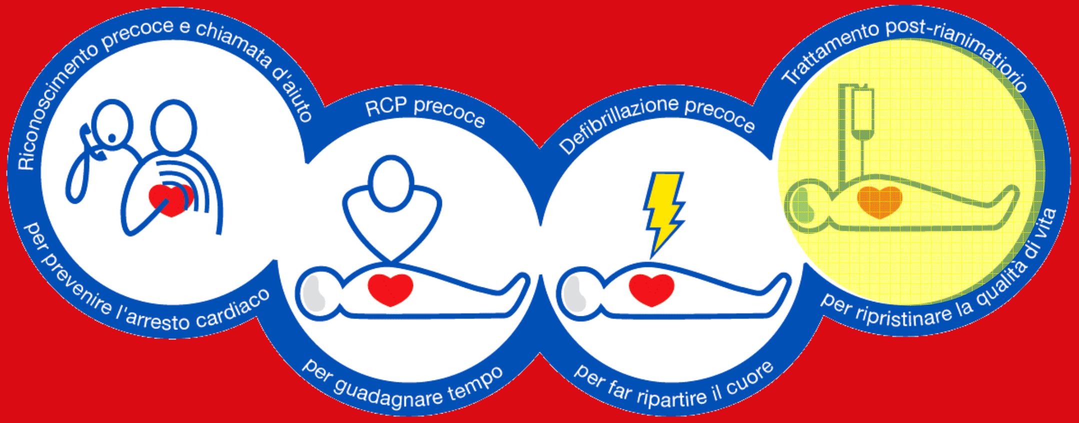
Post Resuscitation Care


Riconoscimento precoce e chiamata d'aiuto
per prevenire l'arresto cardiaco
RCP precoce
per guadagnare tempo
Defibrillazione precoce
per far ripartire il cuore
Trattamento post-rianimatorio
per ripristinare la qualità di vita

Claudio Sandroni
Dept. of Anaesthesiology and Intensive Care
Catholic University School of Medicine –Rome –Italy
IRC Scientific Committee

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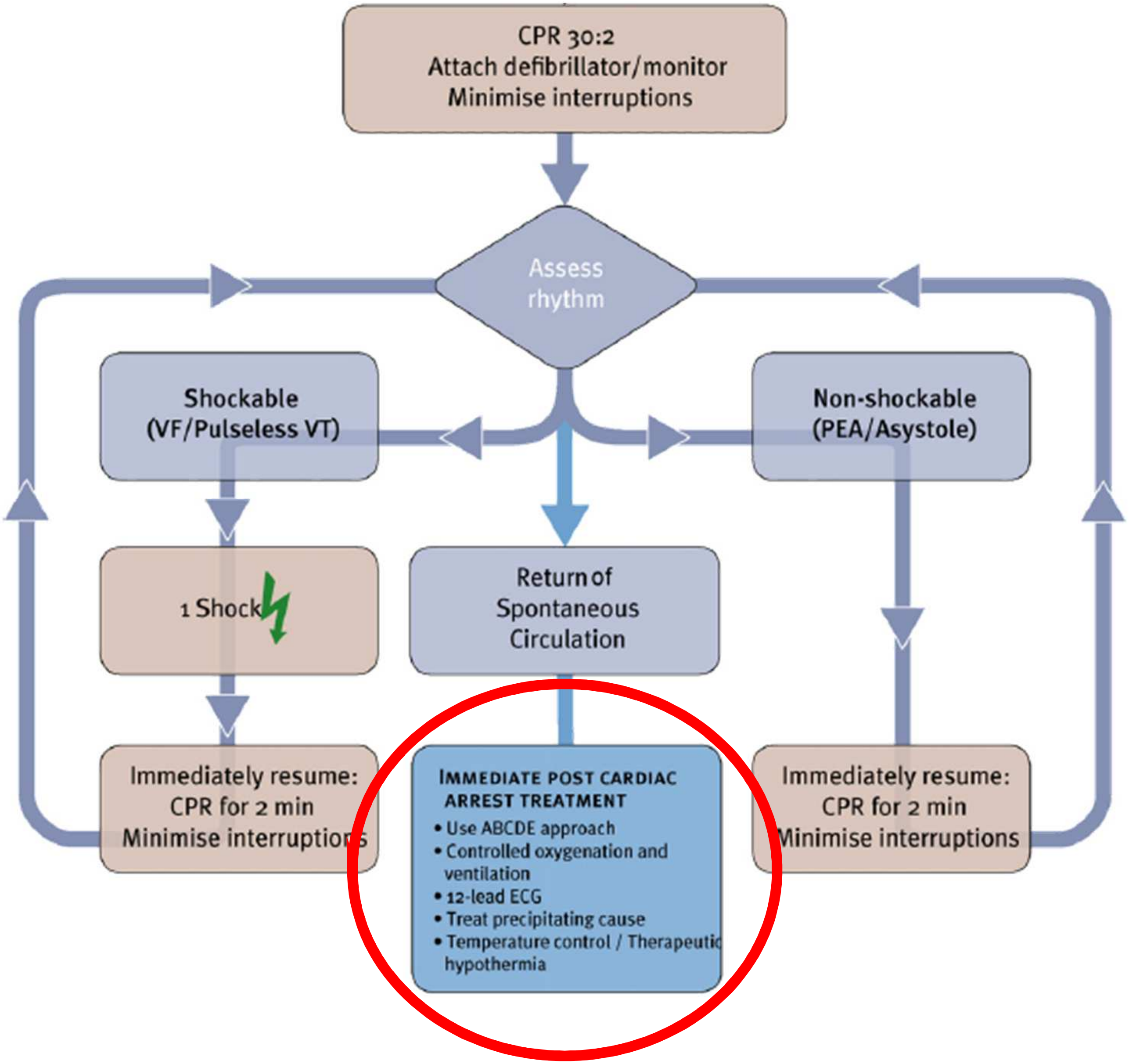
Resuscitation
Council

2010.....



CPR 30:2
Attach defibrillator/monitor
Minimise interruptions

Assess rhythm

Shockable
(VF/Pulseless VT)

1 Shock

Immediately resume:
CPR for 2 min
Minimise interruptions

Return of
Spontaneous
Circulation

IMMEDIATE POST CARDIAC ARREST TREATMENT

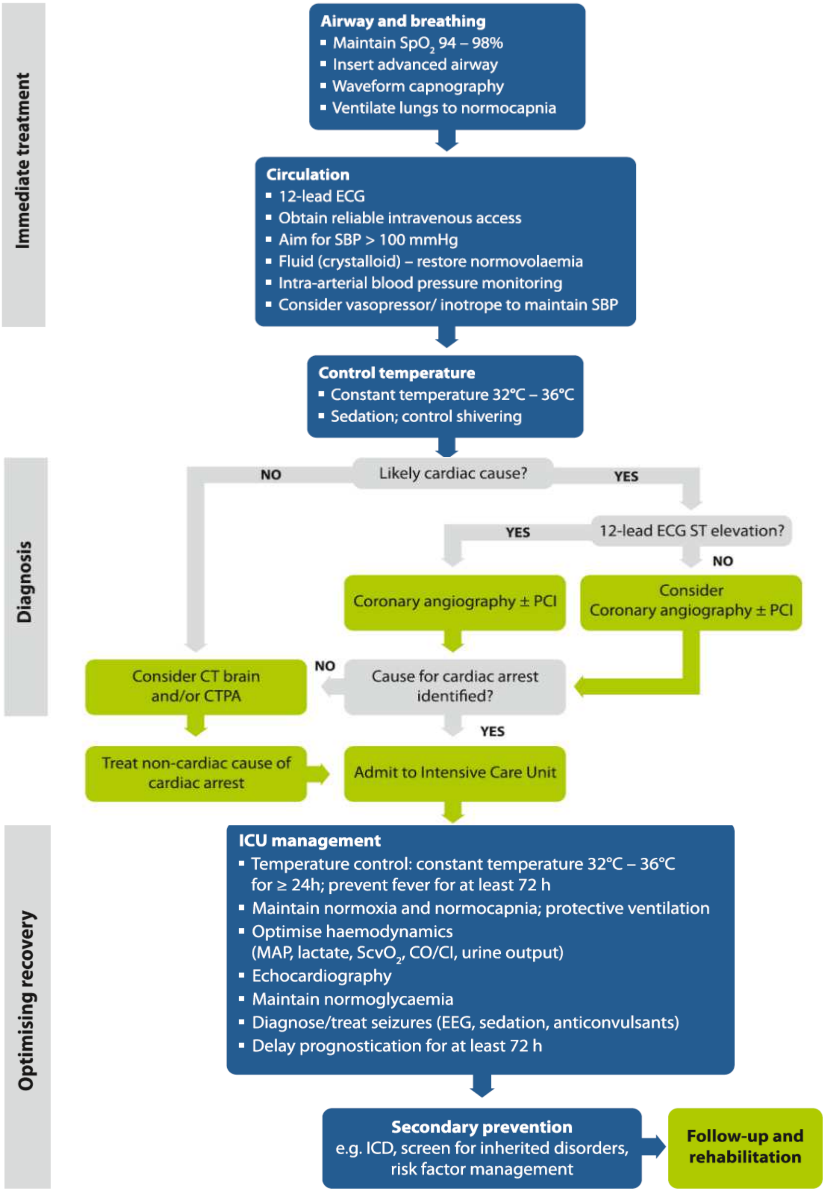
- Use ABCDE approach
- Controlled oxygenation and ventilation
- 12-lead ECG
- Treat precipitating cause
- Temperature control / Therapeutic hypothermia

Non-shockable
(PEA/Asystole)

Immediately resume:
CPR for 2 min
Minimise interruptions

…..2015

Return of spontaneous circulation and comatose



Immediate treatment

Airway and breathing
- Maintain SpO_2 94 – 98%
- Insert advanced airway
- Waveform capnography
- Ventilate lungs to normocapnia

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

Control temperature
- Constant temperature 32°C – 36°C
- Sedation; control shivering

Diagnosis

Likely cardiac cause?

