CONGRESSO NAZIONALE IRC 2022

TRAUMA: NUOVE EVIDENZE E PERCORSI

AUDITORIUM DELLA TECNICA • ROMA • 14-15 OTTOBRE

IRC | Italian Resuscitation Council

CONGRESSO NAZIONALE IRC 2022
TRAUMA: NUOVE EVIDENZE E PERCORSI
AUDITORIUM DELLA TECNICA - ROMA - 14-15 OTTOBRE

Gemelli
Fondazione Policlinico Universitario A. Gemelli
Università Cattolica del Sacro Cuore

Prognostication in traumatic cardiac arrest: sappiamo veramente la fine della storia?

Sonia D'Arrigo

UOC Rianimazione, Terapia Intensiva e Tossicologia Clinica

Fondazione Policlinico Universitario A. Gemelli IRCCS

Roma

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Resuscitation 105 (2016) 188–195

Contents lists available at ScienceDirect

Resuscitation

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

EUROPEAN RESUSCITATION COUNCIL

EuReCa ONE European Registry of Cardiac arrest

Clinical paper

EuReCa ONE—27 Nations, ONE Europe, ONE Registry
A prospective one month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe☆

2016

Table 2
Selected summary findings from all countries. Results are presented as overall mean value or percentage of all cases, and median with range of the individual country values. Calculations are based on all cases where CPR was started by EMS or bystander.

	No. of countries	No. of cases	Overall average	Median of country values	Range of country values
Cases with CPR attempted	27	7146	264.7	159	4–1536
Mean age (years)	27	6826	66.5	66.0	58.4–75.6
Male gender (%)	27	7004	66.3	65.7	50.0–90.0
Medical/cardiac cause[a] (%)	27	7146[a]	91.4	90.1	78.1–100
Traumatic cause (%)	27	7146[a]	4.1	3.7	0–16.5
Location: residence (%)	27	7052	69.4	67.1	46.4–79.9
Telephone CPR (%)	21	3439	29.9	30.4	0–100
Collapse witnessed (%)	27	6815	66.1	67.5	37.4–93.5
Bystander CPR (%)	27	6619	47.4	50.0	6.3–78.0
Shockable rhythm (%)	26	6533	22.2	23.6	4.4–50.0
ROSC (%)	27	6963	28.6	30.6	9.1–50.0

[a] Missing or unknown values were considered as medical/cardiac.

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CONGRESSO NAZIONALE IRC 2022
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EuReCa TWO European Registry of Cardiac arrest

2020

RESUSCITATION 148 (2020) 218–226

Available online at www.sciencedirect.com

Resuscitation

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

ELSEVIER

EUROPEAN RESUSCITATION COUNCIL

Clinical paper

Survival after out-of-hospital cardiac arrest in Europe - Results of the EuReCa TWO study

Table 1 – Patient and system factors: variation across countries.

	No. of countries	No. of cases	Overall average	Median of country values	Range of country values
Cases with CPR attempted (if CA was confirmed)	28	25,171	899	440	22–3842
Mean age (years)	28	24,687	67.6	67.3	55.8–75.4
Male gender (%)	28	25,078	65.4	65.9	53.4–73.3
Medical/cardiac cause (%)	28	22,927	91.1	91.1	70.0–100
Traumatic cause (%)	28	957	3.9	3.4	0–8.0
Location: residence (%)	28	15,638	70.2	68.9	51.0–81.3
Telephone CPR (%)	24	11,238	53.2	37.3	3.2–87.8
Collapse witnessed (%)	28	15,824	66.6	66.5	50.8–91.8
Bystander CPR (%)*	28	12,445	58.0	57.6	13.0–82.6
Shockable rhythm (%)	28	4,792	20.2	19.2	11.4–36.8
ROSC (%)	28	25,077	32.7	29.7	6.9–43.3

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TRAUMA: NUOVE EVIDENZE E PERCORSI
AUDITORIUM DELLA TECNICA · ROMA · 14-15 OTTOBRE

European Journal of Trauma and Emergency Surgery (2022) 48:3357–3372
https://doi.org/10.1007/s00068-022-01941-y

2022

ORIGINAL ARTICLE

Prehospital traumatic cardiac arrest: a systematic review and meta-analysis

Niek Johannes Vianen[1] · Esther Maria Maartje Van Lieshout[1] · Iscander Michael Maissan[2] · Wichor Matthijs Bramer[3] · Dennis Den Hartog[1] · Michael Herman Jacob Verhofstad[1] · Mark Gerrit Van Vledder[1]

Results Thirty-six studies involving 51.722 patients were included. Overall mortality for TCA was 96.2% and a favorable neurological outcome was seen in 43.5% of the survivors. Mortality rates were 97.2% in studies including prehospital deaths and 92.3% in studies excluding prehospital deaths. Favorable neurological outcome rates were 35.8% in studies including prehospital deaths and 49.5% in studies excluding prehospital deaths. Mortality rates were 97.6% if no physician was available at the prehospital scene and 93.9% if a physician was available. Favorable neurological outcome rates were 57.0% if a physician was available on scene and 38.0% if no physician was available. Only non-shockable rhythm was associated with a higher mortality (RR 1.12, $p=0.06$).

Conclusion Approximately 1 in 20 patients with prehospital TCA will survive; about 40% of survivors have favorable neurological outcome.

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AUDITORIUM DELLA TECNICA - ROMA - 14-15 OTTOBRE

Seewald et al. BMC Emergency Medicine (2022) 22:158
https://doi.org/10.1186/s12873-022-00714-5

BMC Emergency Medicine

RESEARCH Open Access

Survival after traumatic cardiac arrest is possible—a comparison of German patient-registries

Stephan Seewald[1,2*], Jan Wnent[1,2,3], Jan-Thorsten Gräsner[1,2], Ingvild Tjelmeland[1,4,5], Matthias Fischer[6], Andreas Bohn[7,8], Bertil Bouillon[9], Holger Maurer[10] and Rolf Lefering[11]

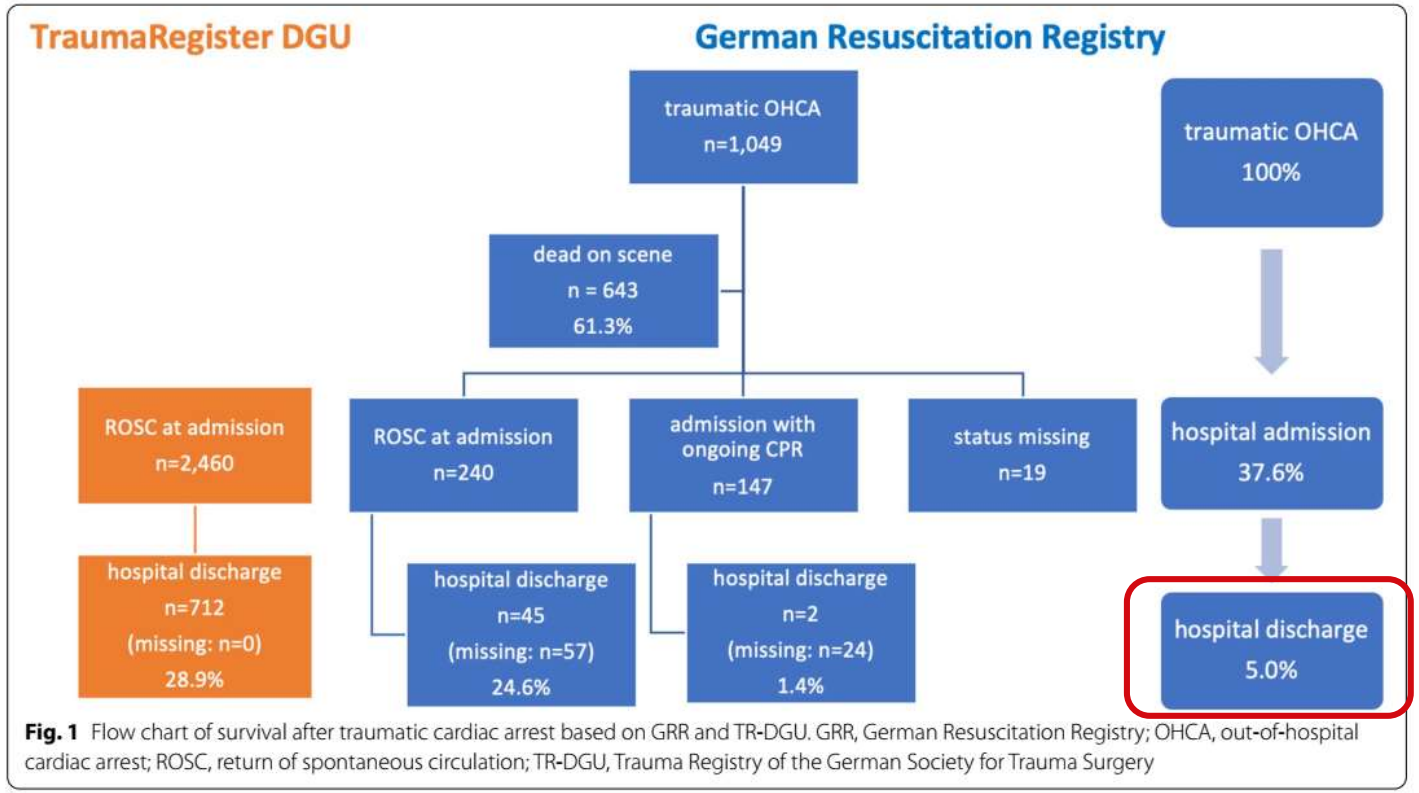

Fig. 1 Flow chart of survival after traumatic cardiac arrest based on GRR and TR-DGU. GRR, German Resuscitation Registry; OHCA, out-of-hospital cardiac arrest; ROSC, return of spontaneous circulation; TR-DGU, Trauma Registry of the German Society for Trauma Surgery

