ARRÊT CARDIORESPIRATOIRE
MASSAGE CARDIAQUE EXTERNE

Dr Ayed Samia

Collège de Réanimation Médicale
28 Mars 2014

- Mort subite: 30000 à 50000 victimes annuelles
- Fibrillation ventriculaire (FV): 90% des AC d'origine médicale.
- Survie faible: 5 à 30%
- Mise en place rapide de la chaîne de survie: seul garant d'un meilleur pronostic.
- Importance de l'hémodynamique au cours de la réanimation cardiopulmonaire: massage cardiaque externe

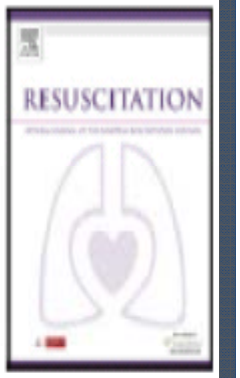
RECOMMANDATIONS RCP 2010

Resuscitation 81 (2010) 1219–1276

Contents lists available at ScienceDirect

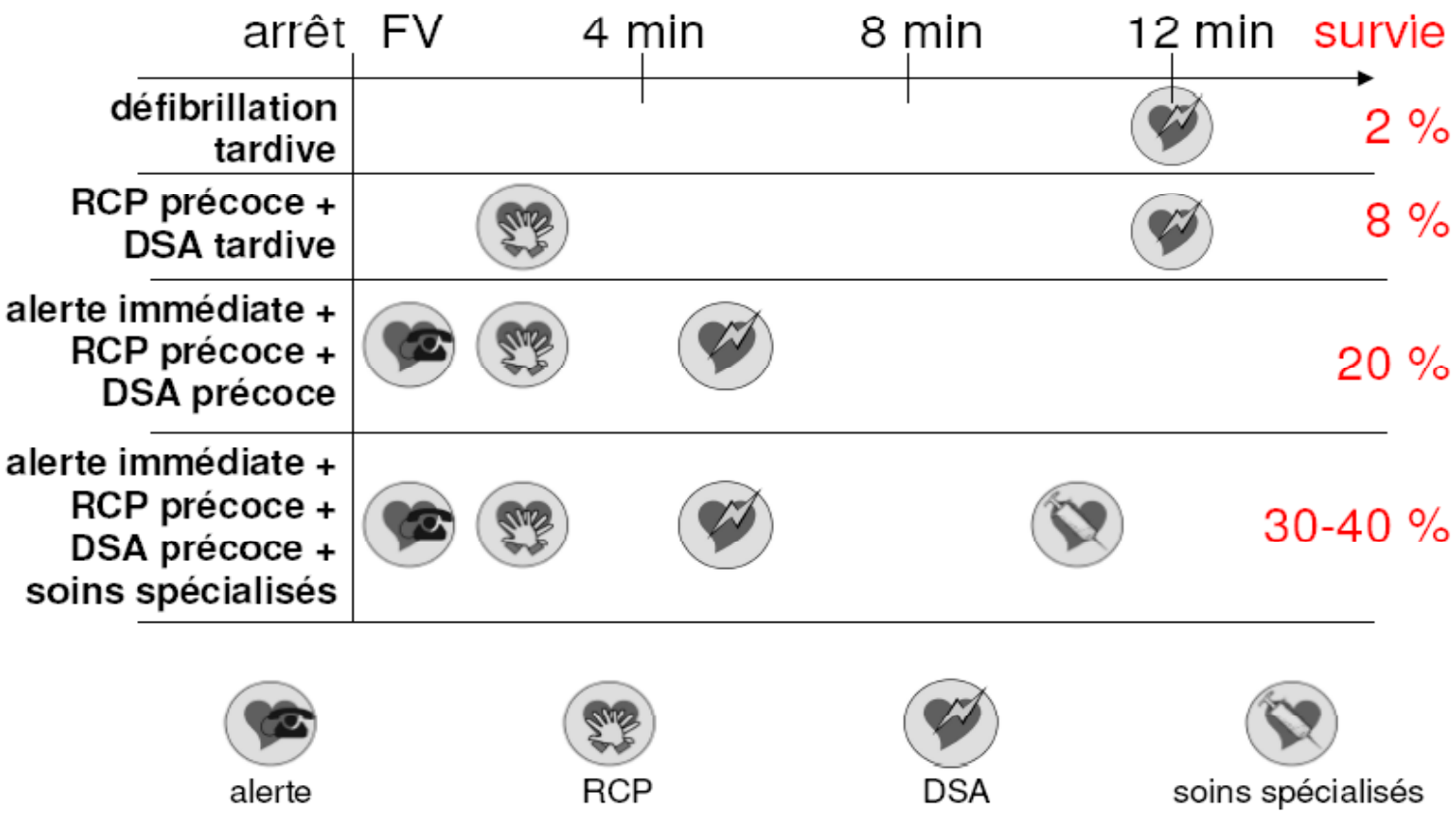
Resuscitation

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

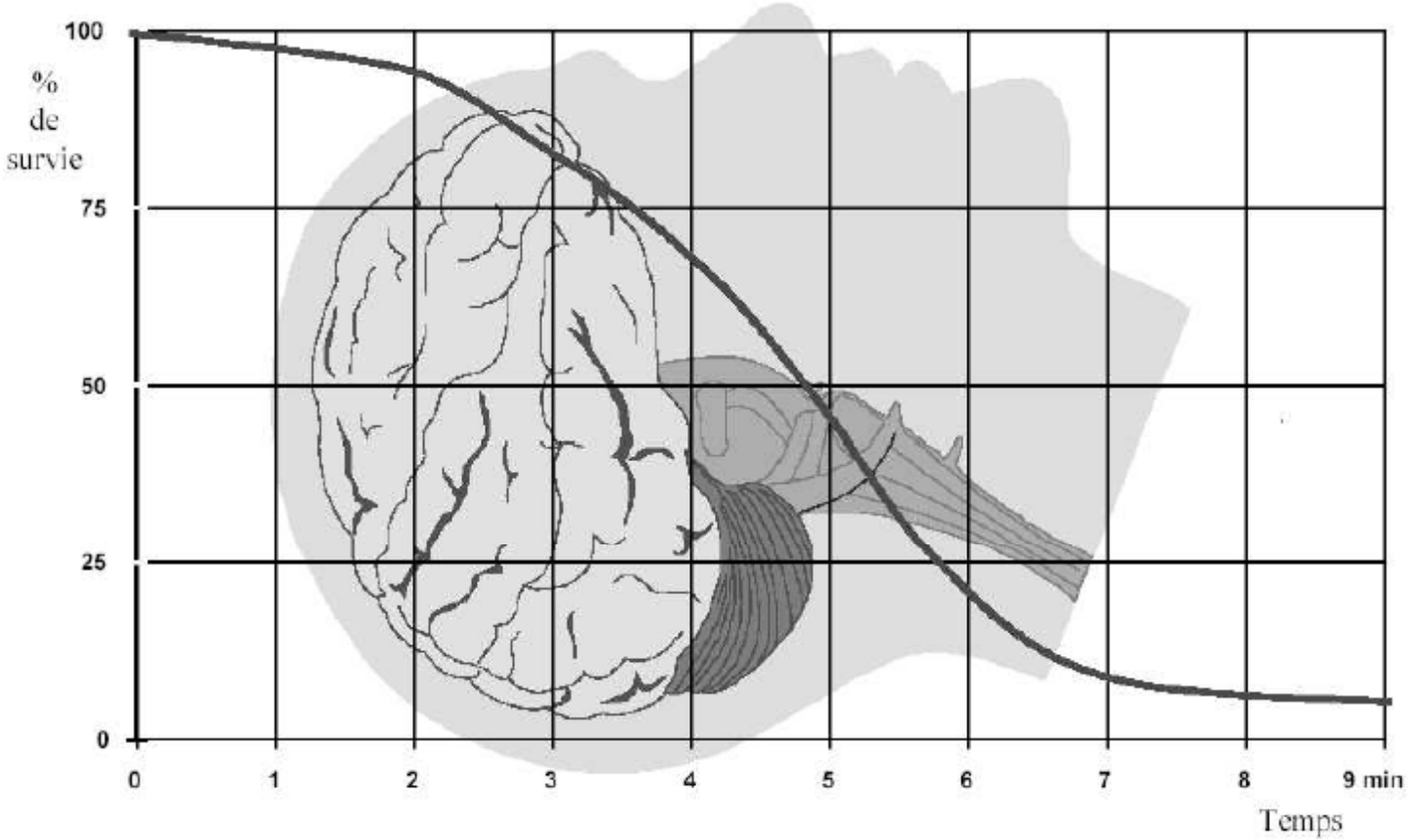


- Alerte - « Chaîne de Survie »
- RCP de base
- Défibrillation
- RCP spécialisée
- Suites de la RCP

