L'IPOTERMIA NEL PAZIENTE RESUSCITATO

RAIMONDI MAURIZIO

AREU Lombardia, AAT 118 PAVIA,
I.R.C.C.S. Fondazione Policlinico
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Resuscitation

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Part 1: Executive summary
2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations☆

ILCOR 2010 RECOMMENDATION

Treatment recommendation

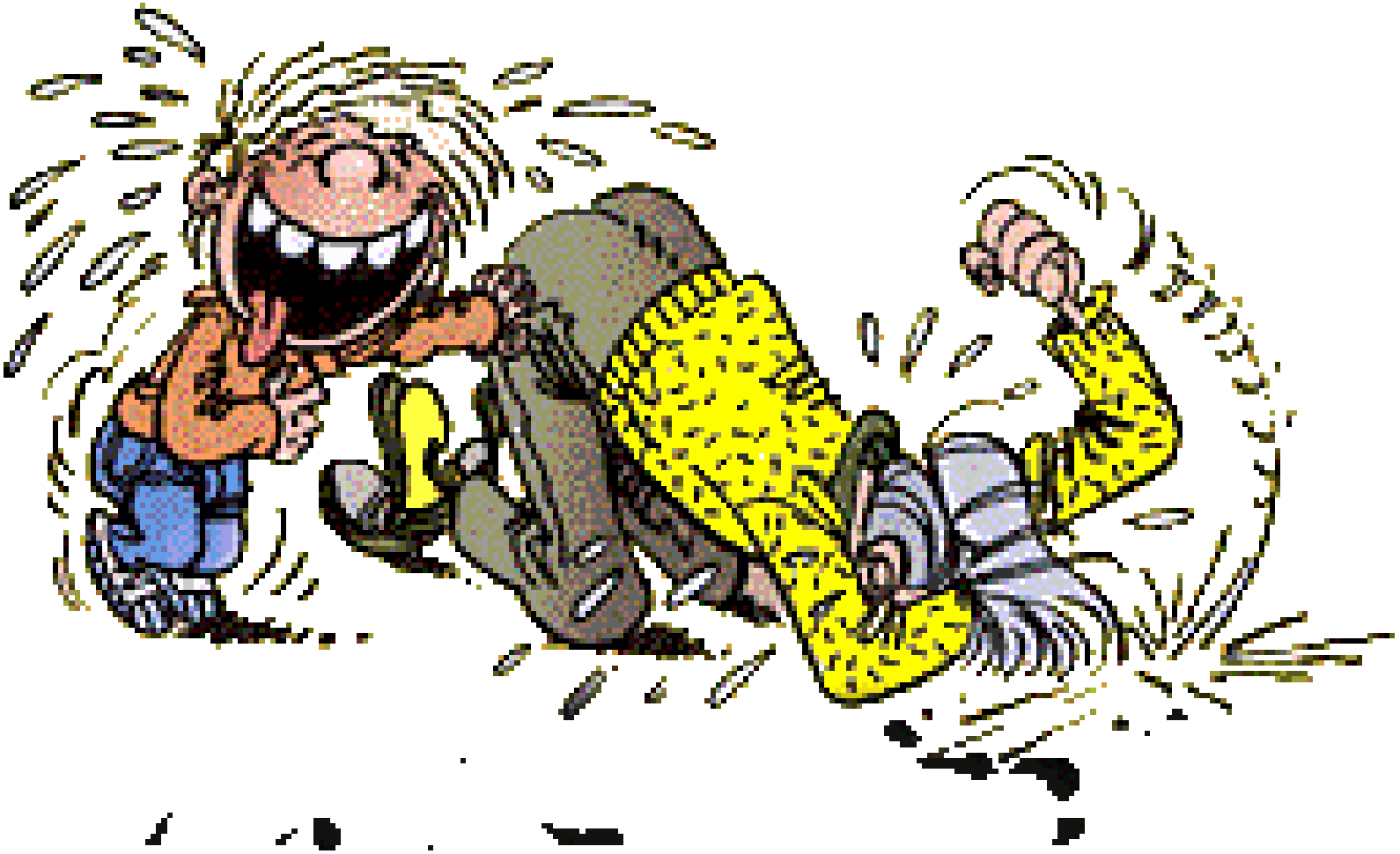
Comatose adult patients (not responding in a meaningful way to verbal commands) with spontaneous circulation after out-of-hospital VF cardiac arrest should be cooled to 32–34 °C for 12–24 h. Induced hypothermia might also benefit comatose adult patients with spontaneous circulation after out-of-hospital cardiac arrest from a nonshockable rhythm, or cardiac arrest in hospital. Rapid infusion of ice-cold IV fluid 30 mL kg^{-1} or ice packs are feasible, safe, and simple methods for initially lowering core temperature up to 1.5 °C. When IV fluids are used to induce hypothermia, additional cooling strategies will be required to maintain hypothermia. Limited available evidence suggests that PCI during therapeutic hypothermia is feasible and safe and may be associated with improved outcome.

IPOTERMIA POST ARRESTO classe I

- TEMPERATURA CENTRALE 32-34°
- 12-24 ORE CON SEDAZIONE
- DOPO FV IIa (extraospedaliera)
- DOPO ASISTOLIA E PEA IIb (intra e extraH)
- ATTENZIONE A COMPLICANZE (coagulopatie, aritmie,sepsi, eccessiva ipotermia, iperglicemia)
- INFUSIONE PREOSPEDALIERA DI RINGER a 4°, 30 ml/Kg

IPOTERMIA POST ARRESTO

- 1 PAZIENTE OGNI 6 HA BUON RECUPERO CEREBRALE: CLASSE I
- AUMENTA SOPRAVVIVENZA SENZA ESITI
- AUMENTA IN VALORE ASSOLUTO I PAZIENTI VIVI
- TUTTI I POST ARRESTI VENGONO SEDATI E CURARIZZATI PER 24-48h E SEGUITI INTENSIVAMENTE
- MENO PAZIENTI MUOIONO NELLE PRIME 24-48h
- PIU' PAZIENTI SOPRAVVIVONO:, ANCHE CON DANNI CEREBRALI (PRIMA DECESSO PRECOCE)
- POCHI INDICI PRECOCI DI DANNO CEREBRALE!



