3rd INTERCONTINENTAL EMERGENCY MEDICINE CONGRESS
3rd INTERNATIONAL CRITICAL CARE AND EMERGENCY MEDICINE CONGRESS
SUENO DELUXE OTEL ANTALYA 19-22 MAY 2016
EPAT Emergency Physicians Association of Turkey

Post-resuscitation care

Prof. Wilhelm Behringer

Center of Emergency Medicine
University of Jena

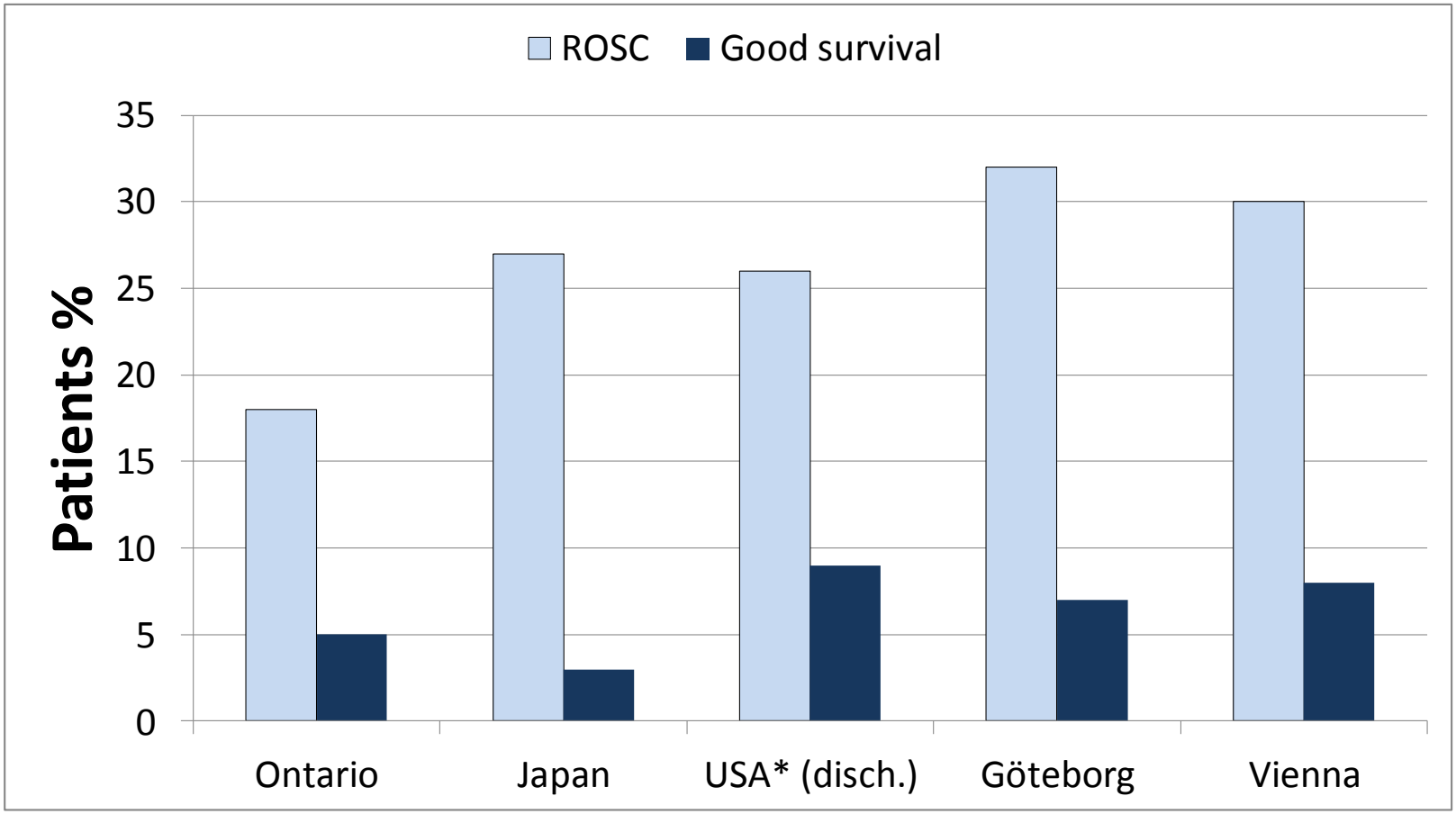
Conflict of interest

Emcools Shareholder and founder, honoraria

Zoll: honoraria

Bard: honoraria, nephew works for Bard

What happens after ROSC?



Stiell, NEJM 2004
Ong, Resuscitation 2015

Chan, Circulation 2014
Fairbanks, Resuscitation 2007
Nürnberger, Resuscitation 2012

What happens after ROSC?

Resuscitation 95 (2015) 202–222

Contents lists available at ScienceDirect

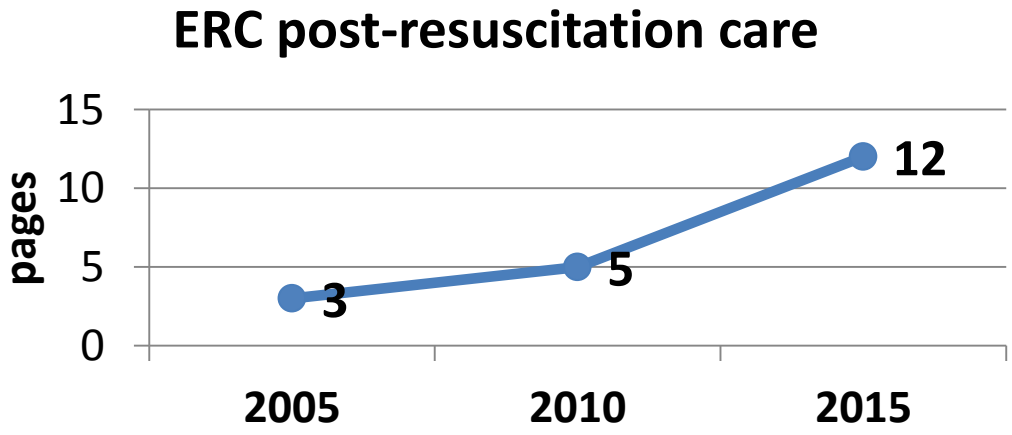
Resuscitation

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

European Resuscitation Council and European Society of Intensive Care Medicine Guidelines for Post-resuscitation Care 2015
Section 5 of the European Resuscitation Council Guidelines for Resuscitation 2015☆

Jerry P. Nolan[a,b,*], Jasmeet Soar[c], Alain Cariou[d], Tobias Cronberg[e], Véronique R.M. Moulaert[f], Charles D. Deakin[g], Bernd W. Bottiger[h], Hans Friberg[i], Kjetil Sunde[j], Claudio Sandroni[k]

- **Emphasis on the treatment of the post-cardiac arrest syndrome**
- **Structured post-resuscitation treatment protocol**



Return of spontaneous circulation and comatose

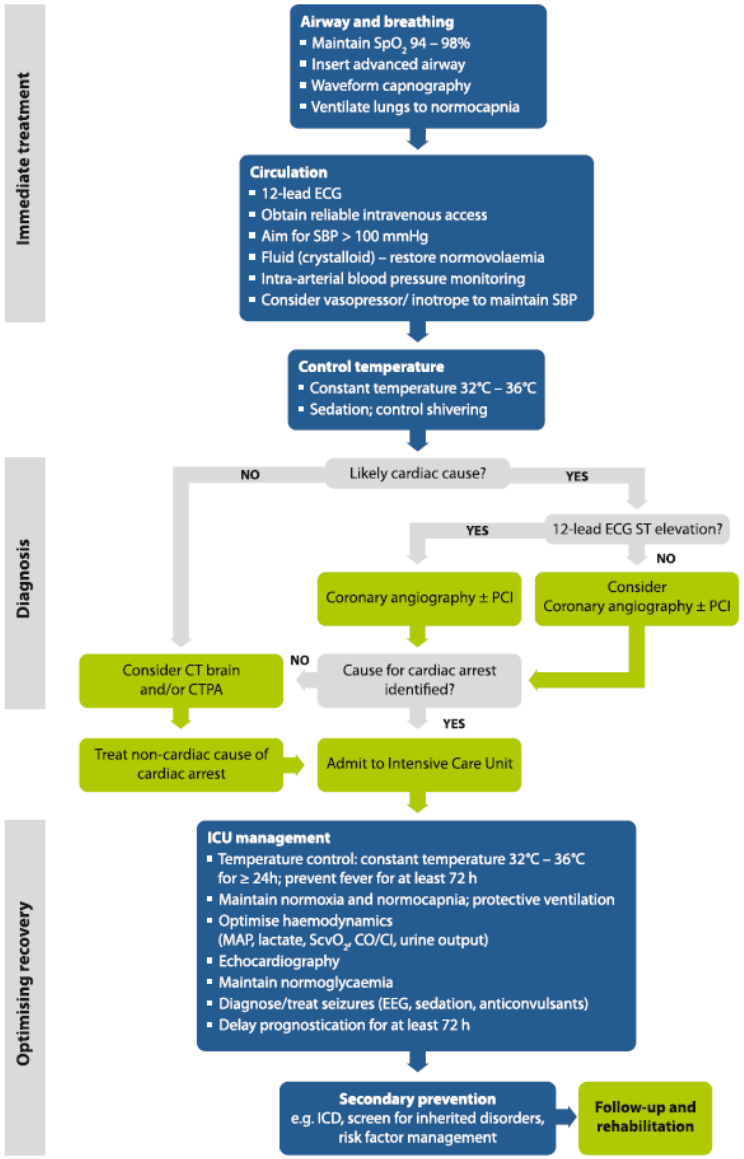


Fig. 5.1. Post-resuscitation care algorithm. SBP: systolic blood pressure; PCI: percutaneous coronary intervention; CTPA: computed tomography pulmonary angiogram; ICU: intensive care unit; MAP: mean arterial pressure; $ScvO_2$: central venous oxygenation; CO/CI: cardiac output/cardiac index; EEG: electroencephalography; ICD: implanted cardioverter defibrillator.