Efficacité de la chaîne de survie



Conséquences de l'arrêt cardio-ventilatoire



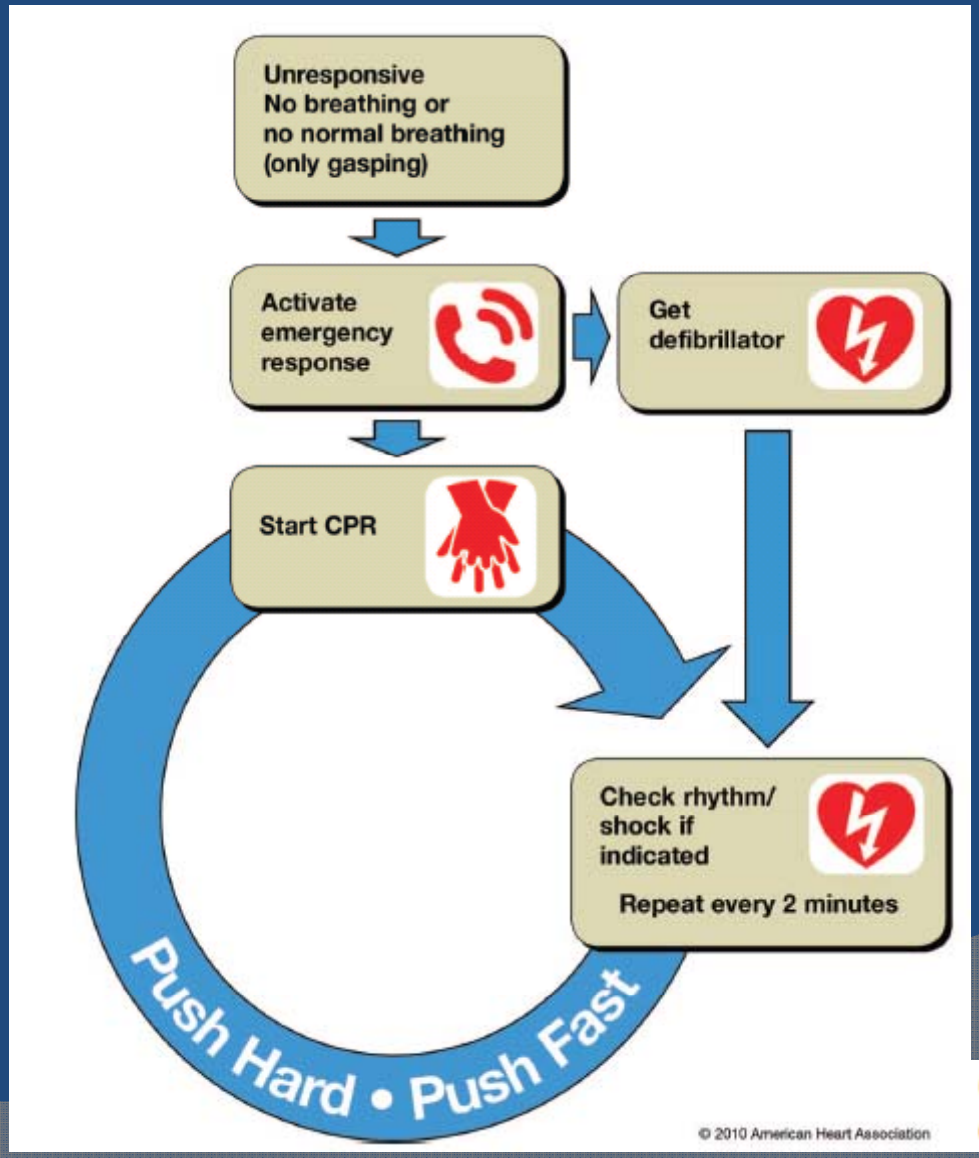
Reconnaissance / Diagnostic de l'AC:

= absence de « signes de vie »

- Conscience - Réactivité = 0
- Respiration absente ou anormale: « gasps » +++
- [+/- pouls = 0]

Part 5: Adult Basic Life Support

2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care



(*Circulation*. 2010;122[suppl 3]:S685–S705.)

OPTIMISATION DU MCE

- **Fréquence: 100/min**
- **Compression : 4 – 5 cm**
- Pas de balancement du tronc
- Main toujours en place
- Durée compression = relâchement
- **30 compressions / 2 insufflations**

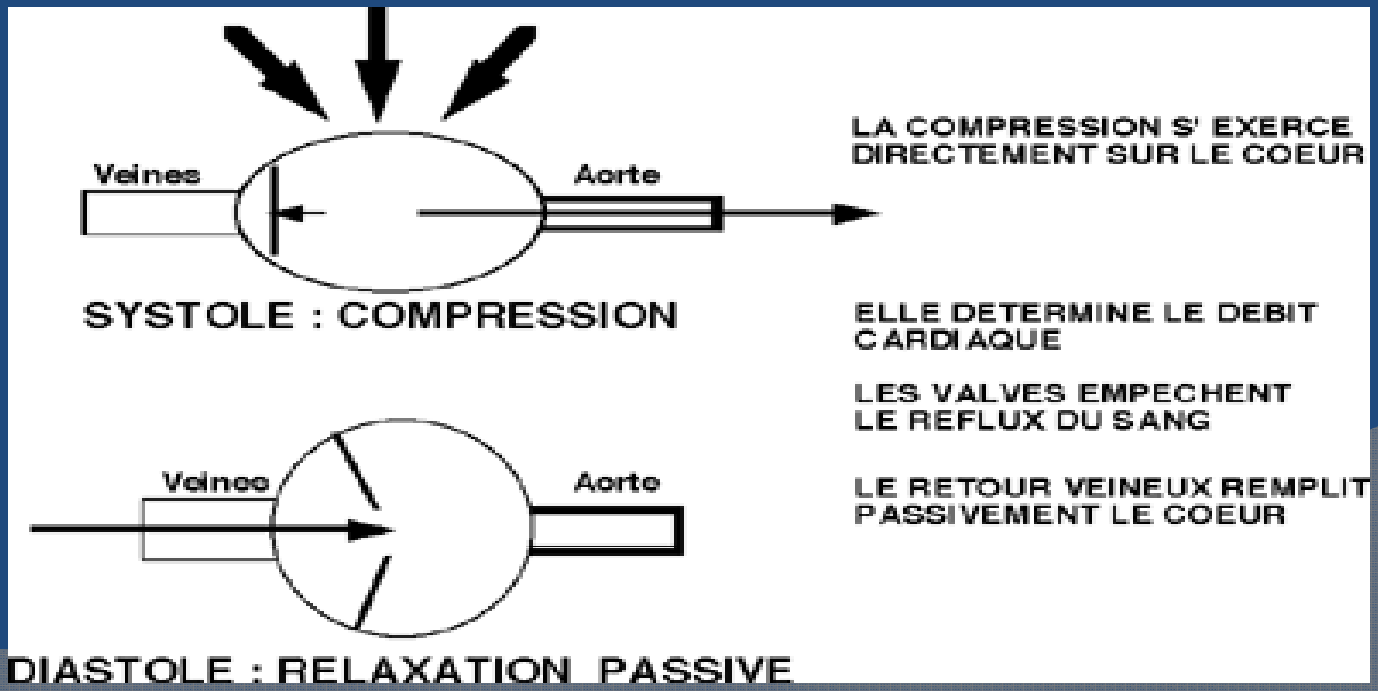
DEBIT SANGUIN SOUS MCE:

- Circulation générale: **30 à 40%** du DC normal
- Circulation coronaire: **5%** du DC normal
- Circulation cérébrale: **2%** du DC normal

Théorie de la pompe cardiaque

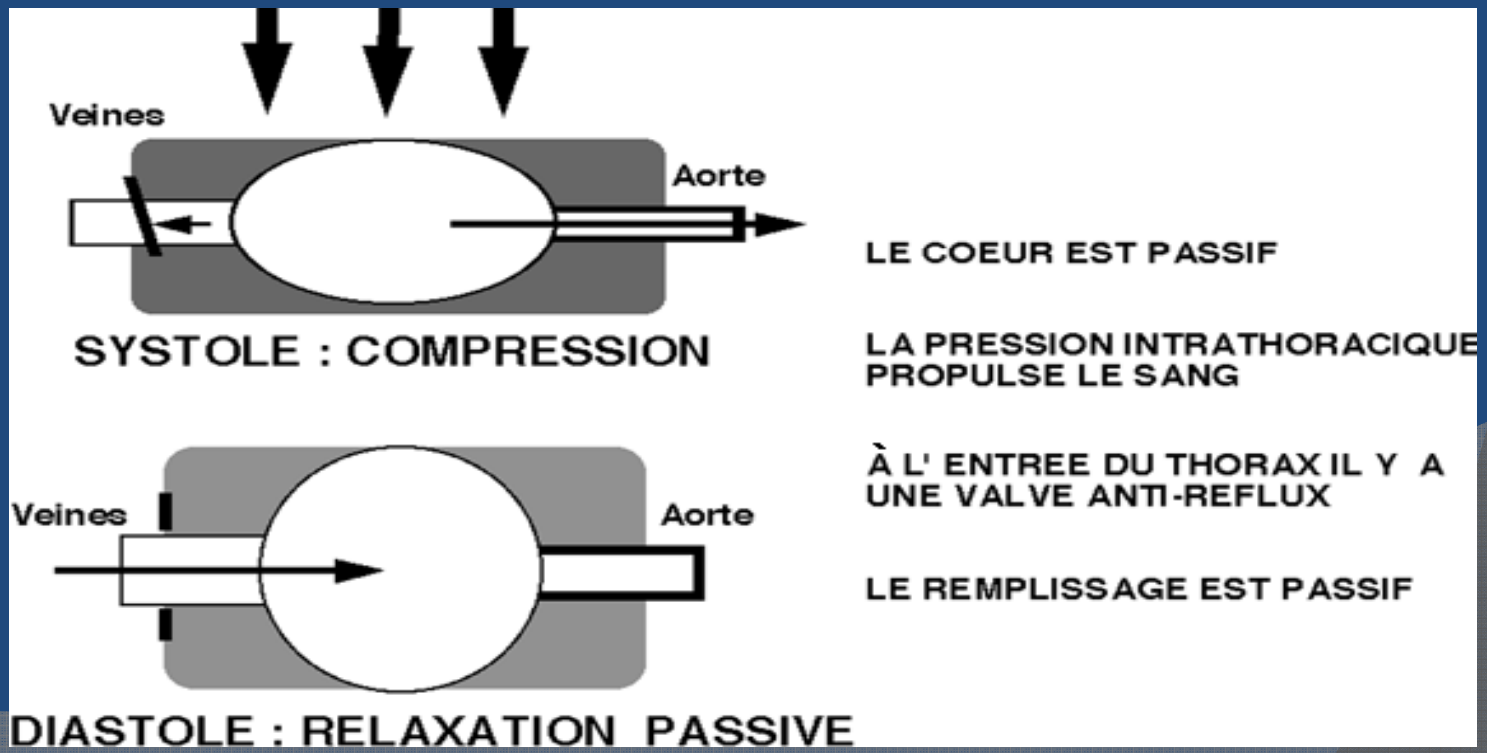
Compression directe du cœur entre le rachis en arrière et le sternum en avant: éjection du sang (les valves cardiaques, en particulier la valve mitrale, jouent le même rôle qu'au cours d'une systole normale, en se fermant lors de la compression du cœur)

Direction du sang vers l'aorte pour le ventricule gauche et vers les artères pulmonaires pour le ventricule droit.



Théorie de la pompe thoracique

Compression du thorax: l'ensemble du volume cardio-pulmonaire, comprenant le cœur et les gros vaisseaux constitue le réservoir sanguin.
Augmentation de la pression intrathoracique: augmentation du retour veineux



MCE SEUL / RCP CONVENTIONNELLE

Articles

Cardiopulmonary resuscitation by bystanders with chest compression only (SOS-KANTO): an observational study

SOS-KANTO study group

Lancet 2007; 369: 920–26

See Comment page 881

*Members listed at end of paper

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Summary

Background Mouth-to-mouth ventilation is a barrier to bystanders doing cardiopulmonary resuscitation (CPR), but few clinical studies have investigated the efficacy of bystander resuscitation by chest compressions without mouth-to-mouth ventilation (cardiac-only resuscitation).

Methods We did a prospective, multicentre, observational study of patients who had out-of-hospital cardiac arrest. On arrival at the scene, paramedics assessed the technique of bystander resuscitation. The primary endpoint was favourable neurological outcome 30 days after cardiac arrest.

Findings 4068 adult patients who had out-of-hospital cardiac arrest witnessed by bystanders were included; 439 (11%) received cardiac-only resuscitation from bystanders, 712 (18%) conventional CPR, and 2917 (72%) received no bystander CPR. Any resuscitation attempt was associated with a higher proportion having favourable neurological outcomes than no resuscitation (5·0% *vs* 2·2%, p<0·0001). Cardiac-only resuscitation resulted in a higher proportion of patients with favourable neurological outcomes than conventional CPR in patients with apnoea (6·2% *vs* 3·1%; p=0·0195), with shockable rhythm (19·4% *vs* 11·2%, p=0·041), and with resuscitation that started within 4 min of arrest (10·1% *vs* 5·1%, p=0·0221). However, there was no evidence for any benefit from the addition of mouth-to-mouth ventilation in any subgroup. The adjusted odds ratio for a favourable neurological outcome after cardiac-only resuscitation was 2·2 (95% CI 1·2–4·2) in patients who received any resuscitation from bystanders.

Interpretation Cardiac-only resuscitation by bystanders is the preferable approach to resuscitation for adult patients with witnessed out-of-hospital cardiac arrest, especially those with apnoea, shockable rhythm, or short periods of untreated arrest.

