RCP ottimale: possiamo fare meglio?

P. Groff

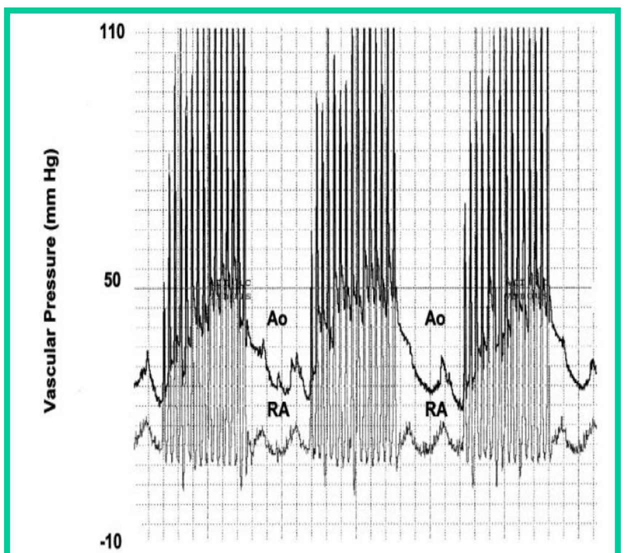
Arresto cardiaco

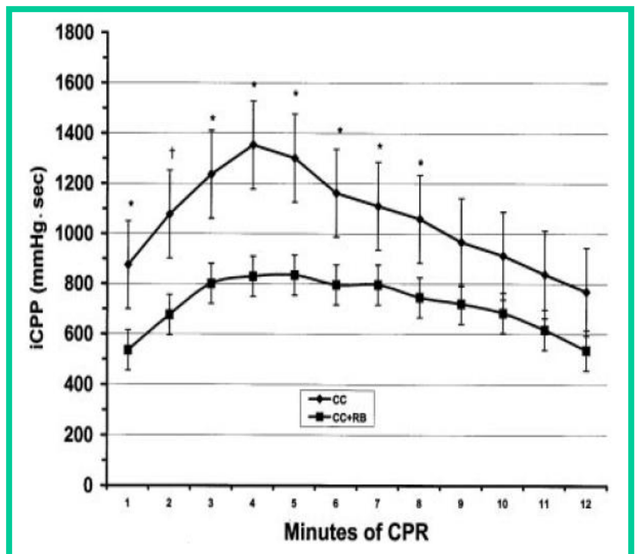
- Circa 1 milione di arresti cardiaci ogni anno in USA e Europa (circa 1 ogni 30 secondi)
- Sopravvivenza di 1: 5 nell’arresto intraospedaliero e di 1: 10 nell’arresto extraospedaliero
- Ripristino dello stato neurologico dipende dal mantenimento di un’adeguato flusso ematico cerebrale
- Una «RCP ottimale» garantisce il 25-30% del flusso ematico normale al cuore e al cervello

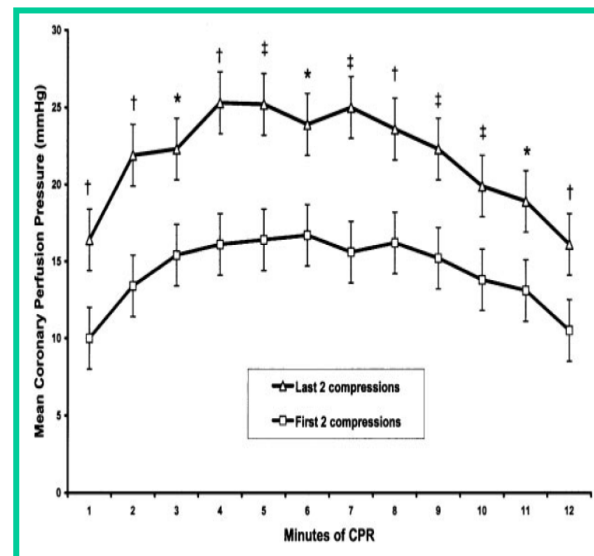
Adverse Hemodynamic Effects of Interrupting Chest Compressions for Rescue Breathing During Cardiopulmonary Resuscitation for Ventricular Fibrillation Cardiac Arrest

Robert A. Berg, MD; Arthur B. Sanders, MD; Karl B. Kern, MD; Ronald W. Hilwig, DVM, PhD; Joseph W. Heidenreich, BA; Matthew E. Porter, BA; Gordon A. Ewy, MD

(*Circulation*. 2001;104:2465-2470.)







