Massage Cardiaque Externe

Manuel vs Automatisé

Un combat gagné d'avance ?

HISTORIQUE

MCE

- 1960
- Kouwenhoven
- Compressions manuelles actives
- Décompressions passives

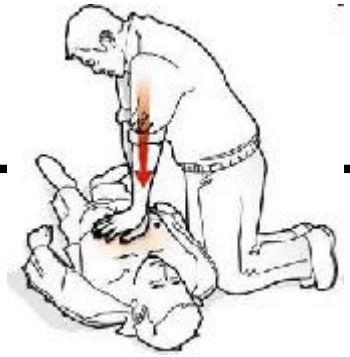


Fig 2.–Position of hands during massage of adult.

Kouwenhoven WB, Jude JR, Knickerbocker GG.
Closed-chest *cardiac massage*.
JAMA 1960 ; 173 : 1064-1067

STOUT HA.
Cardiac arrest: massage without incision.
J Okla State Med Assoc. 1957 ; 50 (3):112–114.

HISTORIQUE

MCE

- 1960
- Kouwenhoven
- Compressions manuelles actives
- Décompressions passives

Cardiopump

- 1992
- Décompressions passives

Les Etudes

Reported survival at 1 year was significantly greater among patients who underwent ACDC-CPR as compared to patients who received S-CPR (5% vs 2%, P =.03).

The rate of patients lacking neurologic impairment at the time of hospital discharge was significantly greater in the ACDC-CPR patients as opposed to the S-CPR patients

(6% vs 2%, P = .01).

n: 750

Plaisance P, Lurie KG, Vicaut E, et al.
A comparison of standard cardiopulmonary resuscitation and active compression-decompression resuscitation for out-of-hospital cardiac arrest. French Active Compression- Decompression Cardiopulmonary Resuscitation Study Group.
N Engl J Med 1999;341:569-75.

Les Etudes

The authors found no significant difference in the survival rates between the 2 groups: S-CPR (12%) vs ACDC-CPR (13%).

n : 302

Skogvoll E, Wik L.
Active compression-decompression cardiopulmonary resuscitation: a population-based, prospective randomised clinical trial in out-of-hospital cardiac arrest.
Resuscitation 1999;42:163-72.

HISTORIQUE

MCE automatisé

- Année 90-2000

Lund University Cardiopulmonary Assist System

Les Etudes

Of 100 patients studied, 31% had a stable ROSC and were subsequently admitted to the intensive care unit. Of the patients with witnessed cardiac arrest who received LUCAS-CPR within 15 min from the ambulance call (n = 43), 16% survived for 30 days with good neurologic outcome.

Steen S, Sjoberg T, Olsson P, et al.
Treatment of out-of-hospital cardiac arrest with LUCAS, a new device for automatic mechanical compression and active decompression resuscitation.
Resuscitation 2005;67:25-30.

Les Etudes

AutoPulse produces a CPP of ~ 21mm Hg compared to ~ 14 mm Hg produced by S-CPR and generates ~ 36% of normal coronary blood flow compared to ~ 13% generated in the S-CPR device.

Ong ME, Ornato JP, Edwards DP, et al.
Use of an automated, load distributing band chest compression device for out-of-hospital cardiac arrest resuscitation.
JAMA 2006;295:2629-37.

1er round : MCE ?

Délai mise en place ??

Tableau I : Résultats.

Patients	Âge (ans)	Sexe	conditions de mise en place	Délai de mise en place (sec)	Conditions d'utilisation	Pouls carotidien	Pouls fémoral	Doppler	RACS (min)	Durée d'utilisation
1	66	F	5	90	5	Non	Oui	NR	non	20
2	54	F	5	30	5	Non	Non	NR	non	30
3	71	F	5	60	5	Oui	Oui	Oui	Oui	30
4	58	M	5	60	5	Oui	Oui	Oui	non	20
5	71	M	4	120	4	Oui	Oui	NR	non	45
6	80	M	5	30	5	Oui	Oui	Oui	Oui	12
7	79	M	5	60	5	Oui	Oui	Oui	non	20
8	76	F	5	90	5	Oui	Non	NR	non	30
9	79	F	5	20	5	Non	Non	Non	non	9
10	20	M	4	60	5	Oui	Oui	NR	Oui	25
11	51	M	3	180	5	Oui	Oui	NR	Oui	20
Médiane (ET)	64 (±18)		5 (±0,5)	60 (± 31)	5 (±0,3)					20 (±10,4)