PRONOSTIC NEUROLOGIQUE A J30:
MCE SEUL 6,2% VS RCP CONVENTIONNELLE 3,1% (p=0,01)

Chest Compression–Only CPR by Lay Rescuers and Survival From Out-of-Hospital Cardiac Arrest

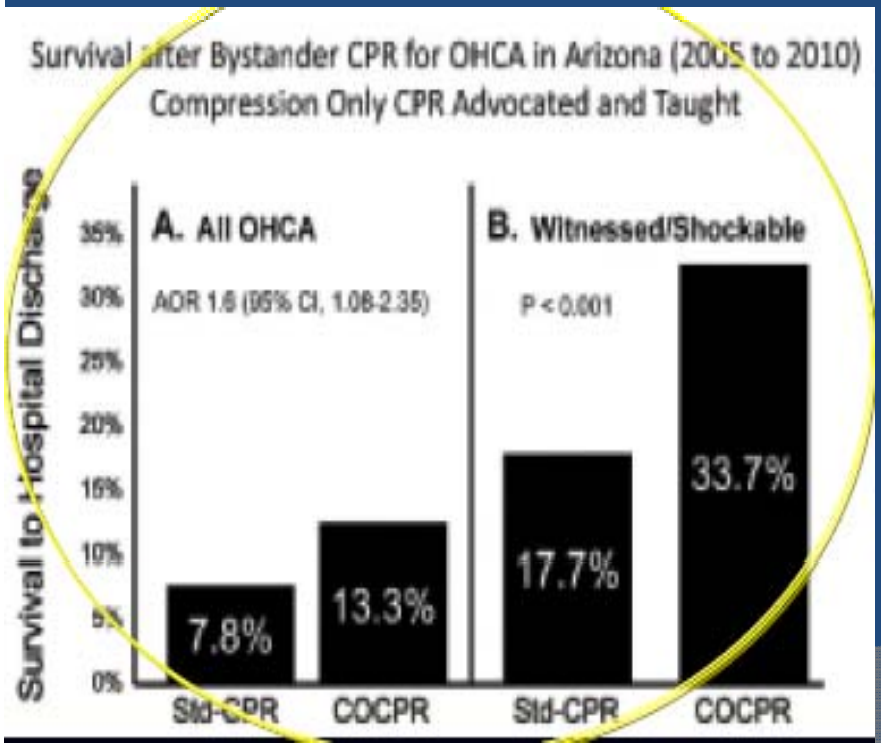
Bentley J. Bobrow, MD
Daniel W. Spaite, MD
Robert A. Berg, MD
Uwe Stolz, PhD, MPH
Arthur B. Sanders, MD
Karl B. Kern, MD
Tyler F. Vadeboncoeur, MD
Lani L. Clark, BS

Context Chest compression–only bystander cardiopulmonary resuscitation (CPR) may be as effective as conventional CPR with rescue breathing for out-of-hospital cardiac arrest.

Objective To investigate the survival of patients with out-of-hospital cardiac arrest using compression-only CPR (COCPR) compared with conventional CPR.

Design, Setting, and Patients A 5-year prospective observational cohort study of survival in patients at least 18 years old with out-of-hospital cardiac arrest between January 1, 2005, and December 31, 2009, in Arizona. The relationship between layperson bystander CPR and survival to hospital discharge was evaluated using multivariable logistic regression.

Main Outcome Measure Survival to hospital discharge.



MCE seul 2005: 19,6% VS 2009: 75,9% (p<0,001)
Survie 2005: 3,7% VS 2009: 9,8% (p<0,001)

Conclusion Among patients with out-of-hospital cardiac arrest, layperson compression-only CPR was associated with increased survival compared with conventional CPR and no bystander CPR in this setting with public endorsement of chest compression–only CPR.

JAMA. 2010;304(13):1447-1454 www.jama.com

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Compression-Only CPR or Standard CPR in Out-of-Hospital Cardiac Arrest

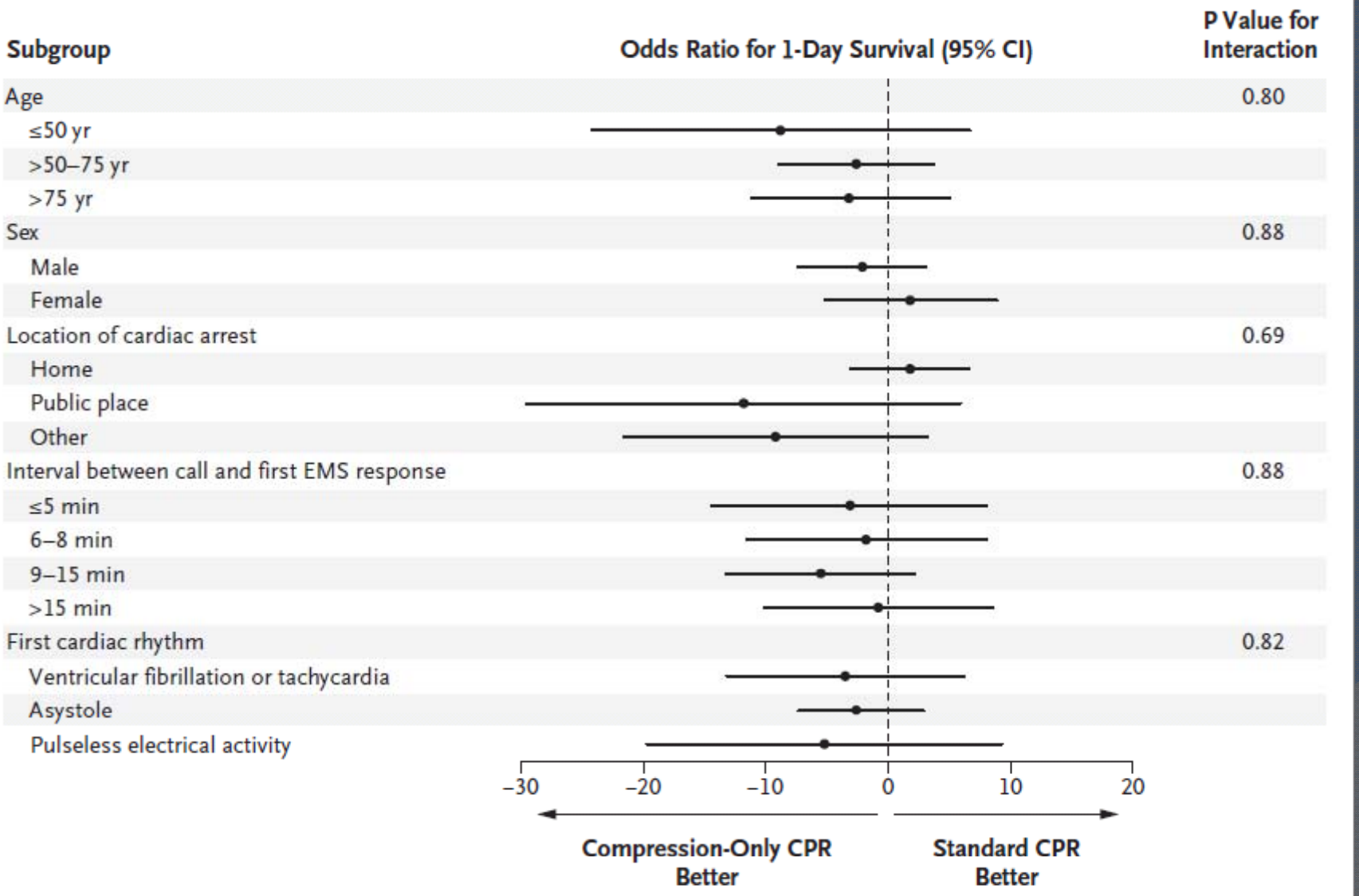
Leif Svensson, M.D., Ph.D., Katarina Bohm, R.N., Ph.D.,
Maaret Castrèn, M.D., Ph.D., Hans Pettersson, Ph.D., Lars Engerström, M.D.,
Johan Herlitz, M.D., Ph.D., and Mårten Rosenqvist, M.D., Ph.D.

