Post-Resuscitation Care

Prof. Wilhelm Behringer
Center of Emergency Medicine
University of Jena

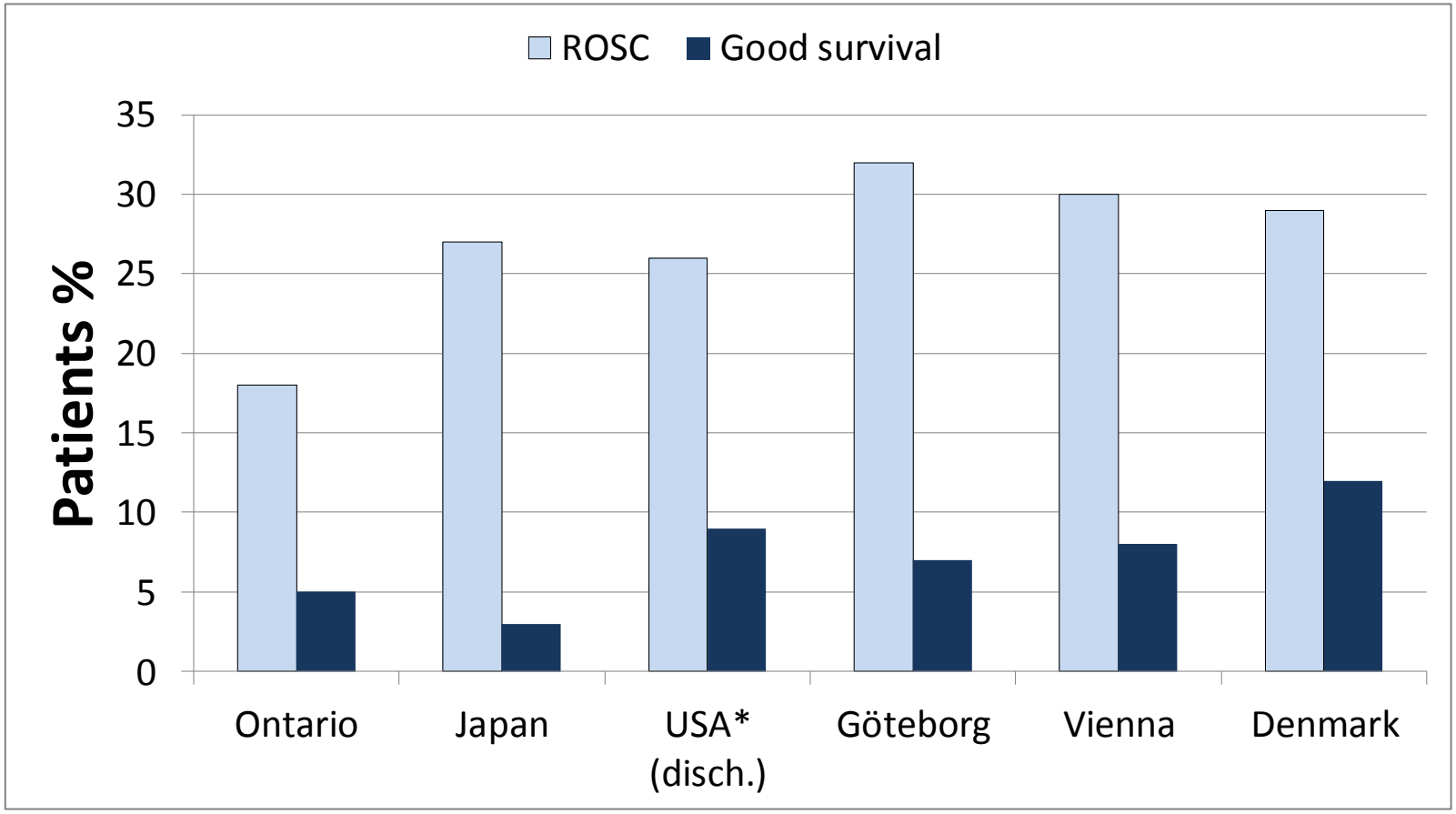
Conflict of interest

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
Tanberg, Eur H J 2017

What happens after ROSC?

Resuscitation 95 (2015) 202–222

Contents lists available at ScienceDirect

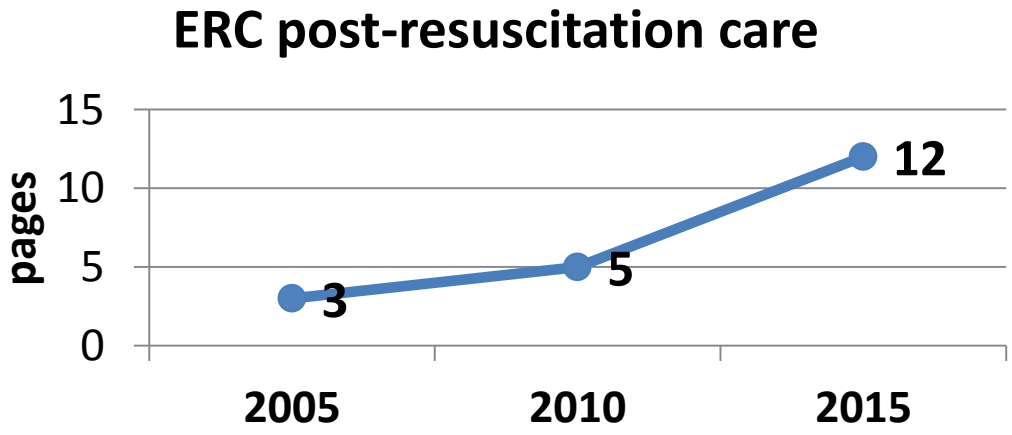
Resuscitation

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

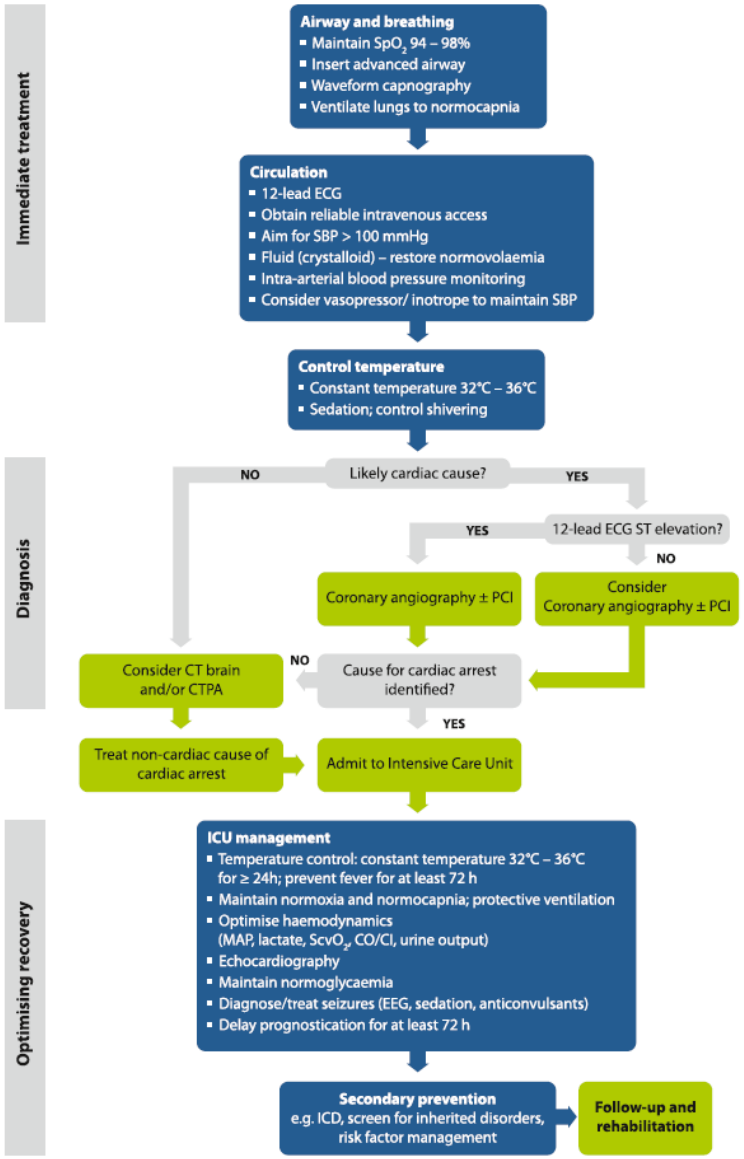


Fig. 5.1. Post-resuscitation care algorithm. SBP: systolic blood pressure; PCI: percutaneous coronary intervention; CTPA: computed tomography pulmonary angiogram; ICU: intensive care unit; MAP: mean arterial pressure; $ScvO_2$: central venous oxygenation; CO/CI: cardiac output/cardiac index; EEG: electroencephalography;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