NO

YES

12-lead ECG ST elevation?

YES

NO

Coronary angiography ± PCI

Consider
Coronary angiography ± PCI

Cause for cardiac arrest identified?

NO

YES

Consider CT brain and/or CTPA

Treat non-cardiac cause of cardiac arrest

Admit to Intensive Care Unit

Optimising recovery

ICU management
- Temperature control: constant temperature 32°C – 36°C for ≥ 24h; prevent fever for at least 72 h
- Maintain normoxia and normocapnia; protective ventilation
- Optimise haemodynamics (MAP, lactate, $ScvO_2$, CO/CI, urine output)
- Echocardiography
- Maintain normoglycaemia
- Diagnose/treat seizures (EEG, sedation, anticonvulsants)
- Delay prognostication for at least 72 h

Secondary prevention
e.g. ICD, screen for inherited disorders, risk factor management

Follow-up and rehabilitation

Post Resuscitation Care

Corso Post-ROSC 1° Livello

Workshop Post-ROSC 2° Livello Adulto

Workshop Post-ROSC 2° Livello Pediatrico/Neonatale

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Post Resuscitation Care

- **Obiettivo:** fornire un approccio standard ed aggiornato all'evidenza clinica recente
- **Focus** sulla fase intraospedaliera
  - Pronto soccorso
  - Emodinamica
  - UTI
  - Riabilitazione neurologica per acuti
- **Destinatari**: medici ed infermieri

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Competenze principali

1. Gestione della temperatura
2. Gestione emodinamica e riperfusione
3. Ossigenazione e ventilazione
4. Prognosi
5. Raccolta dati (Utstein)

1 - Gestione della temperatura

- 33 vs. 36 °C
- Durata 24 h
- VF/pVT vs. tutti i ritmi
- Extra- vs. intra

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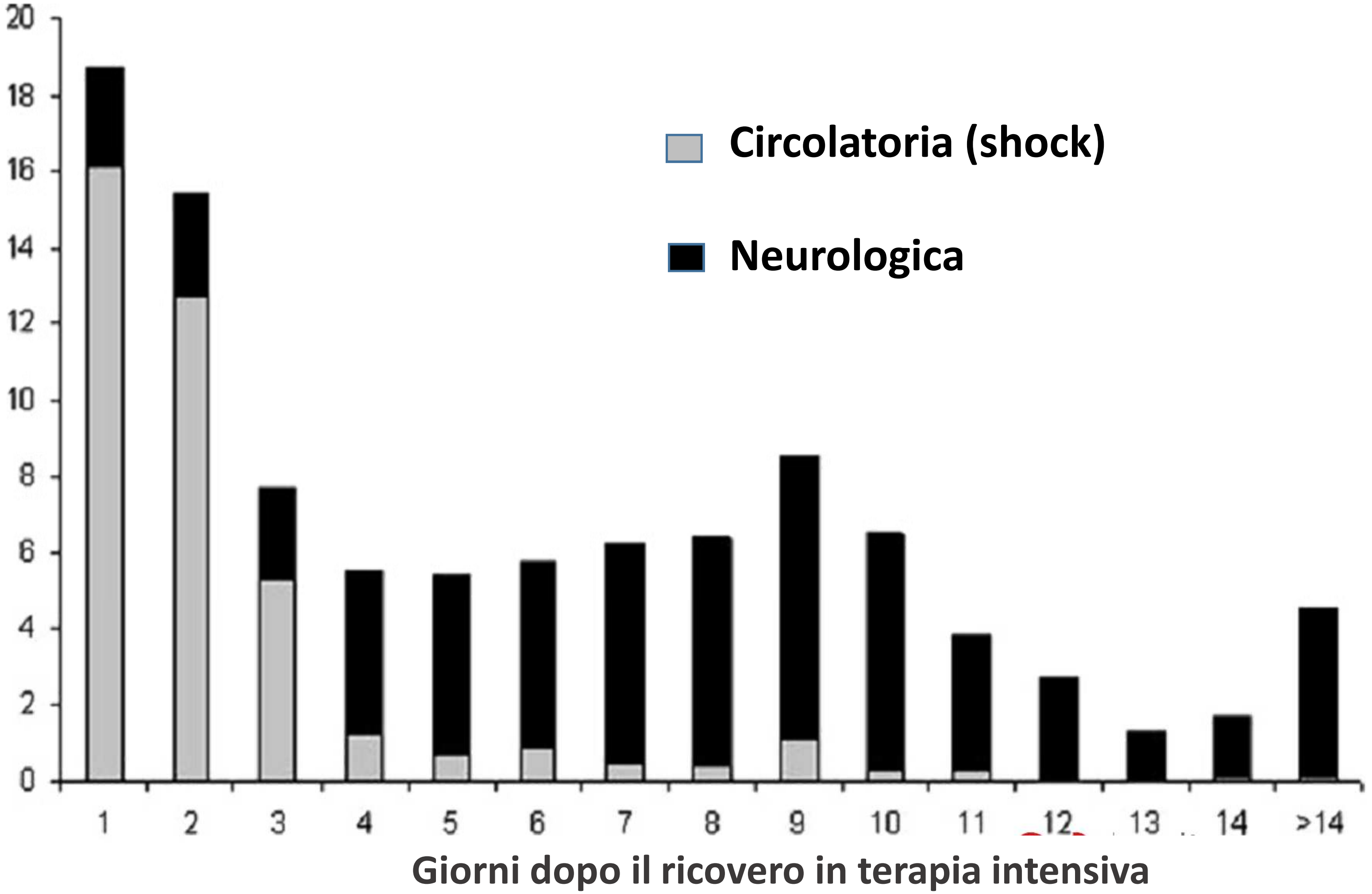
2 - Emodinamica e riperfusione



2 - Emodinamica e riperfusione

Circulation

- 12-lead ECG
- Obtain reliable intravenous access
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- Fluid (crystalloid) – restore normovolaemia
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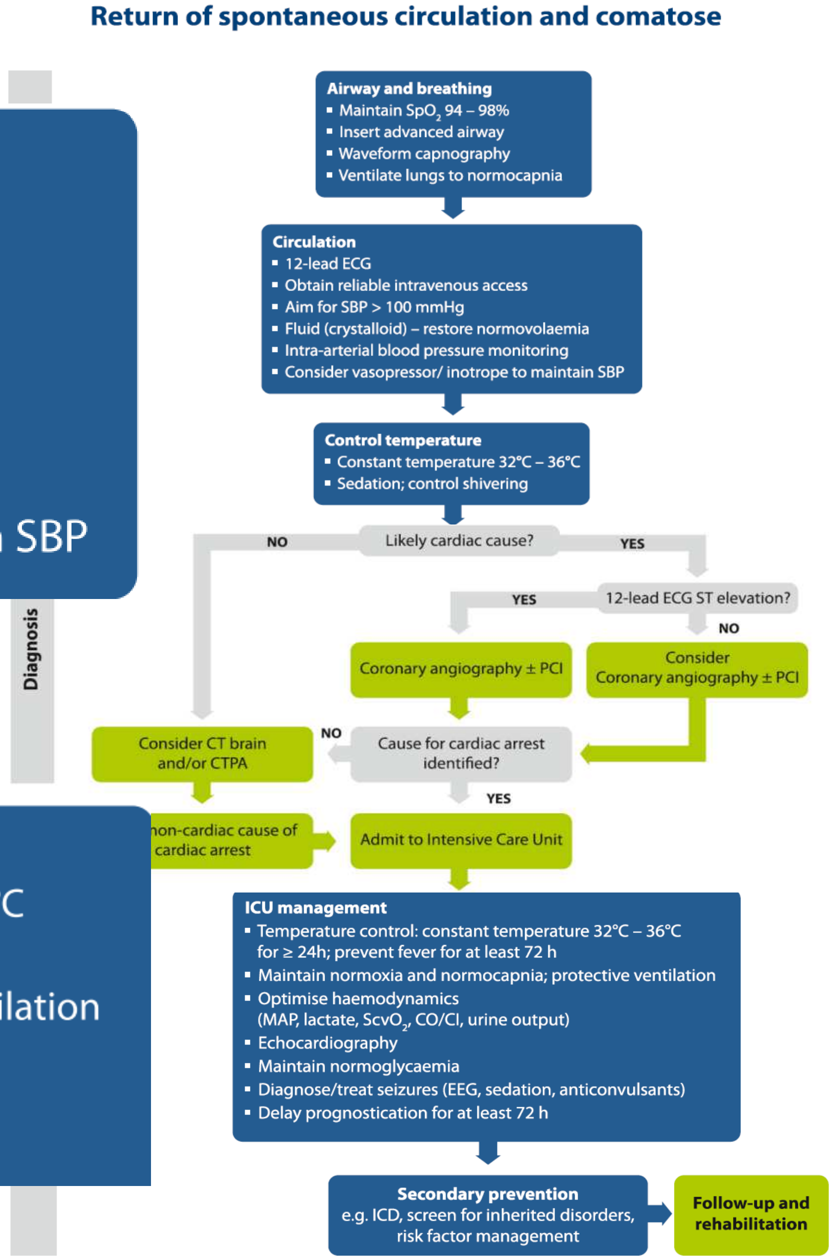

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Control temperature
- Constant temperature 32°C – 36°C
- Sedation; control shivering

Likely cardiac cause?

NO

YES

12-lead ECG ST elevation?

YES

NO

Coronary angiography ± PCI

Consider Coronary angiography ± PCI

Diagnosis

Consider CT brain and/or CTPA

NO

Cause for cardiac arrest identified?

