b,e,h}, Éloi Marijon^{b,d,e}, Wulfran Bougouin^{c,d}, Jean-Pierre Tourtierⁱ, Frédéric Baud^a, Xavier Jouven^{b,d,e}, Nicolas Danchin^{d,e}, Christian Spaulding^{b,d,e}, Pierre Carli^{a,e}

Réduire le low flow par ECPR préhospitalier

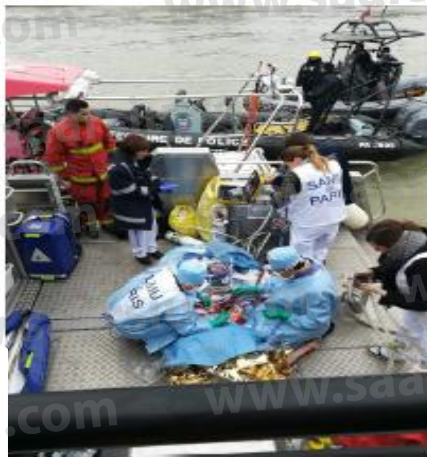
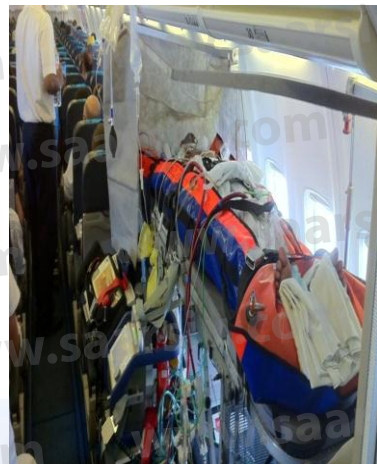


* :Period 1 vs Period 2 $p < 0,001$
 ** :Period 1 in vs pre-hospital $p < 0,001$
 ***:Period 2 in vs pre-hospital $p < 0,001$



Protocole :
 ECPR préhospitalier
 + Adrénaline < 5 mg
 + Angiographie

Une approche globale agressive permet d'atteindre des taux de survie de 38%



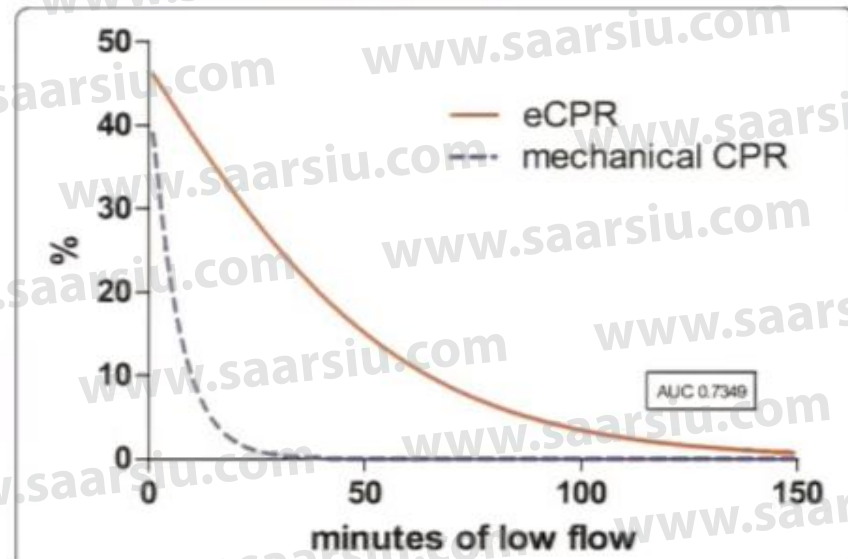
ECPR en France

Journal of Intensive Care Medicine 2015 25 157
DOI: 10.1177/1053185414517176

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Influence of low-flow time on survival after extracorporeal cardiopulmonary resuscitation (eCPR)



ECPR en France

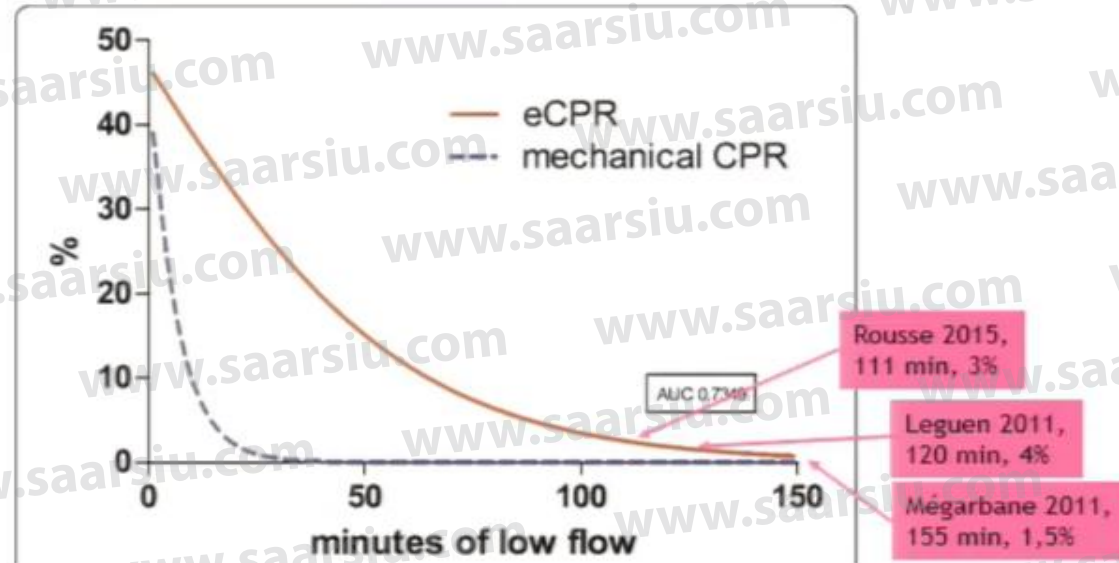
Wongcharatana et al. Critical Care (2015) 25:157
DOI 10.1186/s13054-017-1744-8

Critical Care

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Influence of low-flow time on survival after extracorporeal cardiopulmonary resuscitation (eCPR)