The NEW ENGLAND JOURNAL of MEDICINE

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

ORIGINAL ARTICLE

N Engl J Med 2013.
DOI: 10.1056/NEJMoa1310519

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

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

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

Australian Critical Care (2012) 25, 170–177

ELSEVIER

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Adherence to therapeutic hypothermia guidelines for out-of-hospital cardiac arrest

Regina Boyce BN, Masters Intensive Care Nursing[a,*,d],
Kelly Bures BN, GCert Intensive Care Nursing[a,d],
Jan Czamanski BN, GCert Intensive Care Nursing[b,e],
Marion Mitchell BN(Hons), GCert Higher Education

Conclusion

This study examined adherence to therapeutic hypothermia practice guidelines for patients admitted to an ICU following OOHCA. Adherence to the practice guidelines at the site ICU was low. Less than a third of the patients experienced therapeutic induced hypothermia as recommended by the evidence based site guidelines and only 12% ($n = 4$) were at the goal temperature within the required 2 h. The study results have been the impetus for change to address the issues impeding guideline implementation. Ultimately it is hoped that the changes to practice introduced as a result of this study lead to increased neurological protection and functioning for patients post OOHCA.

The NEW ENGLAND JOURNAL of MEDICINE

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The NEW ENGLAND JOURNAL of MEDICINE

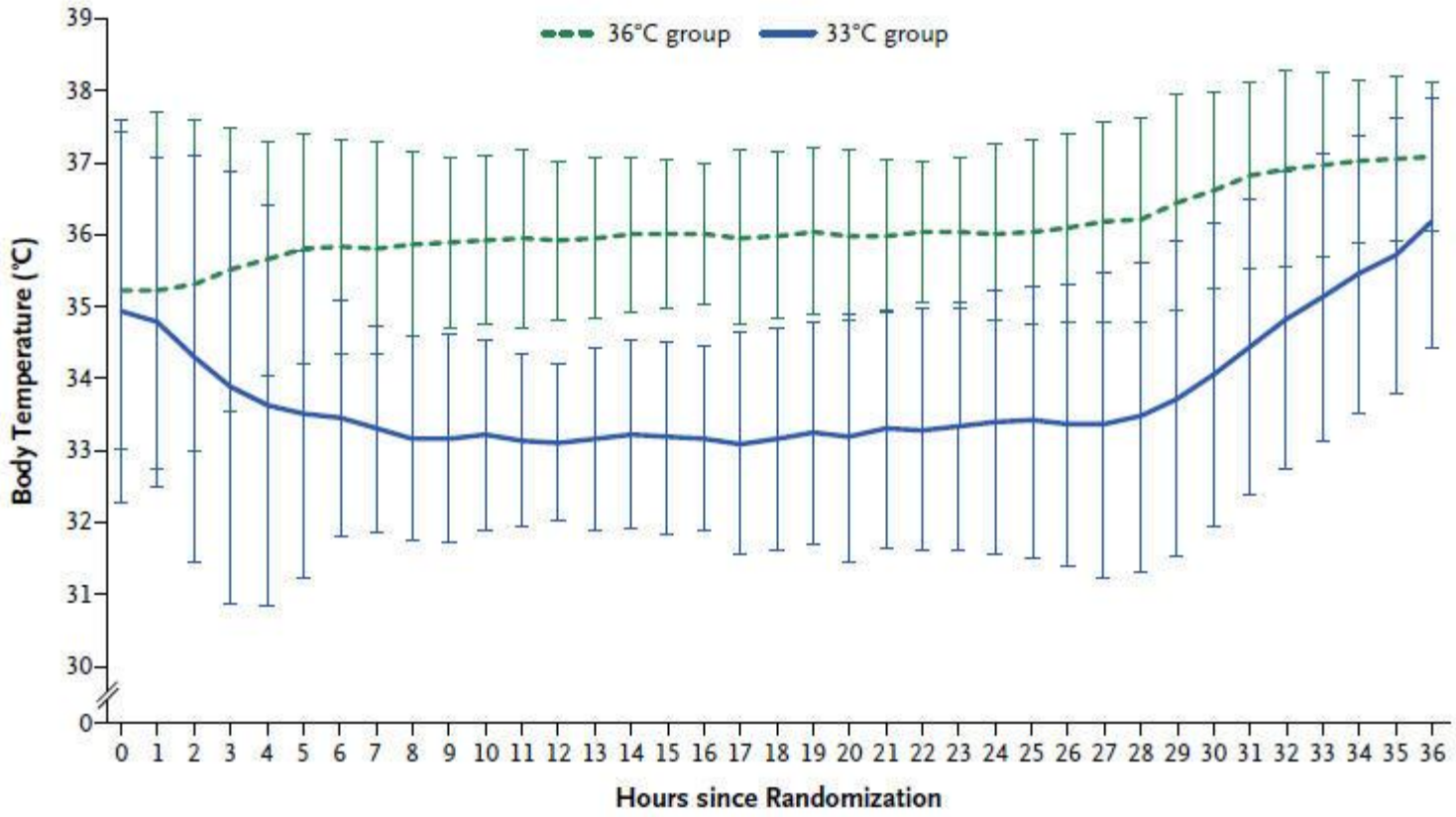

Figure 1. Body Temperature during the Intervention Period.

Shown are body-temperature curves in the 33°C and 36°C groups for the 860 patients in whom a bladder temperature was recorded. In the remaining 79 patients, the temperature was recorded with an intravascular or esophageal probe, with a similar temperature profile (data not shown). Rewarming was commenced at 28 hours after randomization. The temperature curves display the means, and the I bars indicate ±2 SD (95% of the observations are within the error bars).

