Urg'Ara

JOURNEE DES FILIERES
« ARRET CARDIAQUE » et « COEUR »

4 rue René Charre – 42800 Saint-Martin-la-Plaine

11 décembre 2025

Arrêt cardiaque :
Prise en charge post RACS immédiat

Prof. Alain Cariou

Intensive Care Unit – Cochin University Hospital (AP-HP)

Paris Cité University (medical school) – INSERM U970 (France)

Paris Centre de recherche Cardiovasculaire PARCC HEGP

Inserm Institut national de la santé et de la recherche médicale

AfterROSC

Cochin - APHP

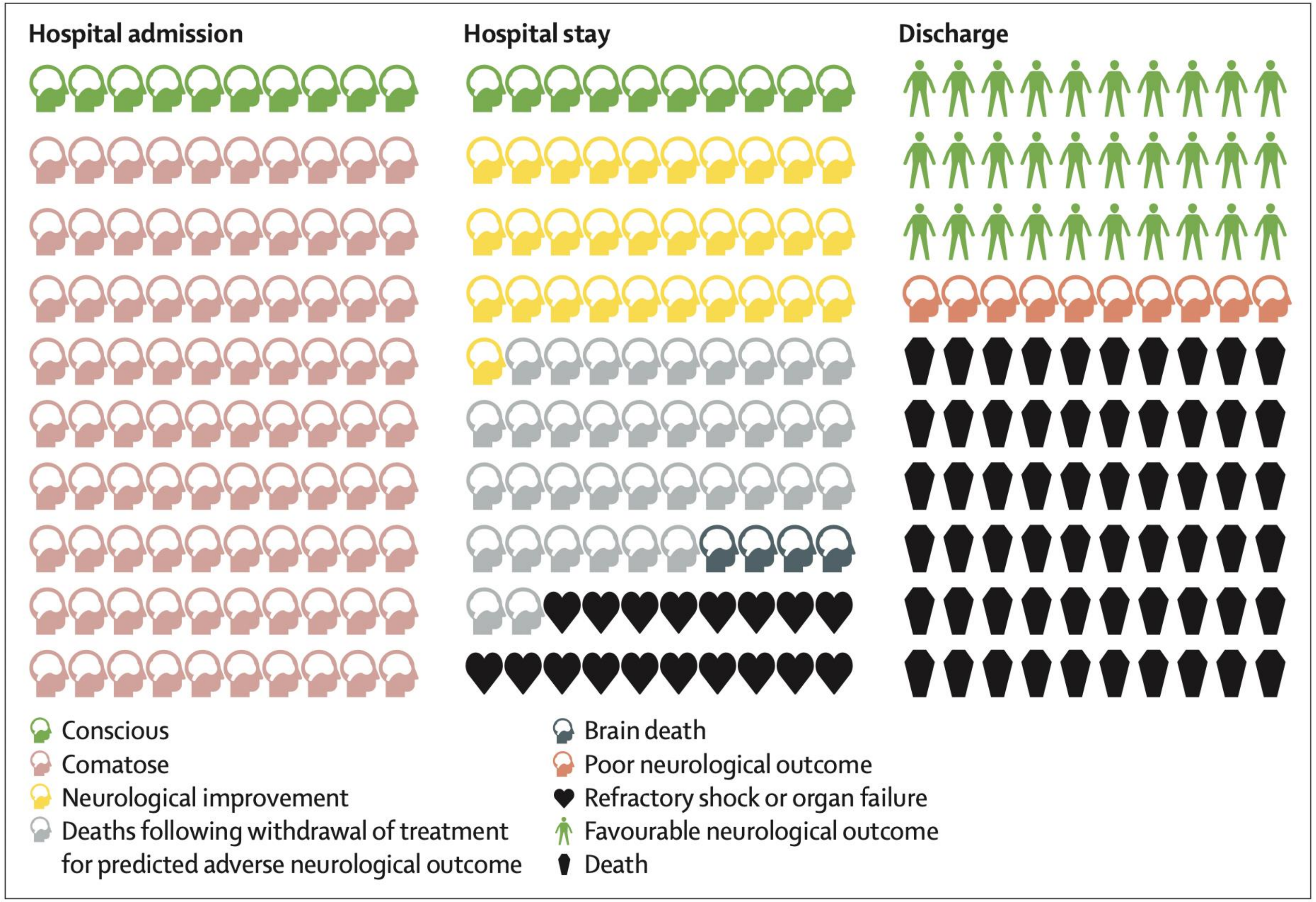
AP-HP. Centre Université Paris Cité

COI disclosure

ORIXHA: Member of the scientific committee

Outcomes following admission for out-of-hospital cardiac arrests

Perkins GD, et al. Lancet 2021



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Médecine Santé Université Paris Cité
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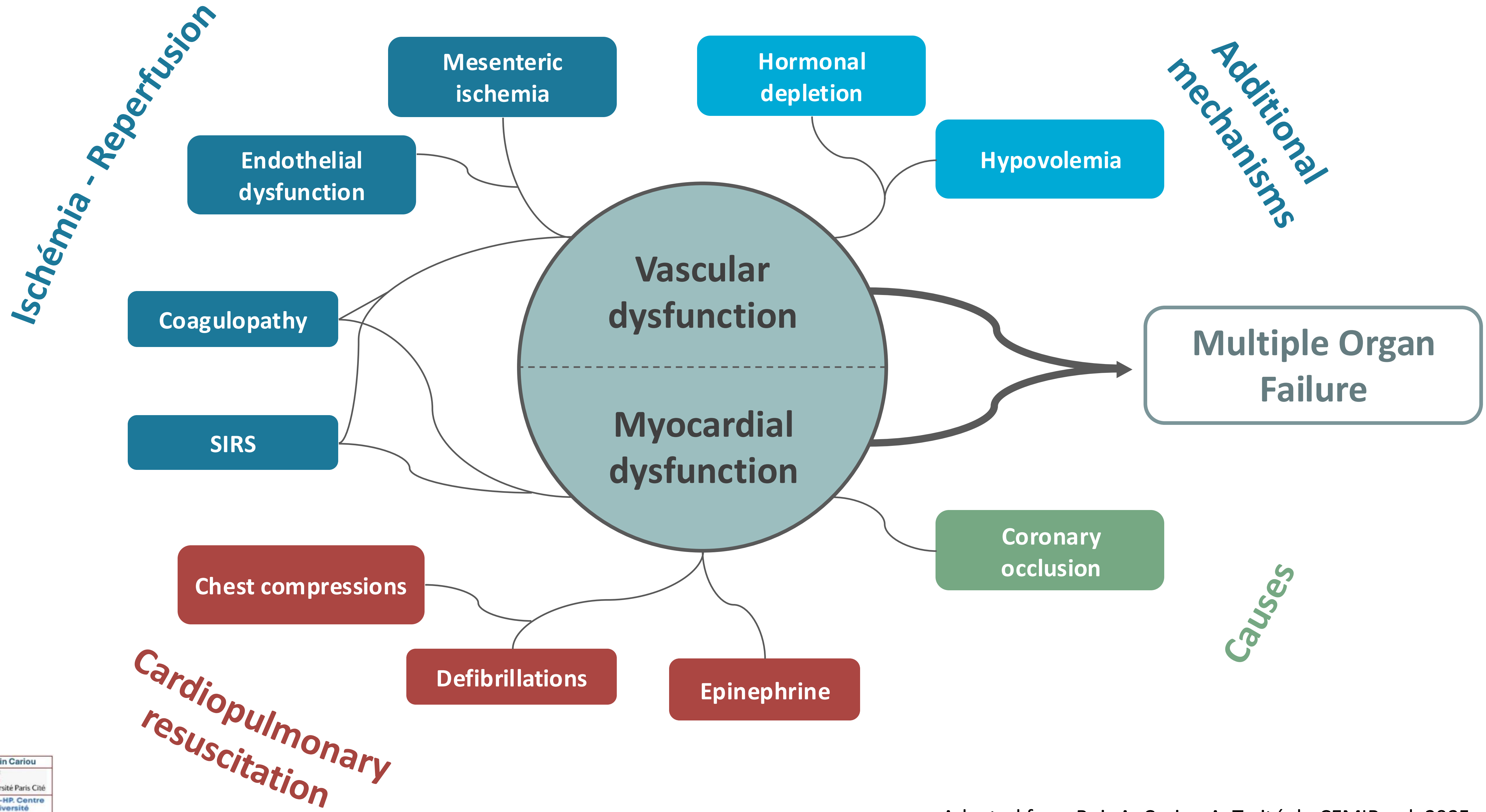

Adapted from Bois A, Cariou A. Traité du CEMIR, ed. 2025

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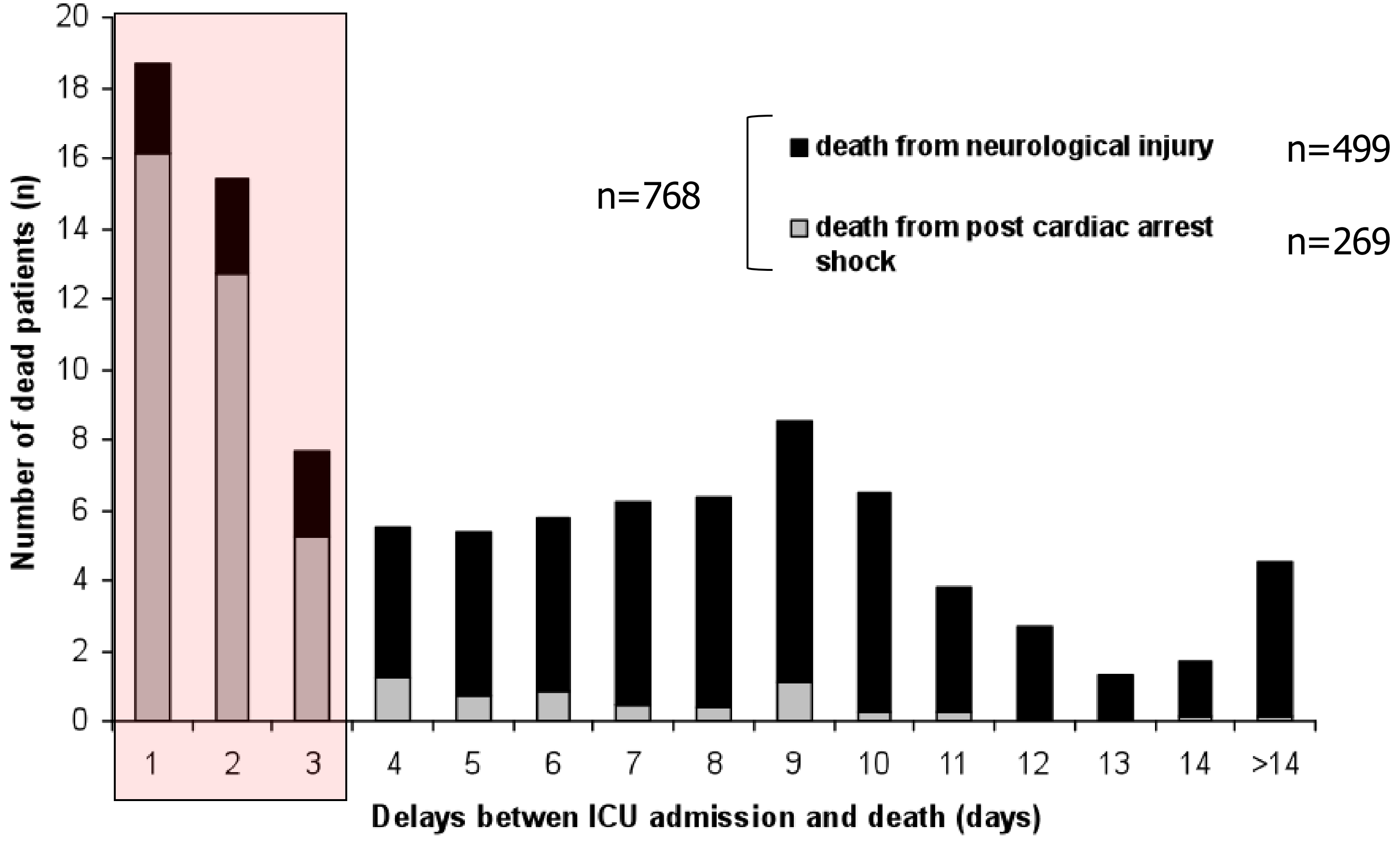
ICU mortality after cardiac arrest: the relative contribution of shock and brain injury

Lemiale V, Dumas F, Mongardon N, Giovanetti O, Charpentier J, Chiche JD, Carli P, Mira JP, Nolan J, Cariou A
Intensive Care Med 2013



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European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care

Nolan JP, Sandroni C, Cariou A, Cronberg T, D'Arrigo S, Haywood K, Hoedemaekers A, Lilja G, Nikolaou N, Olasveengen TM, Robba C, Skrifvars MB, Swindell P, Soar J.

Intensive Care Med 2025 – Resuscitation 2025

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Intensive Care Med
https://doi.org/10.1007/s00134-025-08117-3

CONFERENCE REPORTS AND EXPERT PANEL

European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care

Jerry P. Nolan[1,2], Claudio Sandroni[3,4*], Alain Cariou[5], Tobias Cronberg[6], Sonia D'Arrigo[3,4], Kirstie Haywood[7], Astrid Hoedemaekers[8], Gisela Lilja[9,10], Nikolaos Nikolaou[11], Theresa Mariero Olasveengen[12], Chiara Robba[13], Markus B. Skrifvars[14], Paul Swindell[15] and Jasmeet Soar[16]

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Abstract

The European Resuscitation Council (ERC) and the European Society of Intensive Care Medicine (ESICM) have collaborated to produce these post-resuscitation care guidelines for adults, which are based on the International Consensus on Cardiopulmonary Resuscitation Science with Treatment Recommendations (CoSTR) pubished by the International Liaison Committee on Resuscitation (ILCOR). The topics covered include the post-cardiac arrest syndrome, diagnosis of cause of cardiac arrest, control of oxygenation and ventilation, coronary reperfusion, haemodynamic monitoring and management, control of seizures, temperature control, general intensive care management, prognostication, long-term outcome, rehabilitation, and organ donation. The post-resuscitation care of children is described in the ERC guidelines 2025 Paediatric Life Support.

Keywords: Post-cardiac arrest syndrome, Cardiac arrest, Acute coronary syndrome, Coma, Temperature, Prognosis, Rehabilitation, Tissue and organ procurement

Introduction and scope

In 2015, the European Resuscitation Council (ERC) and the European Society of Intensive Care Medicine (ESICM) collaborated to produce their first combined post-resuscitation care guidelines, which were co-published in *Resuscitation* and *Intensive Care Medicine* [1, 2]. These 2025 guidelines represent the third collaboration between the ERC and ESICM and reflect the science published since the previous guidelines were issued In 2021 [3, 4]. The topics covered include the post-cardiac arrest syndrome, control of oxygenation and ventilation, haemodynamic targets, coronary reperfusion, temperature control, control of seizures, prognostication, long-term outcome and rehabilitation.

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Jerry P. Nolan and Claudio Sandroni Joint first authors.

This paper has been copublished in Resuscitation: https://doi.org/10.1016/j.resuscitation.2025.110809

Methods

The international consensus on cardiopulmonary resuscitation science evidence review process

The International Liaison Committee on Resuscitation (ILCOR, www.ilcor.org) includes representatives from the American Heart Association (AHA), the European Resuscitation Council (ERC), the Heart and Stroke Foundation of Canada (HSFC), the Australian and New

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Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
EUROPEAN RESUSCITATION COUNCIL

Practice Guideline

European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2025 Post-Resuscitation Care ☆

Jerry P. Nolan [a,b,#,], Claudio Sandroni [c,d,#], Alain Cariou [e], Tobias Cronberg [f], Sonia D'Arrigo [b,c], Kirstie Haywood [g], Astrid Hoedemaekers [h], Gisela Lilja [i,j], Nikolaos Nikolaou [k], Theresa Mariero Olasveengen [l], Chiara Robba [m], Markus B. Skrifvars [n], Paul Swindell [o], Jasmeet Soar [p]*

Abstract

The European Resuscitation Council (ERC) and the European Society of Intensive Care Medicine (ESICM) have collaborated to produce these post-resuscitation care guidelines for adults, which are based on the International Consensus on Cardiopulmonary Resuscitation Science with Treatment Recommendations (CoSTR) pubished by the International Liaison Committee on Resuscitation (ILCOR). The topics covered include the post-cardiac arrest syndrome, diagnosis of cause of cardiac arrest, control of oxygenation and ventilation, coronary reperfusion, haemodynamic monitoring and management, control of seizures, temperature control, general intensive care management, prognostication, long-term outcome, rehabilitation, and organ donation. The post-resuscitation care of children is described in the ERC Guidelines 2025 Paediatric Life Support.

