agswn
28. Notfallmedizinische Jahrestagung

Arbeitsgemeinschaft Südwestdeutscher Notärzte e.V.
29. Notfallmedizinische Jahrestagung

Notfallmedizin ganz aktuell - Die wichtigsten notfallmedizinischen Arbeiten im letzten Jahr

Matthias Fischer

Klinik für Anästhesiologie, Operative Intensivmedizin und Schmerztherapie der Klinik am Eichert, Göppingen

AUSWAHL 2012

Resuscitation 84 (2013) 85–92
Contents lists available at SciVerse ScienceDirect
Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation

Simulation and education

Comparison of physician staffed emergency teams with paramedic teams assisted by telemedicine – a randomized, controlled simulation study

Daniel Rörtgen[a,d], Sebastian Bergrath[a,*,d,e], Rolf Rossaint[a], Stefan K. Beckers[a,b], Harold Fischermann[a], In-Sik Na[a], David Peters[a], Christina Fitzner[c], Max Skorning[a]

Resuscitation 83 (2012) 347–352
Contents lists available at SciVerse ScienceDirect
Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

Randomised study of hypertonic saline infusion during resuscitation from out-of-hospital cardiac arrest

Martin Breil[a,*,f], Henning Krep[b,f], Ulli Heister[a], Andreas Bartsch[c], Raphael Bender[d], Bernadette Schaefers[a], Andreas Hoeft[a], Matthias Fischer[e]

Clinical Study

Survival after Cardiac Arrest and Changing Task Profile of the Cardiac Arrest Team in a Tertiary Care Center

Patrick Möhnle, Volker Huge, Jan Polasek, Isabella Weig, Rolf Atzinger, Uwe Kreimeier, and Josef Briegel

European Heart Journal (2011) 32, 1649–1656
doi:10.1093/eurheartj/ehr107

CLINICAL RESEARCH
Acute coronary syndromes

ROSC after cardiac arrest—the RACA score to predict outcome after out-of-hospital cardiac arrest

JACC: CARDIOVASCULAR INTERVENTIONS
© 2012 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER INC.

Reduction in Treatment Times Through Formalized Data Feedback

Results From a Prospective Multicenter Study of ST-Segment Elevation Myocardial Infarction

Neukamm et al. Critical Care 2011, 15:R282
http://ccforum.com/content/15/6/R282

RESEARCH — Open Access

The impact of response time reliability on CPR incidence and resuscitation success: a benchmark study from the German Resuscitation Registry

Intra-Arrest Transnasal Evaporative Cooling

A Randomized, Prehospital, Multicenter Study (PRINCE: Pre-ROSC IntraNasal Cooling Effectiveness)

The Quality of Emergency Medical Care in Baden-Württemberg (Germany)

Four Years in Focus

Martin Messelken, Eduard Kehrberger, Burkhard Dirks, Matthias Fischer

Resuscitation 83 (2012) 1212–1218
Contents lists available at SciVerse ScienceDirect
Resuscitation
journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

Chest compression quality management and return of spontaneous circulation: A matched-pair registry study

Roman-Patrick Lukas[a,h], Jan Thorsten Gräsner[b,h], Stephan Seewald[c], Rolf Lefering[d], Thomas Peter Weber[e], Hugo Van Aken[a], Matthias Fischer[f], Andreas Bohn[a,g,*]

Prehospital Epinephrine Use and Survival Among Patients With Out-of-Hospital Cardiac Arrest

Akihito Hagihara, DMSc, MPH
Manabu Hasegawa, MD
Takeru Abe, MA
Takashi Nagata, MD
Yoshifumi Wakata, MD
Shogo Miyazaki, PhD

TOP-Paper Notfallme...

Prof. M. Fischer   Klinik am...

ALB FILS KLINIKEN

KOMPETENZ, QUALITÄT, ZUWENDUNG

agswn
28. Notfallmedizinische Jahrestagung

1. HAES: Ja oder Nein?

Ihre Zeichen Ihre Nachricht vom Unsere Zeichen Durchwahl/Fax

Anwendungsbeschränkung für HES
(Hydroxyethlystärke-haltige Arzneimitte

HAES-steril 3%, 6% und 10% Infusionslösung, Hemohes® Infusionslösung, HyperHAES Infusionslösung,* Infukoll® HE HES 10% Infusionslösung, *PlasmaVolume Redibag®, Tetra % Infusionslösung, Venofundin® 60 mg/ml Infusionslösu* Vitafusal® , Vitafusal® 6%, Vitafusal® 10%, *Volulyte 6% In Voluven 6% und Voluven 10% Infusionslösung

Sehr geehrte Damen und Herren,

mit diesem Schreiben wollen wir Sie über das Ergebnis der aktuel Nutzen-Risiko-Analyse Hydroxyethylstärke (HES)-haltiger Produk

Dieses Schreiben wurde mit der EMA (Europäische Arzneimittel-A BfArM abgestimmt.

Zusammenfassung der neuen Empfehlungen

- **HES-haltige Infusionslösungen sollen nur für die Hypovolämie aufgrund akuten Blutverlustes verwende Gabe von kristalloiden Infusionslösungen alleine nic betrachtet wird.**
- **HES-haltige Infusionslösungen sollten in der niedrigst und so kurz wie möglich angewendet werden. Die Beha den Ergebnissen kontinuierlicher hämodynamisc orientieren, so dass die Infusion beendet werden hämodynamischen Ziele erreicht wurden.**
- **HES-haltige Infusionslösungen sind nun kontraindiziert**
  - **Sepsis**
  - **Verbrennungen**
  - **Eingeschränkter Nierenfunktion oder bei N**
  - **Intrakranieller oder zerebraler Blutung**
  - **Kritisch kranken Patienten (in der Regel au Intensivstation)**

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

John A. Myburgh, M.B., B.Ch., Ph.D., and Michael G. Mythen, M.D., M.B., B.S.

FLUID RESUSCITATION WITH COLLOID AND CRYSTALLOID SOLUTIONS IS A ubiquitous intervention in acute medicine. The selection and use of resuscitation fluids is based on physiological principles, but clinical practice is determined largely by clinician preference, with marked regional variation. No ideal resuscitation fluid exists. There is emerging evidence that the type and dose of resuscitation fluid may affect patient-centered outcomes.

Despite what may be inferred from physiological principles, colloid solutions do not offer substantive advantages over crystalloid solutions with respect to hemodynamic effects. Albumin is regarded as the reference colloid solution, but its cost is a limitation to its use. Although albumin has been determined to be safe for use as a resuscitation fluid in most critically ill patients and may have a role in early sepsis, its use is associated with increased mortality among patients with traumatic brain injury. The use of hydroxyethyl starch (HES) solutions is associated with increased rates of renal-replacement therapy and adverse events among patients in the intensive care unit (ICU). There is no evidence to recommend the use of other semisynthetic colloid solutions.

Balanced salt solutions are pragmatic initial resuscitation fluids, although there is little direct evidence regarding their comparative safety and efficacy. The use of normal saline has been associated with the development of metabolic acidosis and acute kidney injury. The safety of hypertonic solutions has not been established.

All resuscitation fluids can contribute to the formation of interstitial edema, particularly under inflammatory conditions in which resuscitation fluids are used excessively. Critical care physicians should consider the use of resuscitation fluids as they would the use of any other intravenous drug. The selection of the specific fluid should be based on indications, contraindications, and potential toxic effects in order to maximize efficacy and minimize toxicity.

HISTORY OF FLUID RESUSCITATION

In 1832, Robert Lewins described the effects of the intravenous administration of an alkalinized salt solution in treating patients during the cholera pandemic. He observed that "the quantity necessary to be injected will probably be found to depend upon on the quantity of serum lost; the object being to place the patient in nearly his ordinary state as to the quantity of blood circulating in the vessels."[1] The observations of Lewins are as relevant today as they were nearly 200 years ago.

Asanguinous fluid resuscitation in the modern era was advanced by Alexis Hartmann, who modified a physiologic salt solution developed in 1885 by Sidney Ringer for rehydration of children with gastroenteritis.[2] With the development of blood fractionation in 1941, human albumin was used for the first time in large quantities for resuscitation of patients who were burned during the attack on Pearl Harbor in the same year.

Today, asanguinous fluids are used in almost all patients undergoing general

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial

Djillali Annane, MD, PhD; Shidasp Siami, MD; Samir Jaber, MD, PhD; Claude Martin, MD, PhD; Souheil Elatrous, MD; Adrien Descorps Declère, MD; Jean Charles Preiser, MD; Hervé Outin, MD; Gilles Troché, MD; Claire Charpentier, MD; Jean Louis Trouillet, MD; Antoine Kimmoun, MD; Xavier Forceville, MD, PhD; Michael Darmon, MD; Olivier Lesur, MD, PhD; Jean Régnier, MD; Fékri Abroug, MD; Philippe Berger, MD; Christophe Clech, MD; Joël Cousson, MD; Laure Thibault, MD; Sylvie Chevret, MD, PhD; for the CRISTAL Investigators

IMPORTANCE Evidence supporting the choice of intravenous colloid vs crystalloid solutions for management of hypovolemic shock remains unclear.

OBJECTIVE To test whether use of colloids compared with crystalloids for fluid resuscitation alters mortality in patients admitted to the intensive care unit (ICU) with hypovolemic shock.

DESIGN, SETTING, AND PARTICIPANTS A multicenter, randomized clinical trial stratified by case mix (sepsis, trauma, or hypovolemic shock without sepsis or trauma). Therapy in the Colloids Versus Crystalloids for the Resuscitation of the Critically Ill (CRISTAL) trial was open label but outcome assessment was blinded to treatment assignment. Recruitment began in February 2003 and ended in August 2012 of 2857 sequential ICU patients treated at 57 ICUs in France, Belgium, North Africa, and Canada; follow-up ended in November 2012.

INTERVENTIONS Colloids (n = 1414; gelatins, dextrans, hydroxyethyl starches, or 4% or 20% of albumin) or crystalloids (n = 1443; isotonic or hypertonic saline or Ringer lactate solution) for all fluid interventions other than fluid maintenance throughout the ICU stay.

MAIN OUTCOMES AND MEASURES The primary outcome was death within 28 days. Secondary outcomes included 90-day mortality; and days alive and not receiving renal replacement therapy, mechanical ventilation, or vasopressor therapy.

RESULTS Within 28 days, there were 359 deaths (25.4%) in colloids group vs 390 deaths (27.0%) in crystalloids group (relative risk [RR], 0.96 [95% CI, 0.88 to 1.04]; $P = .26$). Within 90 days, there were 434 deaths (30.7%) in colloids group vs 493 deaths (34.2%) in crystalloids group (RR, 0.92 [95% CI, 0.86 to 0.99]; $P = .03$). Renal replacement therapy was used in 156 (11.0%) in colloids group vs 181 (12.5%) in crystalloids group (RR, 0.93 [95% CI, 0.83 to 1.03]; $P = .19$). There were more days alive without mechanical ventilation in the colloids group vs the crystalloids group by 7 days (mean: 2.1 vs 1.8 days, respectively; mean difference, 0.30 [95% CI, 0.09 to 0.48] days; $P = .01$) and by 28 days (mean: 14.6 vs 13.5 days; mean difference, 1.10 [95% CI, 0.14 to 2.06] days; $P = .01$) and alive without vasopressor therapy by 7 days (mean: 5.0 vs 4.7 days; mean difference, 0.30 [95% CI, −0.03 to 0.50] days; $P = .04$) and by 28 days (mean: 16.2 vs 15.2 days; mean difference, 1.04 [95% CI, −0.04 to 2.10] days; $P = .03$).