Table 1. Characteristics of the Modified Intention-to-Treat Population before Randomization.*

Characteristic	33°C Group (N = 473)	36°C Group (N = 466)
Demographic characteristics		
Age — yr	64±12	64±13
Male sex — no. (%)	393 (83)	368 (79)
Medical history — no. (%)		
Chronic heart failure	32 (7)	29 (6)
Previous AMI	107 (23)	86 (18)
Ischemic heart disease	145 (31)	115 (25)
Previous cardiac arrhythmia	87 (18)	79 (17)
Arterial hypertension	193 (41)	181 (39)
Previous TIA or stroke	35 (7)	38 (8)
Diabetes mellitus	61 (13)	80 (17)
Asthma or COPD	48 (10)	49 (11)
Previous percutaneous coronary intervention	58 (12)	50 (11)
Previous coronary-artery bypass grafting	47 (10)	42 (9)
Characteristics of the cardiac arrest		
Location of cardiac arrest — no. (%)†		
Place of residence	245 (52)	255 (55)
Public place	197 (42)	188 (40)
Other	31 (7)	22 (5)
Bystander witnessed cardiac arrest — no. (%)	420 (89)	418 (90)
Bystander performed CPR — no. (%)	344 (73)	339 (73)
First monitored rhythm — no. (%)†		
Shockable rhythm	375 (79)	377 (81)
Ventricular fibrillation	349 (74)	356 (77)
Nonperfusing ventricular tachycardia	12 (3)	12 (3)
Unknown rhythm but responsive to shock	5 (1)	5 (1)
Perfusing rhythm after bystander-initiated defibrillation	9 (2)	4 (1)
Asystole	59 (12)	54 (12)
Pulseless electrical activity	37 (8)	28 (6)
Unknown first rhythm, not responsive to shock or not shocked	2 (<0.5)	6 (1)
Time from cardiac arrest to event — min‡		
Start of basic life support		
Median	1	1
Interquartile range	0–2	0–2
Start of advanced life support		
Median	10	9
Interquartile range	6–13	5–13
Return of spontaneous circulation		
Median	25	25
Interquartile range	18–40	16–40

Table 1. (Continued.)

Characteristic	33°C Group (N=473)	36°C Group (N=466)
Clinical characteristics on admission		
First measured body temperature — °C	35.2±1.3	35.3±1.1
Glasgow Coma Scale score§		
Median	3	3
Interquartile range	3–4	3–4
Corneal reflex present — no./total no. (%)	264/407 (65)	258/392 (66)
Pupillary reflex present — no./total no. (%)	344/460 (75)	363/458 (79)
Serum pH	7.2±0.2	7.2±0.2
Serum lactate — mmol/liter	6.7±4.5	6.7±4.5
Circulatory shock — no. (%)¶	70 (15)	67 (14)
ST-segment elevation myocardial infarction — no. (%)	190 (40)	194 (42)

* Plus–minus values are means ±SD. P>0.05 for all comparisons. AMI denotes acute myocardial infarction, COPD chronic obstructive pulmonary disease, CPR cardiopulmonary resuscitation, and TIA transient ischemic attack.
† In the 36°C group, data for location of cardiac arrest and first monitored rhythm were missing for one patient.
‡ For unwitnessed arrests, intervals were calculated from the time of the emergency call.
§ Scores on the Glasgow Coma Scale range from 3 to 15, with lower scores indicating reduced levels of consciousness. The distribution of Glasgow Coma Scale motor scores is provided in Table S1 in the Supplementary Appendix.
¶ Circulatory shock was defined as a systolic blood pressure of less than 90 mm Hg for more than 30 minutes or end-organ hypoperfusion (cool extremities, a urine output of <30 ml per hour, and a heart rate of <60 beats per minute).

Table 2. Outcomes.

Outcome	33°C Group	36°C Group	Hazard Ratio or Risk Ratio (95% CI)*	P Value
	no./total no. (%)			
Primary outcome: deaths at end of trial	235/473 (50)	225/466 (48)	1.06 (0.89–1.28)	0.51
Secondary outcomes				
Neurologic function at follow-up†				
CPC of 3–5	251/469 (54)	242/464 (52)	1.02 (0.88–1.16)	0.78
Modified Rankin scale score of 4–6	245/469 (52)	239/464 (52)	1.01 (0.89–1.14)	0.87
Deaths at 180 days	226/473 (48)	220/466 (47)	1.01 (0.87–1.15)	0.92

* The hazard ratio is shown for the primary outcome, and risk ratios are shown for the secondary outcomes. CI denotes confidence interval.

† The neurologic follow-up was specified in the protocol to be performed at 180 days ±2 weeks, but the time to follow-up was in some cases several weeks longer for logistic reasons. The Cerebral Performance Category (CPC) scale ranges from 1 to 5, with 1 representing good cerebral performance or minor disability, 2 moderate cerebral disability (function is sufficient for independent activities of daily life), 3 severe cerebral disability, 4 coma or vegetative state, and 5 brain death. Scores on the modified Rankin scale range from 0 to 6, with 0 representing no symptoms, 1 no clinically significant disability despite some symptoms, 2 slight disability (patient is able to look after own affairs without assistance), 3 moderate disability (patient requires some help but is able to walk unassisted), 4 moderately severe disability (patient is unable to attend to own bodily needs), 5 severe disability (patient is bedridden), and 6 death.

CONCLUSIONS

In unconscious survivors of out-of-hospital cardiac arrest of presumed cardiac cause, hypothermia at a targeted temperature of 33°C did not confer a benefit as compared with a targeted temperature of 36°C. (Funded by the Swedish Heart–Lung Foundation and others; TTM ClinicalTrials.gov number, NCT01020916.)

Targeted Temperature Management after Cardiac Arrest

TO THE EDITOR: Nielsen and coauthors (Dec. 5 issue)[1] show the importance of avoiding hyperthermia in patients who have had a cardiac arrest. However, if the clinical objective is to improve the neurologic outcome, it is important to define the expected neurologic outcome in individual patients. Studies have shown that the severity of neuronal lesions is dependent on the delay in initiation of cooling after reperfusion.[2]

In the article by Nielsen et al., the studied patients had a median return of spontaneous circulation of 25 minutes, with a wide interquartile range of 18 to 40 in the hypothermic group and 16 to 40 in the normothermic group. In prolonged cardiac arrest, we do not expect that a reduction of neurologic metabolism by hypothermia will have a real effect on already damaged structures.