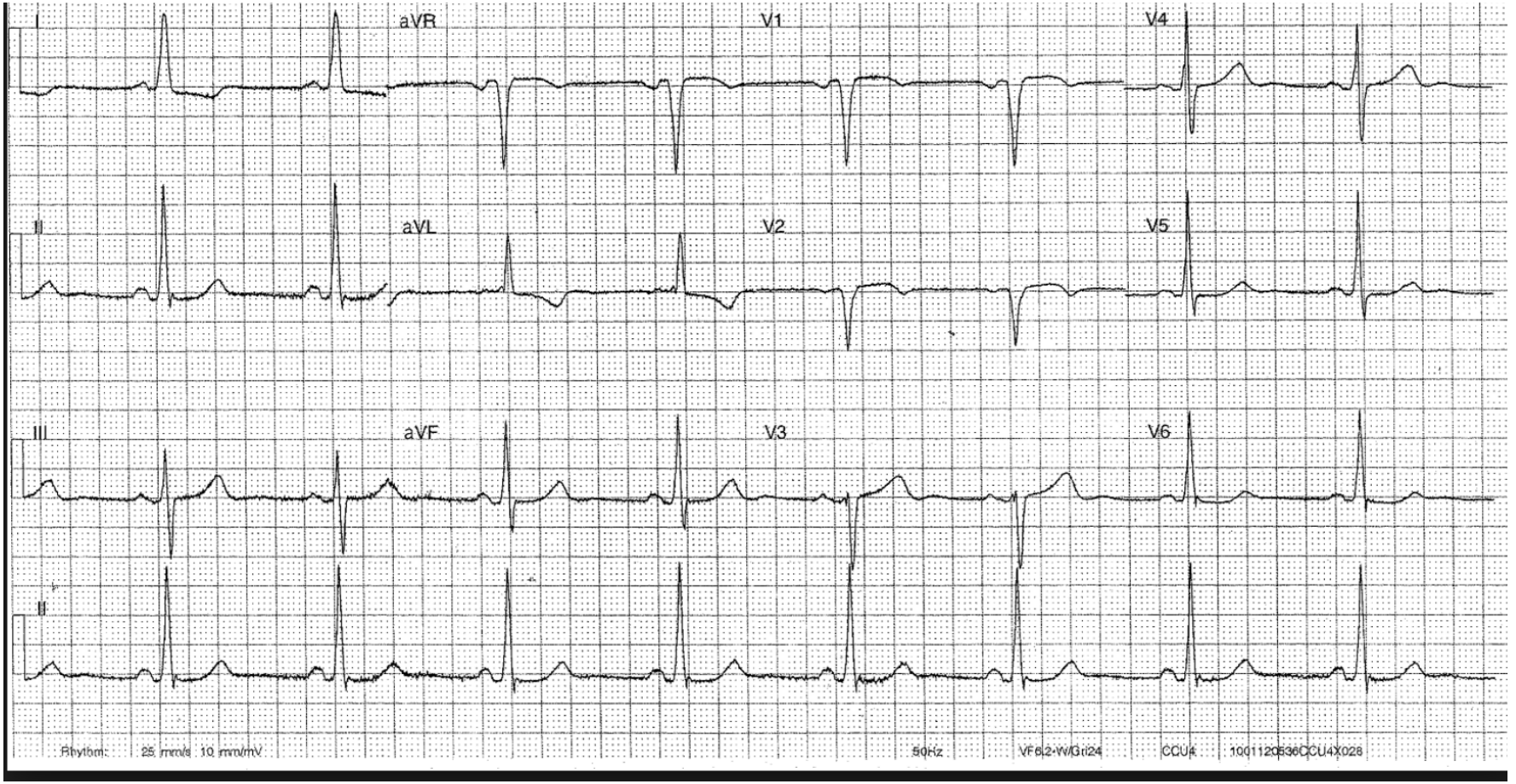
Case

- 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

Resuscitation 85 (2014) 1142–1148

Contents lists available at ScienceDirect

Resuscitation

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

Review

The effect of hyperoxia on survival following adult cardiac arrest: A systematic review and meta-analysis of observational studies☆

Chih-Hung Wang[a,b], Wei-Tien Chang[a], Chien-Hua Huang[a], Min-Shan Tsai[a], Ping-Hsun Yu[c], An-Yi Wang[a], Nai-Chuan Chen[d], Wen-Jone Chen[a,e,*]

[a] Department of Emergency Medicine, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan
[b] Graduate Institute of Clinical Medicine, College of Medicine, National Taiwan University, Taipei, Taiwan
[c] Department of Emergency Medicine, Taipei Hospital, Ministry of Health and Welfare, New Taipei City, Taiwan
[d] Department of Emergency Medicine, Tao Yuan General Hospital, Ministry of Health and Welfare, Taoyuan, Taiwan
[e] Department of Emergency Medicine, Lotung Poh-Ai Hospital, Yilan County, Taiwan

- **14 studies**
- **Hyperoxia: PaO2 > 300 mmHg**
- **Hypoxia: PaO2 < 60 mmHg**

Ventilation and oxygenation

Resuscitation 85 (2014) 1142–1148

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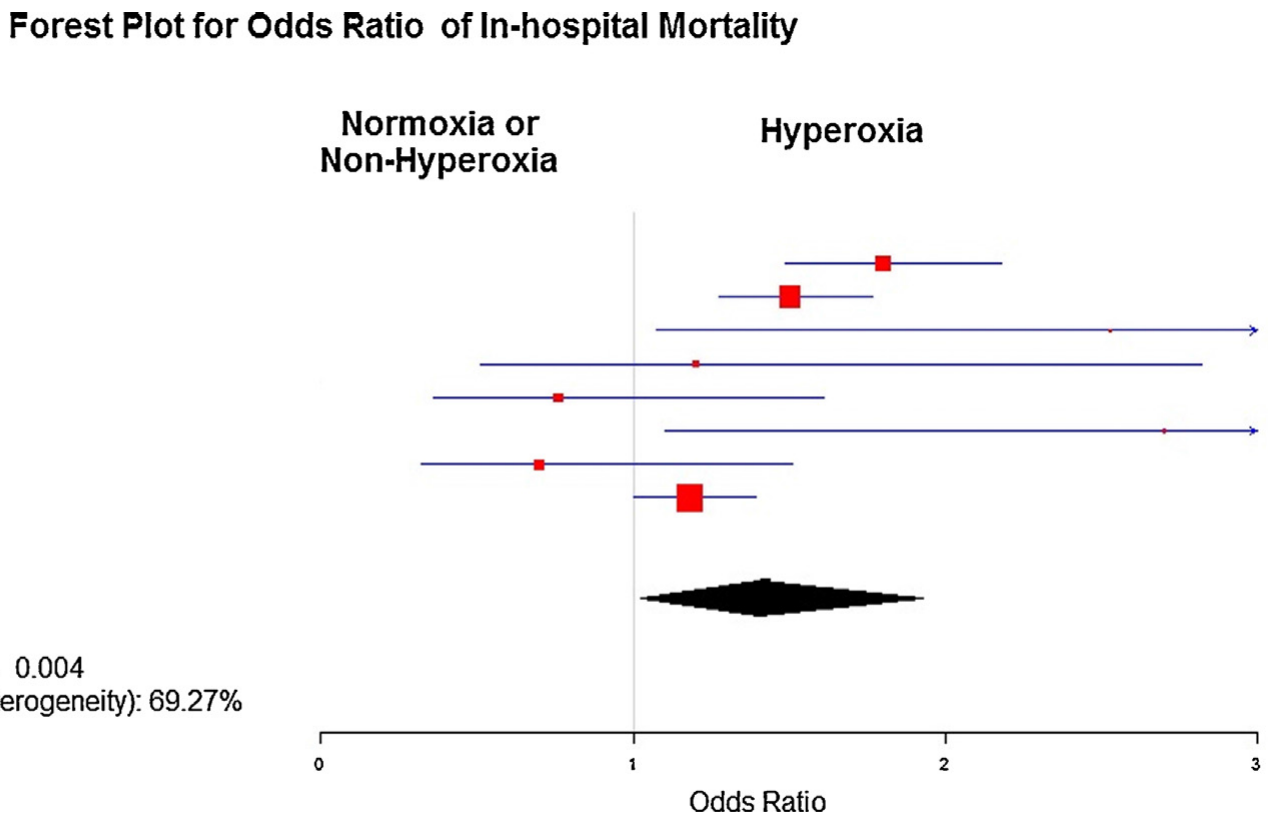

Fig. 2. Forest plot for odds ratios of in-hospital mortality.

