LES JEUDIS DE L'URGENCE

JEUDI 16 DÉCEMBRE 2021

L'ARRÊT CARDIAQUE :
DES DRONES AUX SUPPLÉANCES

Président : MC DERKENNE
Coordinateur : MP MARTINEZ-LORENZI (BMPM)

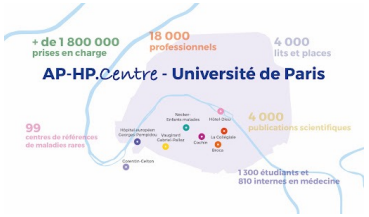
Prise en charge préhospitalière de l'Arrêt Cardiaque Réfractaire

Pr. Benoît VIVIEN

SAMU de Paris
Service d'Anesthésie Réanimation
Hôpital Universitaire - Enfants Malades

SAMU DE PARIS

Hôpital Necker Enfants malades AP-HP



Université de Paris

Absence de conflit d'intérêt en relation avec cette conférence

Pronostic de l'Arrêt Cardiaque Extra-Hospitalier

Out-of-hospital cardiac arrest (OHCA) is a significant global health burden with an annual incidence ranging from 29 to 55 cases per 100,000 population, of which only 2% to 11% survive to hospital discharge.[1] Approximately 75% of adult patients treated for OHCA do not achieve return of spontaneous circulation (ROSC) despite conventional cardiopulmonary resuscitation (CPR) and advanced cardiac life support.[2] Many patients who do not survive to hospital admission after OHCA have autopsy evidence of acute coronary occlusion.[3] Similarly, patients with other reversible etiologies of cardiac arrest, such as fulminant myocarditis, variant angina, and massive pulmonary embolism, are sometimes refractory to standard resuscitation measures.[4-6]

Clin Exp Emerg Med 2018 Apr 30

Pronostic de l'Arrêt Cardiaque Extra-Hospitalier

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

Jean-Stephane David, MD, PhD; Pierre-Yves Gueugniaud, MD, PhD; Bruno Riou, MD, PhD; Emmanuel Pham, PhD; Pierre-Yves Dubien, MD; Patrick Goldstein, MD; Marc Freysz, MD, PhD; Paul Petit, MD

(Crit Care Med 2007; 35:2251–2255)

Variables	Trauma Group / Medical Group Odds Ratio (95% CI)	*p* Value
Return of spontaneous circulation (n)	1.240 (0.932–1.649)	.139
Hospital admission (n)	1.263 (0.938–1.701)	.124
Survival		
24 hrs	0.924 (0.634–1.346)	.697
1 wk	0.680 (0.361–1.280)	.232
1 mo	0.675 (0.312–1.456)	.316
1 yr	0.579 (0.222–1.510)	.264

NS

L'arrêt cardiaque d'origine traumatique a le même pronostic que l'arrêt cardiaque d'origine médicale !

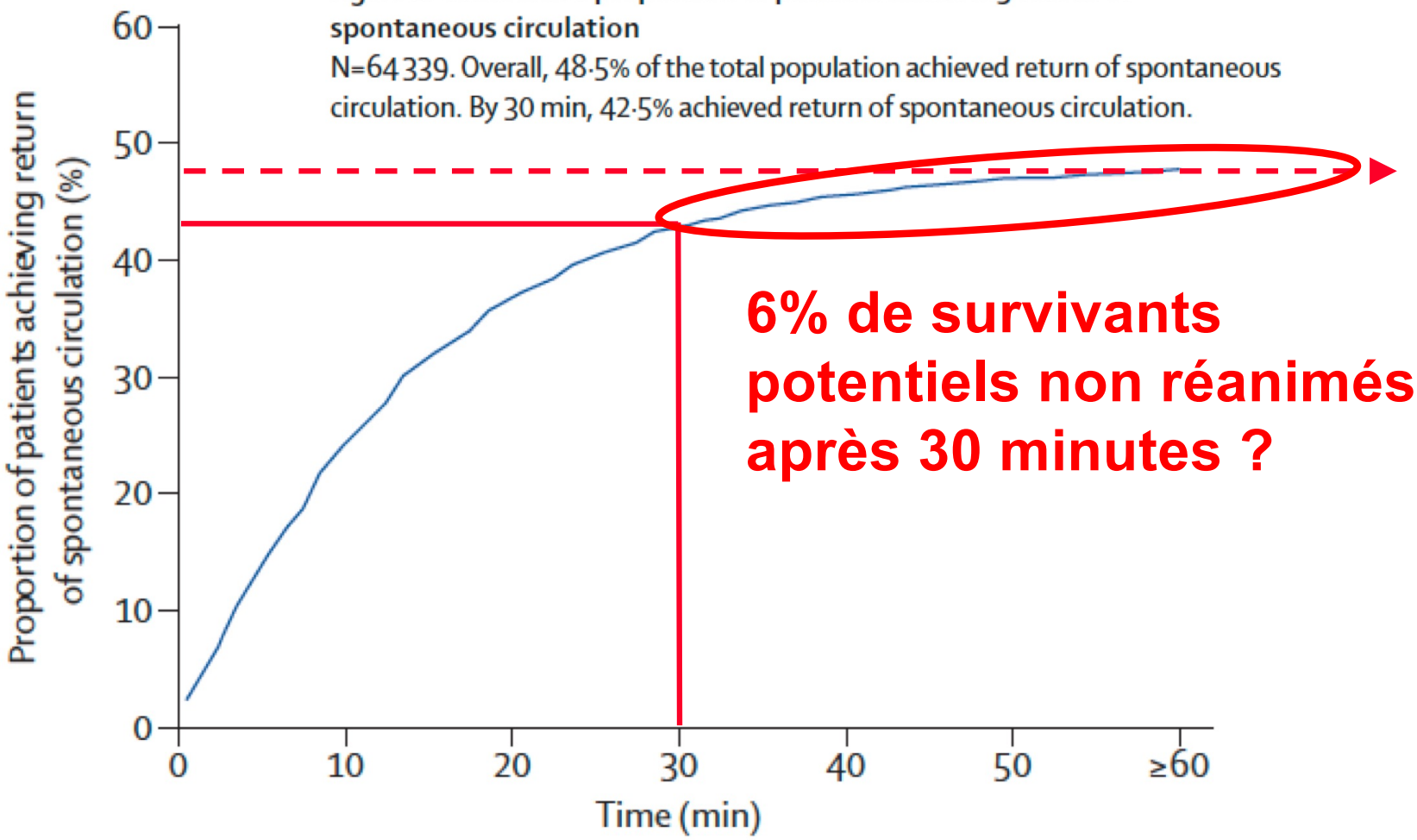
Duration of resuscitation efforts and survival after in-hospital cardiac arrest: an observational study

*Zachary D Goldberger, Paul S Chan, Robert A Berg, Steven L Kronick, Colin R Cooke, Mingrui Lu, Mousumi Banerjee, Rodney A Hayward, Harlan M Krumholz, Brahmajee K Nallamothu, for the American Heart Association Get With The Guidelines—Resuscitation (formerly the National Registry of Cardiopulmonary Resuscitation) Investigators**

Lancet 2012; 380: 1473–81

Figure 1: **Cumulative proportion of patients achieving return of spontaneous circulation**

N=64 339. Overall, 48·5% of the total population achieved return of spontaneous circulation. By 30 min, 42·5% achieved return of spontaneous circulation.



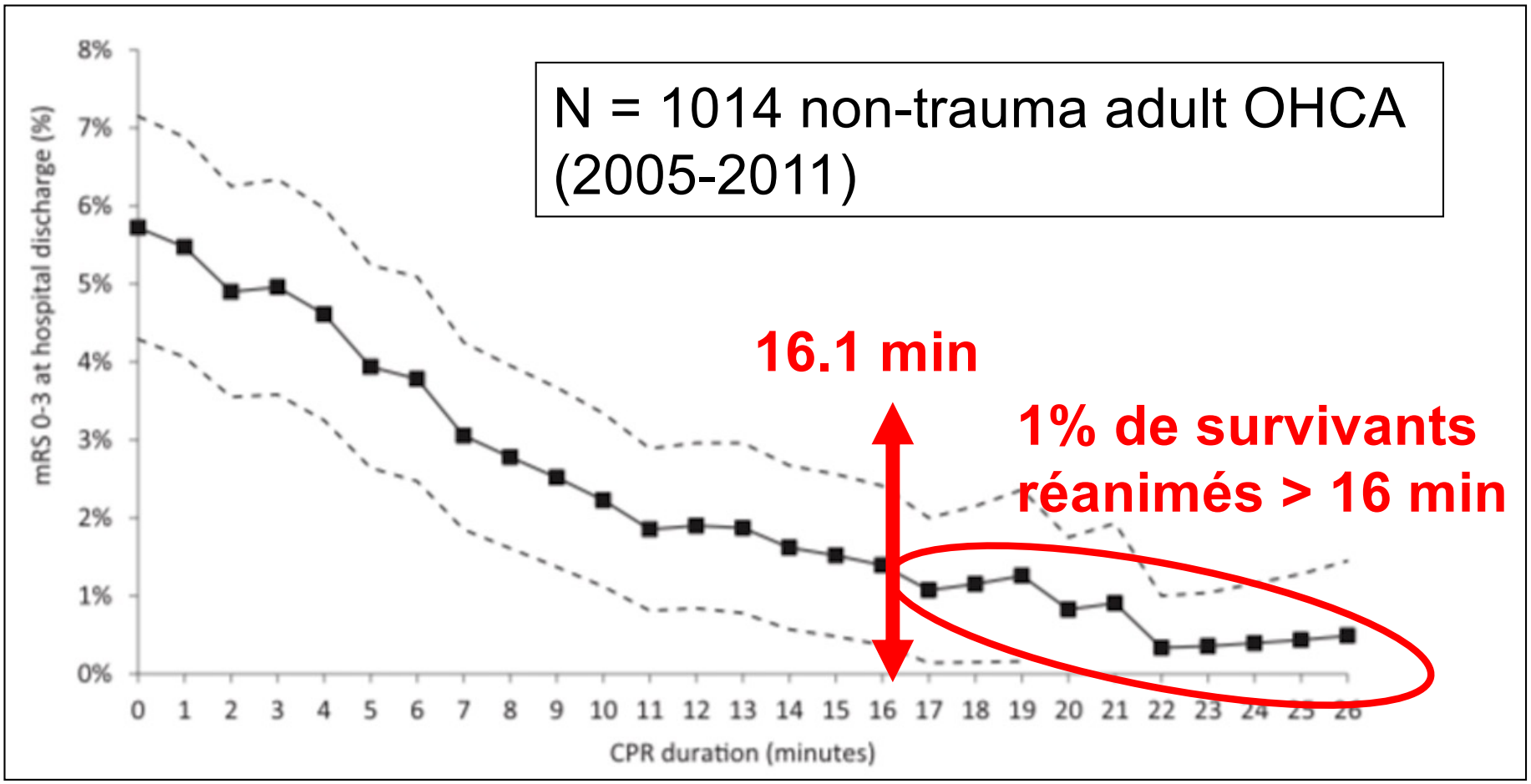
6% de survivants potentiels non réanimés après 30 minutes ?

Duration of Resuscitation Efforts and Functional Outcome After Out-of-Hospital Cardiac Arrest

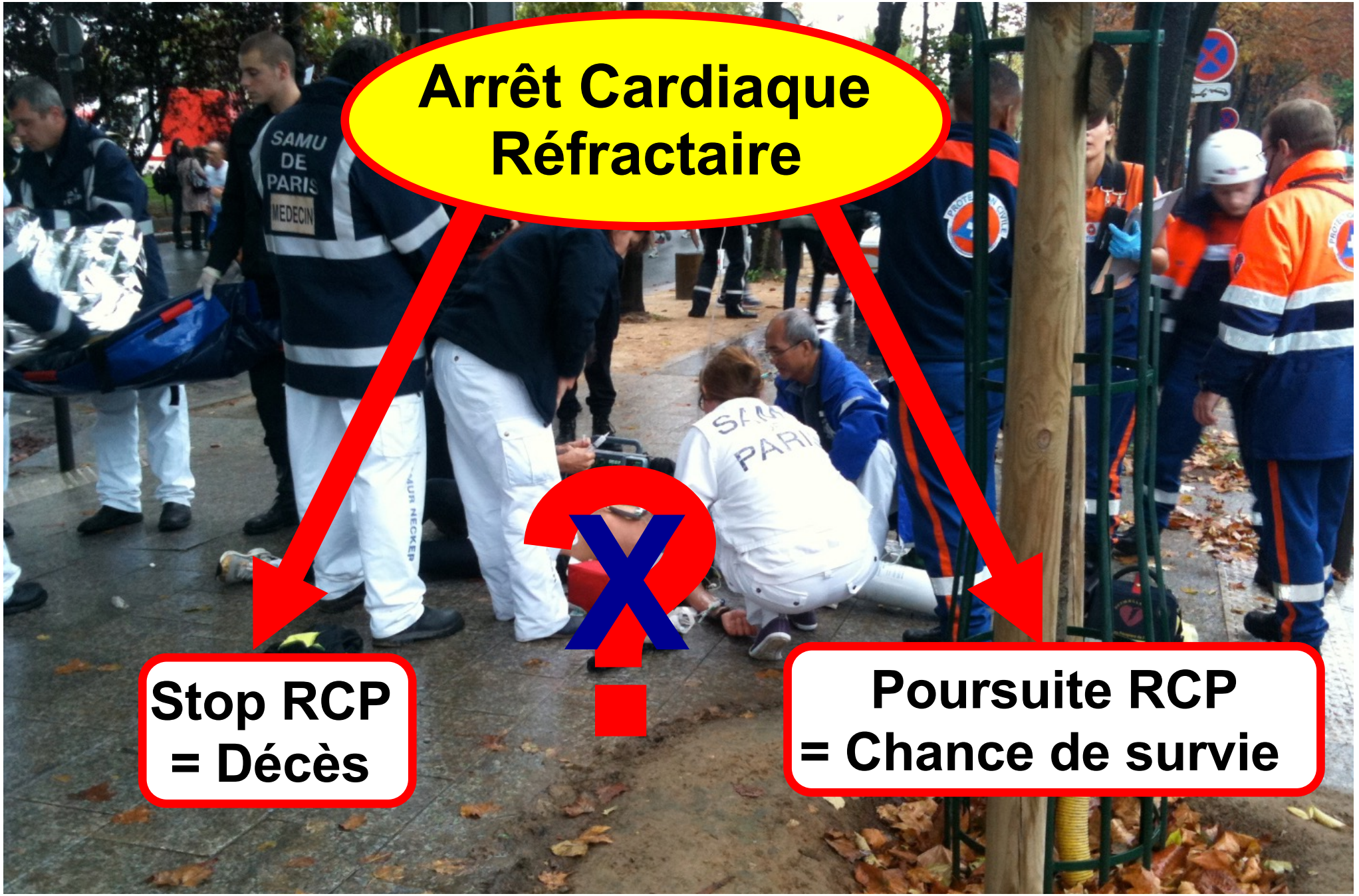
When Should We Change to Novel Therapies?

Joshua C. Reynolds, MD, MS; Adam Frisch, MD, MS; Jon C. Rittenberger, MD, MS; Clifton W. Callaway, MD, PhD

(*Circulation*. 2013;128:2488-2494.)



Une question inappropriée !



Enquète sur le «miracle» Chevènement. Ou comment un homme revient à la vie contre tous les pronostics.

Libération

Par Eric Favereau — 23 octobre 1998 à 12:26

y avait beaucoup de monde disponible». La réaction de l'équipe a pu être immédiate, entre l'oxygénation, des perfusions massives d'adrénaline, et surtout le massage cardiaque. «Le massage a pu être initié dés le début, et par des personnes qui savent le faire», dit-on au Val-de-Grâce. L'arrêt cardiaque a duré 57 minutes; sept anesthésistes et infirmières se sont relayés pour effectuer le massage cardiaque (car il s'agit d'un geste très fatigant); au bout de trente minutes, le coeur a eu une première réaction. Mais il s'est arrêté à nouveau. Les médecins ont poursuivi. Et effectué également douze chocs électriques sur le patient.

05 Avril 2018

MIRACULÉ - Un habitant de Béziers (Hérault) de 53 ans a survécu après un arrêt cardiaque d'une durée exceptionnellement longue : 18 heures. Outre la persévérance des secouristes et des médecins, sa température corporelle très faible aurait permis de le sauver.

Le donneur d'organes n'était pas mort

…les chirurgiens pouvant pratiquer les prélèvements d'organes n'étaient pas immédiatement disponibles. Lorsqu'ils arrivent au bloc, leurs confrères pratiquent le massage cardiaque depuis une heure et trente minutes, sans résultat apparent. Mais au moment même où ils s'apprêtent à opérer, les médecins ont la très grande surprise de découvrir que leur patient présente des signes de respiration spontanée, une réactivité pupillaire et un début de réaction à la stimulation douloureuse.

Définition de l'Arrêt Cardiaque Réfractaire

- **Absence de retour d'une activité cardiaque spontanée**
  - Malgré 30 minutes de RCP bien conduite
  - En l'absence de facteurs de protection cérébrale
    - *Hypothermie*
    - *Intoxication (cardiotropes)*
    - *Anesthésie générale*
- **Corollaires**
  - Absence d'espoir de récupération cardiaque
  - Absence d'espoir de récupération neurologique

Définition de l'AC Réfractaire aux USA

- **Recommandations AHA 2010**
  - Arrêt RCP basique si :
    - *ACEH sans témoin secouriste*
    - *& pas de RACS malgré 3 cycles de RCP*
    - *& aucun CEE n'a été délivré*
  - Arrêt RCP médicalisée si :
    - *ACEH sans témoin*
    - *& pas de MCE par un témoin*
    - *& pas de RACS malgré RCP médicalisée*
    - *& aucun CEE n'a été délivré*

- **Recommandations NAEMSP 2000**
  - Arrêt RCP si absence de RACS malgré 20 min. de RCP

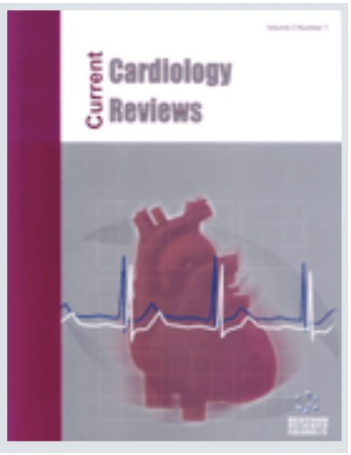
2010 AHA Guidelines, Partie 3 : Ethics, *Circulation* 2010
Bailey ED, *Prehosp Emerg Care* 2000

Refractory Out of Hospital Cardiac Arrest

(E-pub Ahead of Print)

Author(s): Madhan Shanmugasundaram*, Kapildeo Lotun.

Journal Name: Current Cardiology Reviews

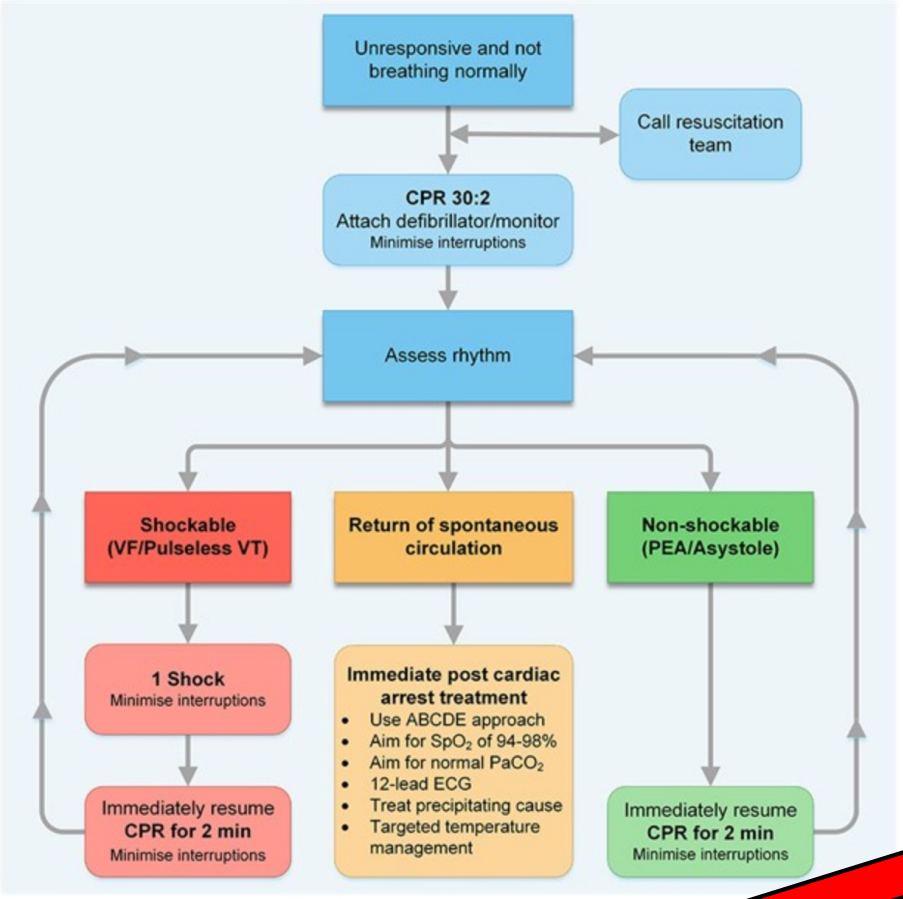


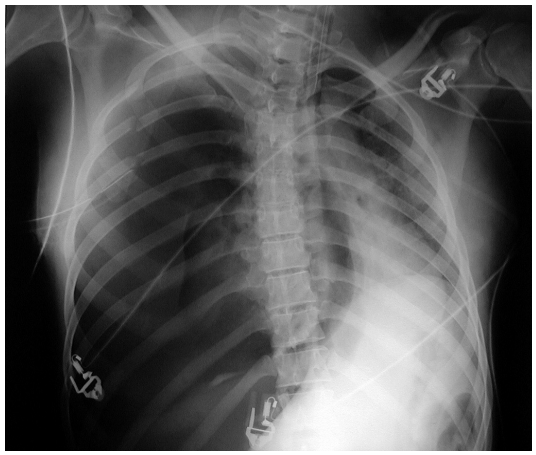
Abstract:

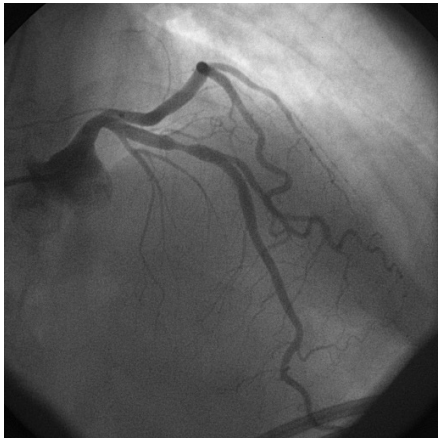
Background: Refractory out of hospital cardiac arrest is a common problem that is associated with poor overall survival rates and neurological outcomes. There are various definitions that have been used but the most accepted one is cardiac arrest that requires more than 10 minutes of cardiopulmonary resuscitation (CPR) efforts or more than 3 defibrillation attempts. There have been different pharmacologic and non-pharmacologic therapies that were studied in these patients. None of the antiarrhythmic or vasopressor medications have been consistently shown to improve survival or neurological outcomes in this subset of patients...