Overview

- Introduction
- Ventilation and oxygenation strategies
- Reperfusion strategies
- Metabolic control
- Antibiotic therapy
- Targeted temperature management
- Cardiac arrest center
- Conclusions and recommendations

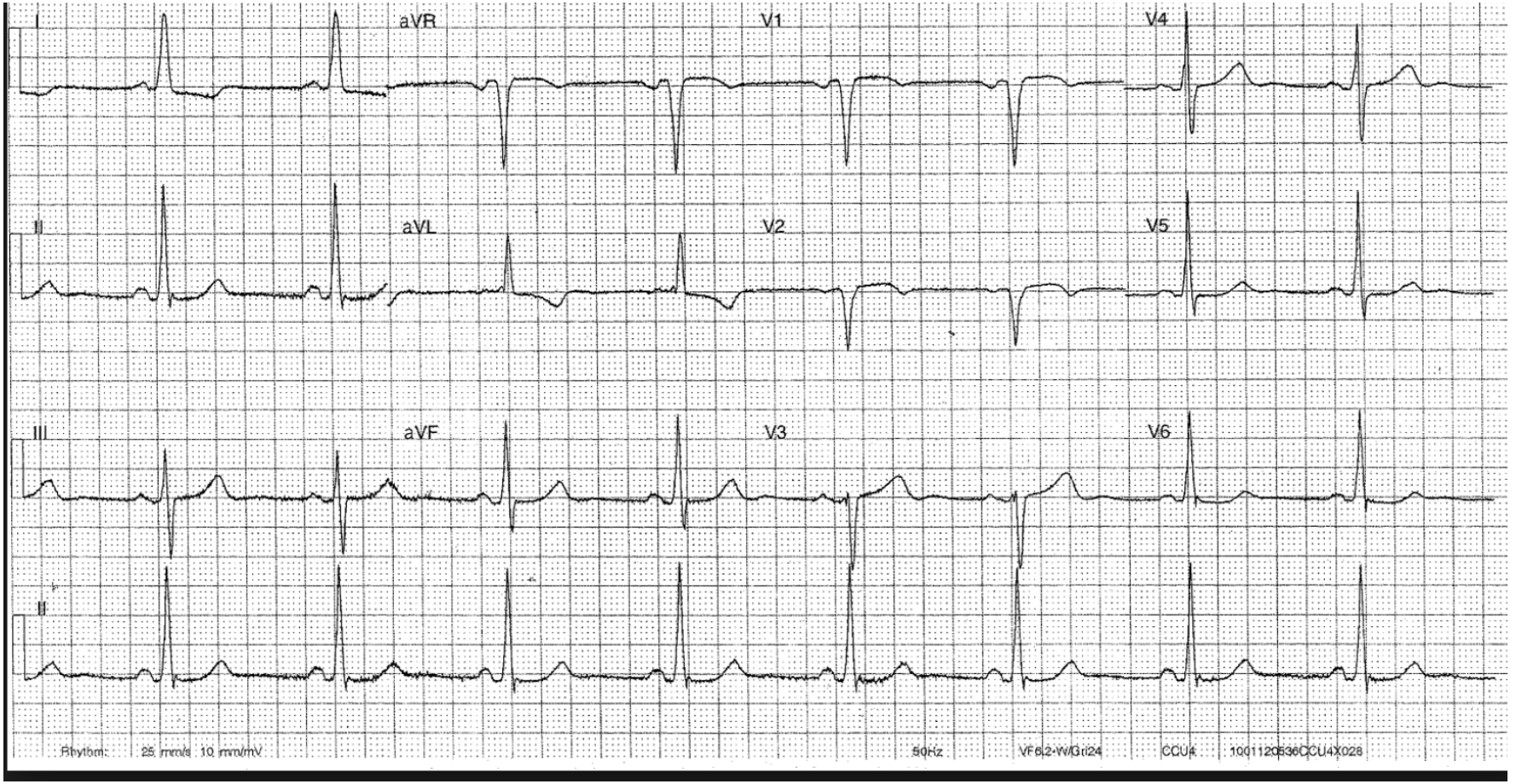
Case

- 64 yo male, Hx: HTN, smoking, antihypertensive drugs
- Witnessed CA at home, bystander CPR wife
- Ambulance arrives after 8 min
- Initial EKG VF, total epi 3 mg, shock 4x, ROSC 23 min
- Arrives in the ED, correctly intubated, 100% FiO_2

Case

- MAP = 70 mmHg
- HR = 110/min
- SaO_2 = 100%
- Temp = 36,8°C
- pO_2 = 320 mmHg (42 kPa)
- pCO_2 = 32 mmHg (4,3 kPa)
- pH = 7,12
- Lactate = 13 mmol/L
- Glucose = 280 mg/dL (15,5 mmol/L)
- K = 3,6 mmol/L
- Na = 136 mmol/L

Case


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Rhythm
25 mm/s 10 mm/mV
50Hz
VF6.2-W/Gri24
CCU4
1001120636CCU4X028

Overview

- Introduction
- **Ventilation and oxygenation strategies**
- Reperfusion strategies
- Metabolic control
- Antibiotic therapy
- Targeted temperature management
- Cardiac arrest center
- Conclusions and recommendations

Ventilation and oxygenation

Helmerhorst *et al. Critical Care* (2015) 19:348
DOI 10.1186/s13054-015-1067-6

CRITICAL CARE

RESEARCH Open Access

Associations of arterial carbon dioxide and arterial oxygen concentrations with hospital mortality after resuscitation from cardiac arrest

Hendrik J. F. Helmerhorst[1,2*], Marie-José Roos-Blom[3,4], David J. van Westerloo[1], Ameen Abu-Hanna[3], Nicolette F. de Keizer[3,4] and Evert de Jonge[1,4]

5,258 cardiac arrest patients admitted to 82 ICUs in the Netherlands

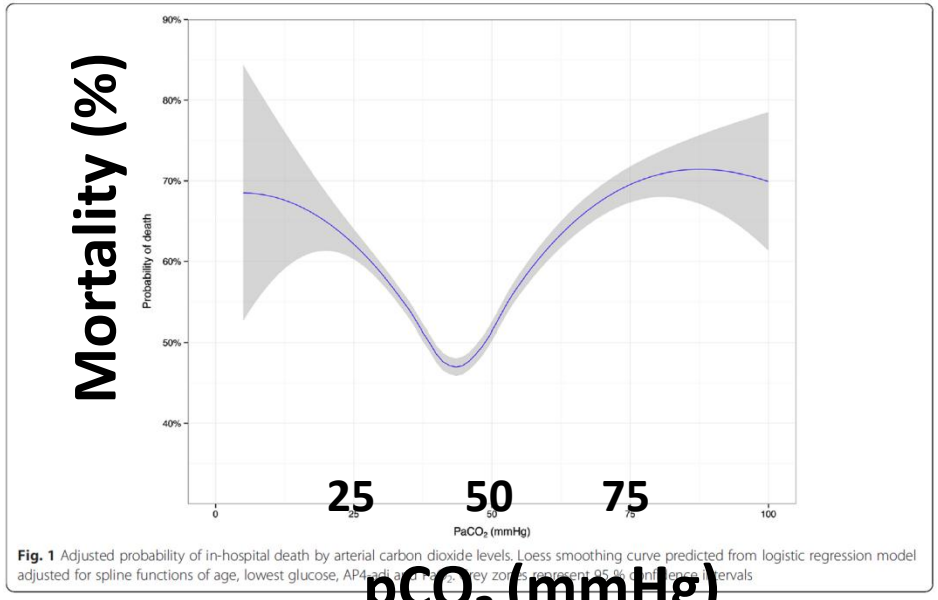


Fig. 1 Adjusted probability of in-hospital death by arterial carbon dioxide levels. Loess smoothing curve predicted from logistic regression model adjusted for spline functions of age, lowest glucose, AP4-adj and PaCO2. Grey zones represent 95 % confidence intervals

pCO_2 (mmHg)