RCP «ottimale»

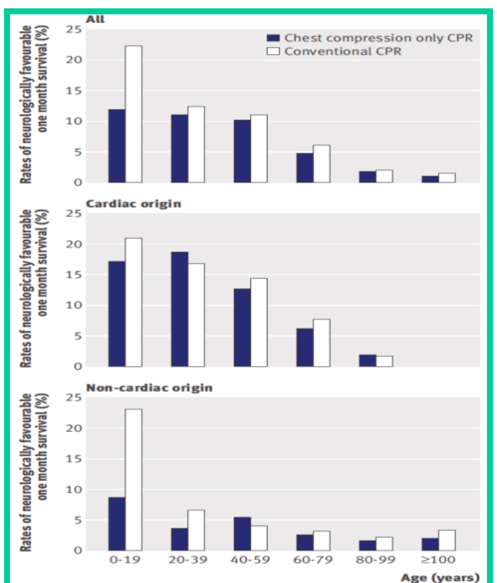
- Attenzione alla qualità delle compressioni toraciche
- Passaggio dal rapporto 15:2 al rapporto 30:2
- «Chest Compressions Only CPR»
- CC only CPR come tecnica base per il «bystander» in associazione a programmi PAD
- Dispatcher-assisted CC only CPR

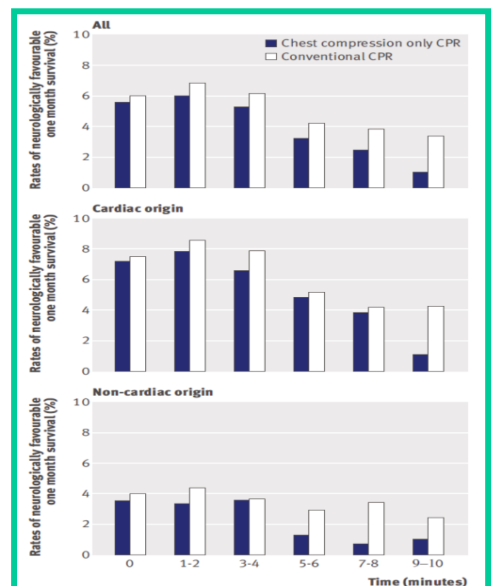
Outcomes of chest compression only CPR versus conventional CPR conducted by lay people in patients with out of hospital cardiopulmonary arrest witnessed by bystanders: nationwide population based observational study

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]

BMJ 2011;342:c7106

			Odds ratio (95% CI), P value	
	Chest compression only CPR	Conventional CPR	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





Chest Compression–Only Cardiopulmonary Resuscitation for Out-of-Hospital Cardiac Arrest With Public-Access Defibrillation

A Nationwide Cohort Study

Taku Iwami, MD, MPH, PhD; Tetsuhisa Kitamura, MD, MSc, DrPH; Takashi Kawamura, MD, PhD; Hideo Mitamura, MD, PhD; Ken Nagao, MD, PhD; Morimasa Takayama, MD, PhD; Yoshihiko Seino, MD, PhD; Hideharu Tanaka, MD, PhD; Hiroshi Nonogi, MD, PhD; Naohiro Yonemoto, DrPH; Takeshi Kimura, MD, PhD; for the Japanese Circulation Society Resuscitation Science Study (JCS-ReSS) Group

(*Circulation*. 2012;126:2844-2851.)

Table 3. Outcomes of Out-of-Hospital Cardiac Arrest Patients With Public-Access Automated External Defibrillation Shocks by Type of Bystander-Initiated Cardiopulmonary Resuscitation

	Compression-Only CPR (n=506)	Conventional CPR (n=870)	*P*
Prehospital ROSC, n (%)	254 (50.2)	352 (40.5)	<0.001
1-mo survival, n (%)	235 (46.4)	347 (39.9)	0.018
Neurologically favorable 1-mo survival, n (%)	206 (40.7)	286 (32.9)	0.003

CPR indicates cardiopulmonary resuscitation; ROSC, return of spontaneous circulation.

Duration of Ventilations During Cardiopulmonary Resuscitation by Lay Rescuers and First Responders

Relationship Between Delivering Chest Compressions and Outcomes

Stefanie G. Beesems, MSc; Lizzy Wijmans, MSc; Jan G.P. Tijssen, PhD;
Rudolph W. Koster, MD, PhD

(*Circulation*. 2013;127:1585-1590.)