CONCLUSIONS AND RELEVANCE Among ICU patients with hypovolemia, the use of colloids vs crystalloids did not result in a significant difference in 28-day mortality. Although 90-day mortality was lower among patients receiving colloids, this finding should be considered exploratory and requires further study before reaching conclusions about efficacy.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT00318942

JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

Editorial

Supplemental content at jama.com

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Djillali Annane, MD, PhD, University of Versailles, 104 Blvd Raymond Poincaré, 92380 Garches, France (djillali.annane@rpc.aphp.fr).

ALB FILS KLINIKEN
KOMPETENZ, QUALITÄT, ZUWENDUNG

agswn
28. Notfallmedizinische Jahrestagung

2. Mechanische Reanimationsgeräte

Resuscitation 84 (2013) 1214–1222

Contents lists available at SciVerse ScienceDirect

Resuscitation

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

Clinical paper

Treatment of non-traumatic out-of-hospital cardiac arrest compression decompression cardiopulmonary resuscitatio threshold device

Ralph J. Frascone[a], Marvin A. Wayne[b], Robert A. Swor[c], Brian D. Mahoney Michael L. Olinger[f], David E. Tupper[g], Cindy M. Setum[h], Nathan Burkhart[h] Joshua G. Salzman[a,*], Sandi S. Wewerka[a], Demetris Yannopoulos[i], Keith G Richard G. Holcomb[k], Tom P. Aufderheide[l]

[a] Department of Emergency Medicine, Regions Hospital, St. Paul, MN, United States
[b] Whatcom County Emergency Medical Services, Department of Emergency Medicine, PeaceHealth St. Joseph Medical Center, Bell
[c] Department of Emergency Medicine, William Beaumont Hospital, Royal Oak, MI, United States
[d] Department of Emergency Medicine, Hennepin County Medical Center, Minneapolis, MN, United States
[e] Department of Emergency Medicine, St. Joseph Hospital, Ann Arbor, MI, United States
[f] Department of Emergency Medicine, Indiana University School of Medicine, Indianapolis, IN, United States
[g] Department of Neurology, University of Minnesota Medical Center, Minneapolis, MN, United States
[h] Advanced Circulatory Systems, Inc., Roseville, MN, United States
[i] Department of Medicine, Cardiovascular Division, University of Minnesota Medical Center, Minneapolis, MN, United States
[j] Department of Emergency Medicine, Wayne State University, School of Medicine Specialist-in-Chief, Detroit, MI, United States
[k] Quintiles Consulting, Rockville, MD, United States
[l] Department of Emergency Medicine, Medical College of Wisconsin, Milwaukee, WI, United States

ARTICLE INFO

Article history:
Received 19 December 2012
Received in revised form 29 April 2013
Accepted 2 May 2013

Keywords:
Cardiopulmonary resuscitation
Heart arrest
Out-of-hospital cardiac arrest
Randomized controlled trial
Mortality
Outcome

ABSTRACT

Background: A recent out-of-hospital cardiac arrest (OHCA) cli pital discharge (HD) with favorable neurologic function for p treated with active compression decompression cardiopulm threshold device (ACD + ICD) versus standard (S) CPR. The cu with ACD + ITD is more effective than standard (S-CPR) for regardless of the etiology.
Methods: This is a secondary analysis of data from a randomi treat, OHCA clinical trial. Adults with presumed non-traumat for one year post arrest. The primary endpoint was survival neurologic function (Modified Rankin Scale score ≤ 3).
Results: Between October 2005 and July 2009, 2738 ACD + ITD = 1403). Survival to HD with favorable neurologic pared with S-CPR: 7.9% versus 5.7%, (OR 1.42, 95% CI 1.04, greater: 7.9% versus 5.7%, (OR 1.43, 95% CI 1.04, 1.96, $p = 0.0$ returned to their baseline neurological function by one ye between groups.
Conclusions: Treatment of out-of-hospital non-traumatic car in a significant increase in survival to hospital discharge v compared with S-CPR. A significant increase survival rates subjects treated with ACD + ITD, regardless of the etiology of

1. Introduction

Use of active compres resuscitation (CPR) plus an i has been shown in animal s bral perfusion and to imp

* Corresponding author at: Regions Hospital Emergency Medical Services, 640 Jackson St. MS: 11109F, St. Paul, MN 55101, United States.
E-mail address: Joshua.g.salzman@healthpartners.com (J.G. Salzman).

0300-9572/$ – see front matter © 2013 Elsevier Ireland Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.resuscitation.2013.05.002

Research

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest
The LINC Randomized Trial

Sten Rubertsson, MD, PhD; Erik Lindgren, MD; David Smekal, MD, PhD; Ollie Östlund, PhD; Johan Silfverstolpe, MD; Robert A. Lichtveld, MD, PhD; Rene Boomars, MPA; Björn Ahlstedt, MD; Gunnar Skoog, MD; Robert Kastberg, MD; David Halliwell, RN; Martyn Box, RN; Johan Herlitz, MD, PhD; Rolf Karlsten, MD, PhD

IMPORTANCE A strategy using mechanical chest compressions might improve the poor outcome in out-of-hospital cardiac arrest, but such a strategy has not been tested in large clinical trials.

OBJECTIVE To determine whether administering mechanical chest compressions with defibrillation during ongoing compressions (mechanical CPR), compared with manual cardiopulmonary resuscitation (manual CPR), according to guidelines, would improve 4-hour survival.

DESIGN, SETTING, AND PARTICIPANTS Multicenter randomized clinical trial of 2589 patients with out-of-hospital cardiac arrest conducted between January 2008 and February 2013 in 4 Swedish, 1 British, and 1 Dutch ambulance services and their referring hospitals. Duration of follow-up was 6 months.

INTERVENTIONS Patients were randomized to receive either mechanical chest compressions (LUCAS Chest Compression System, Physio-Control/Jolife AB) combined with defibrillation during ongoing compressions (n = 1300) or to manual CPR according to guidelines (n = 1289).

MAIN OUTCOMES AND MEASURES Four-hour survival, with secondary end points of survival up to 6 months with good neurological outcome using the Cerebral Performance Category (CPC) score. A CPC score of 1 or 2 was classified as a good outcome.

RESULTS Four-hour survival was achieved in 307 patients (23.6%) with mechanical CPR and 305 (23.7%) with manual CPR (risk difference, −0.05%; 95% CI, −3.3% to 3.2%; $P > .99$). Survival with a CPC score of 1 or 2 occurred in 98 (7.5%) vs 82 (6.4%) (risk difference, 1.18%; 95% CI, −0.78% to 3.1%) at intensive care unit discharge, in 108 (8.3%) vs 100 (7.8%) (risk difference, 0.55%; 95% CI, −1.5% to 2.6%) at hospital discharge, in 105 (8.1%) vs 94 (7.3%) (risk difference, 0.78%; 95% CI, −1.3% to 2.8%) at 1 month, and in 110 (8.5%) vs 98 (7.6%) (risk difference, 0.86%; 95% CI, −1.2% to 3.0%) at 6 months with mechanical CPR and manual CPR, respectively. Among patients surviving at 6 months, 99% in the mechanical CPR group and 94% in the manual CPR group had CPC scores of 1 or 2.

CONCLUSIONS AND RELEVANCE Among adults with out-of-hospital cardiac arrest, there was no significant difference in 4-hour survival between patients treated with the mechanical CPR algorithm or those treated with guideline-adherent manual CPR. The vast majority of survivors in both groups had good neurological outcomes by 6 months. In clinical practice, mechanical CPR using the presented algorithm did not result in improved effectiveness compared with manual CPR.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT00609778

JAMA. doi:10.1001/jama.2013.282538
Published online November 17, 2013.

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Sten Rubertsson, MD, PhD, Department of Surgical Sciences/Anaestesiology and Intensive Care, Uppsala University, Uppsala University Hospital, SE 75185 Uppsala, Sweden (sten.rubertsson @akademiska.se).

Leitthema

Anaesthesist 2014
DOI 10.1007/s00101-013-2265-8

M. Fischer[1] · M. Breil[2] · M. Ihli[3] · M. Messelken[1] · S. Rauch[1] · J.-C. Schewe[2]
[1] Klinik für Anästhesiologie, Operative Intensivmedizin, Notfallmedizin und Schmerztherapie, Klinik am Eichert der ALB FILS Kliniken, Göppingen
[2] Klinik und Poliklinik für Anästhesiologie und Operative Intensivmedizin, Universitätsklinikum Bonn (AöR)
[3] Medizinische Klinik, Helfenstein Klinik der ALB FILS Kliniken, Geislingen

Redaktion

Mechanische Reanimationshilfen

die „chronisch-ischämische Herzerkrankung" [International Statistical Classification of Diseases and Related Health Problems(ICD)-10 I25] mit 70.557, der „akute Myokardinfarkt" (ICD-10 I21) mit 52.113 und die „Herzinsuffizienz" (ICD-10 I50) mit 45.428, zusammen insgesamt 168.098 Sterbefälle kardialer Genese. Auf der Basis einzelner Studien aus kommunalen Gebietskörperschaften ergibt sich eine Inzidenz des plötzlichen Herztods von 120 bis über 200 Ereignissen/100.000 Einwohnern und Jahr [2, 3]. Diese Studien haben anhand der Utstein-Definitionen die plötzlichen Todesfälle in Bonn und Berlin erfasst, nachdem Trauma, Ertrinken und offensichtlich nichtkardiale Ursachen ausgeschlossen wurden. Anhand dieser Resultate lässt sich für Deutschland hochrechnen, dass pro Jahr zwischen 100.000 und 160.000 Menschen einen plötzlichen Herztod außerhalb eines Krankenhauses erleiden. Damit ist der plötzliche Herztod wahrscheinlich eine der häufigsten Todesursachen in Deutschland.

Im Deutschen Reanimationsregister und der internationalen Literatur wird die Häufigkeit einer begonnenen Reanimationsbehandlung nach plötzlichem Herztod mit 30–90 Fällen/100.000 Einwohner und Jahr angegeben [3–11]. Damit ist die Inzidenz der kardiopulmonalen Reanimation („cardiopulmonary resuscitation", CPR) im Vergleich zur Häufigkeit des plötzlichen Herztods deutlich geringer [2, 3]. Dies wiederum bedeutet, dass nur 25–50% der Patienten so rechtzeitig vom Notarzt- und Rettungsdienst erreicht werden, dass die Indikation zum Beginn der CPR-Behandlung besteht [8].