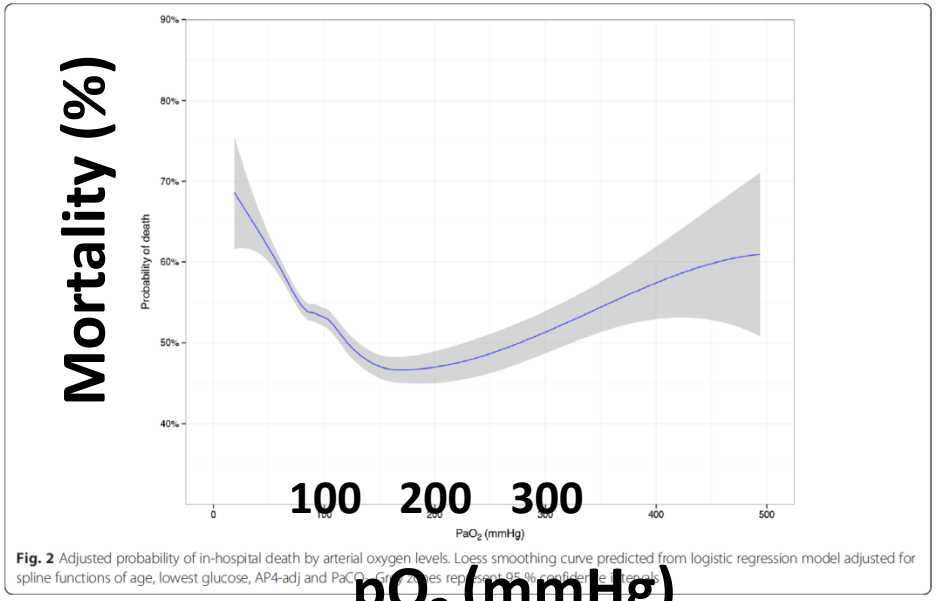


Fig. 2 Adjusted probability of in-hospital death by arterial oxygen levels. Loess smoothing curve predicted from logistic regression model adjusted for spline functions of age, lowest glucose, AP4-adj and PaCO2. Grey zones represent 95 % confidence intervals

pO_2 (mmHg)

Case

- MAP = 70 mmHg
- HR = 110/min
- SaO_2 = 100%
- Temp = 36,8°C

- Reduce FiO_2
- Decrease TV/RR

- pO_2 = 320 mmHg (42 kPa)
- pCO_2 = 32 mmHg (4,3 kPa)
- pH = 7,12
- Lactate = 13 mmol/L
- Glucose = 280 mg/dL (15,5 mmol/L)
- K = 3,6 mmol/L
- Na = 136 mmol/L

Overview

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http://dx.doi.org/10.1016/j.jacc.2015.05.009

THE PRESENT AND FUTURE

COUNCIL PERSPECTIVES

Cardiac Arrest

A Treatment Algorithm for Emergent Invasive Cardiac Procedures in the Resuscitated Comatose Patient

Tanveer Rab, MD,* Karl B. Kern, MD,† Jacqueline E. Tamis-Holland, MD,‡ Timothy D. Henry, MD,§ Michael McDaniel, MD,‖ Neal W. Dickert, MD, PhD,* Joaquin E. Cigarroa, MD,¶ Matthew Keadey, MD,# Stephen Ramee, MD,** on behalf of the Interventional Council, American College of Cardiology

58% of CA patients without ST-elevation have significant CAD

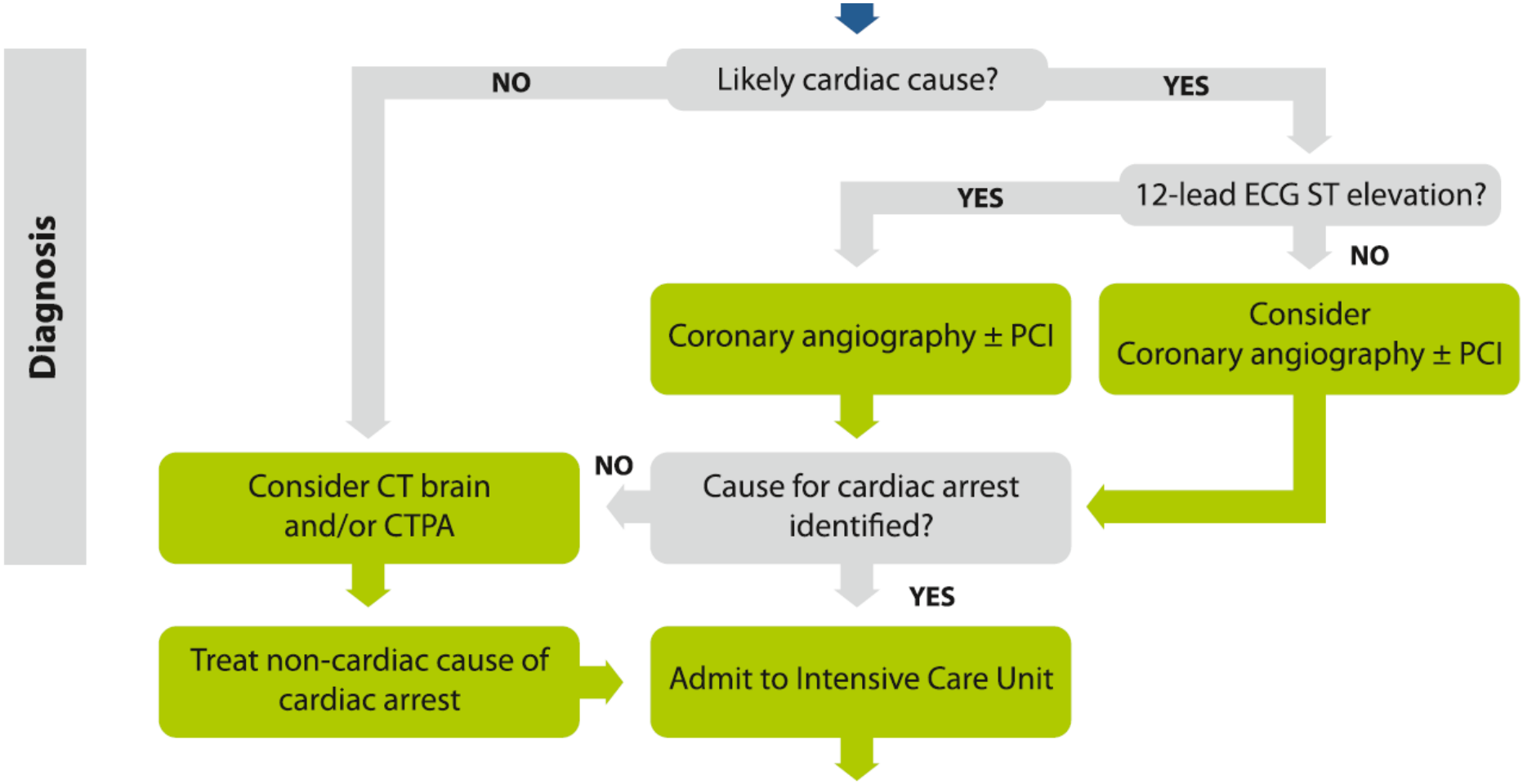
TABLE 2 Angiographic Findings in Patients With Cardiac Arrest and No ST-Segment Elevation on ECG

First Author, Year (Ref. #)	Acute Occlusion	Culprit Lesion*	Significant CAD†
Merchant et al., 2008 (55)	6/17 (35)	–	10/17 (55)
Reynolds et al., 2009 (14)	–	–	31/54 (57)
Anyfantakis et al., 2009 (56)	–	–	27/44 (61)
Radsel et al., 2011 (31)	4/54 (7)	13/54 (24)	32/54 (59)
Bro-Jeppesen et al., 2012 (30)	–	–	43/82 (52)
Dumas et al., 2010 (3)	–	–	176/301 (58)
Hollenbeck et al., 2014 (25)	44/163 (27)	–	–
Kern et al., 2015 (52)	23	33	–
Total (%)	23	29	58

Values are n/N (%) or %. *Defined as acute occlusion or irregular plaque morphology with or without thrombus. †Defined according to the definition used in each study.

CAD = coronary artery disease; ECG = electrocardiogram.