Ventilation and oxygenation

Resuscitation 104 (2016) 83–90

Contents lists available at ScienceDirect

Resuscitation

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

Clinical paper

Targeted therapeutic mild hypercapnia after cardiac arrest: A phase II multi-centre randomised controlled trial (the CCC trial)☆

Glenn M. Eastwood[a,*], Antoine G. Schneider[b], Satoshi Suzuki[c], Leah Peck[a], Helen Young[a], Aiko Tanaka[a], Johan Mårtensson[a], Stephen Warrillow[a], Shay McGuinness[d], Rachael Parke[d], Eileen Gilder[d], Lianne Mccarthy[d], Pauline Galt[e], Gopal Taori[e], Suzanne Eliott[e], Tammy Lamac[f], Michael Bailey[g], Nerina Harley[h], Deborah Barge[h], Carol L. Hodgson[i], Maria Cristina Morganti-Kossmann[j,k], Alice Pébay[l,m], Alison Conquest[l,m], John S. Archer[n], Stephen Bernard[j], Dion Stub[o], Graeme K. Hart[a], Rinaldo Bellomo[a]

24 hours:

- **target normocapnia (TN) (PaCO2 35–45 mmHg) (n=41)**
- **mild hypercapnia (TTMH) (PaCO2 50–55 mmHg) (n=42)**

Resuscitation 104 (2016) 83–90

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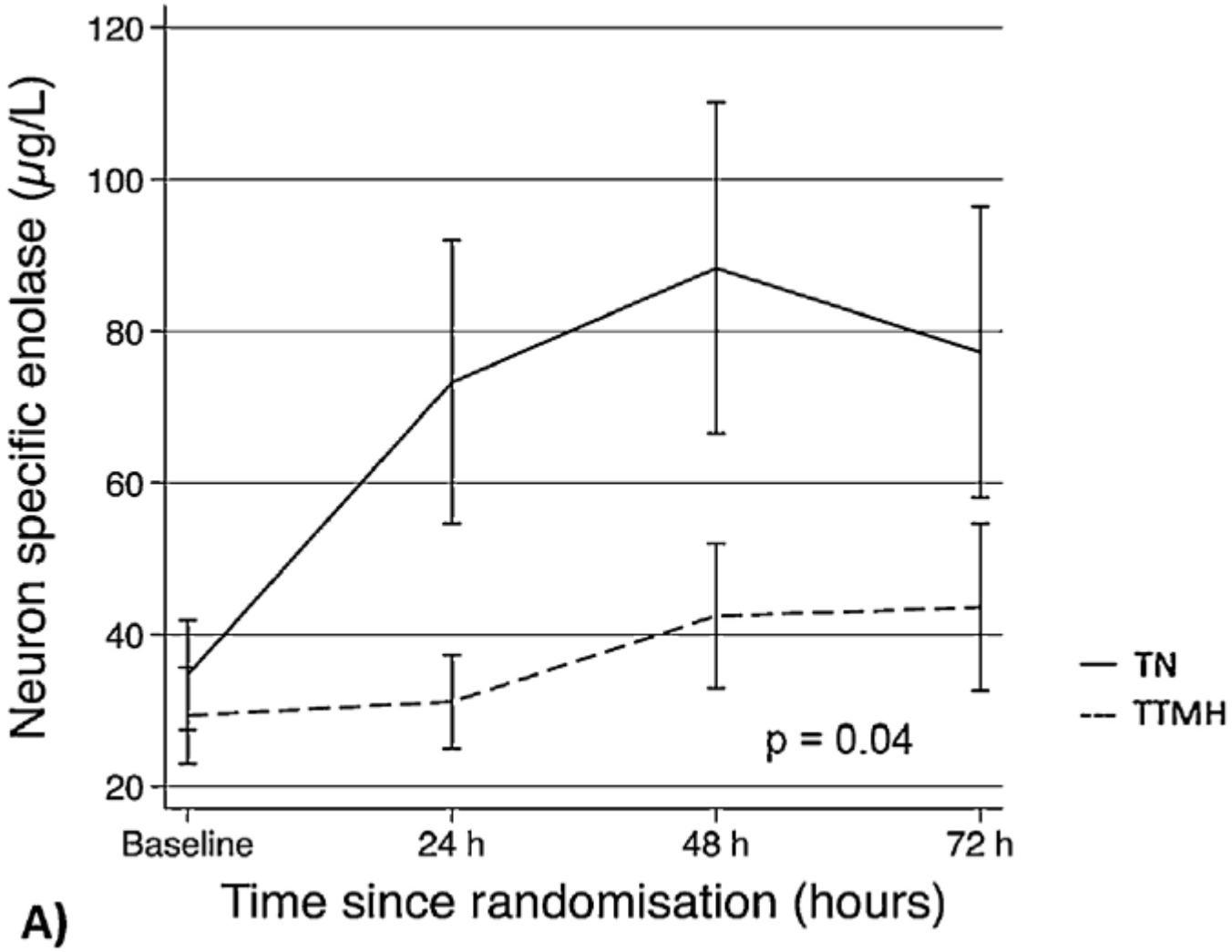

Ventilation and oxygenation

ORIGINAL ARTICLE

Favorable Neurocognitive Outcome with Low Tidal Volume Ventilation after Cardiac Arrest

Jeremy R. Beitler[1], Tiffany Bita Ghafouri[2], Sayuri P. Jinadasa[3], Ariel Mueller[3], Leeyen Hsu[2], Ryan J. Anderson[2], Jisha Joshua[2], Sanjeev Tyagi[2], Atul Malhotra[1], Rebecca E. Sell[1], and Daniel Talmor[3]

[1]Division of Pulmonary and Critical Care Medicine and [2]Department of Medicine, University of California, San Diego, San Diego, California; and [3]Department of Anesthesia and Critical Care Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts

Am J Resp Crit Care 2017

- **time-weighted average VT greater than 8 ml/kg PBW during the first 48 hours.**
- **propensity-adjusted analysis**

Favorable Neurocognitive Outcome with Low Tidal Volume Ventilation after Cardiac Arrest

Jeremy R. Beitler[1], Tiffany Bita Ghafouri[2], Sayuri P. Jinadasa[3], Ariel Mueller[3], Leeyen Hsu[2], Ryan J. Anderson[2], Jisha Joshua[2], Sanjeev Tyagi[2], Atul Malhotra[1], Rebecca E. Sell[1], and Daniel Talmor[3]