ECPR en France

Intensive Care Med. 2017;52:157-167
DOI: 10.1186/s13054-017-1744-8

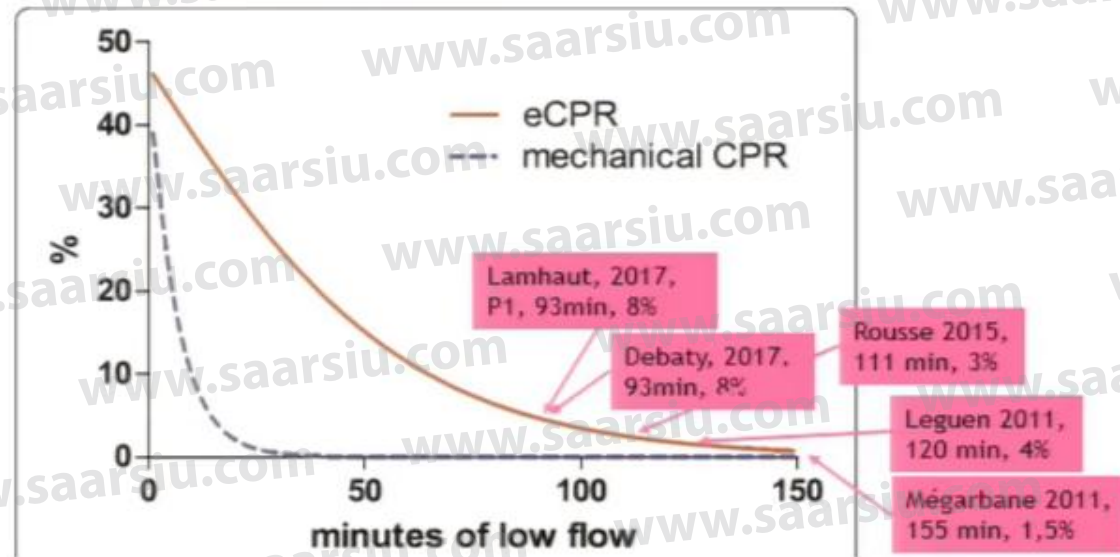
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Critical Care

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Influence of low-flow time on survival after extracorporeal cardiopulmonary resuscitation (eCPR)



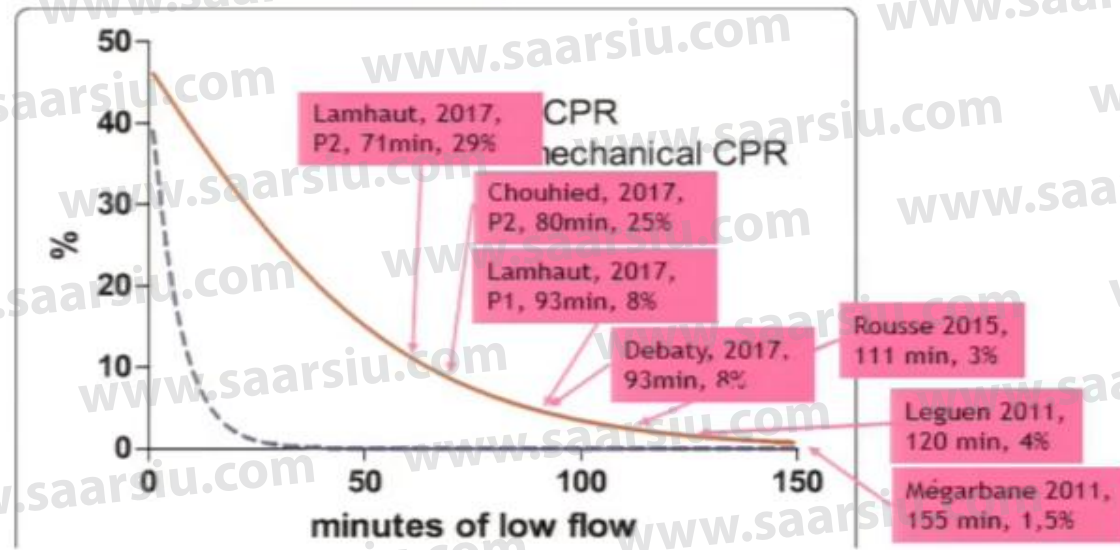
ECPR en France

www.sciencedirect.com
Journal of Intensive Care Medicine
Volume 28, Issue 1, February 2017, Pages 1-7
ISSN 1053-2528
DOI: 10.1016/j.jicm.2016.01.004

RESEARCH

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Influence of low-flow time on survival after extracorporeal cardiopulmonary resuscitation (eCPR)





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<http://dx.doi.org/10.1016/j.jacc.2017.07.782>

Long-Term Prognostic Value of Gasping During Out-of-Hospital Cardiac Arrest

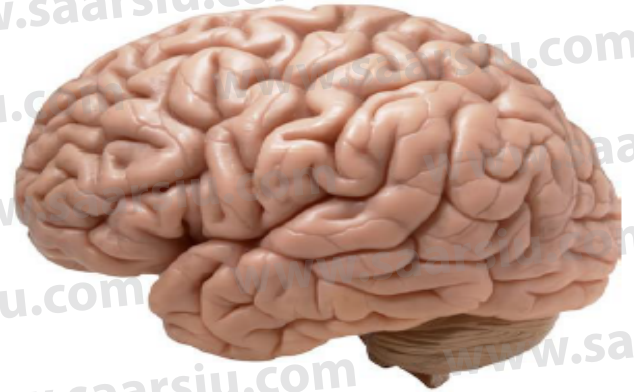


Guillaume Debaty, MD, PhD,^{a,b} Jose Labarere, MD, PhD,^{a,c} Ralph J. Frascone, MD,^d Marvin A. Wayne, MD,^e
Robert A. Swor, MD,^f Brian D. Mahoney, MD,^g Robert M. Domeier, MD,^h Michael L. Olinger, MD,ⁱ Brian J. O'Neil, MD,^j
Demetris Yannopoulos, MD,^k Tom P. Aufderheide, MD,^l Keith G. Lurie, MD^f

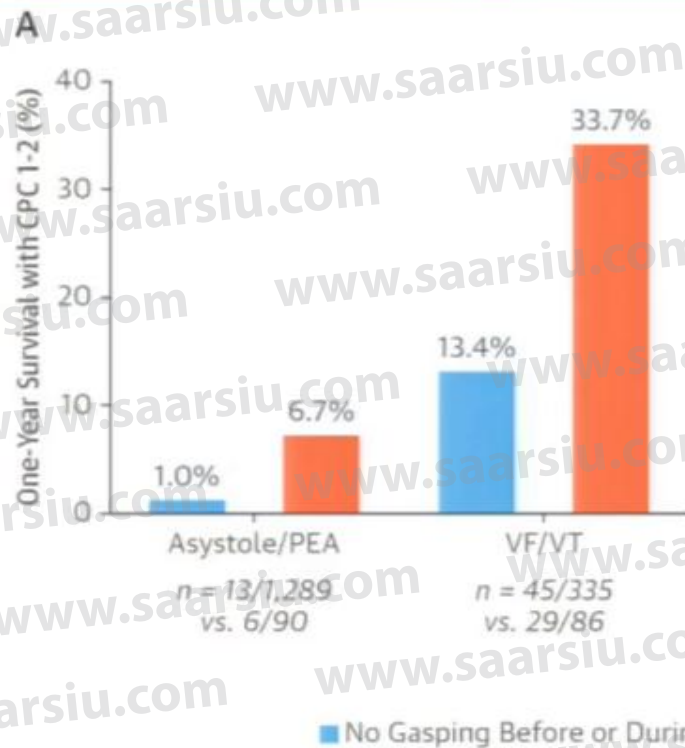


Signs of life

- **Breathing**
- **Gasp**
- **Mouvmment**
- **Myosis**



Effet des gasps sur le devenir neurologique à un an



Debaty, G. et al. J Am Coll Cardiol. 2017;70(12):1467-76.