AGOSTINUCCI JM, DESMAIZIÈRES M, BERTRAND P, GRAVELO S, GARRIGUE B, LECLERCQ G, LAPOSTOLLE F
Etude de faisabilité et d'efficacité du massage cardiaque externe par le système de compression thoracique mécanique Autopulse™. résultats préliminaires
La Revue des SAMU - 2005 - 4

1er round : Arbitrage

Savoir mettre en place le dispositif

Equipes entrainées et habituées au matériel.
2 équipes distinctes : MCE / Autopulse ™

2nd round : MCE-A par fatigue

l'efficacité du MCE manuel se dégrade après la première minute de massage,

il est recommandé d'assurer une rotation toutes les 1 à 2 minutes afin de garder les bons critères de massage cardiaque (rapport compression-décompression, fréquence à 100 par minute).

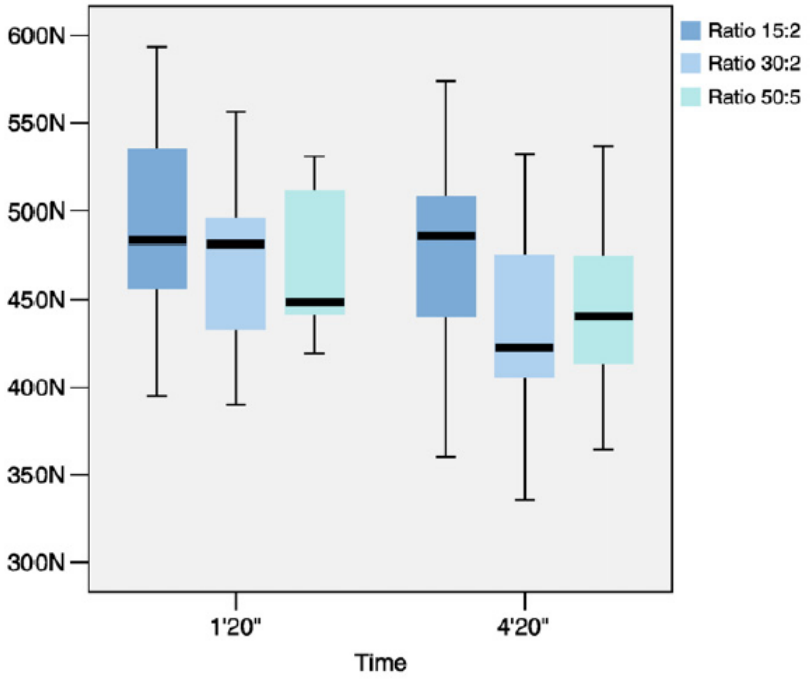


Fig. 1 Compression force delivered at 1 minute 20 seconds and at 4 minutes 20 seconds for C/V ratios of 15:2, 30:2, and 50:5 (in Newtons).

Chi CH, Tsou JY, Su FC.
Effects of compression-to-ventilation ratio on compression force and rescuer fatigue during cardiopulmonary resuscitation
Am J Emerg Med. 2010 Nov;28(9):1016-23

3ième round : MCE-A par pression

Meilleure perfusion coronaire

Meilleure hémodynamique

amélioration significative de la PA diastolique, systolique et moyenne observée sous AutoPulse™ comparée au MCE manuel dans l'AC prolongé