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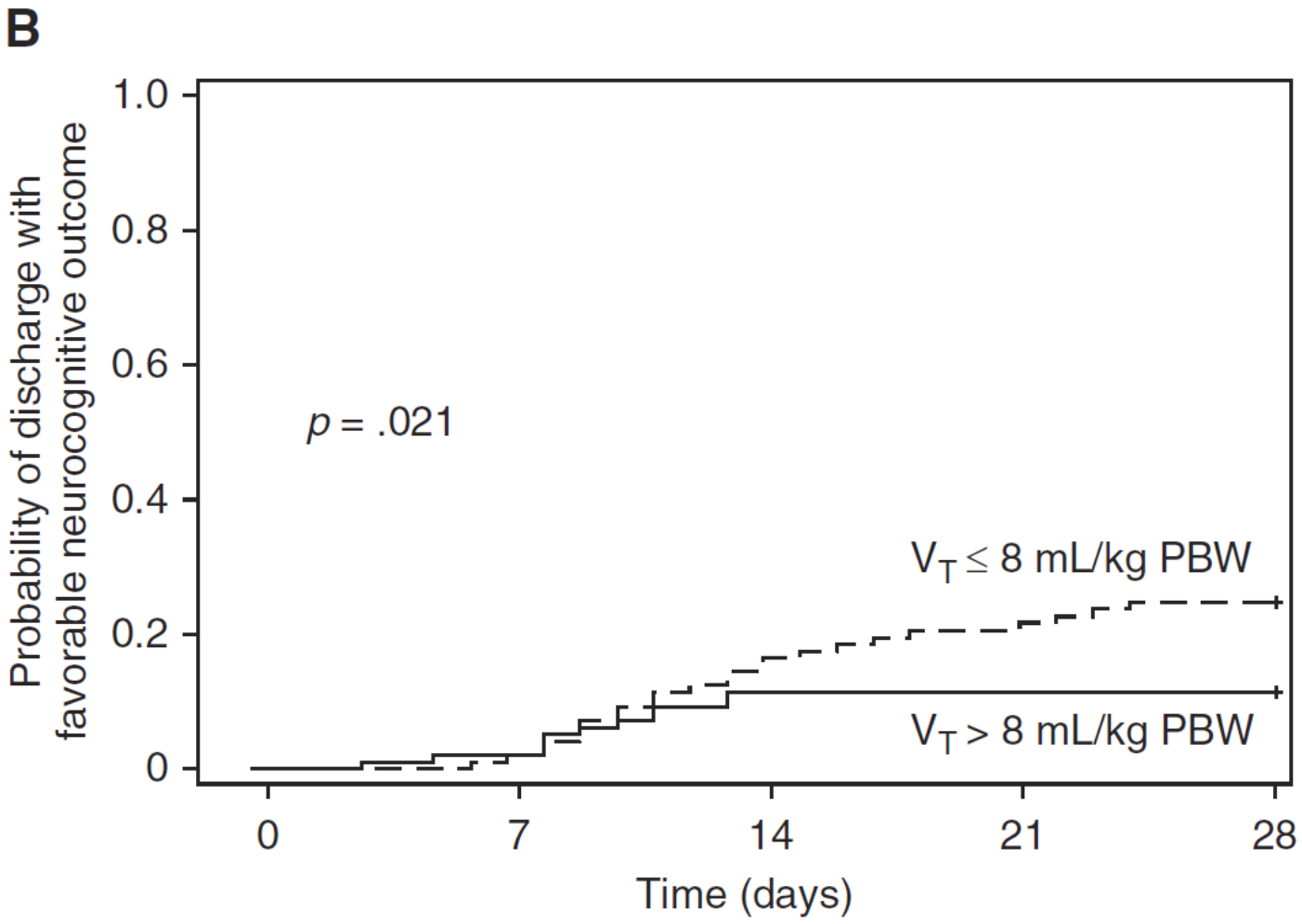

Case

- 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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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

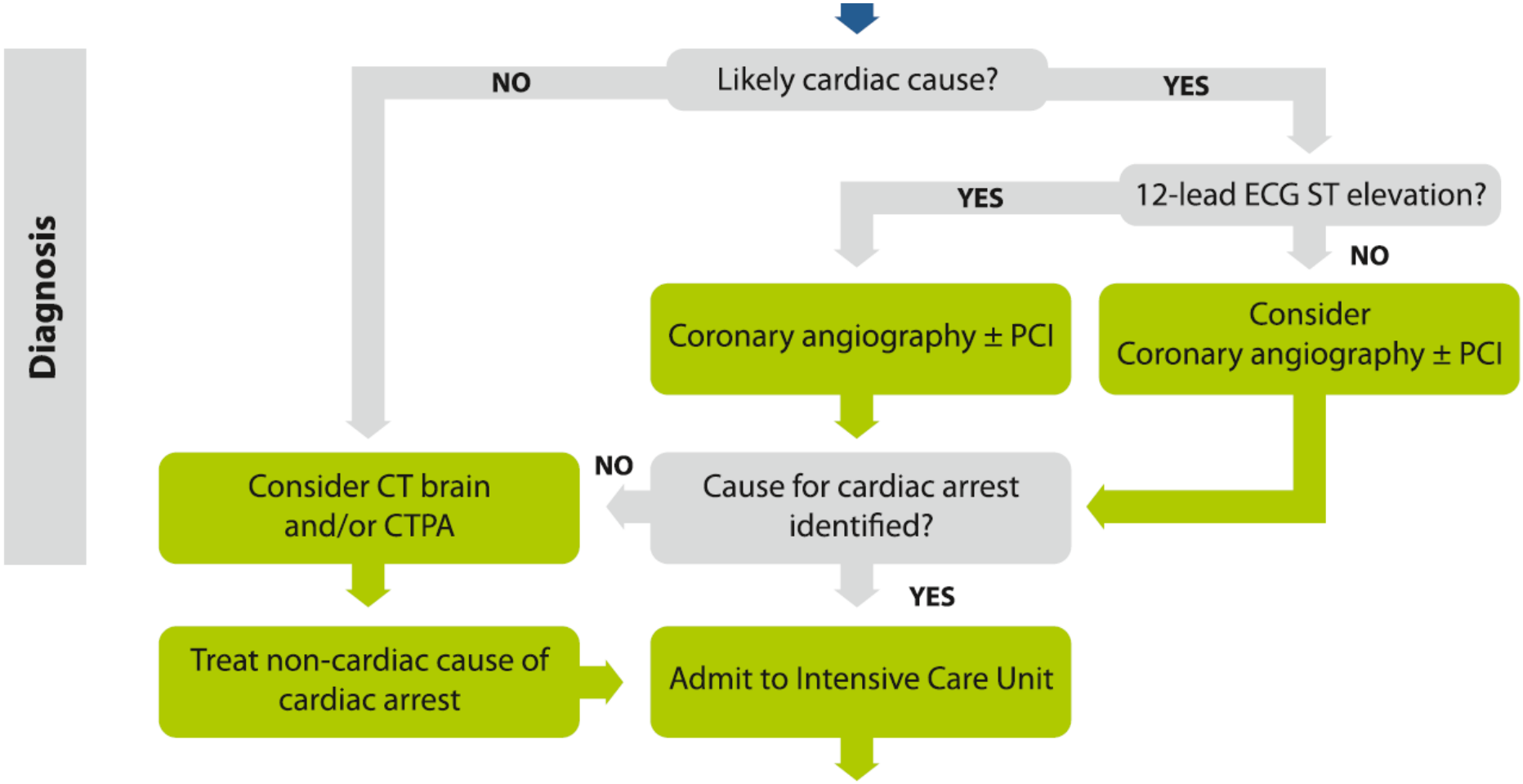
TABLE 2 Angiographic Findings in Patients With Cardiac Arrest and No ST-Segment Elevation on ECG