Mouvements

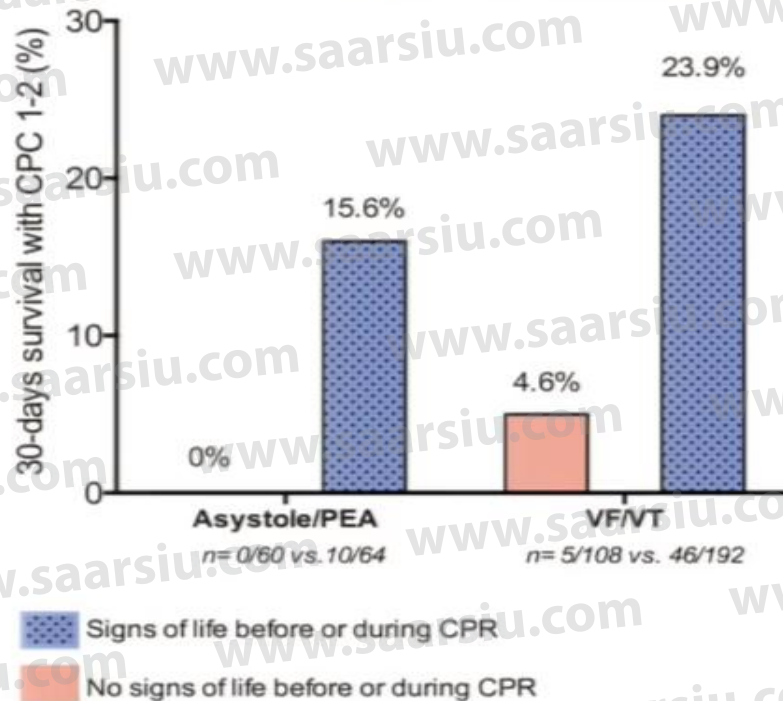
Réactivité pupillaire

Gasps



Signes de Vie avant ou pendant la RCP

434 patients
traités par
ECPR dans
3 centres



Debaty et al - Early Signs of Life as a Prognostic Factor for Extracorporeal Cardiopulmonary Resuscitation in Refractory Out-of-Hospital Cardiac Arrest - Circulation. 2018;138:A362

Signes de Vie avant ou pendant la RCP

Characteristics	Adjusted odds ratio (95% CI) †
Any sign of life during CPR	9.71 (3.69-25.52)
Male gender	0.80 (0.37-1.70)
Age, per 10-year increase	0.84 (0.67-1.06)
≥1 comorbid condition	1.09 (0.59-20.1)
No-flow duration, per 1-minute increase	0.88 (0.79-0.99)
Low-flow duration, per 10-minute increase	0.93 (0.84-1.02)
Initial shockable cardiac rhythm	2.34 (1.08-5.06)
Arterial lactates, per 1-mmol/L increase	0.93 (0.87-1.00)

Debaty et al Early Signs of Life as a Prognostic Factor for Extracorporeal Cardiopulmonary Resuscitation in Refractory Out-of-Hospital Cardiac Arrest - Circulation. 2018;138:A362

ECPR dans l'AC réfractaire

N'agoniser pas, Organiser



Problème d'organisation

Améliorer l'organisation

N'agoniser pas, Organiser



Problème d'organisation



SHOCK, Vol. 49, No. 1, pp. 24–28, 2018

IMPROVING PATIENT SELECTION FOR REFRACTORY OUT OF HOSPITAL CARDIAC ARREST TREATED WITH EXTRACORPOREAL LIFE SUPPORT

Tahar Chouihed,^{§||} Antoine Kimmoun,^{†§¶} Adrien Lauvray,[†]
Francois-Xavier Laithier,[†] Deborah Jaeger,[†] Simon Lemoine,[†]
Juan Pablo Maureira,[†] Lionel Nace,[†] Kevin Duarte,^{||¶} Stéphane Albizzati,[‡]
Nicolas Girerd,^{§||¶} and Bruno Levy^{†§¶}

Améliorer l'organisation

N'agoniser pas, Organiser



Problème d'organisation

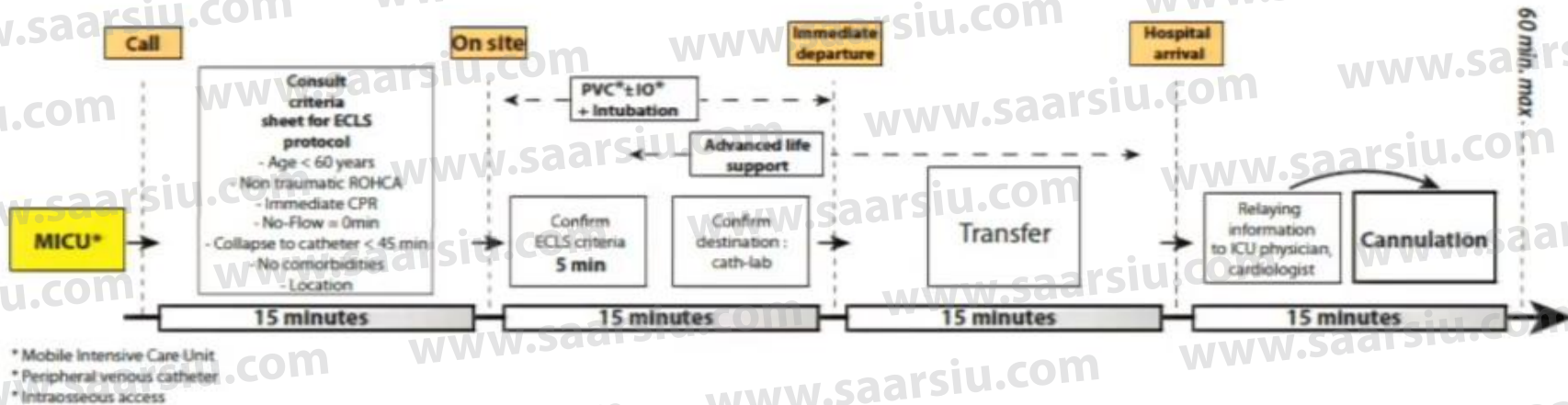


Fig. 1. Description of the OSCAR-ECLS procedure and expected timing of each phase.