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2021

Injury 52 (2021) 1117–1122

Contents lists available at ScienceDirect

Injury

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

Outcomes after Prehospital Traumatic Cardiac Arrest in the Netherlands: a Retrospective Cohort Study

Thymen Houwen[a], Zar Popal[b], Marcel A.N. de Bruijn[c], Anna-Marie R. Leemeyer[a], Joost H. Peters[c], Maartje Terra[b], Esther M.M. van Lieshout[a], Michael H.J. Verhofstad[a], Mark G. van Vledder[a,*]

Results: Nine-hundred-fifteen patients with confirmed TCA were included. ROSC was achieved on-scene in 261 patients (28.5%). Thirty-six (3.9%) patients survived to hospital discharge of which 17 (47.2%) had a good neurological outcome. Age < 70 years (0.7% vs. 5.2%; p=0.041) and a shockable rhythm on first ECG (OR 0.65 95%CI 0.02-0.28; p<0.001) were associated with increased odds of survival.

Conclusion: Neurologic intact survival is possible after prehospital traumatic cardiac arrest. Younger patients and patients with a shockable ECG rhythm have higher survival rates after TCA.

Level of evidence: prognostic study, level III.

RESUSCITATION 161 (2021) 152–219

Available online at www.sciencedirect.com

Resuscitation

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

European Resuscitation Council Guidelines 2021: Cardiac arrest in special circumstances

Traumatic cardiac arrest (TCA)

- Resuscitation in TCA should focus on the immediate, simultaneous treatment of reversible causes.
- The response to TCA is time critical and success depends on a well-established chain of survival, including focused pre-hospital and specialised trauma centre care.
- TCA (hypovolemic shock, obstructive shock, neurogenic shock) is different from cardiac arrest due to medical causes; this is reflected in the treatment algorithm (Fig. 2).
- Use ultrasound to identify the underlying cause of cardiac arrest and target resuscitative interventions.
- Treating reversible causes simultaneously takes priority over chest compressions. Chest compression must not delay treatment of reversible causes in TCA.
- Control haemorrhage with external pressure, haemostatic gauze, tourniquets and pelvic binder.
- 'Don't pump an empty heart'.
- Resuscitative thoracotomy (RT) has a role in TCA and traumatic peri-arrest.

IRC Italian Resuscitation Council

RESUSCITATION 161 (2021) 152 –219

Available online at www.sciencedirect.com

Resuscitation

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

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EUROPEAN RESUSCITATION COUNCIL

European Resuscitation Council Guidelines 2021: Cardiac arrest in special circumstances

Traumatic cardiac arrest (TCA)

Traumatic cardiac arrest (TCA) carries a very high mortality, but in those where ROSC can be achieved, neurological outcome in survivors appears to be much better than in other causes of cardiac arrest.[28,29] The response to TCA is time-critical and success depends on a well-established chain of survival, including advanced prehospital and specialised trauma centre care. Immediate resuscitative efforts in TCA focus on simultaneous treatment of reversible causes, which takes priority over chest compressions.

Epidemiology and pathophysiology

Traumatic cardiac arrest (TCA) carries a high mortality. Registry data for survival range from 1.6% to 32%.[33–37] The considerable variation in reported survival mainly reflects heterogeneity in entry criteria but also in case mix and care in different systems.

In survivors, the neurological outcome appears to be much better than in other causes of cardiac arrest.[26,29,35,37] The reversible causes of TCA are uncontrolled haemorrhage (48%); tension pneumothorax (13%); asphyxia (13%); pericardial tamponade (10%).[26] The prevalent initial heart rhythms found in TCA are either PEA or asystole, depending on the time interval between circulatory arrest and the first electrocardiogram (ECG) recording PEA (66%); asystole (30%); VF (6%).[26]

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

European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2021: Post-resuscitation care☆

EUROPEAN RESUSCITATION COUNCIL

Post-resuscitation care

- Diagnosis of cause of cardiac arrest
- Control of oxygenation and ventilation
- Coronary reperfusion
- Haemodynamic monitoring and management
- Control of seizures
- Temperature control
- Prognostication
- Long-term outcomes and rehabilitation
- Organ donation

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WHI prognosticate

To provide correct information

To provide proportionate care

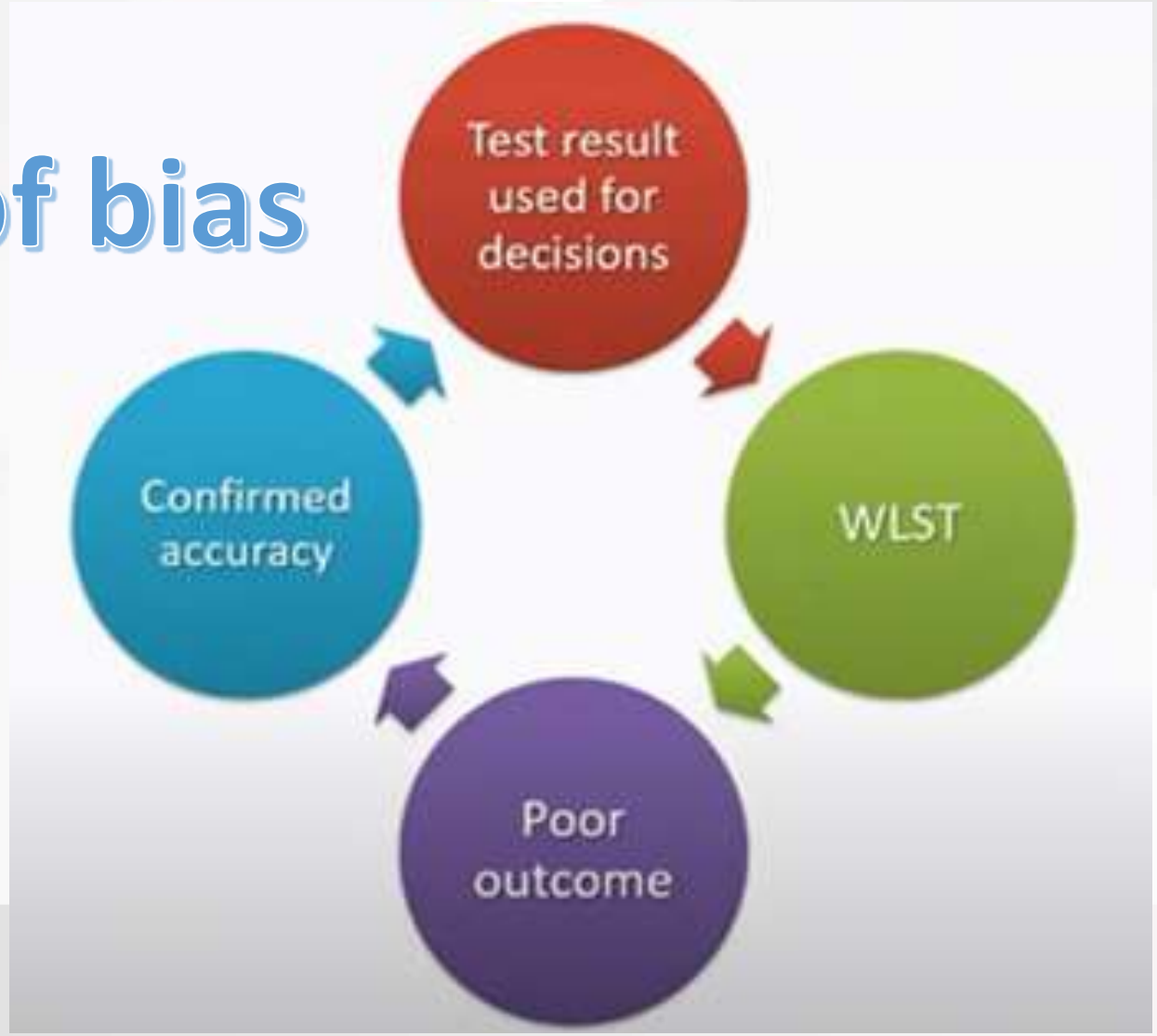
Proportionate care

Avoid
futile treatments

Avoid
inappropriate
withdrawal

Self-fulfilling prophecy

Risk of bias



Systematic reviews

Resuscitation 84 (2015) 1310–1323

Contents lists available at ScienceDirect

Resuscitation

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

Review article

Predictors of poor neurological outcome in adult comatose survivors of cardiac arrest: A systematic review and meta-analysis. Part 1: Patients not treated with therapeutic hypothermia☆

Claudio Sandroni[a,*], Fabio Cavallaro[a], Clifton W. Callaway[b], Tommaso Sanna[c], Sonia D'Arrigo[a], Michael Kuiper[d], Giacomo Della Marca[e], Jerry P. Nolan[f]