Innerhalb des Notarztdienstes stellt die CPR mit ca. 4% aller Einsätze nicht die häufigste Einsatzindikation dar [10]. Dabei ist der plötzliche Herztod mit CPR jedoch die Diagnose mit der höchsten Letalität sowie der größten medizinischen Dringlichkeit und benötigt die sachgerechte Behandlung durch die gesamte Rettungskette.

Manuelle Thoraxkompression

Unabhängig von der primären – meist kardialen – Ursache mündet ein Herz-Kreislauf-Stillstand in eine eigene pathophysiologische Endstrecke. In ◘ **Abb. 1** sind die pathophysiologischen Prozesse nach tierexperimentell elektrisch-induziertem Kammerflimmern dargestellt. Mit Einsetzen des Kammerflimmerns, aufgezeichnet im Elektrokardiogramm (EKG), sistiert umgehend die Spontanzirkulation. Dies ist am Abfall des aortalen (AoD) und linksventrikulären Blutdrucks (LVD) zu erkennen. Die Perfusion aller Organe bricht zusammen, auch die des Herzens. Mit Einsetzen der Ischämie degeneriert das Kammerflimmern über den dargestellten Zeitraum von 15 min zu einer Asystolie (markiert durch *3 Pfeile* nach einer ein-, 5- und 15-minütigen

Die vorliegende Arbeit „Mechanische Reanimationshilfen" ist als Aktualisierung und Update des Beitrags „Mechanische Reanimationsgeräte" (Notfall Rettungsmed 2010,13:189–196) zu verstehen.

TOP-Paper Notfallmedizin
Prof. M. Fischer Klinik am Eichert

ALB FILS KLINIKEN
KOMPETENZ, QUALITÄT, ZUWENDUNG

3. Hypothermie: Ja oder Nein?

Research

Original Investigation

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

Francis Kim, MD; Graham Nichol, MD, MPH; Charles Maynard, PhD; Al Hallstrom, PhD; Peter J.
Thomas Rea, MD, MPH; Michael K. Copass, MD; David Carlbom, MD; Steven Deem, MD; W. T. L
Michele Olsufka, RN; Leonard A. Cobb, MD

IMPORTANCE Hospital cooling improves outcome after cardiac arrest, but preho
immediately after return of spontaneous circulation may result in better outcon

OBJECTIVE To determine whether prehospital cooling improves outcomes after
from cardiac arrest in patients with ventricular fibrillation (VF) and without VF.

DESIGN, SETTING, AND PARTICIPANTS A randomized clinical trial that assigned ac
prehospital cardiac arrest to standard care with or without prehospital cooling,
by infusing up to 2 L of 4°C normal saline as soon as possible following return of
circulation. Adults in King County, Washington, with prehospital cardiac arrest a
resuscitated by paramedics were eligible and 1359 patients (583 with VF and 77
were randomized between December 15, 2007, and December 7, 2012. Patient
completed by May 1, 2013. Nearly all of the patients resuscitated from VF and ac
hospital received hospital cooling regardless of their randomization.

MAIN OUTCOMES AND MEASURES The primary outcomes were survival to hospit
and neurological status at discharge.

RESULTS The intervention decreased mean core temperature by 1.20°C (95% C
−1.07°C) in patients with VF and by 1.30°C (95% CI, −1.40°C to −1.20°C) in patier
by hospital arrival and reduced the time to achieve a temperature of less than 3
hour compared with the control group. However, survival to hospital discharge
among the intervention and control groups among patients with VF (62.7% [95
57.0%-68.0%] vs 64.3% [95% CI, 58.6%-69.5%], respectively; $P = .69$) and an
without VF (19.2% [95% CI, 15.6%-23.4%] vs 16.3% [95% CI, 12.9%-20.4%], res
$P = .30$). The intervention was also not associated with improved neurological s
recovery or mild impairment at discharge for either patients with VF (57.5% [95
51.8%-63.1%] of cases had full recovery or mild impairment vs 61.9% [95% CI, 5
of controls; $P = .69$) or those without VF (14.4% [95% CI, 11.3%-18.2%] of cases
[95% CI,10.4%-17.2%] of controls; $P = .30$). Overall, the intervention group expe
rearrest in the field more than the control group (26% [95% CI, 22%-29%] vs 2
18%-24%], respectively; $P = .008$), as well as increased diuretic use and pulmor
first chest x-ray, which resolved within 24 hours after admission.

CONCLUSION AND RELEVANCE Although use of prehospital cooling reduced core
by hospital arrival and reduced the time to reach a temperature of 34°C, it did n
survival or neurological status among patients resuscitated from prehospital VF
without VF.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT00391469

JAMA. doi:10.1001/jama.2013.282173
Published online November 17, 2013.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

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

Niklas Nielsen, M.D., Ph.D., Jørn Wetterslev, M.D., Ph.D., Tobias Cronberg, M.D., Ph.D., David Erlinge, M.D., Ph.D., Yvan Gasche, M.D., Christian Hassager, M.D., D.M.Sci., Janneke Horn, M.D., Ph.D., Jan Hovdenes, M.D., Ph.D., Jesper Kjaergaard, M.D., D.M.Sci., Michael Kuiper, M.D., Ph.D., Tommaso Pellis, M.D., Pascal Stammet, M.D., Michael Wanscher, M.D., Ph.D., Matt P. Wise, M.D., D.Phil., Anders Åneman, M.D., Ph.D., Nawaf Al-Subaie, M.D., Søren Boesgaard, M.D., D.M.Sci., John Bro-Jeppesen, M.D., Iole Brunetti, M.D., Jan Frederik Bugge, M.D., Ph.D., Christopher D. Hingston, M.D., Nicole P. Juffermans, M.D., Ph.D., Matty Koopmans, R.N., M.Sc., Lars Køber, M.D., D.M.Sci., Jørund Langørgen, M.D., Gisela Lilja, O.T., Jacob Eifer Møller, M.D., D.M.Sci., Malin Rundgren, M.D., Ph.D., Christian Rylander, M.D., Ph.D., Ondrej Smid, M.D., Christophe Werer, M.D., Per Winkel, M.D., D.M.Sci., and Hans Friberg, M.D., Ph.D., for the TTM Trial Investigators*

ABSTRACT

BACKGROUND
Unconscious survivors of out-of-hospital cardiac arrest have a high risk of death or poor neurologic function. Therapeutic hypothermia is recommended by international guidelines, but the supporting evidence is limited, and the target temperature associated with the best outcome is unknown. Our objective was to compare two target temperatures, both intended to prevent fever.

METHODS
In an international trial, we randomly assigned 950 unconscious adults after out-of-hospital cardiac arrest of presumed cardiac cause to targeted temperature management at either 33°C or 36°C. The primary outcome was all-cause mortality through the end of the trial. Secondary outcomes included a composite of poor neurologic function or death at 180 days, as evaluated with the Cerebral Performance Category (CPC) scale and the modified Rankin scale.

RESULTS
In total, 939 patients were included in the primary analysis. At the end of the trial, 50% of the patients in the 33°C group (235 of 473 patients) had died, as compared with 48% of the patients in the 36°C group (225 of 466 patients) (hazard ratio with a temperature of 33°C, 1.06; 95% confidence interval [CI], 0.89 to 1.28; P=0.51). At the 180-day follow-up, 54% of the patients in the 33°C group had died or had poor neurologic function according to the CPC, as compared with 52% of patients in the 36°C group (risk ratio, 1.02; 95% CI, 0.88 to 1.16; P=0.78). In the analysis using the modified Rankin scale, the comparable rate was 52% in both groups (risk ratio, 1.01; 95% CI, 0.89 to 1.14; P=0.87). The results of analyses adjusted for known prognostic factors were similar.

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.)

The authors' affiliations are listed in the Appendix. Address reprint requests to Dr. Nielsen at the Department of Anesthesia and Intensive Care, Intensive Care Unit, Helsingborg Hospital, S Vallgatan 5, 251 87, Helsingborg, Sweden, or at niklas.nielsen@med.lu.se.

*A complete list of investigators participating in the Target Temperature Management 33°C versus 36°C after Out-of-Hospital Cardiac Arrest (TTM) trial is provided listed in the Supplementary Appendix, available at NEJM.org.

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

N Engl J Med 2013.
DOI: 10.1056/NEJMoa1310519

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Targeted temperature management at 33°C versus 36°C after cardiac arrest.

Nielsen N, Wetterslev J, Cronberg T, et al.
N Engl J Med 2013; 369:2197-206
Department of Anesthesia and Intensive Care, Intensive Care Unit, Helsingborg Hospital, Helsingborg, Sweden.

BACKGROUND: Unconscious survivors of out-of-hospital cardiac arrest have a high risk of death or poor neurologic function. Therapeutic hypothermia is recommended by international guidelines, but the supporting evidence is limited, and the target temperature associated with the best outcome is unknown. Our objective was to compare two target temperatures, both intended to prevent fever.

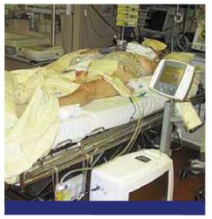
METHODS: In an international trial, we randomly assigned 950 unconscious adults after out-of-hospital cardiac arrest of presumed cardiac cause to targeted temperature management at either 33°C or 36°C. The primary outcome was all-cause mortality through the end of the trial. Secondary outcomes included a composite of poor neurologic function or death at 180 days, as evaluated with the Cerebral Performance Category (CPC) scale and the modified Rankin scale.

RESULTS: In total, 939 patients were included in the primary analysis. At the end of the trial, 50% of the patients in the 33°C group (235 of 473 patients) had died, as compared with 48% of the patients in the 36°C group (225 of 466 patients) (hazard ratio with a temperature of 33°C, 1.06; 95% confidence interval [CI], 0.89 to 1.28; P=0.51). At the 180-day follow-up, 54% of the patients in the 33°C group had died or had poor neurologic function according to the CPC, as compared with 52% of patients in the 36°C group (risk ratio, 1.02; 95% CI, 0.88 to 1.16; P=0.78).

In the analysis using the modified Rankin scale, the comparable rate was 52% in both groups (risk ratio, 1.01; 95% CI, 0.89 to 1.14; P=0.87). The results of analyses adjusted for known prognostic factors were similar.

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.

Therapeutische Hypothermiebehandlung (Targeted Temperature Management, TTM) nach dem Herz-Kreislauf-Stillstand ist auf vielen Intensivstationen bereits gelebter Standard *(Binks AC; Anaesthesia 2010; 65:260)*, da dies auch von Reanimationsleitlinien empfohlen wird *(Deakin; Resuscitation 2010; 81: 1305)*. Die Empfehlungen der Leitlinien beruhen mehr oder weniger auf den Ergebnissen von zwei Studien zur therapeutischen Hypothermie nach Herz-Kreislauf-Stillstand *(Bernard SA; N Engl Med 2002; 346:557, The Hypothermia After Cardiac Arrest Study Group; N Engl Med 2002; 346:549)*, die bereits vor mehr als 10 Jahren veröffentlicht wurden. Auch systematische Reviews, die weitere randomisierte Untersuchungen einschließen, bestätigten diese Vorgangsweise *(Arrich J; Cochrane Database Syst Rev 2012; 9:CD004128)*. Die nun von Nielsen et al. kürzlich im New England Journal of Medicine veröffentlichten Ergebnisse stellen diese Vorgangsweise jedoch scheinbar in Frage *(Nielsen N; N Engl J Med 2013; 369:2197)*.