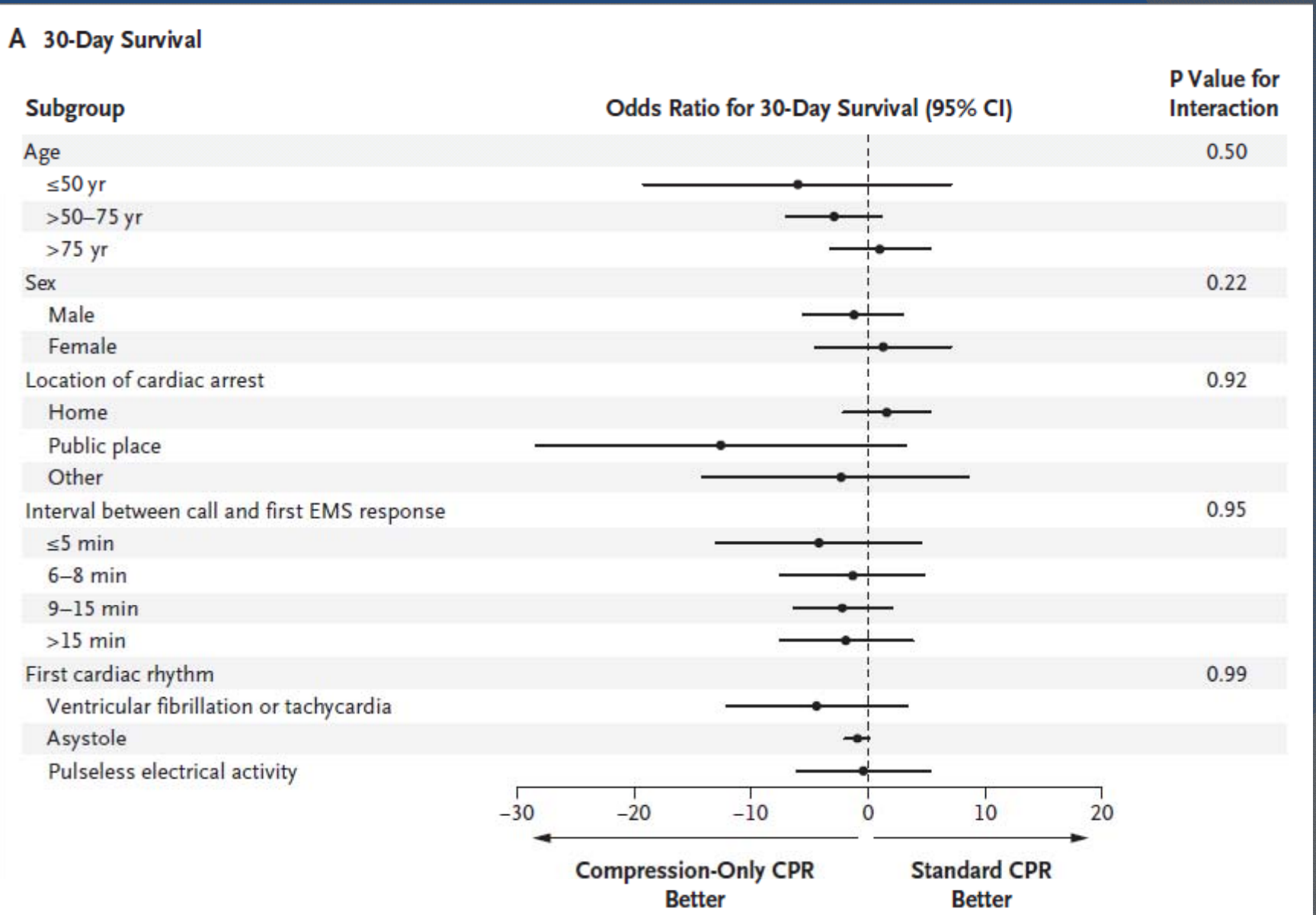
N Engl J Med 2010;363:434-42.

CONCLUSIONS

This prospective, randomized study showed no significant difference with respect to survival at 30 days between instructions given by an emergency medical dispatcher, before the arrival of EMS personnel, for compression-only CPR and instructions for standard CPR in patients with suspected, witnessed, out-of-hospital cardiac arrest. (Funded by the Swedish Heart–Lung Foundation and others; Karolinska Clinical Trial Registration number, CT20080012.)

B 1-Day Survival




A 30-Day Survival
Subgroup
Odds Ratio for 30-Day Survival (95% CI)
P Value for Interaction
Age
0.50
≤50 yr
>50–75 yr
>75 yr
Sex
0.22
Male
Female
Location of cardiac arrest
0.92
Home
Public place
Other
Interval between call and first EMS response
0.95
≤5 min
6–8 min
9–15 min
>15 min
First cardiac rhythm
0.99
Ventricular fibrillation or tachycardia
Asystole
Pulseless electrical activity
−30
−20
−10
0
10
20
Compression-Only CPR Better
Standard CPR Better

BMJ

RESEARCH

Outcomes of chest compression only CPR versus conventional CPR conducted by lay people in patients with out of hospital cardiopulmonary arrest witnessed by bystanders: nationwide population based observational study

Toshio Ogawa, assistant professor,[1] Manabu Akahane, lecturer,[1] Soichi Koike, associate professor,[2] Seizan Tanabe, professor,[3] Tatsuhiro Mizoguchi, specialist for ambulance service,[4] Tomoaki Imamura, professor[1]

T Ogawa et al. BMJ 2011; 342: c7106

Table 2 | One month survival and neurologically favourable one month survival in cases of out of hospital cardiopulmonary arrest witnessed by bystander with chest compression only CPR and conventional CPR. Figures are percentages (numbers of participants)

	Chest compression only CPR	Conventional CPR	Odds ratio (95% CI), P value	
			Unadjusted	Adjusted*
One month survival	8.7 (1799/20 707)	10.3 (1997/19 327)	1.21 (1.13 to 1.29), <0.001	1.17 (1.06 to 1.29), 0.002
Neurologically favourable one month survival	4.6 (943/20 662)	5.6 (1070/19 247)	1.23 (1.12 to 1.35), <0.001	1.17 (1.01 to 1.35), 0.037

*Adjusted for age, sex, assistance from dispatcher, initial identified cardiac rhythm, cause of cardiac arrest, relation of bystander to patient, use of public access automated external defibrillator, first shock from emergency medical staff, use of drug during CPR, and duration between bystander witnessing event to bystander starting CPR, to CPR by emergency medical staff, and to patient's arrival at hospital.

RCP DE BASE

- Principe fondamental:

  MASSAGE CARDIAQUE EXTERNE

  - Continuité du MCE: diminution des interruptions
  - Réduction de la ventilation
  - Prise de pouls différée

> The lay rescuer should not check for a pulse and should assume that cardiac arrest is present if an adult suddenly collapses or an unresponsive victim is not breathing normally.

CIRCULATION 2010

MASSAGE CARDIAQUE EXTERNE AUTOMATISE

- Deux systèmes
  - LUCAS ™ (Lund University Cardiopulmonary Assist System)

  - AUTOPULSE ™

LUCAS™

- Dérivé de la Cardiopump™
- Principe: ventouse appliquée sur le sternum permettant une décompression active: négativation de la pression intrathoracique, augmentation du retour veineux et optimisation de la diastole
- Inconvéniant: ventouse actionnée de façon mécanique grâce à une bouteille d'oxygène ou d'air
- Conception d'une deuxième génération sur batterie

LUCAS^{TM} vs MCE manuel

- *Resuscitation 2002:* étude expérimentale: débit cardiaque, débit carotidien, CO2 expiré, pression de perfusion coronaire et survie meilleurs

- *Resuscitation 2006:* étude humaine: meilleure Pet CO2 avec une survie identique (5% avec LUCAS vs 5,9% groupe témoin)

- *Resucitation 2006:* pic plasmatique d'Adrénaline arrivant plus vite dans le groupe LUCAS (90 vs 150 sec), meilleur pression de perfusion coronaire et flux sanguin cortical cérébral

LUCAS compared to manual cardio-pulmonary resuscitation is more effective during helicopter rescue—a prospective, randomized, cross-over manikin study (*American Journal of Emergency Medicine* 32:384-389, February 2013)

RESULTATS:

LUCAS compared to manual chest-compressions were more frequently correct (99% vs 59%, *P* < .001) and were more often performed correctly regarding depth (99% vs 79%, *P* < .001), pressure point (100% vs 79%, *P* < .001) and pressure release (100% vs 97%, *P* = .001). Hands-off time was shorter in the LUCAS than in the manual group (46 vs 130 seconds, *P* < .001). Time until first defibrillation was longer in the LUCAS group (112 vs 49 seconds, *P* < .001).