Table 2. Ratio of Compressions and Ventilations Delivered

	Ventilation Duration, s					
	3–5	6–7	8–9	10–12	≥13	*P* Value*
Cases, n (%)	42 (21)	58 (29)	50 (25)	28 (14)	21 (11)	
Chest compression rate/min, median†	107 (101–121)	105 (102–118)	113 (103–126)	111 (101–118)	106 (96–116)	0.18
Chest compression rate >100/min, %	81	80	88	82	72	0.73
Chest compression rate >120/min, %	26	19	34	14	14	0.39
Compressions/ventilations delivered						
≥60 chest compressions delivered/r						
≥70 chest compressions delivered/r						
≥80 chest compressions delivered/r						
Chest compression fraction, median						
Survival, % (n/N)						

Table 4. Survival Analyses

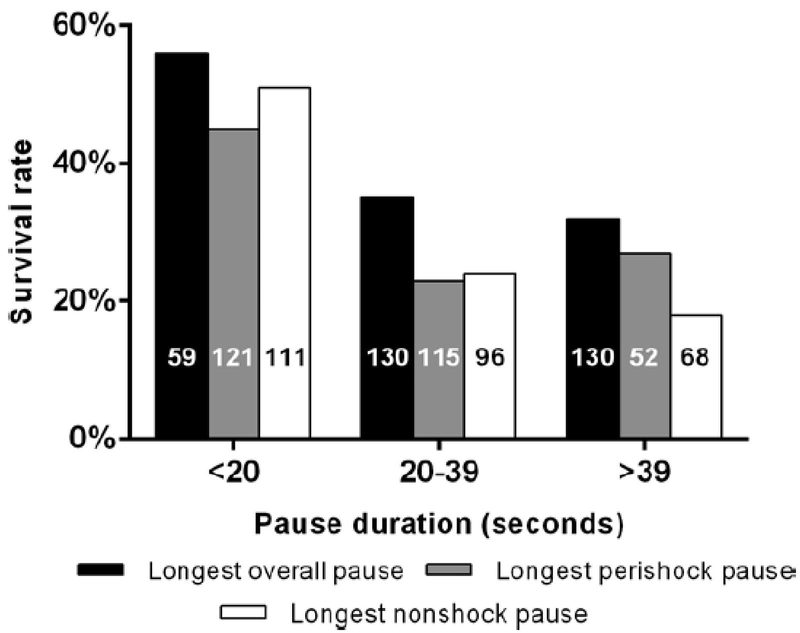
Variable	OR (95% CI), Univariable Analysis	*P* Value	OR (95% CI), Multivariable Analysis	*P* Value
Ventilation duration of 3–5 s	Reference		Reference	
Ventilation duration of 6–7 s	2.14 (0.70–6.55)	0.183	1.62 (0.43–6.10)	0.48
Ventilation duration of 8–9 s	2.60 (0.84–8.03)	0.097	1.02 (0.27–3.78)	0.98
Ventilation duration of 10–12 s	2.96 (0.85–10.3)	0.087	1.30 (0.29–5.97)	0.73
Ventilation duration ≥13 s	5.55 (1.55–19.8)	0.008	2.38 (0.46–12.1)	0.30
Time from emergency call to AED attachment	0.82 (0.74–0.90)	<0.001	0.81 (0.71–0.92)	<0.001
Dispatched first responder/onsite rescuers	0.29 (0.14–0.58)	<0.001	0.67 (0.27–1.64)	0.38
VF as initial rhythm	26.2 (7.77–88.22)	<0.001	32.6 (8.86–120.1)	<0.001

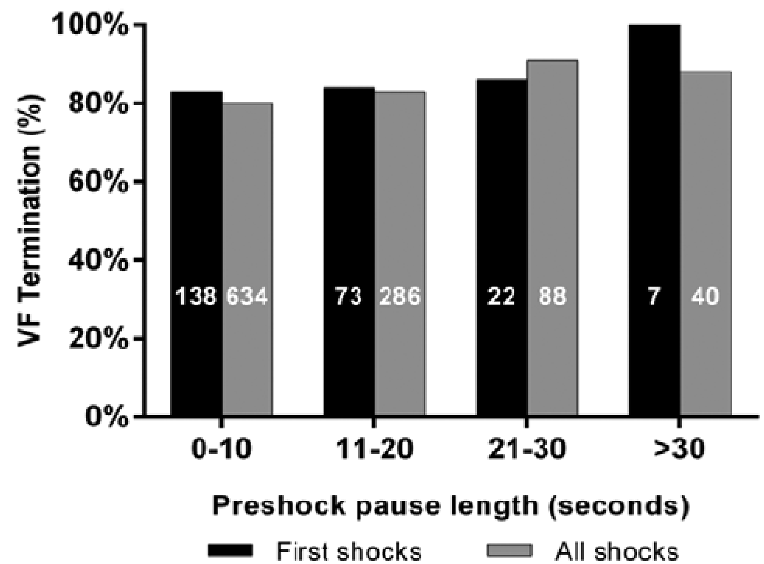
CI indicates confidence interval; OR, odds ratio for survival; and VF, ventricular fibrillation.