Keywords: Post-cardiac arrest syndrome, Cardiac arrest, Acute coronary syndrome, Coma, Temperature, Prognosis, Rehabilitation, Tissue and organ procurement

Abbreviations: ACNS, American Clinical Neurophysiology Society, ACS, Acute coronary syndrome, ADC, Apparent diffusion coefficient, AF, Atrial fibrillation, AHA, American Heart Association, AKI, Acute kidney injury, ALS, Advanced Life Support, AMI, Acute myocardial infarction, ARDS, Acute respiratory distress syndrome, ATP, Adenosine triphosphate, BIS, Bi-spectral index, BOX, Blood Pressure and Oxygenation Targets after OHCA, BS, Burst suppression, CAC, Cardiac arrest centre, CAD, obstructive coronary artery disease, CAG, Coronary angiography, CBF, Cerebral blood flow, COSCA, Core Outcome Set for Cardiac Arrest, CoSTR, Consensus on Cardiopulmonary Resuscitation Science with Treatment Recommendations, CPC, Cerebral Performance Category, CPR, Cardiopulmonary resuscitation, CR, Corneal reflex, CT, Computed tomography, DBD, Organ donation after brain death, DCD, Donation after Circulatory Determination of Death, DVT, Deep venous thrombosis, DWI, Diffusion-weighted imaging, ECG, Electrocardiogram, ECPR, Extracorporeal cardiopulmonary resuscitation, EEG, Electroencephalogram, FPR, False positive rate, FSS, Fatigue Severity Scale, GFAP, Glial fibrillary acidic protein, GRADE, Grading of Recommendations Assessment, Development, and Evaluation, GWR, Grey white matter ratio, HADS, Hospital Anxiety and Depression Scale, HIBI, Hypoxic ischaemic brain injury, ICD, Implantable cardioverter defibrillator, ICP, Intracranial pressure, ICU, Intensive care unit, ILCOR, International Liaison Committee on Resuscitation, LBBB, Left bundle branch block, LMWH, Low molecular weight heparin, MAP, Mean arterial pressure, MCS, Mechanical circulatory support, MRI, Magnetic resonance imaging, NSE, Neuron specific enolase, OHCA, Out-of-hospital cardiac arrest, PCAS, Post-cardiac arrest syndrome, PCI, Percutaneous coronary intervention, PLR, Pupillary light reflex, PPCI, Primary percutaneous coronary intervention, RASS, Richmond Agitation Sedation Scale, ROC, Receiver operating characteristic, ROSC, Return of spontaneous circulation, SBP, Systolic blood pressure, SCA, Sudden cardiac arrest, SCD, Sudden cardiac death, SGA, Supraglottic airway, SSEP, Somatosensory evoked potential, STEMI, ST elevation myocardial infarction, TBI, Traumatic brain injury, TCD, Transcranial Doppler, VF, Ventricular fibrillation, VT, Ventricular tachycardia, WLST, Withdrawal of life-sustaining treatment

☆ This paper has been copublished in Intensive Care Medicine.

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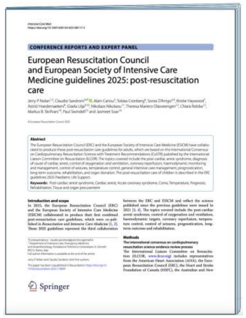
Immediate post-resuscitation care

Post-resuscitation care is started immediately after sustained return of spontaneous circulation (ROSC), regardless of location



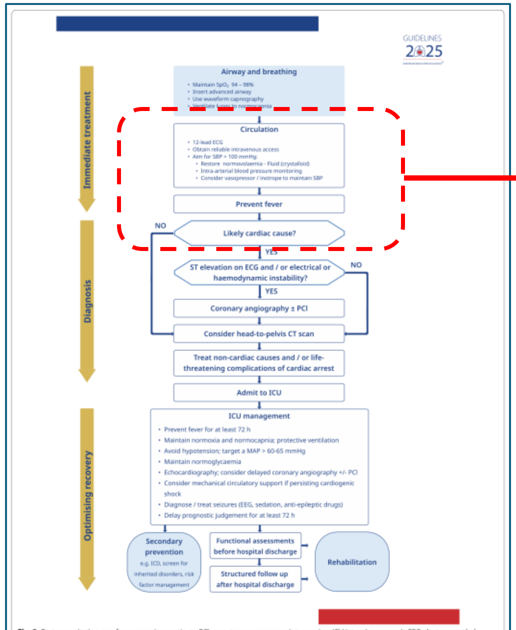


Fig. 2 Post-resuscitation care for unconscious patients. PCI percutaneous coronary intervention; ICU intensive care unit; EEG electroencephalogram; ICD implantable cardioverter defibrillator

Airway and breathing

- Maintain SpO_2 94 – 98%
- Insert advanced airway
- Use waveform capnography
- Ventilate lungs to normocapnia

Circulation

- 12-lead ECG
- Obtain reliable intravenous access
- Aim for SBP > 100 mmHg:
  - Restore normovolaemia - Fluid (crystalloid)
  - Intra-arterial blood pressure monitoring
  - Consider vasopressor / inotrope to maintain SBP

Prevent fever

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JAMA | Original Investigation

Effect of Bag-Mask Ventilation vs Endotracheal Intubation During Cardiopulmonary Resuscitation on Neurological Outcome After Out-of-Hospital Cardiorespiratory Arrest
A Randomized Clinical Trial

JAMA. 2018;319(8):779-787. doi:10.1001/jama.2018.0156

Patricia Jabre, MD, PhD; Andrea Penaloza, MD, PhD; David Pinero, MD; Francois-Xavier Duchateau, MD; Stephen W. Borron, MD, MS; Francois Javaudin, MD; Olivier Richard, MD; Diane de Longueville, MD; Guillem Bouilleau, MD; Marie-Laure Devaud, MD; Matthieu Heidet, MD, MPH; Caroline Lejeune, MD; Sophie Fauroux, MD; Jean-Luc Greingor, MD; Alessandro Manara, MD; Jean-Christophe Hubert, MD; Bertrand Guihard, MD; Olivier Vermylen, MD; Pascale Lievens, MD; Yannick Auffret, MD; Celine Maisondieu, MD; Stephanie Huet, MD; Benoît Claessens, MD; Frederic Lapostolle, MD, PhD; Nicolas Javaud, MD, PhD; Paul-Georges Reuter, MD, MS; Elinor Baker, MD; Eric Vicaut, MD, PhD; Frédéric Adnet, MD, PhD

Outcome	No. of Patients (%) BMV Group	ETI Group	Proportion Difference, BMV(%) − ETI(%) (95% CI)	*P* Value[a]
Intention-to-Treat Population	**n = 1018**	**n = 1022**		
Survival at 28 d	55 (5.4)	54 (5.3)	0.1 (−1.8 to 2.1)	.90
CPCs[b]				
1, Good cerebral performance	35 (3.4)	37 (3.6)		
2, Moderate cerebral disability	9 (0.9)	6 (0.6)		
3, Severe cerebral disability	4 (0.4)	7 (0.7)		.68
4, Coma or vegetative state	7 (0.7)	4 (0.4)		
5, Death	963 (94.6)	968 (94.7)		
Survival to hospital admission	294 (28.9)	333 (32.6)	−3.7 (−7.7 to 0.3)	.07
Return of spontaneous circulation	348 (34.2)	397 (38.9)	−4.7 (−8.8 to −0.5)	.03
Per-Protocol Analysis	**n = 995**	**n = 943**		
Survival at 28 d	54 (5.4)	51 (5.4)	0.1 (−10 to 9.7)	.99
CPCs[b]				
1, Good cerebral performance	35 (3.5)	34 (3.5)		
2, Moderate cerebral disability	8 (0.8)	6 (0.6)		
3, Severe cerebral disability	4 (0.4)	7 (0.7)		.76
4, Coma or vegetative state	7 (0.7)	4 (0.4)		
5, Death	941 (94.6)	892 (94.6)		
Survival to hospital admission	289 (29.1)	312 (33.1)	−4.0 (−7.6 to 0.6)	.055
Return of spontaneous circulation	342 (34.4)	377 (30.0)	−5.6 (−9.9 to −1.3)	.01

JAMA | Original Investigation

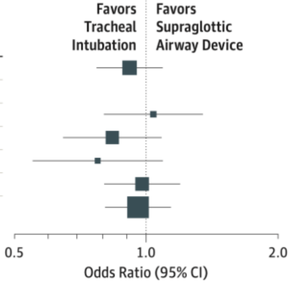
Effect of a Strategy of a Supraglottic Airway Device vs Tracheal Intubation During Out-of-Hospital Cardiac Arrest on Functional Outcome
The AIRWAYS-2 Randomized Clinical Trial

JAMA. 2018;320(8):779-791. doi:10.1001/jama.2018.11597

Jonathan R. Benger, MD; Kim Kirby, MRes; Sarah Black, DClinRes; Stephen J. Brett, MD; Madeleine Clout, BSc; Michelle J. Lazaroo, MSc; Jerry P. Nolan, MBChB; Barnaby C. Reeves, DPhil; Maria Robinson, MOst; Lauren J. Scott, MSc; Helena Smartt, PhD; Adrian South, BSc (Hons); Elizabeth A. Stokes, DPhil; Jodi Taylor, PhD; Matthew Thomas, MBChB; Sarah Voss, PhD; Sarah Wordsworth, PhD; Chris A. Rogers, PhD

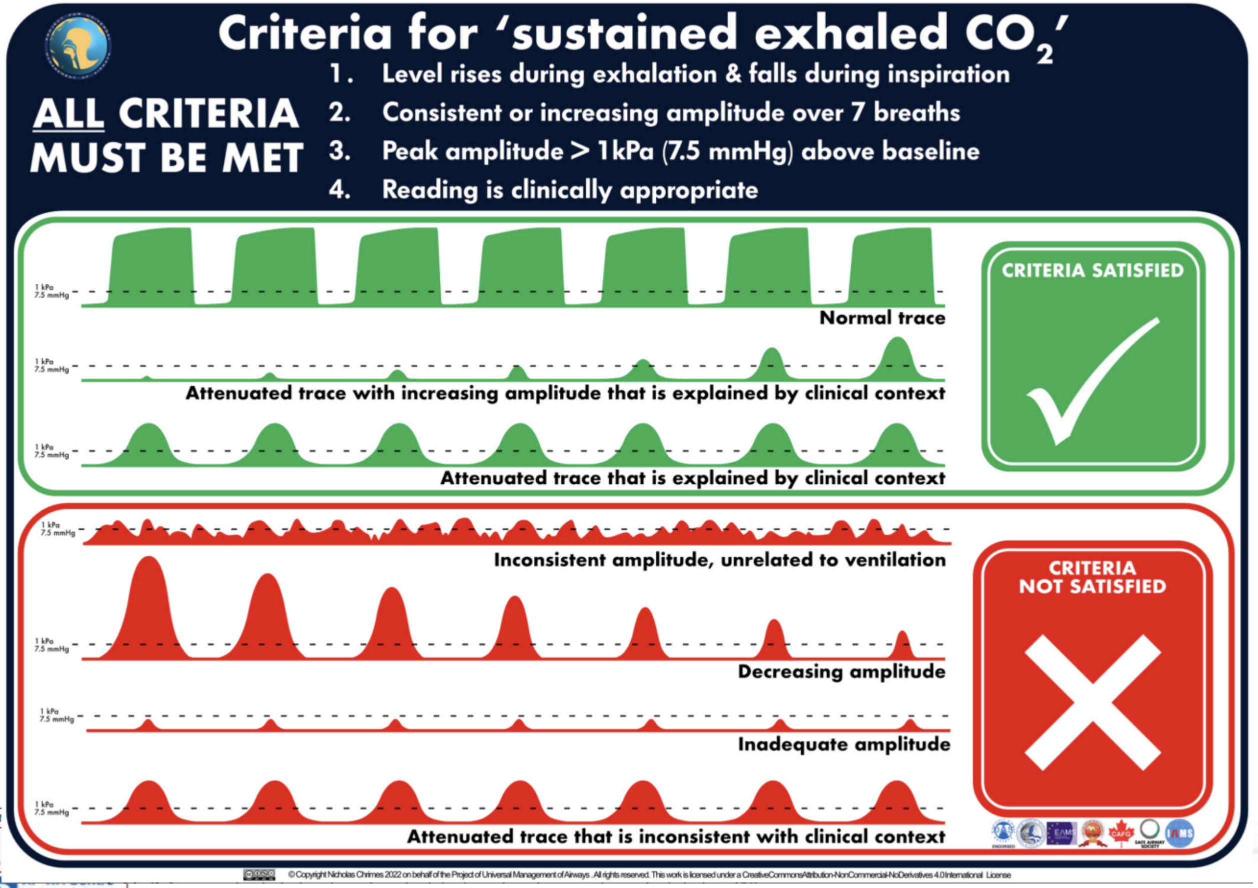
	No. of Patients/Total No. (%)[a] Tracheal Intubation (n = 4410)	Supraglottic Airway Device (n = 4886)
Primary Outcome: Modified Rankin Scale Score at Hospital Discharge or 30 d		
0-3 range (good outcome)	300/4407 (6.8)	311/4882 (6.4)
0 (no symptoms)	124/4407 (2.8)	117/4882 (2.4)
1	48/4407 (1.1)	41/4882 (0.8)
2	50/4407 (1.1)	58/4882 (1.2)
3	78/4407 (1.8)	95/4882 (1.9)
4-6 range (poor outcome to death)	4107/4407 (93.2)	4571/4882 (93.6)
4	46/4407 (1.0)	45/4882 (0.9)
5	27/4407 (0.6)	39/4882 (0.8)
6 (died)	4034/4407 (91.5)	4487/4882 (91.9)

	No. of Patients/Total No.[a] Tracheal Intubation	Supraglottic Airway Device	Adjusted Odds Ratio (95% CI)	*P* Value
Primary analysis for modified Rankin Scale score[b]	300/4407	311/4882	0.92 (0.77-1.09)	.33
Subgroup analysis				
Utstein comparator[c]	154/697	177/764	1.04 (0.80-1.35)	.24[d]
Utstein noncomparator[c]	130/3658	123/4067	0.84 (0.65-1.09)	
Out-of-hospital cardiac arrest witnessed by paramedic[e]	87/556	76/607	0.78 (0.55-1.09)	.24[d]
Out-of-hospital cardiac arrest not witnessed by paramedic[e]	212/3848	235/4271	0.98 (0.80-1.20)	
Sensitivity analysis for primary outcome[f]	300/10741	311/11462	0.96 (0.81-1.14)	.63



Preventing unrecognised oesophageal intubation: a consensus guideline from the Project for Universal Management of Airways and international airway societies

Chrimes N et al. Anaesthesia 2022



- While the CO2 level may be attenuated in a patient in cardiac arrest receiving chest compressions, a level below 1 kPa (7.5 mmHg) would generally reflect either an incorrectly placed tube or a very high likelihood of a poor outcome from resuscitation.
- In the presence of high-quality chest compressions, cardiac arrest cannot be assumed to be the cause of inability to satisfy the criteria for sustained exhaled carbon dioxide, and certainly does not explain a 'flat trace'. This should prompt exclusion of oesophageal intubation as its cause

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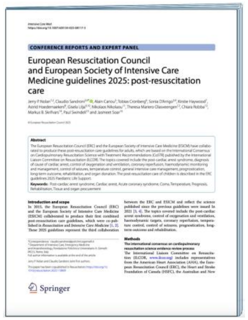
Immediate post-resuscitation care



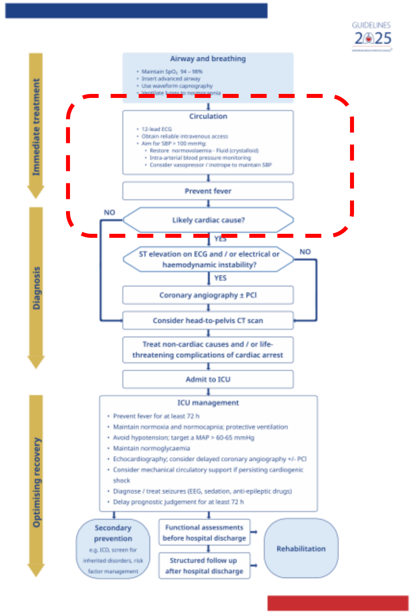


Fig. 2 Post-resuscitation care for unconscious patients. PCI percutaneous coronary intervention; ICU intensive care unit; EEG electroencephalogram; ICD implantable cardioverter defibrillator

Airway management after ROSC

- Patients who remain comatose following ROSC, or who have another clinical indication for sedation and mechanical ventilation, **should have their trachea intubated** if this has not been done already during CPR.
- Tracheal intubation (with or without drugs) should be **performed only by experienced operators** who have a high success rate.
- Correct placement of the tracheal tube must be confirmed with **waveform capnography**.
- Post ROSC patients may require drug assisted tracheal intubation – the same level of care should be provided as for any other critically ill patient with a physiologically or anatomically challenging airway in terms of skills of the provider, monitoring, and choice of drugs for induction, and maintenance of sedation

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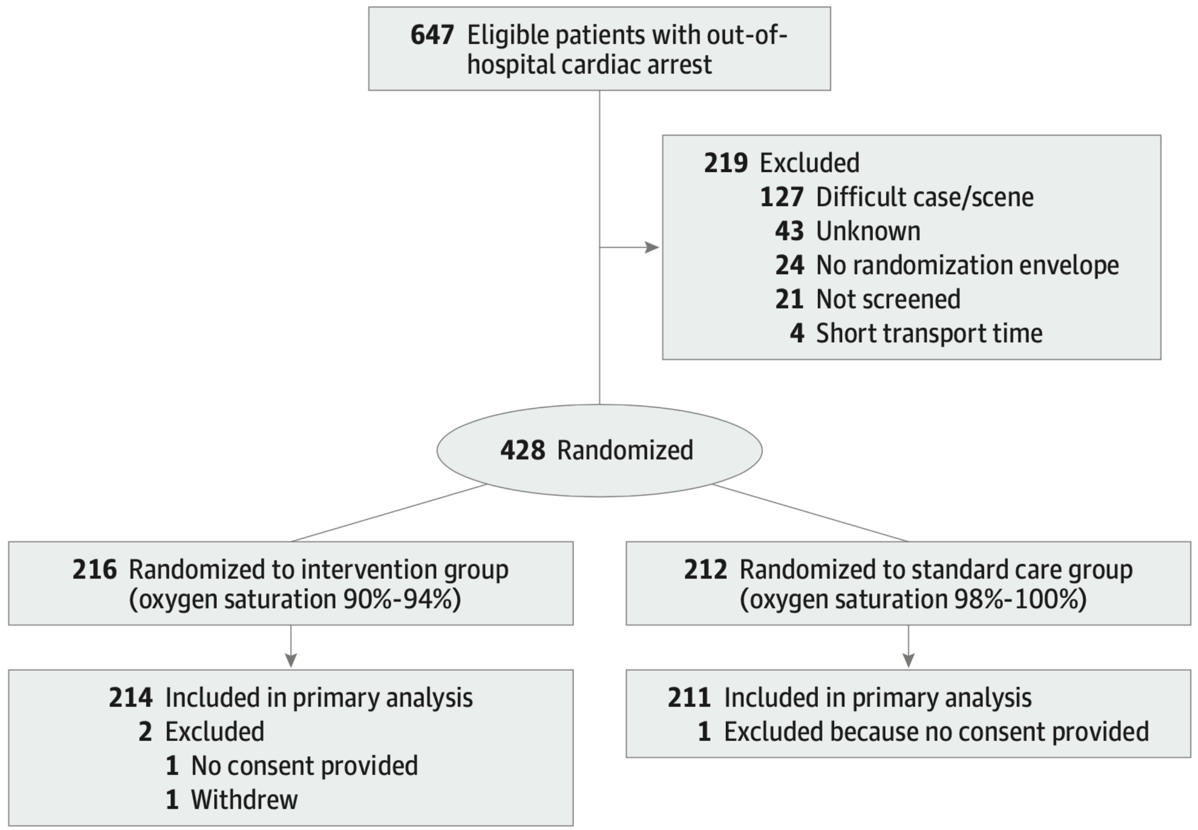
JAMA | Original Investigation JAMA November 8, 2022