YES

on-cardiac cause of cardiac arrest

Admit to Intensive Care Unit

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- Temperature control: constant temperature 32°C – 36°C for ≥ 24h; prevent fever for at least 72 h
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- Delay prognostication for at least 72 h

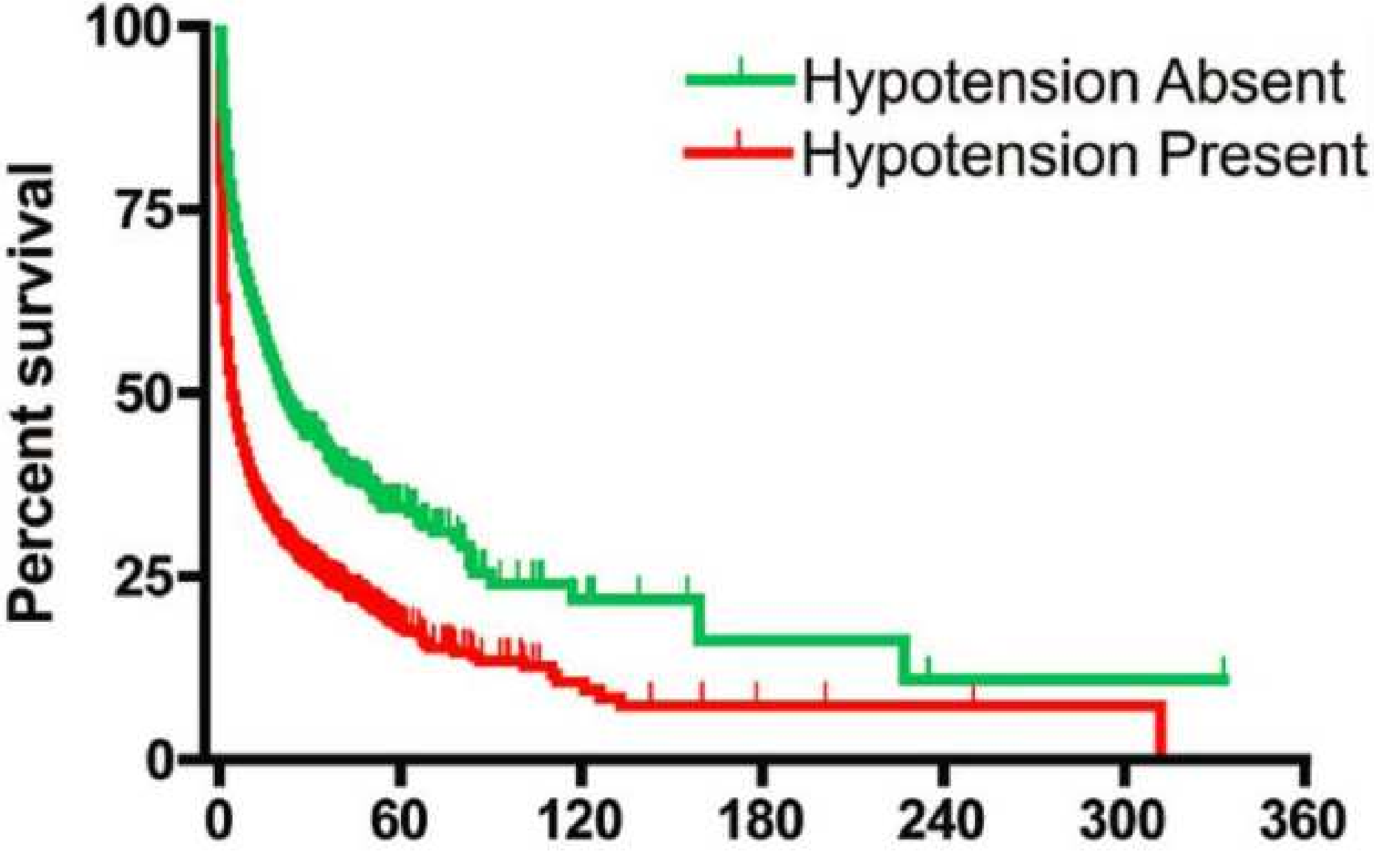
Secondary prevention
e.g. ICD, screen for inherited disorders, risk factor management

Follow-up and rehabilitation

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

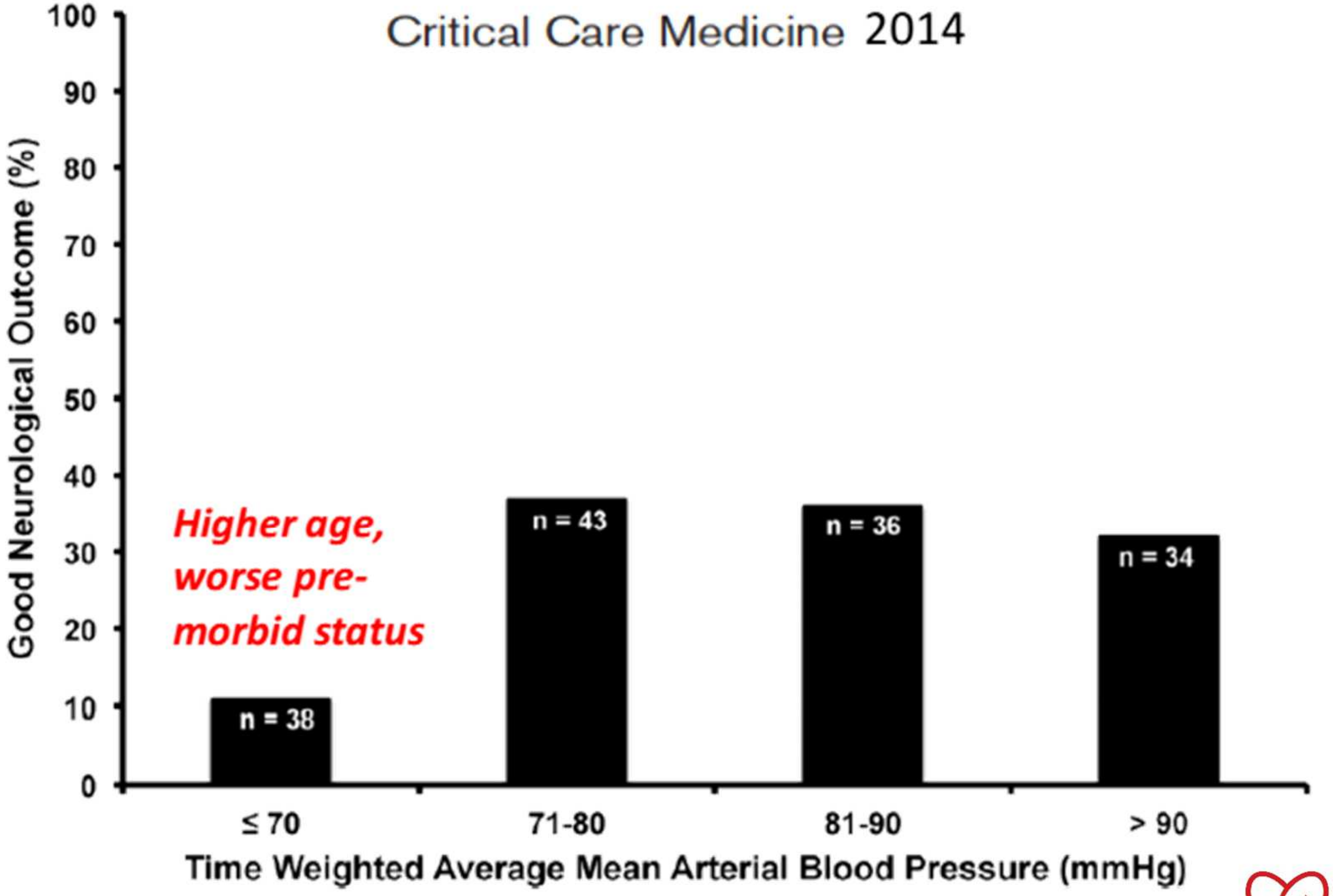
Crit Care Med 2009 Vol. 37, No. 11



Arterial Blood Pressure and Neurologic Outcome After Resuscitation From Cardiac Arrest*

J. Hope Kilgannon, MD[1]; Brian W. Roberts, MD[1]; Alan E. Jones, MD[2]; Neil Mittal, MD[1];
Evan Cohen, MD[1]; Jessica Mitchell, MD[1,3]; Michael E. Chansky, MD[1]; Stephen Trzeciak, MD, MPH[1,3]

Critical Care Medicine 2014



Higher age, worse pre-morbid status

Bradycardia During Targeted Temperature Management: An Early Marker of Lower Mortality and Favorable Neurologic Outcome in Comatose Out-of-Hospital Cardiac Arrest Patients*

Jakob Hartvig Thomsen, MD[1]; Niklas Nielsen, MD, PhD[2]; Christian Hassager, MD, DMSc[1];
Michael Wanscher, MD, PhD[3]; Steen Pehrson, MD, DMSc[1]; Lars Køber, MD, DMSc[1];
John Bro-Jeppesen, MD, PhD[1]; Helle Søholm, MD[1]; Matilde Winther-Jensen, MSc[1]; Tommaso Pellis, MD[4];
Michael Kuiper, MD, PhD[5]; David Erlinge, MD, PhD[6]; Hans Friberg, MD, PhD[7];
Jesper Kjaergaard, MD, PhD, DMSc[1]