Association Between Chest Compression Interruptions and Clinical Outcomes of Ventricular Fibrillation Out-of-Hospital Cardiac Arrest

Tom F. Brouwer, MD; Robert G. Walker, BA; Fred W. Chapman, PhD; Rudolph W. Koster, MD, PhD

(*Circulation*. 2015;132:1030-1037.





Trial of Continuous or Interrupted Chest Compressions during CPR

Graham Nichol, M.D., M.P.H., Brian Leroux, Ph.D., Henry Wang, M.D., Clifton W. Callaway, M.D., Ph.D., George Sopko, M.D., Myron Weisfeldt, M.D., Ian Stiell, M.D., Laurie J. Morrison, M.D., Tom P. Aufderheide, M.D., Sheldon Cheskes, M.D., Jim Christenson, M.D., Peter Kudenchuk, M.D., Christian Vaillancourt, M.D., Thomas D. Rea, M.D., Ahamed H. Idris, M.D., Riccardo Colella, D.O., M.P.H., Marshal Isaacs, M.D., Ron Straight, Shannon Stephens, Joe Richardson, Joe Condle, Robert H. Schmicker, M.S., Debra Egan, M.P.H., B.S.N., Susanne May, Ph.D., and Joseph P. Ornato, M.D., for the ROC Investigators*

N ENGL J MED 373;23 NEJM.ORG DECEMBER 3, 2015

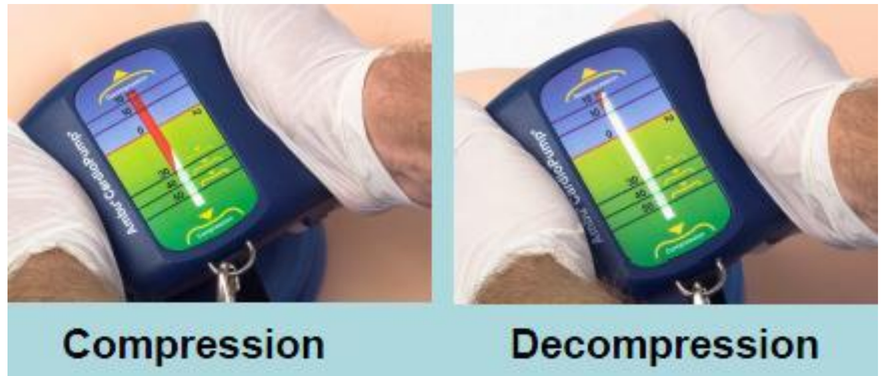
CONCLUSIONS

In patients with out-of-hospital cardiac arrest, continuous chest compressions during CPR performed by EMS providers did not result in significantly higher rates of survival or favorable neurologic function than did interrupted chest compressions. (Funded by the National Heart, Lung, and Blood Institute and others; ROC CCC ClinicalTrials.gov number, NCT01372748.)

RCP e flusso ematico cardio-cerebrale

- La RCP con massaggio ininterrotto può essere un modo per aumentare la perfusione coronarica e cerebrale
- La sua efficacia clinica appare però controversa e variabile nei diversi contesti di applicazione
- Un incremento del flusso ematico cardiaco e cerebrale durante RCP correla con la % di ROSC e sopravvivenza a lungo termine con funzione corticale integra

Intrathoracic Pressure Regulation CPR



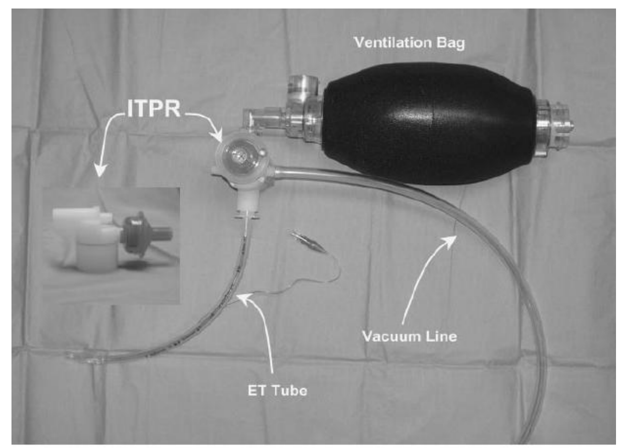
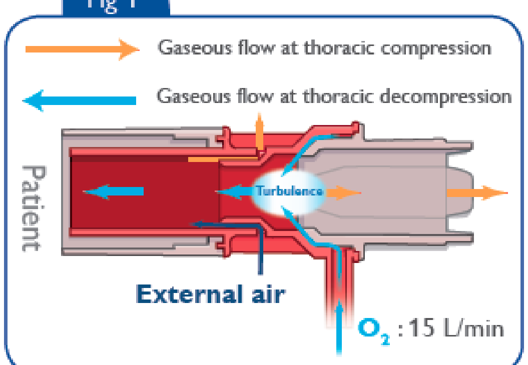