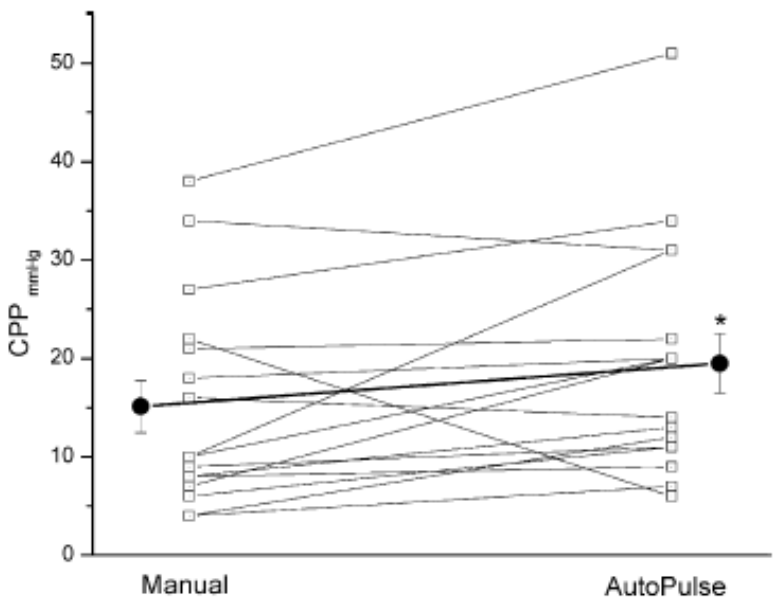


Fig. 4. Coronary perfusion pressure during manual and A-CPR. Each connected pair of squares are data from one patient. Symbols to the left and right of the pressures are means ± S.E. There is a significant increase in vascular pressures with A-CPR (* $P < 0.015$).