We should not conclude, on the basis of this trial, that hypothermia is simply an antihyperthermic strategy. Not all cardiac arrests are equal in terms of the time to return of sponta-

2. Kuboyama K, Safar P, Radovsky A, Tisherman SA, Stezoski SW, Alexander H. Delay in cooling negates the beneficial effect of mild resuscitative cerebral hypothermia after cardiac arrest in dogs: a prospective, randomized study. Crit Care Med 1993;21:1348-58.

DOI: 10.1056/NEJMc1401250

TO THE EDITOR: Nielsen et al. confirm that fever should be avoided in resuscitated patients. However, several unanswered questions remain before abandoning therapeutic hypothermia in patients after cardiac arrest. One key issue is the potential benefit of early cooling initiated during cardiopulmonary resuscitation (CPR).

Pathophysiological mechanisms[1] as well as experimental data suggest a benefit of early cooling, with intra-arrest cooling clearly superior to postresuscitation cooling.[2] Thus, when moving from very early cooling in the experimental setting to several hours of delay in clinical practice, we might miss the time window for the greatest effectiveness of hypothermia.[3]

Transnasal evaporative cooling can be induced

Nielsen et al. permitted a time to initiate cooling of 4 hours. We suggest that this time window may be crucial to influence outcome.

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DR. NIELSEN AND COLLEAGUES REPLY: Perchiazzi et al., Nordberg et al., and Stub suggest that a delay in the initiation of temperature management might influence outcome. The window of 240 minutes from return of spontaneous circulation to randomization was based on a study of data from the Hypothermia Network Registry, in which there was no association between time to the initiation of temperature management and 6-month neurologic outcome.[1] Other large observational studies have given similar signals.[2] Data from a recent randomized trial showed that early initiation of temperature management does not improve outcome.[3] Intra-arrest cooling is, however, compelling, and we look forward to results from ongoing trials.

However, the neurologic evaluation in Nielsen et al. was based on the Cerebral Performance Category (CPC) scale and a modified Rankin scale. These are simple tests devised for assessing patients' independent daily living and are inadequate for assessing cognitive prognosis, when mild cognitive impairment is a real concern in survivors of cardiac arrest.[1-3] Thus, the findings

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DR. NIELSEN AND COLLEAGUES REPLY:

Oh and colleagues ask for more detailed neurologic assessment at follow-up, and we agree that the CPC scale and the modified Rankin scale represent crude measures. However, the CPC scale was used in trials introducing temperature management in clinical practice. Data from more detailed assessment were collected but have not yet been published.[4] Survival being the primary outcome, it is important to acknowledge that the TTM trial was not powered to conclusively assess these measures.

TO THE EDITOR: Data from the study by Nielsen et al. showing that maintaining temperature at 33°C and at 36°C have similar benefits in comatose survivors of cardiac arrest originate from patients with an impressively short time to CPR and a higher percentage of bystander-initiated CPR (73%) than in previous clinical trials (49 to 58%).[1,2] Thus, whether such results could be widely applied to communities with a longer time to resuscitation remains to be clarified. Moreover, both midazolam and propofol provide additional neuroprotective effects[3]; however, doses of agents used were not specifically recorded. Fi-

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DR. NIELSEN AND COLLEAGUES REPLY:

Taccone and Dell'Anna comment on the high rate of bystander-initiated CPR in the TTM trial. During the past decade, there has been a continuous rise in bystander-initiated CPR, with positive consequences on overall outcome.[5] The time to bystander-initiated CPR is naturally relevant only for patients receiving such help and should be short. The time to bystander-initiated CPR was, to our knowledge, not reported in earlier trials on temperature management.

First, patients in the current study underwent randomization up to 4 hours after cardiac arrest and had a further 4 hours to achieve mean temperatures below 34°C.[1] A briefer time to the target temperature after cardiac arrest[2] or in patients with ST-segment elevation myocardial infarction[3] may be required to modify reperfusion injury. Second, patients were sedated for 36 hours. Although details were not provided, it is plausible that sedation with propofol may have attenuated the effect of temperature management on the reduction of reperfusion injury.[4,5]

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DR. NIELSEN AND COLLEAGUES REPLY: Perchiazzi et al., Nordberg et al., and Stub suggest that a delay in the initiation of temperature management might influence outcome. The window of 240 minutes from return of spontaneous circulation to randomization was based on a study of data from the Hypothermia Network Registry, in which there was no association between time to the initiation of temperature management and 6-month neurologic outcome.[1] Other large observational studies have given similar signals.[2] Data from a recent randomized trial showed that early initiation of temperature management does not improve outcome.[3] Intra-arrest cooling is, however, compelling, and we look forward to results from ongoing trials.

ducted but has potential limitations. One is a rapid rate of rewarming, from 33°C to 36°C in 6 hours — a much faster rate than in previous trials. Rapid warming is harmful and can negate the benefits of therapeutic hypothermia.[4,5] In addition, were all consecutive patients with cardiac arrest and return of spontaneous circulation screened for this study, or did physicians preassess potential eligibility? Participating centers routinely used therapeutic hypothermia before this study and continued to treat nonstudy patients with it. Physicians could have subconsciously selected patients with potential benefit for "routine" therapeutic hypothermia rather than refer for screening. The study enrolled an average of only one patient per center per month, possibly indicating preselection.

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DR. NIELSEN AND COLLEAGUES REPLY:

baseline characteristics, active care (60% early angiography and 40% coronary intervention), and survival rates strongly contradict a selection of patients with a presumed poor outcome.

Whether goal-directed changes in post–cardiac arrest care, sedatives, or the rewarming rate influence outcome is to our knowledge unknown and remains to be investigated in future randomized clinical trials.

We disagree that our trial showed a benefit of avoiding fever; to do so, a no-intervention group would have been necessary. That said, we definitely would not advocate abandoning any temperature management on the basis of the results of the TTM trial.