Effect of Lower vs Higher Oxygen Saturation Targets on Survival to Hospital Discharge Among Patients Resuscitated After Out-of-Hospital Cardiac Arrest
The EXACT Randomized Clinical Trial

Stephen A. Bernard, MD; Janet E. Bray, PhD; Karen Smith, PhD; Michael Stephenson, BHlthSci; Judith Finn, PhD; Hugh Grantham, MBBS; Cindy Hein, PhD; Stacey Masters, PhD; Dion Stub, PhD; Gavin D. Perkins, MD; Natasha Dodge, MPH; Catherine Martin, PhD; Sarah Hopkins, MBBS; Peter Cameron, PhD; for the EXACT Investigators

Our Performance

Ambulance Victoria



Outcome	No. (%) Target SpO_2 90%-94% (n = 214)	No. (%) Target SpO_2 98%-100% (n = 211)	Difference (95% CI)[a]	Odds ratio (95% CI)	*P* value[b]
Primary					
Survival to hospital discharge	82 (38.3)	101 (47.9)	−9.6 (−18.9 to −0.2)	0.68 (0.46 to 1.00)	.05
Secondary					
Rearrest					
Pre-ICU[c]	27 (12.7) [n = 213]	21 (10.0) [n = 209]	2.6 (−3.4 to 8.7)	1.30 (0.71 to 2.38)	.40
Prehospital	7 (3.3)	3 (1.4)	1.8 (−1.0 to 4.7)		
ED	26 (12.2) [n = 213]	20 (9.5) [n = 210]	2.7 (−3.2 to 8.6)		
Hypoxia (any SpO_2 <90%) prior to ICU	67 (31.3)	34 (16.1)	15.2 (7.2 to 23.1)	2.37 (1.49 to 3.79)	<.001
Peak troponin, median (IQR)	n = 193	n = 198			
Troponin T	581 (134 to 2363)	557 (179 to 2234)	24 (−405 to 453)		.91
Troponin I	1838 (316 to 8578)	1550 (270 to 6710)	288 (−756 to 1332)		.59
Survival to ICU discharge	96/192 (50.0)	106/197 (53.8)	−3.8 (−13.7 to 6.1)	0.86 (0.58 to 1.28)	.45
ICU length of stay, median (IQR), d					
Survivors	4.0 (2.0 to 6.0) [n = 96]	4.0 (2.0 to 6.0) [n = 105]	0.0 (−1.2 to 1.2)		>.99
Deaths	3.0 (1.0 to 5.5) [n = 96]	4.0 (1.0 to 7.0) [n = 91]	−1.0 (−2.8 to 0.8)		.27
Hospital length of stay, median (IQR), d					
Survivors	11.0 (7.0 to 17.0) [n = 82]	11.0 (7.0 to 16.0) [n = 101]	0.0 (−2.8 to 2.8)		>.99
Nonsurvivors	3.0 (1.0 to 6.0) [n = 132]	4.0 (1.0 to 7.0) [n = 109]	−1.0 (−2.4 to 0.4)		.16

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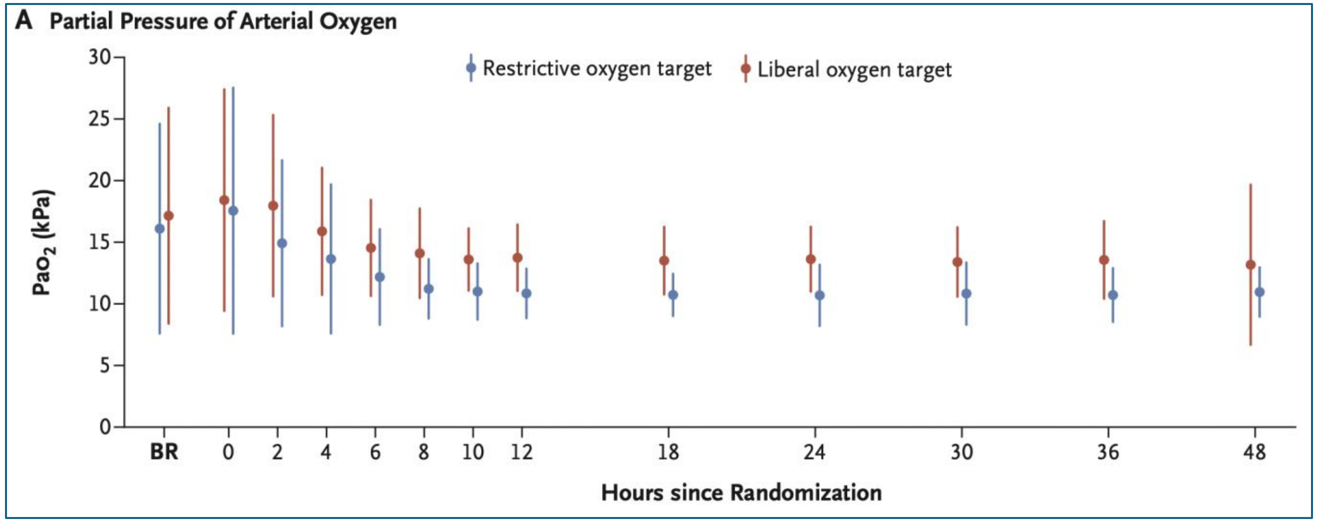
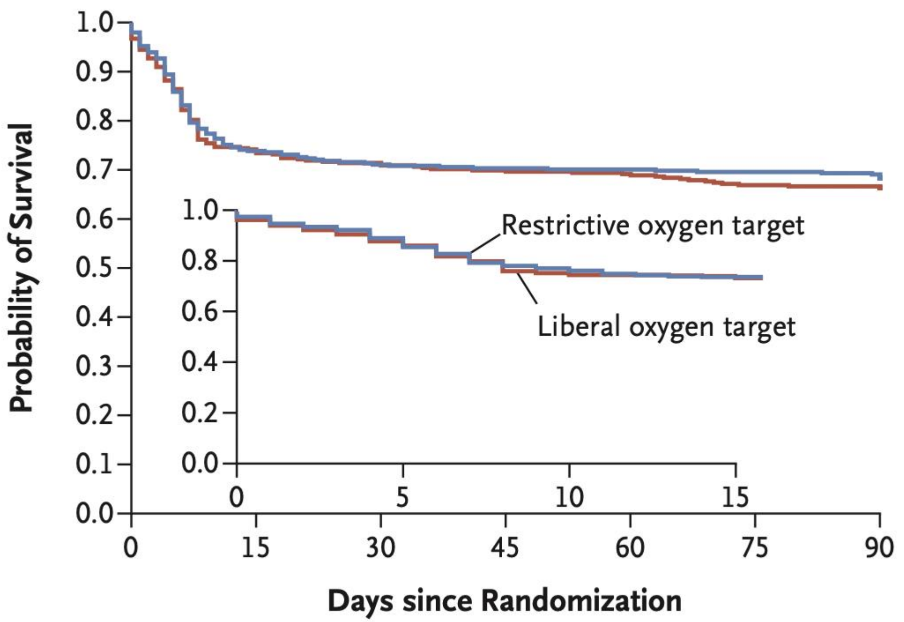
ORIGINAL ARTICLE

Schmidt et al. NEJM 2022

Oxygen Targets in Comatose Survivors of Cardiac Arrest

Oxygenation during the First 48 Hours





No. at Risk							
Restrictive target	394	290	279	276	275	273	271
Liberal target	395	292	281	275	272	263	262

BOX Trial

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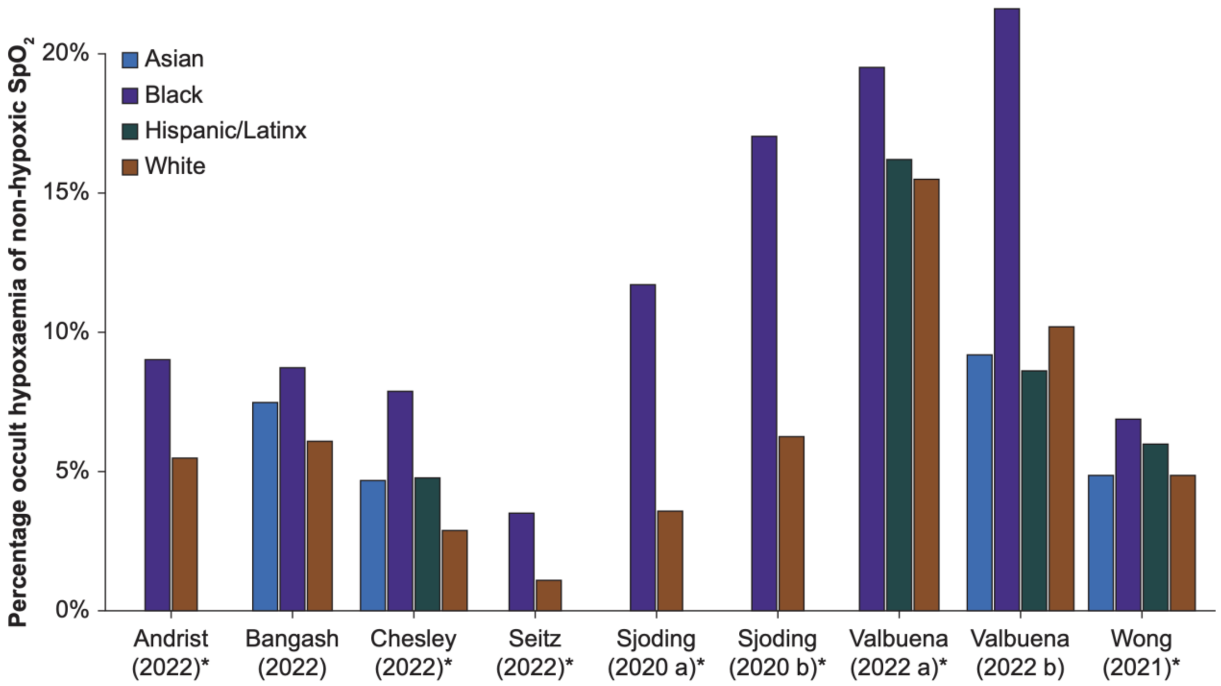
Effect of skin tone on the accuracy of the estimation of arterial oxygen saturation by pulse oximetry: a systematic review

Martin D et al. Br J Anaesthesia 2024

Frequency of occult hypoxaemia in paired SpO2-SaO2 measurements



- The majority of studies reported overestimation of SaO2 by pulse oximetry in participants with darker skin tones or from ethnicities assumed to have darker skin tones.
- Pulse oximetry can overestimate true SaO2 in people with darker skin tones.

European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care

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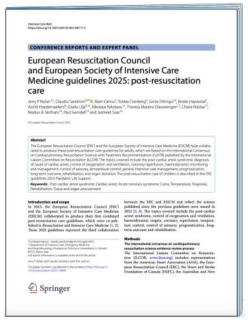
Immediate post-resuscitation care



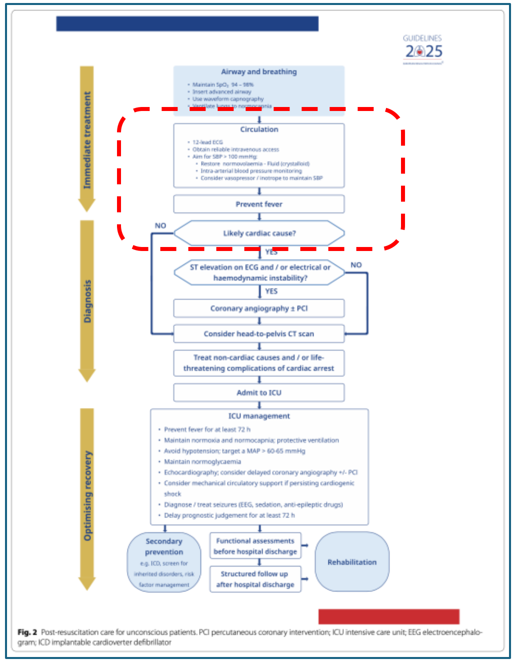


Fig. 2 Post-resuscitation care for unconscious patients. PCI percutaneous coronary intervention; ICU intensive care unit; EEG electroencephalogram; ICD implantable cardioverter defibrillator

Control of oxygenation

- Immediately after ROSC, **use 100%** (or the maximum available) inspired oxygen until the arterial oxygen saturation (SpO2) can be measured and titrated reliably with pulse oximetry or the partial pressure of arterial oxygen (PaO2) can be measured.
- As soon as SpO2 can be measured reliably or arterial blood gas values are obtained, **titrate the inspired oxygen to achieve an arterial oxygen saturation of 94-98%** or arterial partial pressure of oxygen (PaO2) of 10–13 kPa (75–100 mmHg). Be aware that pulse oximetry can **overestimate the true oxygen saturation in people with darker skin tones**, and low-flow states will cause low signal quality.
- Avoid both hypoxaemia (PaO2<8 kPa or 60 mmHg) and hyperoxaemia following ROSC.

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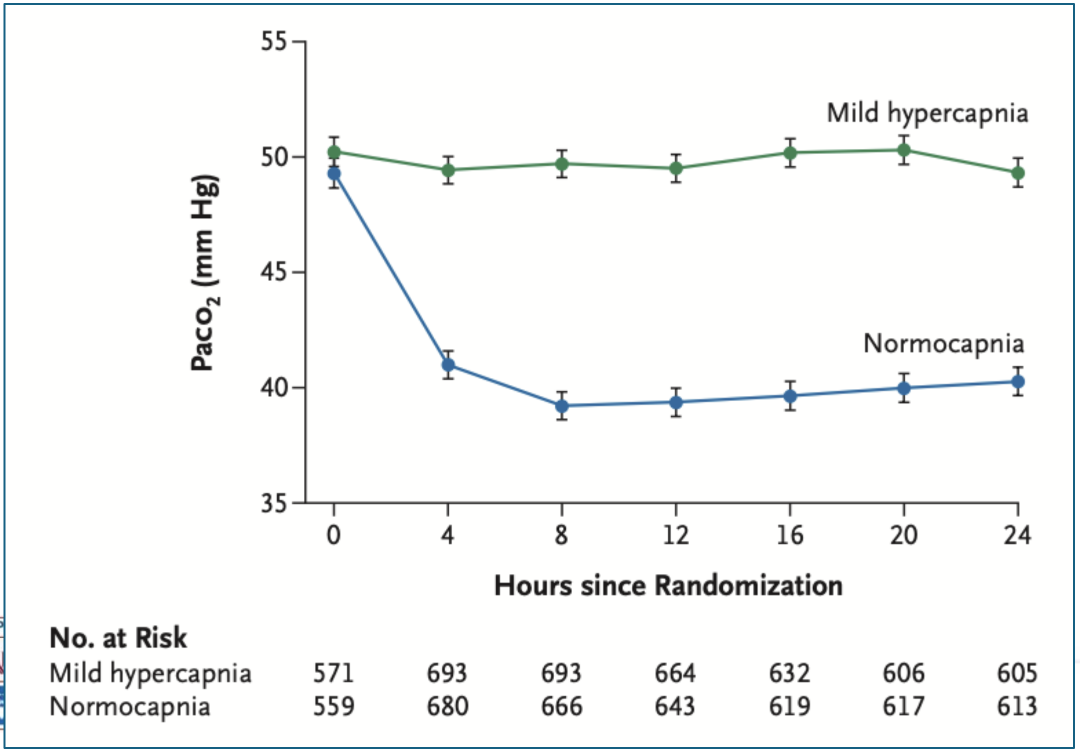
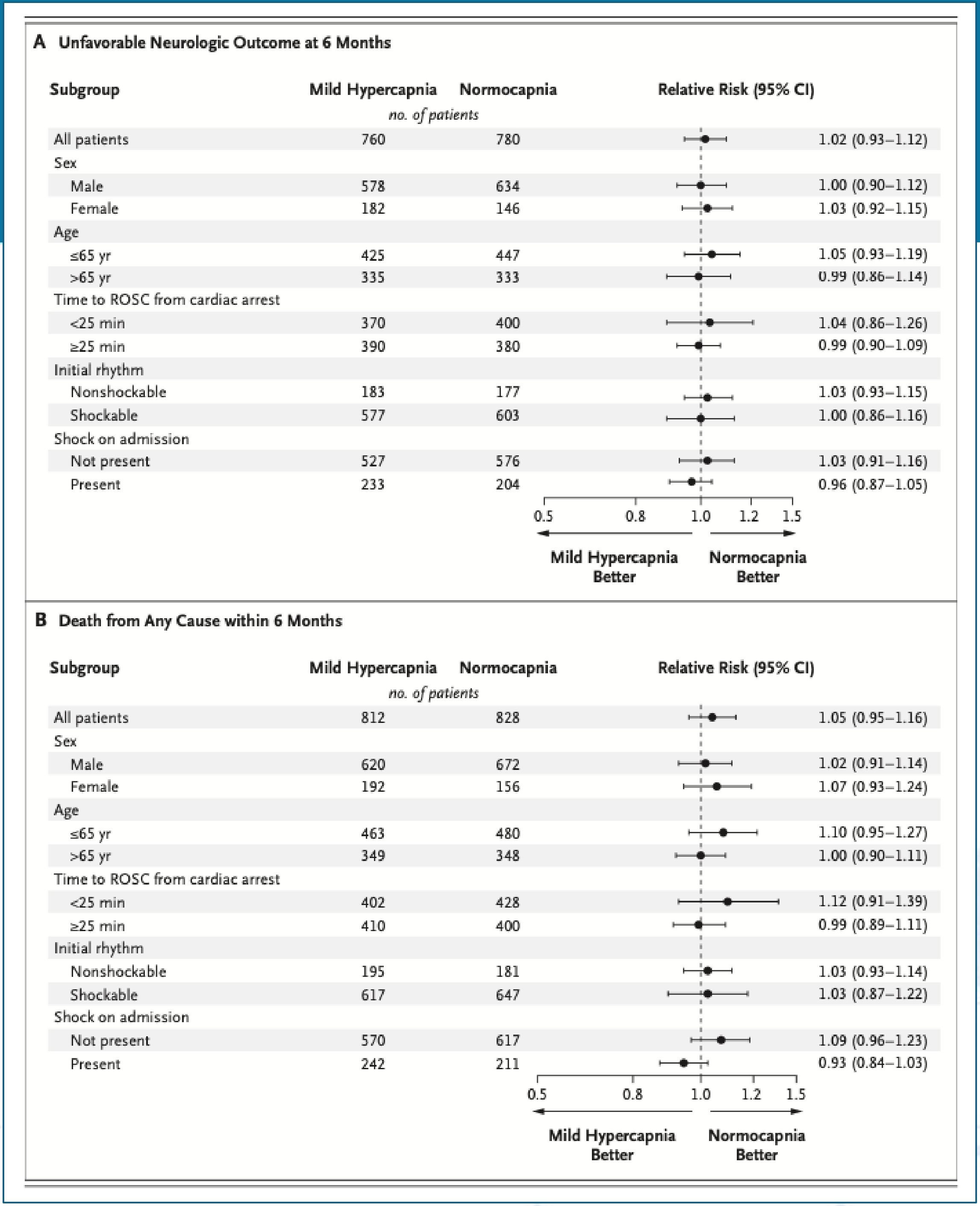
ORIGINAL ARTICLE