Post-ROSC coronary angiography



Significance of arterial hypotension after resuscitation from cardiac arrest*

Stephen Trzeciak, MD, MPH; Alan E. Jones, MD; J. Hope Kilgannon, MD; Barry Milcarek, PhD; Krystal Hunter, MBA; Nathan I. Shapiro, MD, MPH; Steven M. Hollenberg, MD; R. Phillip Dellinger, MD; Joseph E. Parrillo, MD

(Crit Care Med 2009; 37:2895–2903)

8.736 patients, 120 ICUs US

Hypotension: one or more documented SBP <90 mmHg within 1 hr of ICU arrival

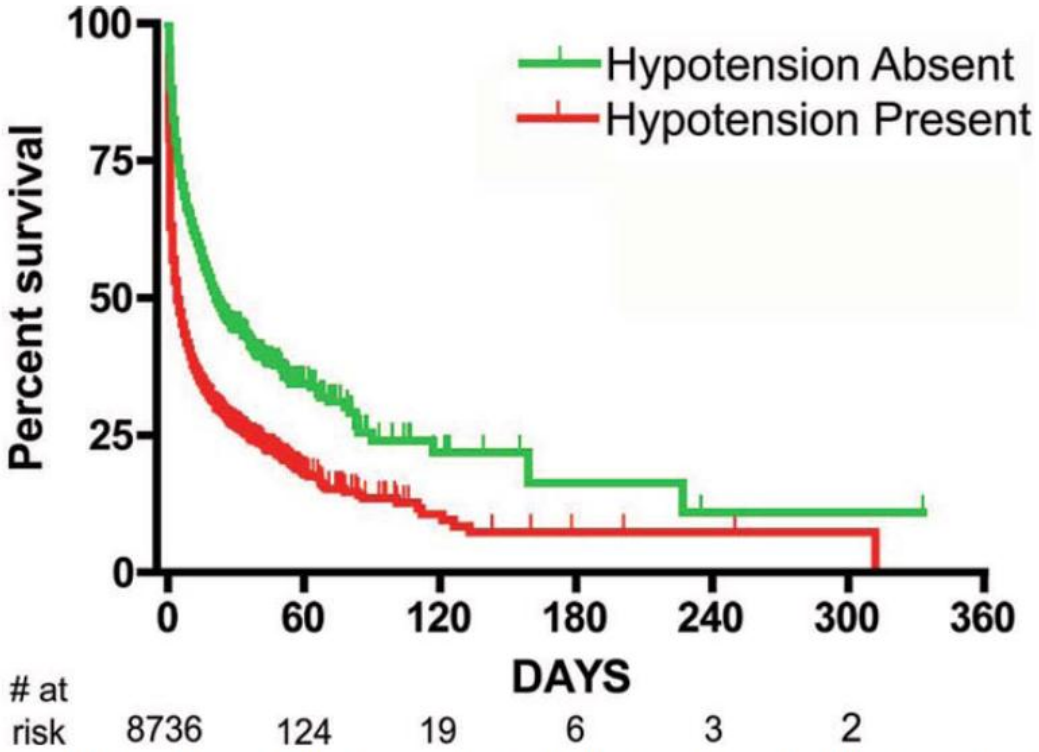


Figure 1. Kaplan-Meier survival curves for patients with Hypotension Present and Hypotension Absent after return of spontaneous circulation from cardiac arrest (with censoring). The survival fractions diverged significantly by log-rank test ($p < .001$).

Resuscitation 90 (2015) 121–126

Contents lists available at ScienceDirect

Resuscitation

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

Clinical Paper

An observational near-infrared spectroscopy study on cerebral autoregulation in post-cardiac arrest patients: Time to drop 'one-size-fits-all' hemodynamic targets?☆

K. Ameloot[a,*,1], C. Genbrugge[b,c,1], I. Meex[b,c], F. Jans[b,c], W. Boer[b], M. Vander Laenen[b], B. Ferdinande[a], W. Mullens[a,c], M. Dupont[a], J. Dens[a,c], C. DeDeyne[b,c]

[a] Department of Cardiology, Ziekenhuis Oost-Limburg, Genk, Belgium
[b] Department of Anesthesiology and Critical Care Medicine, Ziekenhuis Oost-Limburg, Genk, Belgium
[c] Faculty of Medicine and Life Sciences, University Hasselt, Diepenbeek, Belgium

- **51 patients after CA**
- **NIRS measurment of cerebral oxygen saturation**
- **35% disturbed autoregulation (independant predictor for poor outcome)**

Resuscitation 90 (2015) 121–126

Contents lists available at ScienceDirect

Resuscitation

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

EUROPEAN RESUSCITATION COUNCIL

Clinical Paper

An observational near-infrared spectroscopy study on cerebral autoregulation in post-cardiac arrest patients: Time to drop 'one-size-fits-all' hemodynamic targets?☆

K. Ameloot[a,*,1], C. Genbrugge[b,c,1], I. Meex[b,c], F. Jans[b,c], W. Boer[b], M. Vander Laenen[b], B. Ferdinande[a], W. Mullens[a,c], M. Dupont[a], J. Dens[a,c], C. DeDeyne[b,c]

[a] Department of Cardiology, Ziekenhuis Oost-Limburg, Genk, Belgium
[b] Department of Anesthesiology and Critical Care Medicine, Ziekenhuis Oost-Limburg, Genk, Belgium
[c] Faculty of Medicine and Life Sciences, University Hasselt, Diepenbeek, Belgium

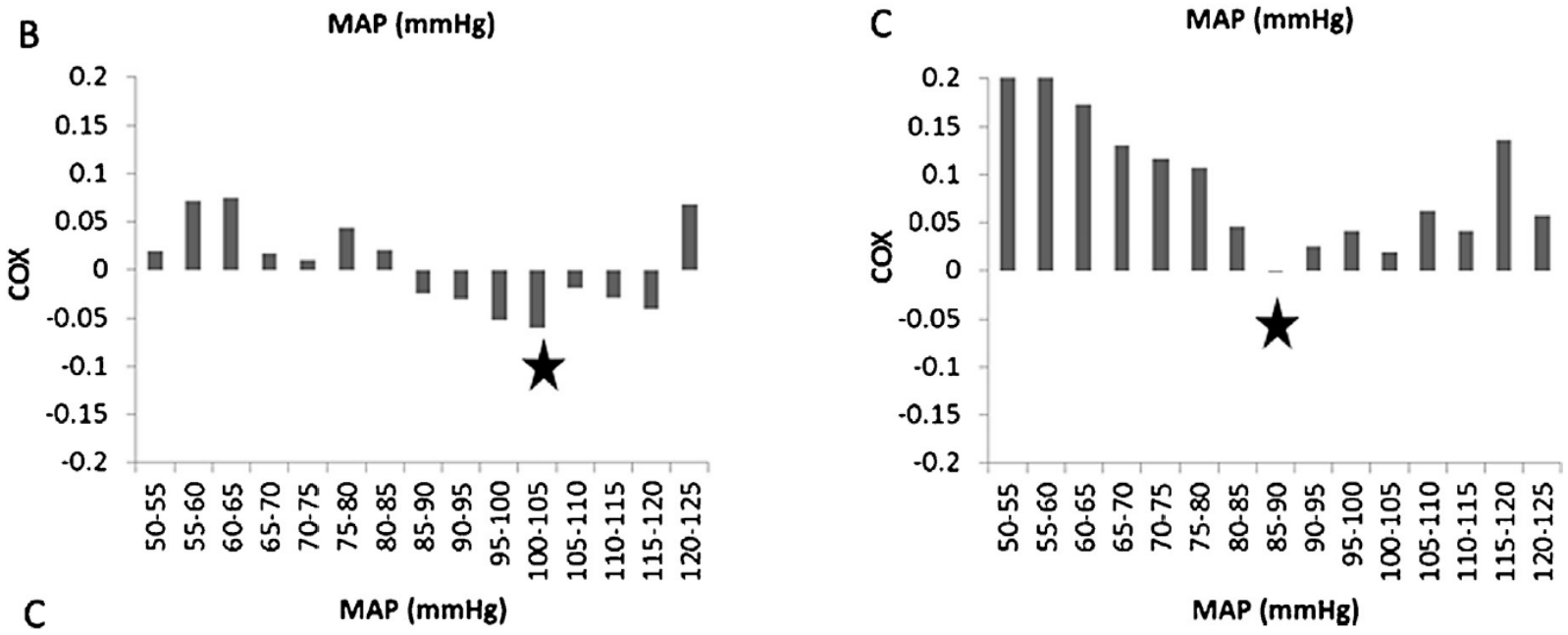


Fig. 2. Pooled COX per 5 mmHg MAP plot. (A) For all 51 study patients, (B) for 18 patients with disturbed/right shifted autoregulation, (C) for 33 patients with preserved autoregulation. * Cox predicted optimal MAP.