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Scolletta *et al. Critical Care* 2012, **16**:R41
http://ccforum.com/content/16/2/R41

CRITICAL CARE

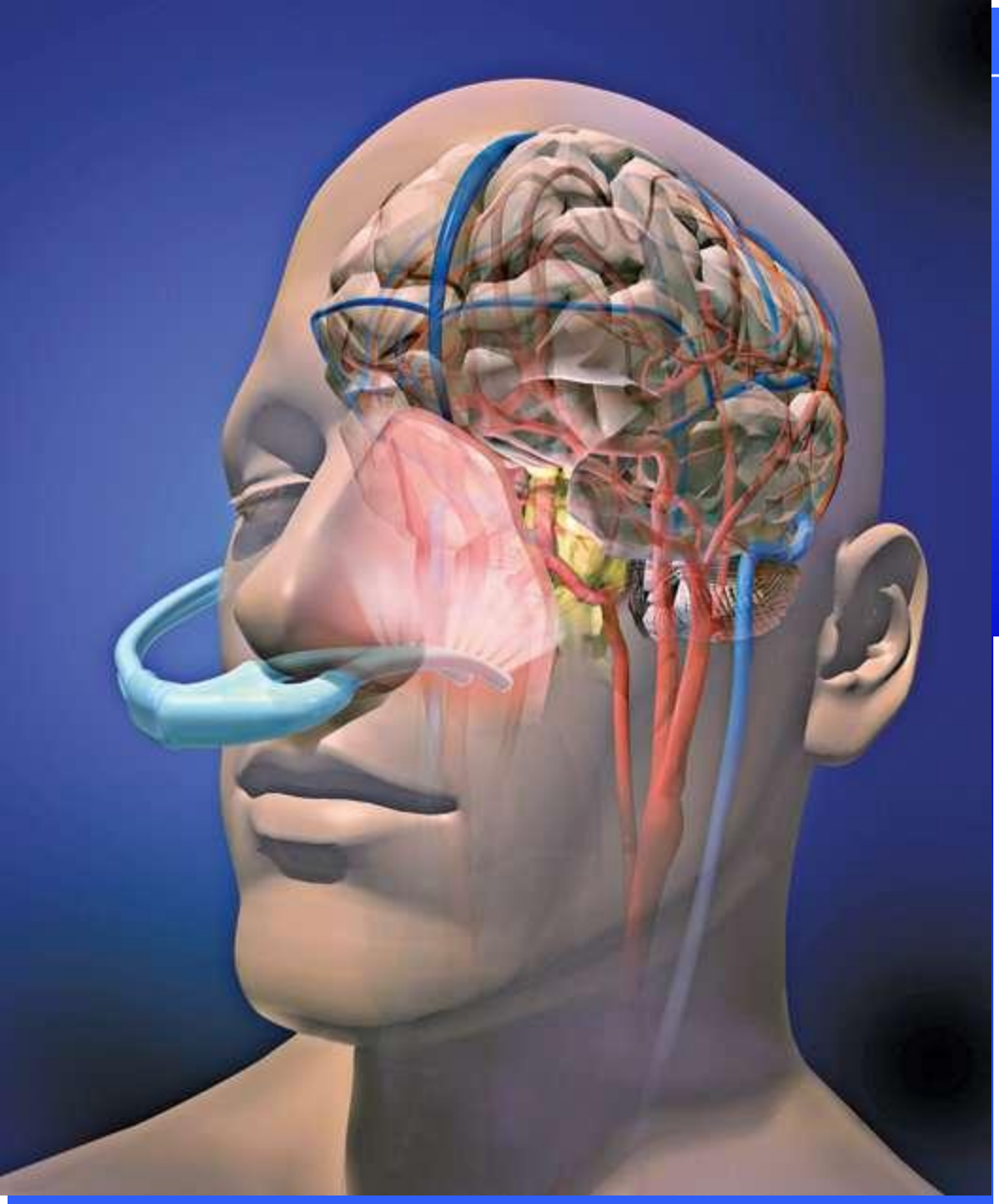
RESEARCH Open Access

Intra-arrest hypothermia during cardiac arrest: a systematic review

Sabino Scolletta[1], Fabio Silvio Taccone[1], Per Nordberg[2], Katia Donadello[1], Jean-Louis Vincent[1*] and Maaret Castren[3]

Conclusion

The use of hypothermia has been associated with improved outcomes for survivors from CA; however, it has been suggested that the timing of the induced cooling may influence its beneficial effects. Experimental studies have shown that IATH can protect the heart against the ischemic processes occurring after CA and reduce the neuronal injury secondary to global ischemia. These beneficial effects seem to be significant when IATH is compared not only to normothermia, but also to PATH. Nevertheless, not all of these studies have reported similar conclusions, probably because of the different experimental conditions that have been used. Also, the evidence that IATH is superior to PATH in animal studies is more limited than the evidence comparing IATH to normothermia. Human data on IATH remain limited; however, several large cohort studies have suggested some beneficial effects of IATH on ROSC rates and neurological outcomes, especially if initiated within a short no-flow time. Selective brain cooling may have potential advantages in protecting the brain before reperfusion and has shown promising results in experimental and clinical studies; however, this technique may limit potentially beneficial effects of hypothermia on cardiac function and needs to be further evaluated in the human setting.




RhinoChill

ARTICLE IN PRESS

Journal of Cardiothoracic and Vascular Anesthesia,

Therapeutic Hypothermia After In-hospital Cardiac Arrest: A Critique

Eugene A. Hessel II, MD, FACS

More than 210,000 in-hospital cardiac arrests occur annually in the United States. Use of moderate therapeutic hypothermia (TH) in comatose survivors after return of spontaneous circulation following out-of-hospital cardiac arrest (OOH-CA) caused by ventricular fibrillation or pulseless ventricular tachycardia is recommended strongly by many professional organizations and societies. The use of TH after cardiac arrest associated with nonshockable rhythms and after in-hospital cardiac arrest (IH-CA) is recommended to be considered by these same organizations and is being applied widely. The use in these latter circumstances is based on an extrapolation of the data supporting its use after out-of-hospital cardiac arrest associated with shockable rhythms.