AC réfractaire : pourquoi ? …

- **Recherche des étiologies curables / réversibles**







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
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Thrombosis - coronary or pulmonary
- Tension pneumothorax
- Tamponade – cardiac
- Toxins

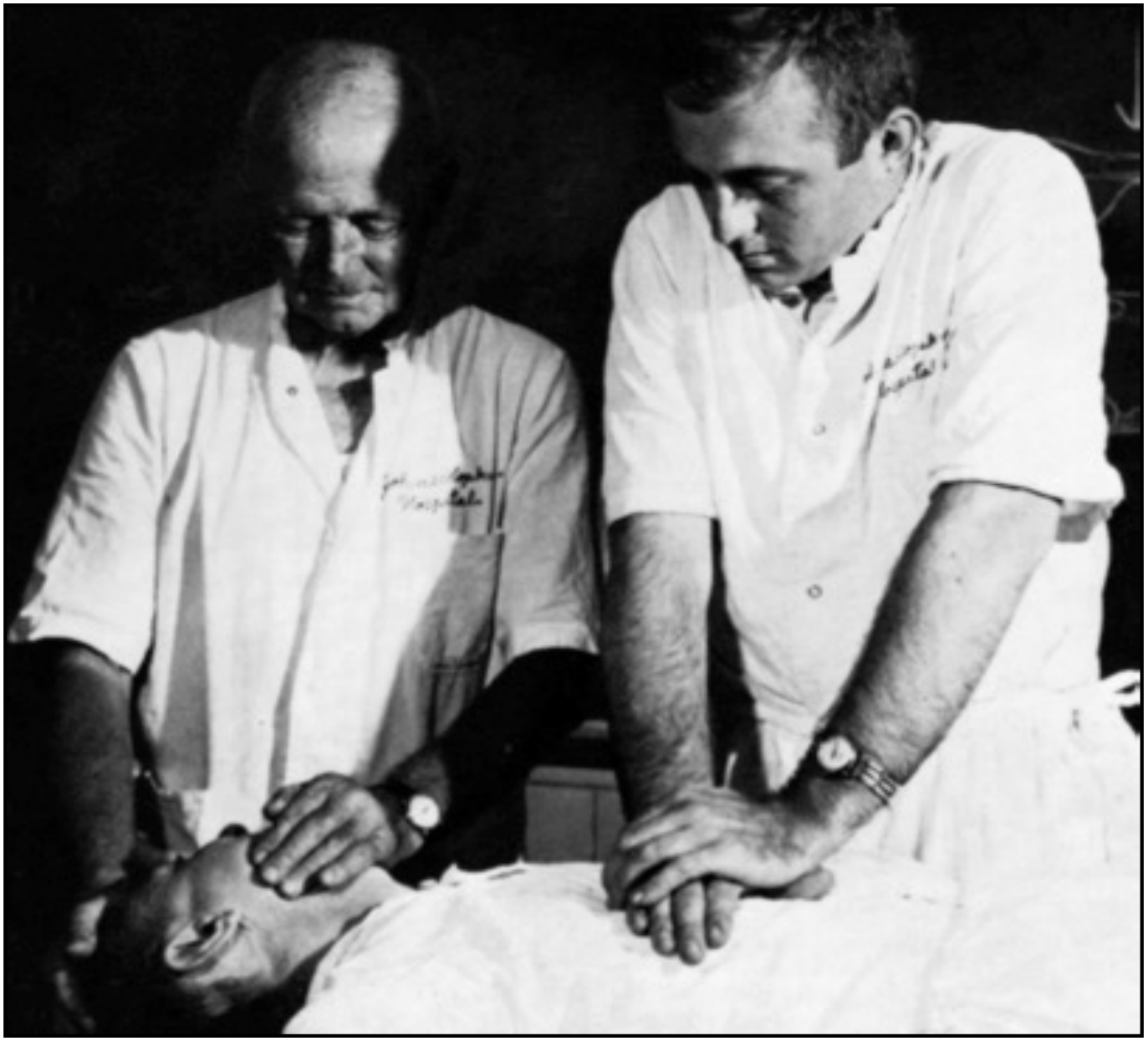
Consider
- Ultrasound imaging
- Mechanical chest compressions to facilitate transfer/treatment
- Coronary angiography and percutaneous coronary intervention
- Extracorporeal CPR

4H

4T

Treat Reversible Causes
- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Thrombosis - coronary or pulmonary
- Tension pneumothorax
- Tamponade – cardiac
- Toxins

Le massage cardiaque, ou … ?

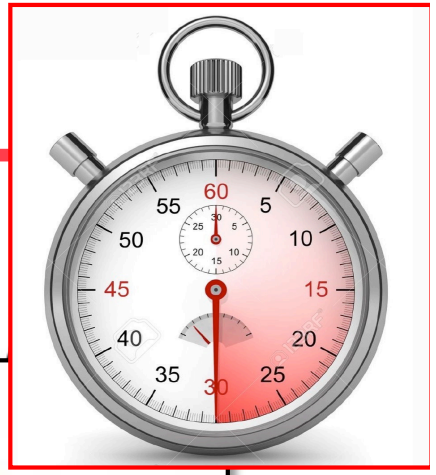


W Kouwenhoven, G Knickerbocker, 1961 Baltimore

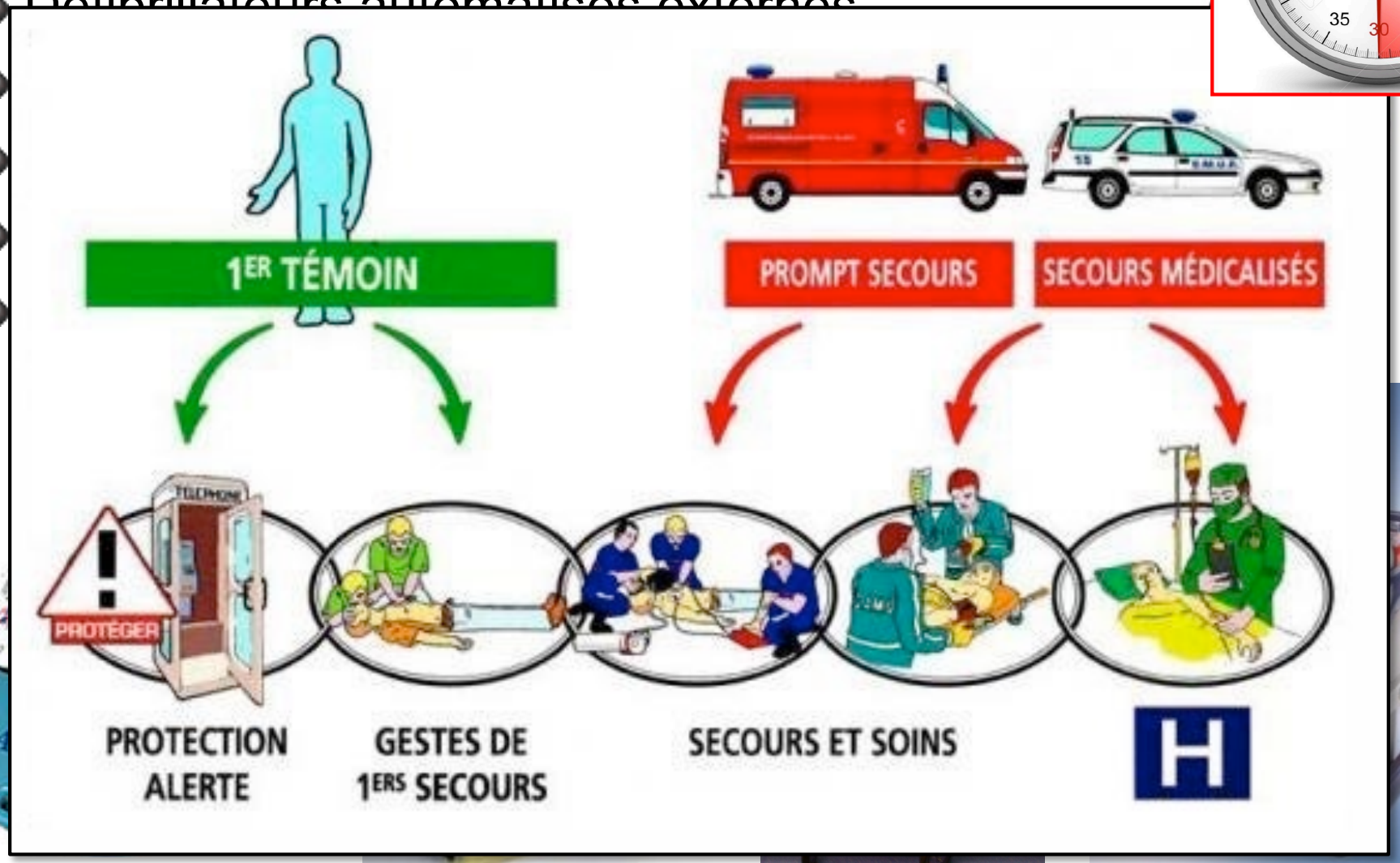
Progrès technologiques ...

- **Intra- et/ ou extra-hospitaliers**
  - Défibrillateurs automatisés externes
  - MCE automatisé
  - Circulation extra-corporelle
  - Hypothermie thérapeutique modérée
  - …

Progrès technologiques ...

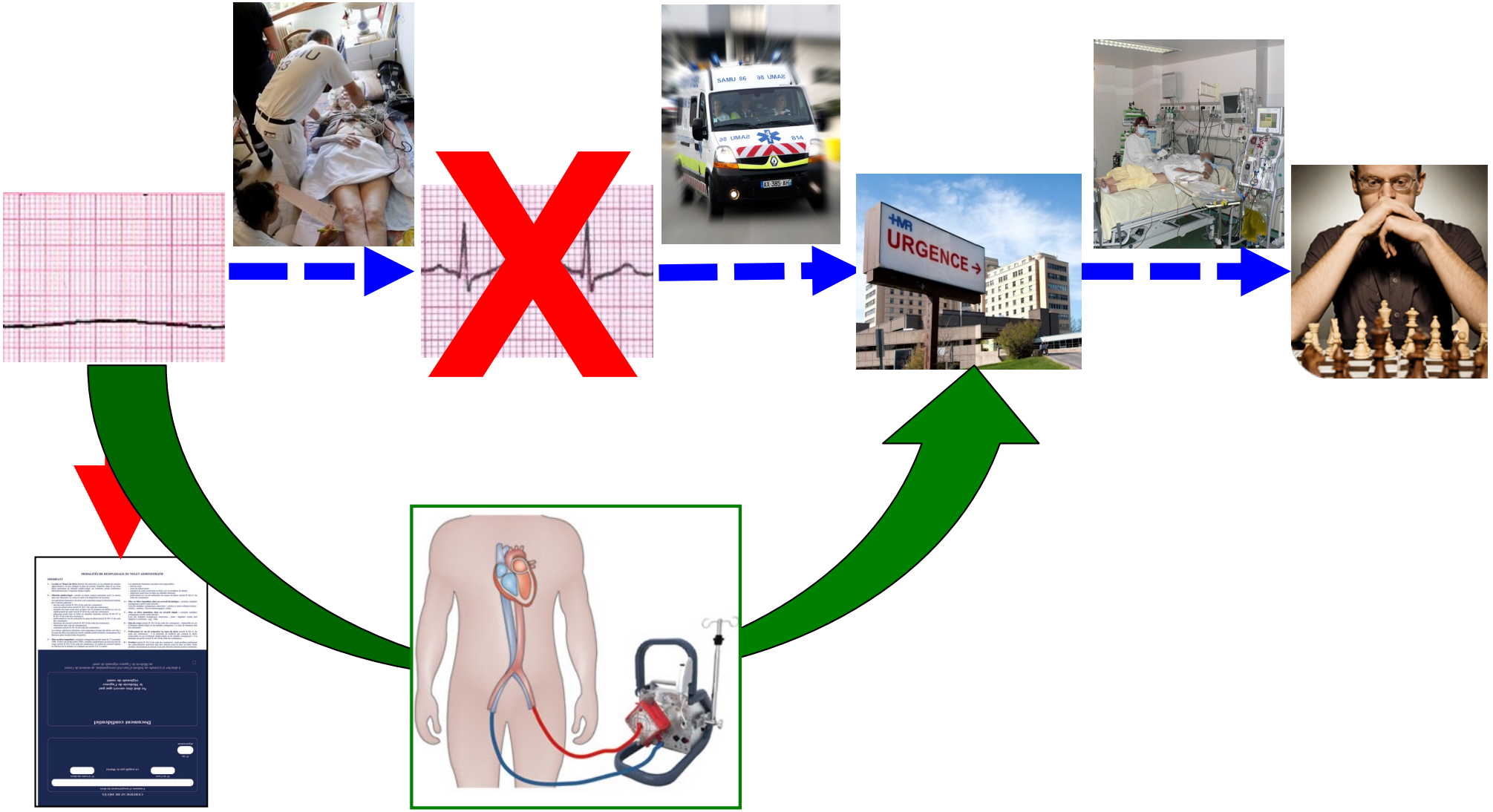


- **Intra- et/ ou extra-hospitaliers**
  - Défibrillateurs automatisés externes



L'ECLS : un changement de paradigme

- **Le pronostic n'est plus conditionné par la reprise immédiate d'une activité circulatoire spontanée**



L'ECLS : un changement de paradigme

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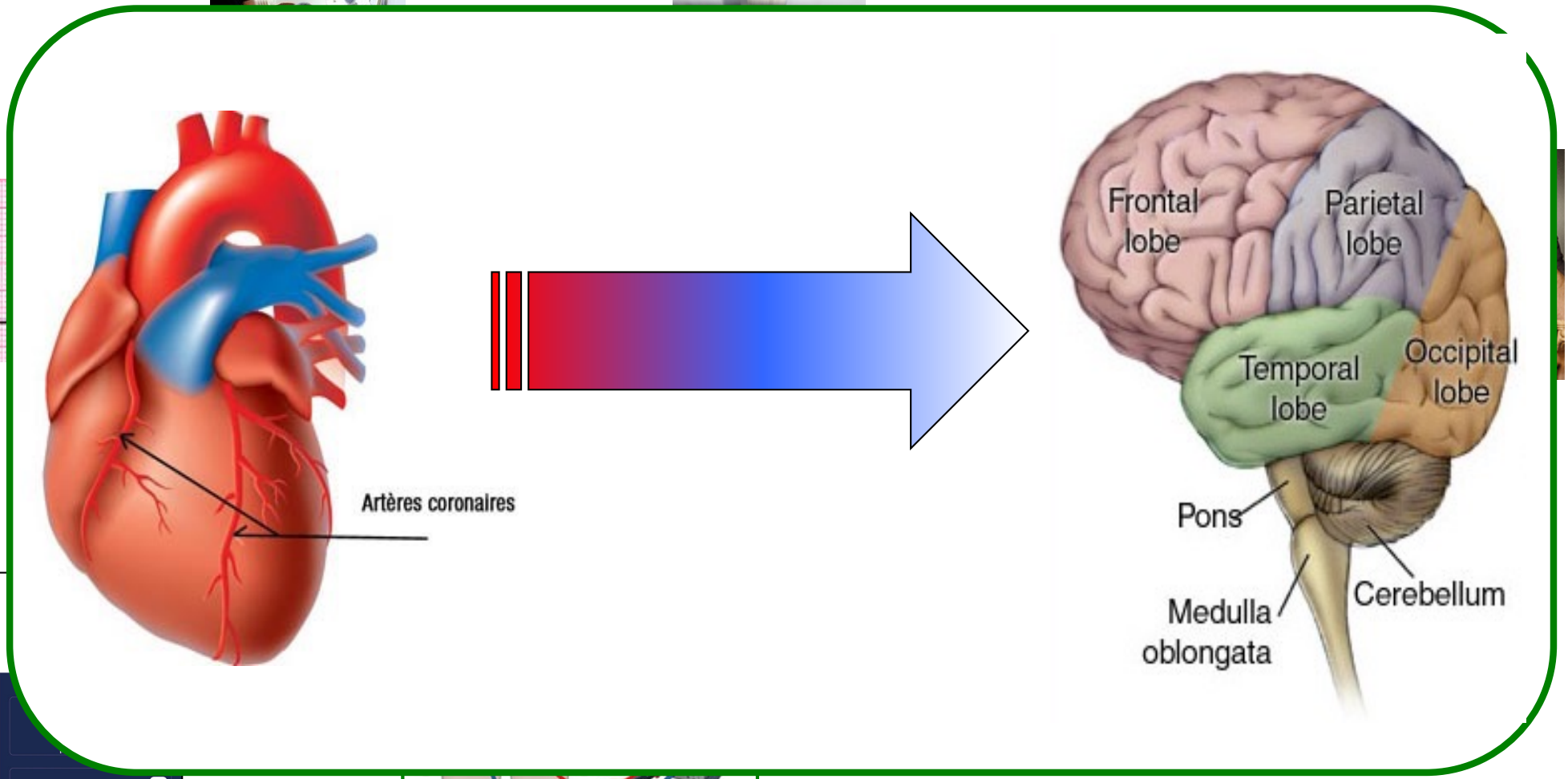

Un bel exemple de succès (1)

- **Mr B… 49 ans**
- **Atcd :**
  - IDM à 42 ans / cocaïne
  - tabac 3 pq / j
  - arrêt Ttt depuis 2 ans
- **Douleur thoracique à 16h15**
- **Appel SAMU à 16h25**
- **Déclenchement SMUR 16h30**
- **PC + convulsions à 16h35**
- **Arrivée PSR et SMUR à 16h45**
- **Asystolie puis 2 CEE sur FV**
- **Constatation d'un ACR réfractaire > 30 min**

Un bel exemple de succès (2)

- **MCE automatisé débuté à 17h24**
- **Transfert à l'hôpital**
- **Arrivée à l'hôpital à 18h00**
- **Début CEC à 18h20 (H+110 min)**
- **Présence de « signes de vie »**
  - Mouvements inspiratoires
  - Clignements de paupières
  - Ebauche de flexion adaptée du membre sup. gauche
- **Coronarographie normale**
- **Evolution initialement difficile en réanimation**
  - SDMV, CIVD, transfusion massive …
- **Restitution neurologique ~ *ad integrum* à 1 mois**

Il y a 50 ans …

- **5 cas d' AC réfractaires**
  - au bloc opératoire
  - avant chirurgie cardiaque
  - échec de la RCP
  - mise en place CEC

=> RACS = 4

=> Survie à long terme = 3

bly unwise in an arteriosclerotic patient to place both needles simultaneously. During the period that the intima was raised in this individual, there was undoubtedly additional cerebral anoxia which made pathological reflexes more likely.

Generic and Trade Names of Drug

Sodium heparin—*Heparin Sodium, Liquaemin Sodium.*

References

1. Kouwenhoven, W.B.; Jude, J.R.; and Knickerbocker, G.G.: Closed-Chest Cardiac Massage, *JAMA* **173**:1064-1067 (July 9) 1960.
2. Cotlar, A.M., et al: Increased Survival From Cardiac Arrest Since Introduction of External Massage, *Dis Chest* **44**:400-407 (Oct) 1963.
3. Klassen, G.A., et al: Cardiac Resuscitation in 126 Medical Patients, *Lancet* **1**:1290-1292 (June 15) 1963.
4. Baringer, J.R., et al: External Cardiac Massage, *New Eng J Med* **265**:62-69 (July 13) 1961.
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6. Thaler, M.M., and Krause, V.W.: Serious Trauma in Children After External Cardiac Massage, *New Eng J Med* **267**:500-501 (Sept 6) 1962.
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8. Frank, H.A.: Management of Cardiac Arrest, *Surg Clin N Amer* **43**:703-714 (June) 1963.

Extracorporeal Circulation as an Adjunct to Resuscitation of the Heart

William L. Joseph, MD, and James V. Maloney, Jr., MD

THE NUMBER OF persons who can be resuscitated following cardiac arrest during operations on the heart has progressively increased with the use of direct cardiac massage, electrical defibrillation of the heart, and the judicious use of intracardiac drugs. However, there remains a number of patients whose hearts cannot be restarted despite the fact that their neurological and physiological status is compatible with survival. The refractory nature of these cases of cardiac arrest is presumably due

For editorial comment see page 678.

to the fact that cardiac massage does not produce sufficient arterial blood pressure and coronary circulation to permit recovery of myocardial function.[1,2] The sustained use of extracorporeal circulation to increase coronary perfusion in such circumstances offers a means of resuscitating these patients.

This report is concerned with five cases of intractable cardiac arrest in which prolonged periods of cardiac massage with the administration of drugs and the use of electric shock were ineffective in restoring myocardial activity. In each instance, the arrest occurred in the operating room in the setting of a planned open-heart procedure, at a time when a device for extracorporeal circulation and cross-matched blood were already available. While one surgeon did cardiac massage, another surgeon connected the patient to the heart-lung machine. Effective myocardial action was restored in four of the five patients, and three of the patients were long-term survivors without evidence of physiological impairment.

From the Department of Surgery, University of California School of Medicine, Los Angeles.
Reprint requests to Department of Surgery, UCLA Medical Center, Los Angeles 90024 (Dr. Maloney).

Report of Cases

CASE 1.—A 29-year-old man, with aortic insufficiency, had a cardiac arrest shortly after the skin incision was made. The thorax was opened rapidly and cardiac massage was begun. The heart failed to respond to the usual resuscitative measures. While the surgeon continued cardiac massage, technicians prepared the heart-lung machine for use. A second surgeon inserted an arterial cannula in the femoral artery and a venous drainage catheter through the right atrial appendage. The surgeon doing the cardiac massage ceased for periods of 10 to 15 seconds to permit the second surgeon to insert the venous cannula into the right atrium. A period of 22 minutes passed from the time of cardiac arrest to the initiation of extracorporeal circulation. The aortic valve was then replaced by a prosthesis, and cardiac rhythm reverted to normal with a single electric shock at the end of the period of extracorporeal circulation. The patient had an uneventful postoperative course. Unfortunately, bacterial endocarditis developed following a dental extraction, and the patient died of this infection five months following operation.

CASE 2.—The patient was a 42-year-old man with aortic stenosis. Shortly after the thorax was opened at operation, hypotension, ventricular tachycardia, and finally ventricular fibrillation developed. Normal rhythm could not be reinstated by cardiac massage, electric shock, or the intracardiac administration of drugs. Cardiac massage was done for a period of 25 minutes, while a second surgeon inserted arterial and venous cannulae. The aortic valve was repaired. Because extracorporeal circulation maintained an adequate arterial blood pressure and good coronary arterial flow, only a single electric shock was necessary to revert the heart to a normal rhythm at the end of the operative procedure. The patient had an uneventful postoperative course.

CASE 3.—A 16-year-old boy had had a left ventriculotomy for the treatment of hypertrophic muscular subaortic stenosis. Thirty minutes after completion of extracorporeal circulation, ventricular fibrillation developed. Despite vigorous resuscitative measures and numerous attempts at electrical defibrillation, a satisfactory myocardial rhythm could not be established. While the surgeon did continuous cardiac massage, the assistant reinstituted extracorporeal circulation. The heart-lung machine was used to support the circulation for a period of one hour. With the aid of this artificial support of the circulation and rapid administration of digitalis, a normal sinus rhythm was reestablished. The postoperative course was satisfactory.