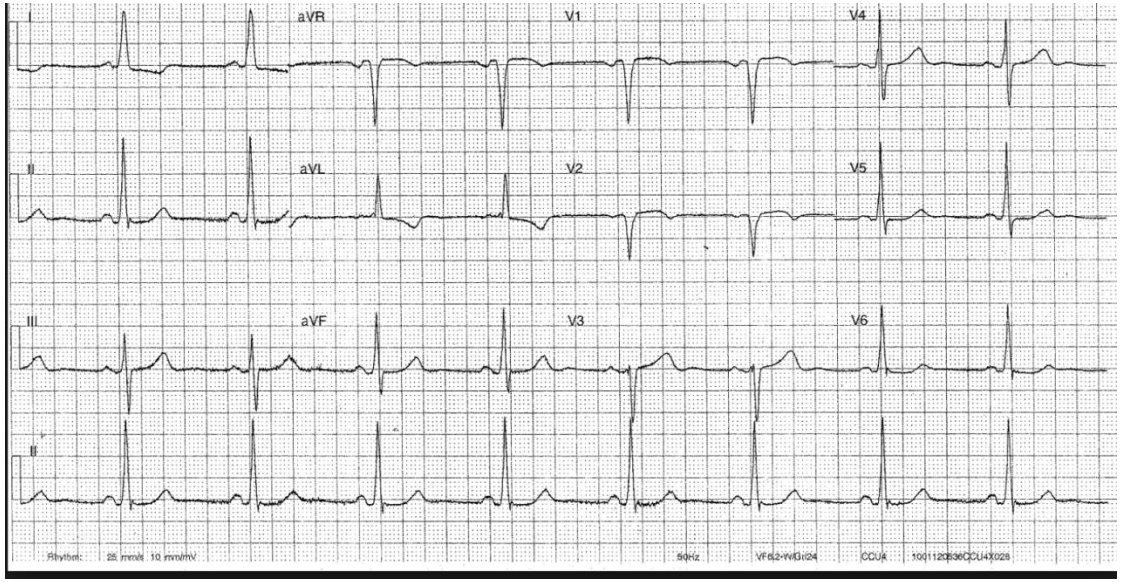
Case

- MAP = 70 mmHg
- HR = 110/min
- SaO_2 = 100%
- Temp = 36,8°C

- Give fluids
- Give vasopressors
- Aim MAP 80-100 mmHg

- pO_2 = 320 mmHg (42 kPa)
- pCO_2 = 32 mmHg (4,3 kPa)
- pH = 7,12
- Lactate = 13 mmol/L
- Glucose = 280 mg/dL (15,5 mmol/L)
- K = 3,6 mmol/L
- Na = 136 mmol/L

Case



Consider cath-lab

Overview

- Introduction
- Ventilation and oxygenation strategies
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- **Metabolic control**
- Antibiotic therapy
- Targeted temperature management
- Cardiac arrest center
- Conclusions and recommendations

Resuscitation 80 (2009) 624–630

Contents lists available at ScienceDirect

Resuscitation

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

Clinical paper

Derangements in blood glucose following initial resuscitation from in-hospital cardiac arrest: A report from the national registry of cardiopulmonary resuscitation☆

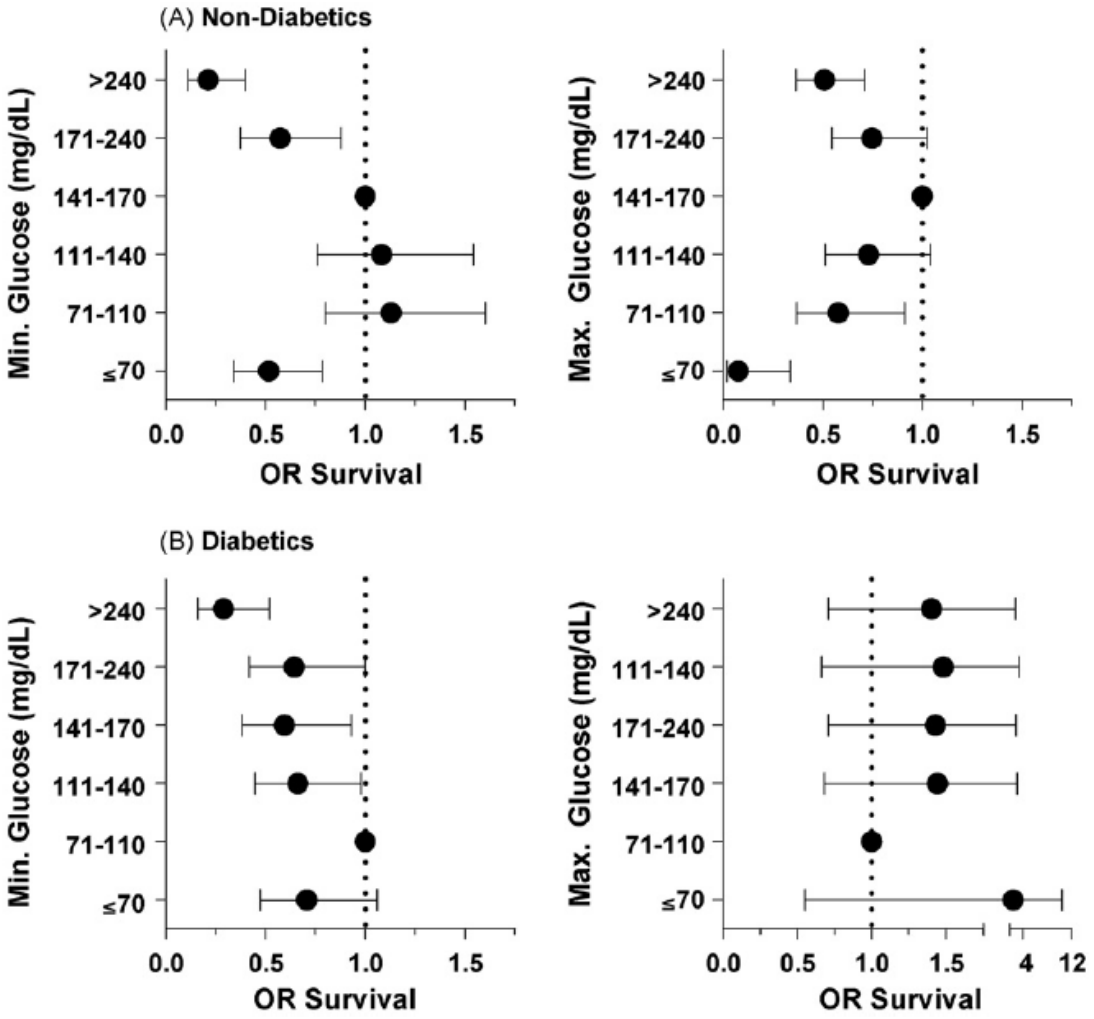
David G. Beiser[a,*,d], Gordon E. Carr[b,d], Dana P. Edelson[b,d], Mary Ann Peberdy[c,d], Terry L. Vanden Hoek[a,d]

[a] Section of Emergency Medicine, Department of Medicine, University of Chicago, Chicago, IL 60637, USA
[b] Section of Pulmonary and Critical Care Medicine, Department of Medicine, University of Chicago, Chicago, IL 60637, USA
[c] Division of Cardiology, Virginia Commonwealth University, Richmond, VA 23298, USA

17.800 adult IHCA

Odds ratio of survival

after CA



Case

- MAP = 70 mmHg
- HR = 110/min
- SaO_2 = 100%
- Temp = 36,8°C

- Consider insulin
- Avoid hypoglycemia

- pO_2 = 320 mmHg (42 kPa)
- pCO_2 = 32 mmHg (4,3 kPa)
- pH = 7,12
- Lactate = 13 mmol/L
- Glucose = 280 mg/dL (15,5 mmol/L)
- K = 3,6 mmol/L
- Na = 136 mmol/L

Overview

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- Conclusions and recommendations

Resuscitation 92 (2015) 154–159

Contents lists available at ScienceDirect

Resuscitation

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

Clinical Paper

Prophylactic antibiotics are associated with a lower incidence of pneumonia in cardiac arrest survivors treated with targeted temperature management☆

David J. Gagnon[a,*], Niklas Nielsen[b], Gilles L. Fraser[a,c], Richard R. Riker[c,d,e], John Dziodzio[c], Kjetil Sunde[f], Jan Hovdenes[g], Pascal Stammet[h], Hans Friberg[i], Sten Rubertsson[j], Michael Wanscher[k], David B. Seder[c,d,e]

Retrospective CA patients 32-34°C:

- **416 pts prophylactic AB**
- **824 pts no prophylactic AB**

lower incidence of pneumonia (OR 0.09, 95% 0.06–0.14, p<0.001)