Fig 1



ORIGINAL RESEARCH Open Access

Effect of regulating airway pressure on intrathoracic pressure and vital organ perfusion pressure during cardiopulmonary resuscitation: a non-randomized interventional cross-over study

Younghoon Kwon[1,2*], Guillaume Debaty[3,4], Laura Puertas[4], Anja Metzger[4], Jennifer Rees[4], Scott McKnite[4], Demetris Yannopoulos[1] and Keith Lurie[1,4]

Kwon *et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* (2015) 23:83

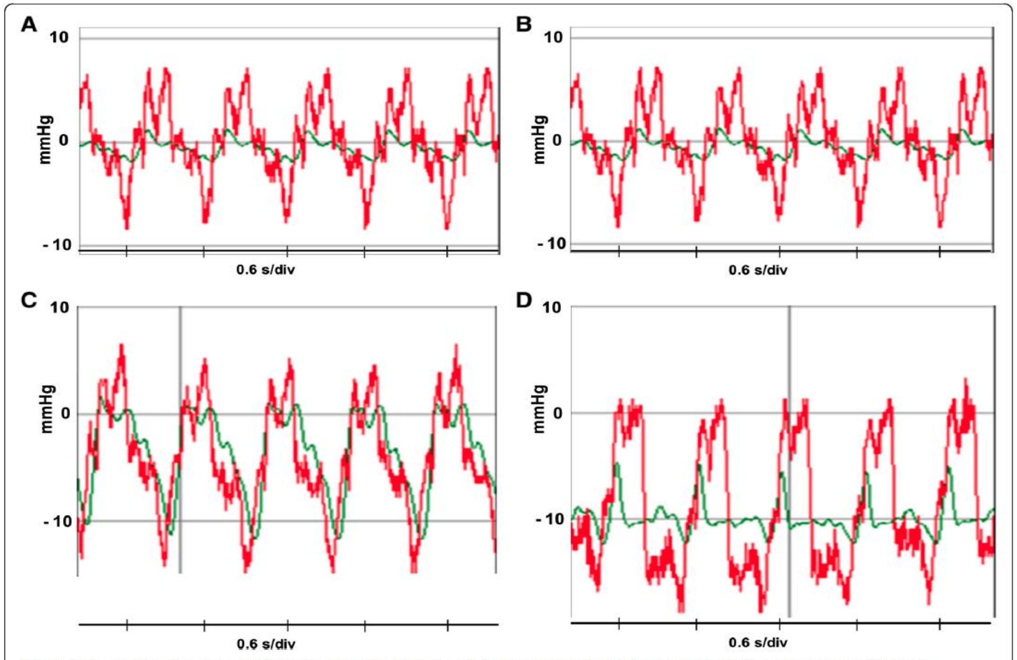


Fig. 2 Representative change in Ppl (Intrapleural pressure) (red) and Paw (airway pressure) (green) during CPR. **a** Standard (STD); **b** Active compression decompression (ACD); **c** ACD-Impedance Threshold Device (ITD); **d** ACD-Intrathoracic Pressure Regulator (ITPR)

Table 1 Summary of hemodynamic data

	STD	ACD	ACD-ITD	ACD-ITPR
SBP	59.4 ± 7.7	63.1 ± 7.9*	71.3 ± 9.8*,**	75.4 ± 11.6*,**
DBP	21.7 ± 3.6	16.4 ± 3.0	21.5 ± 4.6	23.8 ± 5.4**
Pra max	58.2 ± 7.6	68.1 ± 10.5*	70.4 ± 9.6*	74.3 ± 9.8*
Pra min	1.8 ± 1.6	−0.5 ± 1.7	−1.4 ± 1.6*	−2.4 ± 1.4*
Pra mean	23.3 ± 2.9	21.8 ± 3.8	22.5 ± 3.3	23.7 ± 3.6
ICP	20.9 ± 1.1	19.0 ± 1.5	19.7 ± 1.7	19.9 ± 2.1
CePP	13.0 ± 3.1	13.2 ± 3.0	17.1 ± 4.1	19.0 ± 5.3*,**
CPP	12.9 ± 3.0	11.6 ± 1.7	16.7 ± 2.9**	18.1 ± 3.6*,**
CBF	37.7 ± 6.4	48.8 ± 8.7*	53.3 ± 9.0*	57.4 ± 10.5*
$ETCO_2$	21.5 ± 2.2	23.7 ± 3.1	30.3 ± 1.9*,**	30.3 ± 3.5*,**