CASE 4.—A 52-year-old man underwent surgery for prosthetic replacement of the mitral valve for combined stenosis and insufficiency. While the thorax was being surgically closed, one hour after the completion of the cardiac portion of the operation, hypotension suddenly developed followed by ventricular fibrillation. Thirty minutes of cardiac massage, electrical defibrillation, and the

ECLS pour des AC intra-hospitaliers

ASAIO Trans. 1989 Jul-Sep;35(3):475-7.

Experience with an emergency resuscitation system. **1989**

Raithel SC[1], Swartz MT, Braun PR, Dake SB, Taub JO, Zambie MA, Miller LW, Deligonul U, McBride LR, Pennington DG.

⊕ Author information

Abstract

The need for a portable extracorporeal support system that can be rapidly initiated for various types of cardiopulmonary failure is well known. The authors report on a system consisting of 3/8 inch tubing, a Sci-Med membrane oxygenator, Omnitherm heat exchanger, Biomedicus or Sarns centrifugal pump, portable battery, and oxygen tanks. The system is mounted on a cart for easy mobility and can be primed in 5-10 min. USCI, DLP, or Axiom cannulas can be inserted femorally. Over 30 months, 29 patients, aged 19-78 years, underwent extracorporeal membrane oxygenation (ECMO) support for cardiac arrest during catheterization (10 patients), shock secondary to acute myocardial infarction (MI) (10 patients), elective percutaneous transluminal coronary angioplasty (PTCA) support (four patients), postcardiotomy failure (four patients), and exposure hypothermia (one patient). Adequate support was achieved in all but one patient. Device flows ranged from 0.2 to 6.0 l/min. There were six survivors (elective PTCA support, three patients; cardiac arrest during catheterization, three patients). Complications included bleeding (15 patients), deep venous thrombosis (three patients), and pump failure (one patient). A portable ECMO system has been developed that allows rapid institution of circulatory support.

Ann Thorac Surg. 1993 Jan;55(1):304-9.

Emergency resuscitation using portable extracorporeal membrane oxygenation. **1993**

Dembitsky WP[1], Moreno-Cabral RJ, Adamson RM, Daily PO.

⊕ Author information

Abstract

Manual cardiopulmonary resuscitation is currently the standard treatment for cardiac arrest patients both in and out of the hospital. Accumulated experimental and anecdotal clinical evidence suggests enhanced survival in patients with extreme circulatory decompensation who have been emergently supported with portable cardiopulmonary bypass. Long-term survival is possible even when application is delayed, but early institution of support after cardiac arrest in selected patients offers the best survival advantages. In our hospital this has been achieved by training a team of in-house personnel to emergently prepare, apply, and temporarily manage cardiopulmonary bypass until personnel with greater specialty training arrive. Machinery needed to perform emergency cardiopulmonary bypass is currently available in all hospitals with open heart surgery programs. Simple support is often therapeutic but can also serve as a bridge to definitive diagnostic and other therapeutic procedures. Commercial units are becoming more biocompatible and easier to use, making both wider application and more prolonged support likely in the future.

ECLS pour des AC extra-hospitaliers

SEVERE HYPOTHERMIA AS A RESULT OF BARBITURATE OVERDOSE COMPLICATED BY CARDIAC ARREST

R. H. FELL
M.B. Lond., F.F.A. R.C.S., D.A.
LECTURER, NUFFIELD DEPARTMENT OF ANÆSTHETICS

A. J. GUNNING
M.A., M.B. Cape Town, F.R.C.S., D.L.O.
CONSULTANT SURGEON, NUFFIELD DEPARTMENT OF SURGERY, AND LECTURER IN CLINCIAL SURGERY, OXFORD UNIVERSITY

K. D. BARDHAN
M.B. Madras
RHODES SCHOLAR, NUFFIELD DEPARTMENT OF CLINICAL MEDICINE

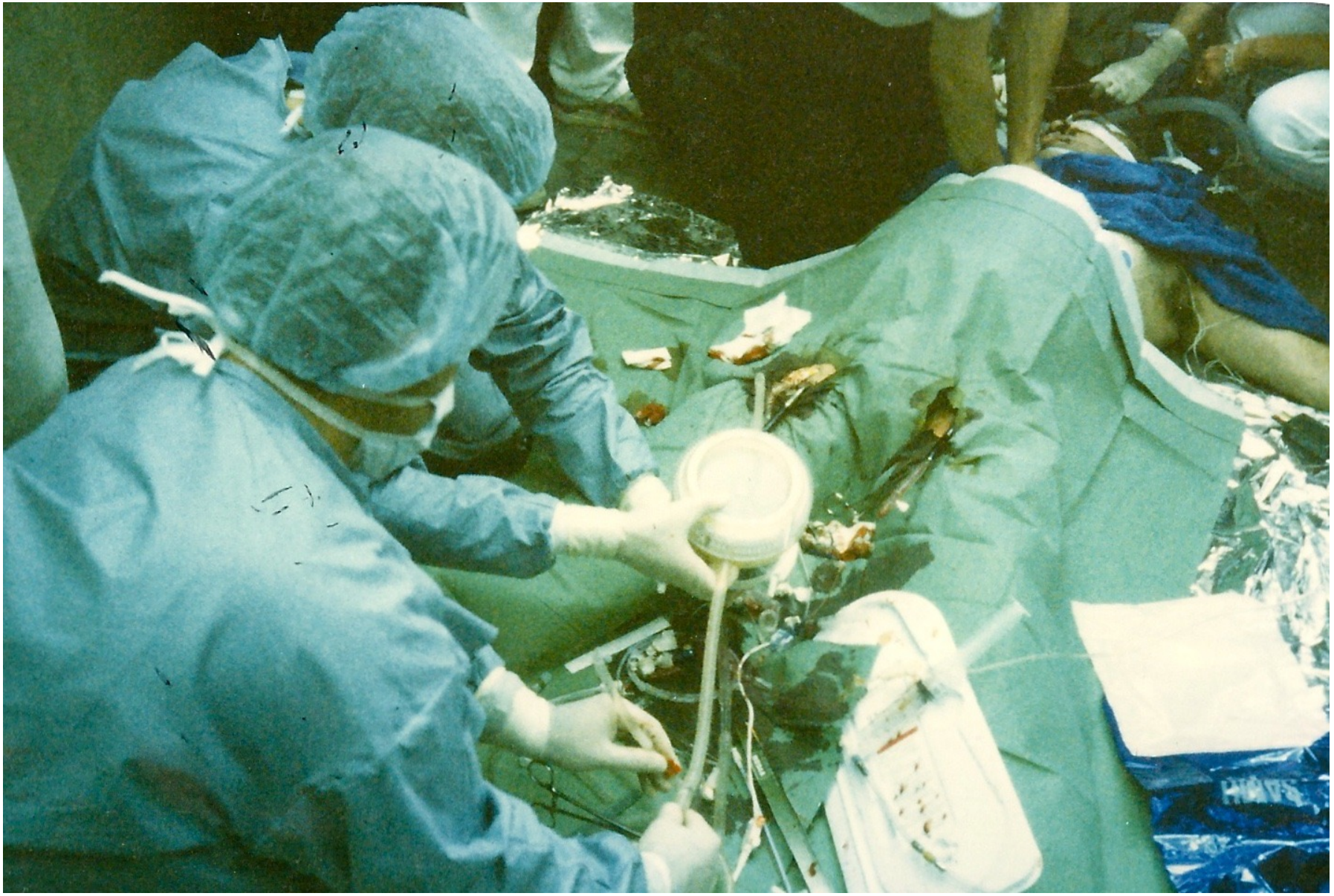
D. R. TRIGER
M.A., B.M. Oxon.
HOUSE-PHYSICIAN

From the Radcliffe Infirmary, Oxford

Summary A patient who recovered fully from severe hypothermia (22°C, 71·6°F) and from cardiac arrest lasting $3^1/_2$ hours was treated by external cardiac massage, intermittent positive-pressure ventilation, rewarming on cardiopulmonary bypass, and internal defibrillation.

The Lancet
1968

Faisabilité de l'ECLS en préhospitalier ?



Philippe MAURIAT, SAMU de Paris, 1992

Retour aux années 2000

Analysis and Results of Prolonged Resuscitation in Cardiac Arrest Patients Rescued by Extracorporeal Membrane Oxygenation

Yih-Sharng Chen, MD, Anne Chao, MD, Hsi-Yu Yu, MD, Wen-Je Ko, MD, I-Hui Wu, MD, Robert Jen-Chen Chen, MD, Shu-Chien Huang, MD, Fang-Yue Lin, MD, Shoei-Shan Wang, MD
Taipei, Taiwan

(J Am Coll Cardiol 2003;41:197–203)

- Mise en place d'une CEC chez 57 patients en AC réfractaire
  - Age = 57 ± 15 ans
  - 2 AC extra-hospitaliers
  - AC d'origine cardiaque
  - MCE > 10-20 min

  -> durée effective du MCE = 48 ± 13 min

CPR Duration	n	%	Weaning n (%)	Survival n (%)
<15 min	0	0		
<30 min	2	3.5	2 (100%)	2 (100%)
<45 min	14	24.56	11 (78.57%)	8 (57.14%)†
<60 min	31	54.39	25 (80.65%)*	15 (48.39%)*
>60 min	26	46.61	13 (50%)	3 (11.5%)
Total	57	100	38 (66.7%)	18 (31.6%)

*p < 0.05 compared with CPR >60 min.
†p < 0.05 compared with CPR >45 min.

-> 18 patients vivants (32%) dont 16 à long terme

-> Survie corrélée à la durée de MCE (p=0,0014) avant CEC

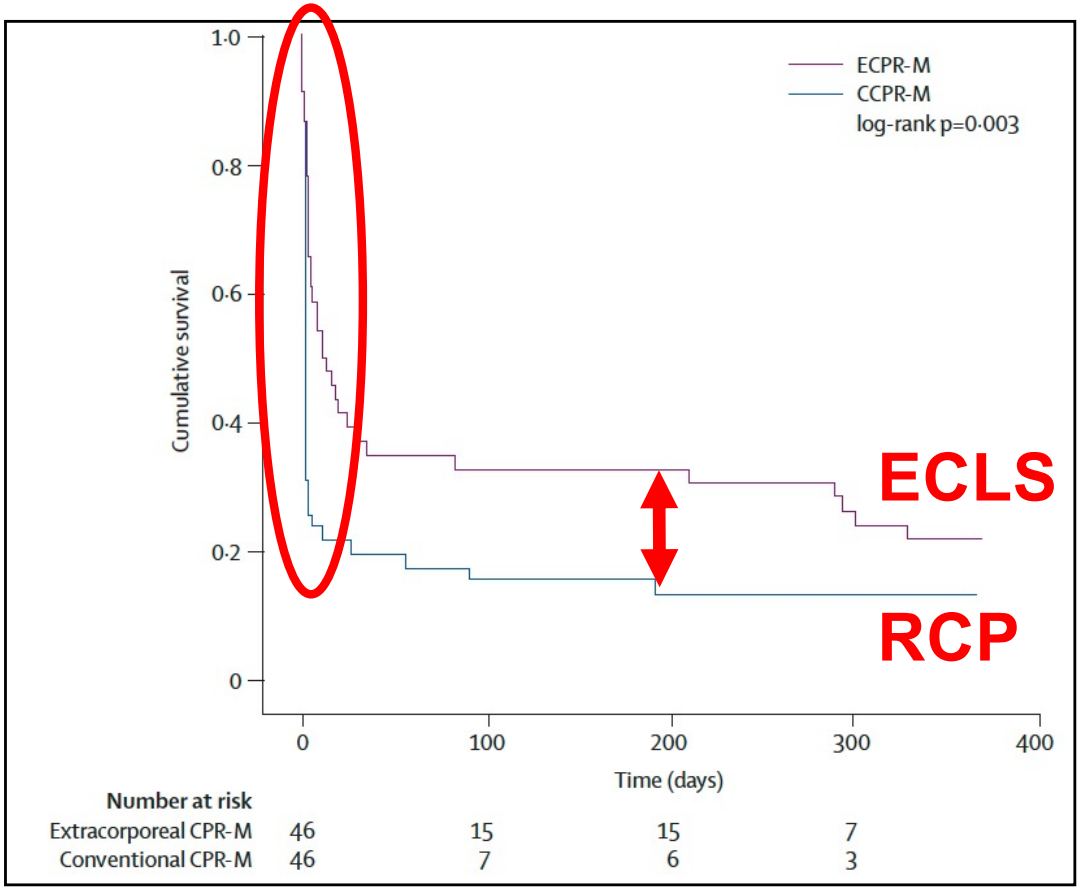
Cardiopulmonary resuscitation with assisted extracorporeal life-support versus conventional cardiopulmonary resuscitation in adults with in-hospital cardiac arrest: an observational study and propensity analysis

Yih-Sharng Chen, Jou-Wei Lin*, Hsi-Yu Yu, Wen-Je Ko, Jih-Shuin Jerng, Wei-Tien Chang, Wen-Jone Chen, Shu-Chien Huang, Nai-Hsin Chi, Chih-Hsien Wang, Li-Chin Chen, Pi-Ru Tsai, Sheoi-Shen Wang, Juey-Jen Hwang, Fang-Yue Lin*

Lancet 2008; 372: 554–61

- 975 patients en AC intra-hospitalier
  - 59 ECLS *versus*
  - 113 RCP classiques

	Extracorporeal (N=46)	Conventional (N=46)	p
Neurological outcome			
CPC status at discharge	n (%)	n (%)	
1 or 2	14 (30·4)	7 (15·2)	0·09
3 or 4	1 (2·2)	1 (2·2)	0·09
5 (death)	31 (67·4)	38 (82·6)	0·09
CPC status at 1 year	n (%)	n (%)	
1 or 2	9 (19·5)	5 (10·8)	0·27
3 or 4	1 (2·2)	1 (2·2)	0·27
5 (death)	36 (78·3)	40 (87·0)	0·27



Back from Irreversibility: Extracorporeal Life Support for Prolonged Cardiac Arrest

Massimo Massetti, MD, Marine Tasle, MD, Olivier Le Page, MD, Ronan Deredec, MD, Gerard Babatasi, MD, Dimitrios Buklas, MD, Sylvain Thuaudet, MD, Pierre Charbonneau, MD, Martial Hamon, MD, Gilles Grollier, MD, Jean Louis Gerard, MD, and André Khayat, MD

(Ann Thorac Surg 2005;79:178–84)

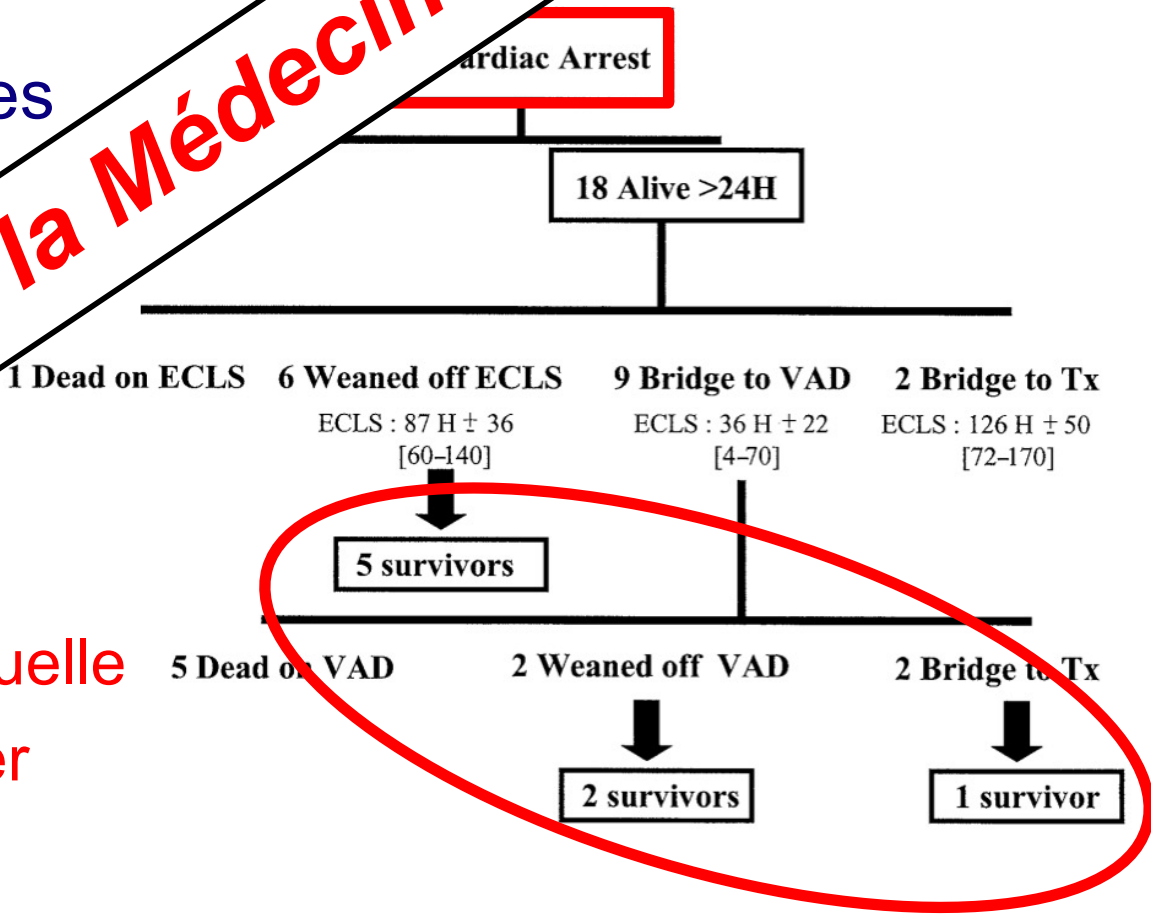
Victoire de la Médecine 2007

- 40 CEC sur AC réfractaires
  - 1997-2003
  - Age = 42 ± 15 ans
  - 5 AC extra-hospitalier
  - MCE = 10 min

-> 22 décès [illegible]

8 patients vivants sans séquelle

dont 1 AC extra-hospitalier



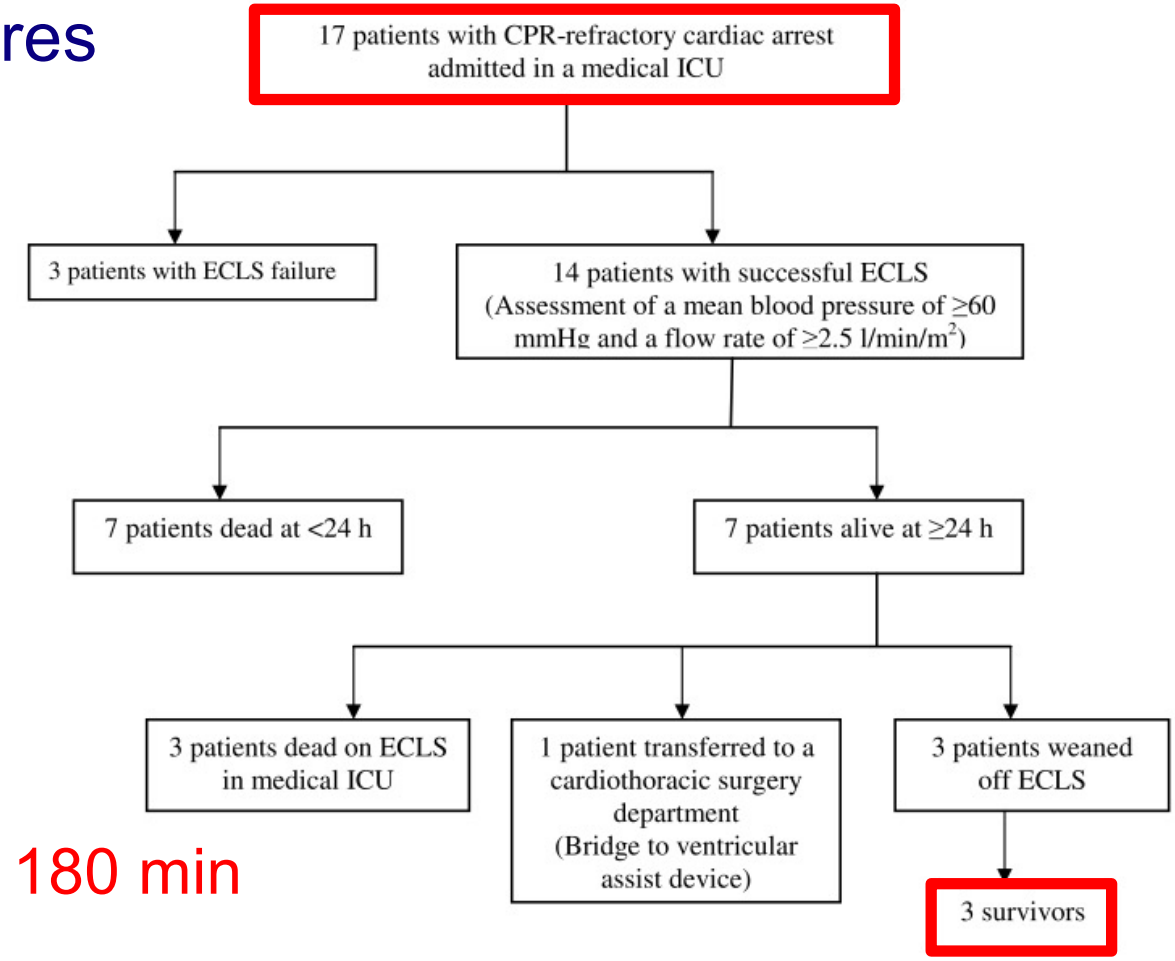
Intensive Care Med (2007) 33:758–764
DOI 10.1007/s00134-007-0568-4

ORIGINAL

Bruno Mégarbane
Pascal Leprince
Nicolas Deye
Dabor Résière
Gilles Guerrier
Samia Rettab
Jonathan Théodore
Souheil Karyo
Iradj Gandjbakhch
Frédéric J. Baud

Emergency feasibility in medical intensive care unit of extracorporeal life support for refractory cardiac arrest

- 17 CEC sur AC réfractaires
  - 2003-2005
  - Age = 47 ans [27-57]
  - 9 AC extra-hospitaliers
  - 12 intoxications aiguës