Resuscitation 84 (2013) 1324–1338

Contents lists available at ScienceDirect

Resuscitation

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

Review article

Predictors of poor neurological outcome in adult comatose survivors of cardiac arrest: A systematic review and meta-analysis. Part 2: Patients treated with therapeutic hypothermia☆

Claudio Sandroni[a,*], Fabio Cavallaro[a], Clifton W. Callaway[b], Sonia D'Arrigo[a], Tommaso Sanna[c], Michael A. Kuiper[d], Matteo Biancone[a], Giacomo Della Marca[e], Alessio Farcomeni[f], Jerry P. Nolan[g]

2013

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Intensive Care Med (2020) 46:1803–1851
https://doi.org/10.1007/s00134-020-06198-w

Update 2020

SYSTEMATIC REVIEW

Prediction of poor neurological outcome in comatose survivors of cardiac arrest: a systematic review

Claudio Sandroni[1,2], Sonia D'Arrigo[1*], Sofia Cacciola[1], Cornelia W. E. Hoedemaekers[3], Marlijn J. A. Kamps[4], Mauro Oddo[5], Fabio S. Taccone[6], Arianna Di Rocco[7], Frederick J. A. Meijer[8], Erik Westhall[9], Massimo Antonelli[1,2], Jasmeet Soar[10], Jerry P. Nolan[11] and Tobias Cronberg[12]

- January 2013-April 2020
- Adult comatose survivors of cardiac arrest
- 94 included studies
- 30,200 patients

Clinex
Biomarkers
Neurophysiology
Imaging

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Quality assessment

- Most included studies were at moderate/high risk of bias

1) lack of blinding

2) confounding

Clinical examination

Author, year	Participation	Attrition	Prognostication	Outcome	Confounding	Statistics	Overall
Admiraal, 2019 [90]	+	?	+	+	-	+	?
Choi, 2017 [91]	?	+	+	-	-	+	?
Chung-Esaki, 2018 [92]	?	+	+	+	-	+	?
De Santis, 2017 [93]	?	?	+	+	-	+	?
Dhakal, 2016 [94]	-	-	+	-	-	+	-
Dragancea, 2015 [95]	+	+	+	+	-	+	?
Fatuzzo, 2018 [96]	?	+	+	+	-	+	?
Greer, 2013 [22]	-	+	+	-	-	?	-
Heimburger, 2016 [23]	+	+	+	+	-	+	?
Hifumi, 2015 [24]	?	?	+	-	-	?	-
Hofmeijer, 2015 [98]	+	+	+	+	-	+	?
Huntgeburth, 2014	?	?	+	-	-	+	-
Javaudin, 2019 [25]	?	?	+	-	-	?	-
Kim, 2013 [100]	?	?	+	-	-	+	-
Kim, 2018 [101]	?	+	+	-	-	+	?
Kongpolprom, 2018 [26]	-	+	+	-	-	+	-
Lee, 2017 [103] (PLR)	?	+	+	-	-	+	?
Lee, 2017 [103] (MR)	?	-	+	-	-	+	-
Lybeck, 2017 [27]	?	?	+	+	-	+	?
Maia, 2013 [104]	?	?	+	-	-	+	-
Martinell, 2017 [28]	?	+	+	+	-	+	?
Matthews, 2018 [29]	?	?	+	-	-	+	-

Sandroni et al. Intensive Care Medicine 2020; 46:1803-1851 (Supplementary Materials)

Studies with no or low-risk of bias

- Blinding :

Stammet 2015 on biomarkers

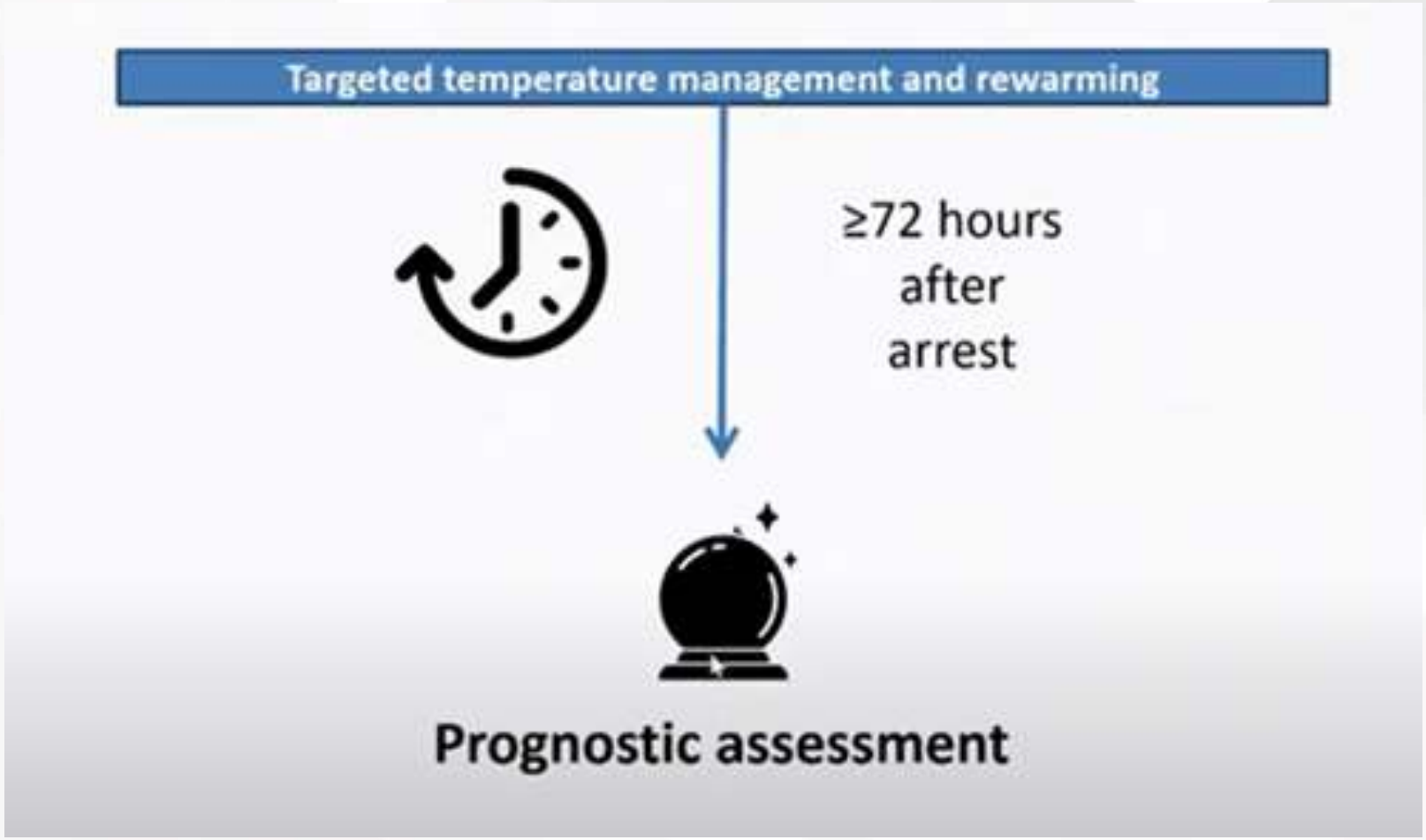
- No WLST:

Scarpino 2020 on EEG, SSEP, brain CT

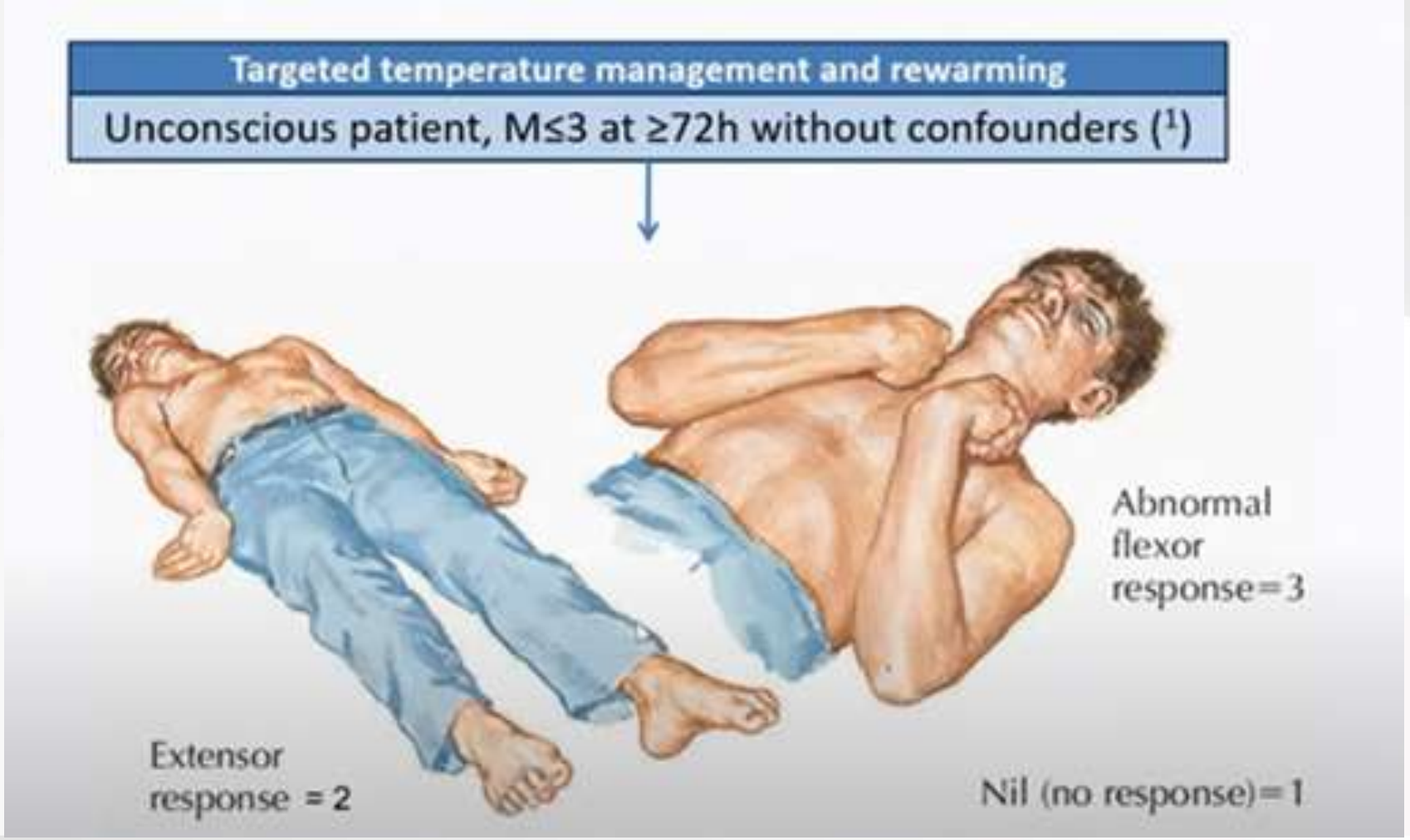
But…

No predictor is perfect

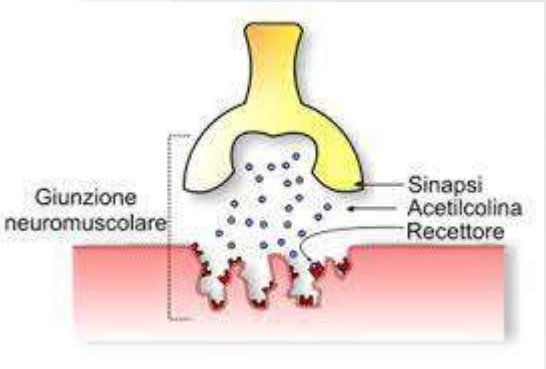
Prognostication: When?

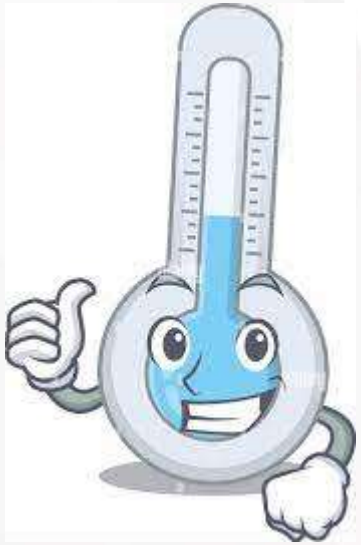


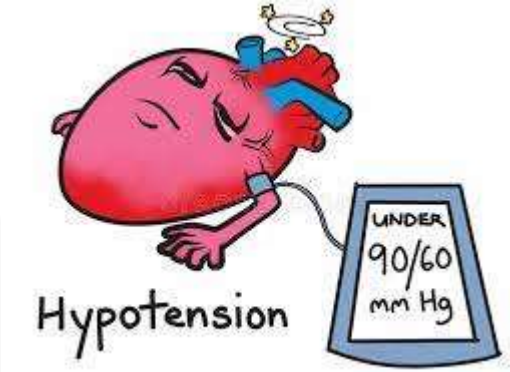
Start point: Unconsciuos patient

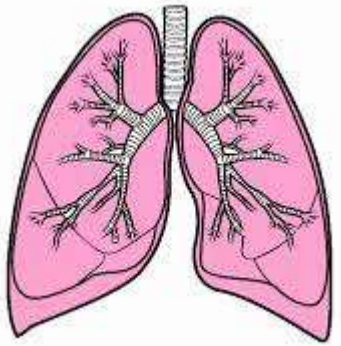


Confounding

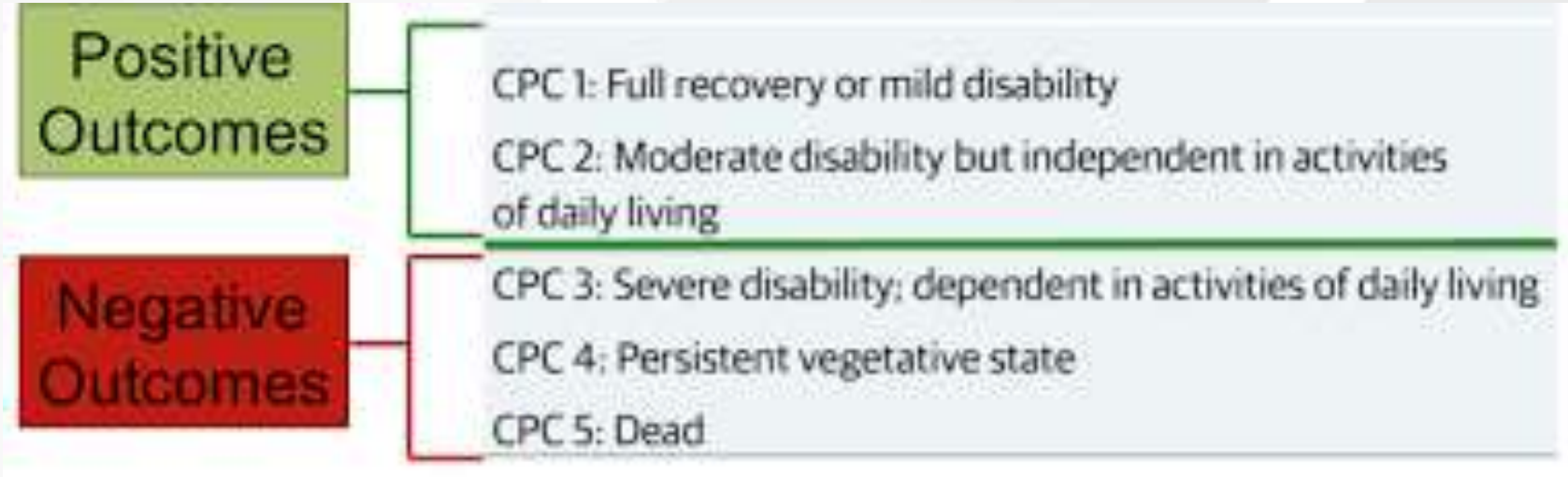




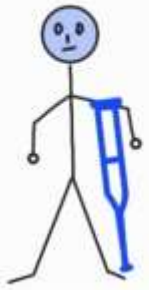
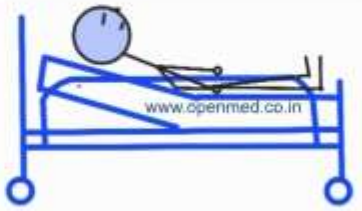




Cerebral Performance Category (CPC)



Glasgow Outcome Scale

5	4	3	2	1
Good recovery	**Moderate disability**	**Severe disability**	**COMA**	**Death**
Resumption of normal life	*Patient independent in daily life.*	*Patient dependent for daily support*	*Neurovegetative state; patient unresponsive for weeks or months*	
				

Good

Poor

Good

Poor

Modified Rankin Scale (MRS)

0 No symptoms
1 No significant disability, despite symptoms; able to perform all usual duties and activities
2 Slight disability; unable to perform all previous activities but able to look after own affairs without assistance
3 Moderate disability; requires some help, but able to walk without assistance
4 Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5 Severe disability; bedridden, incontinent, and requires constant nursing care and attention
6 Death

Prognostication

Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
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European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2021: Post-resuscitation care*

TTM and rewarming

Unconscious, M≤3 at ≥72 h without confounders

Poor neurological outcome: ≥2 unfavourable signs

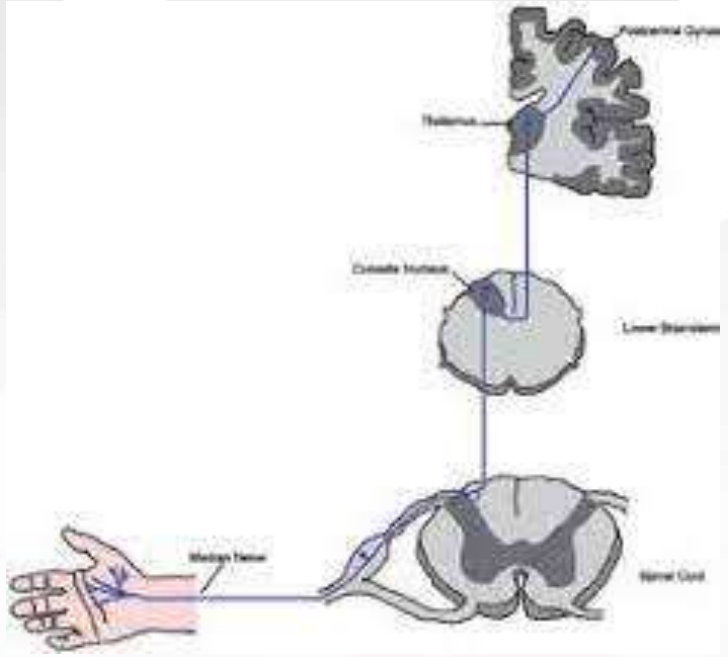
Prognostication

TTM and rewarming

Unconscious, M≤3 at ≥72 h without confounders

At least 2 of:

- No pupillary and cornel reflexes at ≥72 h
- Bilaterally absent N20 SSEP wave



Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
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TRAUMA: NUOVE EVIDENZE E PERCORSI

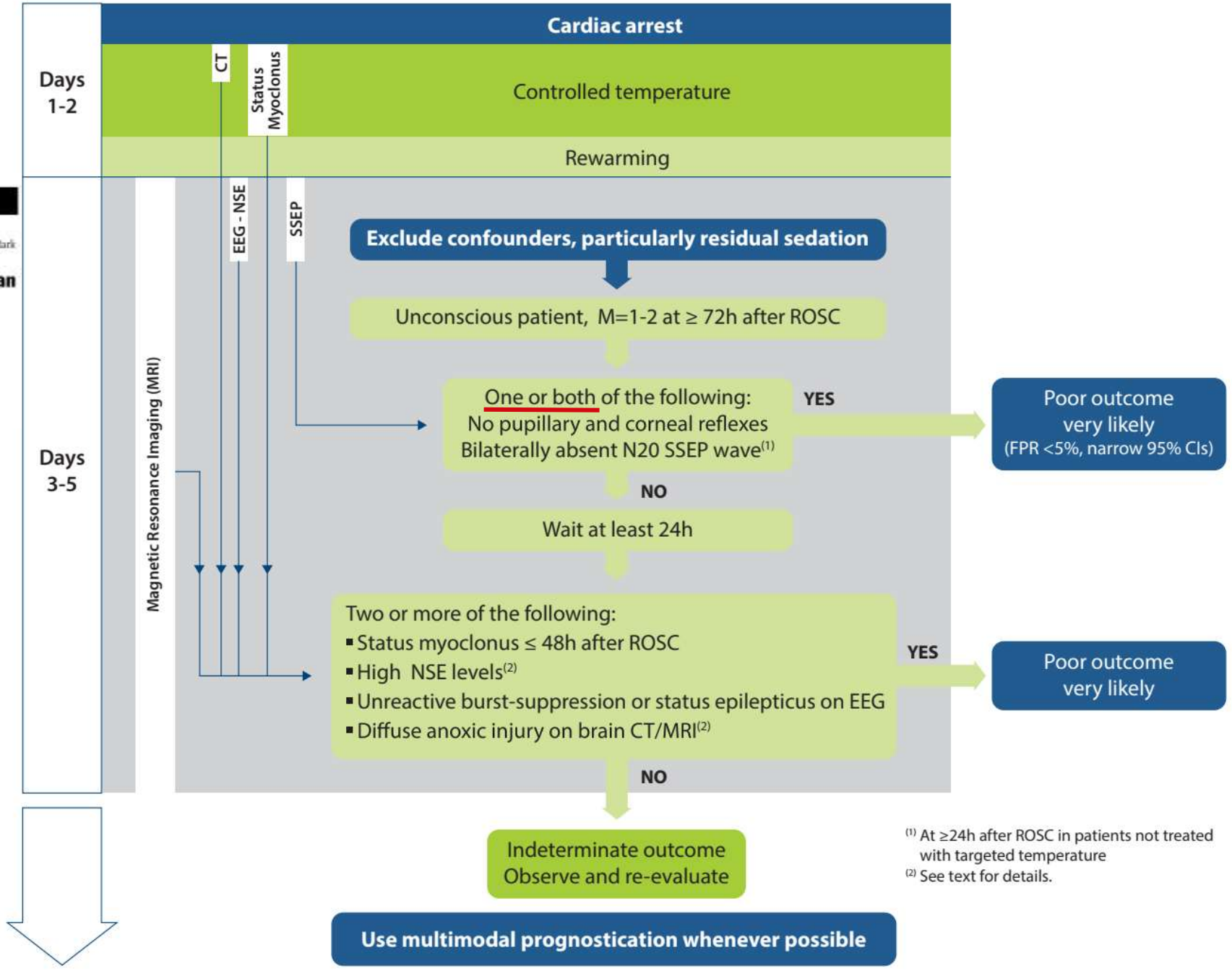
AUDITORIUM DELLA TECNICA - ROMA - 14-15 OTTOBRE

Intensive Care Med
DOI 10.1007/s00134-015-4051-3

CONFERENCE REPORTS AND EXPERT PANEL

Jerry P. Nolan
Jasmeet Soar
Alain Cariou
Tobias Cronberg
Véronique R. M. Moulaert
Charles D. Deakin
Bernd W. Bottiger
Hans Friberg
Kjetil Sunde
Claudio Sandroni

European Resuscitation Council and European Society of Intensive Care Medicine 2015 guidelines for post-resuscitation care



Intensive Care Med (2018) 44:2102–2111
https://doi.org/10.1007/s00134-018-5448-6

ORIGINAL

Quantitative versus standard pupillary light reflex for early prognostication in comatose cardiac arrest patients: an international prospective multicenter double-blinded study

Mauro Oddo[1*], Claudio Sandroni[2], Giuseppe Citerio[3,4], John-Paul Miroz[1], Janneke Horn[5], Malin Rundgren[6], Alain Cariou[7,8], Jean-François Payen[9], Christian Storm[10], Pascal Stammet[11] and Fabio Silvio Taccone[12]

456 comatose resuscitated patients

Standard PLR: FPR 6%

Automated pupillometry: FPR 0%

Table 2 Specificity, sensitivity, positive predictive value, negative predictive value and false-positive rate for unfavorable outcome (CPC 3–5) of the different prognostic tests

Day after cardiac arrest	Sample size (*n*)	CPC 3–5 *n* (%)	Specificity % (95% CI)	Sensitivity % (95% CI)	Positive predictive value % (95% CI)	Negative predictive value % (95% CI)	False-positive rate % (95% CI)
Neurological pupil index (NPi) ≤ 2							
Day 1–3	456	269 (59)	100 (98–100)	32 (27–38)	100 (100–100)	51 (49–53)	0 (0–2) %
Day 1	450	264 (59)	100 (98–100)	22 (17–27)	100 (100–100)	47 (46–49)	0 (0–2) %
Day 2	361	213 (59)	100 (98–100)	19 (14–25)	100 (100–100)	46 (45–48)	0 (0–2) %
Day 3	271	166 (61)	100 (97–100)	17 (12–24)	100 (100–100)	43 (41–44)	0 (0–3) %
Bilaterally absent standard pupillary light reflex (sPLR)							
Day 1	392	225 (57)	90 (85–94)	35 (29–42)	83 (75–89)	51 (48–54)	10 (6–15) %
Day 2	278	163 (59)	90 (84–95)	29 (22–36)	81 (70–89)	47 (44–50)	10 (5–16) %
Day 3	206	128 (62)	94 (86–98)	18 (12–26)	82 (65–92)	41 (39–43)	6 (2–14) %
Bilaterally absent somatosensory evoked potentials (N20 wave)							
Day 2–3	188	133 (71)	100 (94–100)	48 (39–57)	100 (100–100)	44 (40–48)	0 (0–6) %
Combination of NPi ≤ 2 and bilaterally absent somatosensory evoked potentials							
Day 2–3	188	133 (71)	100 (94–100)	58 (49–66)	100 (100–100)	55 (50–59)	0 (0–6) %

CI confidence interval, *CPC* Cerebral Performance Category

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Prognostication

Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2021: Post-resuscitation care*

TTM and rewarming

Unconscious, M≤3 at ≥72 h without confounders

At least 2 of:

- No pupillary and cornel reflexes at ≥72
- Bilaterally absent N20 SSEP wave
- **Highly malignant EEG at ≥24h**

INVITED REVIEW

American Clinical Neurophysiology Society's Standardized Critical Care EEG Terminology: 2012 version

L. J. Hirsch, S. M. LaRoche, N. Gaspard, E. Gerard, A. Svoronos, S. T. Herman, R. Mani, H. Arif, N. Jette, Y. Minazad, J. F. Kerrigan, P. Vespa, S. Hantus, J. Claassen, G. B. Young, E. So, P. W. Kaplan, M. R. Nuwer, N. B. Fountain, and F. W. Drislane