Timerman S, Cardoso LF, Ramires JA, Halperin H.
Improved hemodynamic performance with a novel chest compression device during treatment of in-hospital cardiac arrest
Resuscitation 2004;61:273-280.

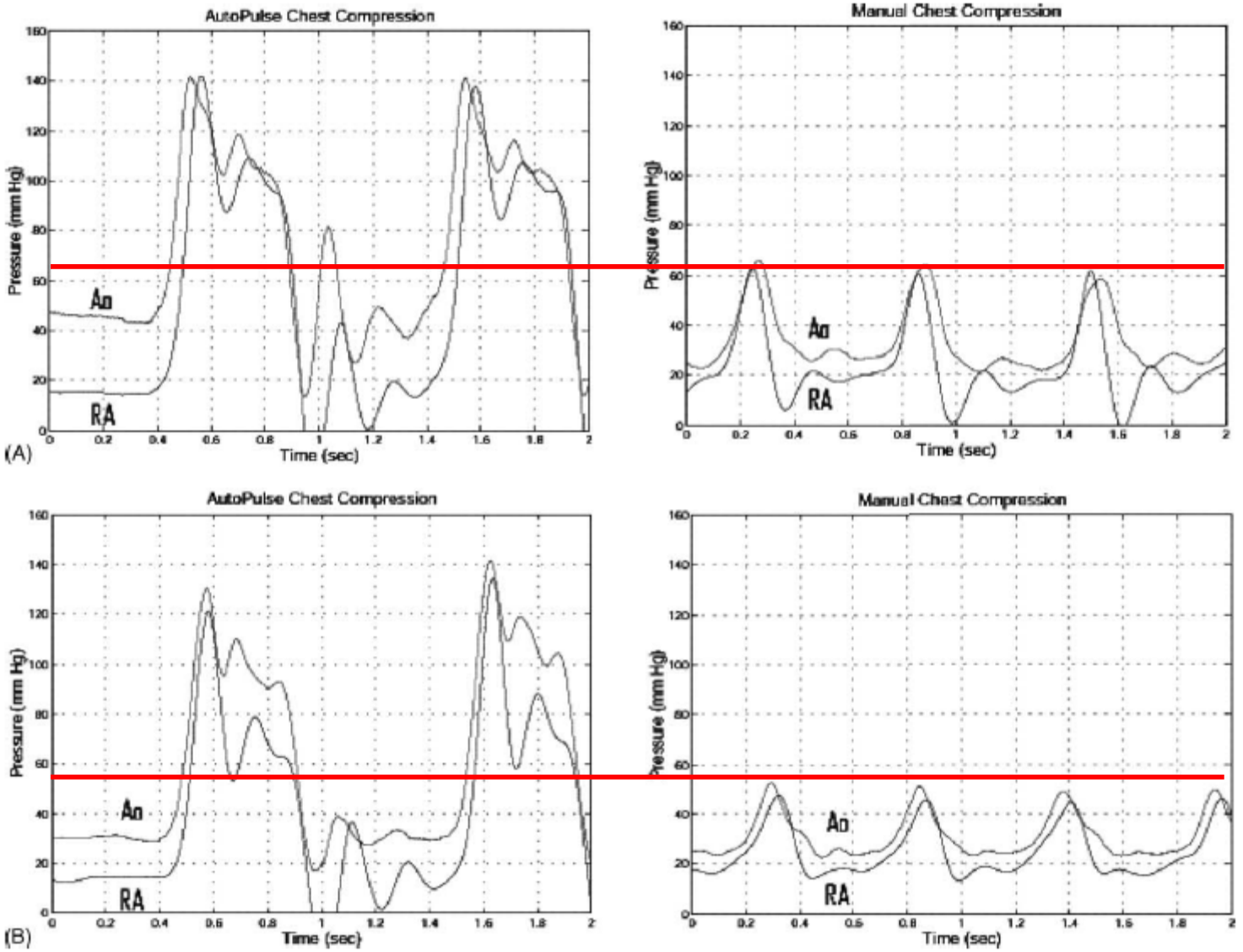
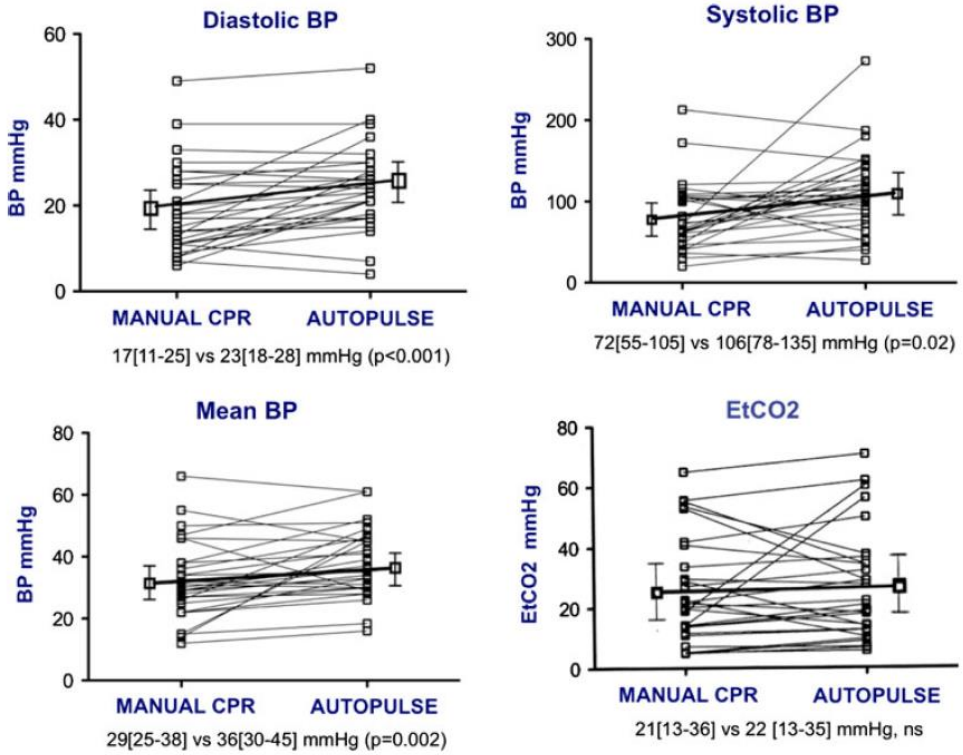