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

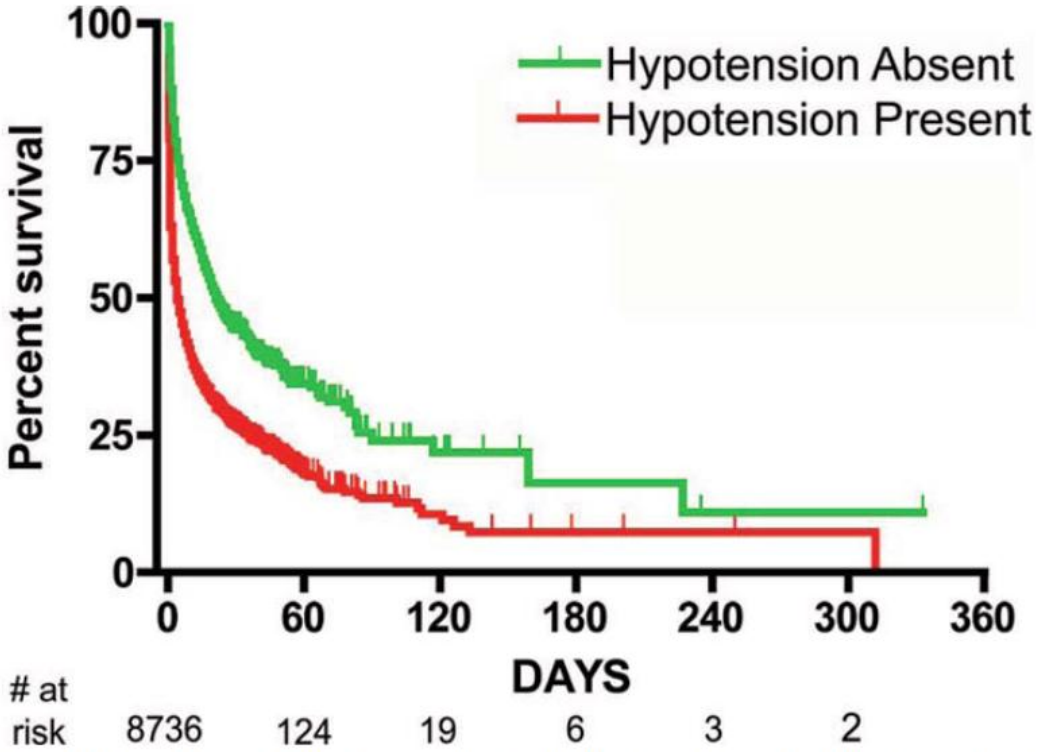


Figure 1. Kaplan-Meier survival curves for patients with Hypotension Present and Hypotension Absent after return of spontaneous circulation from cardiac arrest (with censoring). The survival fractions diverged significantly by log-rank test ($p < .001$).

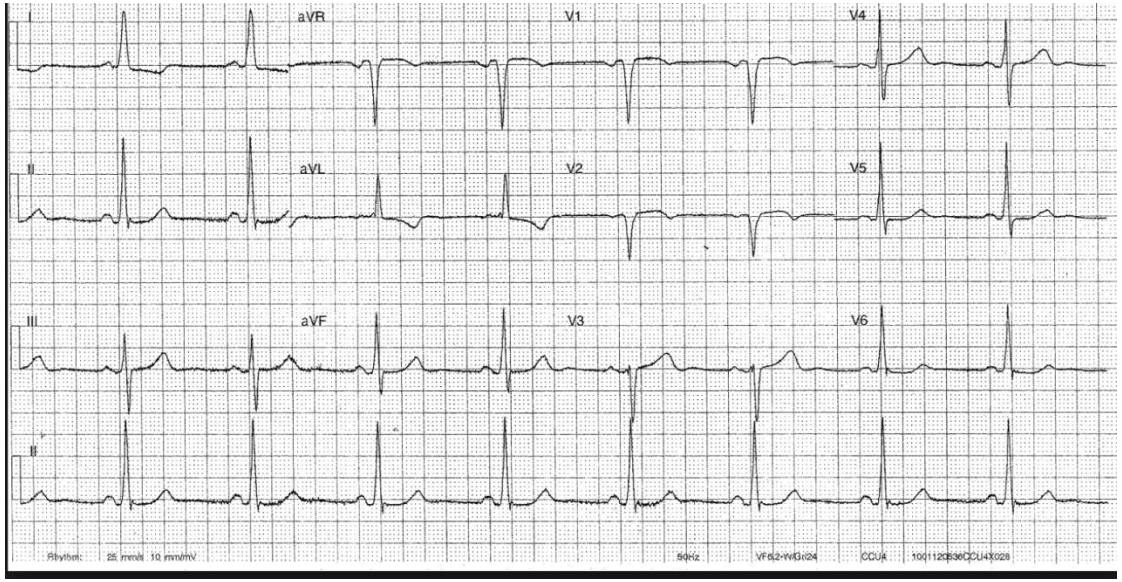
Case

- 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☆

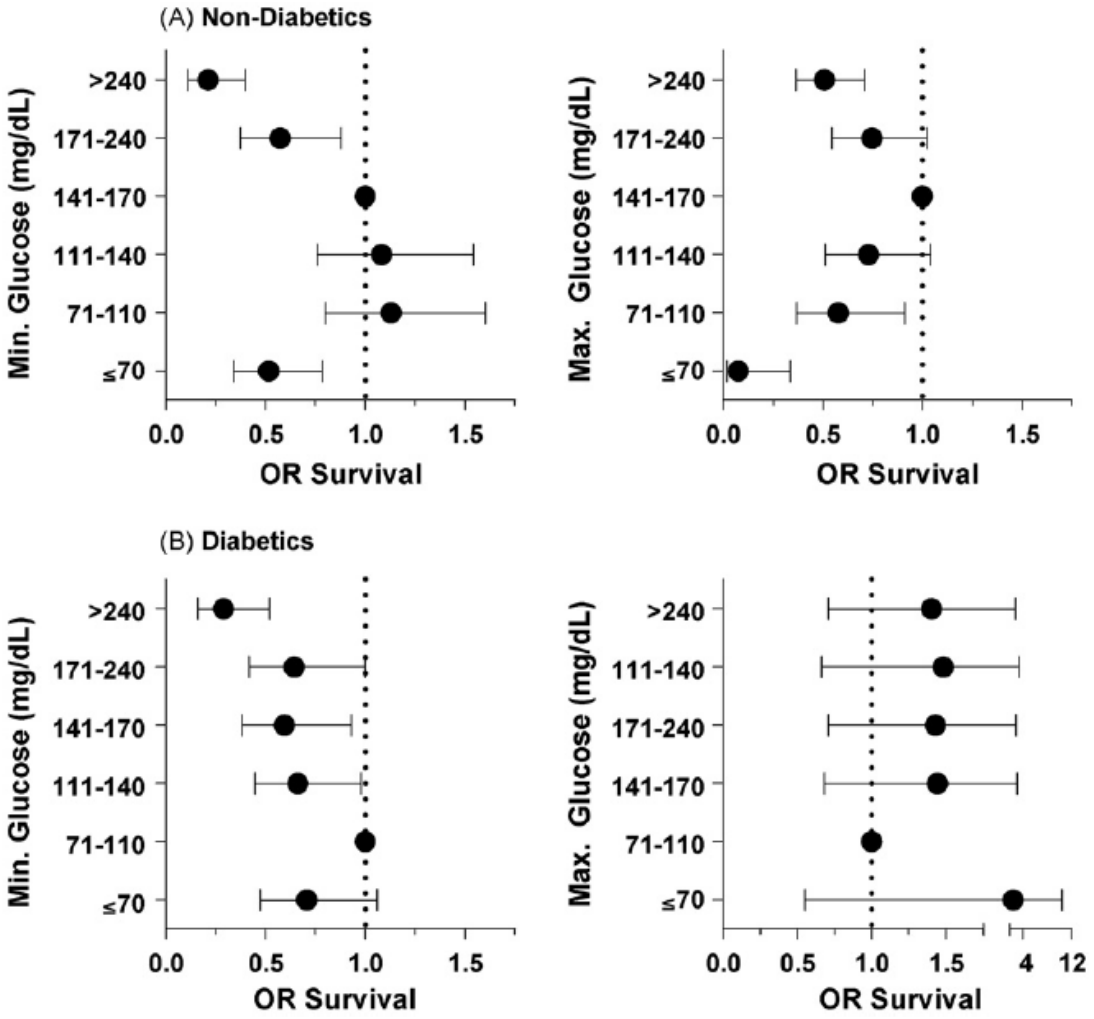
David G. Beiser[a,*,d], Gordon E. Carr[b,d], Dana P. Edelson[b,d], Mary Ann Peberdy[c,d], Terry L. Vanden Hoek[a,d]

[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

- Introduction
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- Targeted temperature management
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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)