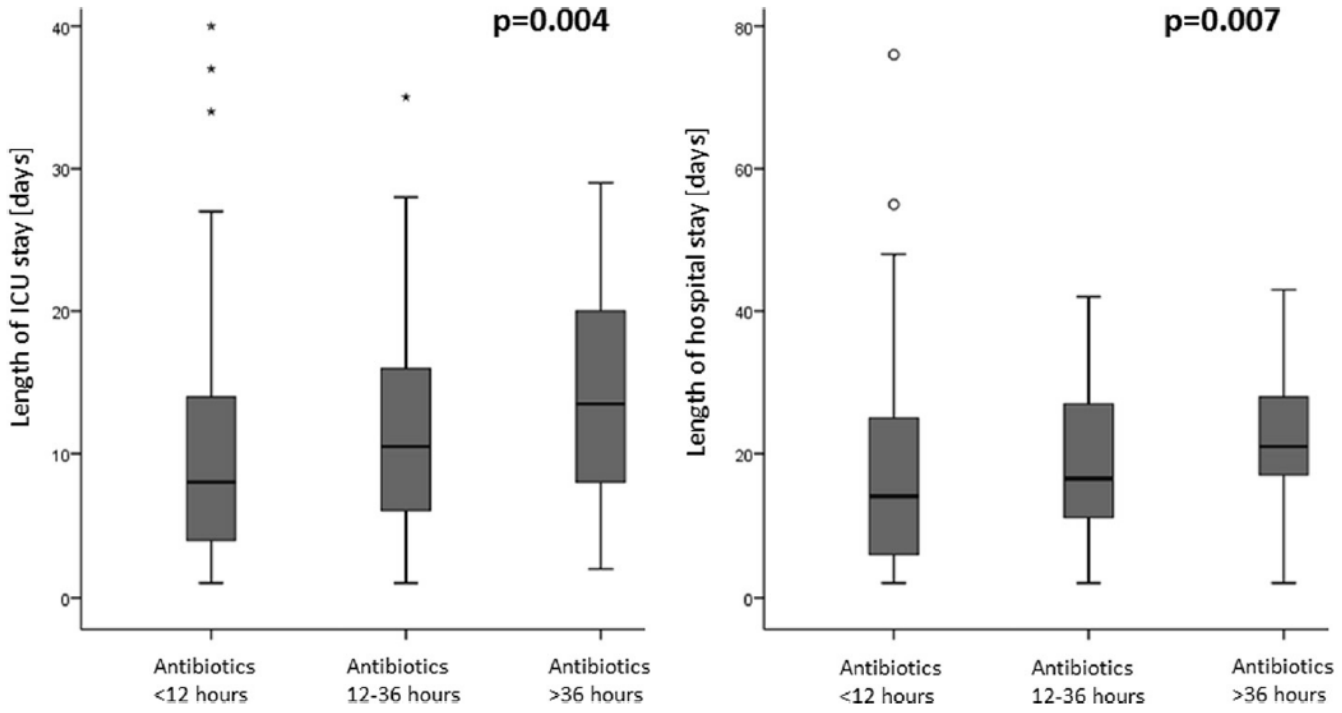

Fig. 3 Influence of timing of antibiotic therapy on the length of the ICU stay and the length of hospital stay

Overview

- Introduction
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- Cardiac arrest center
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Resuscitation 95 (2015) 202–222

Contents lists available at ScienceDirect

Resuscitation

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

2015 Recommendations

European Resuscitation Council and European Society of Intensive Care Medicine Guidelines for Post-resuscitation Care 2015
Section 5 of the European Resuscitation Council Guidelines for Resuscitation 2015☆

Jerry P. Nolan[a,b,*], Jasmeet Soar[c], Alain Cariou[d], Tobias Cronberg[e], Véronique R.M. Moulaert[f], Charles D. Deakin[g], Bernd W. Bottiger[h], Hans Friberg[i], Kjetil Sunde[j], Claudio Sandroni[k]

- **Maintain a constant, target temperature between 32°C and 36°C for those patients in whom temperature control is used**
- **TTM recommended: comatose adults after OHCA with an initial shockable rhythm**
- **TTM suggested:**
  - **comatose adults after OHCA with initial non-shockable rhythm**
  - **Comatose adults after IHCA with any initial rhythm**
- **If TTM is used: duration at least 24**

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest

Niklas Nielsen, M.D., Ph.D., Jørn Wetterslev, M.D., Ph.D., Tobias Cronberg, M.D., Ph.D.,

This article was published on November 17, 2013, at NEJM.org.

"In conclusion, our trial does not provide evidence that targeting a body temperature of 33°C confers any benefit for unconscious patients admitted to the hospital after out-of-hospital cardiac arrest, as compared with targeting a body temperature of 36°C."

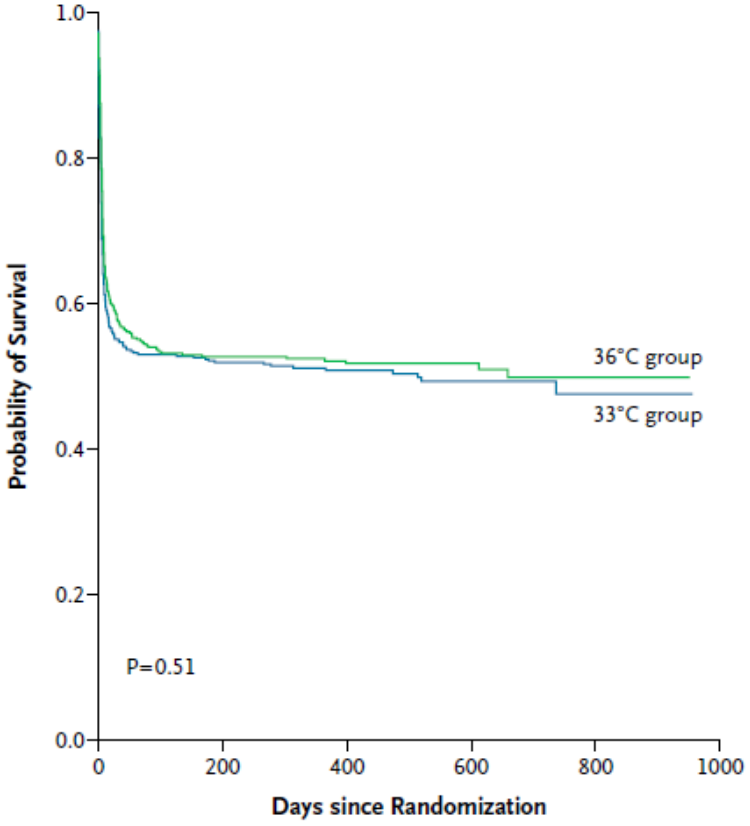


Figure 2. Probability of Survival through the End of the Trial.

Shown are Kaplan–Meier estimates of the probability of survival for patients assigned to a target temperature of either 33°C or 36°C and the number of patients at risk at each time point. The P value was calculated by means of Cox regression, with the effect of the intervention adjusted for the stratification variable of study site.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest

Niklas Nielsen, M.D., Ph.D., Jørn Wetterslev, M.D., Ph.D., Tobias Cronberg, M.D., Ph.D.,

This article was published on November 17, 2013, at NEJM.org.

Limitations of the study:

- No definition of sedation, analgesia, paralysis
- No definition of cooling methods or goals
- No information on timing of cooling with respect to ROSC
- Majority of patients had very short no-flow time (1 min)

33°C or 36°C ?????

More science after publication of the guidelines

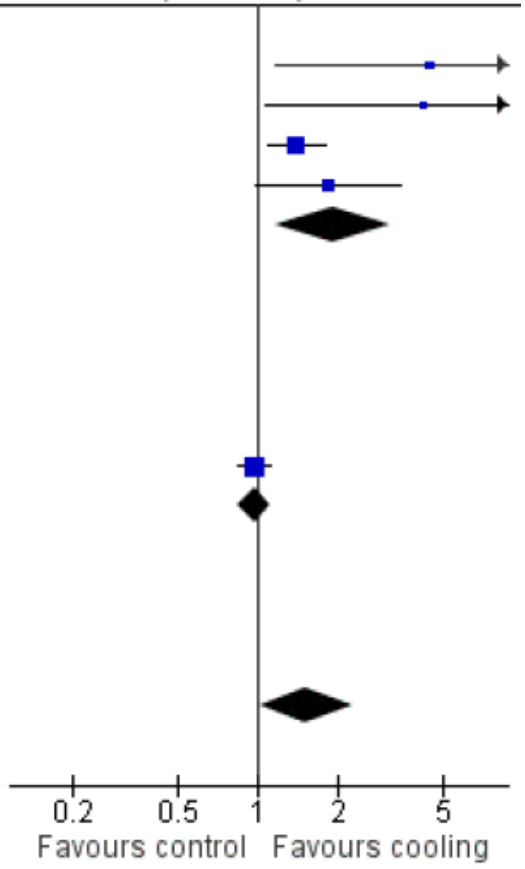
Cochrane Library
Trusted evidence.
Informed decisions.
Better health.

Meta-analysis of randomized trials

Arrich J, Cochrane Database Syst Rev. 2016

Good neurologic outcome (CPC 1 or 2)

Study or Subgroup	cooling to 33°C Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
1.2.1 Conventional cooling vs no cooling						
Mori 2000	18	36	2	18	7.3%	4.50 [1.17, 17.30]
Hachimi-Idrissi 2001	8	16	2	17	6.9%	4.25 [1.06, 17.08]
HACA 2002	75	136	54	137	31.7%	1.40 [1.08, 1.81]
Bernard 2002	21	43	9	34	19.1%	1.84 [0.97, 3.49]
Subtotal (95% CI)		**231**		**206**	**65.1%**	**1.94 [1.18, 3.21]**
Total events	122		67			
Heterogeneity: Tau² = 0.12; Chi² = 5.70, df = 3 (P = 0.13); I² = 47%						
Test for overall effect: Z = 2.60 (P = 0.009)						
1.2.2 Conventional cooling vs 36° temperature management						
Nielsen 2013	218	469	222	464	34.9%	0.97 [0.85, 1.11]
Subtotal (95% CI)		**469**		**464**	**34.9%**	**0.97 [0.85, 1.11]**
Total events	218		222			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.42 (P = 0.68)						
Total (95% CI)		**700**		**670**	**100.0%**	**1.53 [1.02, 2.29]**
Total events	340		289			
Heterogeneity: Tau² = 0.12; Chi² = 17.28, df = 4 (P = 0.002); I² = 77%						
Test for overall effect: Z = 2.04 (P = 0.04)						
Test for subgroup differences: Chi² = 6.84, df = 1 (P = 0.009), I² = 85.4%						