Table 2 Intrapleural and airway pressure during sequential CPR interventions

	STD	ACD	ACD-ITD	ACD-ITPR
Ppl mean	0.8 ± 1.1	−1.6 ± 1.6	−3.7 ± 1.5*,**	−7.0 ± 1.9*,**,***
Ppl max	6.8 ± 0.9	9.4 ± 1.3	8.4 ± 1.2	5.9 ± 1.8**
Ppl min	−6.3 ± 2.2	−13.0 ± 3.8*	−16.9 ± 3.6*,**	−18.7 ± 3.5*,**
Ppl delta	13.1 ± 2.2	22.5 ± 3.5*	26.2 ± 4*	24.6 ± 3.3*
Paw mean	0.3 ± 0.3	0.3 ± 0.3	−2.0 ± 0.6*,**	−8.4 ± 1.0*,**,***
Paw max	1.4 ± 0.3	2.2 ± 0.4	3.3 ± 1.1	−5.1 ± 1.4*,**,***
Paw min	−0.9 ± 0.3	−1.4 ± 0.3	−9.4 ± 0.8*,**	−11.9 ± 0.8*,**,***
Paw delta	2.3 ± 0.3	3.6 ± 0.4	12.6 ± 1.1*,**	6.4 ± 1.4*,**,***

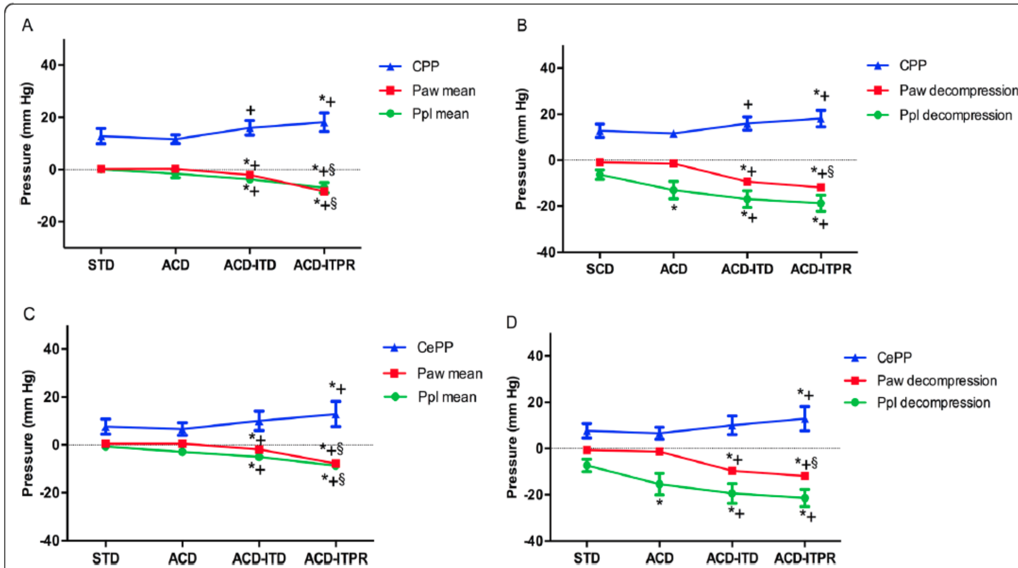
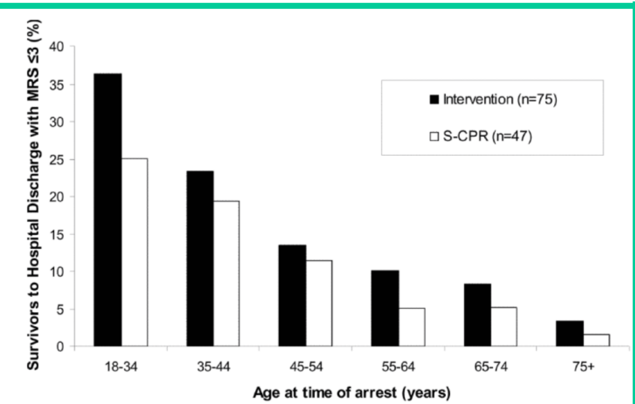