Fig. 2. Phasic vascular pressure traces during manual and A-CPR in two patients (A, B) reproduced from digital recordings. Record A shows one of the largest changes observed in aortic pressure and the diastolic aortic and right atrial pressure difference (coronary perfusion pressure) produced by A-CPR when compared to manual CPR. Record B shows a patient where the diastolic aortic and right atrium differences are near the mean values observed in this study.

3ième round : MCE-A par pression



Duchateau F.-X., Gueye P., Curac S., Tubach F., Broche C., Plaisance P., Payen D., Mantz J., Ricard-Hibon A.

Effect of the AutoPulse automated band chest compression device on hemodynamics in out-of-hospital cardiac arrest resuscitation.

Intensive Care Med 2010; 36, 7 : 1256-60

4ième round : MCE pour les indications

Situations nécessitant une prolongation de la durée du massage cardiaque externe telles que :

- intoxication médicamenteuse,
- hypothermie,
- Thrombolyse de sauvetage.

- troubles métaboliques,
- patient victime d'un arrêt cardiaque sous AG, en salle de coro..

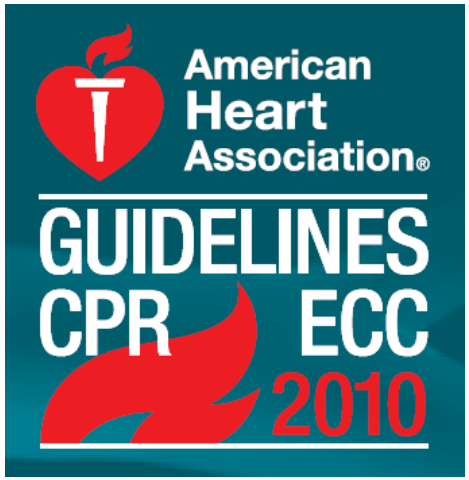
European Resuscitation Council Guidelines for Resuscitation 2010

Et le transport de certains patients …….

5ième round : MCE

- ENCOMBREMENT
- POIDS
- AUTONOMIE
- NE CONCERNE QUE L'ADULTE

- **<u>Pas de recommandations officielles</u>**



6ième round : MCE par complications ??

Etude Tchèque : 30 patients: A-CPR 8, L-CPR 11, and M-CPR 11

Use of mechanical chest compression devices was associated with increased incidence of injuries compared to manual CPR but surprisingly also with a trend to worse survival.

- Injuries were observed in 7/8 (87.5%) in A-CPR, 8/11 (72.7%) in L-CPR, and 3/11 (27.3%) in M-CPR group (P = 0.02).
- Sternal fractures were present in 3/8, 4/11, and 1/11 (P = 0.33), multiple rib fractures (≥3) in 4/8, 6/11, and 2/11 (P = 0.25), and mediastinal haematomas in 5/8, 2/11, and 0/11 patients (P = 0.003). Pericardial effusions (2 pts) and adventitial aortic haematomas (4 pts) were observed in A-CPR group only (P = 0.06 and 0.002).

Truhlar A, Hejna P, Zabka L, Zatopkova L, Cerny V.
Injuries caused by the autopulse and LUCAS II resuscitation systems compared to manual chest compressions
Abstracts / Resuscitation 81S (2010) S1–S114

6ième round : MCE par complications ??

Etude Irlandaise : 40 patients in the LUCAS CPR group and 39 in the manual CPR group.

We did not identify a significant variation in trauma with the use of the LUCAS compared to manual CPR. We do not believe that use of this device should be withheld on the basis of trauma related to CPR..

- Rib fractures were present in 13/40 in the LUCAS CPR group and 19/39 in the manual
- Sternal fractures were present in 9/40 in theLUCAS CPRgroup and 16/39 in the manual
- CPR group. Pearson's Chi-Square Test, P = 0.144.
- Mean number of rib fractures in the LUCAS CPR group was 1.84 and in the manual CPR group was 3.21.

This difference was not significant on the Mann–Whitney U-test (P = 0.096)

Menzies D, Barton D, Nolan N.
Does the LUCAS device result in increased injury during CPR?
Abstracts / Resuscitation 81S (2010) AS076

6ième round : MCE par complications ??

France : 4868 OHCA patients (January 2005 to April 2010)

285 patients (6%) (212 males [74%], 73 females [26%]; median age, 56 [43-70] years).
Results

- time to apply device, 30 seconds (20-60); ease of application and activation, 5 (4-5) and 5 (5-5), respectively;
- duration of use, 30 (20-41) minutes;
- return to spontaneous circulation (ROSC), 76 patients (27%); and time to ROSC, 19 (12-32) minutes after placement.

Lapostolle F. and all.
Out-of-hospital use of an automated chest compression device: facilitating access to extracorporeal life support or non–heart-beating organ procurement
American Journal of Emergency Medicine (2010) in press

6ième round : MCE par complications ??

Table 3 Technical incidents and clinical complications associated with device use

Technical incidents		n	Clinical complications	n
Board	Placed upside down	2	Skin erosion	4
Battery	Became loose	2	Chest/abdominal wall hematoma	5
	Charge fault	3	Hemoptysis	5
Strap	Clothes caught in strap	1	Subcutaneous emphysema	1
	Too short, set off alarm	1	Hemothorax [a]	1
	Jammed	5	Hematemesis	2
	Faulty catch	2	Pneumomediastinum [a]	1
Function	Board stopped (no error message)	1		
	Error message	1		
Other		3		
	Total, n (%)	21 (7)	Total, n (%)	19 (7)

[a] Diagnosed on arrival at hospital.