NEJM 2023

Mild Hypercapnia or Normocapnia after Out-of-Hospital Cardiac Arrest

G. Eastwood, A.D. Nichol, C. Hodgson, R.L. Parke, S. McGuinness, N. Nielsen, S. Bernard, M.B. Skrifvars, D. Stub, F.S. Taccone, J. Archer, D. Kutsogiannis, J. Dankiewicz, G. Lilja, T. Cronberg, H. Kirkegaard, G. Capellier, G. Landoni, J. Horn, T. Olasveengen, Y. Arabi, Y.W. Chia, A. Markota, M. Hænggi, M.P. Wise, A.M. Grejs, S. Christensen, H. Munk-Andersen, A. Granfeldt, G.Ø. Andersen, E. Qvigstad, A. Flaa, M. Thomas, K. Sweet, J. Bewley, M. Bäcklund, M. Tiainen, M. Iten, A. Levis, L. Peck, J. Walsham, A. Deane, A. Ghosh, F. Annoni, Y. Chen, D. Knight, E. Lesona, H. Tlayjeh, F. Svenšek, P.J. McGuigan, J. Cole, D. Pogson, M.P. Hilty, J.P. Düring, M.J. Bailey, E. Paul, B. Ady, K. Ainscough, A. Hunt, S. Monahan, T. Trapani, C. Fahey, and R. Bellomo, for the TAME Study Investigators*



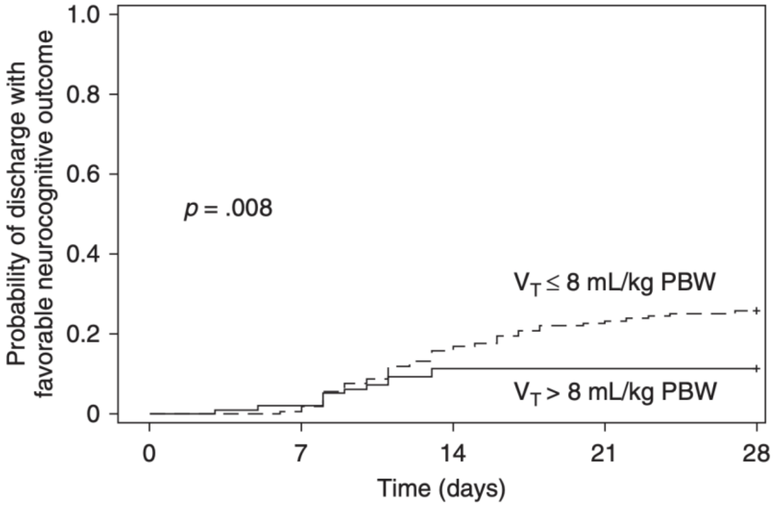


Favorable Neurocognitive Outcome with Low Tidal Volume Ventilation after Cardiac Arrest

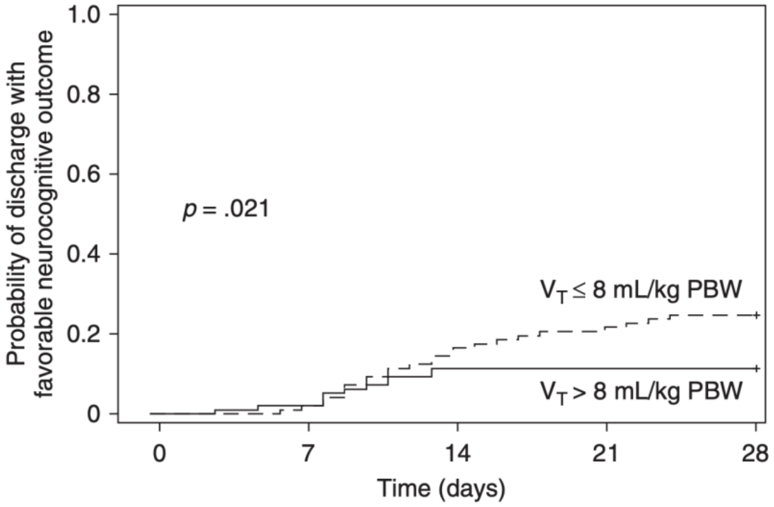
Beitler JR et al. AJRCCM 2017

Probability of discharge with favorable neurocognitive outcome through Day 28

Entire cohort (n=256)



Propensity matched cohort (n=194)



At a Glance Commentary

Scientific Knowledge on the Subject: Patients suffering cardiac arrest have several risk factors for lung injury and often experience poor neurocognitive outcome. Low tidal volumes (V_Ts) attenuate pulmonary and extrapulmonary organ injury in patients at risk of ventilation-induced lung injury. Experimental data suggest low V_T also may be neuroprotective. It is unknown whether low V_T improves neurocognitive outcome postarrest.

What This Study Adds to the Field: In patients suffering nontraumatic out-of-hospital cardiac arrest, lower V_T during the first 48 hours of intensive care unit admission was associated with improved neurocognitive outcome at hospital discharge, more ventilator-free days, and more shock-free days. In context with current understanding of lung–brain crosstalk, these findings suggest low-V_T ventilation may improve neurocognitive outcome after cardiac arrest.

European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care

Nolan JP, Sandroni C, Cariou A, Cronberg T, D'Arrigo S, Haywood K, Hoedemaekers A, Lilja G, Nikolaou N, Olasveengen TM, Robba C, Skrifvars MB, Swindell P, Soar J.

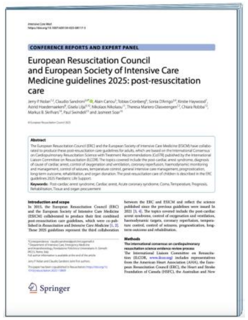
Intensive Care Med 2025 – Resuscitation 2025

GUIDELINES 2025

EUROPEAN RESUSCITATION COUNCIL©

esicm European Society of Intensive Care Medicine

Immediate post-resuscitation care



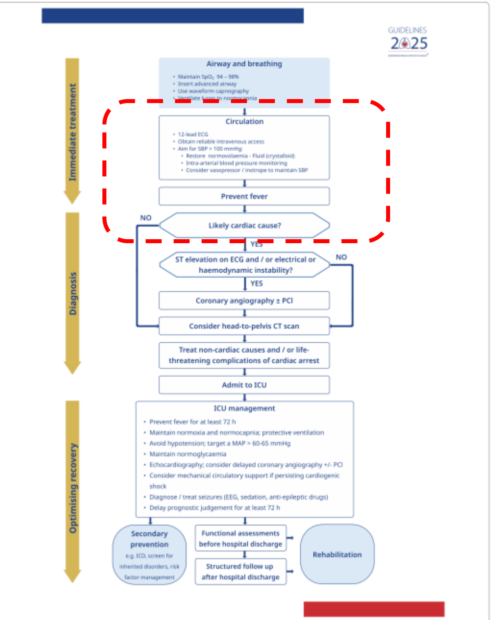


Fig. 2 Post-resuscitation care for unconscious patients. PCI percutaneous coronary intervention; ICU intensive care unit; EEG electroencephalogram; ICD implantable cardioverter defibrillator

Control of ventilation

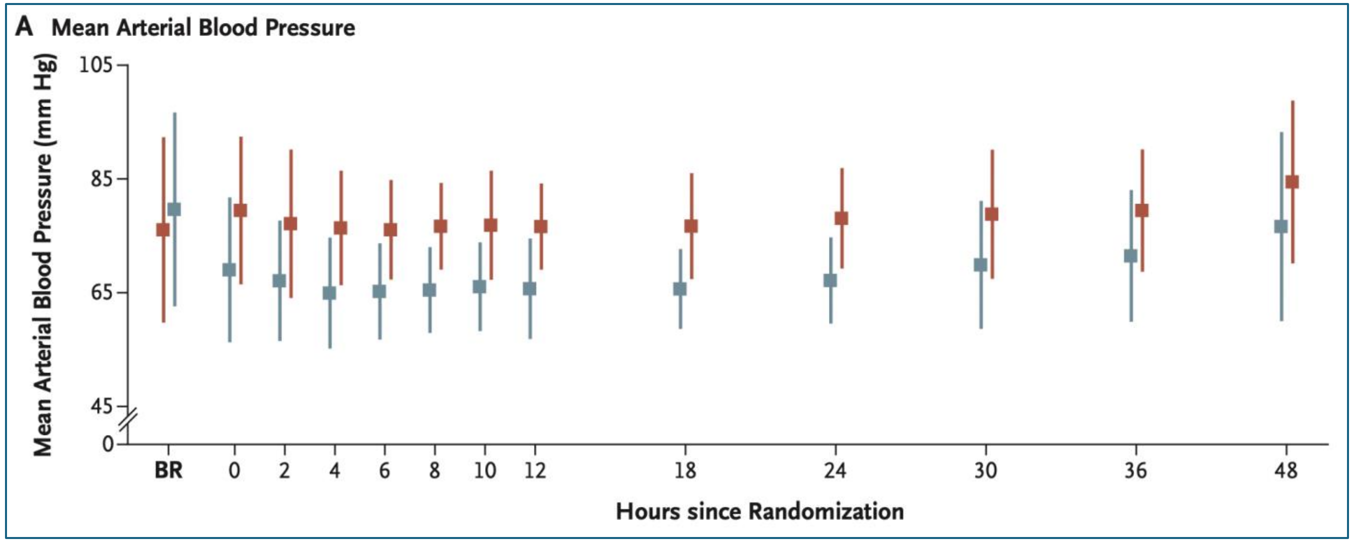
- Obtain arterial blood gases and monitor end tidal CO2 in mechanically ventilated patients.
- **Target normocapnia** – a partial pressure of carbon dioxide of 4.7–6.0 kPa (or approximately 35-45 mmHg) in adults with ROSC after cardiac arrest.
- In patients with accidental hypothermia or treated with hypothermia monitor PaCO2 frequently as hypocapnia may occur.
- In hypothermic patients use consistently either temperature or non-temperature corrected blood gas values.
- Use a lung protective ventilation strategy aiming for **a tidal volume of 6–8 mL/kg ideal body weight**.

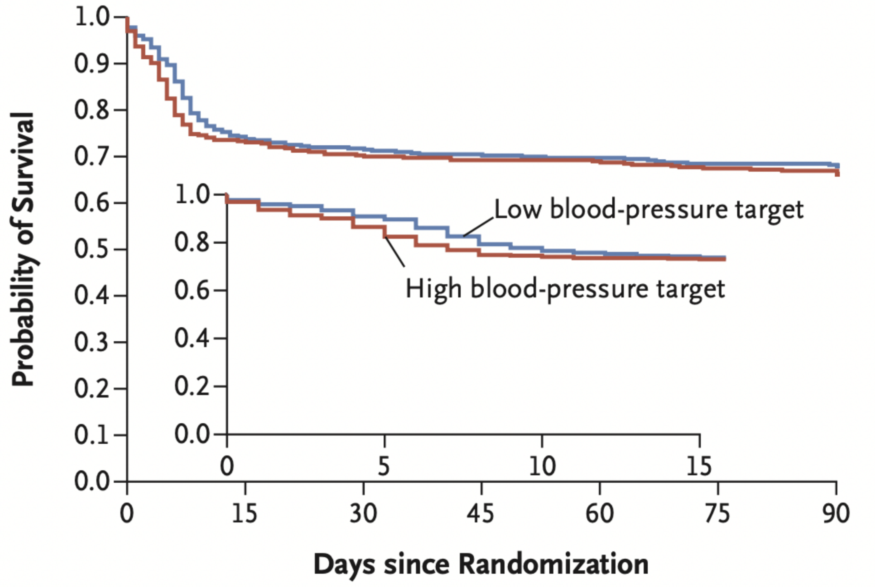
ORIGINAL ARTICLE

Kjaergaard et al. NEJM 2022

Blood-Pressure Targets in Comatose Survivors of Cardiac Arrest

Blood Pressure over the First 48 Hours





No. at Risk

Low blood-pressure target	396	294	284	279	276	271	270
High blood-pressure target	393	288	276	272	271	265	263

BOX Trial

Prof Alain Cariou
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AP-HP. Centre Université Paris Cité

Epinephrine Versus Norepinephrine for Cardiogenic Shock After Acute Myocardial Infarction

JACC VOL. 72, NO. 2, 2018
JULY 10, 2018:173–82

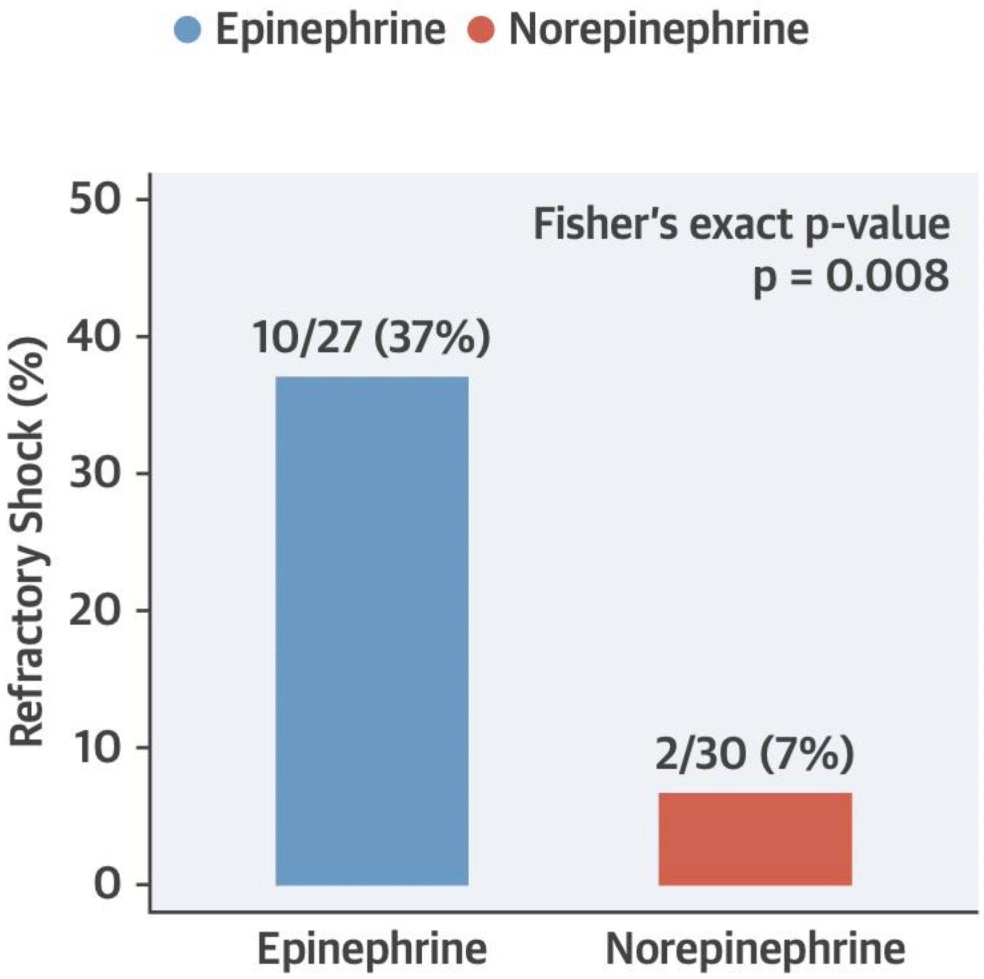
Bruno Levy, MD, PHD,[a] Raphael Clere-Jehl, MD,[b] Annick Legras, MD,[c] Tristan Morichau-Beauchant, MD,[d] Marc Leone, MD, PHD,[e] Ganster Frederique, MD,[f] Jean-Pierre Quenot, MD, PHD,[g] Antoine Kimmoun, MD, PHD,[a] Alain Cariou, MD, PHD,[d] Johan Lassus, MD, PHD,[h] Veli-Pekka Harjola, MD, PHD,[h] Ferhat Meziani, MD, PHD,[b] Guillaume Louis, MD,[i] Patrick Rossignol, MD, PHD,[j] Kevin Duarte, PHD,[j] Nicolas Girerd, MD, PHD,[j] Alexandre Mebazaa, MD, PHD,[k] Philippe Vignon, MD, PHD[l]

TABLE 2 Serious Adverse Events and Outcomes

	Epinephrine (n = 27)	Norepinephrine (n = 30)	p Value*	Odds Ratio (95% Confidence Interval)	p Value†
Refractory shock	10 (37)	2 (7)	0.008	8.24 (1.61–42.18)	0.011
Arrhythmia	11 (41)	10 (33)	0.59	1.37 (0.47–4.05)	0.56
ECLS	3 (11)	1 (3)	0.34	3.62 (0.35–37.14)	0.28
Death	14 (52)	11 (37)	0.29	1.86 (0.65–5.36)	0.25
Death within 7 days	8 (30)	3 (10)	0.093	3.79 (0.89–16.17)	0.072
Death within 28 days	13 (48)	8 (27)	0.11	2.55 (0.84–7.72)	0.097

Values are n (%) unless otherwise indicated. Odds ratios were expressed by using the norepinephrine group as reference. *p value from the Fisher exact test. †p value from the Wald test.