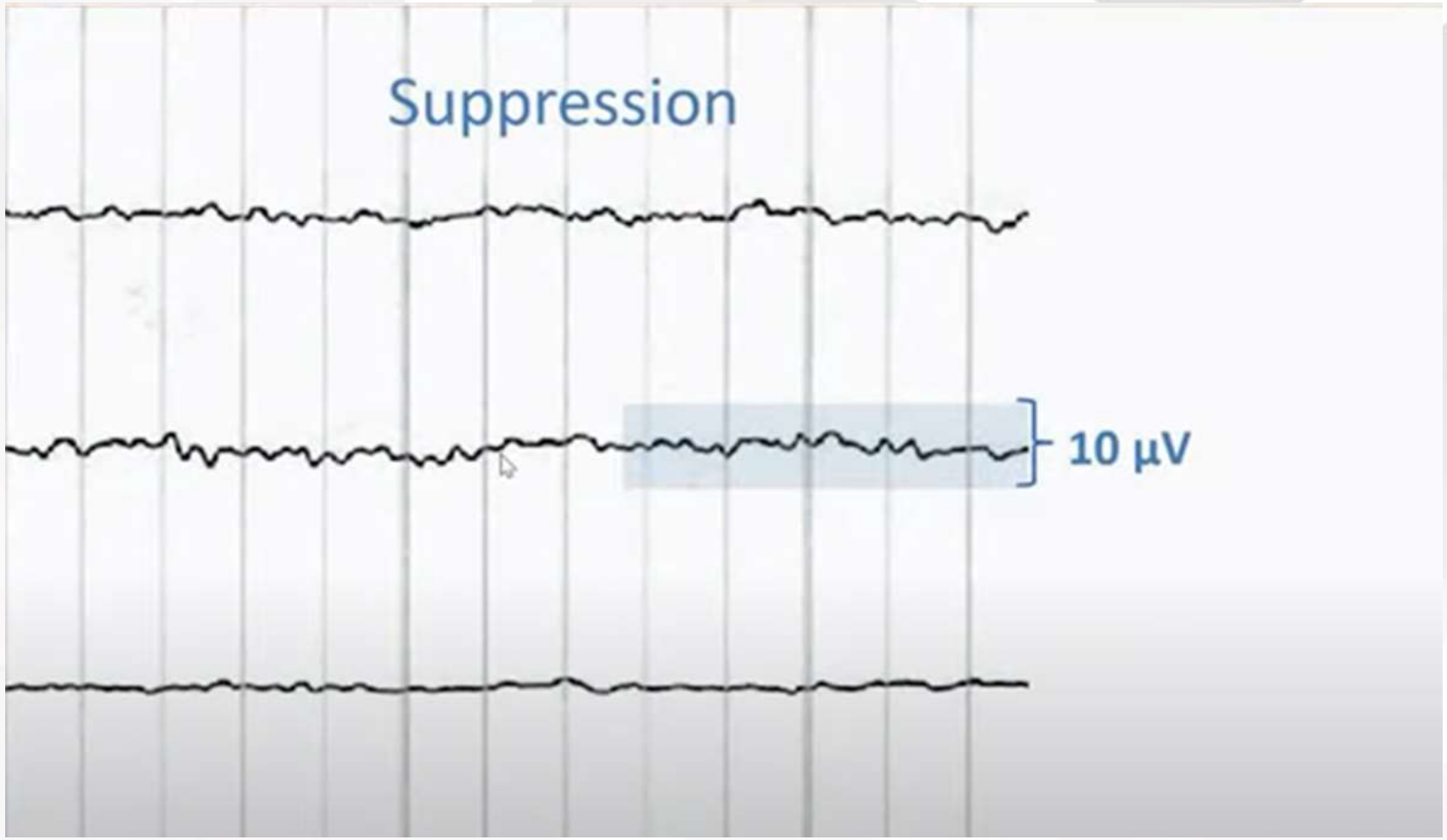
Intensive Care Med (2020) 46:1803–1851
https://doi.org/10.1007/s00134-020-06198-w

SYSTEMATIC REVIEW

Prediction of poor neurological outcome in comatose survivors of cardiac arrest: a systematic review

Claudio Sandroni[1,2], Sonia D'Arrigo[1*], Sofia Cacciola[1], Cornelia W. E. Hoedemaekers[3], Marlijn J. A. Kamps[4], Mauro Oddo[5], Fabio S. Taccone[6], Arianna Di Rocco[7], Frederick J. A. Meijer[8], Erik Westhall[9], Massimo Antonelli[1,2], Jasmeet Soar[10], Jerry P. Nolan[11] and Tobias Cronberg[12]

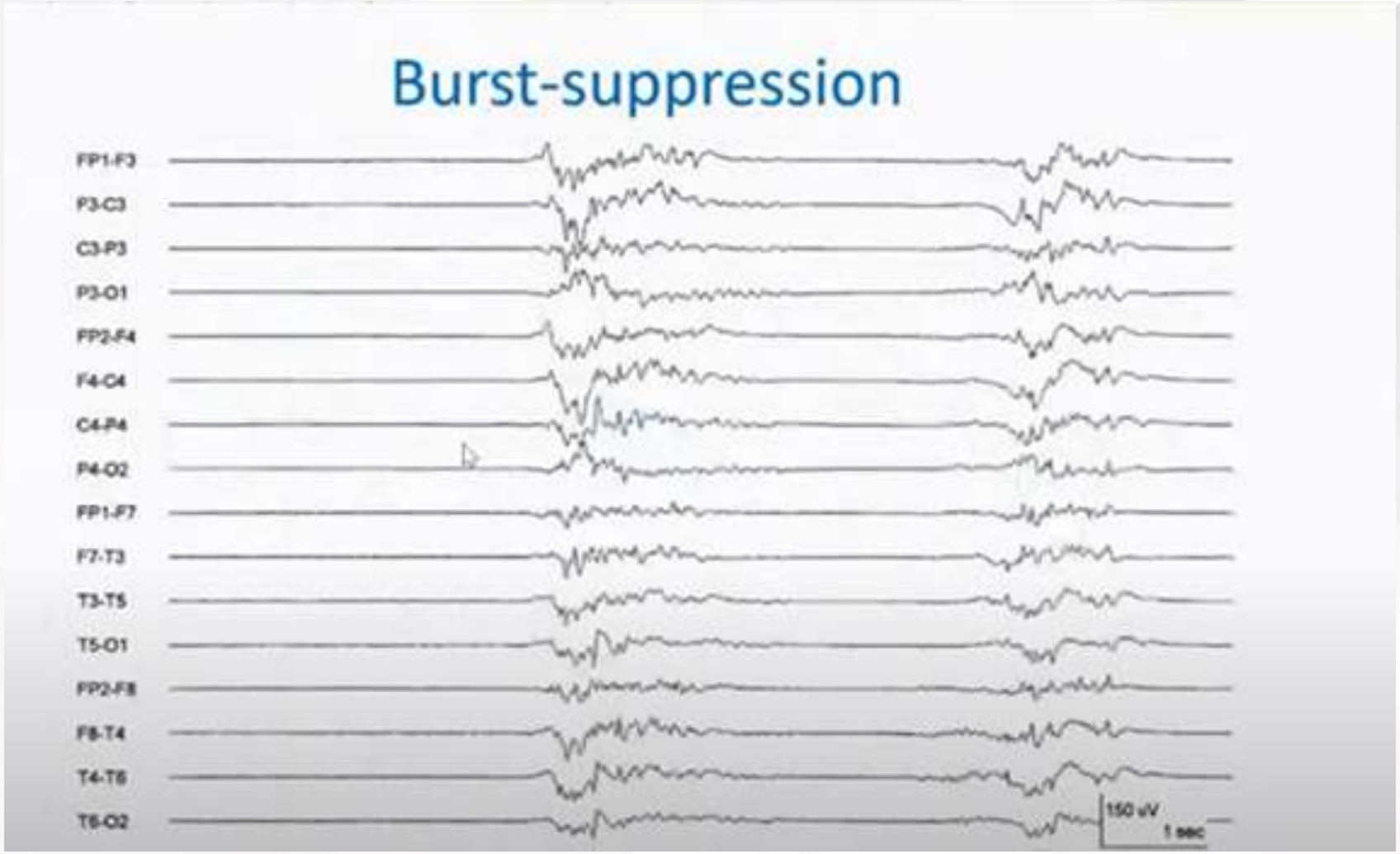
Highly malignant EEG = suppression ± burst suppression



American Clinical Neurophysiology Society's Standardized Critical Care EEG Terminology: 2021 Version

Lawrence J. Hirsch*, Michael W.K. Fong†, Markus Leitinger‡, Suzette M. LaRoche§, Sandor

Burst-suppression



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Prognostication

Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation
European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2021: Post-resuscitation care*

TTM and rewarming

Unconscious, M≤3 at ≥72 h without confounders

At least 2 of:

- No pupillary and cornel reflexes at ≥72
- Bilaterally absent N20 SSEP wave
- Highly malignant EEG at ≥24h
- **NSE>60 µg/L at 48h and/or 72h**