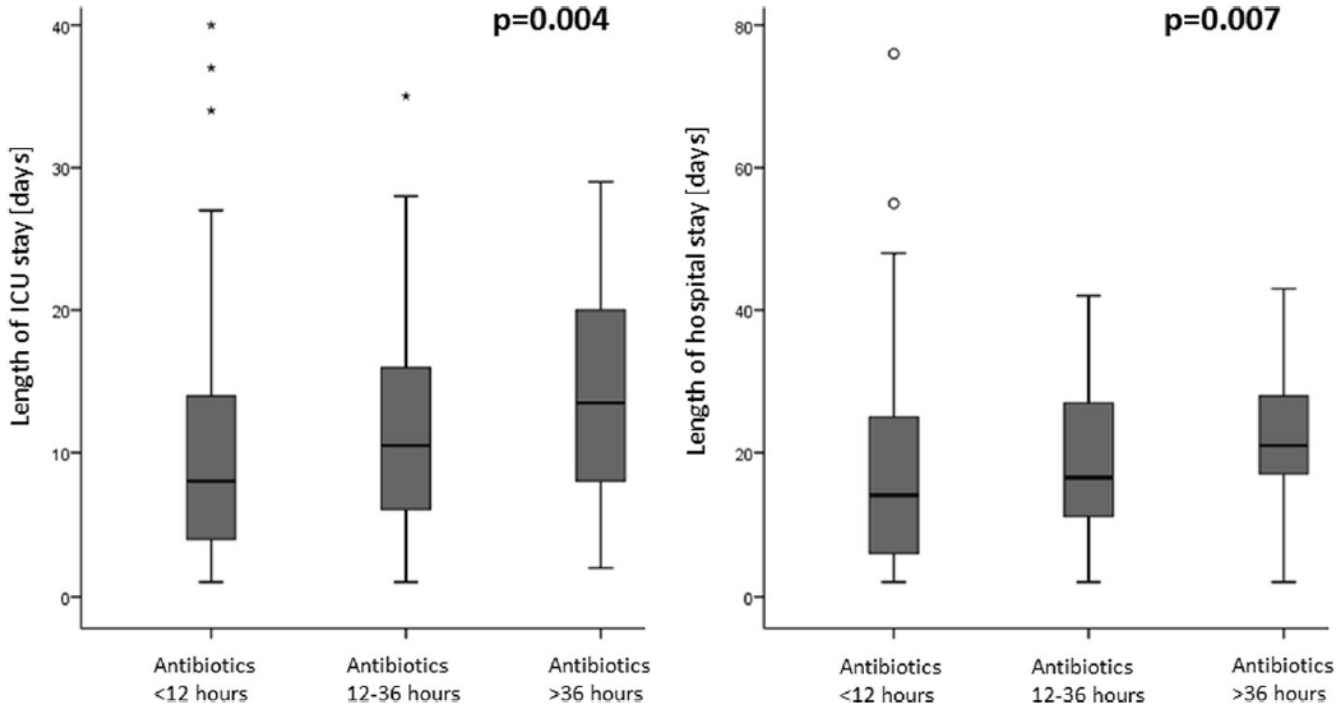

Fig. 3 Influence of timing of antibiotic therapy on the length of the ICU stay and the length of hospital stay

Overview

- Introduction
- Ventilation and oxygenation strategies
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- Cardiac arrest center
- Conclusions and recommendations

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."

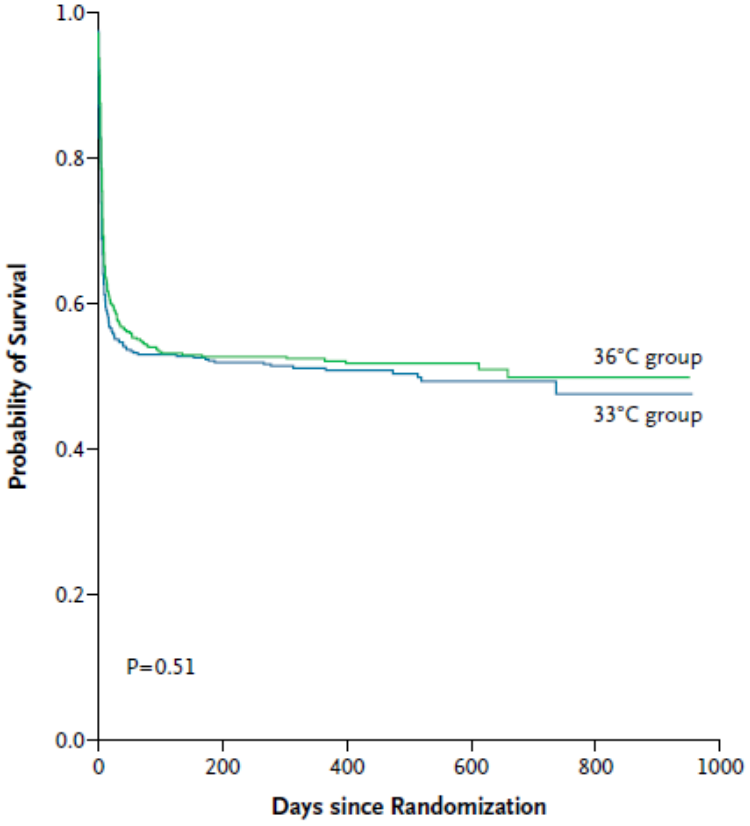


Figure 2. Probability of Survival through the End of the Trial.

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

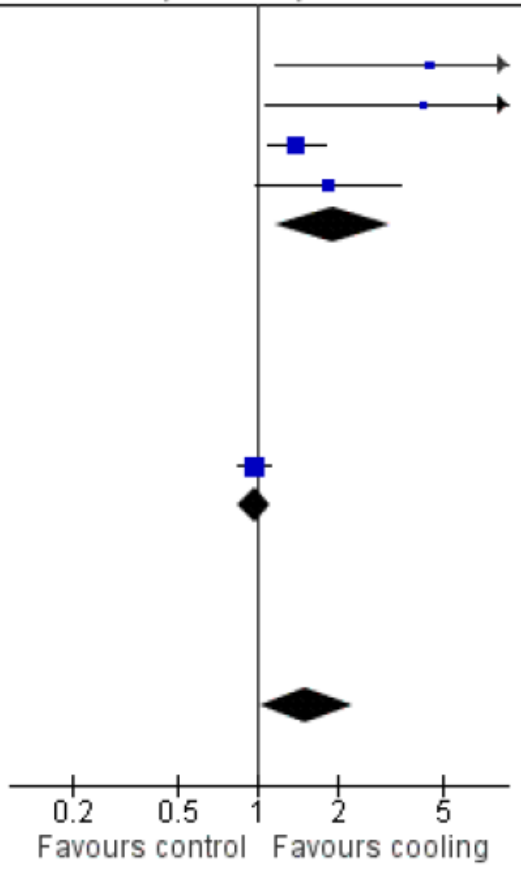
Cochrane Library
Trusted evidence.
Informed decisions.
Better health.

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%						



Resuscitation 113 (2017) 39–43

Contents lists available at ScienceDirect

Resuscitation

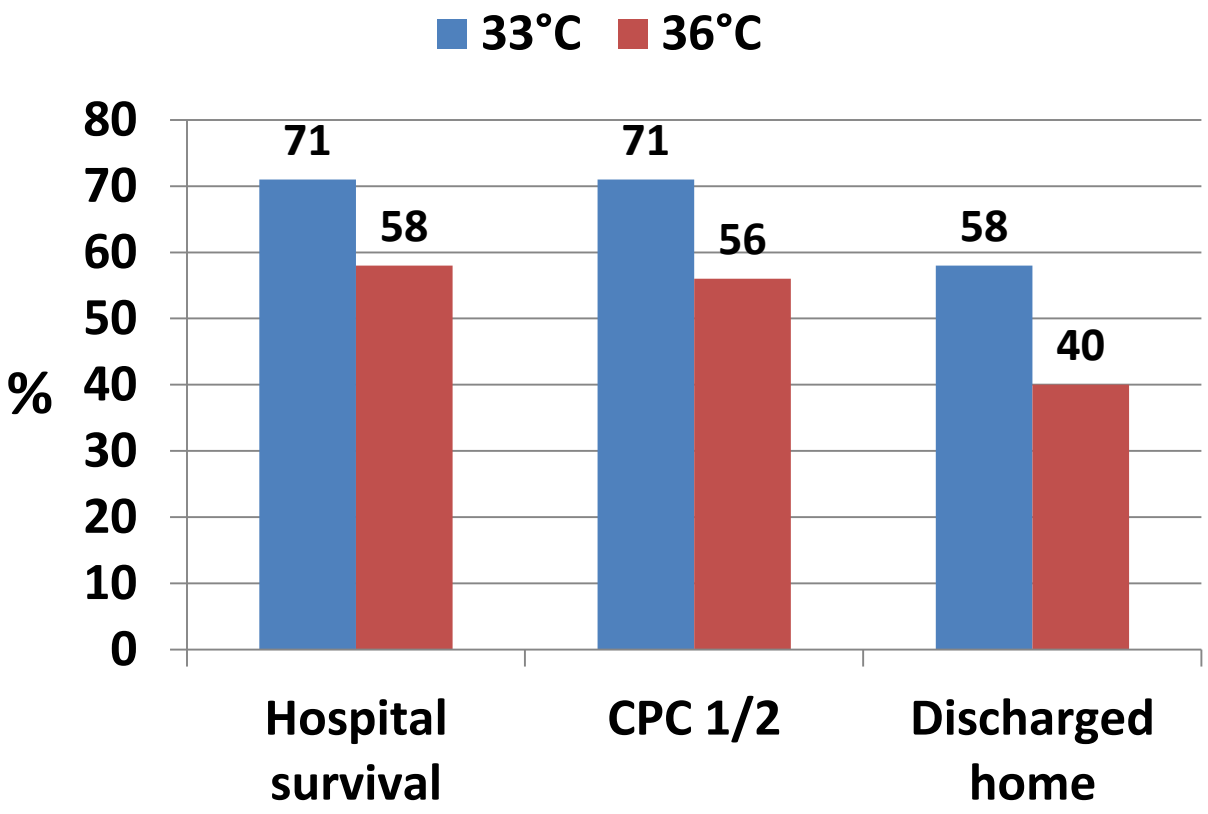
journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