In dieser bisher größten randomisierten Einzelstudie (n=939) zur TTM bei Patienten nach einem Herz-Kreislauf-Stillstand wurden diese entweder auf 33°C abgekühlt oder auf einer Temperatur von 36°C gehalten. Der primäre Outcome-Parameter war die Mortalität innerhalb eines Beobachtungszeitraums von sechs Monaten. Sekundärer Outcome-Parameter war die neurologische Erholung, gemessen mittels Cerebral Performance Category Score und modifiziertem Rankin-Skala.
Es zeigte sich dabei, dass zwischen den beiden Gruppen kein Unterschied im Hinblick auf die Mortalität und neurologische Erholung zu erfassen war. Interessanterweise traten Nebenwirkungen in der 33°C-Gruppe zahlenmäßig häufiger auf als in der moderat ge-

agswn
28. Notfallmedizinische Jahrestagung

4. Sonstiges in der Notfallmedizin

Acta Anaesthesiol Scand 2013; 57: 660–668
Printed in Singapore. All rights reserved

ACTA ANAESTHESIOLOGICA SCANDINAVICA
doi: 10.1111/aas.12052

Impact of a physician-staffed helicopter on a regional trauma system: a prospective, controlled, observational study

R. Hesselfeldt[1], J. Steinmetz[10], H. Jans[2], M.-L. B Jacobsson[3], D. L. Andersen[4], K. Buggeskov[5], M. Kowalski[6], M. Præst[7], L. Øllgaard[8], P. Höiby[9] and L. S. Rasmussen[1]
[1]*Department of Anaesthesia Section 4231, Copenhagen University Hospital, Rigshospitalet, Copenhagen, Denmark,* [2]*Department of Emergency Medicine, Køge Hospital, Køge, Denmark,* [3]*Department of Emergency Medicine, Hillerød Hospital, Hillerød, Denmark,* [4]*Department of Emergency Medicine, Slagelse Hospital, Slagelse, Denmark,* [5]*Department of Emergency Medicine, Holbæk Hospital, Holbæk, Denmark,* [6]*Department of Anaesthesia, Roskilde Hospital, Roskilde, Denmark,* [7]*Department of Anaesthesia, Nykøbing Falster Hospital, Nykøbing Falster, Denmark,* [8]*Department of Emergency Medicine, Næstved Hospital, Næstved, Denmark,* [9]*Department of Forensic Medicine, Section of Forensic Pathology, Copenhagen University, Copenhagen, Denmark and* [10]*Helicopter Emergency Medical Service, Ringsted, Denmark*

Introduction: This study aims to compare the trauma system before and after implementing a physician-staffed helicopter emergency medical service (PS-HEMS). Our hypothesis was that PS-HEMS would reduce time from injury to definitive care for severely injured patients.
Methods: This was a prospective, controlled, observational study, involving seven local hospitals and one level I trauma centre using a before and after design. All patients treated by a trauma team within a 5-month period (1 December 2009–30 April 2010) prior to and a 12-month period (1 May 2010–30 April 2011) after implementing a PS-HEMS were included.We compared time from dispatch of the first ground ambulance to arrival in the trauma centre for patients with Injury Severity Score (ISS) > 15. Secondary end points were the proportion of secondary transfers and 30-day mortality.
Results: We included 1788 patients, of which 204 had an ISS > 15. The PS-HEMS transported 44 severely injured directly to the trauma centre resulting in a reduction of secondary transfers from 50% before to 34% after implementation ($P = 0.04$). Median delay for definitive care for severely injured patients was 218 min before and 90 min after implementation ($P < 0.01$). The 30-day mortality was reduced from 29% (16/56) before to 14% (21/147) after PS-HEMS ($P = 0.02$). Logistic regression showed PS-HEMS had an odds ratio (OR) for survival of 6.9 compared with ground transport.
Conclusions: Implementation of a PS-HEMS was associated with significant reduction in time to the trauma centre for severely injured patients. We also observed significantly reduced proportions of secondary transfers and 30-day mortality.

Accepted for publication 2 December 2012

Preventing trauma-related deaths remains a major challenge for the health care system.* Intermediate admission of severely injured trauma patients to a local hospital facility can cause delay in definitive care, and direct transport to a tertiary trauma centre (TC) is associated with improved outcome.[1,2] Despite this, local emergency medical services (EMS) often bring severely injured patients to the nearest hospital.[3,4]

The Swiss-German physician-staffed helicopter emergency medical service (PS-HEMS) model was introduced and adapted in Scandinavia decades ago, as was the use of anaesthesiologists as pre-hospital emergency physicians.[5] Trauma patients are thought to benefit from such advanced pre-hospital systems,[6,7] and HEMS have been associated with a reduced mortality.[8,9]

Nevertheless, the current literature is often limited by retrospective study designs, and the heterogeneity of trauma systems complicate generalisation of conclusions. Moreover, the risk of helicopter accidents[10,11] and increased cost[12] of helicopter-based systems compared with conven-

*Sethi D, Racioppi F, Baumgar en I, Vida P. Injuries and violence in Europe: why they matter and what can be done. WHO Regional Office Europe; 2006. http://www.euro.who.int/__data/assets/pdf_file/0005/98762/E88037.pdf [Accessed 19 December 2012].

Acta Anaesthesiologica Scandinavica
AN INTERNATIONAL JOURNAL OF ANAESTHESIOLOGY AND INTENSIVE CARE, PAIN AND EMERGENCY MEDICINE

Anaesthesist 2014
DOI 10.1007/s00101-014-2303-1

J. Luxen · H. Trentzsch · B. Urban
Institut für Notfallmedizin und Medizinmanagement, Klinikum der Universität München

Rocuronium und Sugammadex in der Notfallmedizin

Anforderungen an ein Muskelrelaxans für die „rapid sequence induction"

Die erfolgreiche Sicherung der Atemwege ist eine der zentralen Aufgaben in der Notfallmedizin, da ohne adäquate Ventilation und Oxygenierung alle weiteren Therapiemaßnahmen vergeblich bleiben. Die endotracheale Intubation stellt den „Goldstandard" zur Sicherung der Atemwege dar. Sie sollte bei Notfallpatienten, die per se als nichtnüchtern anzusehen sind, als „rapid sequence induction" (RSI) erfolgen. Um die Intubation zu erleichtern, sollte ein Muskelrelaxans verwendet werden.

Der Einsatz von Muskelrelaxanzien zur RSI bei Erwachsenen [9, 15, 18] und im Kindesalter [6] wird in verschiedenen Leitlinien und von Fachgesellschaften empfohlen [18]. Ihre Anwendung verbessert die Intubationsbedingungen signifikant [15].

Eigenschaften von Muskelrelaxanzien

Die Anforderungen an das optimale Muskelrelaxans für die RSI bestehen aus einer kurzen Anschlagszeit und aus einer möglichst kurzen Wirkdauer. Ziel ist es, die Apnoephase so kurz wie möglich zu halten und im Fall einer Situation des „cannot intubate – cannot ventilate" schnellstmöglich die Spontanatmung des Patienten wieder zu ermöglichen. Aufgrund dieser Anforderungen eignen sich nur wenige Substanzen für den Einsatz als Muskelrelaxans im Rahmen der RSI. Bislang galt Succinylcholin mit seiner relativ kurzen Anschlagszeit und Wirkdauer als das Mittel der Wahl für die Muskelrelaxierung im Rahmen der RSI [4].

Gerade in der Notfallmedizin ist jedoch die Indikationsstellung zur Atemwegssicherung in der Regel ohne Alternative. Eine Rückzugsstrategie wie bei der Intubationsnarkose für einen elektiven Eingriff, bei der man zur Spontanatmung des Patienten zurückkehren kann, gibt es hier häufig nicht. Man wird also im Fall des „cannot intubate – cannot ventilate" eher auf alternative Maßnahmen zur Atemwegssicherung und Oxygenierung des Patienten zurückgreifen (Larynxtubus, Larynxmaske) und bei Versagen aller Alternativen die Maßnahmen bis zum chirurgischen Atemweg mithilfe der Notfallkoniotomie (Krikothyreotomie) eskalieren müssen.

Bei den Muskelrelaxanzien werden 2 Substanzklassen unterschieden: depolarisierende und nichtdepolarisierende. Diese weisen im Hinblick auf ihre pharmakokinetischen und pharmakodynamischen Eigenschaften deutliche Unterschiede auf.

Depolarisierende Muskelrelaxanzien

Die depolarisierenden Muskelrelaxanzien bewirken eine lang anhaltende Depolarisation über die n_1-Acetylcholin-Rezeptoren an der motorischen Endplatte. Dabei tritt initial ein unkoordiniertes Muskelzittern (Faszikulieren) auf, und es kommt zu einer fortbestehenden Depolarisation der Muskelzelle ohne Möglichkeit der Wiedererregung. Der Abbauprozess erfolgt nach Diffusion aus dem postsynaptischen Spalt über die Pseudocholinesterase (auch Plasmacholinesterase) im Plasma. Deshalb lässt die Wirkung im Vergleich zum Acetylcholin zeitlich deutlich verzögert (40.000-fach langsamer) nach. Es gibt keine Möglichkeit der Antagonisierung.

Der einzige klinisch noch gebräuchliche Vertreter der depolarisierenden Muskelrelaxanzien ist das Succinylcholin (Sy-

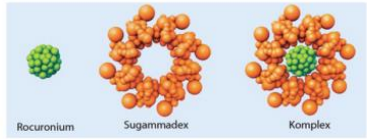


Abb. 1 ▶ Wirkmechanismus von Sugammadex. (Mit freundl. Genehmigung von Sharp and Dohme GmbH)

ALB FILS KLINIKEN
KOMPETENZ, QUALITÄT, ZUWENDUNG


wichtige
Mitteilung
über ein Arzneimittel

Datum
12.11.2013

Anwendungsbeschränkung für HES (Hydroxyethlystärke-haltige Arzneimittel)

HAES-steril 3%, 6% und 10% Infusionslösung, Hemohes® 6 % und 10 % Infusionslösung, HyperHAES Infusionslösung,* Infukoll® HES 6% und Infukoll® HES 10% Infusionslösung, *PlasmaVolume Redibag®, Tetraspan® 6 % und 10 % Infusionslösung, Venofundin® 60 mg/ml Infusionslösung,* VitaHES® , Vitafusal® , Vitafusal® 6%, Vitafusal® 10%, *Volulyte 6% Infusionslösung, Voluven 6% und Voluven 10% Infusionslösung

Dieses Schreiben wurde mit der EMA (Europäische Arzneimittel-Agentur) und dem BfArM abgestimmt.