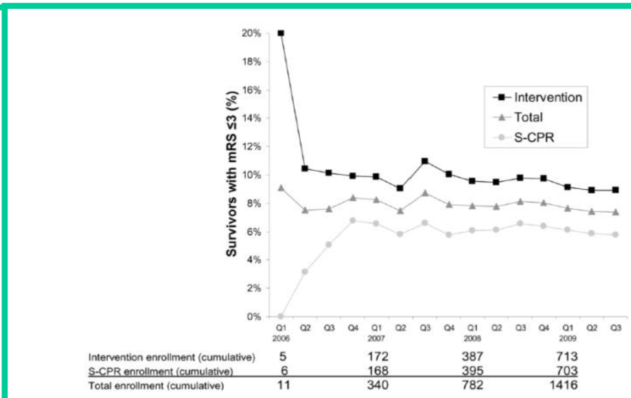
Fig. 5 Ppl (Intrapleural pressure), Paw (Airway pressure) and vital organ perfusion pressure for each sequential intervention. **a**. Ppl mean, Paw mean and CPP (coronary perfusion pressure); **b**. Ppl decompression, Paw decompression and CPP; **c**. Ppl mean, Paw mean and CePP (cerebral perfusion pressure); **d**. Ppl decompression, Paw decompression and CePP. Error bar represents SEM. $N = 6$ for CPP. $N = 8$ for CePP. * denotes $p < 0.05$ for STD vs. (ACD, ACD ITD, ACD ITPR). + denotes $p < 0.05$ for ACD vs. (ACD ITD, ACD ITPR). § denotes $p < 0.05$ for ACD-ITD vs. ACD-ITPR.. P values for linear trend for both CPP and CePP were < 0.05. STD, standard; ACD, active compression decompression, ITD, impedance threshold device; ITPR, intrathoracic pressure regulator

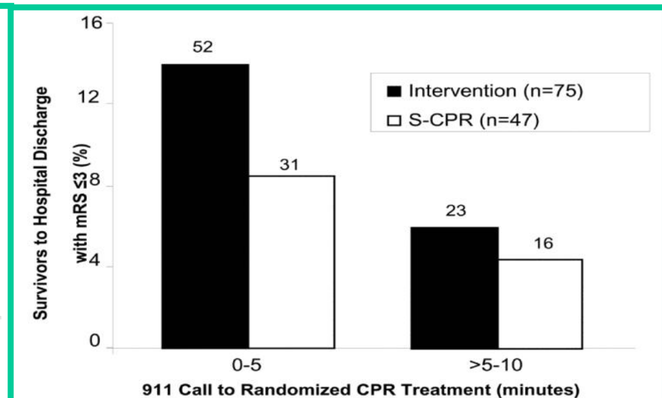
Comparative Effectiveness of Standard CPR versus Active Compression Decompression CPR with Augmentation of Negative Intrathoracic Pressure for Treatment of Out-of-Hospital Cardiac Arrest: Results from a Randomized Prospective Study

Tom P. Aufderheide, M.D., Ralph J. Frascone, M.D., Marvin A. Wayne, M.D., Brian D. Mahoney, M.D., Robert A. Swor, D.O., Robert M. Domeier, M.D., Michael L. Olinger, M.D., Richard G. Holcomb, Ph.D., David E. Tupper, Ph.D., Demetris Yannopoulos, M.D., and **Keith G. Lurie, M.D.**

Lancet. 2011 January 22; 377(9762): 301–311.







Compared with S-CPR, treatment with the study intervention resulted in a 53% relative increase in survival to hospital discharge with a mRS of ≤3 (the primary study endpoint): 75/840 (8.9%) vs. 47/813 (5.8%), p=0.019, OR 1.58 [CI= 1.07, 2.36]. (Table 2) In addition, (Table 3) However, pulmonary edema was more common in the intervention group (p=0.015).

Lung Compliance Following Cardiac Arrest

Kenneth Davis, Jr., MD, Jay A. Johannigman, MD, Robert C. Johnson, Jr., MD, Richard D. Branson, RRT

Acad. Emerg. Med. 1995; 2:874–878.