Changing target temperature from 33 °C to 36 °C in the ICU management of out-of-hospital cardiac arrest: A before and after study☆

Janet E. Bray[a,b,c,*], Dion Stub[a,b,d,e,f], Jason E. Bloom[b], Louise Segan[a,b], Biswadev Mitra[a,b], Karen Smith[a,d,g,h], Judith Finn[a,c], Stephen Bernard[a,b,d]

- VF-OOH CA
- 2 year period
- 24 patients before TTM change (33°C)
- 52 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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In which hospitals should we treat CA patients?

ORIGINAL RESEARCH

American Heart Association | American Stroke Association

Hospital Variation in Survival After In-hospital Cardiac Arrest

Raina M. Merchant, MD, MSHP; Robert A. Berg, MD; Lin Yang, MS; Lance B. Becker, MD; Peter W. Groeneveld, MD, MS; Paul S. Chan, MD; for the American Heart Association's Get With the Guidelines-Resuscitation Investigators

(*J Am Heart Assoc*. 2014;3:e000400 doi: 10.1161/JAHA.113.000400)

163 390 patients from 607 hospitals

In which hospitals should we treat CA patients?

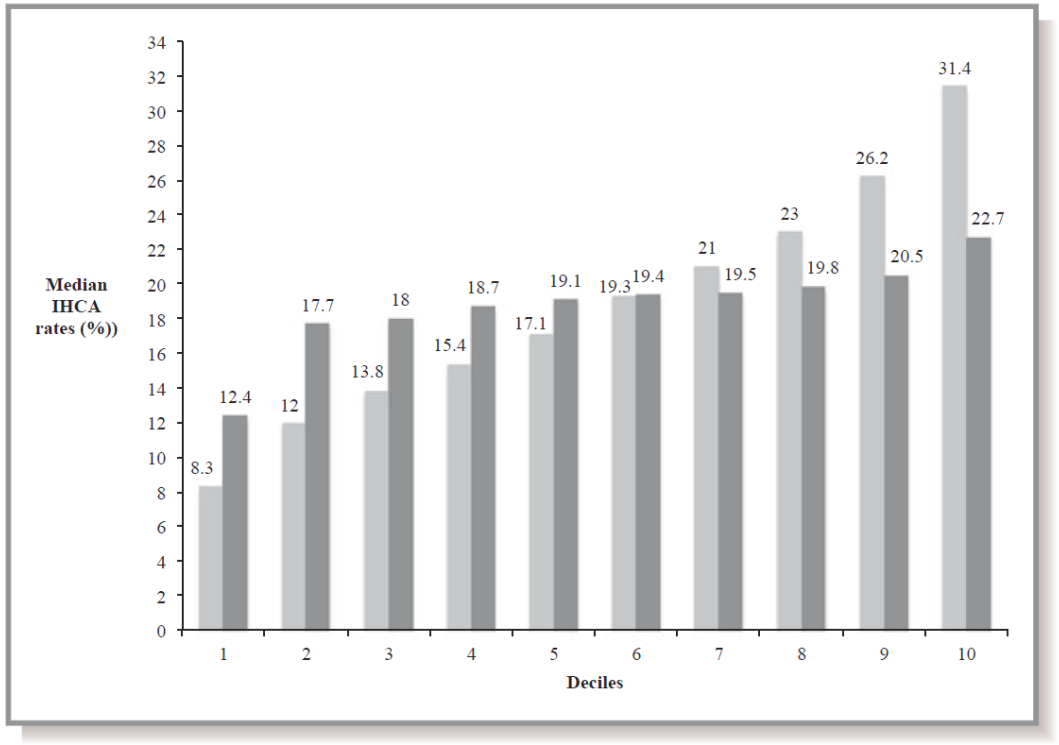

Figure 2. Unadjusted and adjusted median in-hospital cardiac survival rates by hospital decile. This figure illustrates in-hospital cardiac arrest (IHCA) rates (*y*-axis) across hospitals. Median unadjusted rates are light gray bars and adjusted rates are dark gray bars. Hospital deciles are on the *x*-axis. Rates are adjusted for the patient-level factors identified in Table 1.

ORIGINAL RESEARCH

American Heart Association | American Stroke Association

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EUROPEAN SOCIETY OF CARDIOLOGY®

European Heart Journal (2017) **00**, 1–8
doi:10.1093/eurheartj/ehx104

CLINICAL RESEARCH
Acute Coronary Syndromes

Distance to invasive heart centre, performance of acute coronary angiography, and angioplasty and associated outcome in out-of-hospital cardiac arrest: a nationwide study

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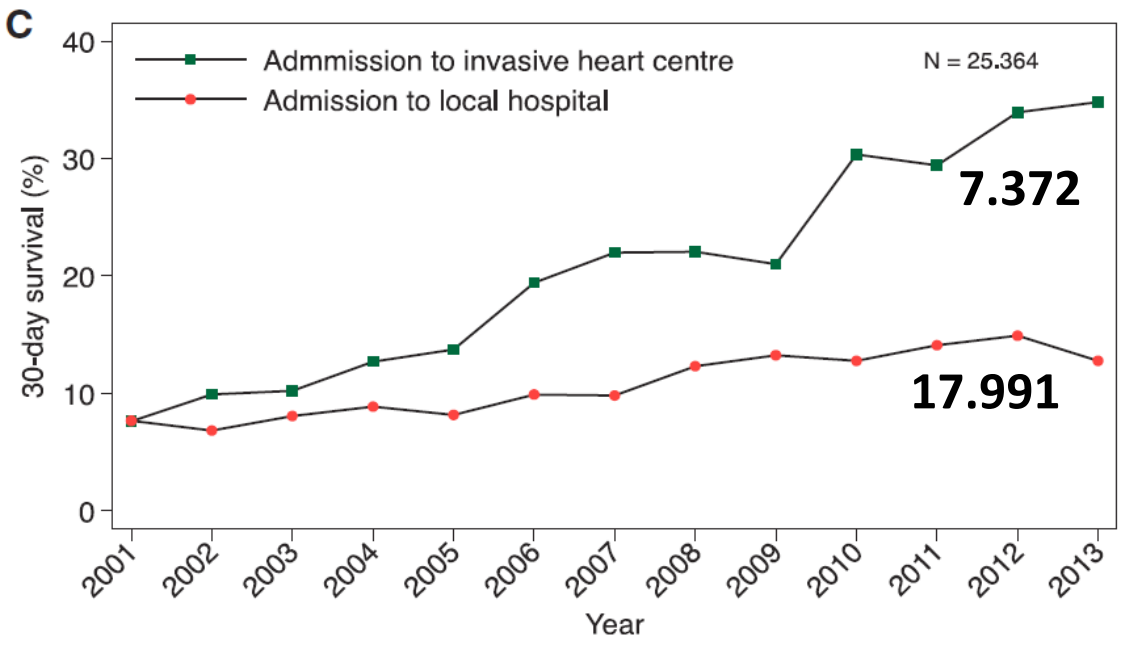

Figure 1 Temporal changes in thirty-day survival stratified according to (*A*) bystander CPR, (*B*) overall 30-day survival, and (*C*) admission to invasive heart centre.