The purpose of this article is to review the limitations of existing data supporting these extended application of TH after cardiac arrest and to suggest approaches to this dilemma. The data supporting its use for OOH-CA appear to this author, and to some others, to be rather weak, and the data supporting the use of TH for IH-CA appear to be even weaker and to include no randomized controlled trials (RCTs) or supportive observational studies. The many reasons why TH might be expected to be less effective following IH-CA are reviewed. The degree of neurologic injury may be more severe in many of these cases and, thus, may not be responsive to TH as currently practiced following OOH-CA. The potential adverse consequences of the routine use of TH for IH-CA are listed and include complications associated with TH, interference with diagnostic and interventional therapy, and use of scarce personnel and financial resources. Most importantly, it inhibits the ability of researchers to conduct needed RCTs. The author believes that the proper method of providing TH in these cases needs to be better defined.

Based on this analysis the author concludes that TH should not be used indiscriminantly following most cases of IH-CA, and instead clinicians should concentrate their efforts in conducting high-quality large RCTs or large-scale, well-designed prospective observation studies to determine its benefits and identify appropriate candidates.

KEY WORDS: cardiac arrest, therapeutic hypothermia

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Editorial

Resuscitation highlights in 2013: Part 2

2.2. Targeted temperature management

Post-cardiac arrest hyperthermia is associated with worse neurological outcome. Gebhardt and associates reviewed retrospectively 336 OHCA patients and documented fever (≥38 °C) among 42%, with a post-arrest median onset of 15 h in those not treated with targeted temperature management (TTM) and 36 h in the TTM cohort.[36] Contrary to previous studies, fever was not associated with neurological outcome in any of the cohorts, but was associated with survival in the non-TTM cohort (OR 0.47, 95% CI 0.20–1.10). Leary and co-investigators studied retrospectively a cohort of 236 post-arrest patients treated with TTM.[37] Rebound pyrexia occurred in 41% but was not associated with lower survival to discharge or worsened neurological outcomes; however, among patients with pyrexia, higher maximum temperature (>38.7 °C) was associated with worse neurological outcomes among survivors to hospital discharge.

Certified translation from the German language

Controversy for IntensivNews Issue 1/2014

Should we continue to cool comatose patients after cardiac arrest?

<<Start of original English text>>

Nielsen N, Wetterslev J, Cronberg T, et al.

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

N Engl J Med. 2013;369:2197

Department of Anesthesia and Intensive Care, Intensive Care Unit, Helsingborg Hospital, S Vallgatan 5, 251 87, Helsingborg, Sweden.

In summary, we are of the opinion that comatose patients after cardiac arrest should be continued to be cooled actively. This should especially be the case if the witnessed cardiac arrest took place outside the hospital, if the primary rhythm was ventricular fibrillation or if a long period of time passed from the collapse to the start of the first resuscitation measures. In consideration of the different inclusion and exclusion criteria of the TTM trial and the HACA study, these patients should be cooled to a target temperature of 33°C for 12 to 24 hours. All other comatose patients after cardiac arrest should at least be cooled to 36°C for 24 hours until further data is available.

EUROPEAN RESUSCITATION COUNCIL

ERC Statement on targeted temperature management

December 2013

Therapeutic hypothermia following cardiac arrest: recent studies on targeted temperature management

Two randomised controlled trials presented at the American Heart Association Scientific Sessions Meeting in Dallas on 17th November and published in JAMA[1] and the New England Journal of Medicine[2] have challenged current practice in the treatment of patients with return of spontaneous circulation (ROSC) after out-of-hospital cardiac arrest (OHCA).

In the first of these studies, the induction of hypothermia using 2 L of ice-cold normal saline in patients with return of spontaneous circulation (ROSC) after OHCA did not improve survival to hospital discharge compared with those in whom cooling was delayed until arrival at hospital.[1] Prehospital cooling reduced mean core temperature by 1.2 – 1.3°C by hospital arrival and reduced by 1 hour the time to achieve a temperature of less than 34°C compared with those not cooled prehospital. The proportion of patients re-arresting during transfer to hospital and of pulmonary oedema on the first chest radiograph was significantly greater in the prehospital cooled group.

The Targeted Temperature Management (TTM) study randomised patients with ROSC after OHCA to TTM at either 33°C or 36°C.[2] Importantly, there was a strict protocol for prognostication and withdrawal of life sustaining treatment (WLST). There was no difference in all cause mortality, the primary end point, between the two groups.

Two questions about the treatment of patients with ROSC after out-of-hospital cardiac arrest (OHCA) arise from these studies:

1. Should ice-cold intravenous fluid continue to be used for inducing hypothermia prehospital?

2. Should the target temperature be 32-34°C or 36°C for the management of comatose cardiac arrest survivors with ROSC?

MILAN

AREU AZIENDA REGIONALE EMERGENZA URGENZA

Regione Lombardia

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IRC

Bologna, 19 dicembre 2013

Aggiornamenti ed indicazioni di Italian Resuscitation Council in merito alla gestione della temperatura pre - ed intraospedaliera

Sulla base degli studi recenti sopra riassunti e commentati, il Comitato Scientifico di IRC, in accordo con il Consiglio Direttivo suggerisce che:

1. La gestione della temperatura rimane un obiettivo importante nell'ambito di un protocollo standardizzato del trattamento post-rianimazione.

2. L'infusione di cristalloidi freddi (2 litri a 4 °C in secca a pressione) come metodo di induzione dell'ipotermia preospedaliera post-ROSC non venga effettuata, in quanto di utilità non dimostrata e potenzialmente gravata da effetti collaterali.

3. I singoli centri sono liberi di scegliere se mantenere i pazienti a 33°C o 36°C per 24 ore dal raggiungimento della temperatura target; protocolli di trattamento post-rianimazione già in uso possono essere mantenuti inalterati in attesa della pubblicazione delle nuove Linee Guida o di *interim statements* dell'ILCOR.