-> 3 patients survivants sans séquelle

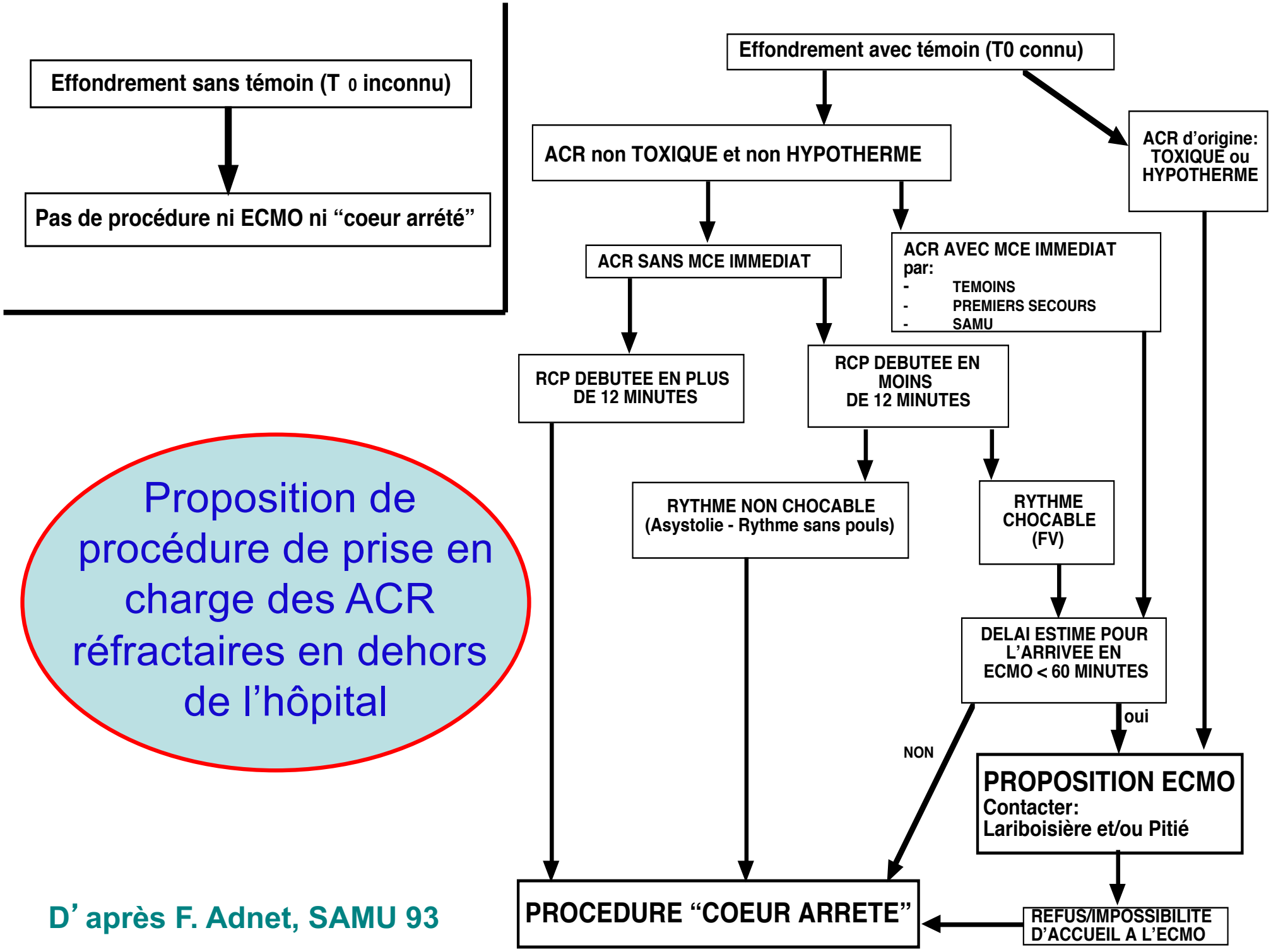
= 3 AC sur intoxications

durées MCE = 30, 100 et 180 min

ECLS dans l'Arrêt Cardiaque Réfractaire

- **De plus en plus de centres …**

- **Mais …**
  - Contraintes logistiques et financières
  - Résultats limités pour l'arrêt cardiaque extra-hospitalier réfractaire



Proposition de procédure de prise en charge des ACR réfractaires en dehors de l'hôpital

D' après F. Adnet, SAMU 93

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

Décembre 2008

Bruno Riou, Frédéric Adnet, Frédéric Baud, Alain Cariou, Pierre Carli, Alain Combes, Denis Devictor, Jean Luc Dubois-Randé, Jean-Louis Gérard, Pierre-Yves Gueugniaud, Agnès Ricard-Hibon, Olivier Langeron, Pascal Leprince, Dan Longrois, Alain Pavie, Philippe Pouard, Jean-Christophe Rozé, Jean-Noël Trochu, André Vincentelli.

Pour :
Conseil Français de Réanimation Cardiopulmonaire, Société Française d'Anesthésie et de Réanimation, Société Française de Cardiologie, Société Française de Chirurgie Thoracique et Cardio-Vasculaire, Société Française de Médecine d'Urgence, Société Française de Pédiatrie-Groupe Francophone de Réanimation et d'Urgence Pédiatriques, Société Française de Perfusion, Société de Réanimation de Langue Française

Sous l'égide de la Direction Générale de la Santé et de la Direction des Hôpitaux et de l'Organisation des soins, Ministère de la Santé, de la Jeunesse, des Sports et de la Vie Associative

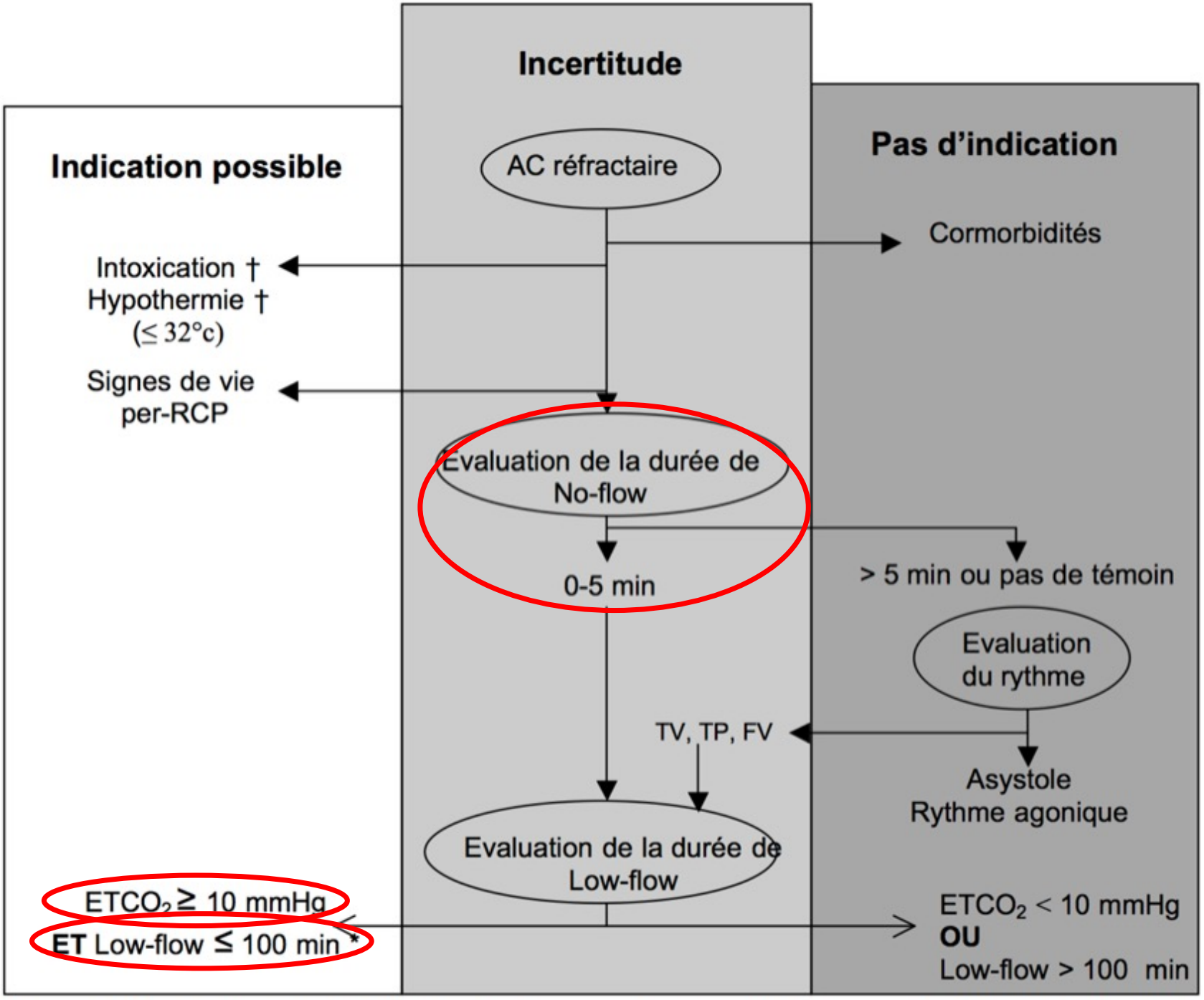


Figure: Proposition d'algorithme de décision d'une assistance circulatoire devant un arrêt cardiaque (AC) réfractaire.

RESEARCH Open Access

CRITICAL CARE

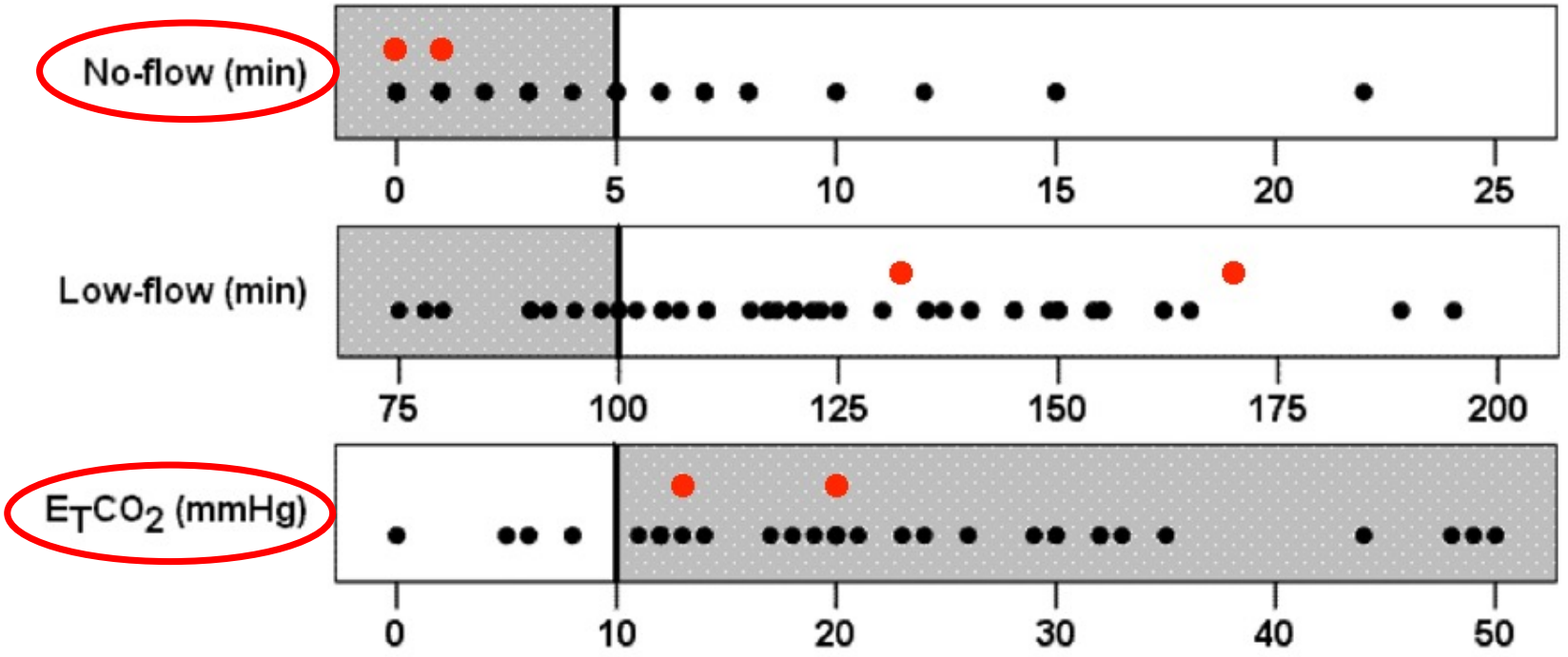
Extracorporeal life support following out-of-hospital refractory cardiac arrest

Le Guen *et al. Critical Care* 2011, **15**:R29
http://ccforum.com/content/15/1/R29

Morgan Le Guen[1], Armelle Nicolas-Robin[1], Serge Carreira[1], Mathieu Raux[1], Pascal Leprince[2], Bruno Riou[3*], Olivier Langeron[1]

- 51 patients en ACR extra-hospitalier réfractaire
  - CEC thérapeutique dès l'admission hospitalière

-> No-Flow = 3 [1-6] min ; Low Flow = 117 [99-146] min ; 9 échecs
2 survivants (~ 4%) avec GOS = 4 et 5



RESEARCH Open Access

CRITICAL CARE

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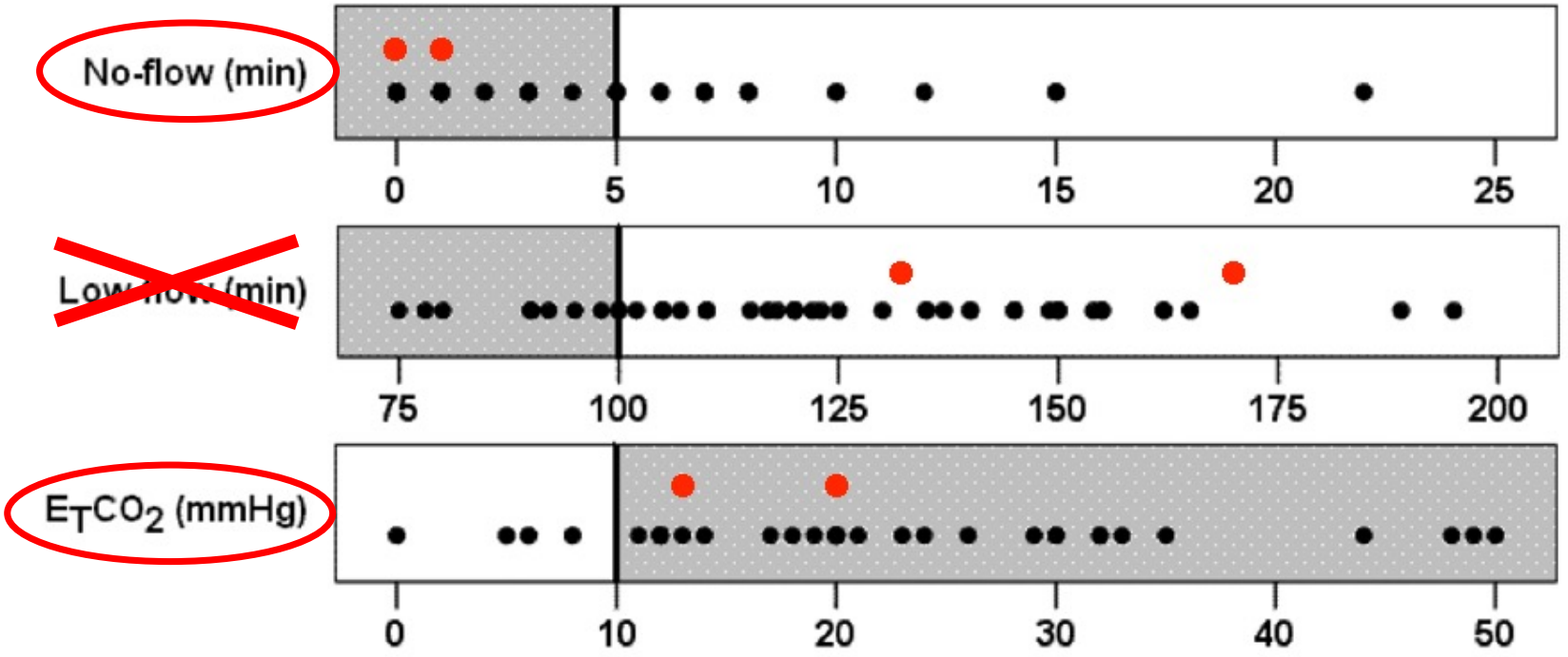
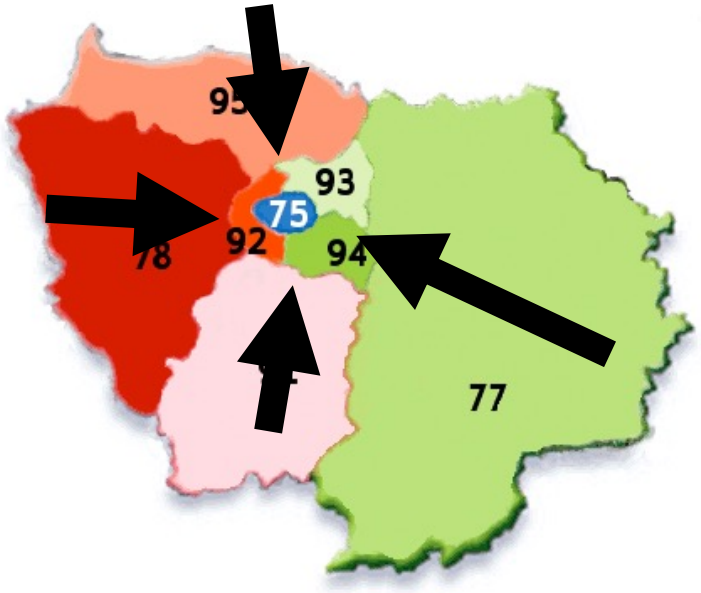


Où en est-on en 2021 ?

Impact des recommandations 2008 sur la durée de Low-Flow avant CEC thérapeutique

	Avant (n=24)	Après (n=7)
Alerte (min)	NR	60 ± 39
Low-flow (min)	130 ± 30	141 ± 24



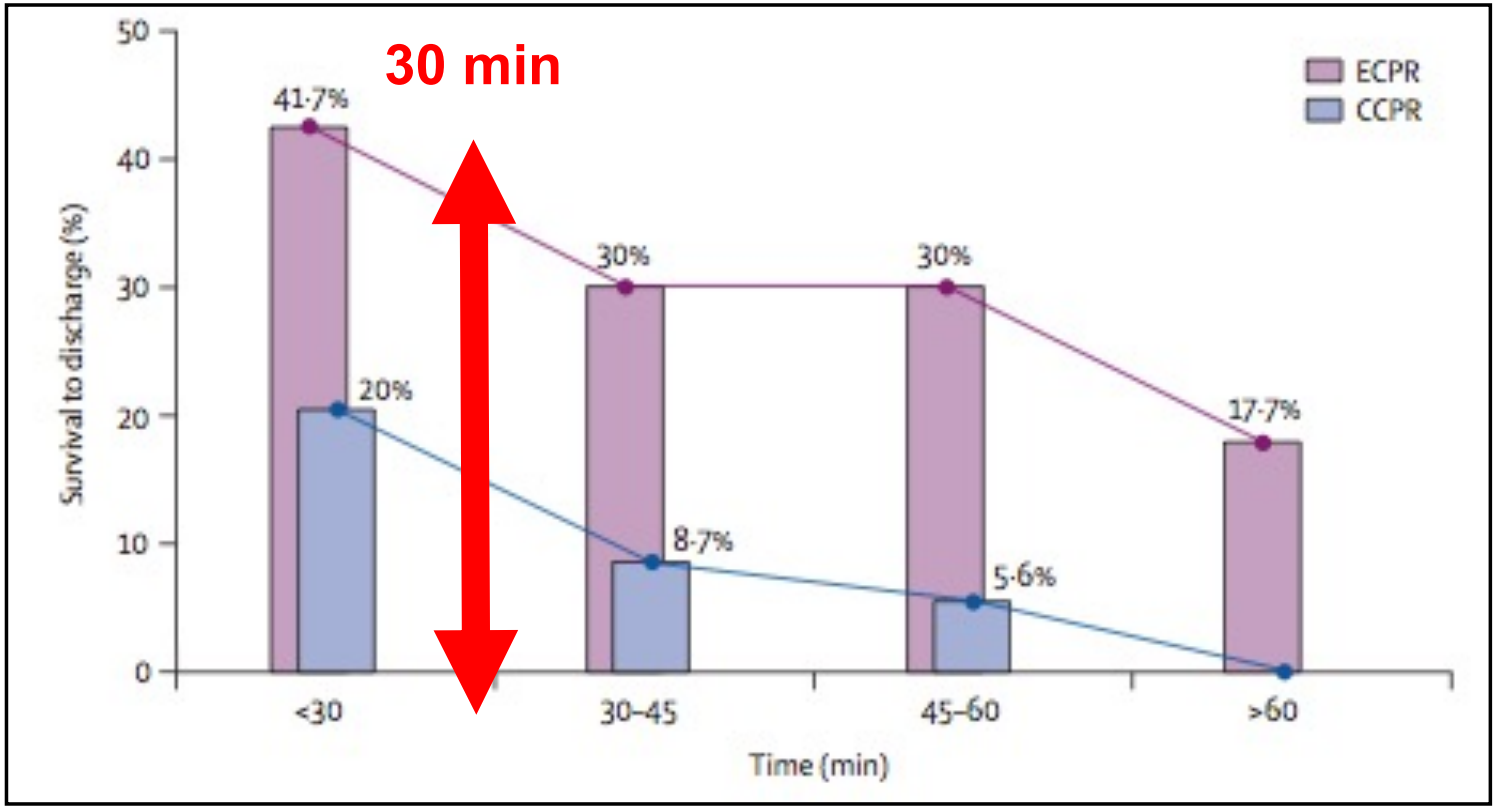
Barouk et al., Pitié-Salpêtrière 2009

Cardiopulmonary resuscitation with assisted extracorporeal life-support versus conventional cardiopulmonary resuscitation in adults with in-hospital cardiac arrest: an observational study and propensity analysis

Yih-Sharng Chen, Jou-Wei Lin*, Hsi-Yu Yu, Wen-Je Ko, Jih-Shuin Jerng, Wei-Tien Chang, Wen-Jone Chen, Shu-Chien Huang, Nai-Hsin Chi, Chih-Hsien Wang, Li-Chin Chen, Pi-Ru Tsai, Sheoi-Shen Wang, Juey-Jen Hwang, Fang-Yue Lin*

Lancet 2008; 372: 554–61

- 975 patients en AC intra-hospitalier
  - 59 CEC *versus* 113 traitements conventionnels



Use of Extracorporeal Membrane Oxygenation for Adults in Cardiac Arrest (E-CPR): A Meta-Analysis of Observational Studies

MARCELO G. CARDARELLI,* ANDREW J. YOUNG,† AND BARTLEY GRIFFITH*

ASAIO Journal 2009

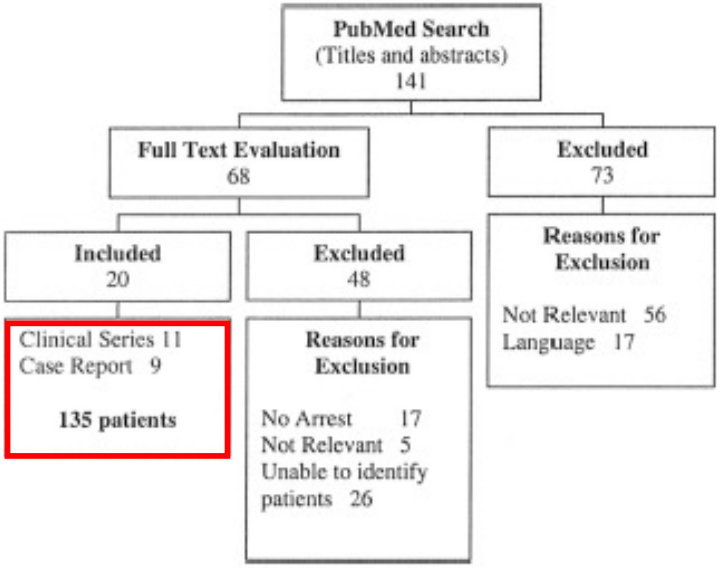


Table 1. Diagnosis and Survival

Cause of Cardiac Arrest	Number of Patients	Survival to Discharge (95% Confidence Interval)
Myocardial infarction	46	36.9% (22.1–49.8)
Postcardiotomy arrest	24	50% (30–70)
Pulmonary embolus	21	57% (35.8–78.1)
Viral cardiomyopathy	7	0
Trauma	6	50% (9.9–90)
Acute heart transplant rejection	5	0
Left ventricular rupture	4	25% (sample too small)
Adult respiratory distress syndrome, Werner granulomatosis, Hanta virus	6	33% (sample too small)
Arrhythmias	3	0

Published data on the use of extracorporeal membrane oxygenation (ECMO) as a supportive measure during or immediately after cardiopulmonary resuscitation (CPR) in adults (older than18 years) shows mixed results. To assess the clinical outcomes of the use of ECMO in this modality and to look for predictors of mortality, we performed a meta-analysis (MA) of individual patients collected from observational studies. An electronic PubMed search restricted to English-language publications between 1990 and 2007, using a consensus restrictive criterion, retrieved 141 titles. After full text evaluation, 11 clinical series and nine case reports were considered appropriate and included in our MA. Data on 135 individually identified adult patients (male:female = 1.6:1) were collected. Median age for the group was 56 years (range 18–83), and the median ECMO run was 54 hours (range 0–3881). Overall survival to hospital discharge was 40% (54 of 135). The most common diagnosis leading to cardiac arrest was acute myocardial infarction (46 of 135 patients). Compared with the youngest group (17–41 years), odds ratio (OR) for mortality was higher for age group 41–56 years (OR 2.9 95%; CL, 1.6–8.2) and those older than 67 years (OR 3.4%; 95% CL, 1.2–9.7). Duration of ECMO support measured in days was also a predictor of mortality, with significant better outcome for those supported between 0.875 and 2.3 days (OR 0.2; 95% CL, 0.07–0.6). There was a negative trend in survival when manual CPR lasted >30 minutes without prompt ECMO initiation (OR 1.9; 95% CL, 0.9–4.2). This work confirms the expectations for a better survival when E-CPR is used in younger patients, for shorter periods of time and after expeditious implementation during or immediately after manual CPR. Neurologic sequelae and other major complications, although suspected to be high, are poorly described in the reviewed literature. *ASAIO Journal* 2009; 55:581–586.