Lapostolle F. and all.
Out-of-hospital use of an automated chest compression device: facilitating access to extracorporeal life support or non–heart-beating organ procurement
American Journal of Emergency Medicine (2010) in press

L’arbitrage

Circulation Improving Resuscitation Care (CIRC)

Effectifs estimés: 5000

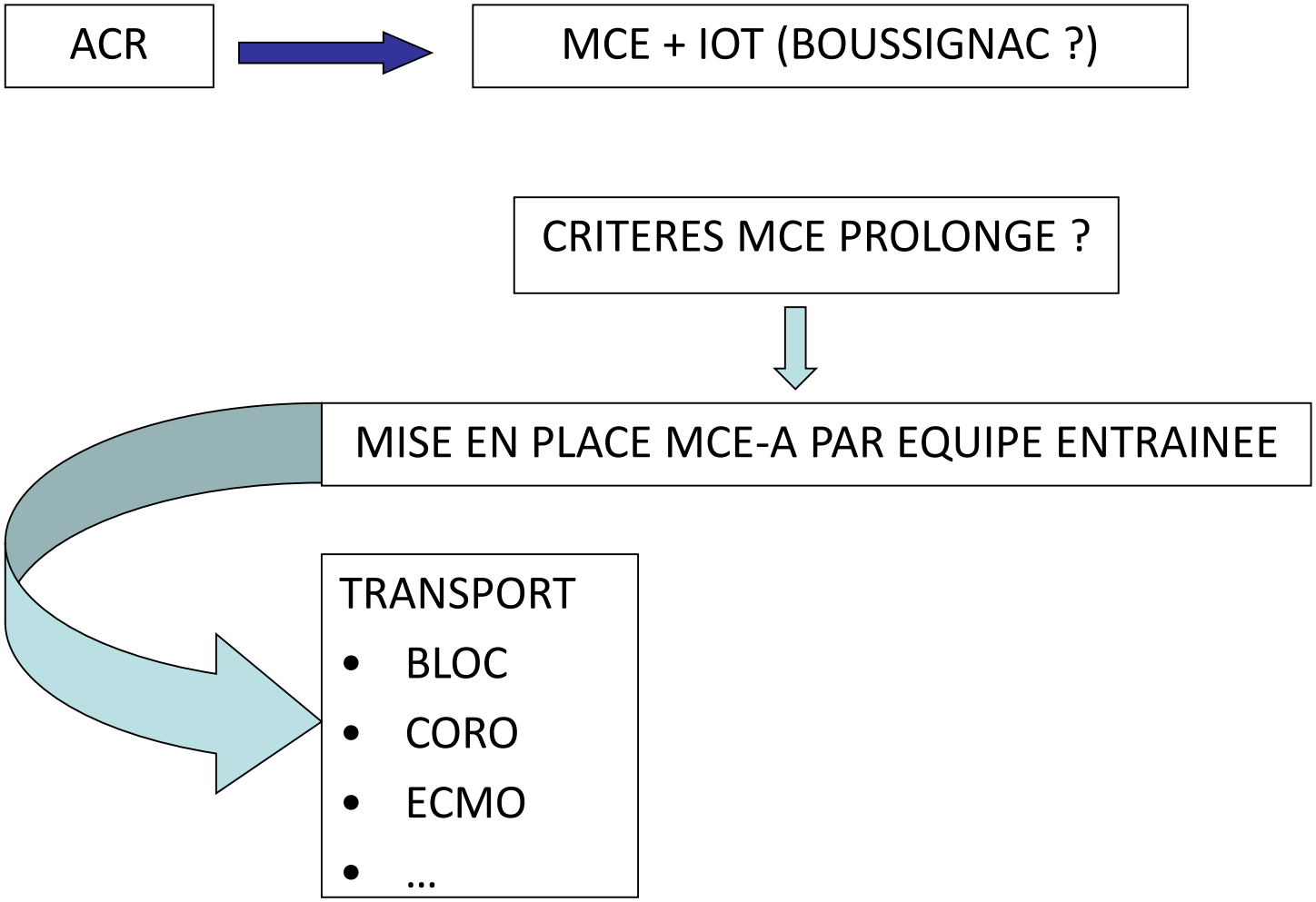
Date de début de l'étude: January 2008

Date d'achèvement prévue étude: November 2012

A Randomized Controlled Study Comparing Autopulse To Manual CPR In A CPR-First Protocol For Out-Of-Hospital Cardiac Arrest (OHCA)

ClinicalTrials.gov
A service of the U.S. National Institutes of Health

Algorithme MCE MCE-A



Ne pas oublier l'essentiel !!