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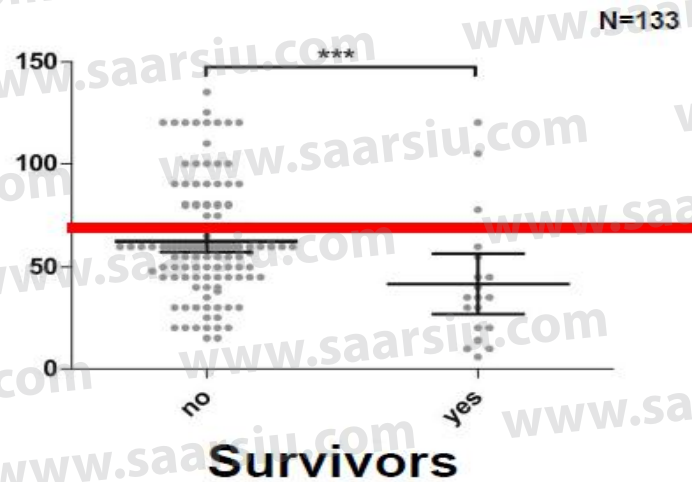
Problème d'organisation



Table 1. Demographics, arrest characteristics, and prehospital management

	Total n = 46	Before OSCAR-ECLS period (n = 14)	OSCAR-ECLS period (n = 32)	P ^a
No- and low-flow times before catheterization laboratory				
No-flow (min)	0 (0-2)	2 (0-5)	0 (0-2)	0.057
No-flow + delay to hospital (min)	67 (55-78)	80 (71-88)	60 (51-72)	0.0003 ^b
Elapsed time to ECLS implantation (min)				
Time from collapse to call Emergency Dispatcher Center	0 (0-3)	3 (1-4)	0 (0-2)	0.002 ^b
Time from call to arrival on site	14 (8-15)	12 (8-16)	15 (8-15)	0.43
Time on site	26 (22-40)	48 (40-54)	24 (20-28)	<0.0001 ^b
Transfer time	15 (10-20)	20 (14-22)	15 (9-18)	0.033 ^b
Time from hospital arrival to ECLS implantation	19 (15-20)	19 (19-19)	18 (12-24)	0.73
Total time	86 (71-98)	99 (90-107)	80 (65-94)	0.0007 ^b
Coronary management				
Angiography (yes)	36 (78)	5 (36)	31 (97)	<0.0001 ^b
Discharged alive		1 (7%)	8 (25%)	0,24

Golden hour for ECPR



Wengenmayer et al. Critical Care (2017) 21:157

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"Coronary Artery Disease in Patients with Out-of-Hospital Refractory Ventricular Fibrillation Cardiac Arrest"



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ISSN 0735-1097/\$16.00
http://dx.doi.org/10.1016/j.jacc.2017.06.059

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Problème d'organisation

FIGURE 1 University of Minnesota Refractory VF/VT OHCA Protocol

Out of Hospital

Determine Early EMS Transport Criteria

- OHCA of presumed cardiac etiology
- VF or VT as first presenting rhythm
- 18-75 years of age
- Received three EMS-delivered DC shocks and 300mg of amiodarone IV/IO without achieving ROSC
- Body morphology able to accommodate LUCAS™ automated CPR device
- Estimated transfer time from the scene to the CCL of < 30 minutes.

If Patient Meets Early EMS Transport Criteria, Transport to CCL

- Ongoing Mechanical CPR with ITD
- Continued ACLS (limit epinephrine to 3 mg total), Defibrillation PRN en Route

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Problème d'organisation

Initial CCL Assessment

Arterial and venous access under ultrasound

Obtain ABGs and serum lactate

Determine the presence of the CCL Resuscitation Discontinuation Criteria

- ETCO₂ on CCL Arrival < 10 mm Hg
- PaO₂ < 50 mm Hg or O₂ Sat < 85%
- Serum Lactate > 18 mmol/L

Patient has one or more of the above criteria.
Terminate Resuscitation
Declare Dead

Patient has none of the above criteria.

ROSC Present: Immediate Coronary Angiography, PCI as appropriate

No ROSC: Initiate ECLS

- Place venous/arterial cannulas 25 Fr/17 Fr (men) and 25 Fr/15Fr (women)

Coronary Angiography, PCI as appropriate immediately following ECLS

IABP Placement if PCI Performed

Continue ACLS/ECLS for up to 90 minutes following angiography and PCI

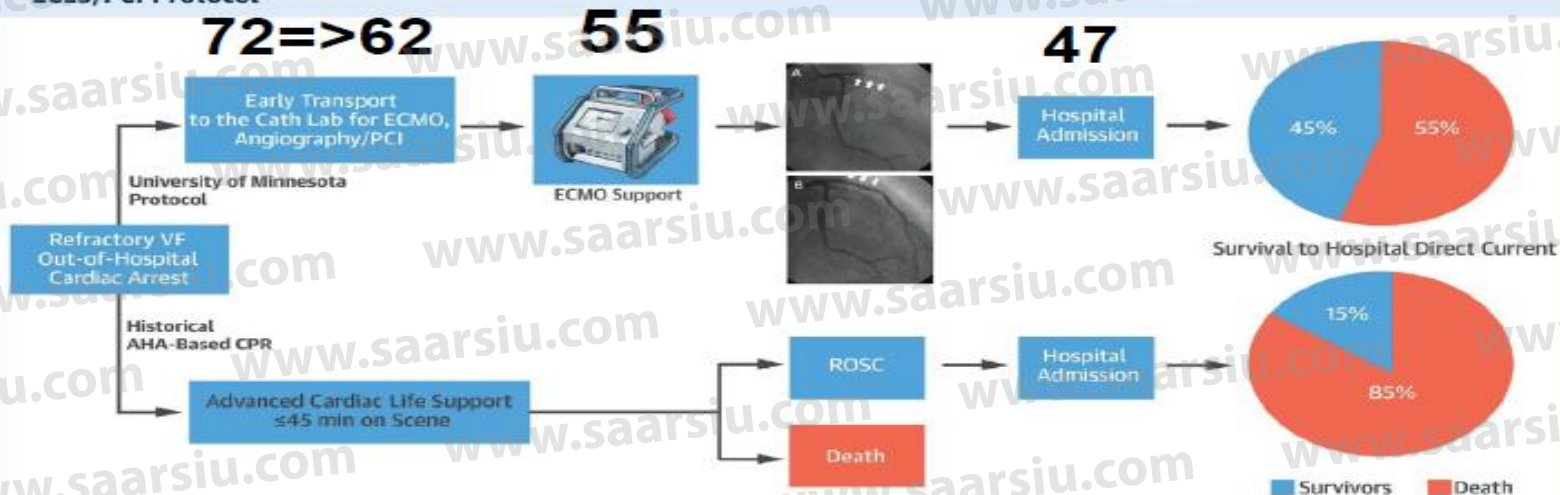
Load and go if transport is short..