Extracorporeal membrane oxygenation support can extend the duration of cardiopulmonary resuscitation*

Crit Care Med 2008 Vol. 36, No. 9

Yih-Sharng Chen, MD; Hsi-Yu Yu, MD; Shu-Chien Huang, MD; Jou-Wei Lin, MD; Nai-Hsin Chi, MD; Chih-Hsien Wang, MD; Shoei-Shan Wang, MD; Fang-Yue Lin, MD; Wen-Je Ko, MD

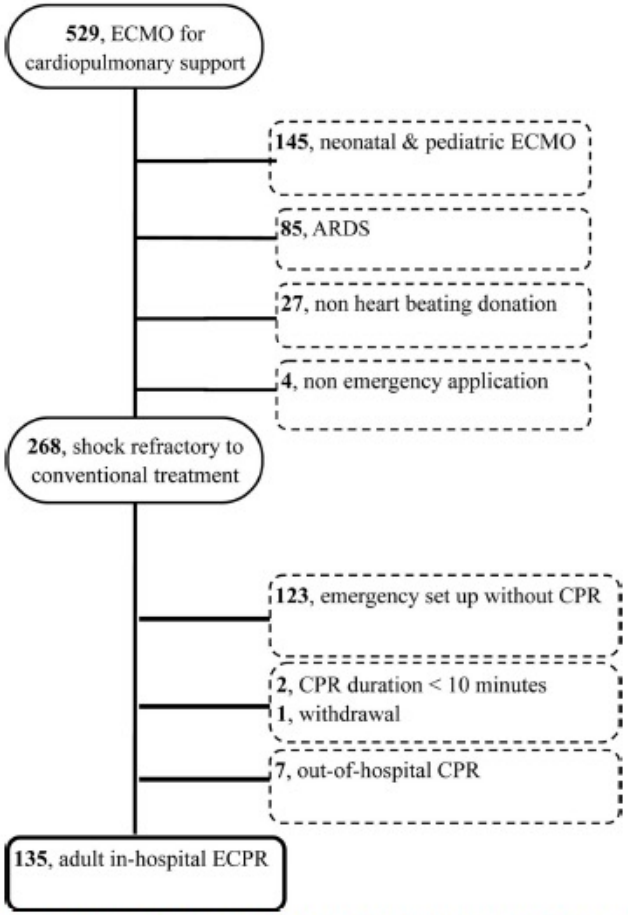
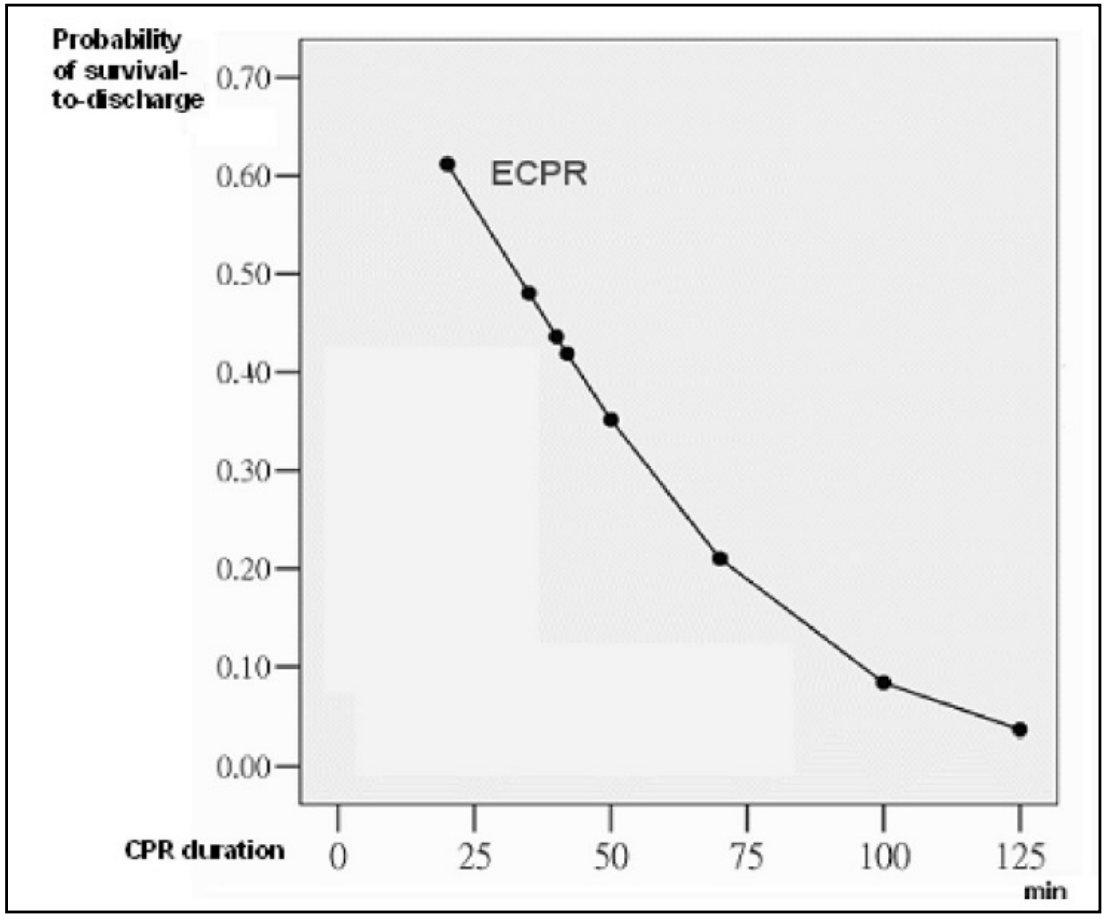


Figure 1. Cohort for the ECPR study. *ARDS*, acute respiratory distress syndrome; *CPR*, cardiopulmonary resuscitation; *ECPR*, ECMO for CPR; *ECMO*, extracorporeal membrane oxygenation.

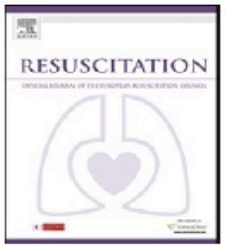


Corrélation de la survie avec la durée de Low-Flow avant ECLS

Assessment of outcomes and differences between in- and out-of-hospital cardiac arrest patients treated with cardiopulmonary resuscitation using extracorporeal life support☆

Eisuke Kagawa*, Ichiro Inoue, Takuji Kawagoe, Masaharu Ishihara, Yuji Shimatani, Satoshi Kurisu, Yasuharu Nakama, Kazuoki Dai, Otani Takayuki, Hiroki Ikenaga, Yoshimasa Morimoto, Kentaro Ejiri, Nozomu Oda

Resuscitation 81 (2010) 968–973

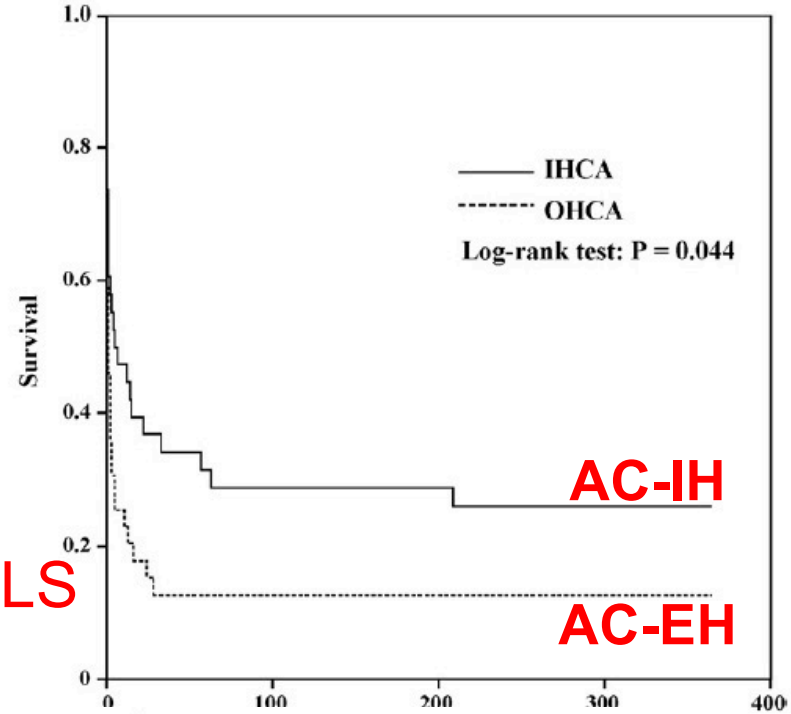


- 77 ECLS sur AC réfractaires
  - 38 AC intra-hospitaliers
  - 39 AC extra-hospitaliers
  - ECLS intra-hospitalière

-> délai ECLS plus rapide si AC-IH

pronostic AC-IH > AC-EH

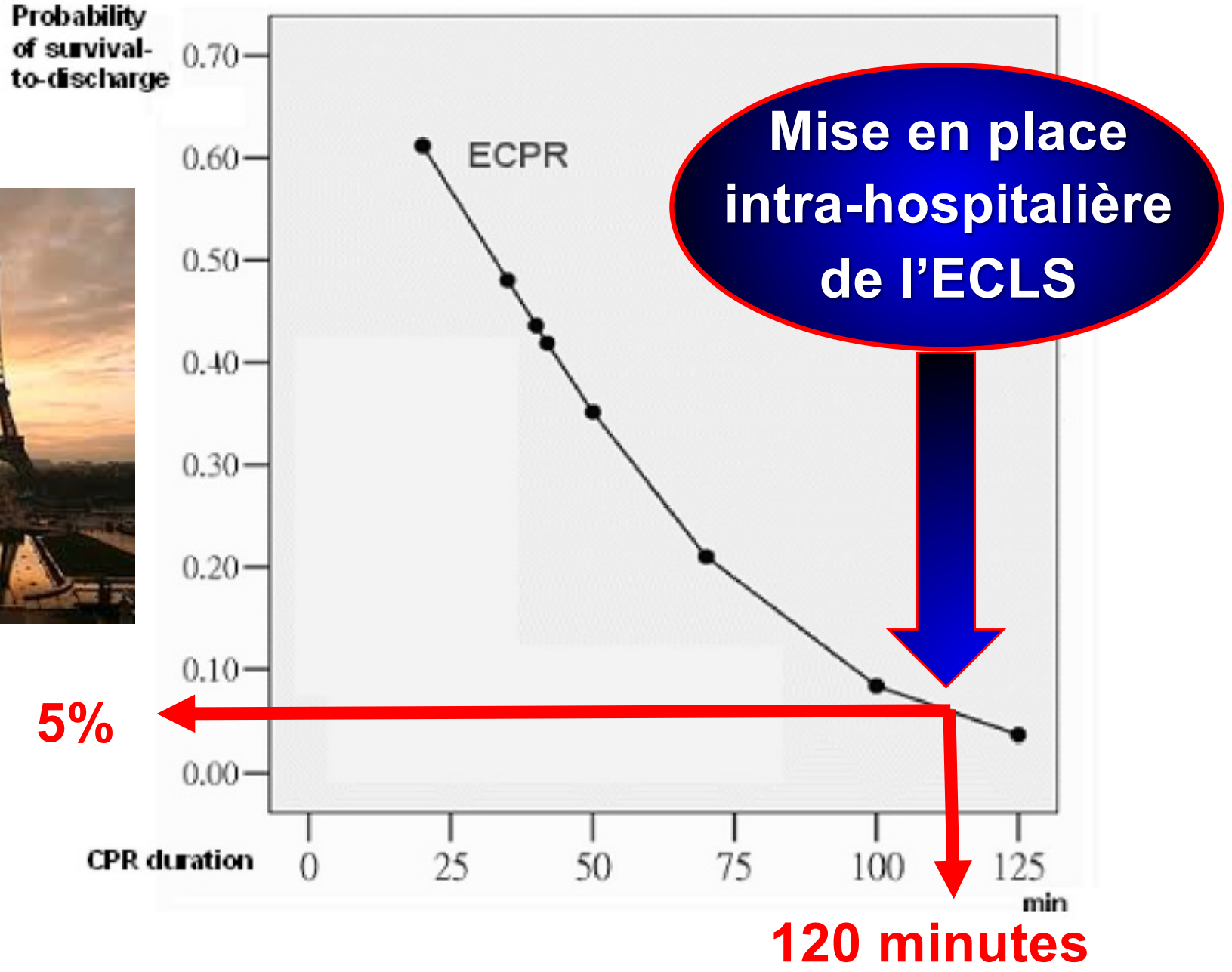
NS après ajustement du délai avant ECLS



Multivariate stepwise Cox regression analysis for the factors associated with the 30-day and 1-year survival.

	Odds ratio	95% confidence interval	*p* value
30-day survival			
Out-of-hospital cardiac arrest	0.94	0.68–1.27	0.67
Time interval from collapse to start of extracorporeal life support (every 1 min)	0.98	0.96–0.99	<0.01
Initial rhythm of ventricular fibrillation	1.32	1.00–1.78	0.048
1-year survival			
Out-of-hospital cardiac arrest	0.99	0.73–1.33	0.95
Time interval from collapse to start of extracorporeal life support (every 1 min)	0.98	0.96–0.99	<0.01
Initial rhythm of ventricular fibrillation	1.28	0.98–1.70	0.07

Délais de PEC des AC réfractaires à Paris



Contraintes de la prise en charge de l'Arrêt Cardiaque en extra-hospitalier

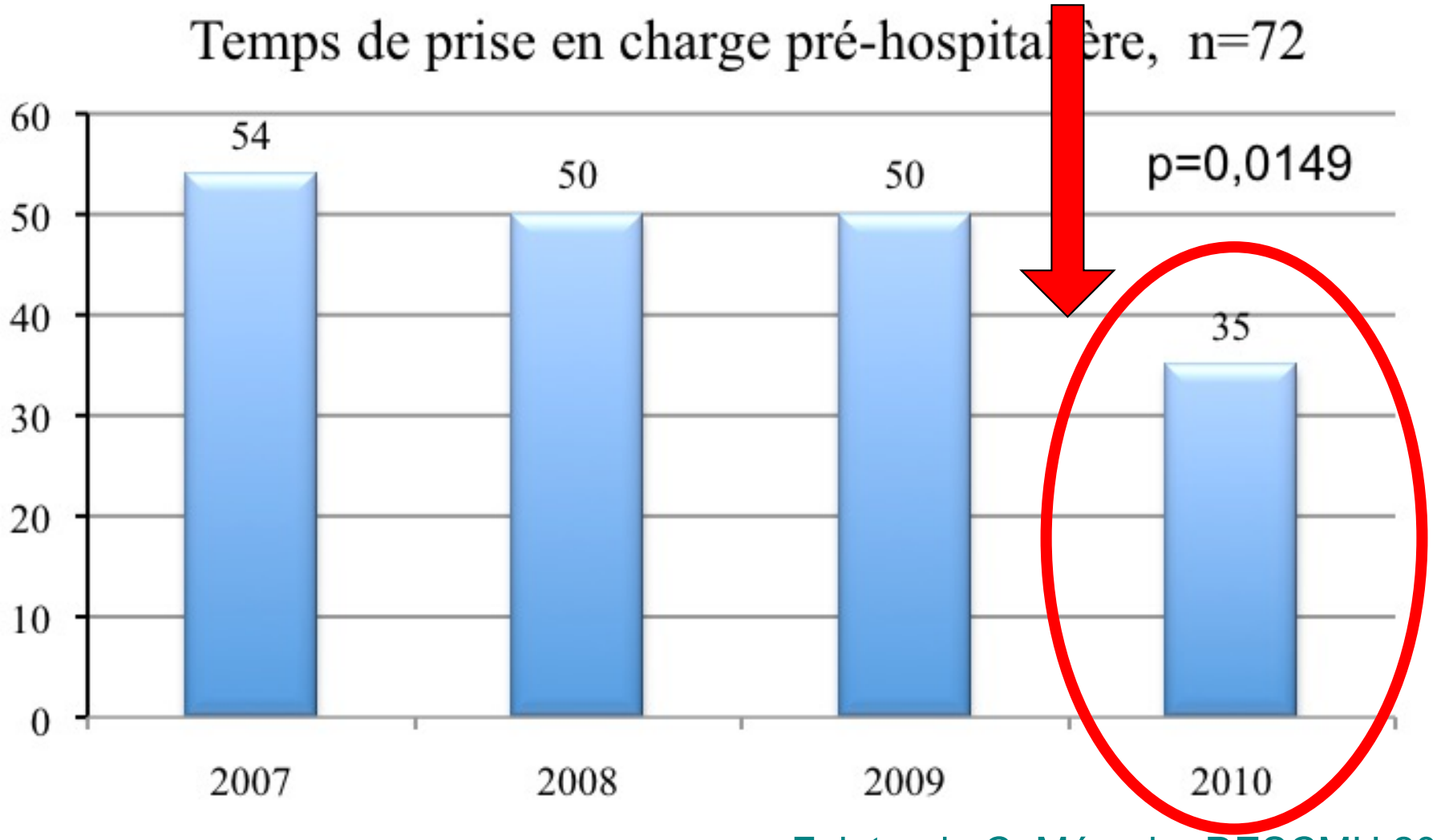
- Délais successifs +++
  - Premiers secours ~ 10 min
  - SMUR ~ 10 min
  - Réanimation spécialisée ~ 30 min
  - Brancardage ~ 10 min
  - Transport ~ 10 min

=> Temps incompressible ≥ 60 minutes pour amener le patient à l'hôpital !

Comment raccourcir le temps de mise en œuvre de l'ECLS ?

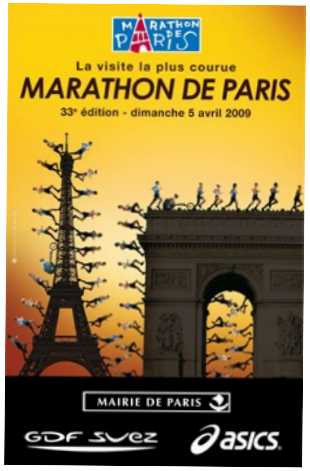
Evolution des délais de PEC des AC réfractaires en pré-hospitalier à Paris

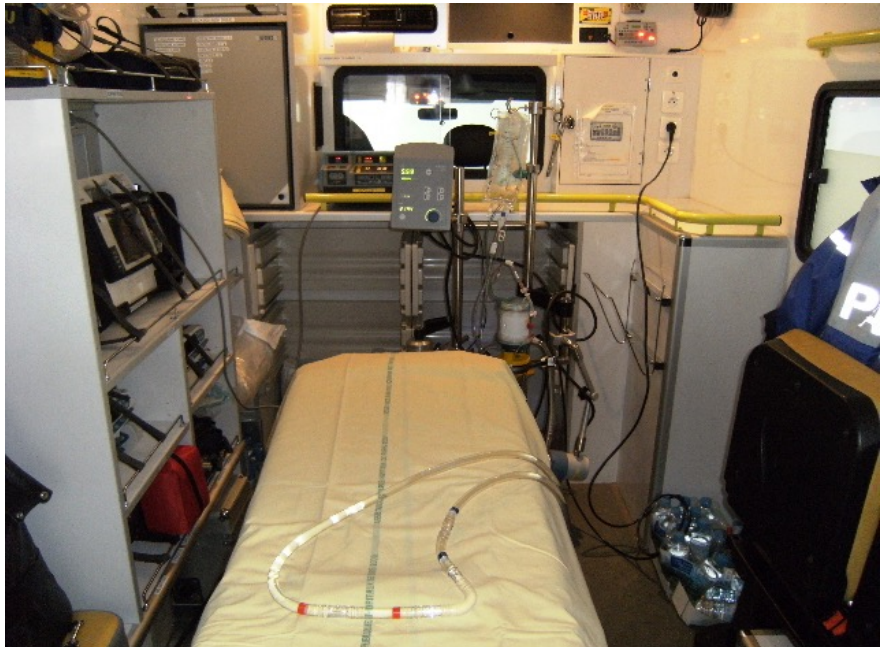
Procédure de PEC des ACEH



Feintrenie C, Mémoire DESCMU 2011

Anticiper la survenue de l'AC réfractaire ?





Cardiac Arrest during Long-Distance Running Races

N Engl J Med 2012;366:130-40.