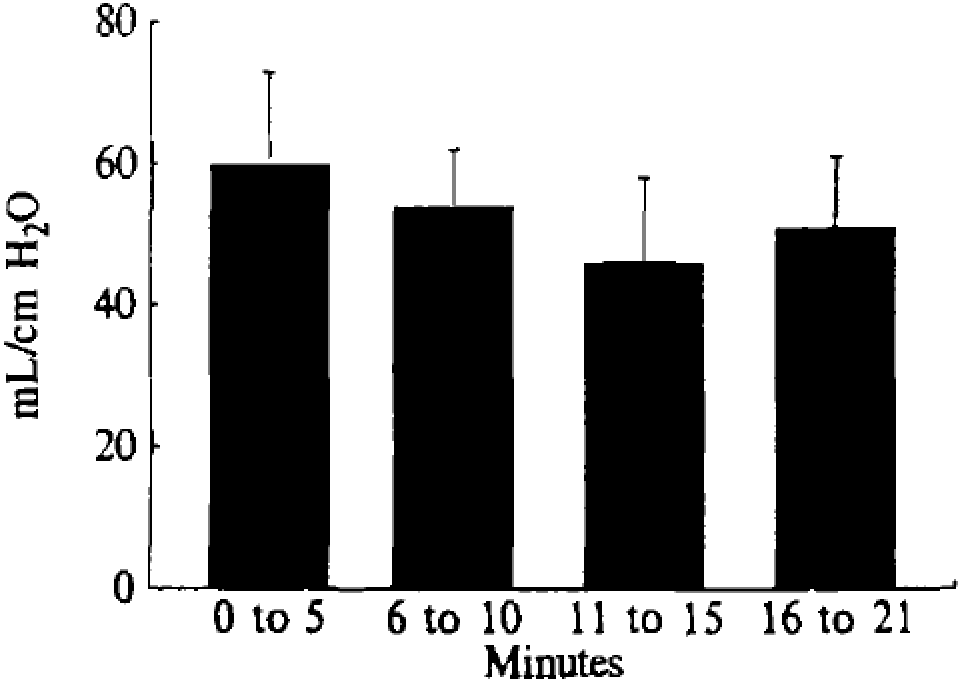
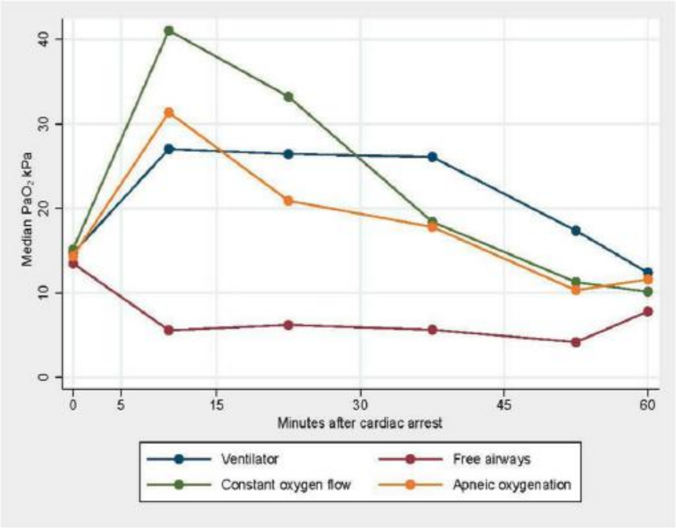


FIGURE 2. Changes in lung compliance associated with increasing duration of CPR.

Four ways to ventilate during cardiopulmonary resuscitation in a porcine model: a randomized study

Benedict Kjærgaard[1,2*], Egidijus Bavarskis[3], Sigridur Olga Magnusdottir[1], Charlotte Runge[4,5], Daiva Erentaite[6], Jes Sefland Vogt[7] and Mette Dahl Bendtsen[8]



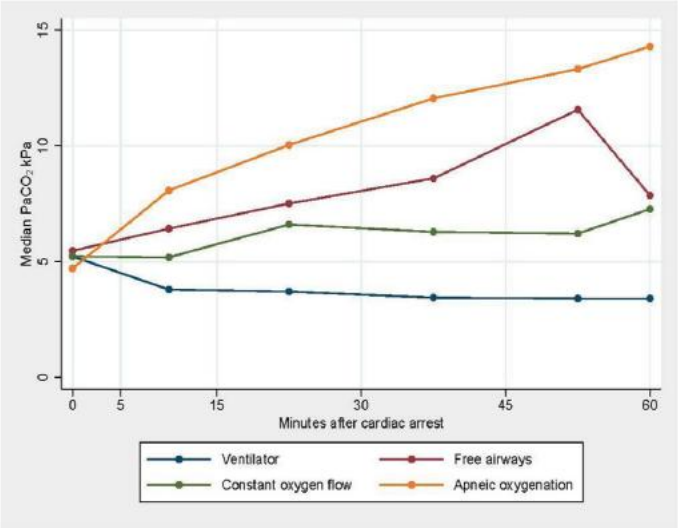


Table 3 Histopathological changes in lung parenchyma

Histology	No changes	Mild changes	Severe changes	Atelectases
Free airways	1	1	3	3 of 5
Ventilator	2	2	1	1 of 5
Constant oxygen flow	1	3	1	3 of 5
Apneic oxygenation	2	2	0	1 of 4

Conclusioni

- La sopravvivenza dopo arresto cardiaco senza sequele neurologiche dipende dalla possibilità di mantenere un adeguato flusso ematico coronarico e cerebrale
- Una «RCP ottimale» può non essere sufficiente a garantire pressioni di perfusione coronarica e cerebrale adeguate
- L'utilizzo di tecniche che associno compressioni toraciche ininterrotte e regolazione della pressione intratoracica con preservazione della CFR può costituire una valida risposta in questo senso


Grazie