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Problème d'organisation

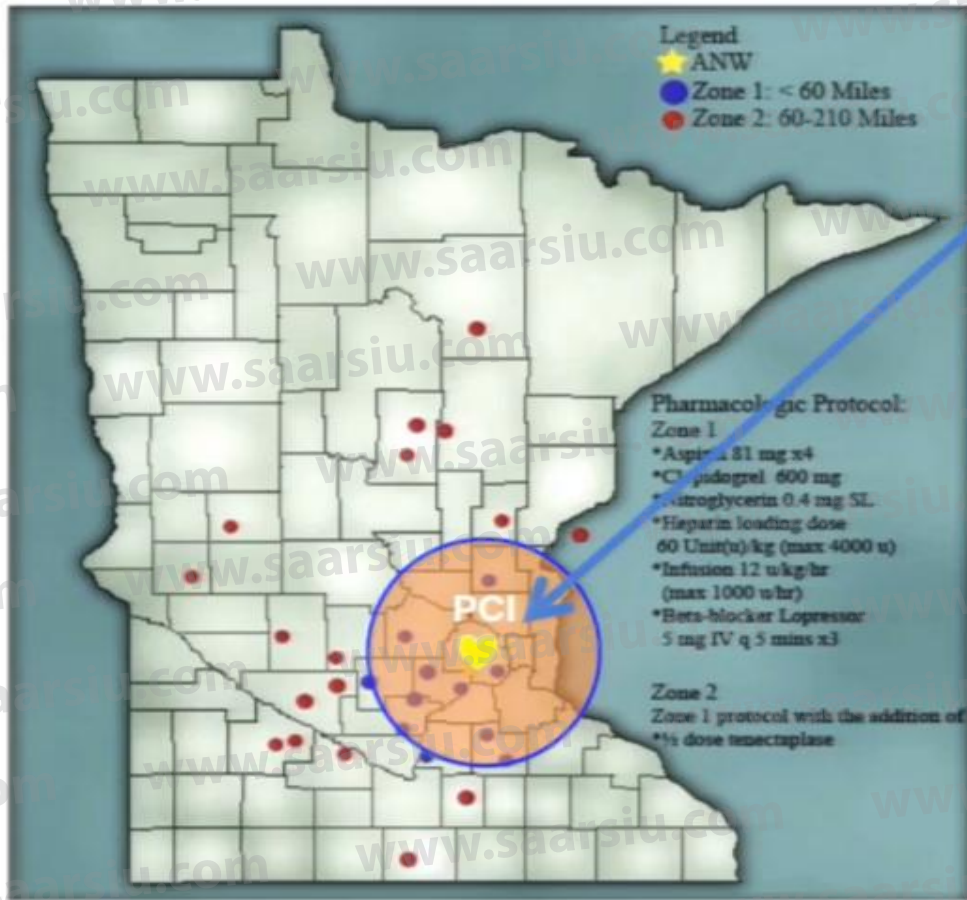
CENTRAL ILLUSTRATION Refractory Cardiac Arrest Due to VF/VT and the University of Minnesota ECLS/PCI Protocol



Yannopoulos, D. et al. J Am Coll Cardiol. 2017;70(9):1109-17.

The University of Minnesota refractory ventricular fibrillation (VF) protocol mobilizes patients with failed initial resuscitation with ongoing cardiopulmonary resuscitation (CPR) to enter the cardiac catheterization laboratory (Cath Lab) where extracorporeal life support (ECLS) is implemented as a bridge to coronary angiography, intervention, and recovery. The program has identified that 86% of the patients had severe coronary artery disease. Survival to hospital discharge was 45%. Historical control subjects treated with the previous standard of care had access to the hospital only after return of spontaneous circulation (ROSC) was achieved and, as such, survival was poor. AHA = American Heart Association; ECMO = extracorporeal membrane oxygenation; PCI = percutaneous coronary intervention; VT = ventricular tachycardia.

Yannopoulos, D. et al. J Am Coll Cardiol. 2017;70(9):1109-17.



ECPR

ECPR - PEC en réanimation des patients

Refractory VT/VE patients Admitted to ICU		Overall (83)	Survivors (46)	Deaths (23)	Brain Death (14)
CT Chest	Rib Fractures	37/83 (45%)	17/46 (37%)	12/23 (52%)	8/14 (57%)
	Lung Injury	64/83 (77%)	33/46 (72%)	20/23 (87%)	11/14 (79%)
	Pneumothorax	6/83 (7.2%)	4/46 (8.7%)	0%	2/14 (14%)
	Pneumothorax Requiring Chest tube	2/83 (2.4%)	2/46 (4.3%)	0%	0%
	Thoracic/Pericardial Bleed	11/83 (13%)	6/46 (13%)	3/23 (13%)	2/14 (14%)
CT Abd/Pelvis	Abdominal Bleed	6/83 (7.2%)	3/46 (6.5%)	3/23 (13%)	0%
	Pancreatitis	4/83 (4.8%)	2/46 (4.3%)	2/23 (8.7%)	0%
	RP Bleed	3/83 (3.6%)	2/46 (4.3%)	1/23 (4.3%)	0%



Bartos et al, Resuscitation, 2018



Complications Requiring a Procedure or Operation				
Complication	Procedure	Total Patients	Survivors	Deaths
CPR-Associated Ruptured RV/Tamponade	Emergent Pericardiocentesis, Sternotomy, and RV Repair	1	1	0
Unable to Wean from ECMO	Durable Left Ventricular Assist Device Implantation	2	2	0
Ischemic Lower Extremity/Hemodynamically Stable	Decannulation of Peripheral ECMO	2	2	0
Ischemic Lower Extremity/Hemodynamically Unstable	Decannulation of Peripheral ECMO and Central Cannulation	1	1	0
Spontaneous RP Bleed	Endovascular Embolization of Lumbar Artery	1	0	1
CPR-Associated Pneumothorax	Chest Tube Insertion	2	2	0
Late Occurrence Pneumothorax	Chest Tube Insertion	2	1	1
Large Hemothorax	Chest Tube Insertion	1	0	1
Recurrent VF	Impella Insertion	1	1	0
Recurrent Cardiogenic Shock	Intra-Aortic Balloon Pump Insertion	1	1	0
Recurrent VF	Defibrillation	4	1	3
Indication for ICD (non-ischemic VF or recurrent VF)	ICD Insertion	10	9	1
Tachy/Brady Syndrome	Permanent Pacemaker Insertion	1	1	0
Bradycardia/Heart Block	Temporary Pacemaker Insertion	3	2	1
Poor Neurologic Recovery/Unable to Protect Airway	Tracheostomy/Gastro-jejunal Tube Insertion	6	5	1
Prolonged respiratory failure	Tracheostomy Insertion	3	3	0
Acute Renal Failure	Dialysis Catheter Insertion	8	5	3
Chronic Renal Failure	Dialysis Catheter Insertion	2	0	2
Pleural Effusion	Thoracentesis	1	1	0
Hypoxia	Bronchoscopy	10	8	2
Upper Gastrointestinal Bleed	Endoscopy	1	1	0