Zusammenfassung der neuen Empfehlungen

- **HES-haltige Infusionslösungen sollen nur für die Behandlung einer Hypovolämie aufgrund akuten Blutverlustes verwendet werden, wenn die Gabe von kristalloiden Infusionslösungen alleine nicht als ausreichend betrachtet wird.**

- **HES-haltige Infusionslösungen sollten in der niedrigsten wirksamen Dosis und so kurz wie möglich angewendet werden. Die Behandlung sollte sich an den Ergebnissen kontinuierlicher hämodynamischer Überwachung orientieren, so dass die Infusion beendet werden kann, sobald die hämodynamischen Ziele erreicht wurden.**

- **HES-haltige Infusionslösungen sind nun kontraindiziert bei:**
  - **Sepsis**
  - **Verbrennungen**
  - **Eingeschränkter Nierenfunktion oder bei Nierenersatztherapie**
  - **Intrakranieller oder zerebraler Blutung**
  - **Kritisch kranken Patienten (in der Regel auf der Intensivstation)**
  - **Hyperhydratation, einschließlich Patienten mit Lungenödem**
  - **Dehydratation**
  - **Schwerer Gerinnungsstörung**
  - **Schweren Leberfunktionsstörungen**

Datum
12.11.2013

- **Es liegen keine ausreichend robusten Langzeitdaten zur Sicherheit von HES bei chirurgischen und Trauma-Patienten vor. Der erwartete Nutzen der Behandlung sollte sorgfältig gegen die Ungewissheit in Bezug auf die langfristige Sicherheit abgewogen werden. Andere verfügbare Behandlungsmöglichkeiten sollten in Betracht gezogen werden.**

- **Große randomisierte klinische Studien haben über ein erhöhtes Risiko für Nierenfunktionsstörungen bei kritisch kranken Patienten, einschließlich Patienten mit Sepsis, berichtet. HES sollte bei diesen Patienten nicht weiter angewendet werden.**

- **Der Einsatz von HES sollte beim ersten Anzeichen einer Nierenschädigung beendet werden und es wird empfohlen, die Nierenfunktion der mit HES behandelten Patienten zu überwachen.**

Steht HES vor dem Aus?

Berlin (BfArM/rd.de) – Das Bundesinstitut für Arzneimittel und Medizinprodukte (BfArM) weist darauf hin, dass am 19.07.2013 ein europäisches Risikobewertungsverfahren bezüglich der Verwendung von Hydroxyethylstärke (HES) eingeleitet worden ist. HES bzw. HyperHES ist derzeit in vielen Rettungsdiensten die einzig verwendete plasmaexpanderartige Lösung. Sie wird bei schweren Blutungen eingesetzt. Je nach Ausgang der Bewertung wird HES künftig nicht mehr eingesetzt werden können.

Bereits im März 2013 hatte das BfArM mitgeteilt, dass die Europäische Arzneimittelagentur ein Risikobewertungsverfahren zur grundlegenden Überprüfung des Nutzen-Risiko-Verhältnisses von HES-haltigen Infusionslösungen eingeleitet hätte. Hintergrund hierfür waren wiederum zwei große klinische Studien aus dem Jahre 2012. Ihre Ergebnisse scheinen eine umfassende Neubewertung des Nutzen-Risiko-Verhältnisses von HES notwendig gemacht zu haben. In keiner der Studien hätte sich ein Überlebensvorteil für die Patienten der HES-Gruppe gegenüber den Patienten ergeben, die mit kristalloiden Infusionslösungen (Ringer-Acetat) behandelt wurden, so das BfArM. Vielmehr scheint aufgefallen zu sein, dass die HES-Gruppe ein erhöhtes Risiko für Nierenschädigung aufwies.

HES: ungünstiges Nutzen-Risiko-Verhältnis?

„Da die Ergebnisse der beiden Studien als deutliches Signal dafür zu werten sind, dass HES in der Therapie kritisch kranker Patienten ein ungünstiges Nutzen-Risiko-Verhältnis haben könnte, hat Deutschland ein Risikobewertungsverfahren auf europäischer Ebene ausgelöst, um das Nutzen-Risiko-Verhältnis von HES-Präparaten grundlegend zu überprüfen“, heißt es auf der Webseite des Bundesinstituts.

Neueste Artikel

- Notfallsanitäter: Online-Umfrage unter Rettungsfachkräften
- Karlsruhe: 17 verletzte Personen nach Explosion
- DGzRS: Neues Seenotrettungsboot in Auftrag gegeben
- Buch-Tipp: Gesichter jenseits der Unfallstatistik
- Report Mainz: TV-Bericht über Notfallsanitäter
- Fußball-WM 2014: Einsatzführung durch Mobilfunkdaten
- Phosphor mit Bernstein verwechselt?
- Lose Radmuttern an Einsatzfahrzeugen
- Europarecht: DRK begrüßt Ausnahmeregelung für

agswn
28. Notfallmedizinische Jahrestagung

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial

Djillali Annane, MD, PhD; Shidasp Siami, MD; Samir Jaber, MD, PhD; Claude Martin, MD, PhD; Souheil Elatrous, MD; Adrien Descorps Declère, MD; Jean Charles Preiser, MD; Hervé Outin, MD; Gilles Troché, MD; Claire Charpentier, MD; Jean Louis Trouillet, MD; Antoine Kimmoun, MD; Xavier Forceville, MD, PhD; Michael Darmon, MD; Olivier Lesur, MD, PhD; Jean Régnier, MD; Fékri Abroug, MD; Philippe Berger, MD; Christophe Clech, MD; Joël Cousson, MD; Laure Thibault, MD; Sylvie Chevret, MD, PhD; for the CRISTAL Investigators

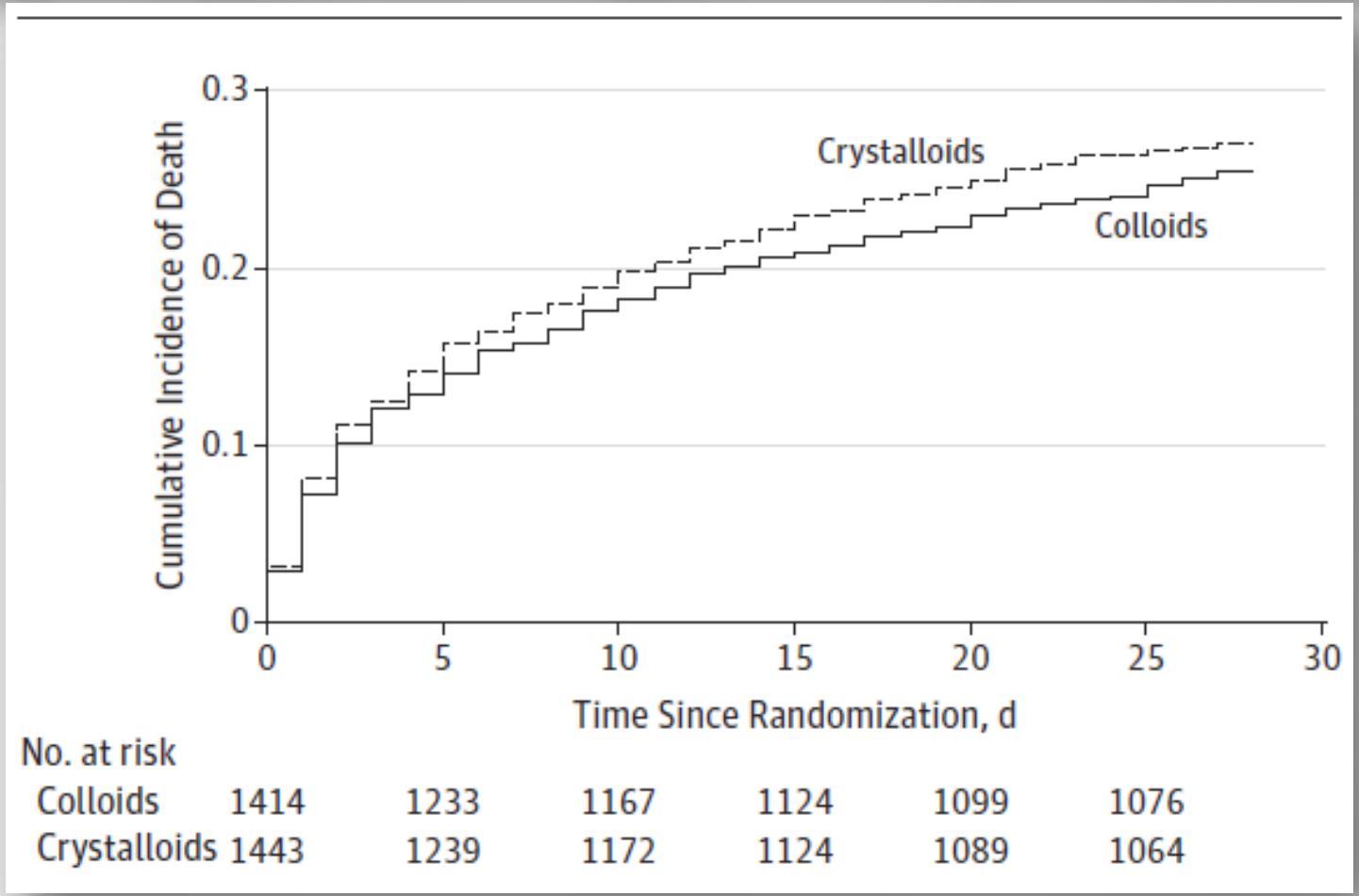
JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