Post Resuscitation Care

AS073

Impact of change to target temperature management on post-arrest care for out-of-hospital cardiac arrest patients

Janet Bray[1,*], Dion Stub[2], Jason Bloom[2], Louise Segan[2], Biswadev Mitra[2], Karen Smith[3], Judith Finn[4], Stephen Bernard[2]

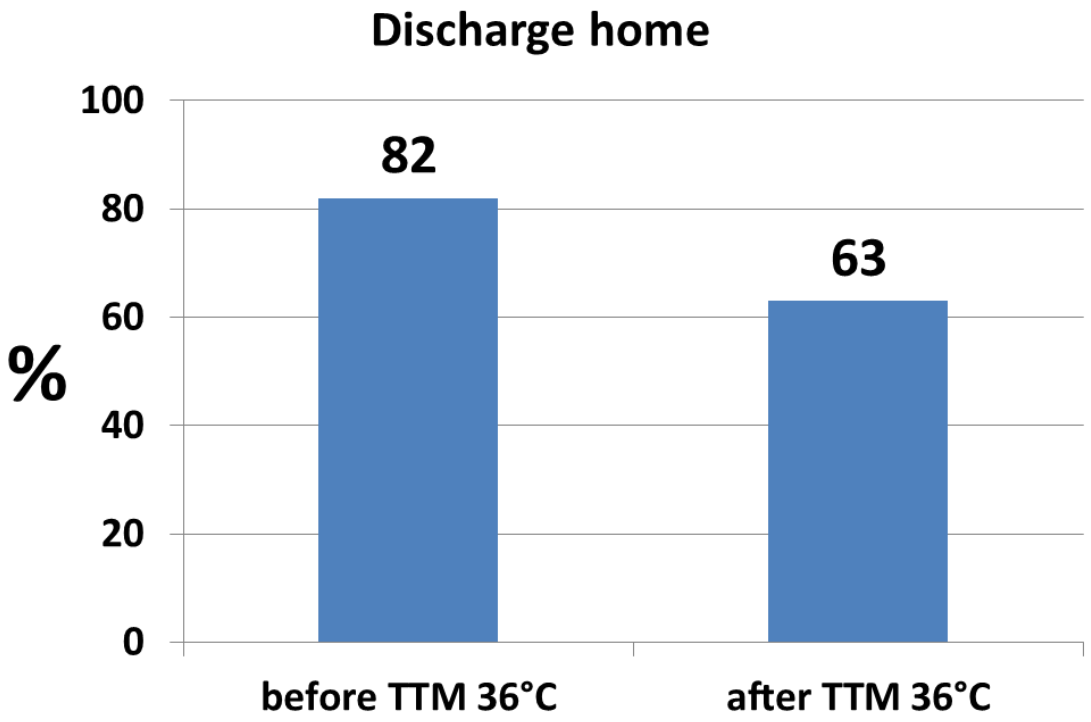
[1] *Monash University, Melbourne, Victoria, Australia*
[2] *Alfred Hospital, Melbourne, Victoria, Australia*
[3] *Ambulance Victoria, Melbourne, Victoria, Australia*
[4] *Curtin University, Perth, Western Australia, Australia*

Purpose of the study: In December 2013, our institution changed the target temperature for post cardiac arrest patients from 33 °C to 36 °C. The aim of this study is to examine the actual temperatures that were achieved and the impact on patient outcomes.

Materials and methods: We conducted an audit of consecutive ventricular fibrillation out-of-hospital cardiac arrest (VF-OHCA) patients admitted to a tertiary referral hospital in Melbourne (Australia). We excluded traumatic OHCAs.

Results: Over the two-year period there were 70 VF-OHCAs admitted (28 before TTM change and 42 after). The median duration of arrest was 16 (IQR = 19) minutes. Patients' demographics, arrest features (e.g. witnessed, bystander CPR etc.) and admissions to the intensive care unit (ICU, 82% vs. 71%, $p = 0.31$) were similar between the two periods. There was no difference in ED cardiology consults (93% vs. 100%, $p = 0.15$), coronary angiography during admission (79% vs. 76%, $p = 0.82$) and all patients admitted to ICU had documented orders for TTM. Compliance with targeted temperature management was significantly worse in the 36 °C target period: the average time at or below target temperature was significantly shorter after the change (22 h vs. 8 h, $p < 0.001$) and 50% of patients recorded temperatures >37.1 °C in the first 24-h after the target change. In ICU patients, rates of survival to hospital discharge were lower in the 36 °C period (74% vs. 63%, $p = 0.41$), as were the numbers of survivors discharged home (82% vs. 63%, $p = 0.34$). A higher temperature (>37.1 °C) in the first 24-h of ICU admission was

- VF-OOH CA
- 2 year period
- 28 patients before TTM change (32-34°C)
- 42 patients after TTM change (36°)



Resuscitation 98 (2016) 48–63

Contents lists available at ScienceDirect

Resuscitation

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

Canadian Guidelines for the use of targeted temperature management (therapeutic hypothermia) after cardiac arrest: A joint statement from The Canadian Critical Care Society (CCCS), Canadian Neurocritical Care Society (CNCCS), and the Canadian Critical Care Trials Group (CCCTG)

Clinical question	Recommendation
What temperature should patients be cooled to?	We suggest that patients undergoing TTM be cooled to a target temperature between 32 °C and 34 °C
How soon should TTM be initiated?	We recommend that clinicians attempt to achieve target temperature as rapidly as possible

Case

- MAP = 70 mmHg
- HR = 110/min
- SaO_2 = 100%
- Temp = 36,8°C

Cool to 33°C as soon as feasible!

- pO_2 = 320 mmHg (42 kPa)
- pCO_2 = 32 mmHg (4,3 kPa)
- pH = 7,12
- Lactate = 13 mmol/L
- Glucose = 280 mg/dL (15,5 mmol/L)
- K = 3,6 mmol/L
- Na = 136 mmol/L

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- Conclusions and recommendations

In which hospitals should we treat CA patients?

ELSEVIER

Resuscitation 43 (2000) 201–211

RESUSCITATION

www.elsevier.com/locate/resuscitation

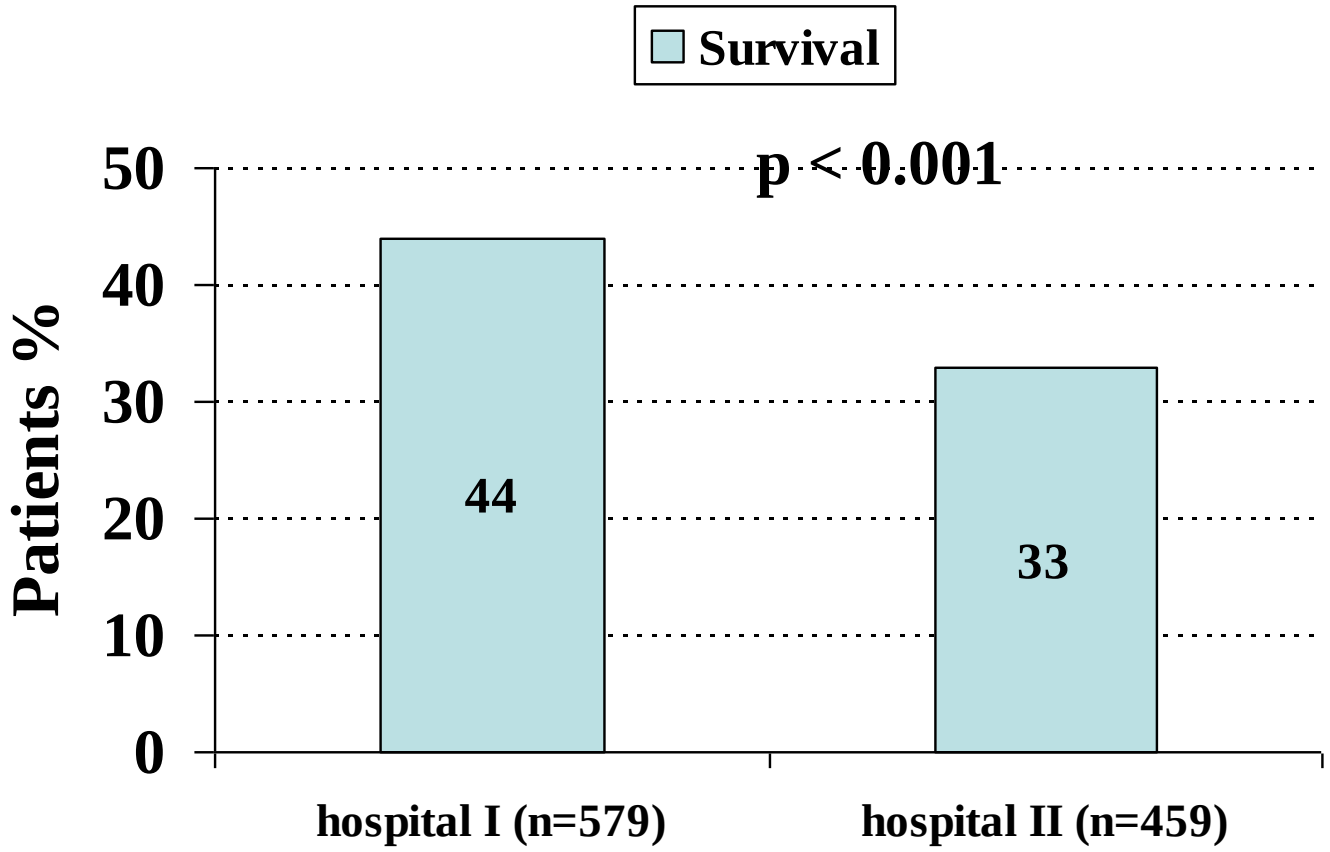
Is hospital care of major importance for outcome after out-of-hospital cardiac arrest? Experience acquired from patients with out-of-hospital cardiac arrest resuscitated by the same Emergency Medical Service and admitted to one of two hospitals over a 16-year period in the municipality of Göteborg