4. La gestione della temperatura in pazienti che rimangano privi di coscienza dopo il graduale riscaldamento deve proseguire avendo come obiettivo la normotermia (37°C di temperatura centrale) almeno per 72 ore dopo il ROSC ed evitando rigorosamente l'ipertermia.

Per il Comitato Scientifico IRC
Il Coordinatore
Dr. Giuseppe Ristagno

Per il Consiglio Direttivo IRC
Il Presidente
Dr. Walter Cataldi

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Aggiornamenti ed indicazioni di Italian Resuscitation Council in merito alla gestione della temperatura pre - ed intraospedaliera

Sulla base degli studi recenti sopra riassunti e commentati, il Comitato Scientifico di IRC, in accordo con il Consiglio Direttivo suggerisce che:

1. La gestione della temperatura rimane un obiettivo importante nell'ambito di un protocollo standardizzato del trattamento post-rianimazione.

2. L'infusione di cristalloidi freddi (2 litri a 4 ℃ in sacca a pressione) come metodo di induzione dell'ipotermia preospedaliera post-ROSC non venga effettuata, in quanto di utilità non dimostrata e potenzialmente gravata da effetti collaterali.

3. I singoli centri sono liberi di scegliere se mantenere i pazienti a 33℃ o 36℃ per 24 ore dal raggiungimento della temperatura target; protocolli di trattamento post-rianimazione già in uso possono essere mantenuti inalterati in attesa della pubblicazione delle nuove Linee Guida o di *interim statements* dell'ILCOR.

4. La gestione della temperatura in pazienti che rimangano privi di coscienza dopo il graduale riscaldamento deve proseguire avendo come obiettivo la normotermia (37℃ di temperatura centrale) almeno per 72 ore dopo il ROSC ed evitando rigorosamente l'ipertermia.

ILCOR 2010

GRANDE ENFASI AL MASSAGGIO CARDIACO

MAGGIORE DETERMINANTE CHE INFLUENZA LA SOPRAVVIVENZA IN ARRESTO CARDIACO

INEFFICACIA DEL MCE DURANTE TRASPORTO, SPOSTAMENTO DEL PAZIENTE, TAC, EMODINAMICA

PRP: PAVIA RESUSCITATION PROGRAM

ECMO

ExtraCorporeal Membrane Oxygenation

"Tecniche di supporto extracorporeo che utilizzano una macchina cuore-polmone per giorni o settimane per supportare le funzioni cardiopolmonari in Tearpia Intensiva "

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PII S0735-1097(02)02716-X

Analysis and Results of Prolonged Resuscitation in Cardiac Arrest Patients Rescued by Extracorporeal Membrane Oxygenation

Yih-Sharng Chen, MD, Anne Chao, MD, Hsi-Yu Yu, MD, Wen-Je Ko, MD, I-Hui Wu, MD, Robert Jen-Chen Chen, MD, Shu-Chien Huang, MD, Fang-Yue Lin, MD, Shoei-Shan Wang, MD
Taipei, Taiwan

Back from Irreversibility: Extracorporeal Life Support for Prolonged Cardiac Arrest

Massimo Massetti,

REVIEW

Treatment of poisoning induced cardiac impairment using cardiopulmonary bypass: a review

S Purkayastha, P Bhangoo, T Athanasiou, R Casula, B Glenville, A W Darzi, J A Henry

Emerg Med J 2006;23:246–250. doi: 10.1136/emj.2005.028605

Severe poisoning can cause potentially fatal cardiac depression. Cardiopulmonary bypass (CPB) can support the depressed myocardium, but there are no clear indications or guidelines available on its use in severe poisoning. A review was conducted of relevant papers in the available literature (seven single case reports of both deliberate and accidental ingestion of cardiotoxic drugs and two animal studies). Although CPB is rarely used in the management of poisoning, it may have potential benefits for haemodynamic instability not responding to conventional measures. At present there is insufficient evidence concerning the use of CPB as a treatment for severe cardiac impairment due to poisoning (grade C). This review suggests that in patients with severe and potentially prolonged reversible cardiotoxicity there is potential for full survival with CPB, provided that the patient has not already sustained hypoxic cerebral damage due to resistant hypotension prior to its use.

30–120 minutes of ingestion,[5] but severe cardiotoxicity and systemic vasodilation (for example, due to calcium channel blockers) may be resistant to standard measures including vasopressors, inotrope infusions, repeated defibrillation, and pacing.[4 6–10]

Once a drug enters the central circulation and the tissues, it may become essential to maintain circulatory function with supportive therapy. This would permit hepatic detoxification over time[6] while providing reliable tissue perfusion and allowing sufficient antidote circulation.[7] Modalities that may be used include continuous cardiopulmonary resuscitation (CPR; manual or with a mechanical device), balloon counterpulsation, and cardiopulmonary bypass (CPB).[8] Emergency extracorporeal membrane oxygenation (ECMO) may also be used to provide adequate cardiac output and restore vital organ perfusion to allow clearance of the toxic metabolite in question. ECMO is a form of partial CPB used for support of a longer duration of respiratory and/or cardiac dysfunction. It is primarily indicated in patients with such severe ventilation and/or oxygenation problems that

Improved Survival After Acute Myocardial Infarction Complicated by Cardiogenic Shock With Circulatory Support and Transplantation: Comparing Aggressive Intervention With Conservative Treatment

Wakkas Tayara, MD,[a] Randall C. Starling, MD, MPH,[b] Mohamad H. Yamani, MD,[b] Oussama Wazni, MD,[b] Fuad Jubran, MD,[b] and Nicholas Smedira, MD[c]

G Model
RESUS-4958; No. of Pages 5

ARTICLE IN PRESS

Resuscitation xxx (2011) xxx–xxx

Contents lists available at SciVerse ScienceDirect

Resuscitation

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

Clinical paper

Favourable survival of in-hospital compared to out-of-hospital refractory cardiac arrest patients treated with extracorporeal membrane oxygenation: An Italian tertiary care centre experience☆