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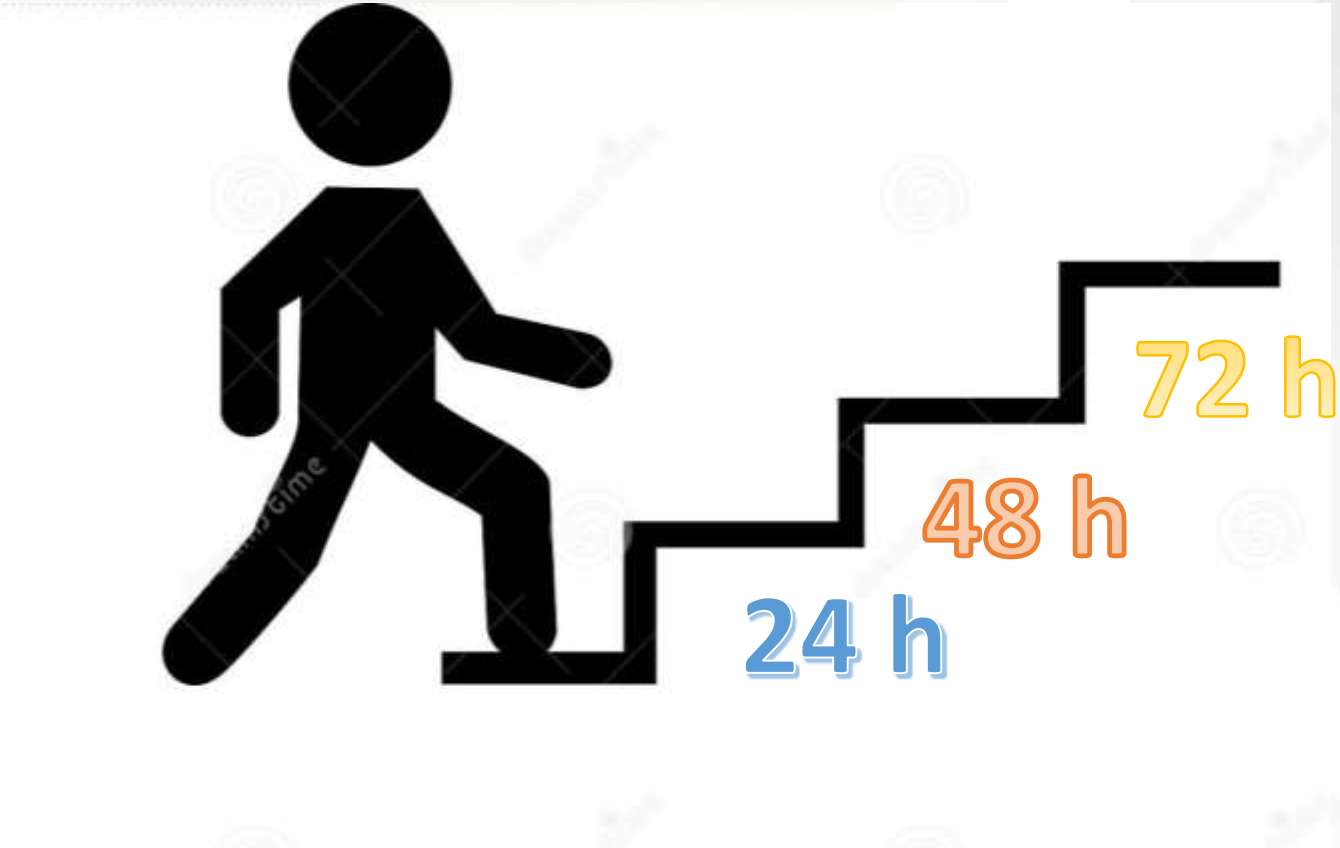
Author, year	Sample size, *n*	Threshold value, µg/L	Timing	Timing outcome	TP	FP	FN	TN	Sensitivity % [95% CI]	FPR % [95% CI]
Helwig, 2017 [38]	100	34	48 ± 12 h	1 mo	27	0	34	39	44.3 [31.5–57.6]	0 [0–7.4]
Duez, 2018 [37]	115	45.12	48 h	6 mo	11	0	25	79	30.6 [16.3–48.1]	0 [0–3.7]
Vondrakova, 2017 [47]	153	51.1	48 h	1 mo	14	0	43	96	24.6 [14.1–37.8]	0 [0–3.1]
Lee, 2013 [102]	224	52.7	48 h	HD	50	0	33	141	60.2 [48.9–70.8]	0 [0–2.1]
You, 2019 [48]	34	54.6	48 h	6 mo	13	0	3	18	81.3 [54.4–96]	0 [0–15.3]
Pfeifer, 2014 [42]	139	66.1	48 h	1 mo	46	0	87	6	34.6 [26.6–43.3]	0 [0–39.3]
Nakstad, 2020 [105]	229	87	48 h	6 mo	39	0	69	121	36.1 [27.1–45.9]	0 [0–2.4]
Stammet, 2015 [44]	686	120	48 h	6 mo	91	0	247	348	26.9 [22.3–32]	0 [0–0.9]

Incremental NSE



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- **Status myoclonus ≤ 72h**

Continuo, generalizzato e persistente per 30 minuti o più

Prognostication

TTM and rewarming

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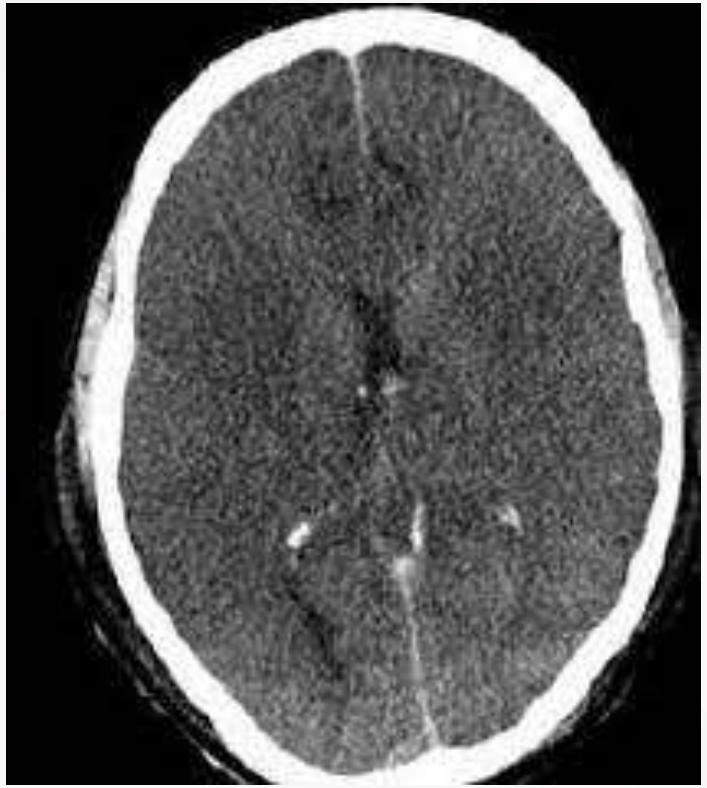
- Bilaterally absent N20 SSEP wave
- Highly malignant EEG at ≥24h
- NSE>60 µg/L at 48h and/or 72h
- Status myoclonus ≤ 72h
- **Diffuse and extensive anoxic injury on brain CT/MRI**

Diffuse and extensive anoxic injury on brain CT/MRI



Within 7 days

Prognostication

TTM and rewarming

Unconscious, M≤3 at ≥72 h without confounders

At least 2 of:

- No pupillary and cornel reflexes at ≥72
- Bilaterally absent N20 SSEP wave
- Highly malignant EEG at ≥24h
- NSE>60 µg/L at 48h and/or 72h
- Status myoclonus ≤ 72h
- Diffuse and extensive anoxic injury on brain CT/MRI