Crit Care Med 2016;
44:308-318

Critical Care Medicine

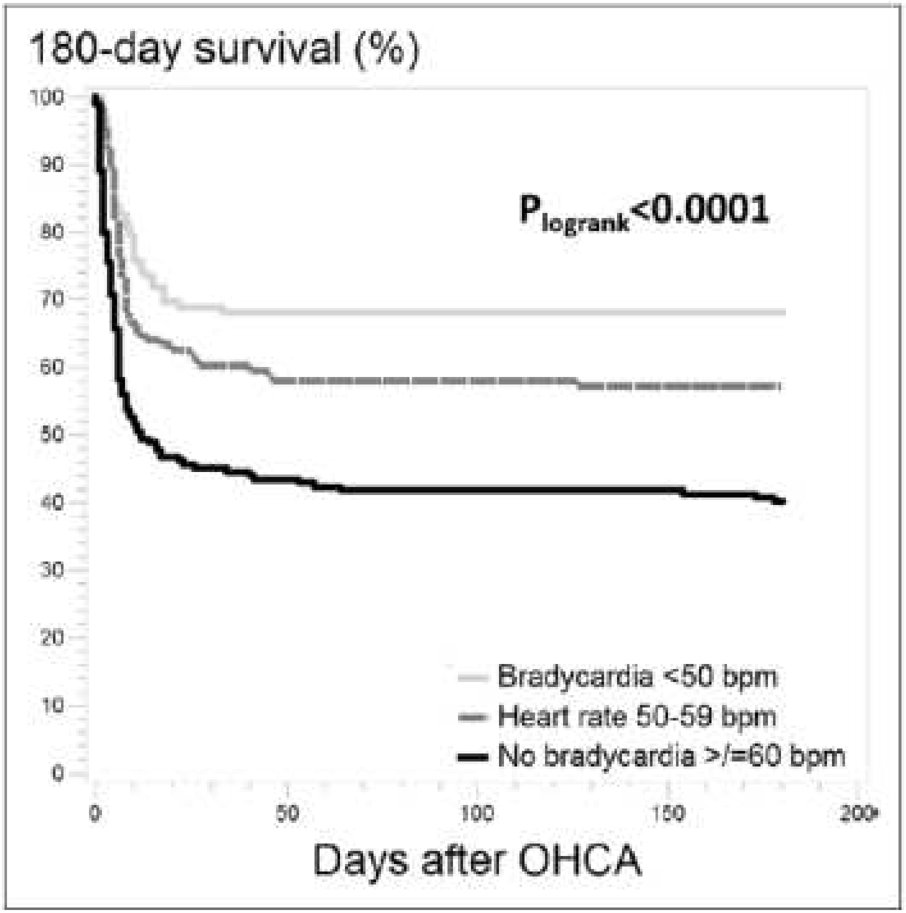
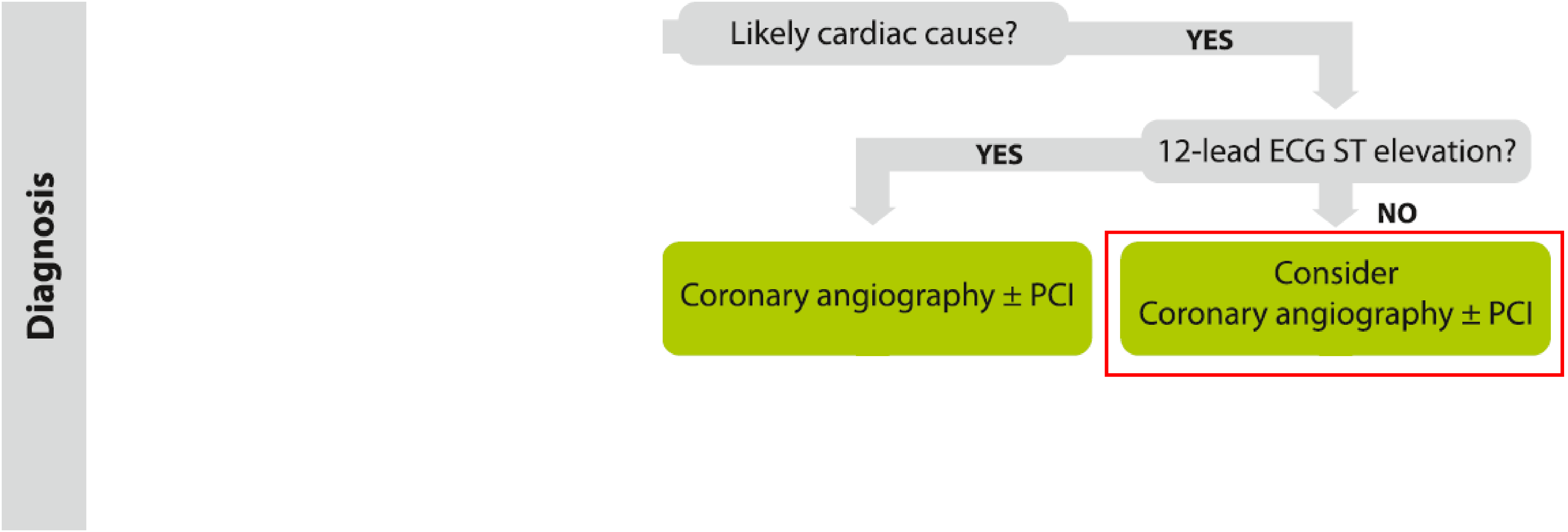


Figure 2. Survival at 180 days in comatose out-of-hospital cardiac arrest (OHCA) patients treated with targeted temperature management (TTM) at 33°C. Patients were stratified by minimum heart rate (< 50 beats/min [bpm], 50–59 bpm, and ≥ 60 bpm) during TTM.

2 - Emodinamica e riperfusione



Diagnosis

Likely cardiac cause?

YES

12-lead ECG ST elevation?

YES

NO

Coronary angiography ± PCI

Consider
Coronary angiography ± PCI

J.P. Nolan et al. Resuscitation 2015; 95:202-22.

ECG post-arresto e PCI

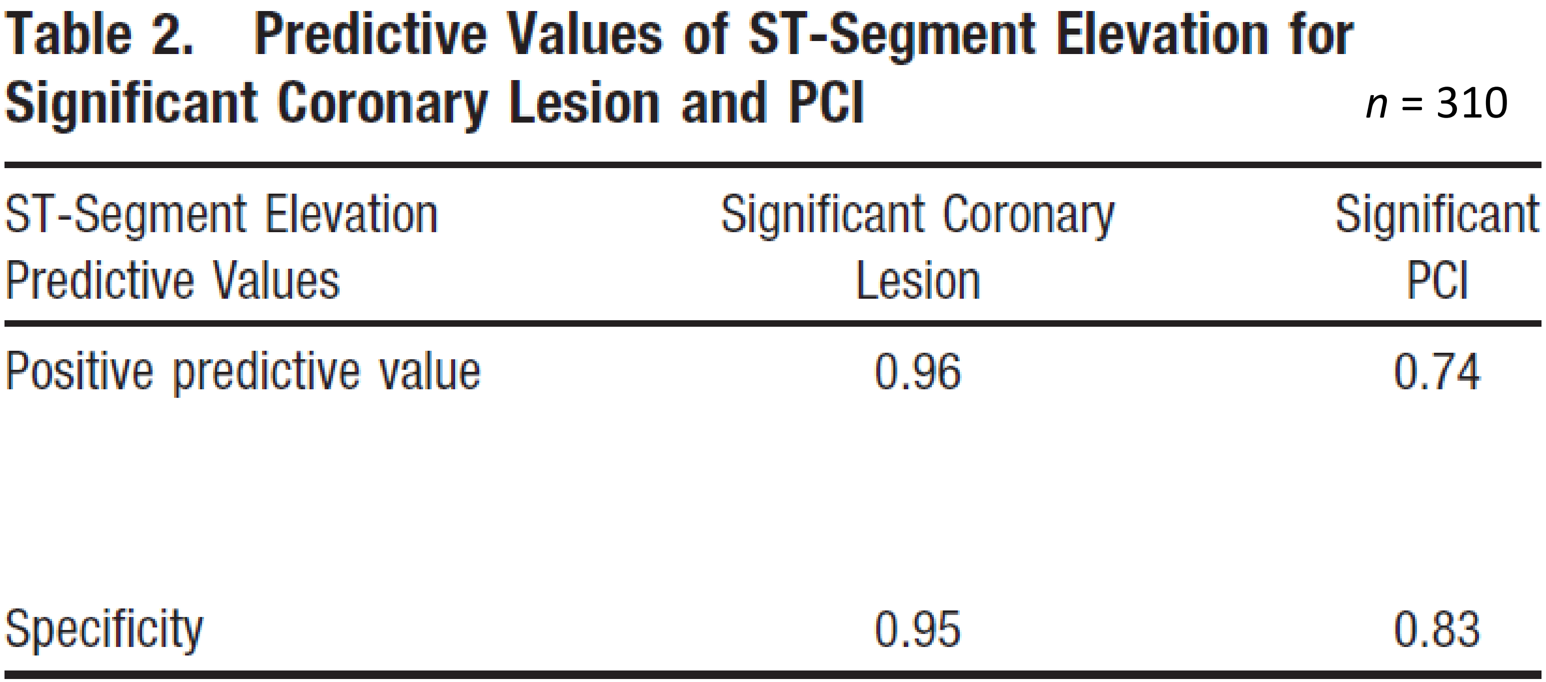


Table 2. Predictive Values of ST-Segment Elevation for Significant Coronary Lesion and PCI

n = 310

ST-Segment Elevation Predictive Values	Significant Coronary Lesion	Significant PCI
Positive predictive value	0.96	0.74
Specificity	0.95	0.83