Jonathan H. Kim, M.D., Rajeev Malhotra, M.D., George Chiampas, D.O., Pierre d'Hemecourt, M.D., Chris Troyanos, A.T.C., John Cianca, M.D., Rex N. Smith, M.D., Thomas J. Wang, M.D., William O. Roberts, M.D., Paul D. Thompson, M.D., and Aaron L. Baggish, M.D., for the Race Associated Cardiac Arrest Event Registry (RACER) Study Group

- 10,9 millions de coureurs (2000-2010)
  - 59 AC -> incidence = 0,54 / 100 000 (fin de course +++)

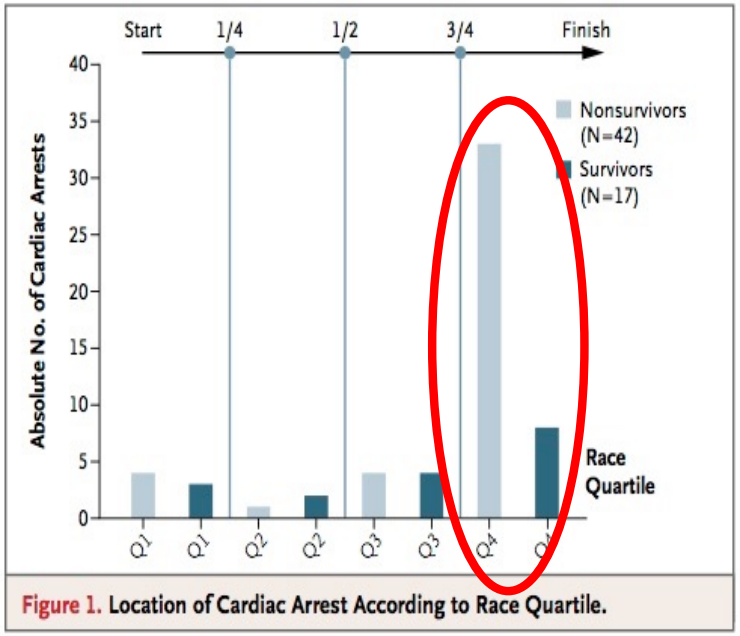


Figure 1. Location of Cardiac Arrest According to Race Quartile.

Table 3. Demographic Characteristics, Running History, Clinical Characteristics, Emergency Medical Treatment, and Cause of Cardiac Arrest among Nonsurvivors and Survivors.*

Variable	Nonsurvivors (N=23)	Survivors (N=8)	P Value†	Odds Ratio (95% CI)‡
Emergency medical treatment				
Bystander-administered CPR performed — no. (%)	10 (43)	8 (100)	0.01‖	
Time to initiation of CPR — min	5.2±4.0	1.5±1.4	0.06	1.51 (0.99–2.30)
Time to emergency-medical-service arrival — min	7.7±6.7	3.9±2.7	0.13	
Initially documented cardiac rhythm — no. (%)				
Ventricular fibrillation or ventricular tachycardia	6 (26)	7 (88)	0.01	0.05 (0.01–0.50)
Pulseless electrical activity, asystole, or other	17 (74)	1 (13)	0.01	19.8 (2.0–196.4)
Automatic external defibrillator used on scene	8 (35)	7 (88)	0.03	0.08 (0.01–0.73)
Autopsy and clinical findings after cardiac arrest — no. (%)				
Definite or probable hypertrophic cardiomyopathy	15 (65)	0	0.002‖	
Ischemic heart disease	4 (17)	5 (63)	0.02	0.13 (0.02–0.76)

-> Efficacité de la mise en place systématique de DAE

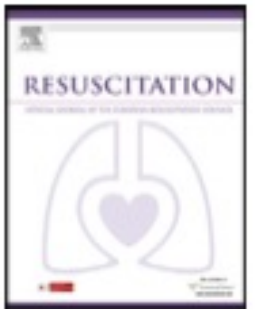
-> Mais malgré les DAE : 31 décès par AC réfractaire (CMH)

Case report

Out-of-hospital extra-corporeal life support implantation during refractory cardiac arrest in a half-marathon runner☆

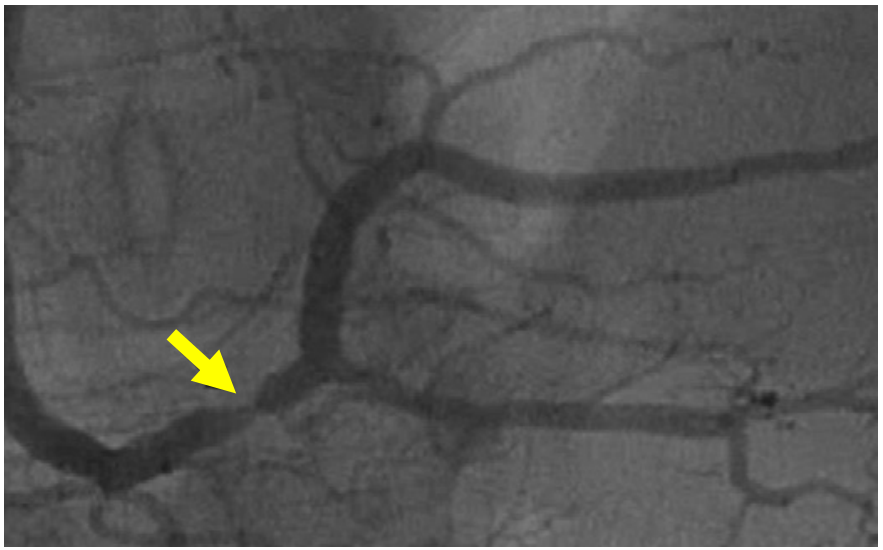
Guillaume Lebreton[a], Matteo Pozzi[a], Charles-Edouard Luyt[b], Jean Chastre[b], Pierre Carli[c], Alain Pavie[a], Pascal Leprince[a], Benoît Vivien[c,*]

Resuscitation 82 (2011) 1239–1242



- H 48 ans, AC au 18ème km du semi-marathon de Paris 2009

-> début CEC à T+60 min dans l'UMH
RACS après qq minutes
hypothermie 31,9° C à l'admission
angioplastie coronaire droite
sevrage CEC à J2, FEVG nle à J5

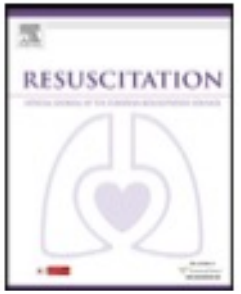


Case report

Out-of-hospital extracorporeal life support for cardiac arrest—A case report☆

M. Arlt[a,*], A. Philipp[b], S. Voelkel[a], B.M. Graf[a], C. Schmid[b], M. Hilker[b]

Resuscitation 82 (2011) 1243–1245



- Enfant 9 ans, noyade dans un lac en été
  - T° eau à 26° C, T° extérieure = 36° C
  - immersion 20 min
  - AC réfractaire en asystolie

-> arrivée ECMO team à T+50 min

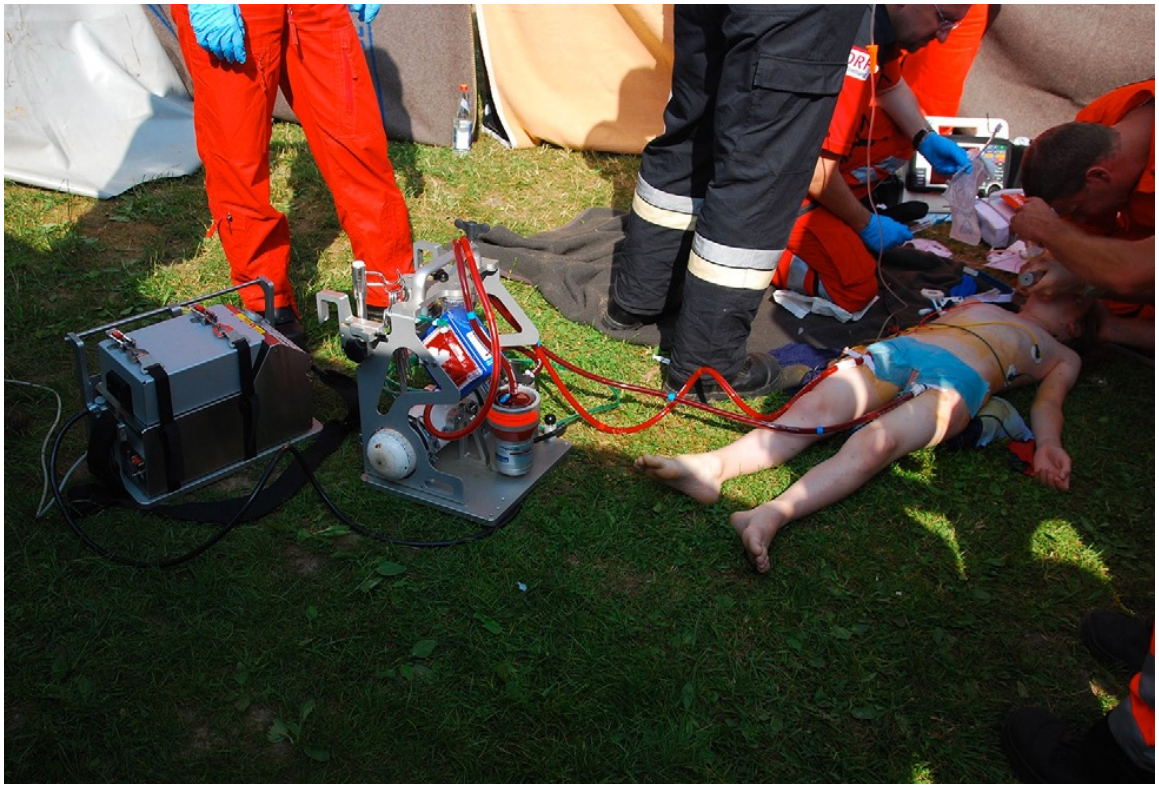
cannulation percutanée

RACS qq minutes après le début de la CEC

hypothermie 35° C

SDMV

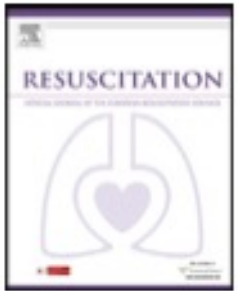
LATA et décès



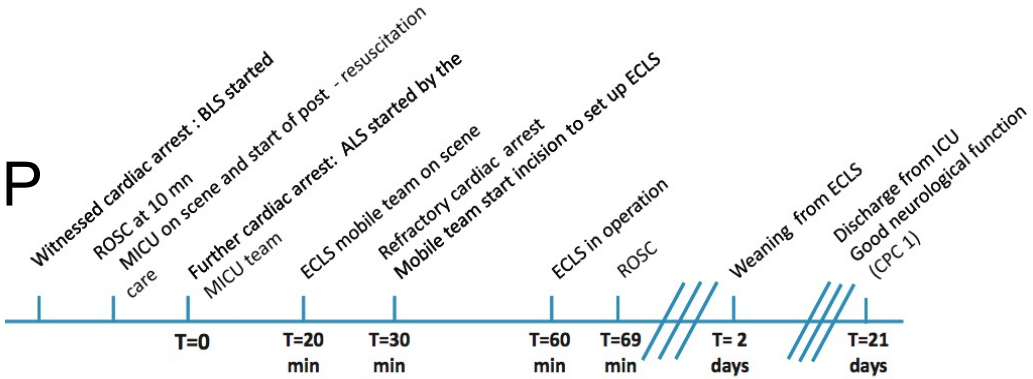
Successful treatment of refractory cardiac arrest by emergency physicians using pre-hospital ECLS☆

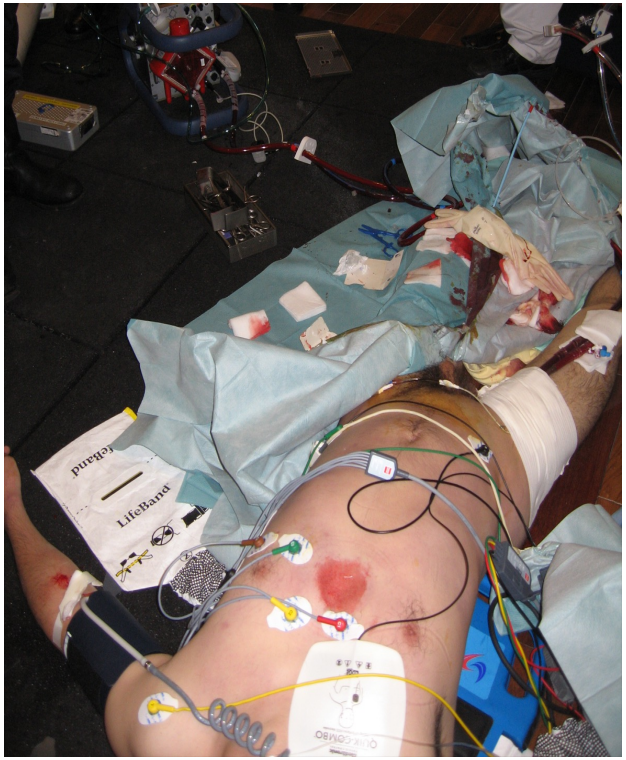
Resuscitation 83 (2012) e177–e178

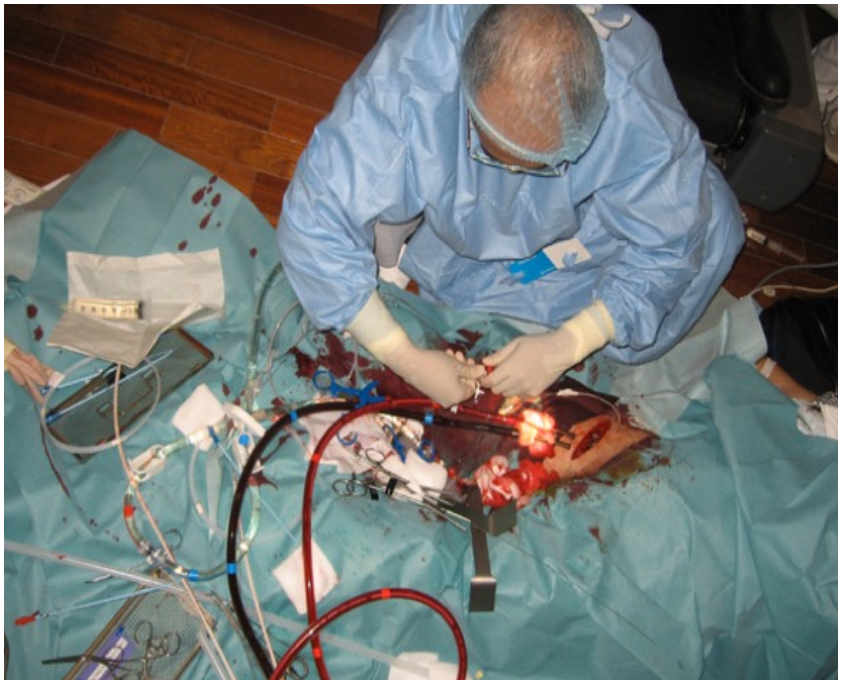
Lionel Lamhaut[a,d,*], Romain Jouffroy[a], Aurélie Kalpodjian[b], Thibaut Deluze[a], Pascal Phillipe[a], Benoit Vivien[a], Kim An[a], Pierre Carli[a,c,d]



- H 32 ans, AC réfractaire en salle de sport
  - FV réfractaire
  - signes de vie pendant la RCP
  - ECLS après 30 min d'échec RCP



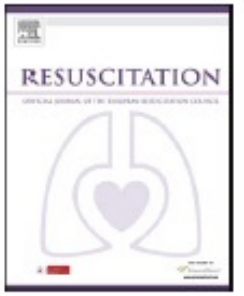




-> Survie sans séquelle, CPC 1

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

Resuscitation 84 (2013) 1525–1529



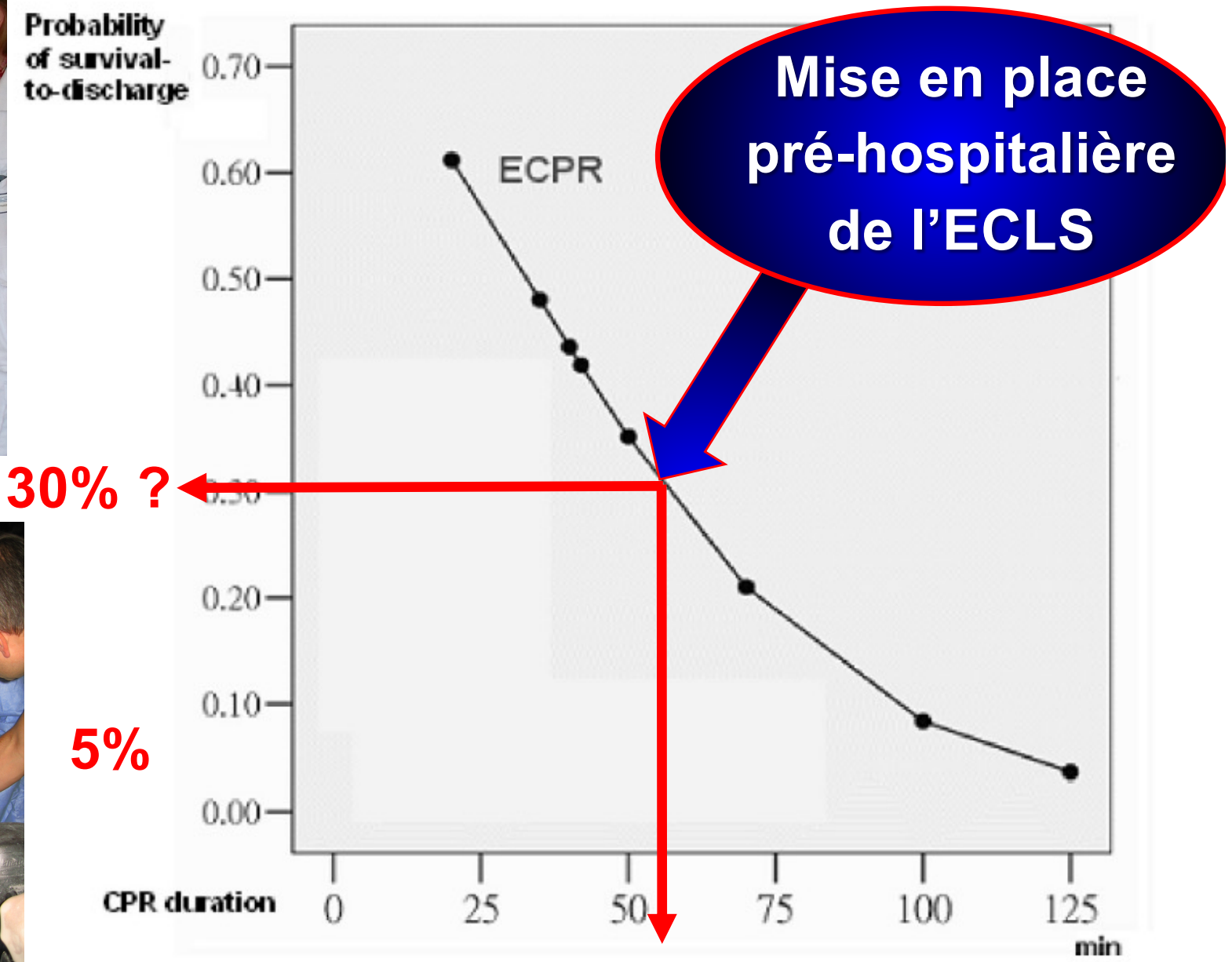
Lionel Lamhaut[a,b,*], Romain Jouffroy[a], Michaela Soldan[a], Pascal Phillipe[a], Thibaut Deluze[a], Murielle Jaffry[a], Christelle Dagron[a], Benoit Vivien[a], Christian Spaulding[b,c], Kim An[a], Pierre Carli[a,b]

- 7 patients en AC réfractaire extra-hospitalier
  - AC devant témoin
  - No-Flow ≤ 5 min.
    ou signes de vie per-RCP
  - mise en place de l'ECLS
    sur le terrain

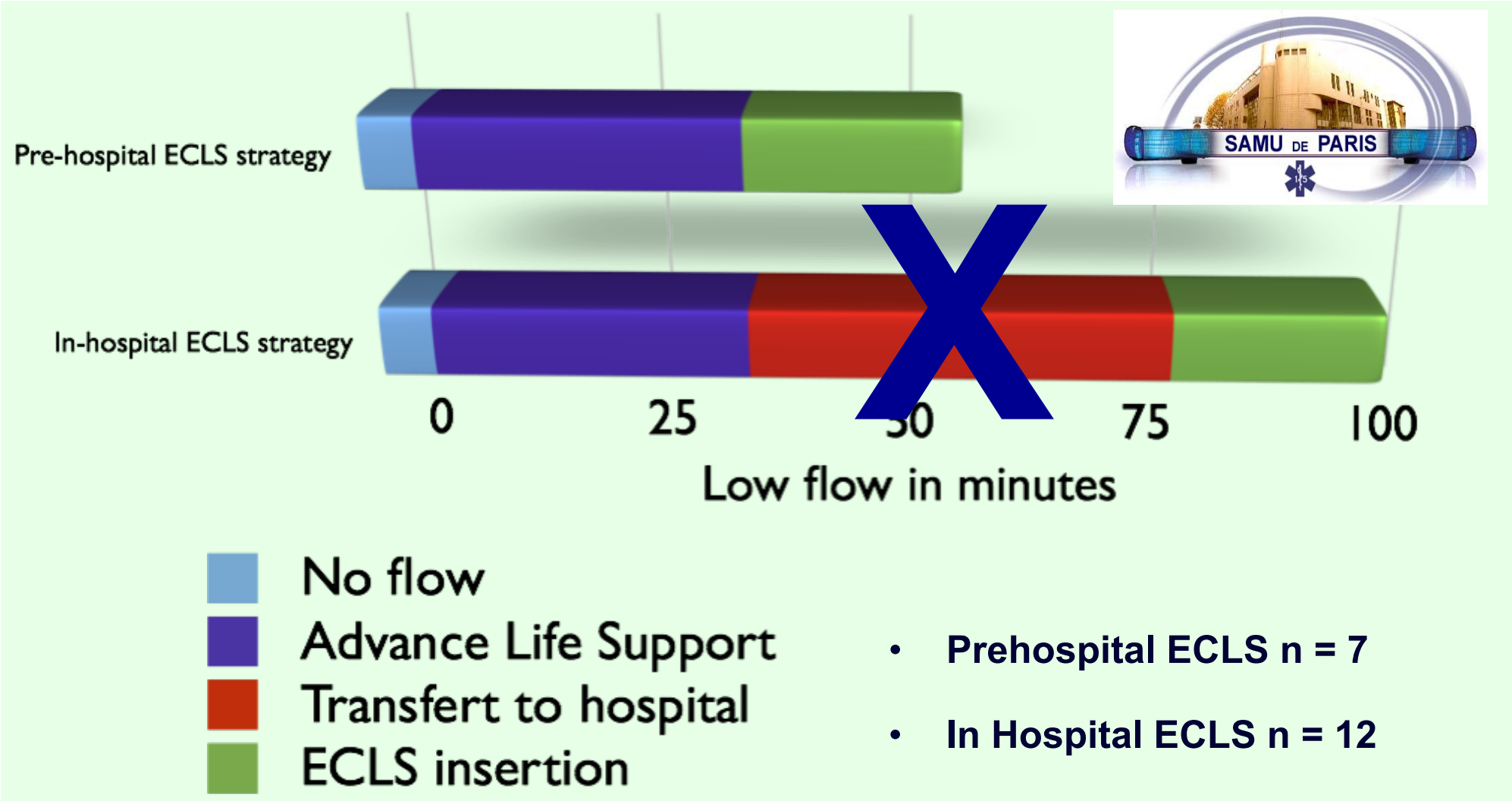
-> début ECLS à 57±21 min.
mise en place = 22±6 min.