AUTOPULSE ™

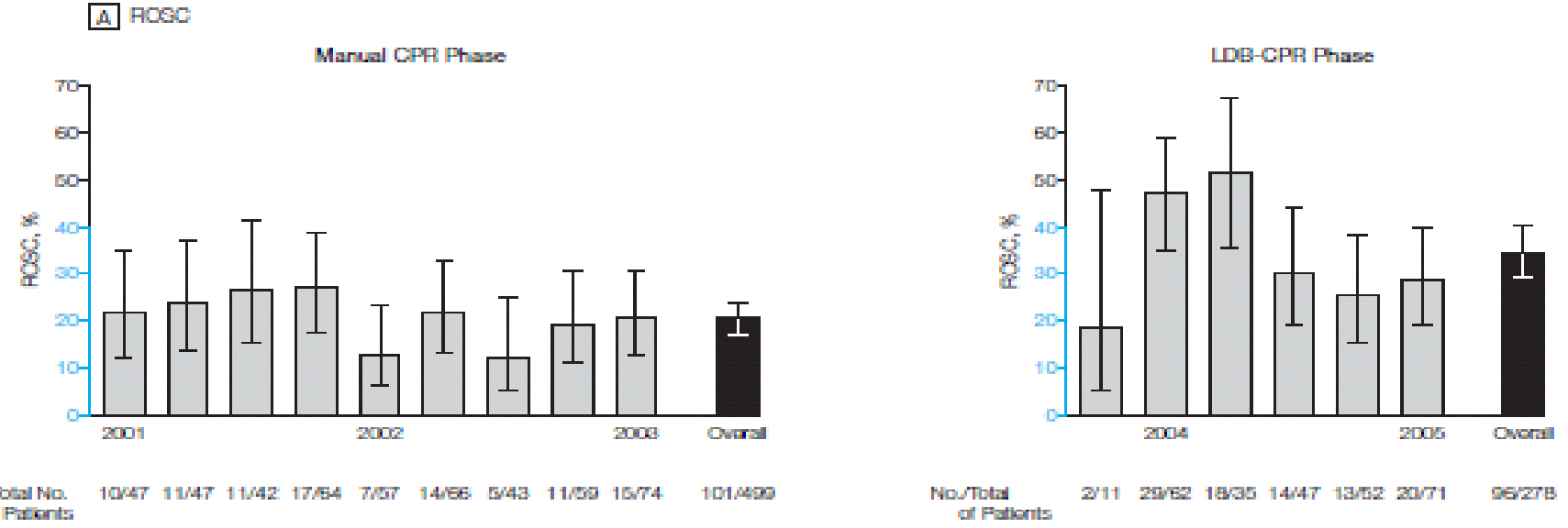
- Machine à masser comprenant une planche thoracique postérieure et une large bande antérieure.
- Principe: compression homogène et uniforme des parties antérieures et latérales du thorax à une fréquence de 100/min avec une décompression complète et active.

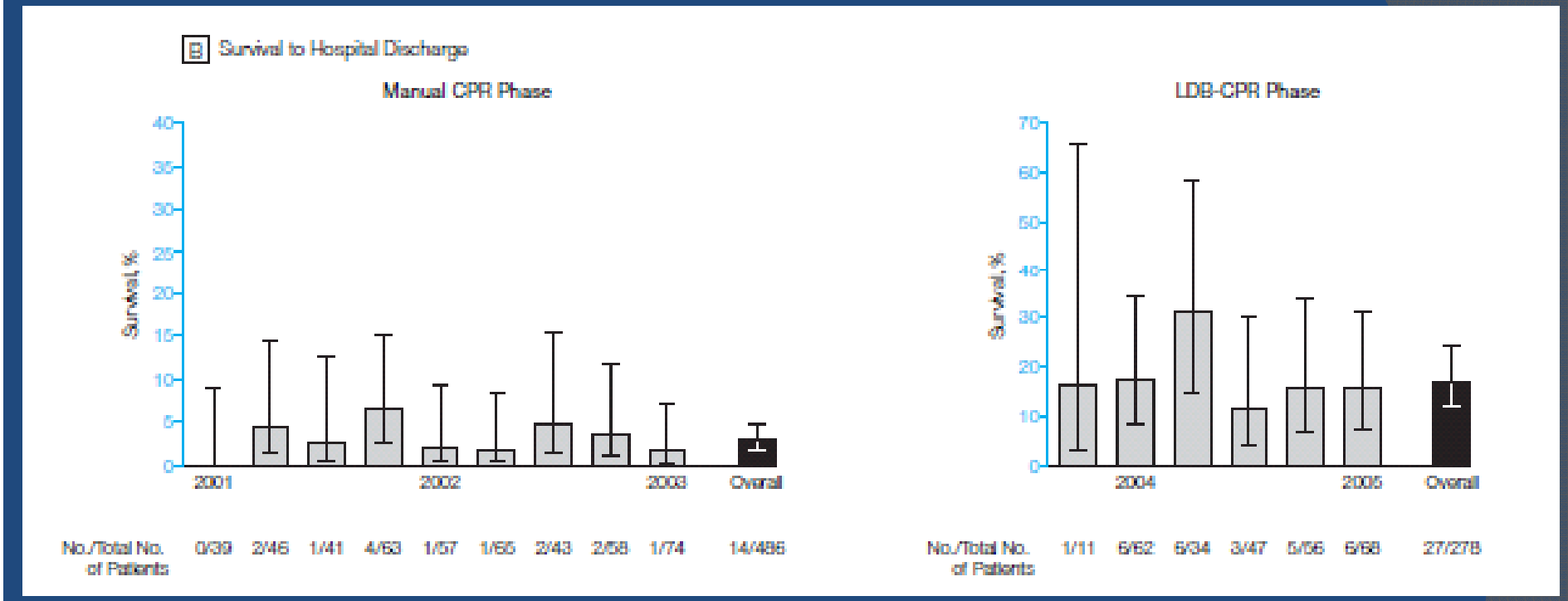
- *ICM 2010:* amélioration du flux sanguin myocardique, de la pression artérielle, de la pression de perfusion coronaire et du débit sanguin cérébral par rapport au MCE manuel

Use of an Automated, Load-Distributing Band Chest Compression Device for Out-of-Hospital Cardiac Arrest Resuscitation

JAMA. 2006;295:2629-2637

Design, Setting, and Patients A phased, observational cohort evaluation with intention-to-treat analysis of 783 adults with out-of-hospital, nontraumatic cardiac arrest. A total of 499 patients were included in the manual CPR phase (January 1, 2001, to March 31, 2003) and 284 patients in the LDB-CPR phase (December 20, 2003, to March 31, 2005); of these patients, the LDB device was applied in 210 patients.