YES → Poor outcome likely

NO ↓ Observe and re-evaluate

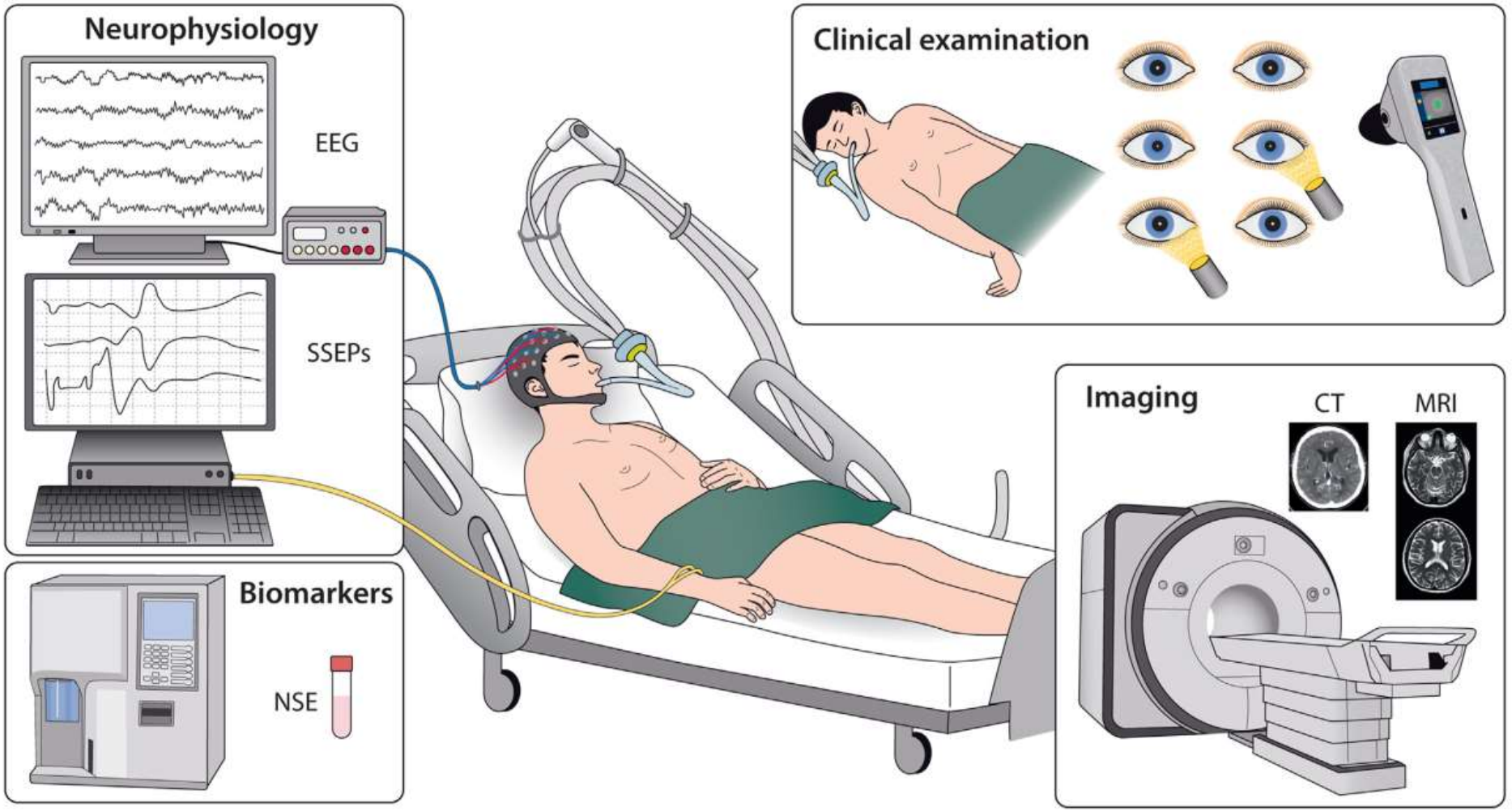


Fig. 4 – Prognostication modes. EEG electroencephalography; NSE neuron specific enolase; SSEP somatosensory evoked potential.

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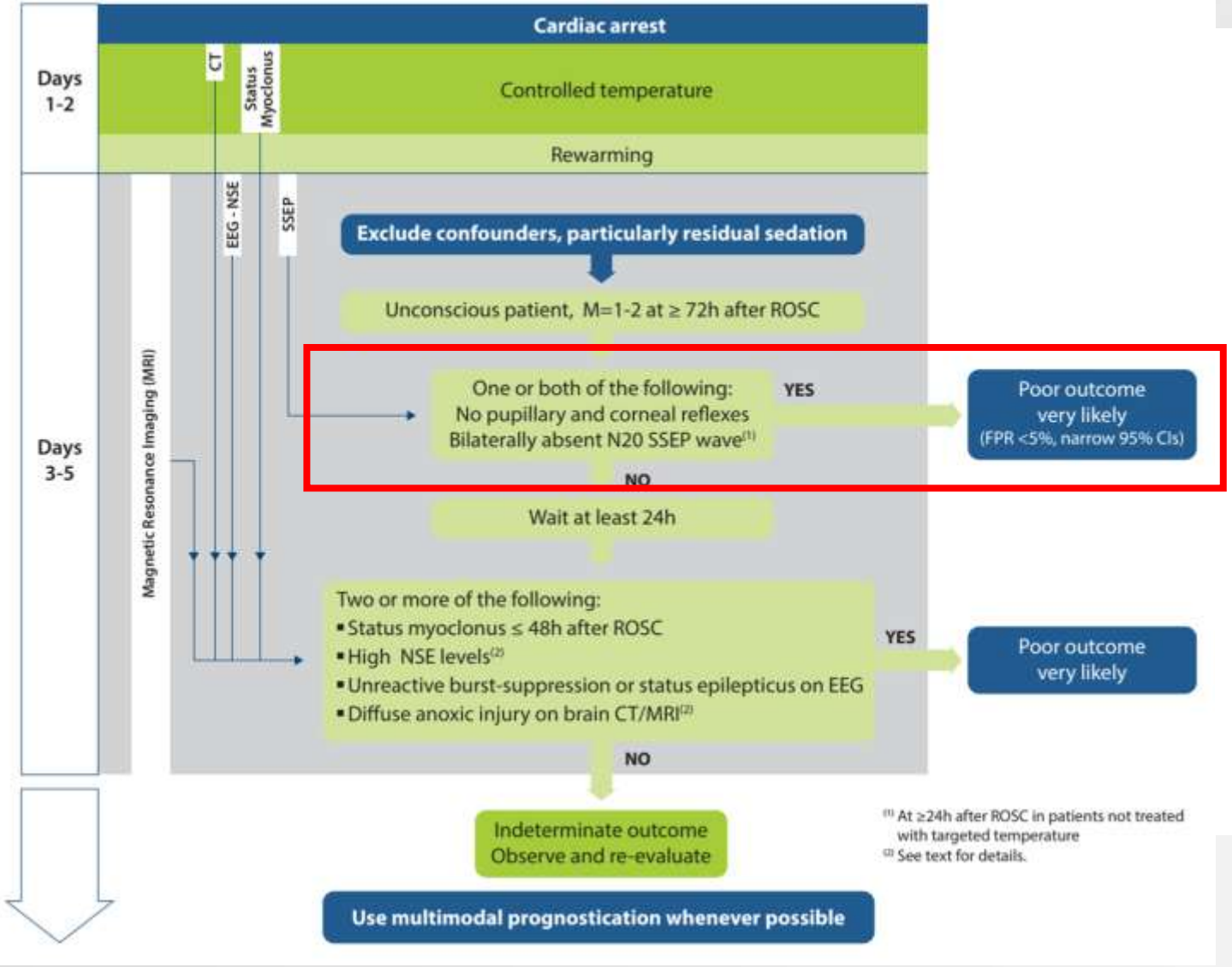
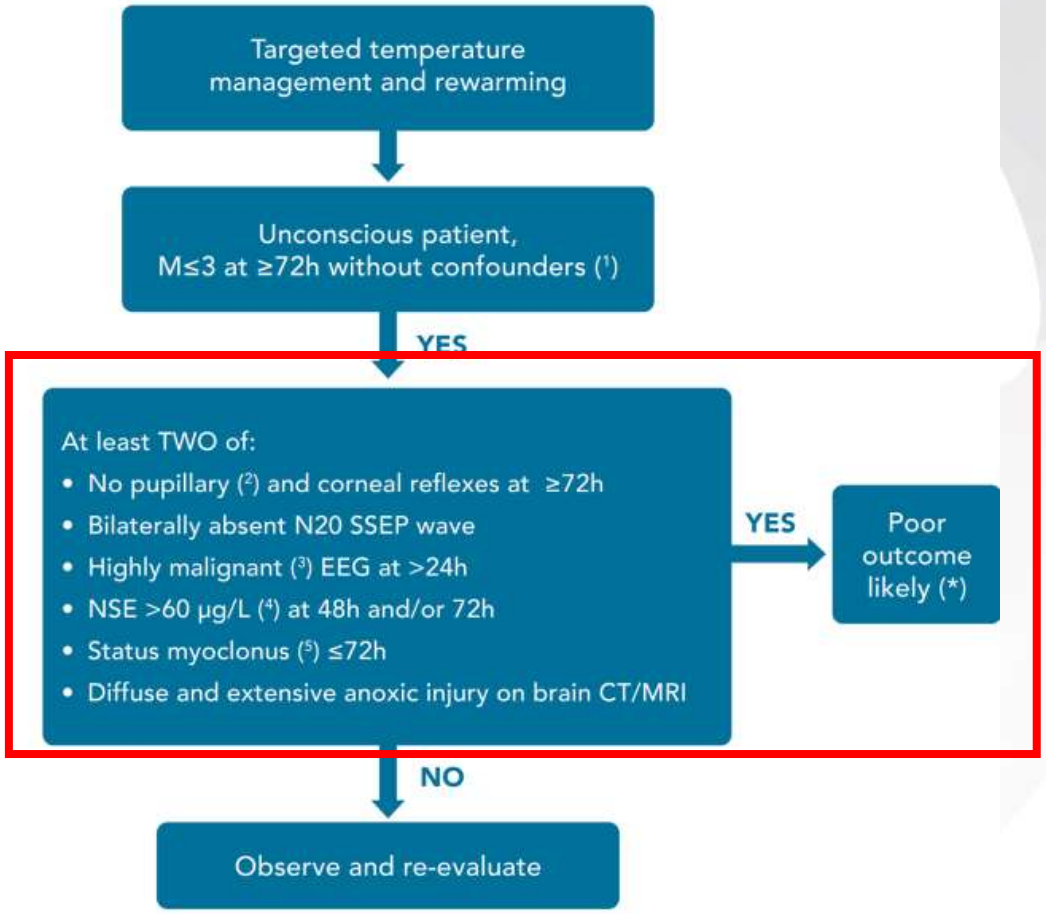
TRAUMA: NUOVE EVIDENZE E PERCORSI

2015 Guidelines



2021 Guidelines



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Good Outcome

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2022

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Good Outcome

2022

- Continuous, normal voltage and reactive EEG
- Low/decreasing levels of biomarkers (NSE)
- Normal MRI

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Conclusions

- Multimodal prognostication
- Not only one predictor
- Be careful
- Caution if discordant signals are present

Prognostication

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TRAUMA: NUOVE EVIDENZE E PERCORSI

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