-> 1 survivant sans séquelle
3 patients en ME -> 2 PMO

Délais de PEC des AC réfractaires à Paris

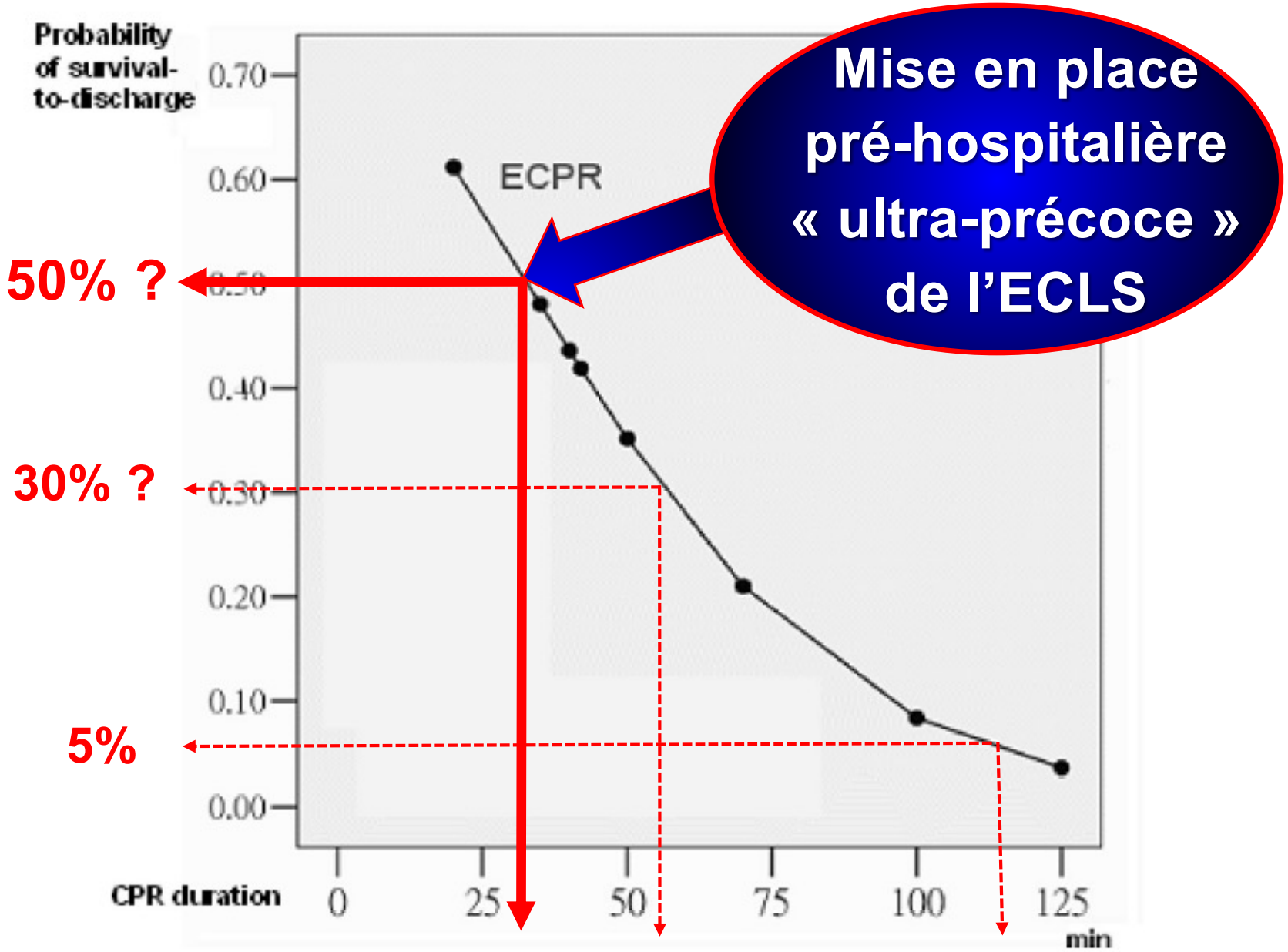


ECLS pré-hospitalière VS intra-hospitalière



- **Prehospital ECLS n = 7**
- **In Hospital ECLS n = 12**

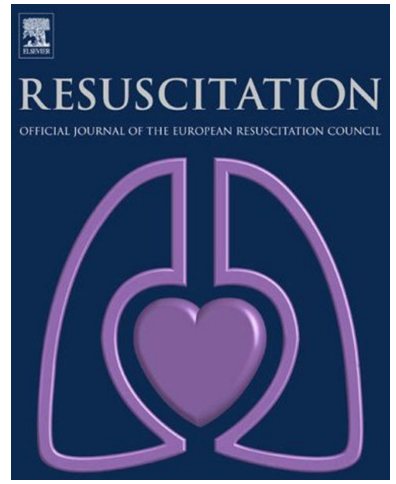
Délais de PEC des AC réfractaires à Paris

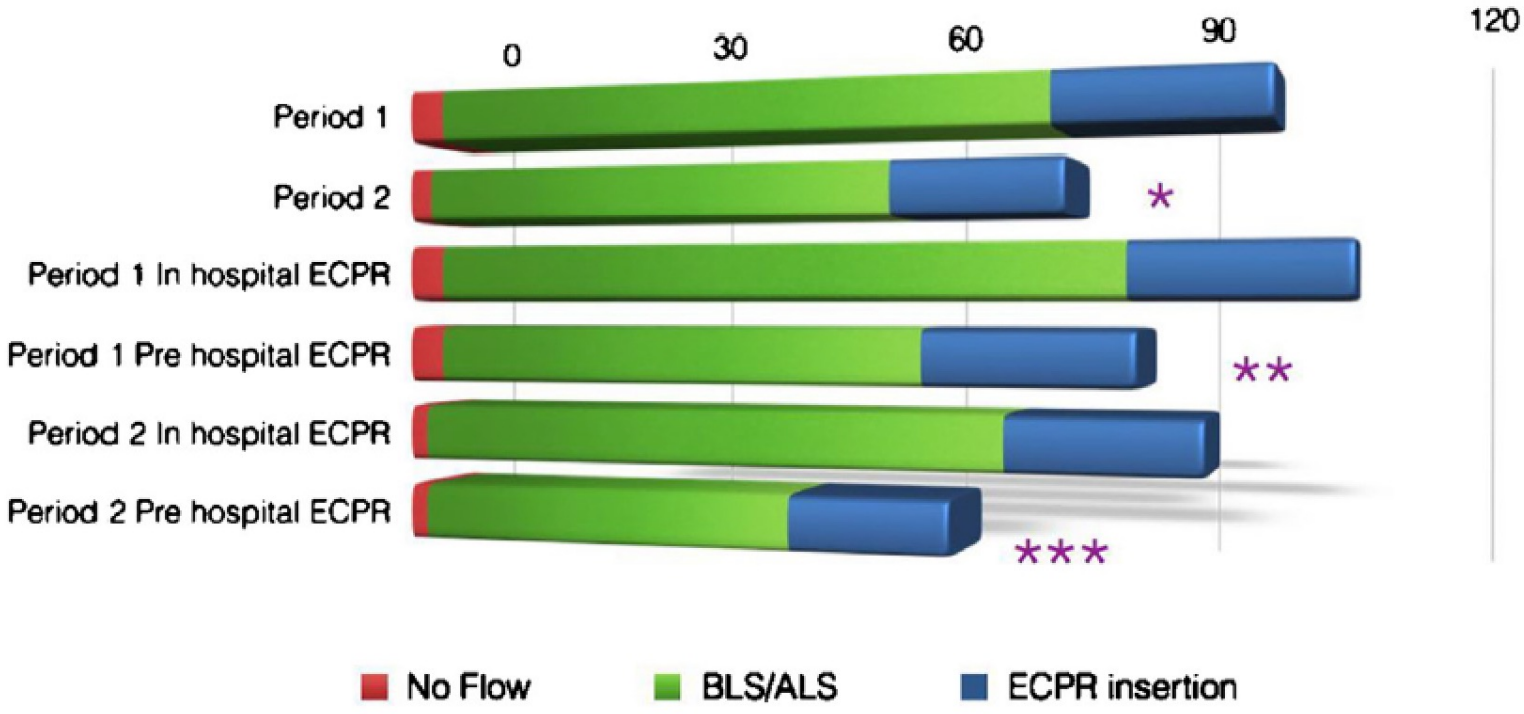


A Pre-Hospital Extracorporeal Cardio Pulmonary Resuscitation (ECPR) strategy for treatment of refractory out hospital cardiac arrest: An observational study and propensity analysis

Lionel Lamhaut[a,b,*], Alice Hutin[a,c], Etienne Puymirat[d,e], Jérome Jouan[f], Jean-Herlé Raphalen[a], Romain Jouffroy[a], Murielle Jaffry[g], Christelle Dagron[a], Kim An[a], Florence Dumas[b,e,h], Eloi Marijon[b,d,e], Wulfran Bougouin[c,d], Jean-Pierre Tourtier[i], Frédéric Baud[a], Xavier Jouven[b,d,e], Nicolas Danchin[d,e], Christian Spaulding[b,d,e], Pierre Carli[a,e]

Resuscitation 117 (2017) 109–117





* :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

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

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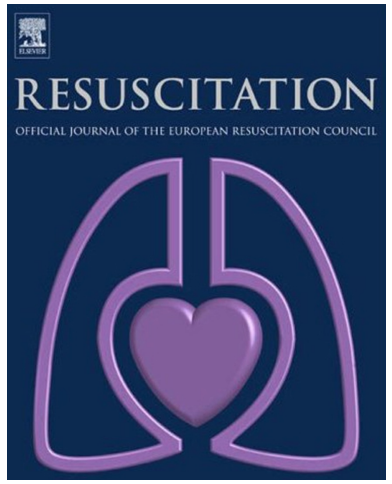
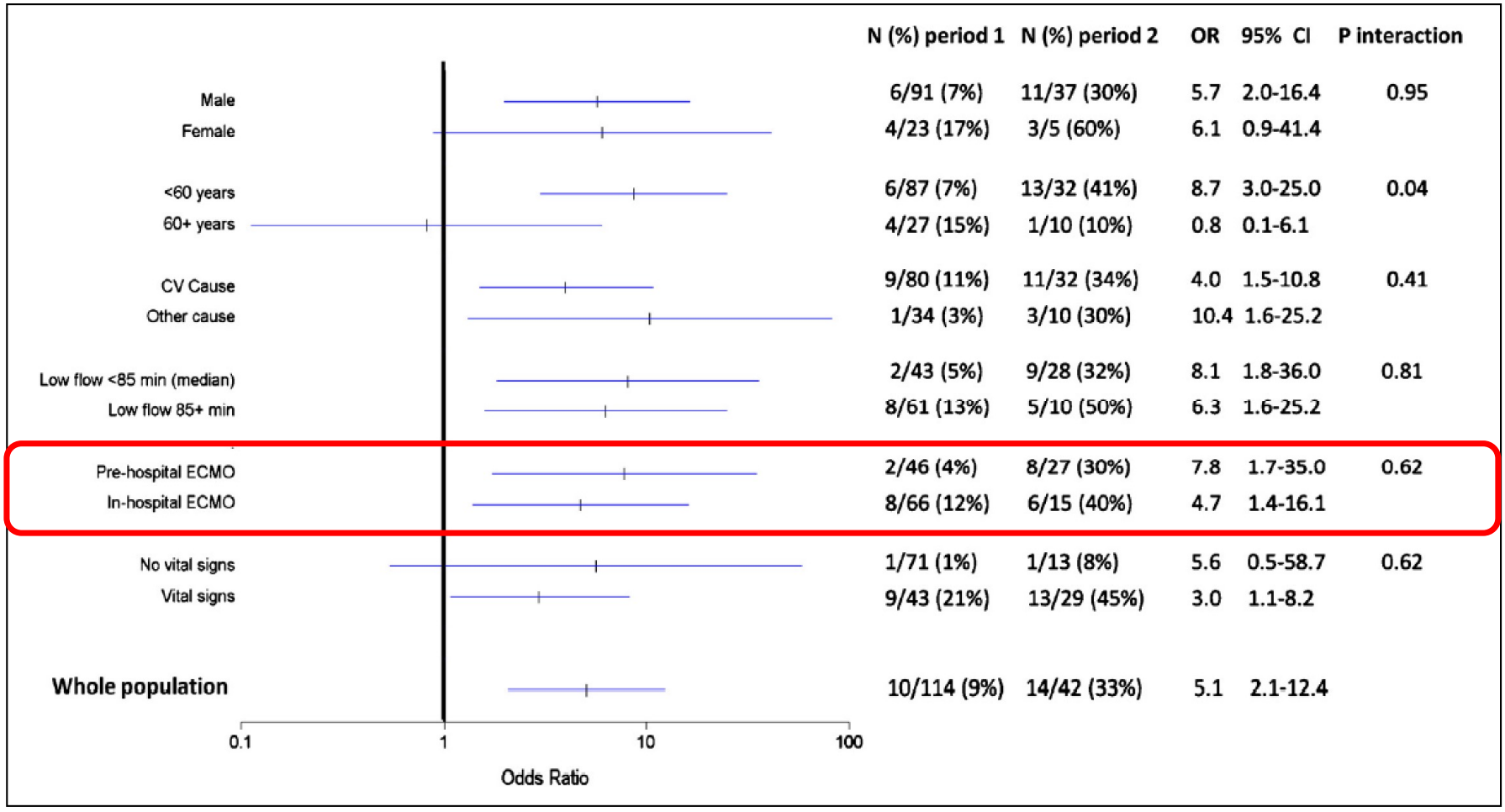
Resuscitation 117 (2017) 109–117





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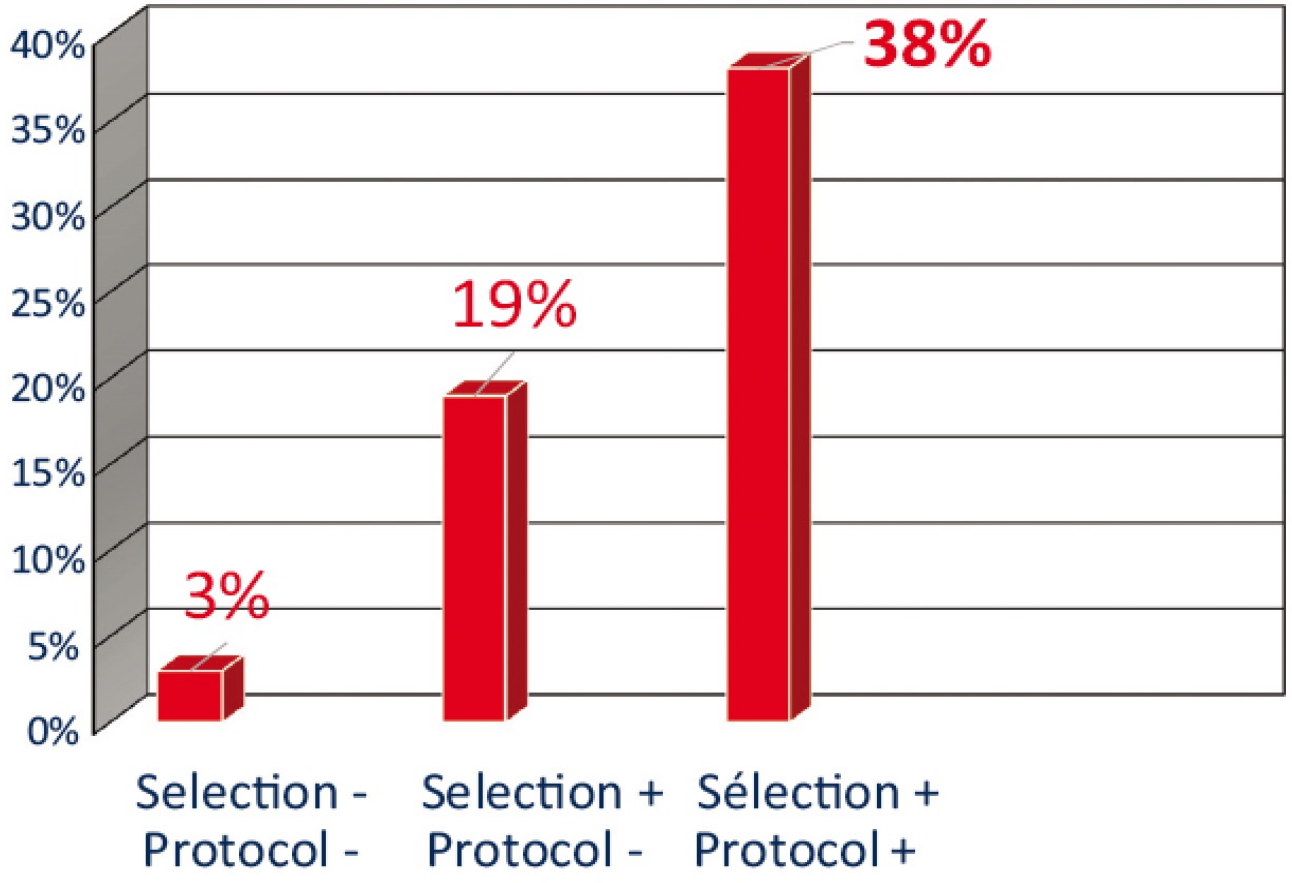
Resuscitation 117 (2017) 109–117



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

Resuscitation 112 (2017) 1–10

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

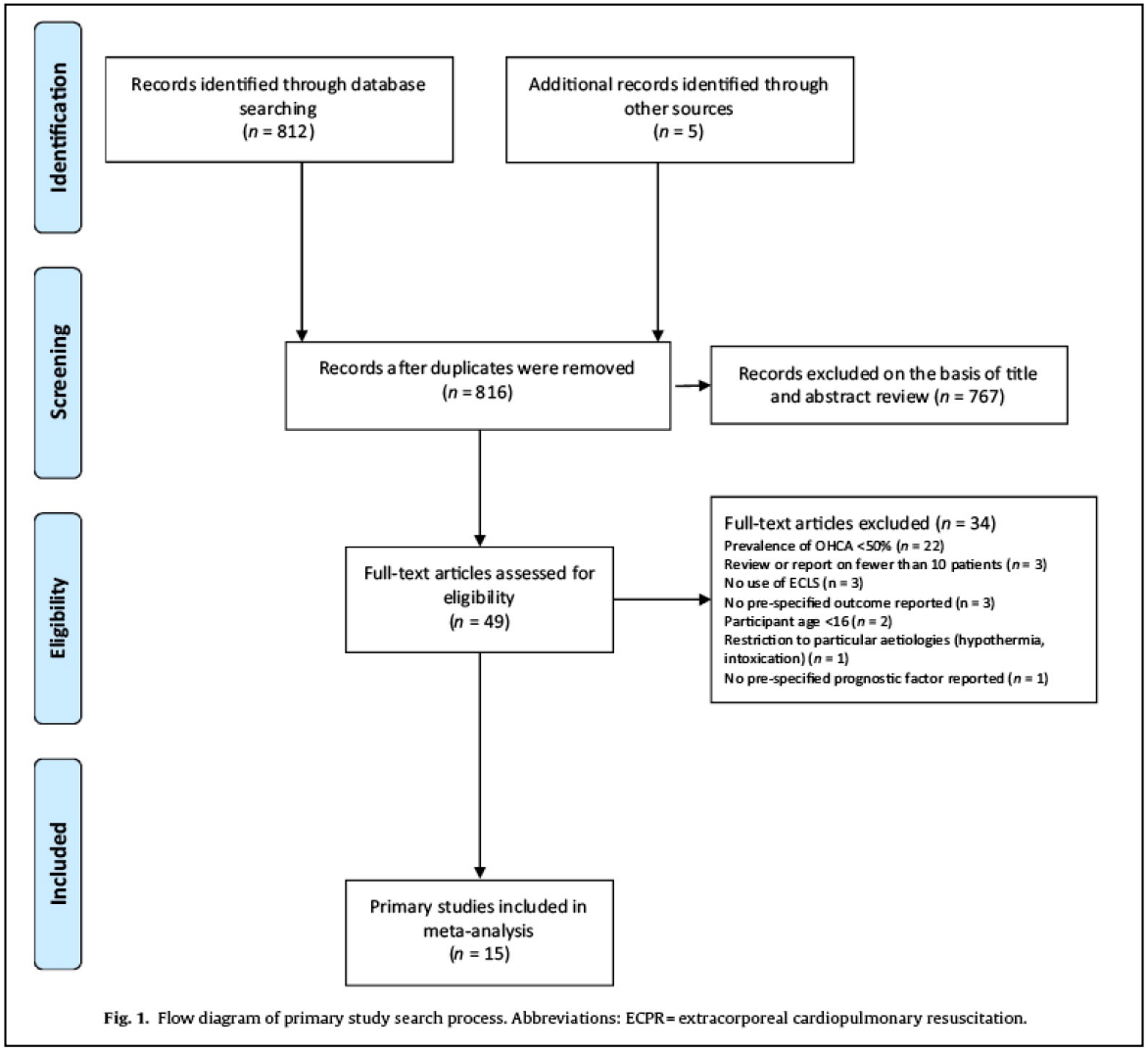


Fig. 1. Flow diagram of primary study search process. Abbreviations: ECPR= extracorporeal cardiopulmonary resuscitation.