TOP-Paper Notfallmedizin
Prof. M. Fischer Klinik am Eichert

ALB FILS KLINIKEN
KOMPETENZ, QUALITÄT, ZUWENDUNG

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial



JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial

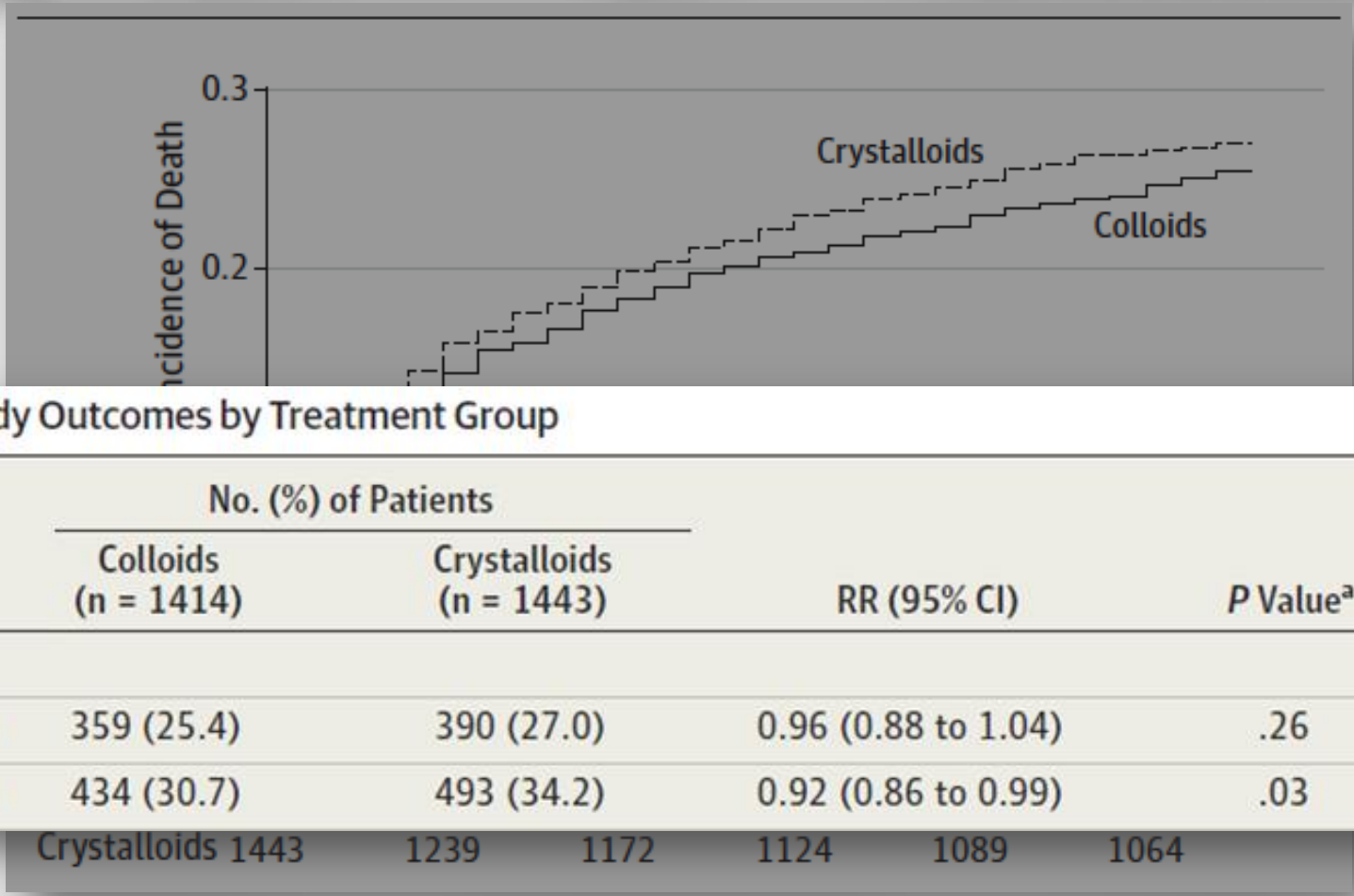


Table 2. Study Outcomes by Treatment Group

	No. (%) of Patients			
	Colloids (n = 1414)	Crystalloids (n = 1443)	RR (95% CI)	*P* Value[a]
Death				
Within 28 d	359 (25.4)	390 (27.0)	0.96 (0.88 to 1.04)	.26
Within 90 d	434 (30.7)	493 (34.2)	0.92 (0.86 to 0.99)	.03

Crystalloids 1443 1239 1172 1124 1089 1064

JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial

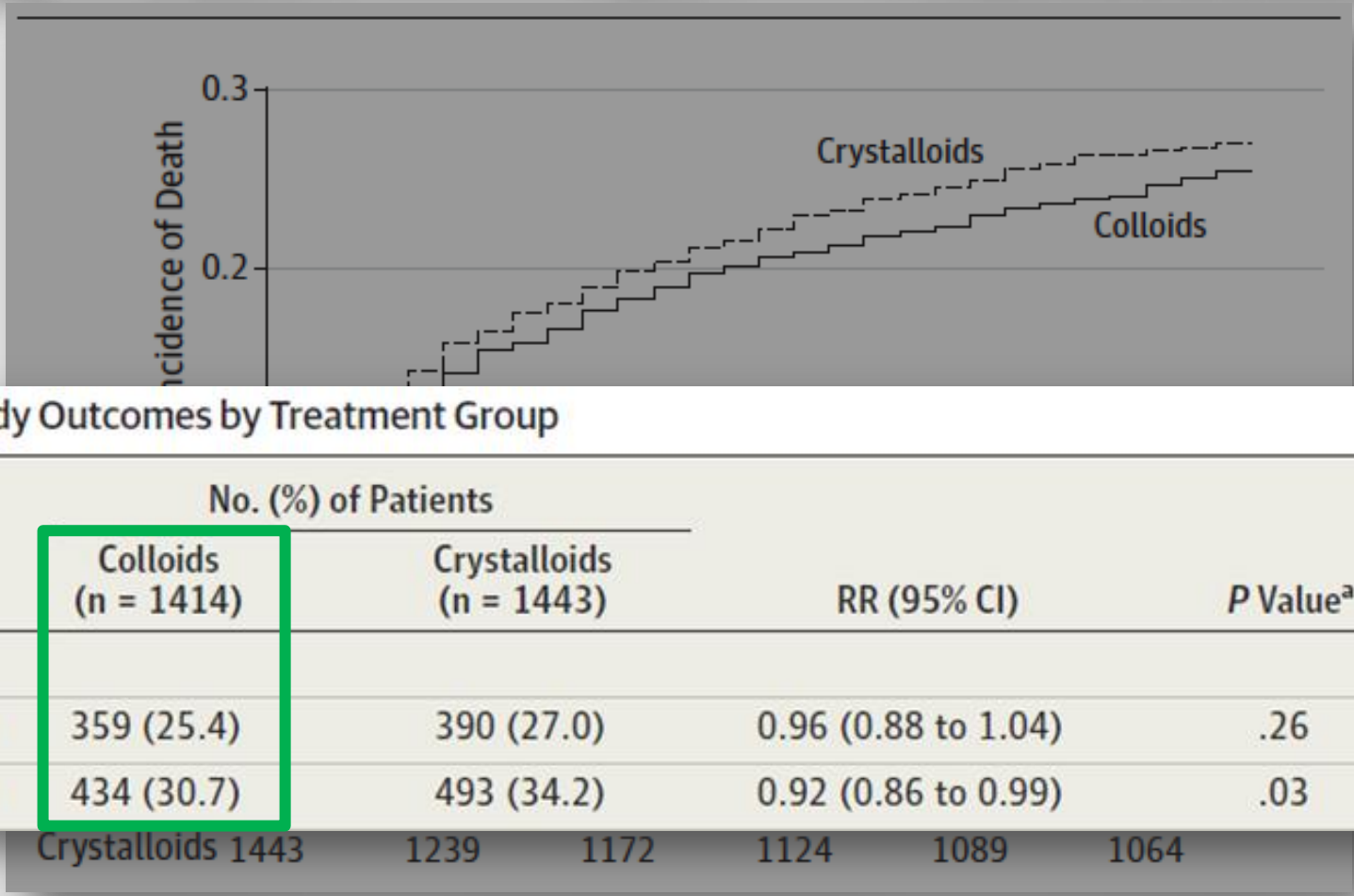


Table 2. Study Outcomes by Treatment Group

	No. (%) of Patients			
	Colloids (n = 1414)	Crystalloids (n = 1443)	RR (95% CI)	*P* Value[a]
Death				
Within 28 d	359 (25.4)	390 (27.0)	0.96 (0.88 to 1.04)	.26
Within 90 d	434 (30.7)	493 (34.2)	0.92 (0.86 to 0.99)	.03

Crystalloids	1443	1239	1172	1124	1089	1064

JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial

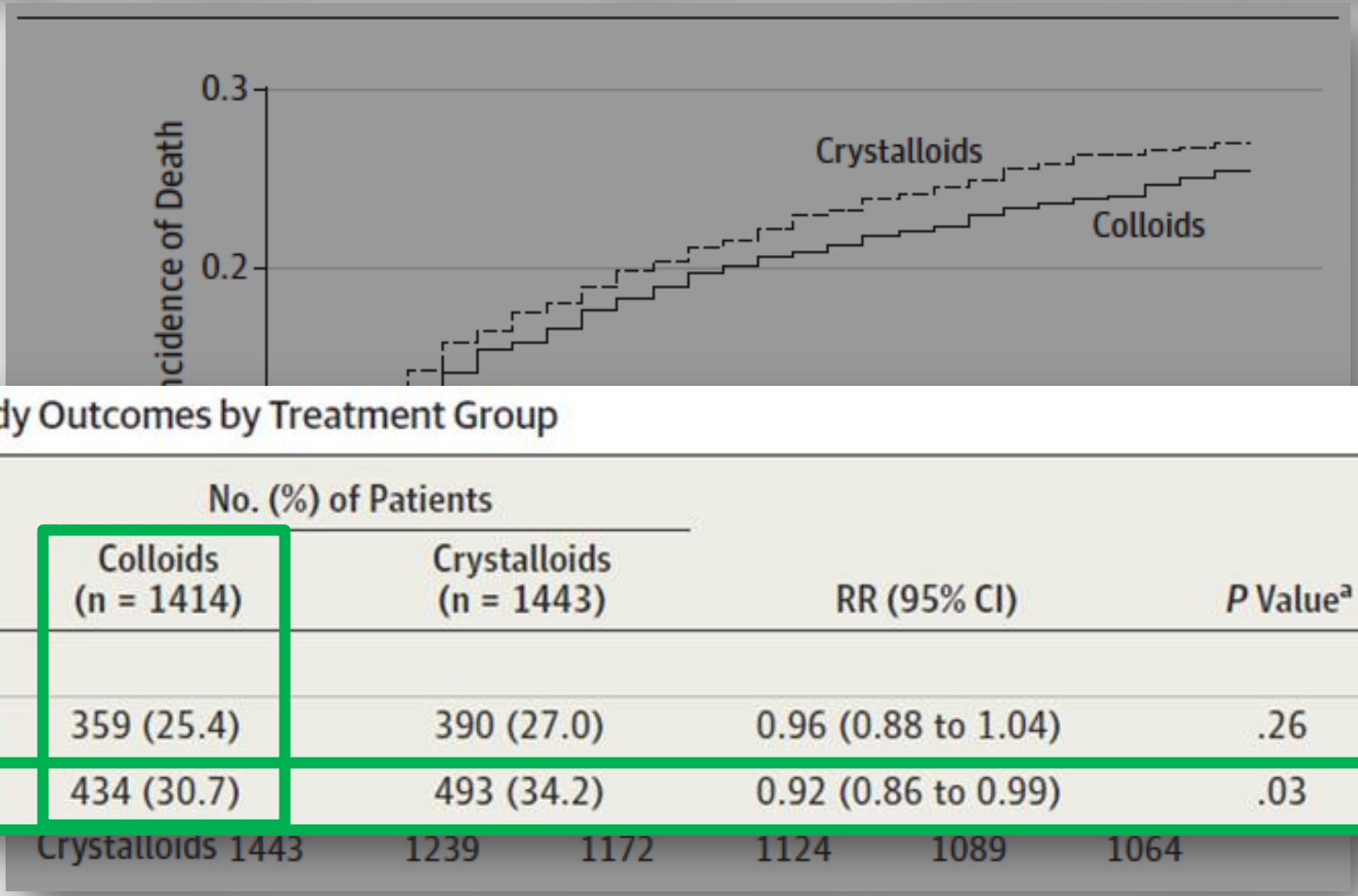


Table 2. Study Outcomes by Treatment Group

	No. (%) of Patients			
	Colloids (n = 1414)	Crystalloids (n = 1443)	RR (95% CI)	*P* Value[a]
Death				
Within 28 d	359 (25.4)	390 (27.0)	0.96 (0.88 to 1.04)	.26
Within 90 d	434 (30.7)	493 (34.2)	0.92 (0.86 to 0.99)	.03