Figure 1
AHA ECC Adult Chain of Survival

The links in the new AHA ECC Adult Chain of Survival are as follows:

1. Immediate **recognition** of cardiac arrest and **activation** of the emergency response system
2. Early **CPR** with an emphasis on chest compressions
3. Rapid **defibrillation**
4. Effective **advanced life support**
5. Integrated **post–cardiac arrest care**

Ne pas oublier l'essentiel !!

Figure 2
Simplified Adult BLS Algorithm

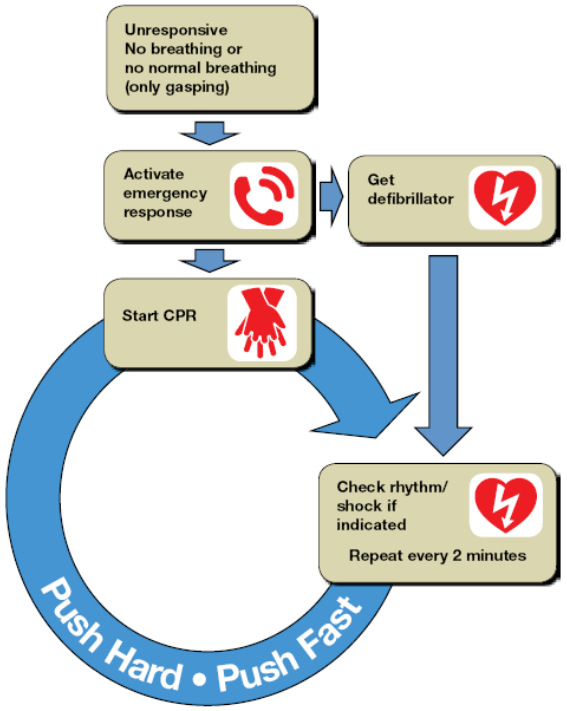
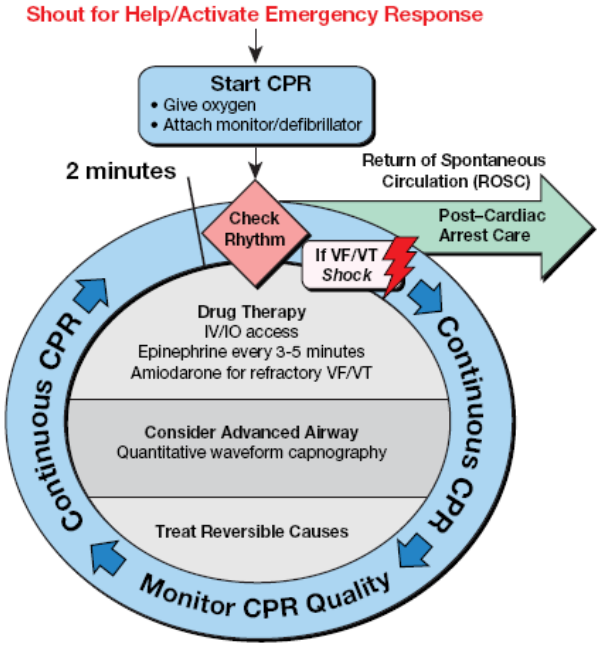


Figure 4
Circular ACLS Algorithm



CPR Quality
- Push hard (≥2 inches [5 cm]) and fast (≥100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
  - If P_{ETCO_2} <10 mm Hg, attempt to improve CPR quality
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality

Return of Spontaneous Circulation (ROSC)
- Pulse and blood pressure
- Abrupt sustained increase in P_{ETCO_2} (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Shock Energy
- **Biphasic:** Manufacturer recommendation (120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- **Monophasic:** 360 J

Drug Therapy
- **Epinephrine IV/IO Dose:** 1 mg every 3-5 minutes
- **Vasopressin IV/IO Dose:** 40 units can replace first or second dose of epinephrine
- **Amiodarone IV/IO Dose:** First dose: 300 mg bolus. Second dose: 150 mg.

Advanced Airway
- Supraglottic advanced airway or endotracheal intubation
- Waveform capnography to confirm and monitor ET tube placement
- 8-10 breaths per minute with continuous chest compressions

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

Un seul vainqueur

le patient