NNT =15 (IC 95% [9-33])

Hock Ong *et al. Critical Care* 2012, **16**:R144
http://ccforum.com/content/16/4/R144

CRITICAL CARE

RESEARCH Open Access

Improved neurologically intact survival with the use of an automated, load-distributing band chest compression device for cardiac arrest presenting to the emergency department

Methods: We conducted a phased, prospective cohort evaluation with intention-to-treat analysis of adults with non-traumatic cardiac arrest. At these two urban EDs, systems were changed from manual CPR to LDB-CPR. Primary outcome was survival to hospital discharge, with secondary outcome measures of return of spontaneous circulation, survival to hospital admission and neurological outcome at discharge.

- In conclusion, this is the first study to show that a resuscitation strategy using LDB-CPR in an ED environment was associated with improved neurologically intact survival on discharge in adults with prolonged, non-traumatic cardiac arrest.

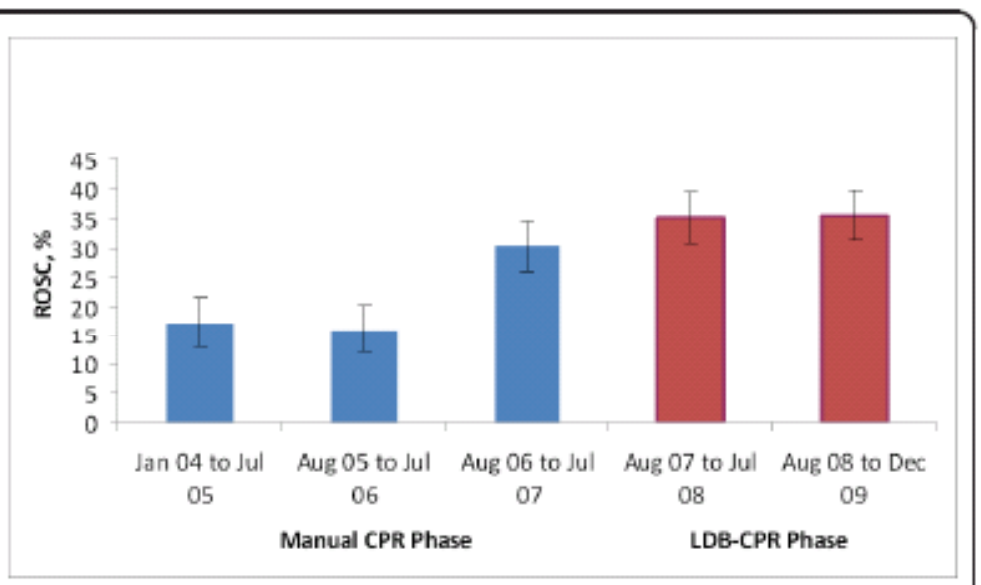


Figure 2 Return of spontaneous circulation by phases. LBD, load-distributing band; CPR, cardiopulmonary resuscitation; ROSC, return of spontaneous circulation.

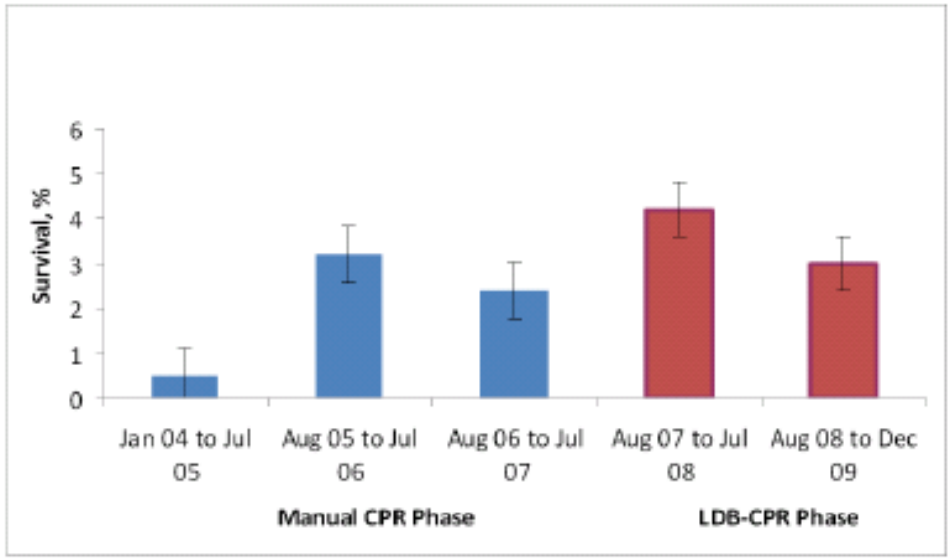


Figure 3 Survival to discharge by phases. LBD, load-distributing band; CPR, cardiopulmonary resuscitation.

Cardiopulmonary resuscitation interruptions with use of a load-distributing band device during emergency department cardiac arrest. *Ann Emerg Med 2010; 56:233–41*

- **Méthodes:** étude observationnelle avant –après incluant les AC extrahospitaliers non traumatiques pris en charge aux urgences entre 2007 et 2008

- **Résultats:** ratio moyen de No Flow durant les 5 première minutes de réanimationde: 0,28 MCE manuel vs 0,40 MCE par Autopulse (différence= -0,12; IC 95% [-0,22 à -0,2])

The analysis of efficacy for AutoPulse™ system in flying helicopter. *Resuscitation 2013; 84: 1045-50*

- **Resultats:**
  - **Retour d'une circulation spontanée:** 30.6% groupe Autopulse vs 7.0% groupe MCE manuel
  - **Survie à la sortie:** 6.1% vs. 2.3%
  - **Analyse multivariée:** facteurs associés à une reprise d'une circulation spontanée: AutoPulse™ (odds ratio 7.22; *P* = 0.005) et age ≤65 years (OR, 0.31; *P* = 0.042).

Conclusion: The present study demonstrates that the use of AutoPulse™ in flying helicopters was significantly effective for the ROSC in CPA patients. The use of automated chest compression devices such as AutoPulse™ might be recommended at least for CPA patients transported by helicopters

Manual Chest Compression vs Use of an Automated Chest Compression Device During Resuscitation Following Out-of-Hospital Cardiac Arrest

A Randomized Trial

JAMA. 2006;295:2620-2628

Main Outcome Measures The primary end point was survival to 4 hours after the 911 call. Secondary end points were survival to hospital discharge and neurological status among survivors.

Results Following the first planned interim monitoring conducted by an independent data and safety monitoring board, study enrollment was terminated. No difference existed in the primary end point of survival to 4 hours between the manual CPR group and the LDB-CPR group overall (N=1071; 29.5% vs 28.5%; *P*=.74) or among the primary study population (n=767; 24.7% vs 26.4%, respectively; *P*=.62). However, among the primary population, survival to hospital discharge was 9.9% in the manual CPR group and 5.8% in the LDB-CPR group (*P*=.06, adjusted for covariates and clustering). A cerebral performance category of 1 or 2 at hospital discharge was recorded in 7.5% of patients in the manual CPR group and in 3.1% of the LDB-CPR group (*P*=.006).

Conclusions Use of an automated LDB-CPR device as implemented in this study was associated with worse neurological outcomes and a trend toward worse survival than manual CPR. Device design or implementation strategies require further evaluation.