Bartos et al, Resuscitation, 2018



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Complications Requiring a Procedure or Operation				
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Large Hemothorax	Chest Tube Insertion	1	0	1

Prolonged respiratory failure	Tracheostomy Insertion	3	3	0
Acute Renal Failure	Dialysis Catheter Insertion	8	5	3
Chronic Renal Failure	Dialysis Catheter Insertion	2	0	2
Pleural Effusion	Thoracentesis	1	1	0
Hypoxia	Bronchoscopy	10	8	2
Upper Gastrointestinal Bleed	Endoscopy	1	1	0



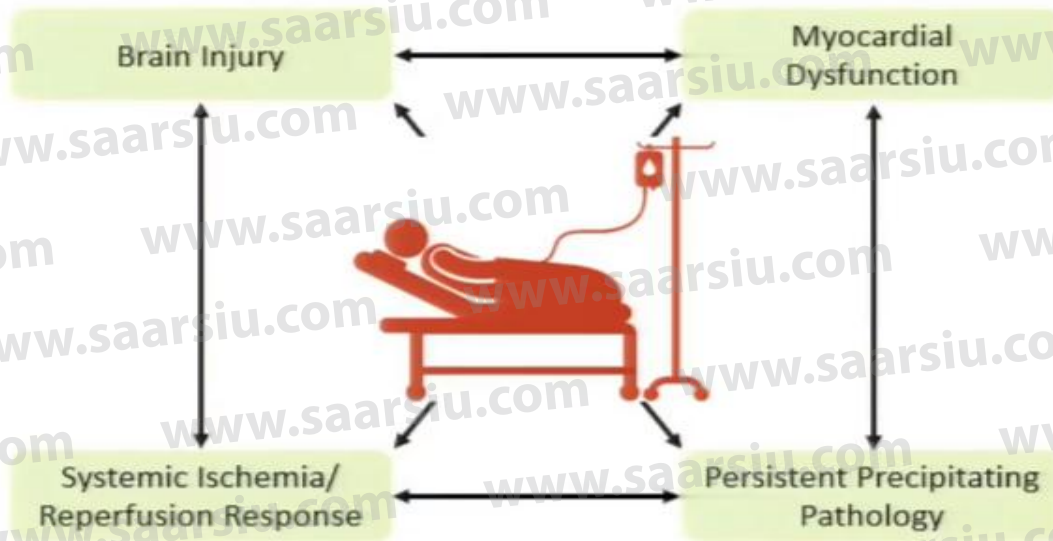
Bartos et al, Resuscitation, 2018

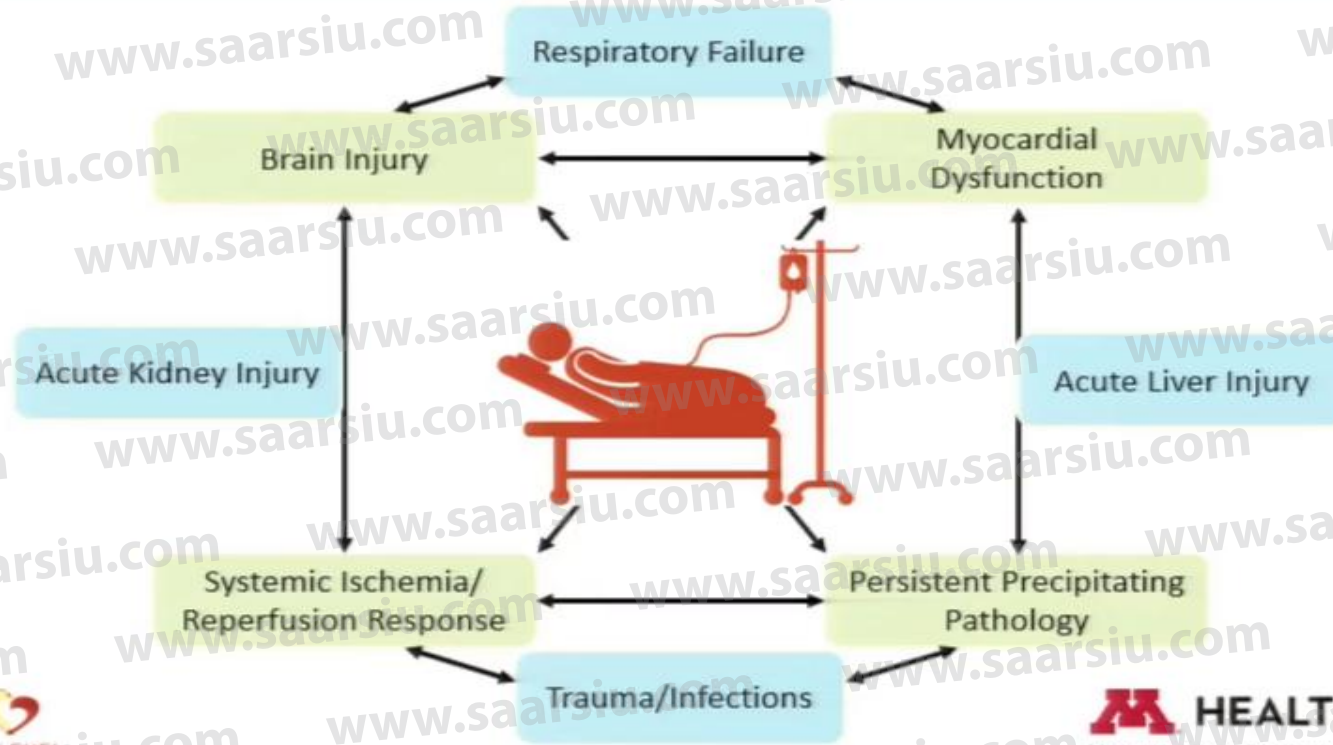


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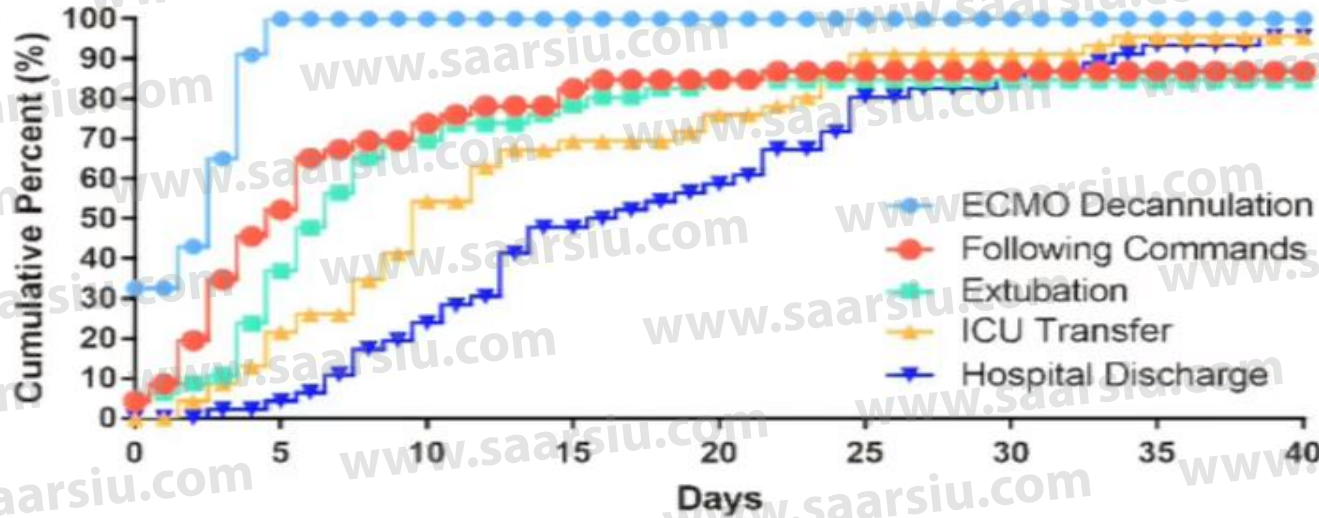
Syndrome post arrêt cardiaque et ECPR





Délai de récupération et ECPR pour AC réfractaire

Hospital Course for Survivors



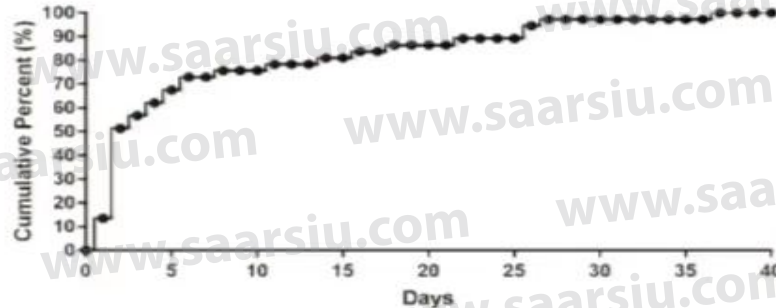
Bartos et al, Resuscitation, 2018



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Cause et délai de décès

Time to Death for CICU Patients



Causes of Death (N=37)		N (%)
Recurrent VF Cardiac Arrest		3/37 (8.1%)