ECLS = extracorporeal life support.



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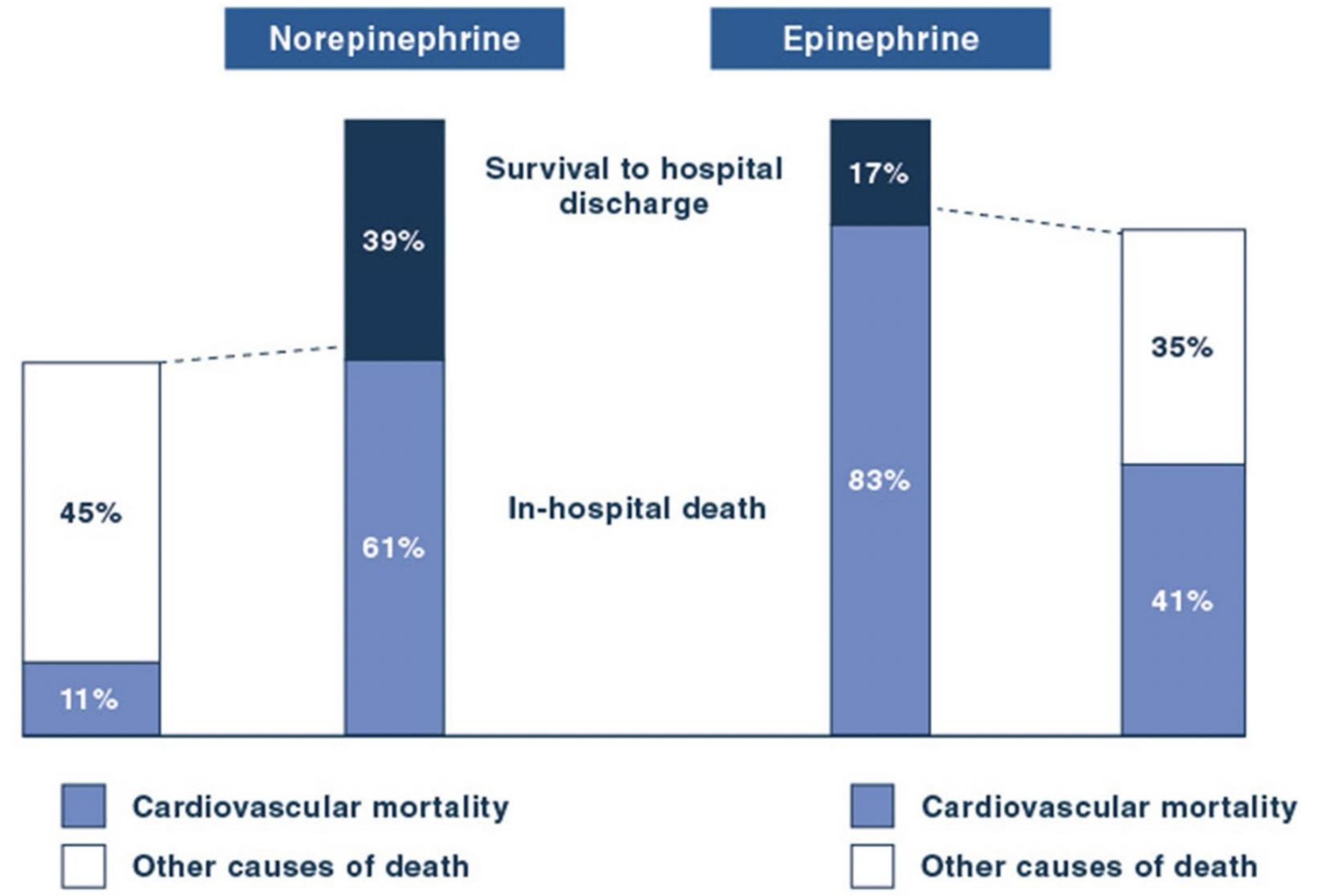


A third of patients received continuous intravenous epinephrine after the ROSC. Epinephrine associated with higher all-cause and cardiovascular-specific mortality, compared with norepin. infusion, in analyses using various methodological approaches

Bougouin W et al. Intensive Care Med 2022

Prehospital high-dose methylprednisolone in resuscitated out-of-hospital cardiac arrest patients (STEROHCA): a randomized clinical trial

Laust E. R. Obling[1*], Rasmus P. Beske[1], Martin A. S. Meyer[1], Johannes Grand[1], Sebastian Wiberg[1,2], Benjamin Nyholm[1], Jakob Josiassen[1], Frederik T. Søndergaard[1], Thomas Mohr[3], Anders Damm-Hejmdal[4], Mette Bjerre[5], Ruth Frikke-Schmidt[6,7], Fredrik Folke[4,7,8], Jacob E. Møller[1,7,9], Jesper Kjaergaard[1,7] and Christian Hassager[1,7]

Intensive Care Med (2023) 49:1467–1478

Study intervention

If eligible for inclusion, patients were randomized to receive a bolus injection of methylprednisolone 250 mg intravenously (2 × 125 mg/2 mL) or placebo (4 mL isotonic NaCl), both administered over 5 min. The dosage was the maximum allowed for methylprednisolone bolus injection in Denmark. The intervention was performed as soon as possible following resuscitation and a minimum of 5 min from ROSC in the prehospital setting. Injection of allocated medicine was completed before hospital arrival, and only allocation number was available at admission.

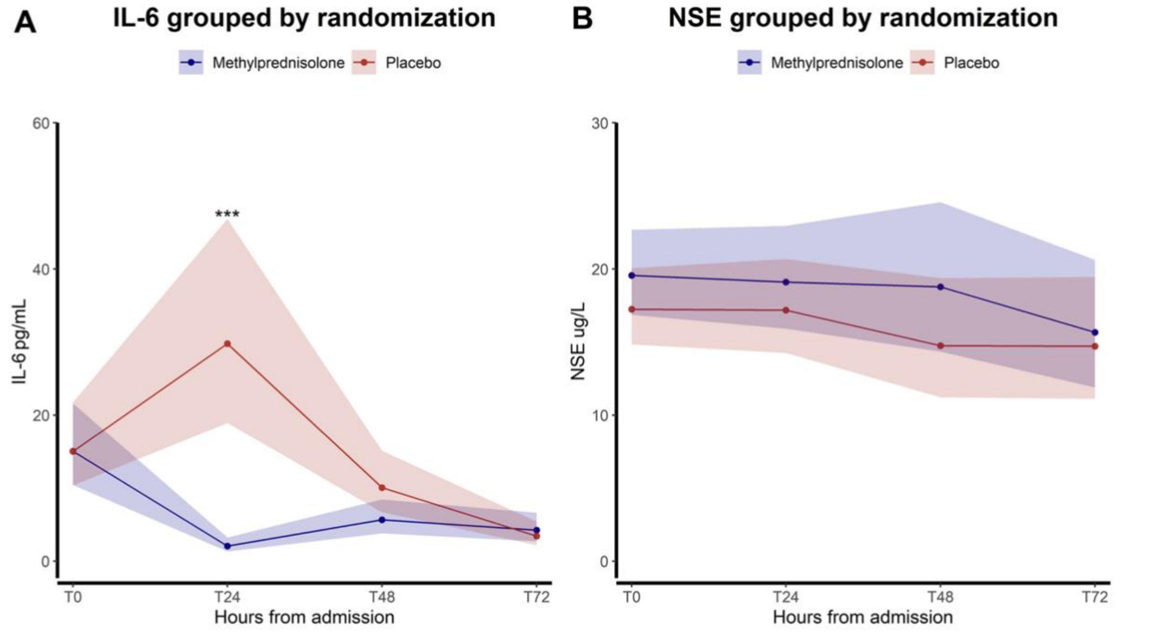
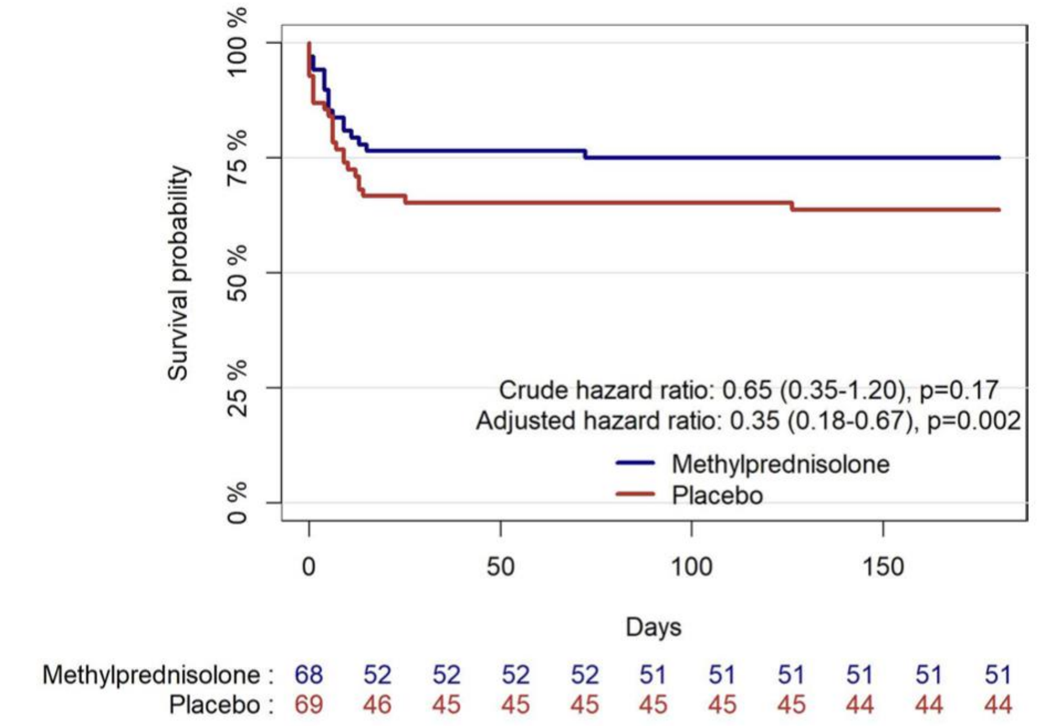


Fig. 2 Primary efficacy analyses: **A** Treatment-by-time interaction for IL-6 (pg/mL) depicting geometric means and 95% confidence intervals after antilog to each time point according to randomization; **B** Treatment-by-time interaction for NSE (ug/L) depicting geometric means and 95% confidence intervals after antilog to each time point according to randomization. The figure includes the measurements for the modified intention-to-treat population ($n = 137$)



AP-HP. Centre Université Paris Cité

European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care

Nolan JP, Sandroni C, Cariou A, Cronberg T, D'Arrigo S, Haywood K, Hoedemaekers A, Lilja G, Nikolaou N, Olasveengen TM, Robba C, Skrifvars MB, Swindell P, Soar J.
Intensive Care Med 2025 – Resuscitation 2025

GUIDELINES 2025
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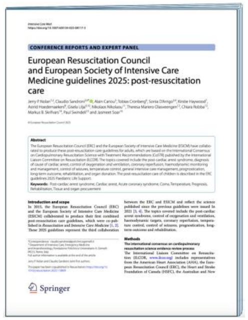
esicm European Society of Intensive Care Medicine

Immediate post-resuscitation care


CONFERENCE REPORTS AND EXPERT PANEL
European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care


Resuscitation
European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2025 Post-Resuscitation Care

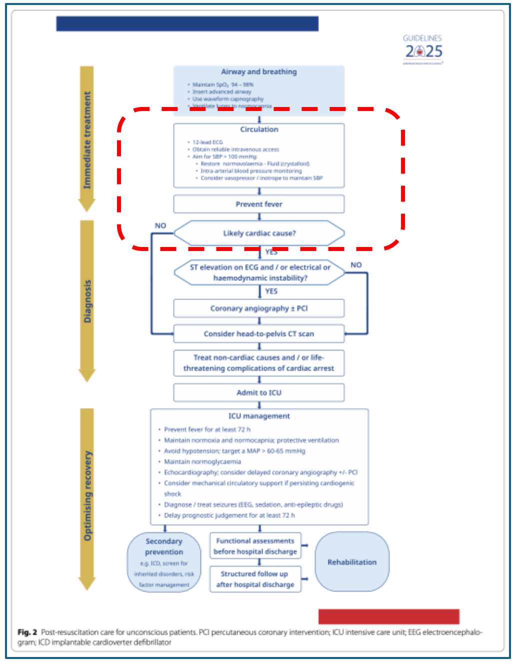


Fig. 2 Post-resuscitation care for unconscious patients. PCI percutaneous coronary intervention; ICU intensive care unit; EEG electroencephalogram; ICD implantable cardioverter defibrillator

Haemodynamic monitoring and management

- Avoid hypotension and **target a SBP >100 mmHg (or a MAP>60–65 mmHg)** after cardiac arrest.
- Maintain perfusion with **fluids, noradrenaline and/or dobutamine**, depending on individual patient need for intra- vascular volume, vasoconstriction or inotropy.
- **Do not give steroids routinely** after cardiac arrest.

- Perform **echocardiograpy** as soon as possible in all patients to detect any underlying cardiac pathology and quantify the degree of myocardial dysfunction.
- All patients should be monitored with an arterial line for continuous blood pressure measurements, and it is reasonable to monitor cardiac output in haemodynamically unstable patients.

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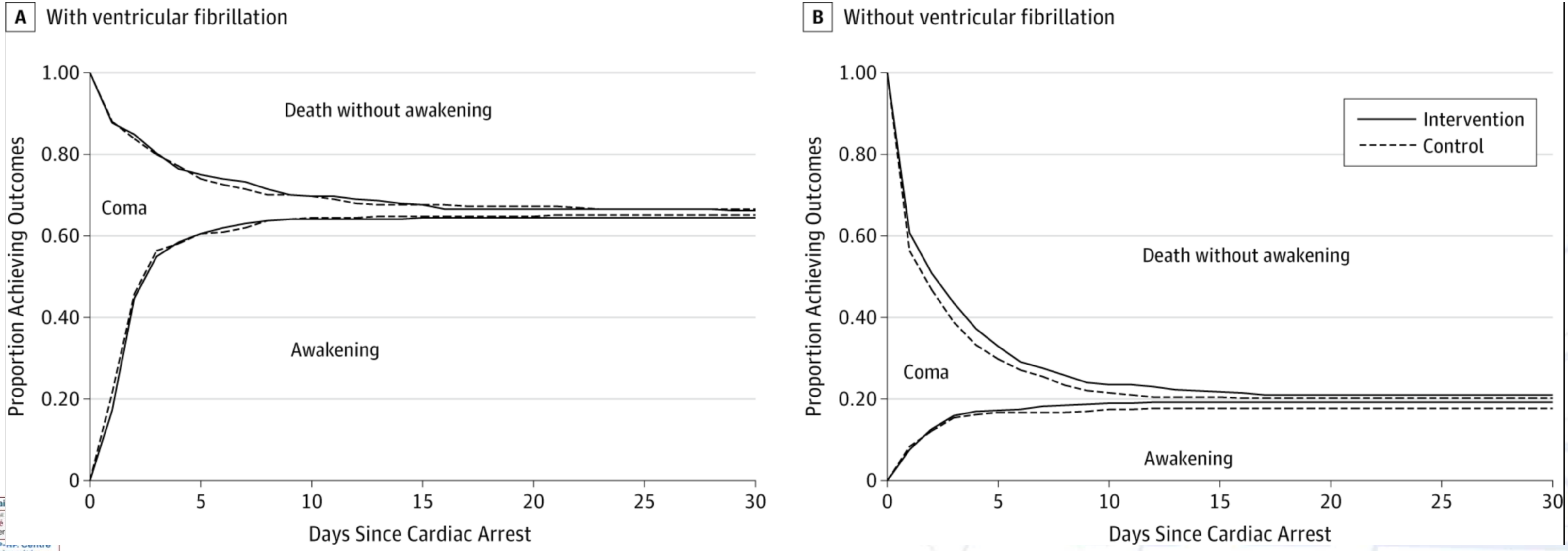
Effect of Prehospital Induction of Mild Hypothermia on Survival and Neurological Status Among Adults With Cardiac Arrest