Dumas F et al Circ Cardiovasc Interv. 2010;3:200-207

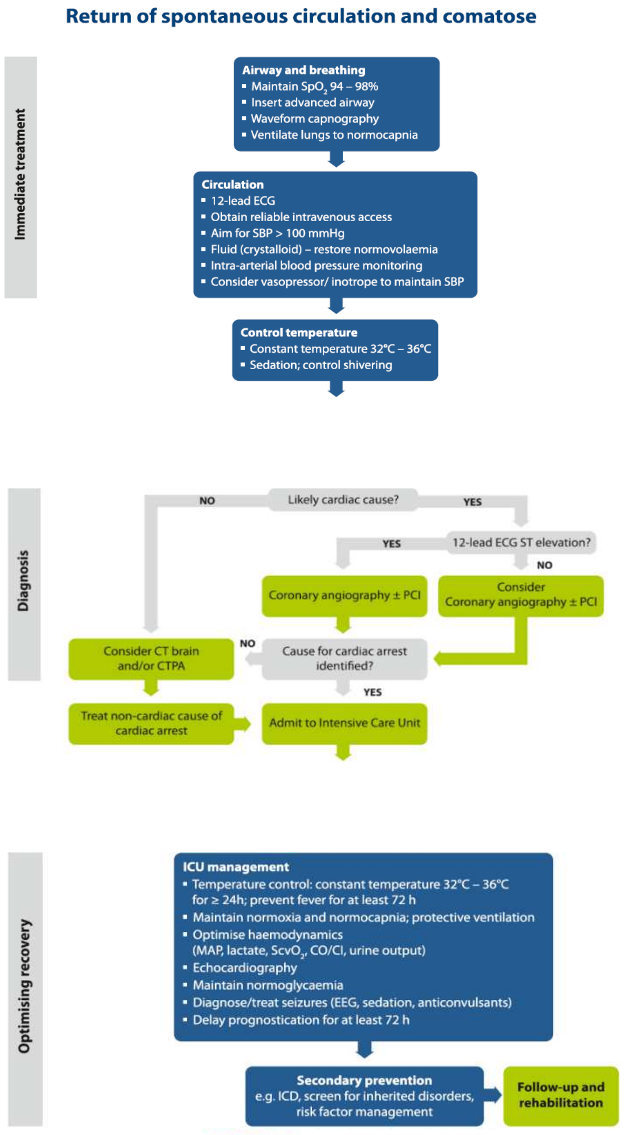
3 - Ossigenazione e ventilazione

Airway and breathing

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

ICU management

- Maintain normoxia and normocapnia; protective ventilation



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- Diagnose/treat seizures (EEG, sedation, anticonvulsants)
- Delay prognostication for at least 72 h

Secondary prevention
e.g. ICD, screen for inherited disorders, risk factor management

Follow-up and rehabilitation

Association Between Arterial Hyperoxia Following Resuscitation From Cardiac Arrest and In-Hospital Mortality

J. Hope Kilgannon, MD
Alan E. Jones, MD
Nathan I. Shapiro, MD, MPH
Mark G. Angelos, MD

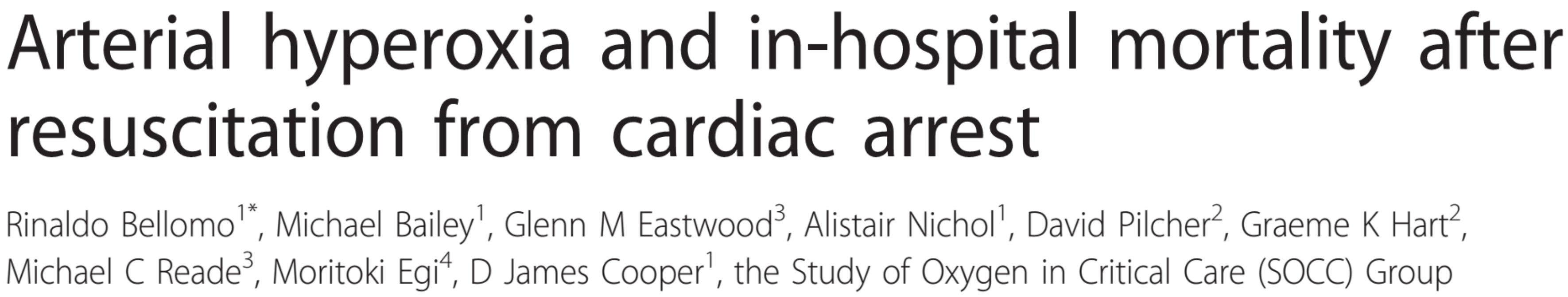
Context Laboratory investigations suggest that exposure to hyperoxia after resuscitation from cardiac arrest may worsen anoxic brain injury; however, clinical data are lacking.

Objective To test the hypothesis that postresuscitation hyperoxia is associated with increased mortality.

Table 4. Outcomes of Study Patients

	All Patients (N = 6326)	Hypoxia (n = 3999)	Normoxia (n = 1171)	Hyperoxia (n = 1156)
In-hospital mortality, No. (%) [95% CI][a]	3561 (56) [55-58]	2297 (57) [56-59]	532 (45) [43-48]	732 (63) [60-66]
Survivors, No. (%)	2765 (44)	1702 (43)	639 (55)	424 (37)
Independent functional status at hospital discharge, No. (%) [95% CI][b]	939 (34) [32-36]	570 (33) [31-36]	245 (38) [35-42]	124 (29) [25-34]

JAMA. 2010;303(21):2165-2171



Arterial hyperoxia and in-hospital mortality after resuscitation from cardiac arrest

Rinaldo Bellomo[1*], Michael Bailey[1], Glenn M Eastwood[3], Alistair Nichol[1], David Pilcher[2], Graeme K Hart[2], Michael C Reade[3], Moritoki Egi[4], D James Cooper[1], the Study of Oxygen in Critical Care (SOCC) Group

- Multicentrico osservazionale, da registro clinico di ICU in Australia
- *n* = 11.000 pazienti rianimati da OHCA
- Outcome primario: mortalità intraospedaliera

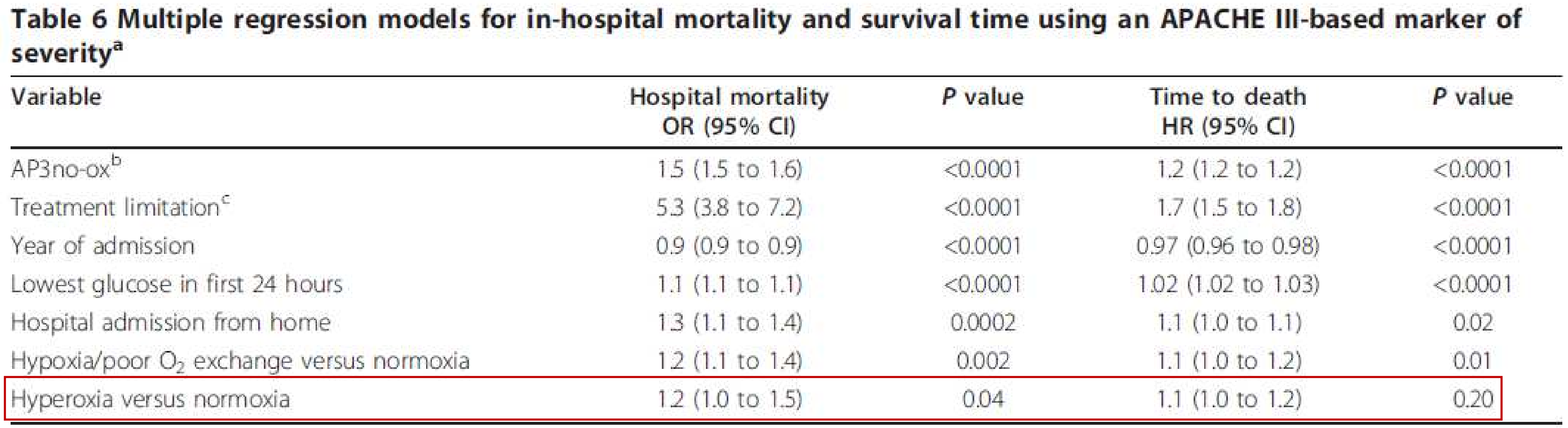


Table 6 Multiple regression models for in-hospital mortality and survival time using an APACHE III-based marker of severity[a]

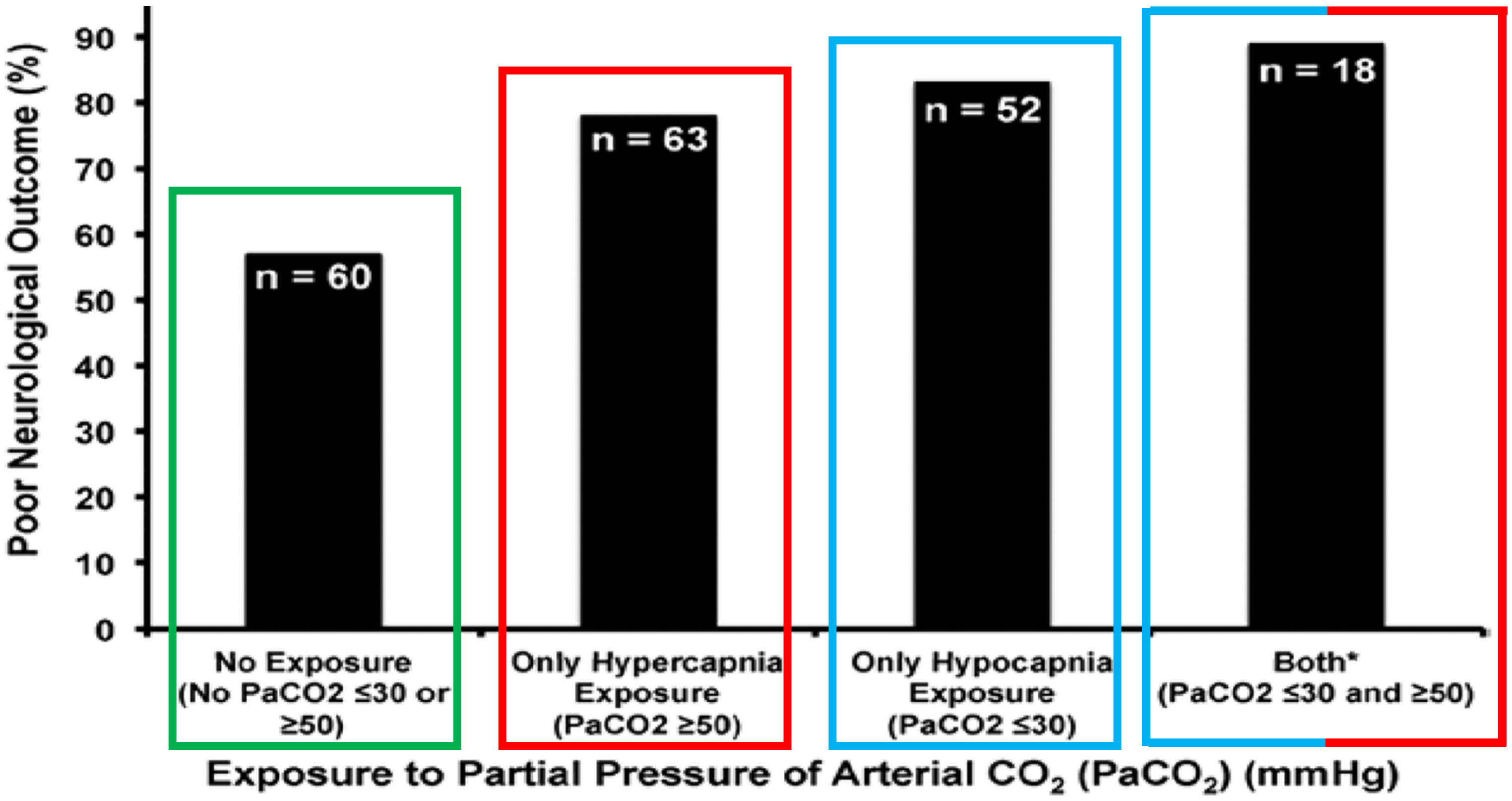
Variable	Hospital mortality OR (95% CI)	*P* value	Time to death HR (95% CI)	*P* value
AP3no-ox[b]	1.5 (1.5 to 1.6)	<0.0001	1.2 (1.2 to 1.2)	<0.0001
Treatment limitation[c]	5.3 (3.8 to 7.2)	<0.0001	1.7 (1.5 to 1.8)	<0.0001
Year of admission	0.9 (0.9 to 0.9)	<0.0001	0.97 (0.96 to 0.98)	<0.0001
Lowest glucose in first 24 hours	1.1 (1.1 to 1.1)	<0.0001	1.02 (1.02 to 1.03)	<0.0001
Hospital admission from home	1.3 (1.1 to 1.4)	0.0002	1.1 (1.0 to 1.1)	0.02
Hypoxia/poor O_2 exchange versus normoxia	1.2 (1.1 to 1.4)	0.002	1.1 (1.0 to 1.2)	0.01
Hyperoxia versus normoxia	1.2 (1.0 to 1.5)	0.04	1.1 (1.0 to 1.2)	0.20