Leonello Avalli[a,*], Elena Maggioni[a], Francesco Formica[b], Gianluigi Redaelli[a], Maurizio Migliari[a], Monica Scanziani[a], Simona Celotti[a], Anna Coppo[a], Rosa Caruso[c], Giuseppe Ristagno[d], Roberto Fumagalli[a]

Extracorporeal Membrane Oxygenation for Resuscitation and Cardiac Arrest Management

Massimo Massetti, MD[a], Mario Gaudino, MD[a,*], Stefano De Paulis, MD[b], Andrea Scapigliati, MD[b], Franco Cavaliere, MD[b]

Heart Failure Clin 10 (2014) S85–S93
http://dx.doi.org/10.1016/j.hfc.2013.08.005
1551-7136/14/$ – see front matter

KEY POINTS

- The integration of extracorporeal membrane oxygenation (ECMO) technology into current strategies for cardiopulmonary resuscitation seems promising.
- Even in the absence of randomized trials and with a limited level of scientific evidence, several investigators have reported sound clinical benefits with the application of extracorporeal circulatory support in patients after cardiac arrest, both in and out of the hospital.
- ECMO support should be accompanied by a strategy of end-organ protection and (ideally) treatment.
- The recently developed concept of ECMO network extends the potential benefits of ECMO therapy to primary care centers and remote locations and is likely to grow considerably in the near future.

CODICE VIOLA/ECLS

Prevede l'impiego della tecnologia ECLS (Extra Corporeal Life Support) ai pazienti in arresto cardiaco refrattario al trattamento medico convenzionale. Questa tecnologia si basa sull'utilizzo di un sistema mobile e miniaturizzato che integra una pompa, un'ossigenatore ed un circuito bio compatibile. Il tutto viene connesso alla circolazione del paziente tramite due canule (venosa e arteriosa) inserite per lo più a livello dei vasi femorali. L'ECLS permette di ristabilire un'emodinamica sufficiente ed appropriata anche durante le manovre di rianimazione cardiopolmonare.

Autopulse 90 minuti

ECLS, ipotermia 28°, PTCA, FV per 8 ore (in ECMO), ECMO per 5 giorni: 2 mesi dopo CPC 1, FE 60%!

Emodinamica acc

Out-Hospital Cardiac Arrest

ROSC

STOP CPR

No ROSC

Rapid core cooling

Therapeutic Hypothermia 12h

HBD, « NORMAL » ORGAN DONOR

GOOD OUTCOME

BAD OUTCOME

Out-Hospital Cardiac Arrest

ROSC

STOP CPR

No ROSC

Rapid core cooling

ECMO/ECLS

Therapeutic Hypothermia 12h

HBD, « NORMAL » ORGAN DONOR or « CLASS 6 DONOR »

GOOD OUTCOME

DEATH


MAQUET
0.04
14
11
26.2
13
24.8
1

PRP/ECLS GOALS

« programma **multisciplinare** per il trattamento avanzato dell'insufficienza respiratoria e cardiaca, e dell'arresto cardiaco refraattario alle terapie tradizionali »

VIGEVANO

10 Km 14 MINUTI

ECLS

PAVIA

42 Km

Ore 15.11
ACC 20 ANNI
BLS DA ASTANTI

30 APRILE 2011

93 MINUTI DA CHIAMATA A DEA

2 ORE E 8 MINUTI (128 MINUTI)
DA CHIAMATA A ECMO

PROTEZIONE CEREBRALE! MA ANCHE PROTEZIONE D'ORGANO!

Dopo l'arresto

SINDROME DELL'ORGANISMO RIANIMATO

PROTEZIONE CEREBRALE

- IPOTERMIA PROFONDA DURANTE RCP (QUANTO?)
- IPOTERMIA PROFONDA DOPO ACC (QUANTO TEMPO?)
- IPOTERMIA PROFONDA DURANTE ECMO (QUANTO?)
- IPOTERMIA PROFONDA DOPO ECMO (QUANTO TEMPO?)

EVIDENCE BASED MEDICINE

BMJ VOLUME 327 20–27 DECEMBER 2003 bmj.com

Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials

Gordon C S Smith, Jill P Pell

Abstract

Objectives To de
effective in preve
gravitational chal
Design Systemat
trials.
Data sources: M
the Cochrane Lib
sites and citation lists.
Study selection: Studies showing the effects of using a parachute during free fall.
Main outcome measure Death or major tr
defined as an injury severity score >15.
Results We were unable to identify any ran
controlled trials of parachute intervention.
Conclusions As with many interventions i
prevent ill health, the effectiveness of parac
not been subjected to rigorous evaluation b
randomised controlled trials. Advocates of
based medicine have criticised the adoptio
interventions evaluated by using only obse
data. We think that everyone might benefit
radical protagonists of evidence based med
organised and participated in a double blir
randomised, placebo controlled, crossover
parachute.

Results

Our search strategy did not find any randomised controlled trials of the parachute.

Parachutes reduce the risk of injury after gravitational challenge, but their effectiveness has not been proved with randomised controlled trials

is topic

leath and
ge

effects
trogenic

Studies of free fall do not show 100% mortality

What this study adds

No randomised controlled trials of parachute use have been undertaken

The basis for parachute use is purely observational, and its apparent efficacy could potentially be explained by a "healthy cohort" effect

Individuals who insist that all interventions need to be validated by a randomised controlled trial need to come down to earth with a bump

Resuscitation 81S (2010) e1–e25

Contents lists available at ScienceDirect

Resuscitation

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

Part 1: Executive summary
2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations☆

ILCOR 2010 RECOMMENDATION

Parachutes reduce the risk of injury after gravitational challenge, but their effectiveness has not been proved with randomised controlled trials

Ta ent
at 3 Arrest
Niklas Nielse rg, M.D., Ph.D.,
tional cc thermia.
Limited herapeu-
tic hypo ted with
improved outcome.

BACK FROM IRREVERSIBILITY

SI …. PUO' ……. FARE!!!!

MILANO

AREU
AZIENDA REGIONALE EMERGENZA URGENZA
Regione Lombardia