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Distance to invasive centre was no factor for survival

In which hospitals should we treat CA patients?

Resuscitation 92 (2015) 45–52

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Clinical paper

Association between hospital post-resuscitative performance and clinical outcomes after out-of-hospital cardiac arrest☆

Dion Stub[a,b,f,i], Robert H. Schmicker[a], Monique L. Anderson[c], Clifton W. Callaway[d], Mohamud R. Daya[e], Michael R. Sayre[a], Jonathan Elmer[d], Brian E. Grunau[f], Tom P. Aufderheide[g], Steve Lin[h], Jason E. Buick[h], Dana Zive[e], Eric D. Peterson[c], Graham Nichol[a,*], ROC Investigators

Clinical paper

Association between hospital post-resuscitative performance and clinical outcomes after out-of-hospital cardiac arrest☆

five individual ILCOR/AHA guide-line recommended, hospital based post-resuscitative therapies in the performance measure:

- **coronary angiogra-phy within 24 h following hospital arrival**
- **initiation of targeted temperature management (TTM)**
- **whether a target temperature of 32–34◦C was achieved**
- **continuation of TTM for more than 12 h**
- **life sustaining treatment not withdrawn prior to day three following hospital arrival**

N=3.252

Association between hospital post-resuscitative performance and clinical outcomes after out-of-hospital cardiac arrest☆

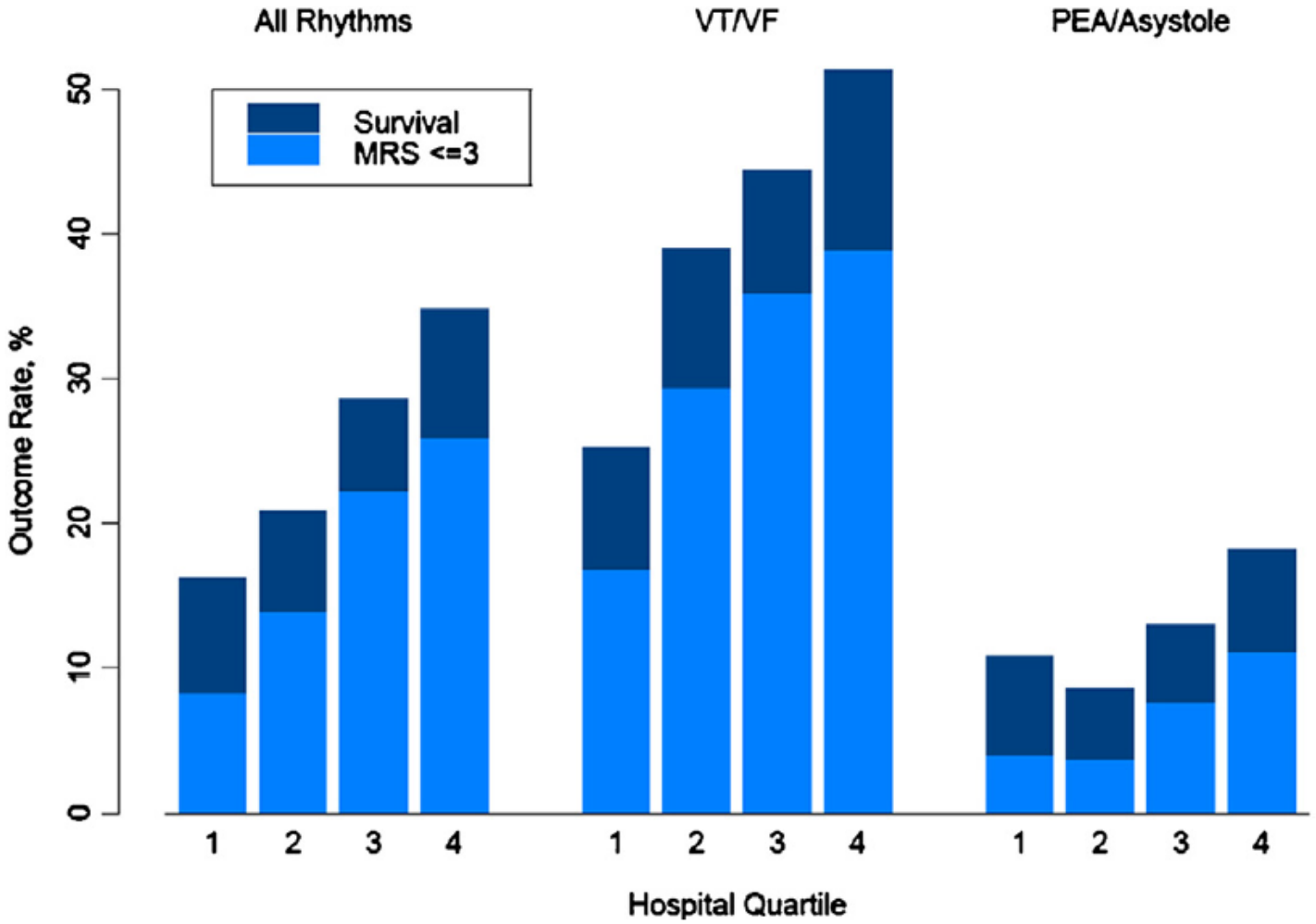


Fig. 3. Adjusted survival and good neurological outcome to hospital discharge according to hospital performance quartile and first presenting rhythm. VF – ventricular fibrillation; VT – ventricular tachycardia; PEA – pulseless electrical activity. *Adjusted for age, cardiac arrest time, witnessed arrest, bystander CPR and location.

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

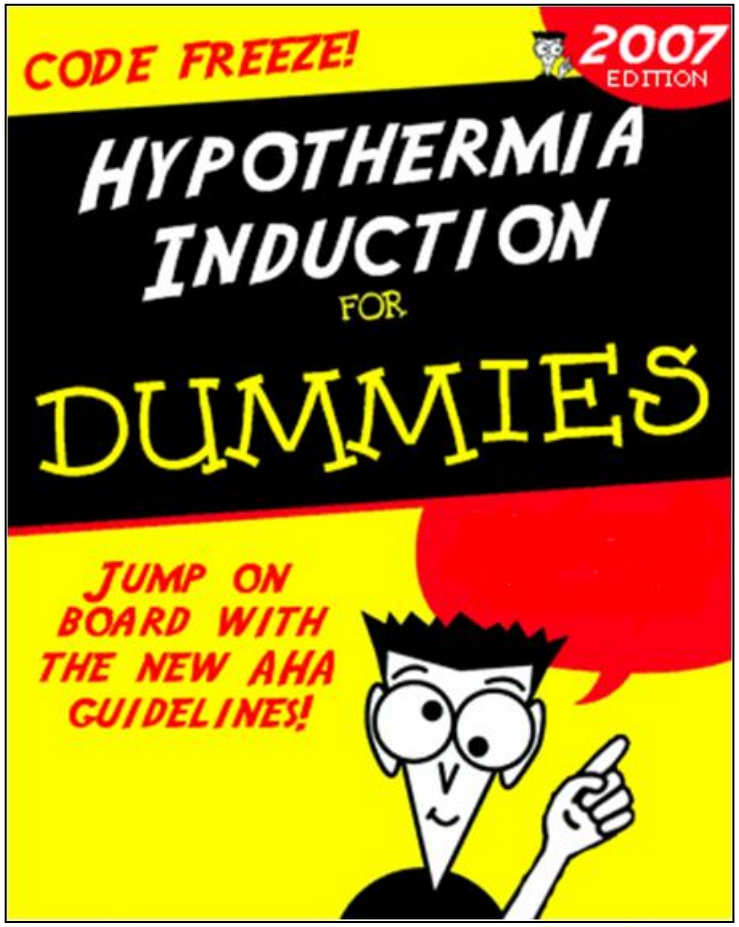
- **Mild therapeutic hypothermia 32-34°C (Guidelines Canada 2016)**
  - **All VF a "must", all non-VF a "can", avoid fever**
  - **As early as possible, pre-hospital setting?**

RCTs!!!!

Conclusion II

Implementation of

cardiac arrest centres!!!!!



Be Hot **Cool Down**