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest: The LINC Randomized Trial (*JAMA.* 2014;311(1):53-61)

- **DESIGN:** étude multicentrique randomisée de 2008 à 2013, incluant 2589 patients
- **Critère de jugement principal:** survie à H4
- **Critère de jugement secondaire:** pronostic neurologique à 6 mois (score CPC favorable 1 à 2)
- **RESULTATS:** aucune différence significative entre les deux groupe avec un bon pronostic neurologique à 6 mois

Ong et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 2012, 20:39
http://www.sjtrem.com/content/20/1/39

SCANDINAVIAN JOURNAL OF
trauma, resuscitation
& emergency medicine

REVIEW Open Access

Mechanical CPR devices compared to manual CPR during out-of-hospital cardiac arrest and ambulance transport: a systematic review

Marcus Eng Hock Ong[1*], Kevin E Mackey[2], Zhong Cheng Zhang[1], Hideharu Tanaka[3], Matthew Huei-Ming Ma[4], Robert Swor[5] and Sang Do Shin[6]

Methods: Databases including PubMed, Cochrane Library (including Cochrane database for systematic reviews and Cochrane Central Register of Controlled Trials), Embase, and AHA EndNote Master Library were systematically searched. Further references were gathered from cross-references from articles and reviews as well as forward search using SCOPUS and Google scholar. The inclusion criteria for this review included manikin and human studies of adult cardiac arrest and anti-arrhythmic agents, peer-review. Excluded were review articles, case series and case reports.

Conclusion: In this review, we found insufficient evidence to support or refute the use of mechanical CPR devices in settings of out-of-hospital cardiac arrest and during ambulance transport. While there is some low quality evidence suggesting that mechanical CPR can improve consistency and reduce interruptions in chest compressions, there is no evidence that mechanical CPR devices improve survival, to the contrary they may worsen neurological outcome.

Mechanical versus manual chest compressions for cardiac arrest (Review)

THE COCHRANE COLLABORATION®

- **Critères d'inclusion:** études randomisées contrôlées ou quasi contrôlées, ayant comparé le MCE automatisé vs MCE manue
- **Résultats:**
  - Moindre survie MCE automatisé vs MCE manuel (RR 0,41 IC 95% [0,21- 0,79])
  - Retour d'une circulation spontanée: RR 2,81 IC 95% (0,96-8,22)
  - Survie à l'hopital: RR IC 95% (0,19- 88,71)

- **MCE automatisé intéressant mais non recommandé en routine selon l'AHA 2010**

- Réservé à certaines situations:
  - Transport de longue durée ou aérien
  - Au cours d'une angioplastie (*Circulation 2007*)
  - Dans l'attente d'une transplantation imminente (*Resuscitation 2009*)

RCP médicalisée

- Défibrillation précoce: pas de période de RCP préalable systématique
  - 1 seul choc: 360J DEF monophasique
    150 à 200J DEF biphasique
- Intubation orotrachéale non prioritaire: ventilation au masque suffisante
- Voies d'abord:
  - Voie veineuse
  - Voie intraosseuse
  - Voie endotrachéale non recommandée

ADRENALINE

- Vasoconstricteur préconisé le plus tôt possible si asystolie ou DEM(absence d'études contre placebo)
  - 1mg toutes les 3min
  - Après le 3éme choc si FV/TV
- Vasopressine: alternative non retenue

ANTIARYTHMIQUES

- Amidarone:
  - 300mg/20ml en IVD (VVP large)
  - FV/TV sans pouls après le 3ème choc en même temps que l'Adrénaline
  - Renouvelable une fois à 150 mg
  - Relais par 900mg/24H PSE
- Lidocaine: non recommandée
- Sulfate de Mg (2g IVD):
  - torsade de pointe
  - hypomagnésémie profonde

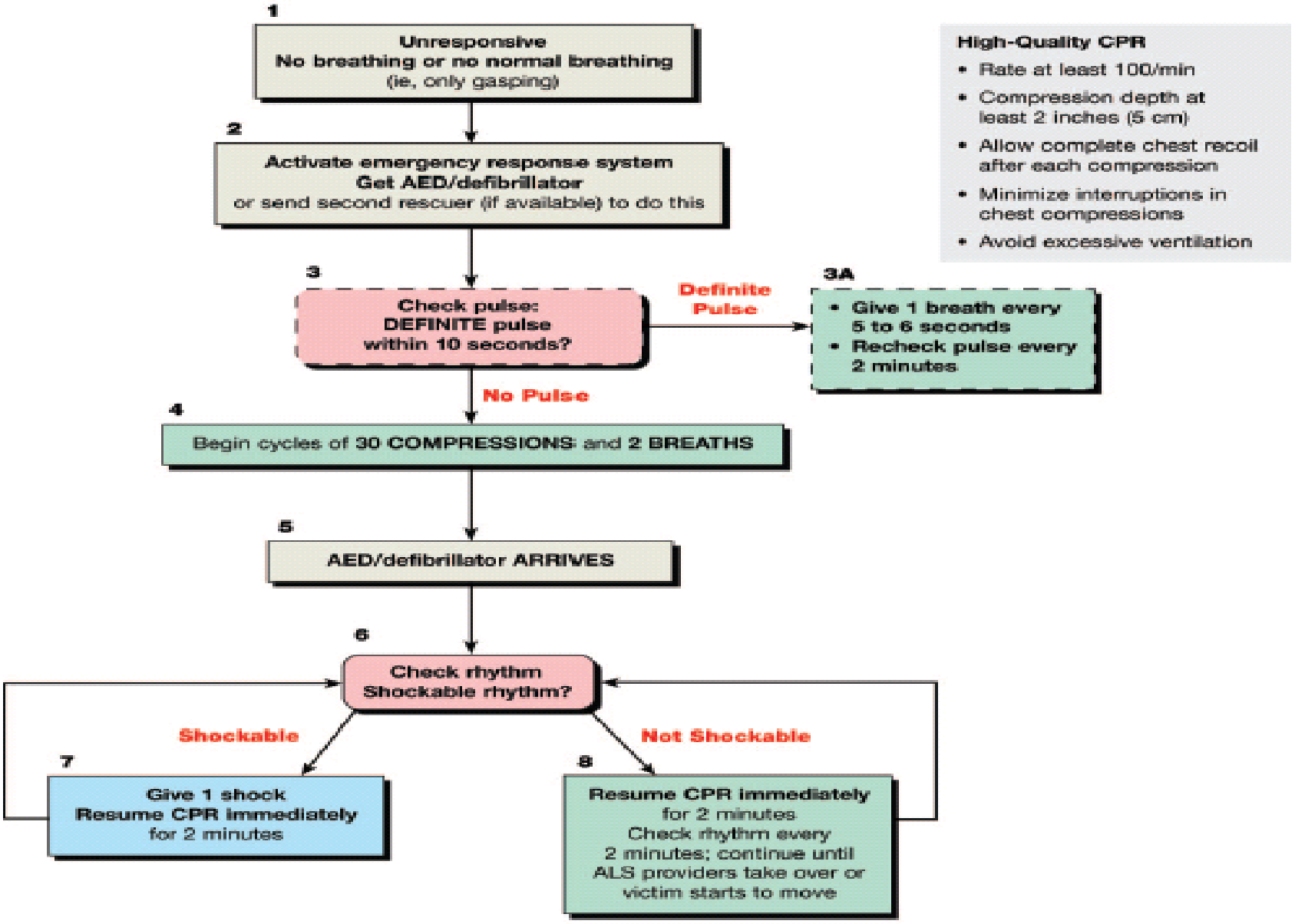
AUTRES

- Atropine: non recommandée
- Alcalinisation: non systématique, indiquée si:
  - Hyperkaliémie
  - Acidose métabolique préexistante
  - Intoxication aux tricycliques
- Fibrinolyse: si AC sur embolie pulmonaire

Réanimation post AC

- Maintien homéostasie: VA pour SpO2 > 92 % (< 98 %: lutte contre hyperoxémie)
- PA « optimale »: hémodynamique stable
- Traiter les manifestations épileptiques
- Sédation
- Traiter l'hyperthermie
- Lutter contre hyperglycémie > 10 mmoles/l
- Hypothermie précoce quel que soit le type de l'arret: 12 à 24H, à 32° à 34°.

Adult BLS Healthcare Providers



Note: The boxes bordered with dashed lines are performed by healthcare providers and not by lay rescuers