15 études, 841 patients
-> Survie ~ 15%

Facteurs pronostiques de survie après ECPR

- **Rythme chocable**
- **Low-flow « court »**
- **pH artériel élevé**
- **Lactatémie basse**

~~**Age, sexe, tentative de RCP par un témoin**~~

Resuscitation 130 (2018) 44–48

Contents lists available at ScienceDirect

Resuscitation

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

Clinical paper

Early ECPR for out-of-hospital cardiac arrest: Best practice in 2018

Alice Hutin[a,b,1], Mamoun Abu-Habsa[c,1], Brian Burns[d,k], Steve Bernard[e], Joe Bellezzo[f], Zack Shinar[f], Ervigio Corral Torres[g], Pierre-Yves Gueugniaud[h], Pierre Carli[a,i], Lionel Lamhaut[a,i,j,*]

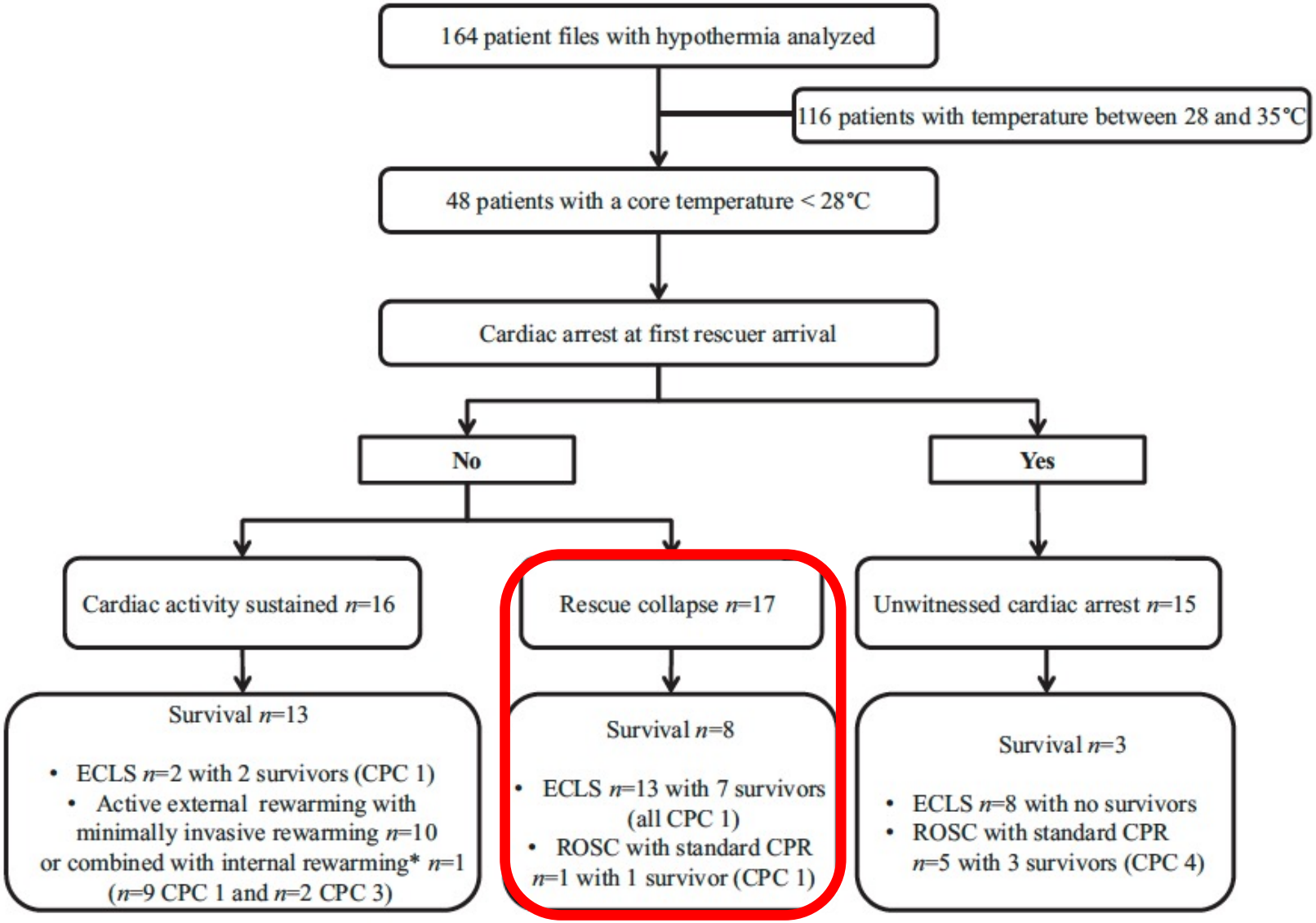
« It seems reasonable to include patients :

- without known major comorbidities,
- presenting with refractory OHCA,
- a no-flow state of under 5 min,
- with a persistent shockable rhythm,
- an EtCO2 > 10 mmHg,
- signs of life (breathing, gasp, pupillary reflex, movements) whatever the rhythm. »

Outcome after severe accidental hypothermia in the French Alps: A 10-year review☆

Resuscitation 93 (2015) 118–123

Guillaume Debaty[a,b,*], Ibrahim Moustapha[b], Pierre Bouzat[c,d,e], Maxime Maignan[a,b], Marc Blancher[b], Amandine Rallo[b], Julien Brun[c], Olivier Chavanon[f,g], Vincent Danel[b], Françoise Carpentier[b], Jean-François Payen[c,d,e], Raphaël Briot[a,b]



L'ECLS ne fait pas tout …

- **Prise en charge du Syndrome post-arrêt cardiaque**

  -> « *Sepsis-like Syndrome* »

ILCOR Consensus Statement

Post–Cardiac Arrest Syndrome

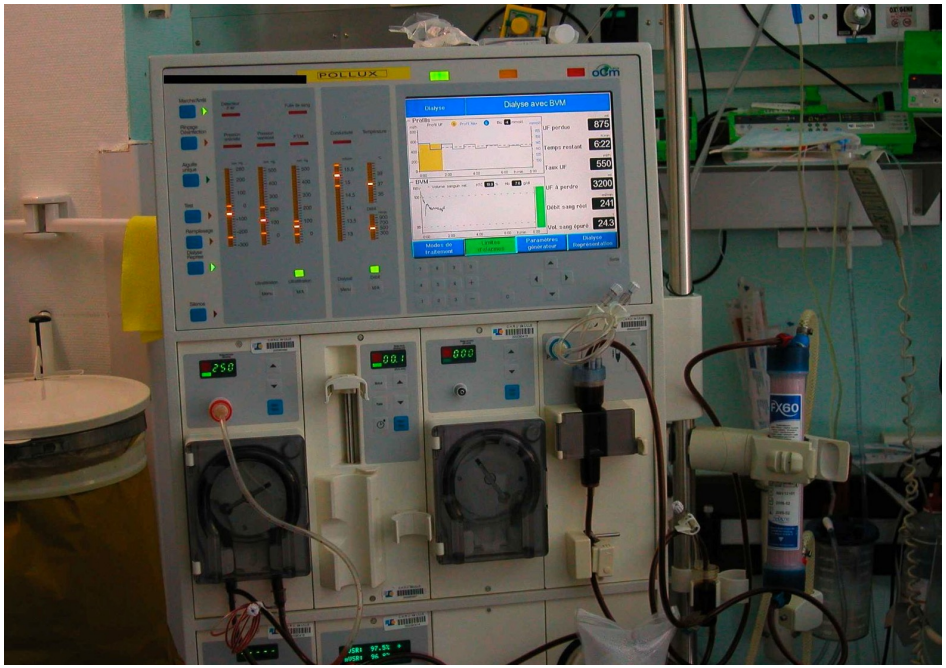
Epidemiology, Pathophysiology, Treatment, and Prognostication

A Consensus Statement From the International Liaison Committee on Resuscitation (American Heart Association, Australian and New Zealand Council on Resuscitation, European Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Asia, and the Resuscitation Council of Southern Africa); the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesia; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Clinical Cardiology; and the Stroke Council

Endorsed by the American College of Emergency Physicians, Society for Academic Emergency Medicine, Society of Critical Care Medicine, and Neurocritical Care Society

Réanimation post-Arrêt Cardiaque

- **Optimisation hémodynamique**
  - Catécholamines
  - Remplissage
  - Transfusion massive
  - Epuration extrarénale

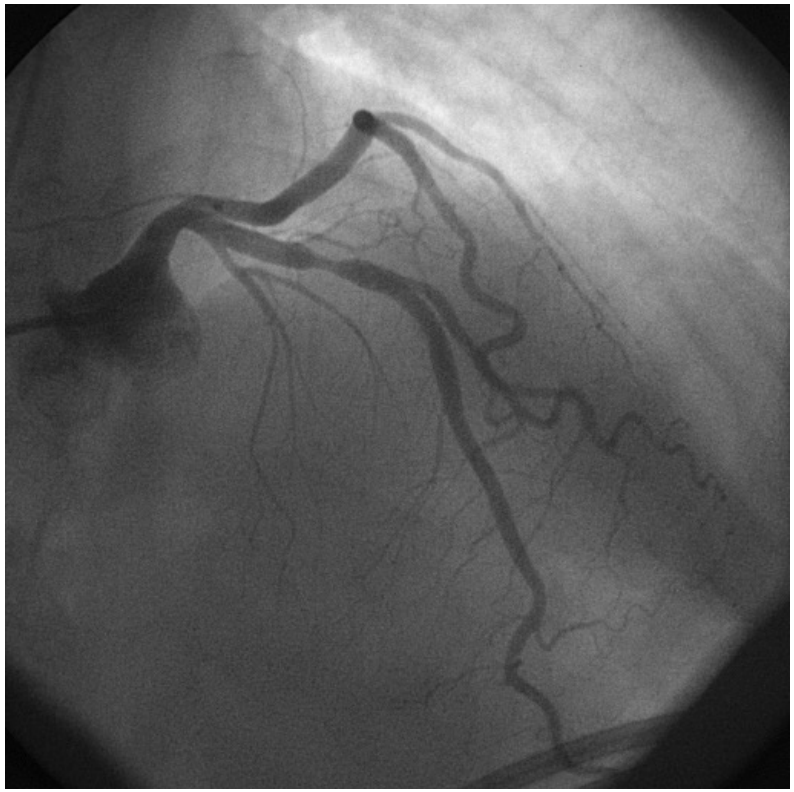


Réanimation post-Arrêt Cardiaque

- **Traitement étiologique**

  - angioplastie coronaire précoce

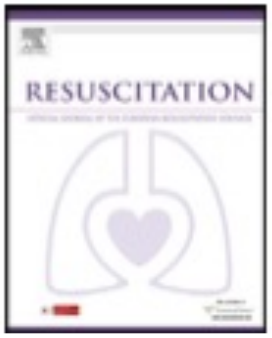
  -> aide à la restauration d'une fonction cardiaque efficace



Letter to the Editor

A new approach for treatment of refractory ventricular fibrillation allowed by extra corporeal life support (ECLS)?

Resuscitation 85 (2014) e118



- FV réfractaire sous ECLS en réanimation

-> Cardioplégie par injection de KCl IV => retour en rythme sinusal

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

« EVALUATION DE L'EFFICACITE DU CHLORURE DE POTASSIUM DANS LA PRISE EN CHARGE DES ARRETS CARDIAQUES EXTRA-HOSPITALIERS PAR FIBRILLATION VENTRICULAIRE REFRACTAIRE»

POTACREH

PROTOCOLE DE RECHERCHE INTERVENTIONNELLE IMPLIQUANT LA PERSONNE HUMAINE PORTANT SUR UN MEDICAMENT A USAGE HUMAIN

Version N°1.0 du 15/11/2019
Code projet : APHP180577 / N° EUDRACT: 2019-002544-24

Investigateur coordonnateur : Pr Benoît VIVIEN
Service d'Anesthésie - Réanimation - SAMU
Hôpital Necker – Enfants malades
Tél : 01 44 49 23 67
Courriel : benoit.vivien@aphp.fr

-> Début du protocole dès la fin de l'épidémie Covid …

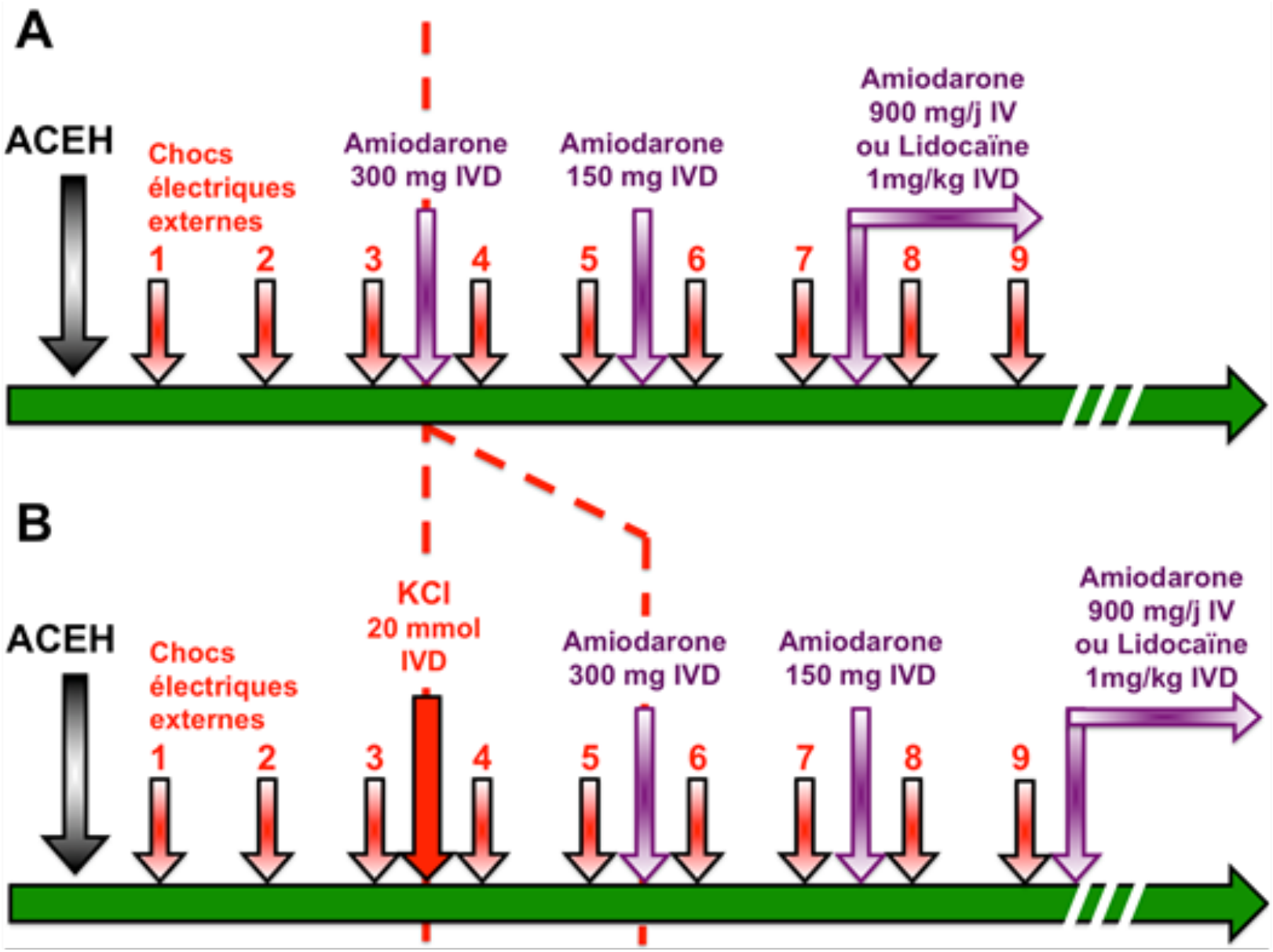


Figure 2 : Algorithme de prise en charge d'un patient en ACEH par FV selon les recommandations internationales (fig. 2A) et dans le cadre de la recherche (fig. 2B). Les injections d'adrénaline ne sont pas représentées sur la figure dans un souci de simplification.

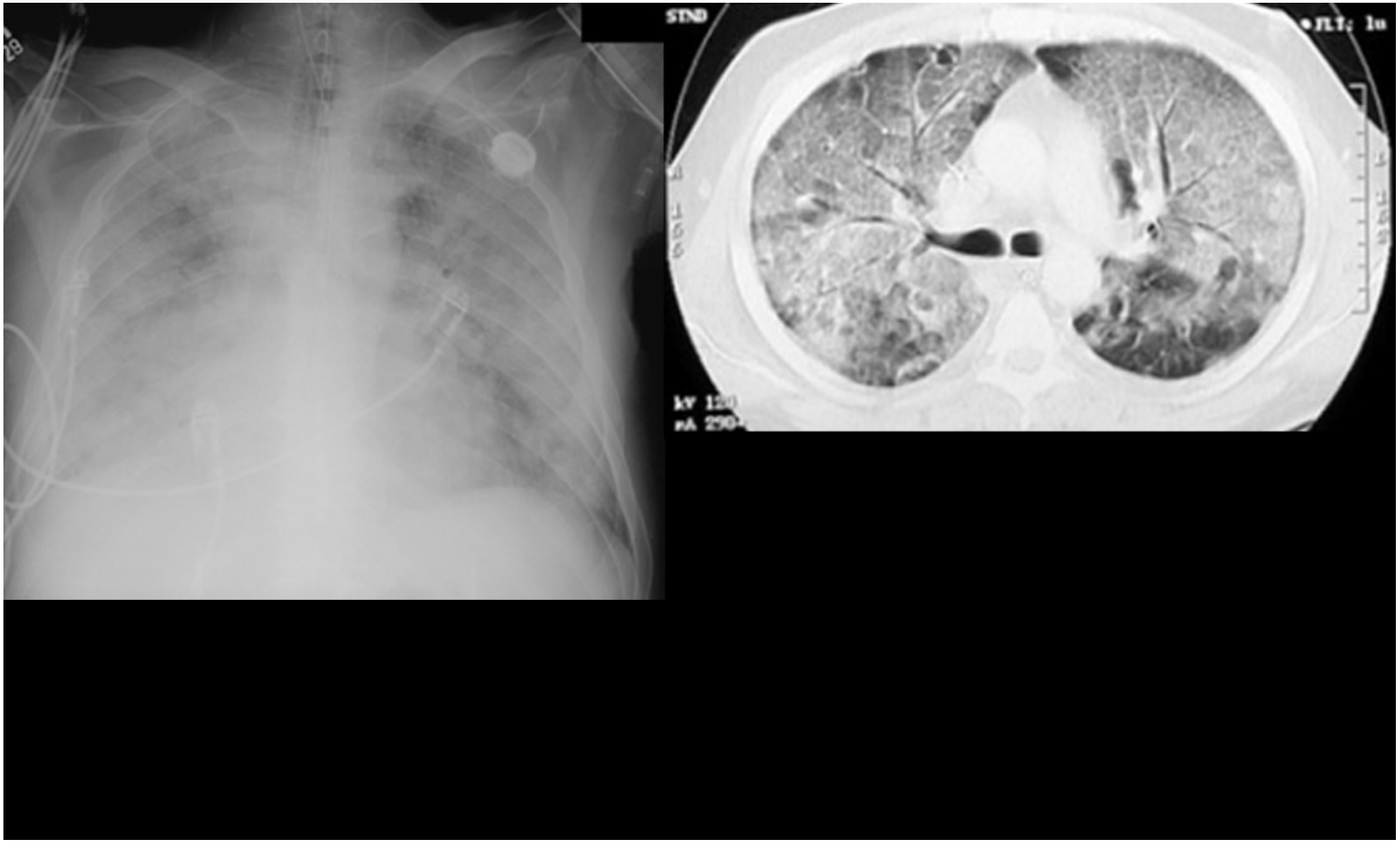
Le jeu en vaut-il la chandelle ?

Philippe MAURIAT
SAMU de Paris, 1992

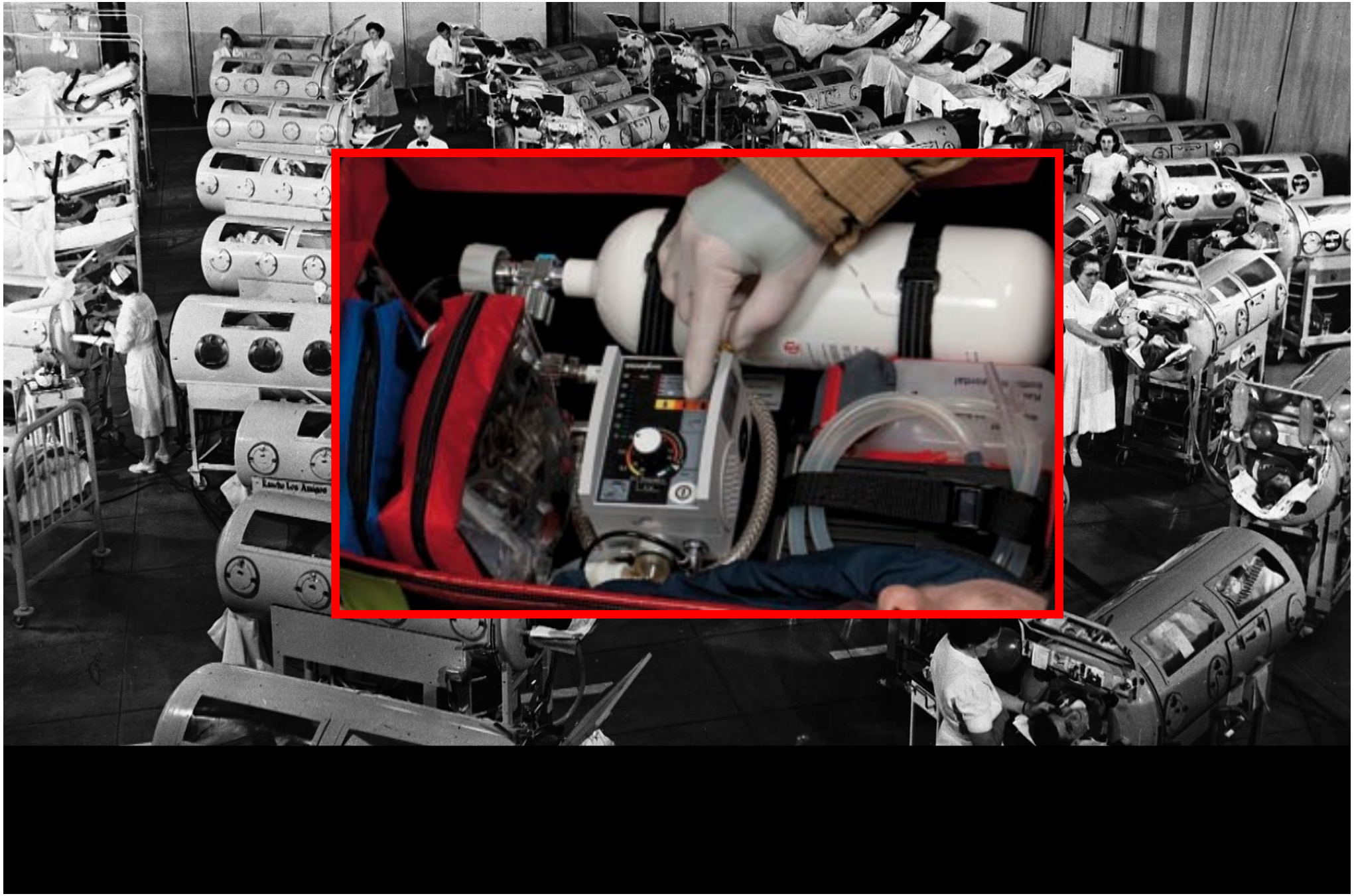
Le jeu en vaut-il la chandelle ?

SAMU de Paris, 2014

Qui remettrait en cause l'assistance ventilatoire en 2015 ?



Le chemin a été long …



Une évolution inéluctable …

FIGURE E1. Cardiopulmonary support cart.

Mais en restant raisonnable !

Conclusion

- **L'AC réfractaire n'est pas une fatalité**
- **Une analyse complète est indispensable**
  - étiologies réversibles curables
  - contexte de protection cérébrale
  - facteurs de bon pronostic

→ **Indication possible de l'ECLS ?**

- **Mais l'ECLS ne peut pas rattraper le temps perdu**

-> rôle fondamental de la chaîne de survie

-> anticipation pour réduire tous les délais de prise en charge

-> importance des traitements associés

-> rôle essentiel des filières de prise en charge

LES JEUDIS DE L'URGENCE

JEUDI 16 DÉCEMBRE 2021

L'ARRÊT CARDIAQUE :
DES DRONES AUX SUPPLÉANCES

Président : MC DERKENNE
Coordinateur : MP MARTINEZ-LORENZI (BMPM)

Merci
de votre attention