Bellomo *et al*. *Critical Care* 2011, **15**:R90

Resuscitation Science

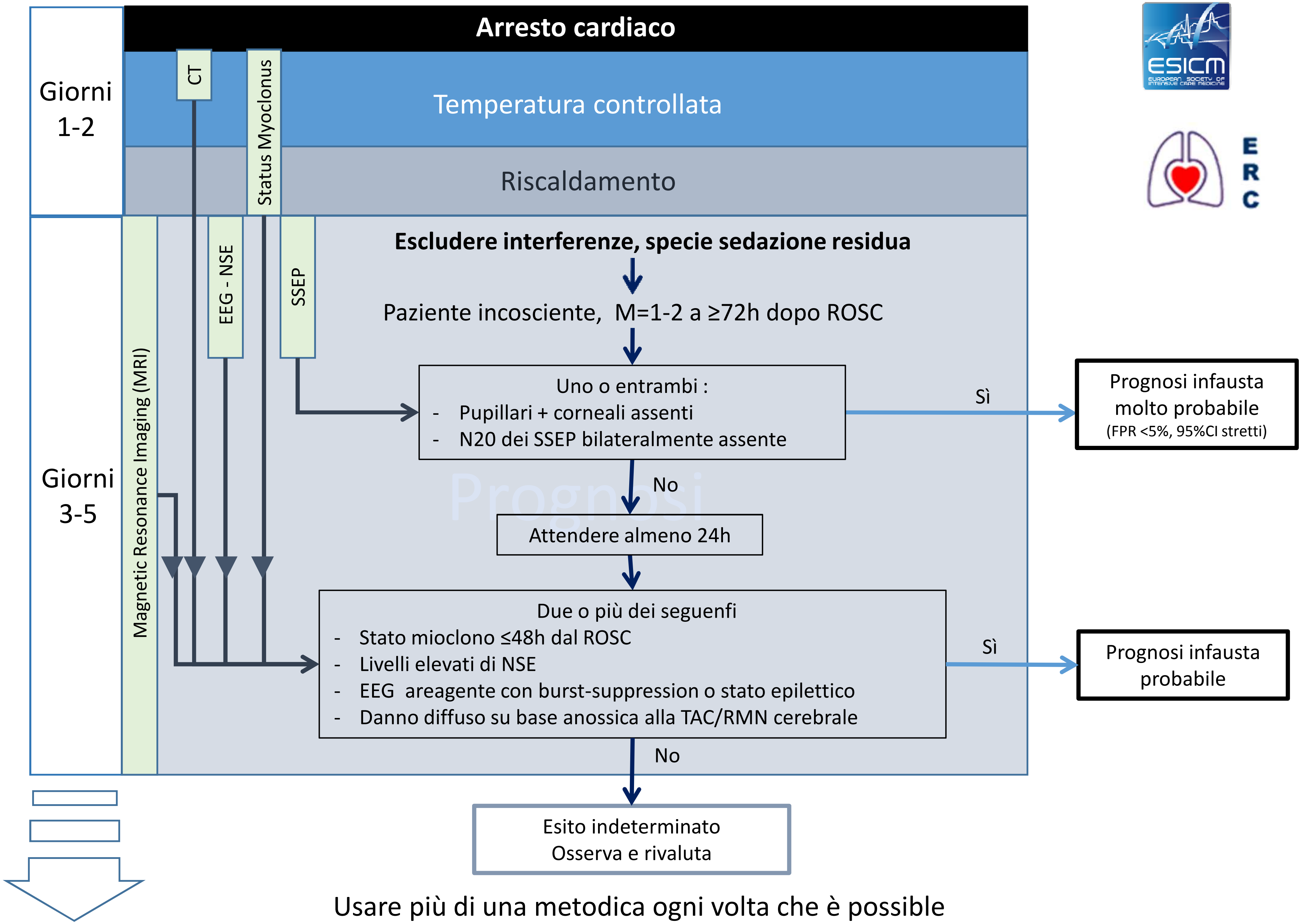
Association Between Postresuscitation Partial Pressure of Arterial Carbon Dioxide and Neurological Outcome in Patients With Post–Cardiac Arrest Syndrome

Brian W. Roberts, MD; J. Hope Kilgannon, MD; Michael E. Chansky, MD; Neil Mittal, MD; Jonathan Wooden, MD; Stephen Trzeciak, MD, MPH



Circulation. 2013;127:2107-2113;

4 - Prognosi



Arresto cardiaco

Giorni 1-2

Temperatura controllata

Riscaldamento

CT

Status Myoclonus

Giorni 3-5

Magnetic Resonance Imaging (MRI)

EEG - NSE

SSEP

Escludere interferenze, specie sedazione residua

Paziente incosciente, M=1-2 a ≥72h dopo ROSC

Uno o entrambi :
- Pupillari + corneali assenti
- N20 dei SSEP bilateralmente assente

Sì → Prognosi infausta molto probabile (FPR <5%, 95%CI stretti)

No

Attendere almeno 24h

Due o più dei seguenfi
- Stato mioclono ≤48h dal ROSC
- Livelli elevati di NSE
- EEG areagente con burst-suppression o stato epilettico
- Danno diffuso su base anossica alla TAC/RMN cerebrale