Kim F et al. JAMA 2014

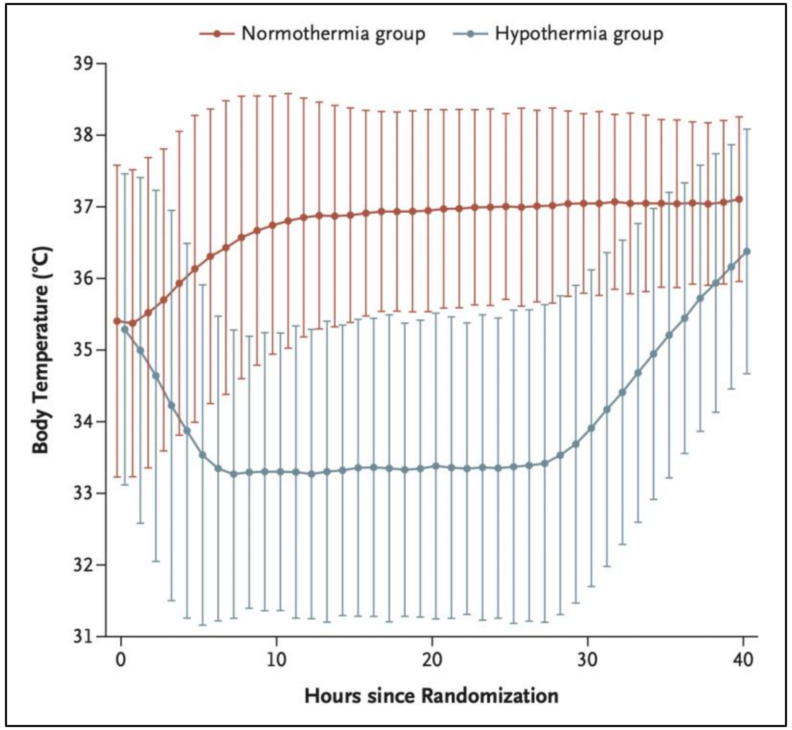
Proportion of comatose patients achieving either death without awakening or awakening as a function of days after cardiac arrest

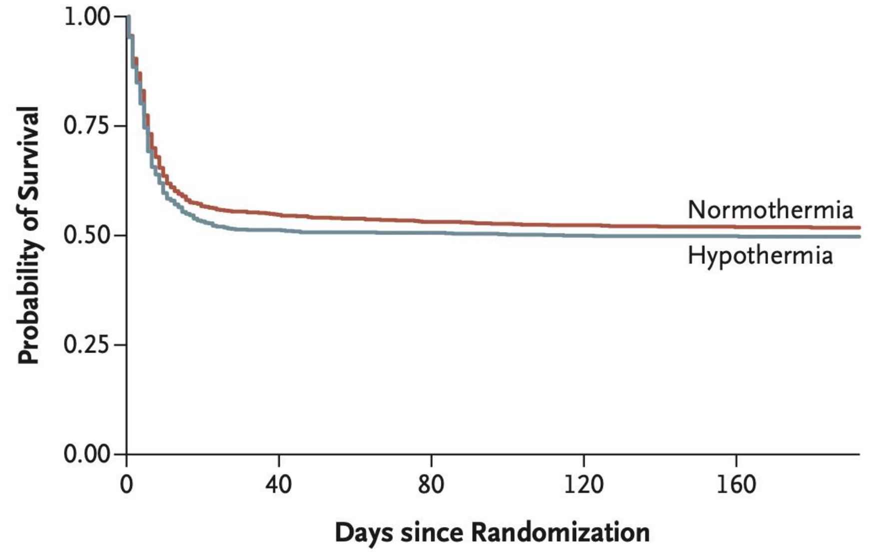


ORIGINAL ARTICLE

Hypothermia versus Normothermia after Out-of-Hospital Cardiac Arrest

N ENGL J MED 384;24 NEJM.ORG JUNE 17, 2021





No. at Risk

Normothermia	925	506	491	484	480
Hypothermia	925	474	468	462	461

TTM 2

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AP-HP. Centre Université Paris Cité

European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care

Nolan JP, Sandroni C, Cariou A, Cronberg T, D'Arrigo S, Haywood K, Hoedemaekers A, Lilja G, Nikolaou N, Olasveengen TM, Robba C, Skrifvars MB, Swindell P, Soar J.

Intensive Care Med 2025 – Resuscitation 2025

GUIDELINES 2025 EUROPEAN RESUSCITATION COUNCIL©

esicm European Society of Intensive Care Medicine

Immediate post-resuscitation care

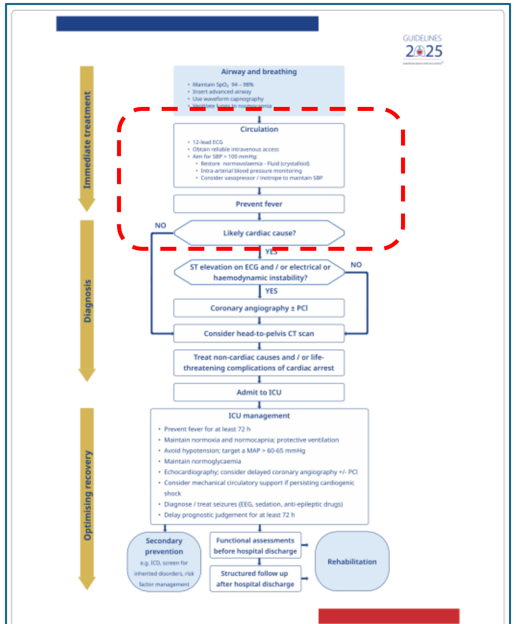

Fig. 2 Post-resuscitation care for unconscious patients. PCI percutaneous coronary intervention; ICU intensive care unit; EEG electroencephalogram; ICD implantable cardioverter defibrillator

Temperature control

- Actively **prevent fever** by targeting a temperature ≤ 37.5 °C for patients who remain comatose after ROSC from cardiac arrest.
- Comatose patients with mild hypothermia (32–36 °C) after ROSC should not be actively warmed to achieve normothermia.
- We recommend **against the routine use of prehospital cooling** with rapid infusion of large volumes of cold intravenous fluid immediately after ROSC.

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Early coronary angiogram after cardiac arrest in non-STEMI patients

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Coronary Angiography after Cardiac Arrest without ST-Segment Elevation

J.S. Lemkes, G.N. Janssens, N.W. van der Hoeven, L.S.D. Jewbali, E.A. Dubois, M. Meuwissen, T.A. Rijpstra, H.A. Bosker, M.J. Blans, G.B. Bleeker, R. Baak, G.J. Vlachojannis, B.J.W. Eikemans, P. van der Harst, I.C.C. van der Horst, M. Voskuil, J.J. van der Heijden, A. Beishuizen, M. Stoel, C. Camaro, H. van der Hoeven, J.P. Henriques, A.P.J. Vlaar, M.A. Vink, B. van den Bogaard, T.A.C.M. Heestermans, W. de Ruijter, T.S.R. Delnoij, H.J.G.M. Crijns, G.A.J. Jessurun, P.V. Oemrawsingh, M.T.M. Gosselink, K. Plomp, M. Magro, P.W.G. Elbers, P.M. van de Ven, H.M. Oudemans-van Straaten, and N. van Royen

COACT

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Angiography after Out-of-Hospital Cardiac Arrest without ST-Segment Elevation

S. Desch, A. Freund, I. Akin, M. Behnes, M.R. Preusch, T.A. Zelniker, C. Skurk, U. Landmesser, T. Graf, I. Eitel, G. Fuernau, H. Haake, P. Nordbeck, F. Hammer, S.B. Felix, C. Hassager, T. Engstrøm, S. Fichtlscherer, J. Ledwoch, K. Lenk, M. Joner, S. Steiner, C. Liebetrau, I. Voigt, U. Zeymer, M. Brand, R. Schmitz, J. Horstkotte, C. Jacobshagen, J. Pöss, M. Abdel-Wahab, P. Lurz, A. Jobs, S. de Waha-Thiele, D. Olbrich, F. Sandig, I.R. König, S. Brett, M. Vens, K. Klinge, and H. Thiele, for the TOMAHAWK Investigators*

TOMAHAWK

JAMA Cardiology | Original Investigation

Emergency vs Delayed Coronary Angiogram in Survivors of Out-of-Hospital Cardiac Arrest
Results of the Randomized, Multicentric EMERGE Trial

Caroline Hauw-Berlemont, MD, MS; Lionel Lamhaut, MD, PhD; Jean-Luc Diehl, MD; Christophe Andreotti, MD; Olivier Varenne, MD, PhD; Pierre Leroux, MD; Jean-Baptiste Lascarrou, MD; Patrice Guerin, MD, PhD; Thomas Loeb, MD; Eric Roupie, MD, PhD; Cédric Daubin, MD; Farzin Beygui, MD, PhD; Florence Boissier, MD, PhD; Nicolas Marjanovic, MD, PhD; Luc Christiaens, MD, PhD; Aurélie Vilfaillot, MS; Sophie Glippa, MS; Juliette Djadi Prat, MD, PhD; Gilles Chatellier, PM, PhD; Alain Cariou, MD, PhD; Christian Spaulding, MD, PhD; for the EMERGE Investigators

EMERGE

JAMA Cardiology | Original Investigation
JAMA Cardiology Published online June 8, 2022

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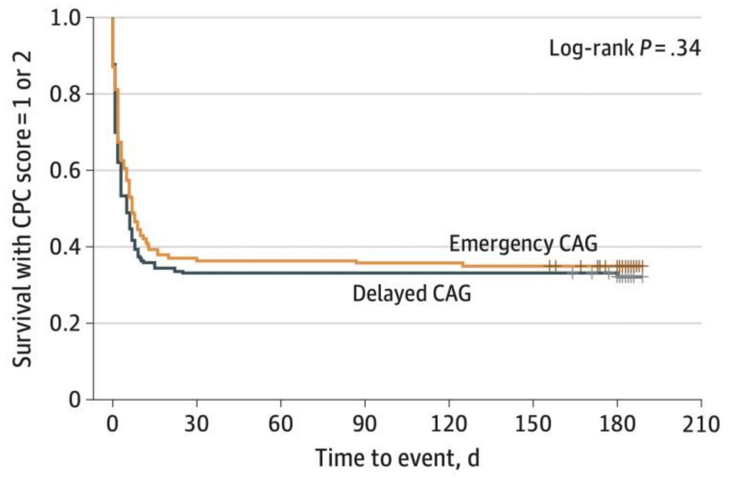
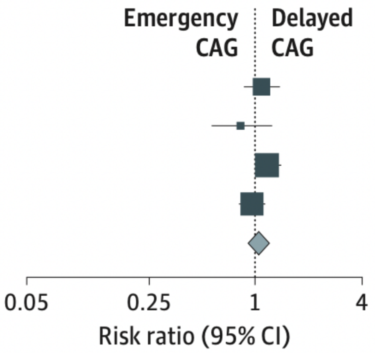
Outcome	Emergency CAG (n = 141)	Delayed CAG (n = 138)	Hazard ratio[a,b] (95% CI)	*P* value
Primary outcome at 180 d,[a,c] No./total No. (%)				
CPC = 1 or 2	47/141 (34.1)	42/138 (30.7)		
CPC = 3, 4, or 5	91/141 (65.9)	95/138 (69.3)	0.87 (0.65-1.15)	.32
Unknown CPC status	3/141 (2.1)	1/138 (0.7)		
Secondary outcomes				
Overall survival rate at 180 d[a]	51/141(36.2)	46/138 (33.3)	0.86 (0.64-1.15)	.31

Figure 2. Patient Survival With a Cerebral Performance Category (CPC) Score of 1 or 2



No. at risk							
Delayed CAG	137	45	45	45	45	45	41
Emergency CAG	138	51	50	49	49	48	41

Studies and year	Emergency CAG Events	Emergency CAG No event	Delayed CAG Events	Delayed CAG No event	Risk ratio (95% CI)
COACT,[10] 2019	97	176	87	178	1.08 (0.86-1.37)
PEARL,[11] 2020	22	27	27	23	0.83 (0.99-1.39)
TOMAHAWK,[12] 2021	143	122	122	143	1.17 (0.99-1.39)
EMERGE,[13] 2020	90	51	92	46	0.96 (0.81-1.14)
Random-effects model: $Q = 4.05$; $df = 3$; $P = .26$; $I^2 = 27.2\%$; $\tau^2 = 0$					1.04 (0.92-1.18)



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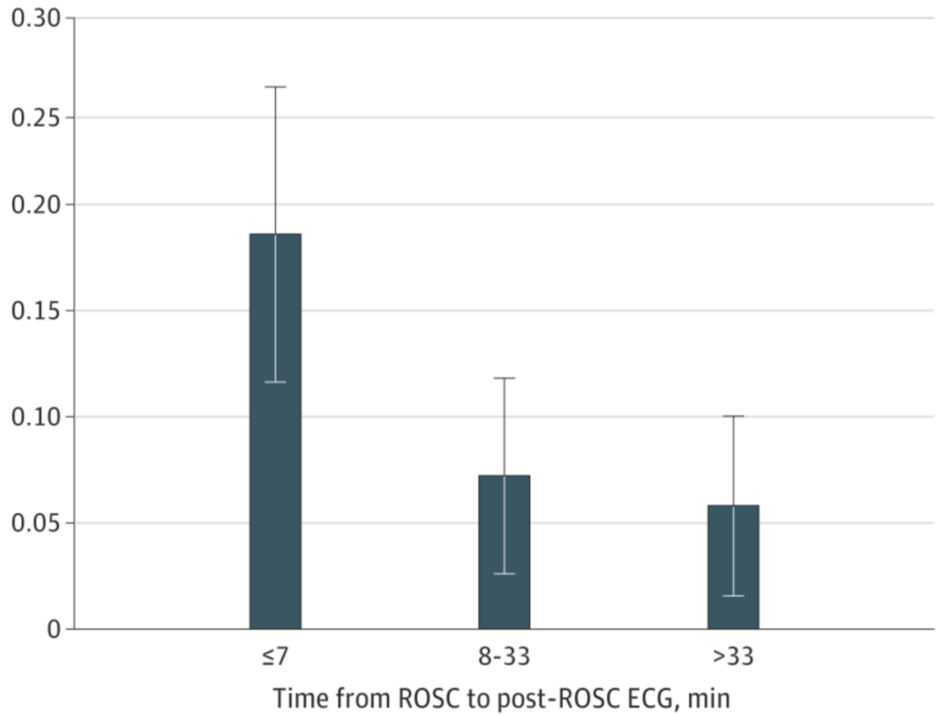
Association of Timing of Electrocardiogram Acquisition After Return of Spontaneous Circulation With Coronary Angiography Findings in Patients With Out-of-Hospital Cardiac Arrest

Baldi Eet al. JAMA Network Open 2021

Proportion of false-positive ECG findings over time



Key Points

- Question: Is the time from the ROSC to ECG acquisition associated with the percentage of false-positive ECG findings for STEMI in patients who experience out-of-hospital cardiac arrest?

- Findings: In this cohort study of 370 patients who were resuscitated from out-of-hospital cardiac arrest, the percentage of false-positive ECG findings among those performed 7 minutes or less after ROSC (18.5%) was significantly higher than those performed between 8 and 33 minutes (7.2%) and over 33 minutes (5.8%) after ROSC.

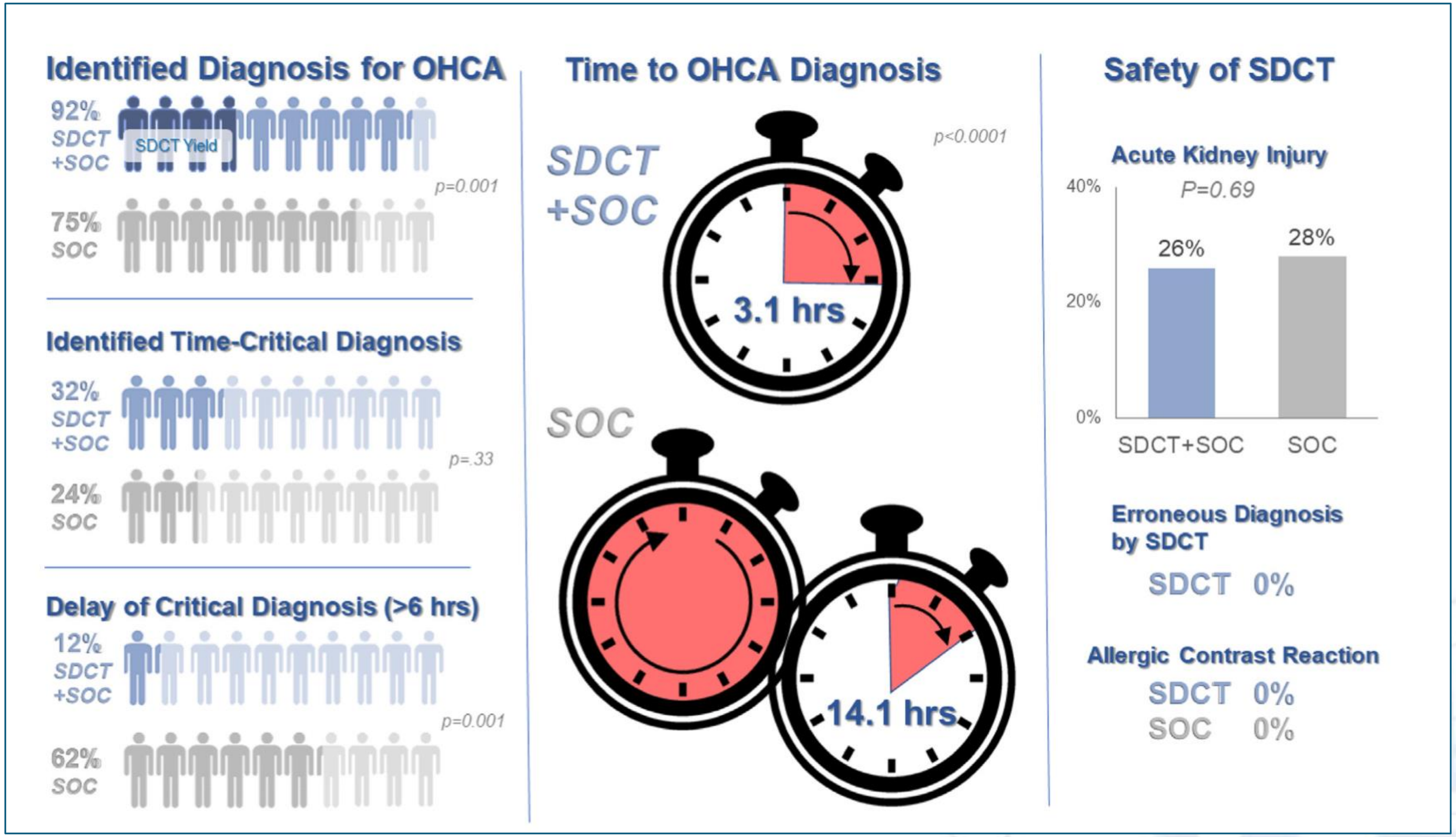
- Meaning: **Results of this study suggest that early ECG acquisition after ROSC is associated with a higher percentage of false-positive ECG findings for STEMI after out-of-hospital cardiac arrest.**