Brain Death		14/37 (38%)
Anoxic Brain Injury		12/37 (32%)
Acute Hemorrhagic Shock Due to Intra-Abdominal Bleeding		2/37 (5.4%)
Refractory Shock		4/37 (11%)
Bowel Infarction		1/37 (2.7%)
Chronic Aspiration and Severe Pneumonia		1/37 (2.7%)

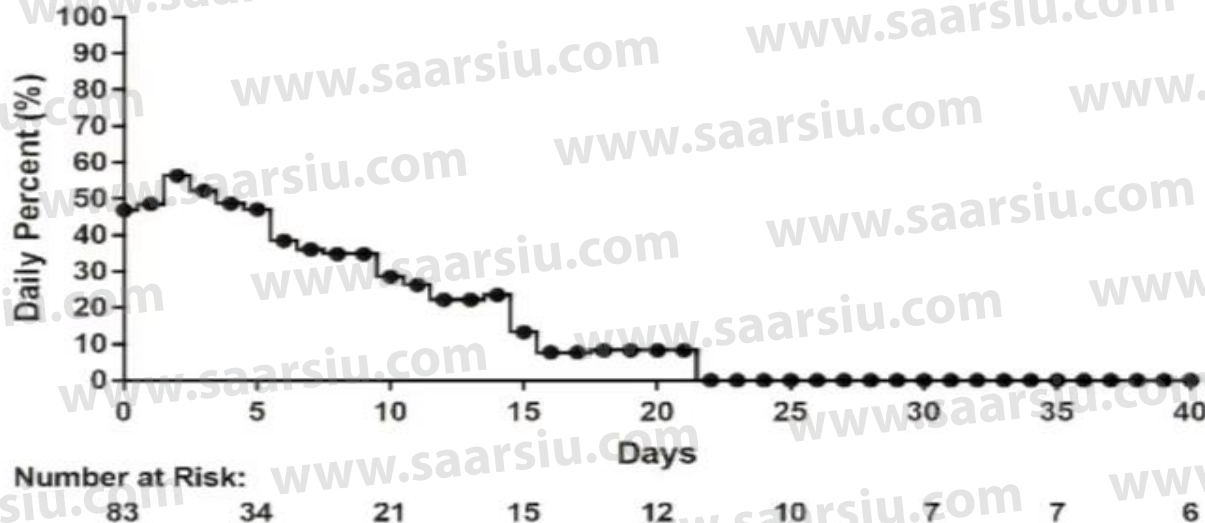


Bartos et al, Resuscitation, 2018



Taux de survie au cours de l'hospitalisation

Neurologically Favorable Survival for Undeclared CICU Patients



Bartos et al, Resuscitation, 2018



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Survie globale

Hospital Discharge		
Denominator:	Full CCL	Admitted to CICU
Survival to Discharge:	46/92 (50%)	46/83 (55%)
Survival to Discharge with CPC 1 or 2	40/92 (43%)	40/83 (48%)
Survival to 3 month clinic follow-up	40/92 (43%)	40/83 (48%)



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Heart Institute

Bartos et al, Resuscitation, 2018



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ECPR dans l'AC réfractaire



Former

Problème de formation

Formation



- Taux d'échec important
25%

- Pose par étapes:
 - Accès veineux et artériels
 - Remplacement sur guide
 - Mise en place de l'ECPR