Sì → Prognosi infausta probabile

No

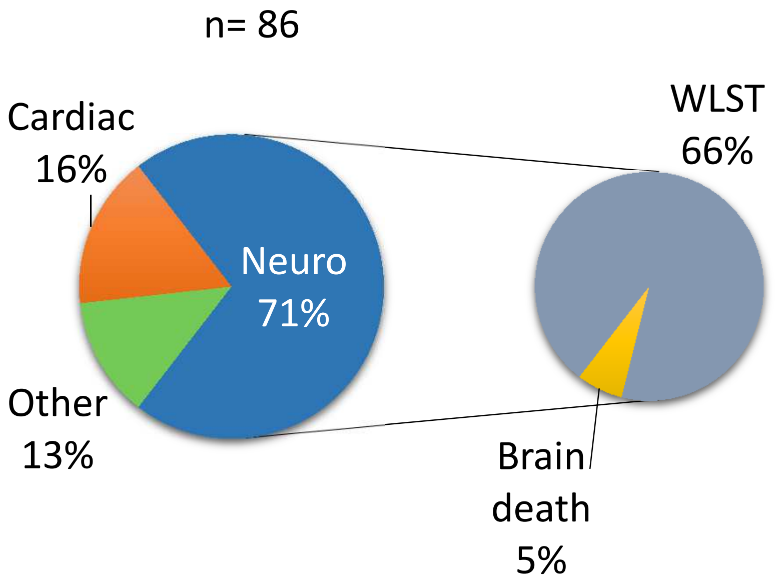
Esito indeterminato
Osserva e rivaluta

Usare più di una metodica ogni volta che è possible

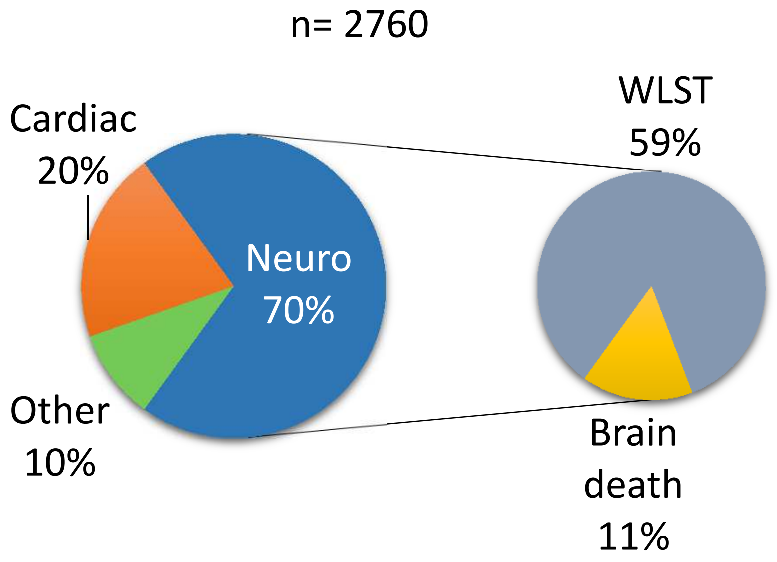
Prognosi

Cause di morte dopo rianimazione

Dragancea 2013, Svezia



Elmer 2016, USA



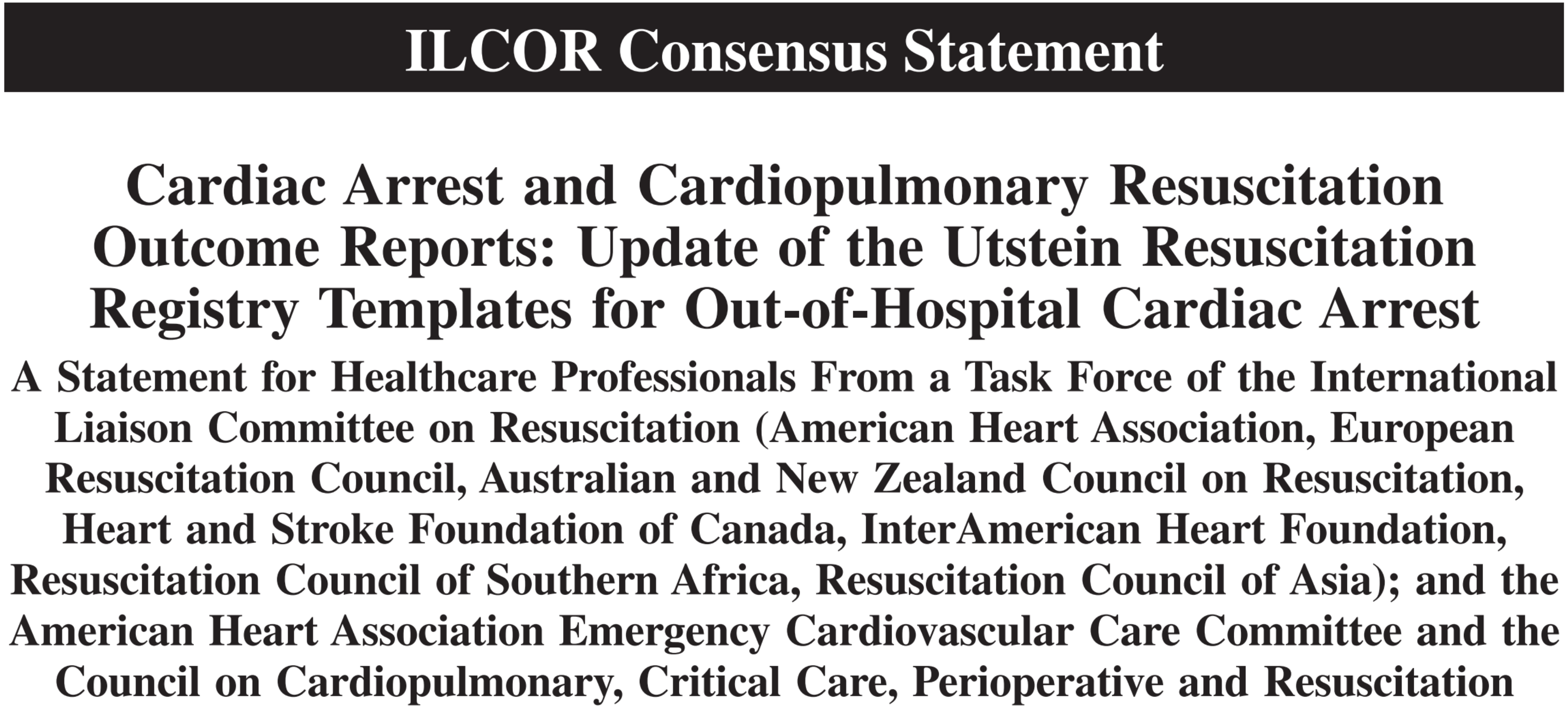
Dragancea I et al Resuscitation 2013; 84:337-42

Elmer J et al Resuscitation 2016; 102:127-35

La prognosi non è solo in UTI

- Mortalità post-UTI elevata
- Evoluzione dei pazienti con esito intermedio (CPC = 2-3)
- Recupero funzionale dissociato dal CPC

5 – Report ed Utstein



ILCOR Consensus Statement

Cardiac Arrest and Cardiopulmonary Resuscitation Outcome Reports: Update of the Utstein Resuscitation Registry Templates for Out-of-Hospital Cardiac Arrest

A Statement for Healthcare Professionals From a Task Force of the International Liaison Committee on Resuscitation (American Heart Association, European Resuscitation Council, Australian and New Zealand Council on Resuscitation, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Southern Africa, Resuscitation Council of Asia); and the American Heart Association Emergency Cardiovascular Care Committee and the Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation

Perkins GD et al. Circulation 2015

In-hospital Utstein in preparation (2018)

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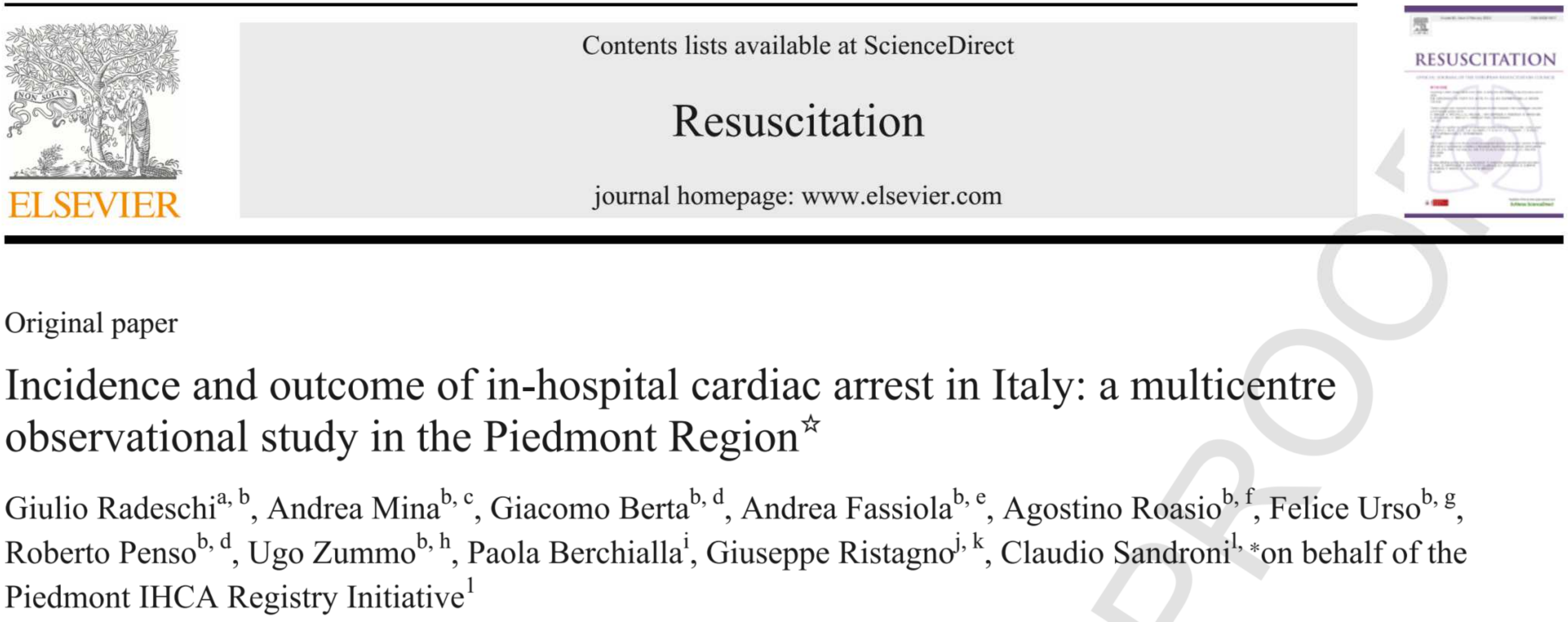
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Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com