Clinical paper

Diagnostic yield, safety, and outcomes of Head-to-pelvis sudden death CT imaging in post arrest care: The CT FIRST cohort study

Kelley R.H. Branch [a,], Medley O. Gatewood [b], Peter J. Kudenchuk [a], Charles Maynard [c], Michael R. Sayre [b], David J. Carlbom [d], Rachel M. Edwards [e], Catherine R. Counts [b], Jeffrey L. Probstfield [a], Robin Brusen [f], Nicholas Johnson [b], Martin L. Gunn [e,g]*

RESUSCITATION 188 (2023) 109785



Studies assessing CT-scan performance for identification of causes or complications of OHCA. *Benghanem & Cariou, Resuscitation 2023*

Studies	Design	Population	CT scan types	CT scan performance
Branch et al, 2023	Prospective	N= 247 idiopathic OHCA N=104 in the systematic strategy Vs N=143 in the standard of care strategy	CT head-to-pelvis, including coronary CT angiographic data, within 6 hours after hospital arrival Vs CT head, thoracic, and/or abdominopelvic	38% of potentials causes (myocardial infarction, pneumonia, heart failure, pulmonary embolism, abdominal catastrophe, haemorrhagic cerebral vascular accident
Chelly et al, 2012	Retrospective	N= 355 OHCA without obvious causes of CA at admission	CT head and pulmonary angiogram	20% of potentials causes: stroke, pulmonary embolism, acute pulmonary edema, traumatic brain injury, pleural effusion, pneumothorax, pneumonia
Adel et al, 2022	Prospective	N= 225 OHCA	CT head and pulmonary angiogram	15% of potentials causes: pulmonary embolism, tension pneumothorax, intra cranial bleeding, aortic dissection, pericardial tamponade 70% of CPR complications: rib or sternal fractures, aspiration, hepatic bleeding, intra-abdominal air
Hwang et al, 2021	Retrospective	N=452 OHCA including:	CT head, chest and abdomen	7% of potentials causes: chest: 12.5%, abdominal: 5.3%, head: 4.4%
Moriwaki et al, 2013	Retrospective	N=1153 idiopathic sudden death survivors	Peri-mortem non-contrast head and/or thorax CT scans	22% of potentials causes of death: aortic dissection, airway obstruction or submersion, hypoxia due to pneumonia, cerebro-vascular disorder, asthma and acute worsening of chronic obstructive pulmonary disease, pulmonary embolism
Yang et al, 2020	Retrospective	N= 93 OHCA with ECPR	CT chest and pelvis	77% of potentials causes of CA or complications of CPR: myocardial infarction, hypoxic brain injury, sternal/rib fractures, aortic dissection, pulmonary embolism, cardiac tamponade

European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care

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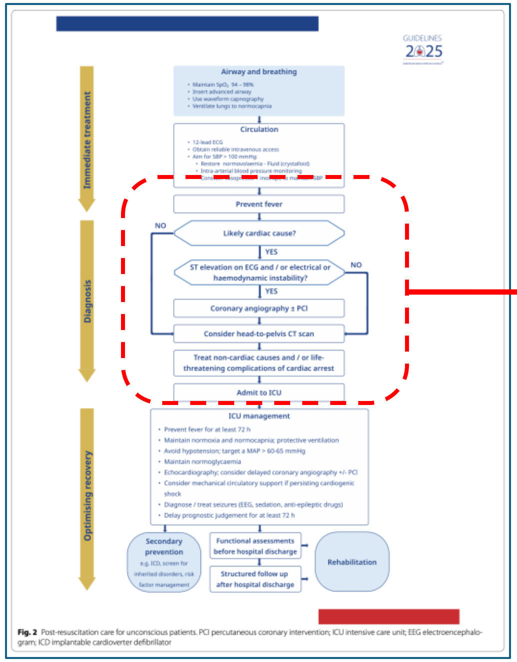

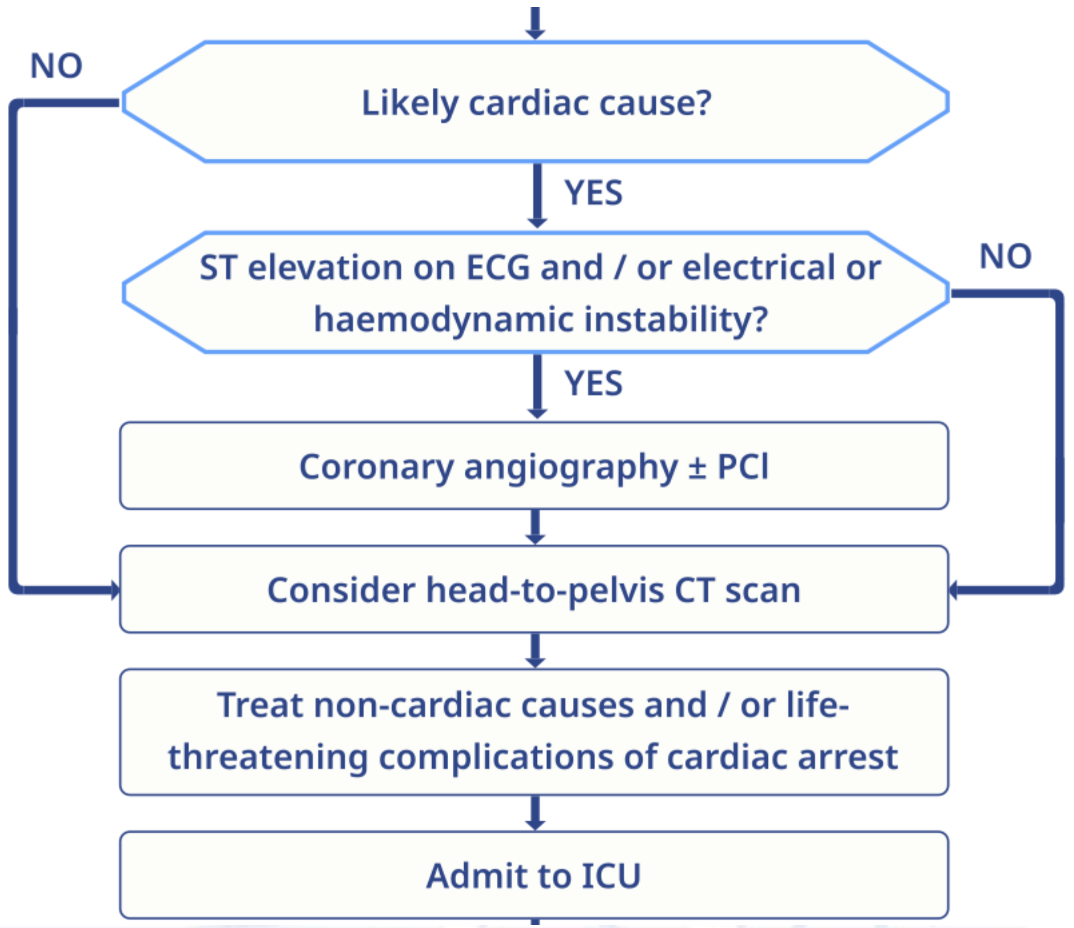

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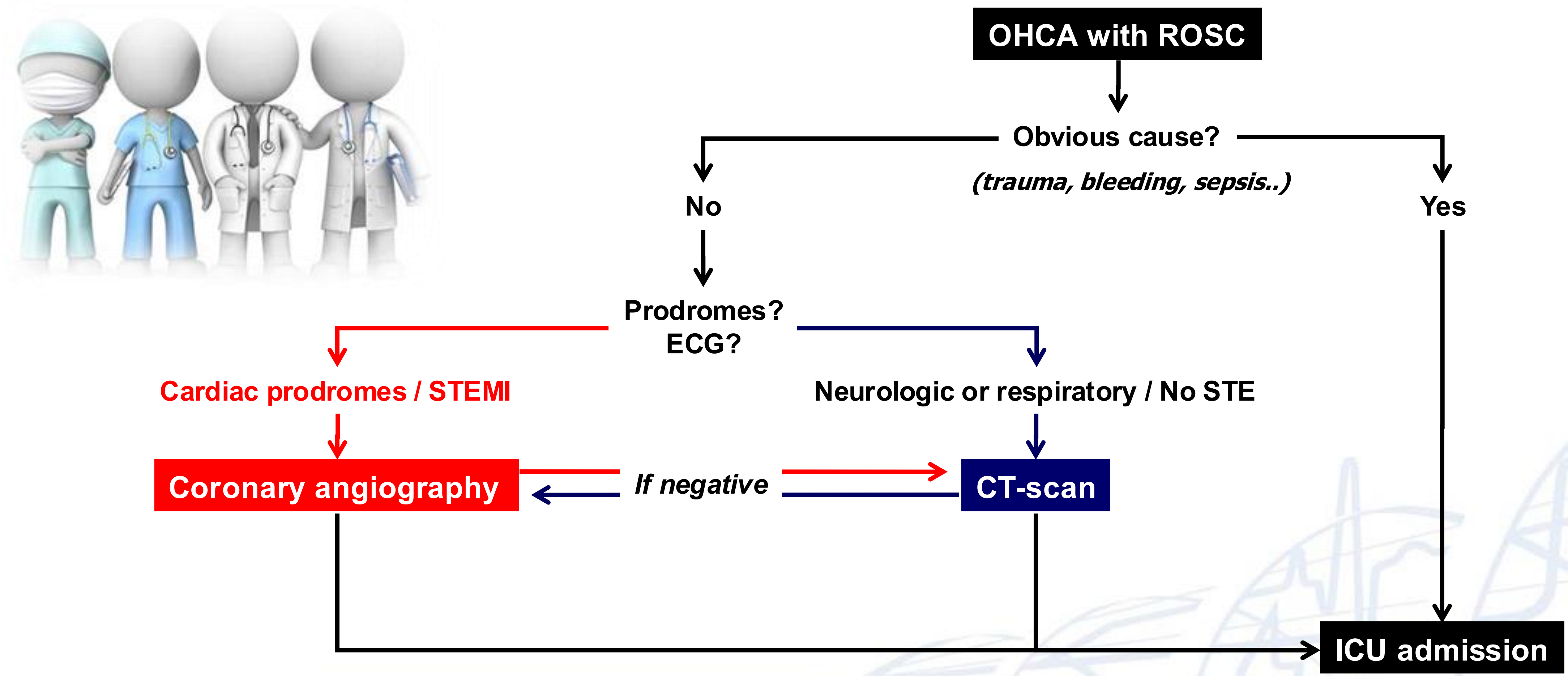
Et à Cochin, vous faites quoi ?



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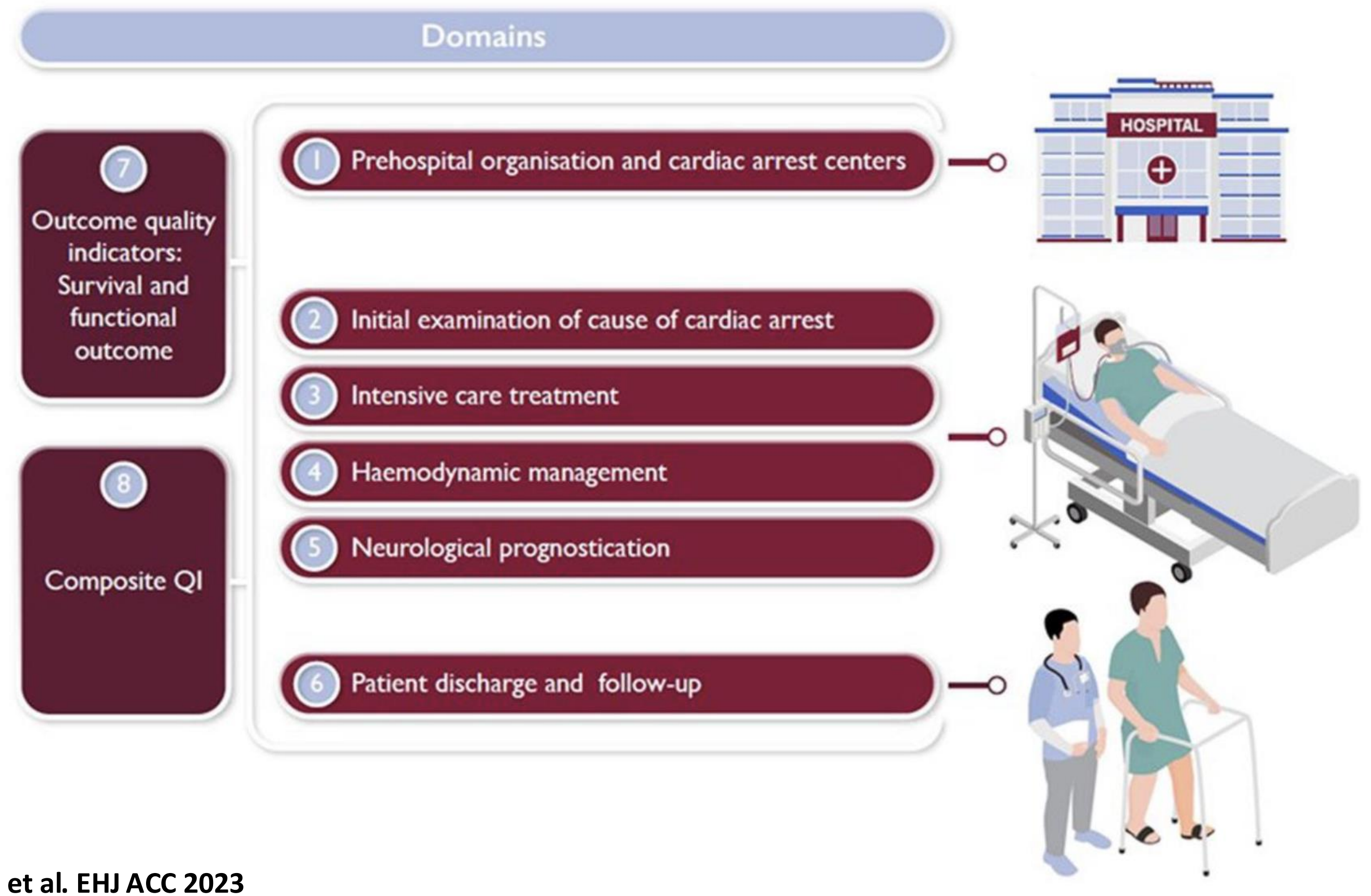
Post-resuscitation care : 8 domains of care where quality should be assessed



Grand J et al. EHJ ACC 2023

European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care

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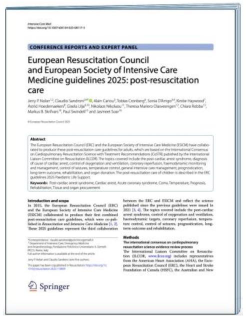
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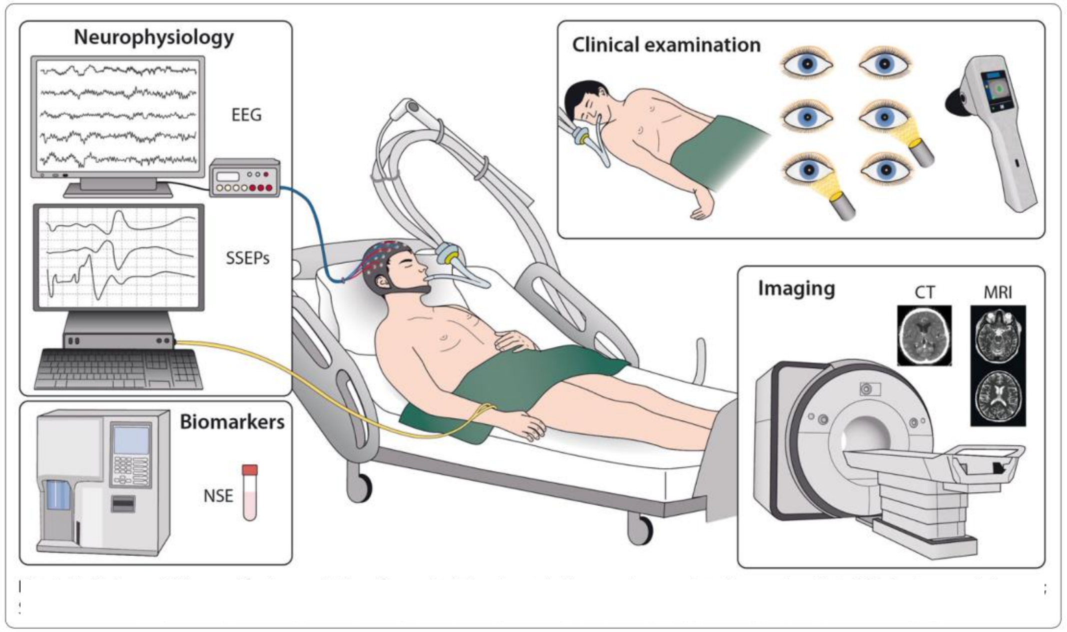
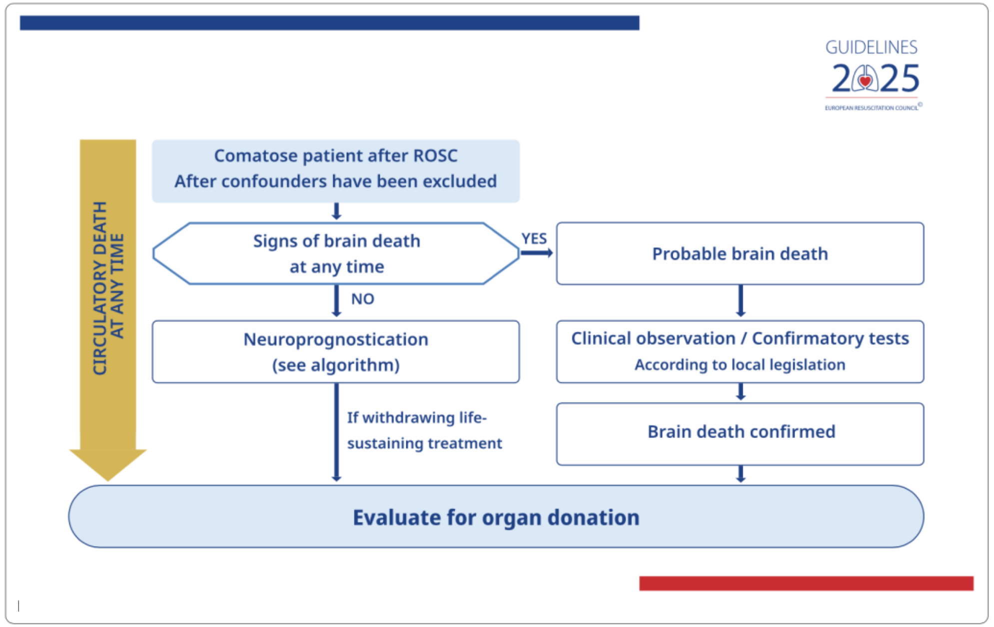
European Resuscitation Council and European Society of Intensive Care Medicine guidelines 2025: post-resuscitation care