Johan Engdahl *, Putte Abrahamsson, Angela Bång, Jonny Lindqvist, Thomas Karlsson, Johan Herlitz

Division of Cardiology, Sahlgrenska University Hospital, SE-413 435, Göteborg, Sweden

Received 14 June 1999; received in revised form 8 November 1999; accepted 18 November 1999

In which hospitals should we treat CA patients?



In which hospitals should we treat CA patients?

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Clinical paper

Inter-hospital variability in post-cardiac arrest mortality☆

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Mortality ranging from 46% to 68%

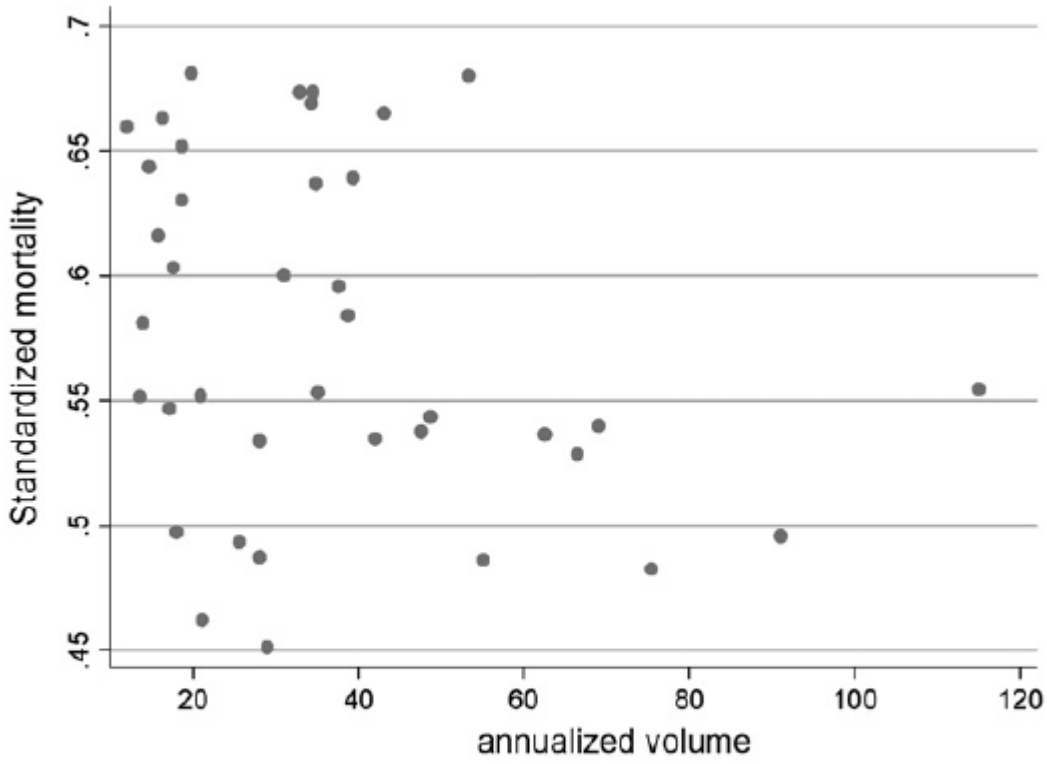


Figure 2. In-hospital mortality rate (mortality rates standardized by age, acute physiology score, Glasgow Coma Scale on admission and ventilation status) vs. annualized post-arrest volume: scatter plot of APACHE ICUs.

Overview

- Introduction
- Ventilation and oxygenation strategies
- Reperfusion strategies
- Metabolic control
- Antibiotic therapy
- Targeted temperature management
- Cardiac arrest center
- **Conclusions and recommendations**

Conclusion I

- **Ventilation and oxygenation strategies (Guidelines ERC 2015):**
  - ***"… titrate the inspired oxygen concentration to maintain the arterial blood oxygen saturation in the range of 94–98%. Avoid hypoxaemia,"***
  - ***"… it is reasonable to adjust ventilation to achieve normocarbia"***
- **Reperfusion strategies (Guidelines ERC 2015):**
  - ***" … PCI for post-cardiac arrest patients with STEMI … it is reasonable to discuss and consider emergent cardiac catheterisation laboratory evaluation after ROSC in patients with the highest risk of a coronary cause for their cardiac arrest."***
  - **Avoid hypotension**
- **Metabolic control (Guidelines ERC 2015):**
  - ***"… following ROSC blood glucose should be maintained at ≤10mmol/L (180mg/dl). Hypoglycaemia should be avoided."***
- **Mild therapeutic hypothermia 32-34°C (Guidelines Canada 2016)**
  - **All VF a "must", all non-VF a "can", avoid fever**
  - **As early as possible, pre-hospital setting?**

Conclusion I

- Ventilation and oxygenation strategies:
  - *"… titrate the inspired oxygen concentration to maintain the arterial blood oxygen saturation in the range of 94–98%. Avoid hypoxaemia,"*
  - *"… it is reasonable to adjust ventilation to achieve normocarbia"*
- Reperfusion strategies
  - *" … PCI for post-cardiac arrest patients with STEMI … it is reasonable to discuss and consider emergent cardiac catheterisation laboratory evaluation after ROSC in patients with the highest risk of a coronary cause for their cardiac arrest."*
  - Avoid hypotension
- Metabolic control
  - *"… following ROSC blood glucose should be maintained at ≤10mmol/L (180mg/dl). Hypoglycaemia should be avoided."*

?

limited evidence

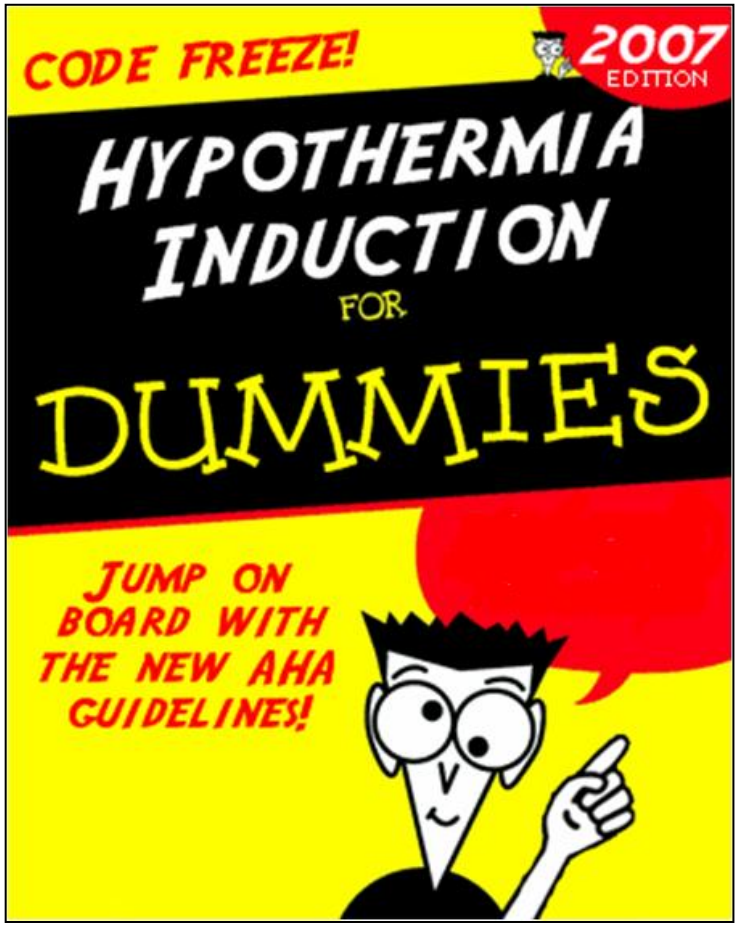
- **Mild therapeutic hypothermia 32-34°C (Guidelines Canada 2016)**
  - **All VF a "must", all non-VF a "can", avoid fever**
  - **As early as possible, pre-hospital setting?**

RCTs!!!!

Conclusion II

Implementation of

cardiac arrest centres!!!!!



Be Hot **Cool Down**