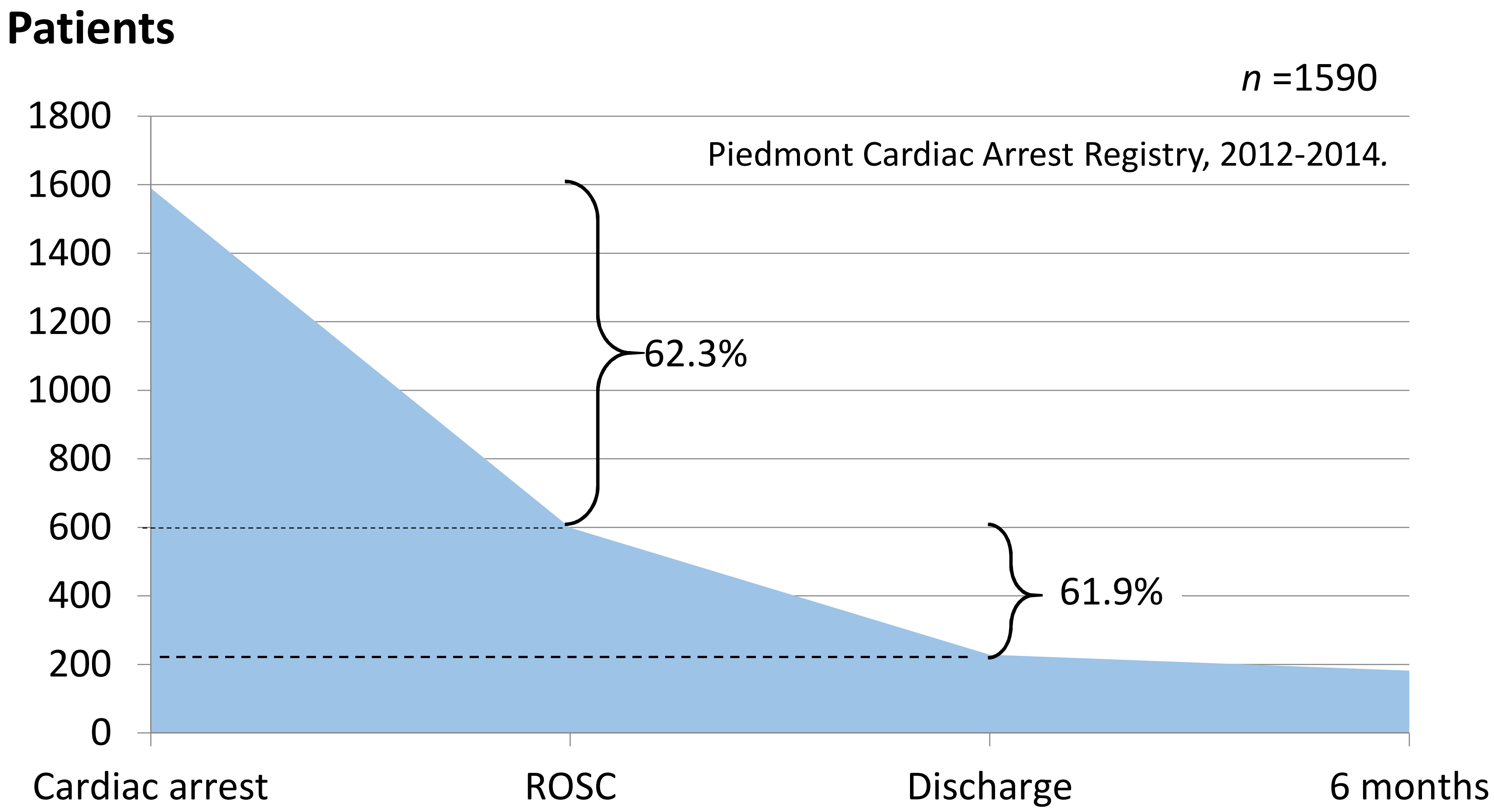
Original paper

Incidence and outcome of in-hospital cardiac arrest in Italy: a multicentre observational study in the Piedmont Region[☆]

Giulio Radeschi[a, b], Andrea Mina[b, c], Giacomo Berta[b, d], Andrea Fassiola[b, e], Agostino Roasio[b, f], Felice Urso[b, g], Roberto Penso[b, d], Ugo Zummo[b, h], Paola Berchialla[i], Giuseppe Ristagno[j, k], Claudio Sandroni[l, *]on behalf of the Piedmont IHCA Registry Initiative[1]

- Radeschi G. et al, 2017; 119:48-55
- Primo report multicentrico italiano sull’IHCA
- La raccolta dati continua

Mortalità dopo ACC intraospedaliero



Radeschi G et al Resuscitation 2017; 119:48-55

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Caratteristiche del corso

Formato didattico: Seminari + discussione a piccoli gruppi

Requisiti di accesso: ALS <5 anni

Durata: 1 giorno (8 ore)

Docenti: Istruttori full ALS/EPALS con esperienza di ITU

- Possibile la partecipazione di esperti non istruttori ≤50% della Faculty

Valutazione: Quiz pre/post MCQ

Materiale Didattico: Manuale IRC + linee guida: studio obbligatorio prima del corso.

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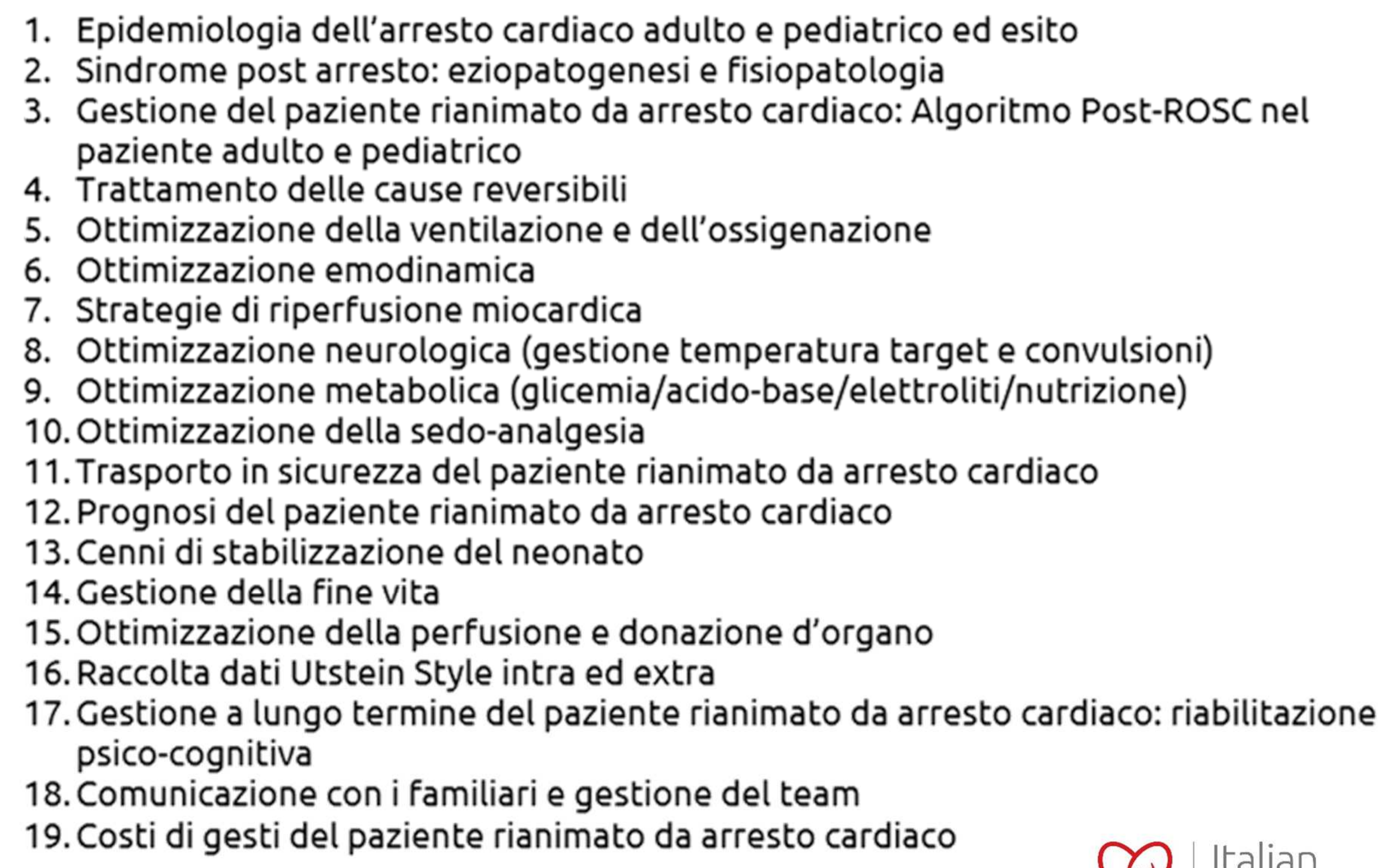
Qualità specifiche del corso

- Alto contenuto scientifico
  - Necessità di relatori esperti
  - Struttura flessibile
- Frequenti aggiornamenti
  - Manuale agile e facilmente aggiornabile
  - “State of the art” lectures
- Multidisciplinarietà
  - Aperto agli esperti non-istruttori

Manuale Post-resuscitation care



1. Epidemiologia dell’arresto cardiaco adulto e pediatrico ed esito
2. Sindrome post arresto: eziopatogenesi e fisiopatologia
3. Gestione del paziente rianimato da arresto cardiaco: Algoritmo Post-ROSC nel paziente adulto e pediatrico
4. Trattamento delle cause reversibili
5. Ottimizzazione della ventilazione e dell’ossigenazione
6. Ottimizzazione emodinamica
7. Strategie di riperfusione miocardica
8. Ottimizzazione neurologica (gestione temperatura target e convulsioni)
9. Ottimizzazione metabolica (glicemia/acido-base/elettroliti/nutrizione)
10. Ottimizzazione della sedo-analgesia
11. Trasporto in sicurezza del paziente rianimato da arresto cardiaco
12. Prognosi del paziente rianimato da arresto cardiaco
13. Cenni di stabilizzazione del neonato
14. Gestione della fine vita
15. Ottimizzazione della perfusione e donazione d’organo
16. Raccolta dati Utstein Style intra ed extra
17. Gestione a lungo termine del paziente rianimato da arresto cardiaco: riabilitazione psico-cognitiva
18. Comunicazione con i familiari e gestione del team
19. Costi di gesti del paziente rianimato da arresto cardiaco

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Programma (bozza)

08.00 – 08.30	Registrazione
08:30 – 10:00	Lezioni 1
10.15 – 11.45	Discussione chiusa a piccoli gruppi
12.00 – 13.00	Lezioni 2
13.00 – 13.30	Lunch break
13:30 – 15:00	Lezioni 3
15-15 – 16.45	Discussione chiusa a piccoli gruppi
17:00 – 17.30	Quiz a scelta multipla
17.30	Chiusura

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Argomenti delle lezioni (bozza)

1. Inquadramento epidemiologico
2. Riperfusione post-ROSC
3. Ottimizzazione emodinamica
4. Insufficienze d’organo extracerebrali
5. Previsione prognostica
6. Esiti a lungo termine
7. Raccolta dati e risultati dei grandi registri

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Domande?