Resuscitation
Practice Guideline
European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2025 Post-Resuscitation Care



Prediction of poor and good outcome



Organ donation if brain death or poor neurological outcome

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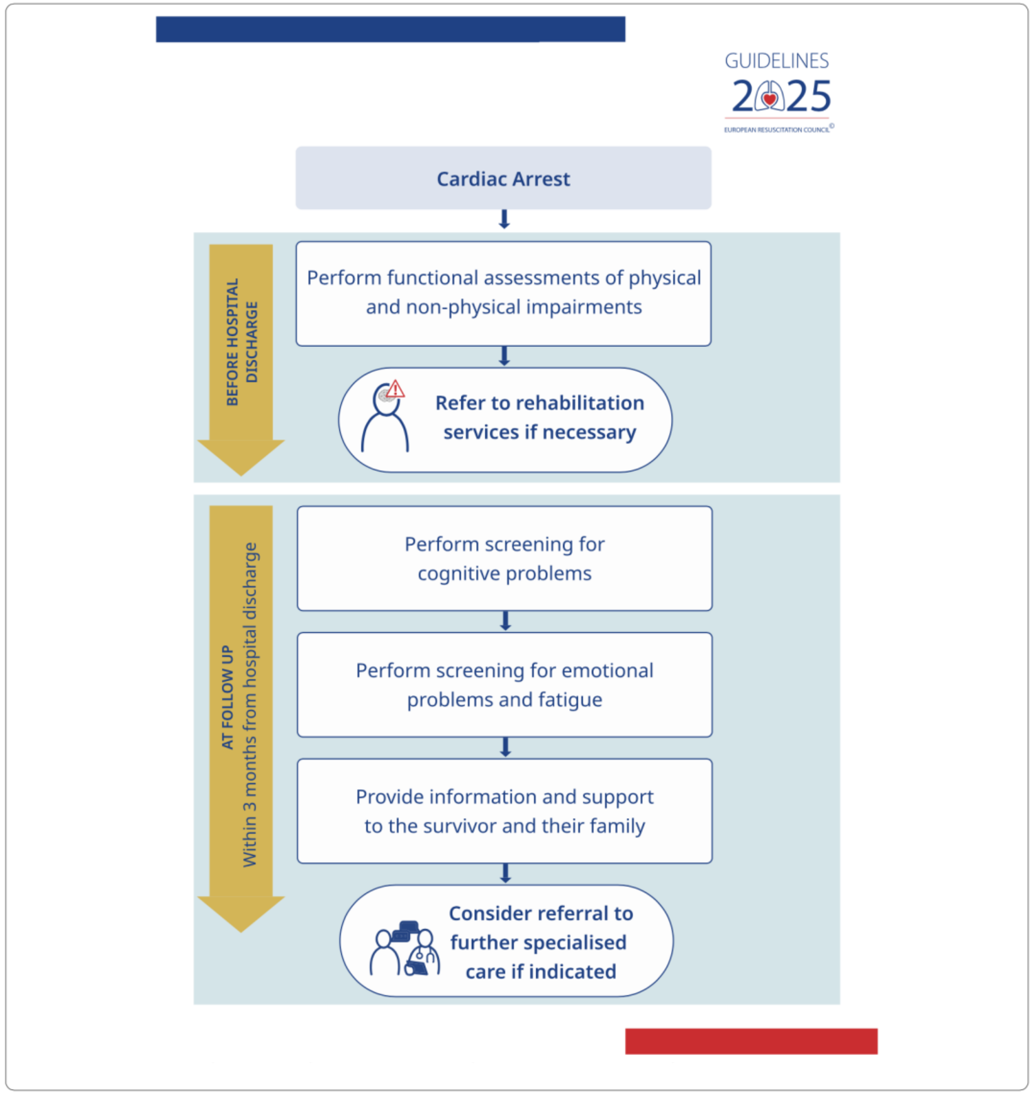
Resuscitation

European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2025 Post-Resuscitation Care

Rehabilitation and follow-up after cardiac arrest

- Implement early mobilisation, delirium management and ICU diaries during hospitalisation
- Provide information for patients and co-survivors
- Perform functional assessments of physical and non-physical impairments before discharge to identify rehabilitation needs and refer to early rehabilitation if indicated.
- Provide cardiac rehabilitation as indicated by the cause of the cardiac arrest.
- Organise a follow-up of cardiac arrest survivors within three months after hospital discharge; screening for cognitive, physical, emotional problems, fatigue, and impact on life roles.
- Invite co-survivors to the follow-up; ask about emotional problems and impact on life roles.
- Undertake specialist referral and further rehabilitation as indicated.



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Cardiac arrest centres for patients with non-traumatic cardiac arrest: a systematic review

Boulton AJ, et al. Resuscitation 2024

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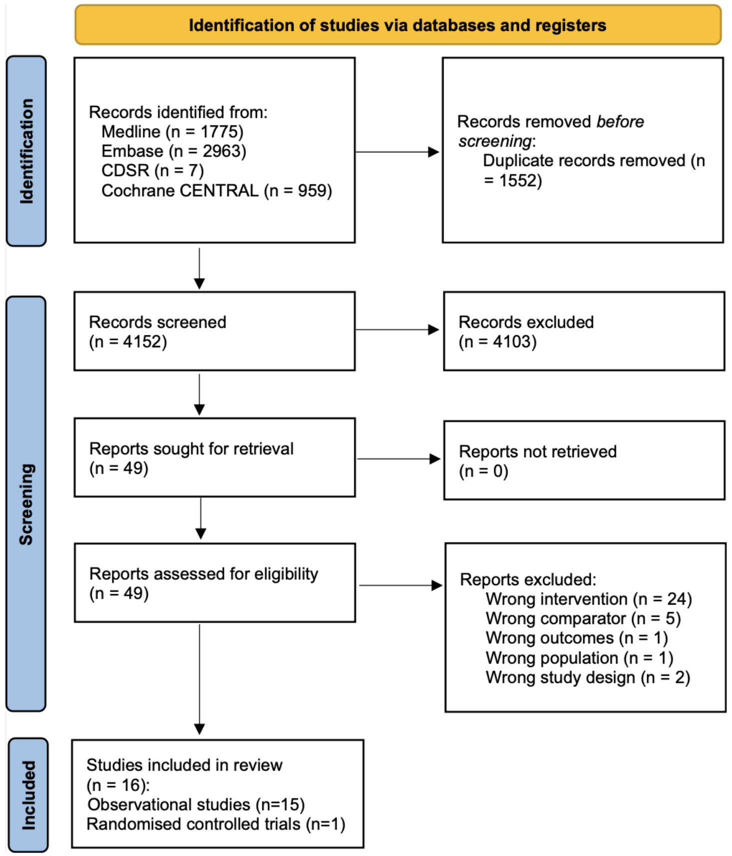
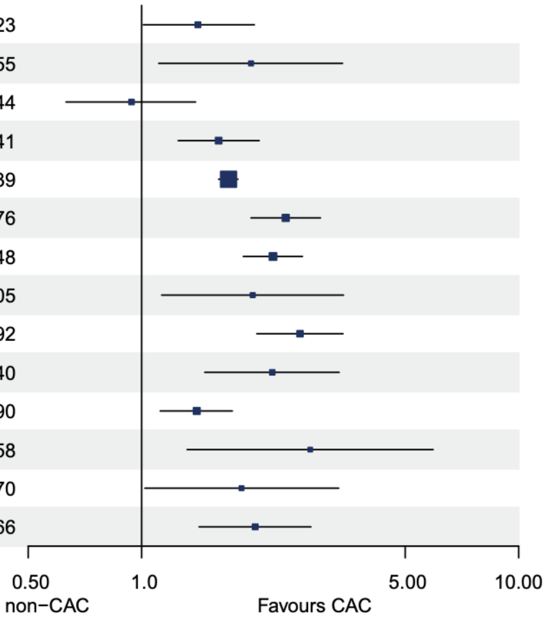


Survival to hospital discharge

Study	Analysis	CAC Events	CAC Total	non−CAC Events	non−CAC Total
Chien 2020 (27)					
Non−shockable	Adj	Not reported	533	Not reported	523
Shockable	Adj	Not reported	2045	Not reported	2055
Chocron 2017 (28)	Adj	66	244	69	244
Cournoyer 2018 (29)	Adj	479	2383	282	2541
Jung 2022 (30)	Adj	3120	23292	5345	72639
Kim 2019 (31)	Adj	455	4036	196	5876
Kragholm 2017 (32)	Adj	455	1359	22	148
McKenzie 2018 (34)	Adj	227	404	47	105
Soholm 2015 (36)	Unadj	264	586	117	492
Spaite 2014 (37)	Adj	250	1734	39	440
Stub 2011 (38)	Adj	611	1816	235	890
Sunde 2007 (39)	Unadj	34	61	18	58
Tagami 2012 (40)	Unadj	30	712	18	770
Yeh 2021 (41)	Adj	248	1222	39	366



"This review supports a weak recommendation that adults with OHCA are cared for at CACs based on very low certainty of evidence"

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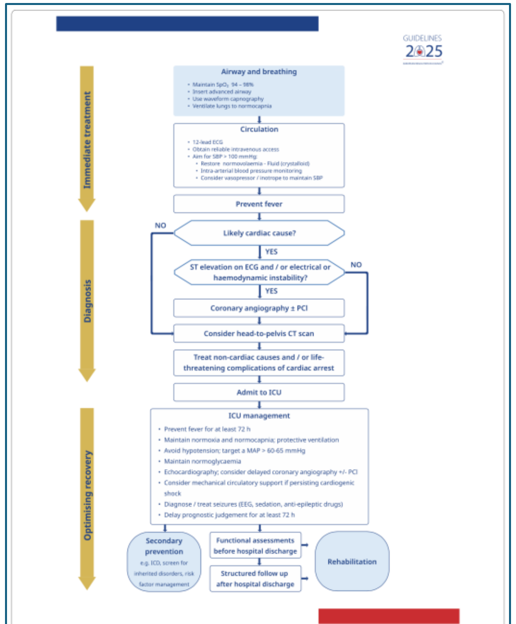

Fig. 2 Post-resuscitation care for unconscious patients. PCI percutaneous coronary intervention; ICU intensive care unit; EEG electroencephalogram; ICD implantable cardioverter defibrillator

Cardiac arrest centres

- Adult patients with non-traumatic OHCA should be considered for transport to a cardiac arrest centre for post-resuscitation care, whenever possible, according to local protocols.
- Health care networks should establish local protocols to develop and maintain a cardiac arrest network.

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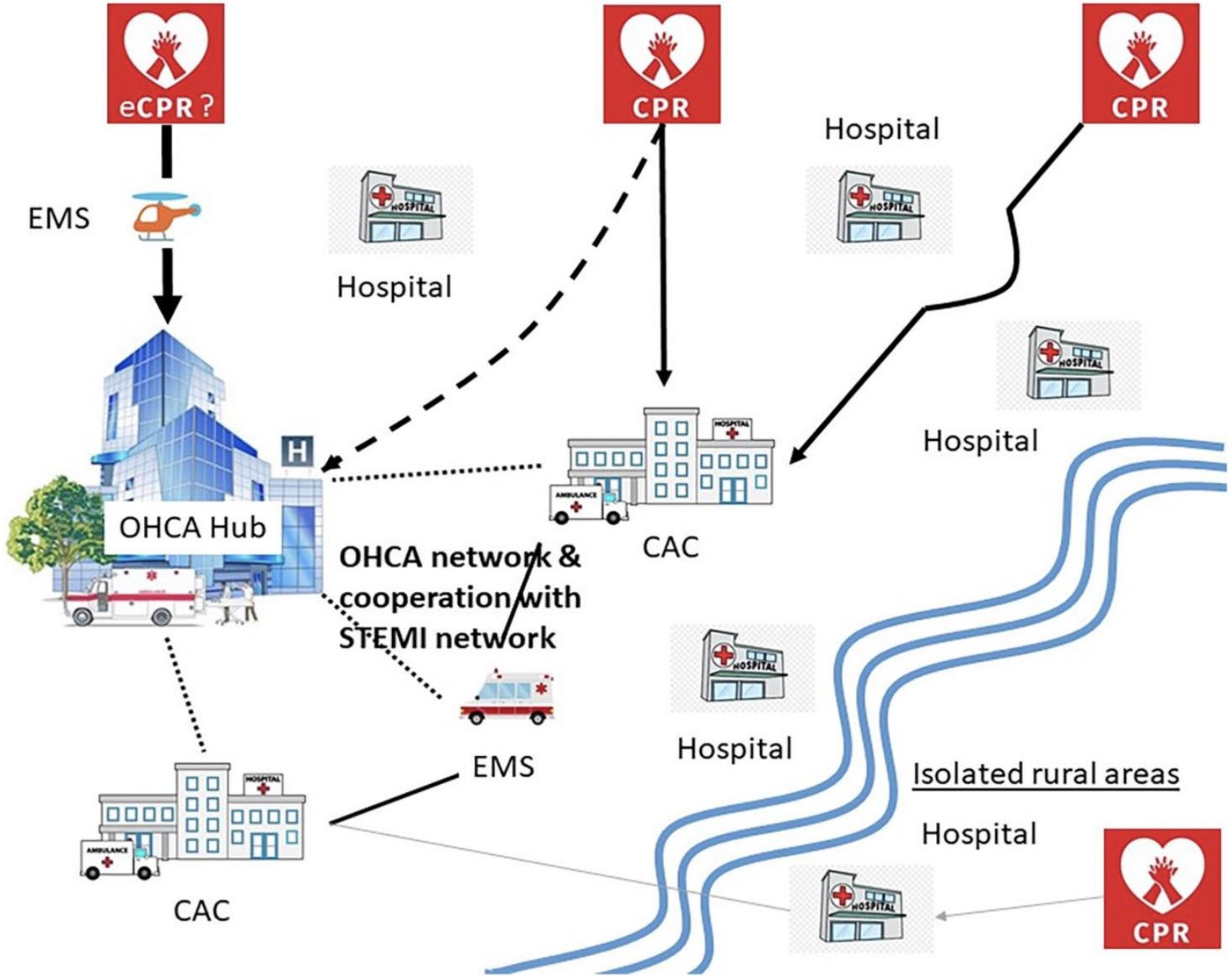
CAC (Cardiac Arrest Centre)

Emergency department for assessment of patient without STEMI criteria for non-cardiac causes
Coronary angiography 24/7
ICU with the option of TTM
Imaging facilities (TTE, TEE, CT and MRI)
Rehabilitation service
Education and teaching
Data acquisition and quality control

OHCA hub hospital

All features of the CAC AND
Mechanical assist device program – eCPR
Arrhythmia management with EPS
Device management
Research facilities and fund raising



Post-resuscitation care: key messages

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POST RESUSCITATION CARE
KEY MESSAGES

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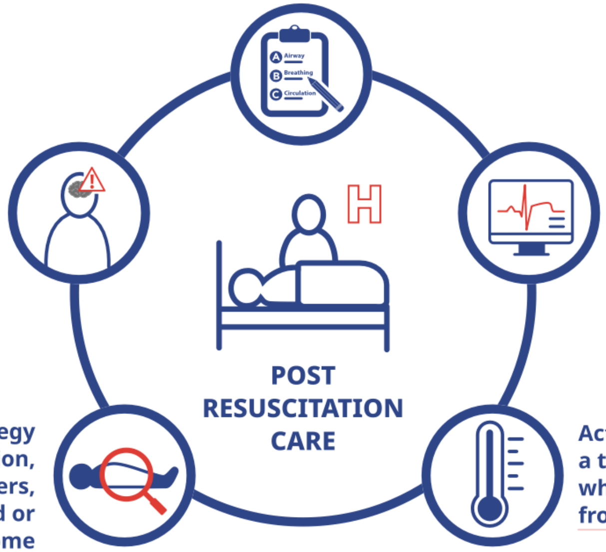
After ROSC use ABCDE approach

- Insert an advanced airway (tracheal intubation when skills available)
- As soon as SpO_2 can be measured reliably or arterial blood gas values are obtained, titrate the inspired oxygen to achieve an arterial oxygen saturation of 94-98%, and ventilate lungs to achieve normocapnia
- Aim for a systolic blood pressure > 100 mmHg or a mean arterial pressure > 60–65 mmHg



Perform functional assessments of physical and non-physical impairments before discharge to identify rehabilitation needs and refer to early rehabilitation if indicated

Prioritise immediate coronary angiography for patients with clear ST-elevation on the ECG or other high suspicion of coronary occlusion (e.g. haemodynamic and/or electrical instability)

Use a multimodal strategy including clinical examination, electrophysiology, biomarkers, and imaging to predict good or poor neurological outcome

Actively prevent fever by targeting a temperature ≤ 37.5 °C for patients who remain comatose after ROSC from cardiac arrest

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