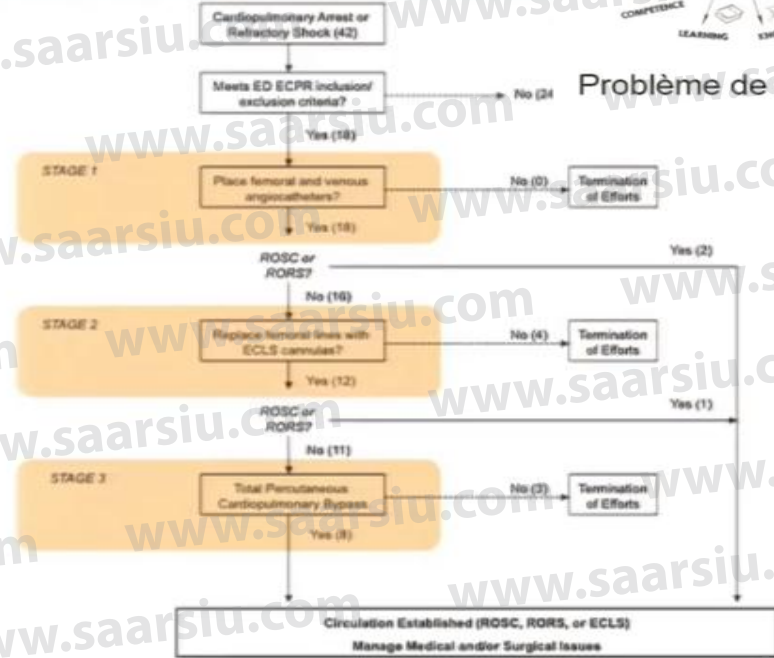


Fig. 1. Case series patient flow diagram (ROSC, return of spontaneous circulation; RORS, resolution of refractory shock; ECLS, extracorporeal life support; ED ECPR, emergency department initiated extracorporeal cardiopulmonary resuscitation).

RESUSCITATION

OFFICIAL JOURNAL OF THE
EUROPEAN RESUSCITATION COUNCIL

Bellezzo 2012

Programme de formation

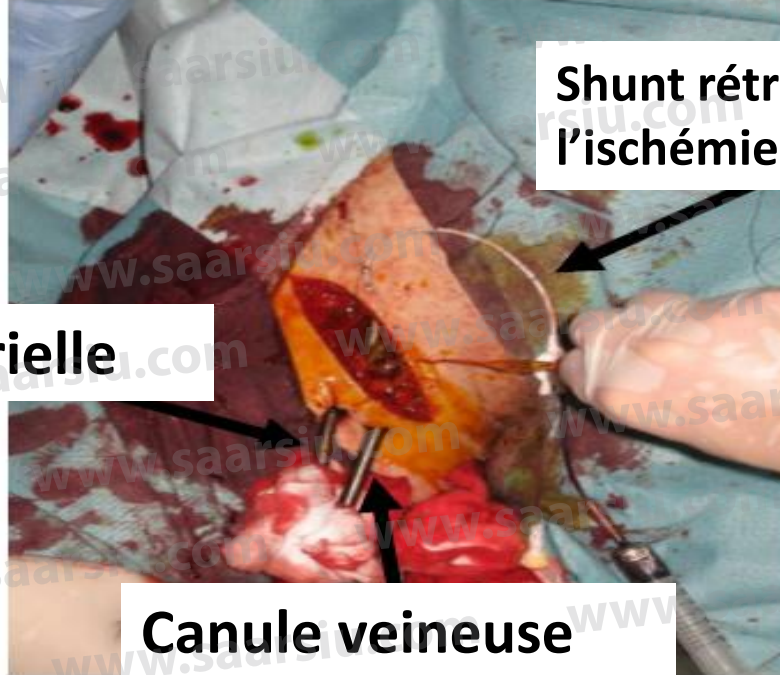
- ➔ En collaboration avec les chirurgiens cardiaques
- ➔ Les connaissances de base
- ➔ Sessions de lecture
- ➔ La simulation
- ➔ L'entraînement sur cadavre
- ➔ Procédures supervisées



Problème de formation



Exemple de mise en place des canules par un non-chirurgien



Canule artérielle

**Shunt rétrograde pour prévenir
l'ischémie du membre**

Canule veineuse

ECPR Cannulation femoral cutdown





ECLS Préhospitalière

Resuscitation 84 (2013) 1525–1529

Contents lists available at ScienceDirect

Resuscitation

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



ELSEVIER



Clinical paper

Safety and feasibility of prehospital extra corporeal life support implementation by non-surgeons for out-of-hospital refractory cardiac arrest[☆]

Lionel Lamhaut^{a,b,*}, Romain Jouffroy^a, Michaela Soldan^a, Pascal Phillippe^a, Thibaut Deluze^a, Murielle Jaffry^a, Christelle Dagon^a, Benoit Vivien^a, Christian Spaulding^{b,c}, Kim An^a, Pierre Carli^{a,b}



ECLS : Matériel



ECPR dans l'AC réfractaire



Problème médico-économique

Coût



	Cardiohelp	ECMO classique
Console	15 000 000 DA	~ 30 000 €
Consommable	600 000 – 800 000 DA	~ 3 000 €





ACC réfractaire après 20 min de RCP avec AED

- Signes de vie per-CPR au moment de la décision,
- OU Hypothermie ($T < 32$),
- OU Intox médicamenteuse ou durant une anesthésie générale

NON

OUI

Envisager
ECPR*

NON

Absence de comorbidité majeure

OUI

Effondrement devant témoin ET RCP d'emblée (< 5 min de no flow)

NON

OUI

ASYSTOLIE

Rythme initial

- FV-TV (choquable)
- AESP

NON

EtCO₂ à la pose de l'ECPR > 10 mmHg

OUI

NON

Mise en place de l'ECPR possible dans l'idéal < 60 min
(acceptable 100min)

OUI

Envisager ECPR

NON

- Age < 55 ans
- No Flow < 30 min
- + Arrivée CH < 120 min de l'effondrement

OUI

Envisager DDAC

Poursuite RCP selon
recommandations
RACS ou décès sur les lieux

* Mise en place de l'ECPR dans le délai le plus court possible
pas de limite de délai dans ces circonstances

L'arrêt cardiaque réfractaire = La mort
????





CrossMark

Extracorporeal cardiopulmonary resuscitation probably good, but adoption should not be too fast and furious!

Clifton W Callaway,¹ Kjetil Sunde²

To cite Callaway CW, Sunde K. *Emerg Med J* 2017;**34**:275–276.



With ECMO Death doesn't mean Death!

With ECMO support: the definition of human viability has changed and the complete arrest of the heart or the lung no longer means death!

[Ann Transl Med.](#) 2017 Mar;5(5):112. doi: 10.21037/atm.2017.01.38.

Extra corporeal membrane oxygenation support: ethical dilemmas.

[Makdisi T](#)¹, [Makdisi G](#)².

Conclusion

Indications claires

- Hypothermie
- Signes de vie per RCP
- FV/TV réfractaire
- RACS intermittentes

- Low-flow cible < 60 min
- FV/TV initiale, AESP ?

- Critères de non selection
(EtCO₂ < 10mmHg, Lactate et pH...)

Pas d'indications

- Asystole + pas de RACS après 2 mg d'adrénaline
- Absence de témoins