Crystalloids 1443 1239 1172 1124 1089 1064

JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial

Table 3. Mortality Outcomes in Patients Who Received Only 1 Type of Fluid

	Colloids Group, No.		Crystalloids Group, No.		
	Patients	Deaths	Patients	Deaths	HR (95% CI)
90-d Mortality					
Entire population	1414	434	1443	493	0.88 (0.77-0.99)
HES vs isotonic saline	645	181	1035	346	0.79 (0.66-0.95)
Gelatins vs isotonic saline	281	84	1035	346	0.87 (0.68-1.10)
HES vs Ringer solution	645	181	72	26	0.72 (0.48-1.09)
Gelatins vs Ringer solution	281	84	72	26	0.80 (0.51-1.24)
Albumin vs isotonic saline	80	28	1035	346	1.02 (0.69-1.50)

JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial

Table 3. Mortality Outcomes in Patients Who Received Only 1 Type of Fluid

	Colloids Group, No.		Crystalloids Group, No.		
	Patients	Deaths	Patients	Deaths	HR (95% CI)
90-d Mortality					
Entire population	1414	434	1443	493	0.88 (0.77-0.99)
HES vs isotonic saline	645	181	1035	346	0.79 (0.66-0.95)
Gelatins vs isotonic saline	281	84	1035	346	0.87 (0.68-1.10)
HES vs Ringer solution	645	181	72	26	0.72 (0.48-1.09)
Gelatins vs Ringer solution	281	84	72	26	0.80 (0.51-1.24)
Albumin vs isotonic saline	80	28	1035	346	1.02 (0.69-1.50)

JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock

The CRISTAL Randomized Trial

Table 3. Mortality Outcomes in Patients Who Received Only 1 Type of Fluid

	Colloids Group, No.		Crystalloids Group, No.		
	Patients	Deaths	Patients	Deaths	HR (95% CI)
90-d Mortality					
Entire population	1414	434	1443	493	0.88 (0.77-0.99)

CONCLUSIONS AND RELEVANCE Among ICU patients with hypovolemia, the use of colloids vs crystalloids did not result in a significant difference in 28-day mortality. Although 90-day mortality was lower among patients receiving colloids, this finding should be considered exploratory and requires further study before reaching conclusions about efficacy.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT00318942

JAMA. doi:10.1001/jama.2013.280502
Published online October 9, 2013.

REVIEW ARTICLE

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

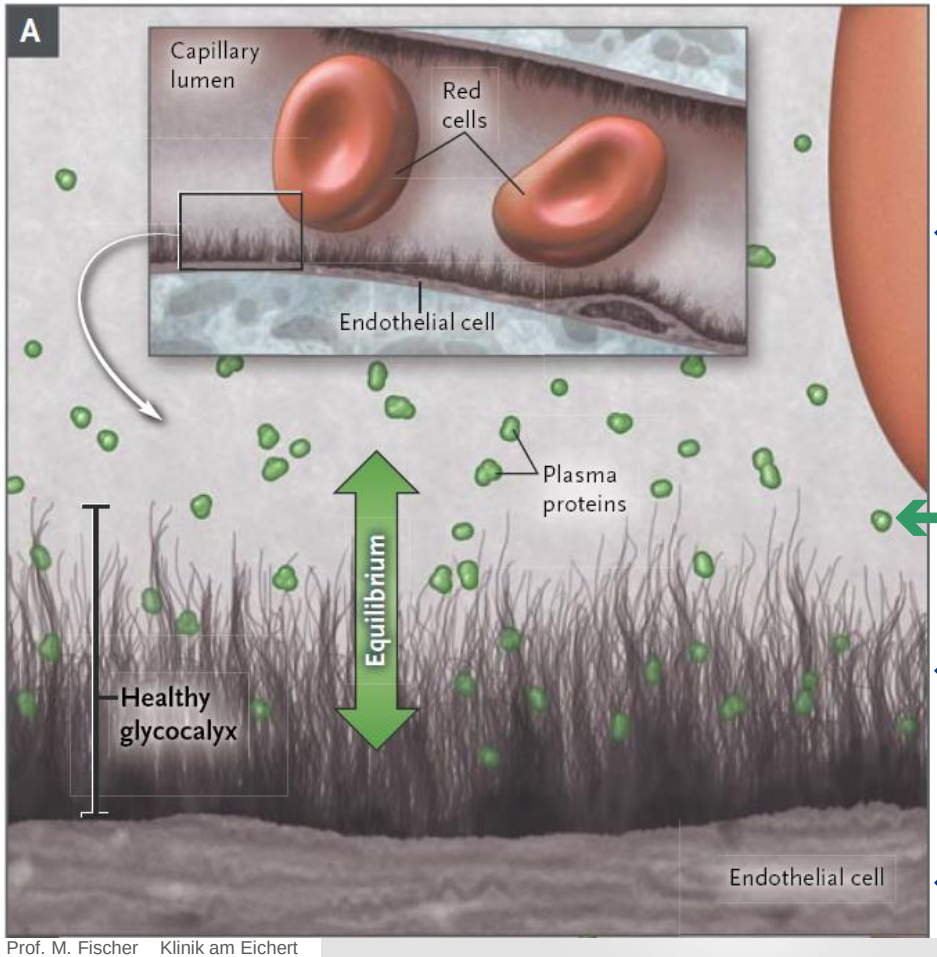
John A. Myburgh, M.B., B.Ch., Ph.D., and Michael G. Mythen, M.D., M.B., B.S.

N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids



← Erythrozyt im Kapillarlumen

← ***Plasmaproteine***

← Glykokalyx, gesund

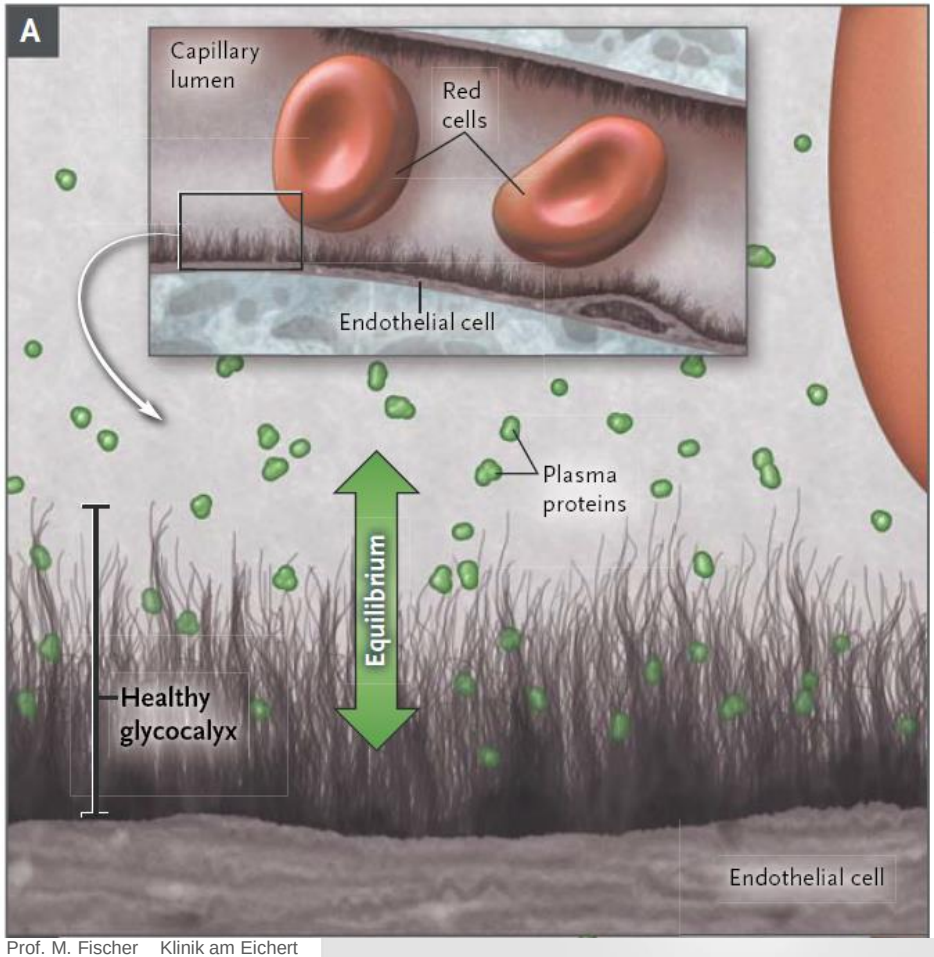
← Endothelzelle

N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

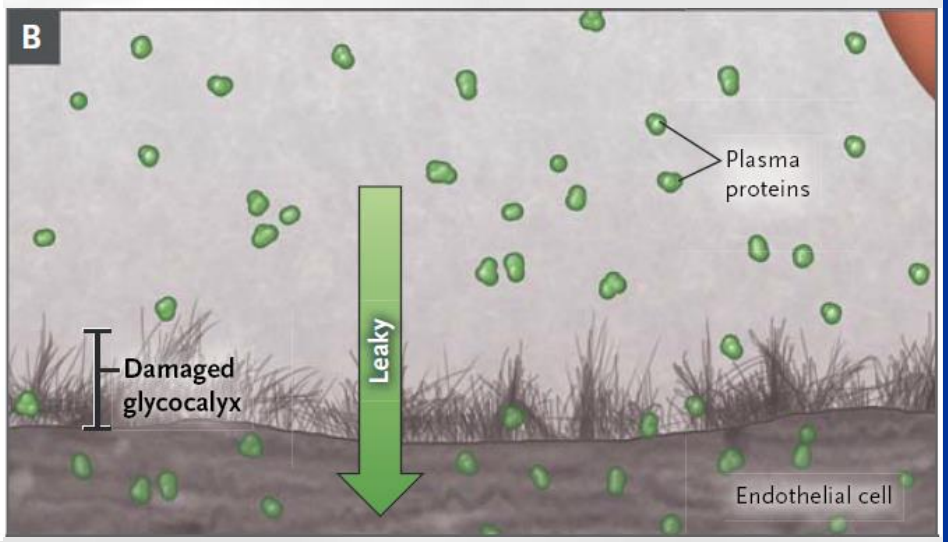
CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids



← Erythrozyt im Kapillarlumen



N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

CRITICAL CARE MEDICINE

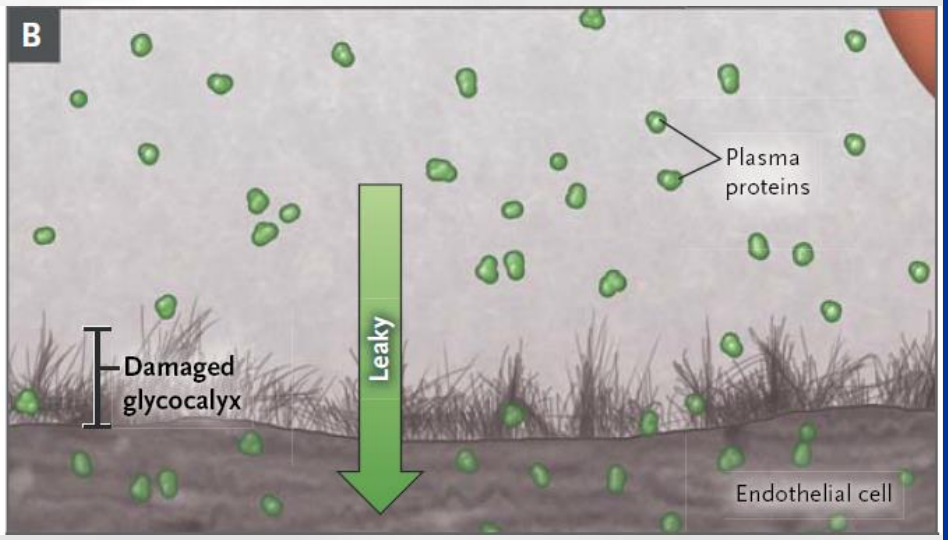
Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

Plasmaproteine und Kapillarleck ➔

Glykokalyx, zerstört ➔

Endothelzelle ➔



N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

THE IDEAL RESUSCITATION FLUID

The ideal resuscitation fluid should be one that produces a predictable and sustained increase in intravascular volume, has a chemical composition as close as possible to that of extracellular fluid, is metabolized and completely excreted without accumulation in tissues, does not produce adverse metabolic or systemic effects, and is cost-effective in terms of improving patient outcomes. Currently, there is no such fluid available for clinical use.

N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

Table 2. Recommendations for Fluid Resuscitation in Acutely Ill Patients.

Fluids should be administered with the same caution that is used with any intravenous drug.

Consider the type, dose, indications, contraindications, potential for toxicity, and cost.

Fluid resuscitation is a component of a complex physiological process.

Identify the fluid that is most likely to be lost and replace the fluid lost in equivalent volumes.

Consider serum sodium, osmolarity, and acid–base status when selecting a resuscitation fluid.

Consider cumulative fluid balance and actual body weight when selecting the dose of resuscitation fluid.

Consider the early use of catecholamines as concomitant treatment of shock.

N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

Table 2. Recommendations for Fluid Resuscitation in Acutely Ill Patients.

Fluid requirements change over time in critically ill patients.

The cumulative dose of resuscitation and maintenance fluids is associated with interstitial edema.

Pathological edema is associated with an adverse outcome.

Oliguria is a normal response to hypovolemia and should not be used solely as a trigger or end point for fluid resuscitation, particularly in the post-resuscitation period.

The use of a fluid challenge in the post-resuscitation period (≥24 hours) is questionable.

The use of hypotonic maintenance fluids is questionable once dehydration has been corrected.

N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

Table 2. Recommendations for Fluid Resuscitation in Acutely Ill Patients.

Specific considerations apply to different categories of patients.

Bleeding patients require control of hemorrhage and transfusion with red cells and blood components as indicated.

Isotonic, balanced salt solutions are a pragmatic initial resuscitation fluid for the majority of acutely ill patients.

Consider saline in patients with hypovolemia and alkalosis.

Consider albumin during the early resuscitation of patients with severe sepsis.

Saline or isotonic crystalloids are indicated in patients with traumatic brain injury.

Albumin is not indicated in patients with traumatic brain injury.

Hydroxyethyl starch is not indicated in patients with sepsis or those at risk for acute kidney injury.

The safety of other semisynthetic colloids has not been established, so the use of these solutions is not recommended.

The safety of hypertonic saline has not been established.

The appropriate type and dose of resuscitation fluid in patients with burns has not been determined.

N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

Although the use of resuscitation fluids is one of the most common interventions in medicine, no currently available resuscitation fluid can be considered to be ideal. In light of recent high-quality evidence, a reappraisal of how resuscitation fluids are used in acutely ill patients is now required (Table 2). The selection, timing, and doses of intravenous fluids should be evaluated as carefully as they are in the case of any other intravenous drug, with the aim of maximizing efficacy and minimizing iatrogenic toxicity.

N ENGL J MED 369;13 NEJM.ORG SEPTEMBER 26, 2013

agswn
28. Notfallmedizinische Jahrestagung

2. Mechanische Reanimationsgeräte

Resuscitation 84 (2013) 1214–1222

Contents lists available at SciVerse ScienceDirect

Resuscitation

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

Clinical paper

Treatment of non-traumatic out-of-hospital cardiac arrest compression decompression cardiopulmonary resuscitatio threshold device

Ralph J. Frascone[a], Marvin A. Wayne[b], Robert A. Swor[c], Brian D. Mahoney Michael L. Olinger[f], David E. Tupper[g], Cindy M. Setum[h], Nathan Burkhart[h] Joshua G. Salzman[a,*], Sandi S. Wewerka[a], Demetris Yannopoulos[i], Keith G Richard G. Holcomb[k], Tom P. Aufderheide[l]

[a] Department of Emergency Medicine, Regions Hospital, St. Paul, MN, United States
[b] Whatcom County Emergency Medical Services, Department of Emergency Medicine, PeaceHealth St. Joseph Medical Center, Bell
[c] Department of Emergency Medicine, William Beaumont Hospital, Royal Oak, MI, United States
[d] Department of Emergency Medicine, Hennepin County Medical Center, Minneapolis, MN, United States
[e] Department of Emergency Medicine, St. Joseph Hospital, Ann Arbor, MI, United States
[f] Department of Emergency Medicine, Indiana University School of Medicine, Indianapolis, IN, United States
[g] Department of Neurology, University of Minnesota Medical Center, Minneapolis, MN, United States
[h] Advanced Circulatory Systems, Inc., Roseville, MN, United States
[i] Department of Medicine, Cardiovascular Division, University of Minnesota Medical Center, Minneapolis, MN, United States
[j] Department of Emergency Medicine, Wayne State University, School of Medicine Specialist-in-Chief, Detroit, MI, United States
[k] Quintiles Consulting, Rockville, MD, United States
[l] Department of Emergency Medicine, Medical College of Wisconsin, Milwaukee, WI, United States

ARTICLE INFO

Article history:
Received 19 December 2012
Received in revised form 29 April 2013
Accepted 2 May 2013

Keywords:
Cardiopulmonary resuscitation
Heart arrest
Out-of-hospital cardiac arrest
Randomized controlled trial
Mortality
Outcome

ABSTRACT

Background: A recent out-of-hospital cardiac arrest (OHCA) cli pital discharge (HD) with favorable neurologic function for p treated with active compression decompression cardiopulm threshold device (ACD + ICD) versus standard (S) CPR. The cu with ACD + ITD is more effective than standard (S-CPR) for regardless of the etiology.
Methods: This is a secondary analysis of data from a randomi treat, OHCA clinical trial. Adults with presumed non-traumat for one year post arrest. The primary endpoint was survival neurologic function (Modified Rankin Scale score ≤ 3).
Results: Between October 2005 and July 2009, 2738 ACD + ITD = 1403). Survival to HD with favorable neurologic pared with S-CPR: 7.9% versus 5.7%, (OR 1.42, 95% CI 1.04, greater: 7.9% versus 5.7%, (OR 1.43, 95% CI 1.04, 1.96, $p = 0.0$ returned to their baseline neurological function by one ye between groups.
Conclusions: Treatment of out-of-hospital non-traumatic car in a significant increase in survival to hospital discharge v compared with S-CPR. A significant increase survival rates subjects treated with ACD + ITD, regardless of the etiology of

1. Introduction

Use of active compres resuscitation (CPR) plus an i has been shown in animal s bral perfusion and to imp

* Corresponding author at: Regions Hospital Emergency Medical Services, 640 Jackson St. MS: 11109F, St. Paul, MN 55101, United States.
E-mail address: Joshua.g.salzman@healthpartners.com (J.G. Salzman).

0300-9572/$ – see front matter © 2013 Elsevier Ireland Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.resuscitation.2013.05.002

Research

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest
The LINC Randomized Trial

Sten Rubertsson, MD, PhD; Erik Lindgren, MD; David Smekal, MD, PhD; Ollie Östlund, PhD; Johan Silfverstolpe, MD; Robert A. Lichtveld, MD, PhD; Rene Boomars, MPA; Björn Ahlstedt, MD; Gunnar Skoog, MD; Robert Kastberg, MD; David Halliwell, RN; Martyn Box, RN; Johan Herlitz, MD, PhD; Rolf Karlsten, MD, PhD

IMPORTANCE A strategy using mechanical chest compressions might improve the poor outcome in out-of-hospital cardiac arrest, but such a strategy has not been tested in large clinical trials.

OBJECTIVE To determine whether administering mechanical chest compressions with defibrillation during ongoing compressions (mechanical CPR), compared with manual cardiopulmonary resuscitation (manual CPR), according to guidelines, would improve 4-hour survival.

DESIGN, SETTING, AND PARTICIPANTS Multicenter randomized clinical trial of 2589 patients with out-of-hospital cardiac arrest conducted between January 2008 and February 2013 in 4 Swedish, 1 British, and 1 Dutch ambulance services and their referring hospitals. Duration of follow-up was 6 months.

INTERVENTIONS Patients were randomized to receive either mechanical chest compressions (LUCAS Chest Compression System, Physio-Control/Jolife AB) combined with defibrillation during ongoing compressions (n = 1300) or to manual CPR according to guidelines (n = 1289).

MAIN OUTCOMES AND MEASURES Four-hour survival, with secondary end points of survival up to 6 months with good neurological outcome using the Cerebral Performance Category (CPC) score. A CPC score of 1 or 2 was classified as a good outcome.

RESULTS Four-hour survival was achieved in 307 patients (23.6%) with mechanical CPR and 305 (23.7%) with manual CPR (risk difference, −0.05%; 95% CI, −3.3% to 3.2%; $P > .99$). Survival with a CPC score of 1 or 2 occurred in 98 (7.5%) vs 82 (6.4%) (risk difference, 1.18%; 95% CI, −0.78% to 3.1%) at intensive care unit discharge, in 108 (8.3%) vs 100 (7.8%) (risk difference, 0.55%; 95% CI, −1.5% to 2.6%) at hospital discharge, in 105 (8.1%) vs 94 (7.3%) (risk difference, 0.78%; 95% CI, −1.3% to 2.8%) at 1 month, and in 110 (8.5%) vs 98 (7.6%) (risk difference, 0.86%; 95% CI, −1.2% to 3.0%) at 6 months with mechanical CPR and manual CPR, respectively. Among patients surviving at 6 months, 99% in the mechanical CPR group and 94% in the manual CPR group had CPC scores of 1 or 2.

CONCLUSIONS AND RELEVANCE Among adults with out-of-hospital cardiac arrest, there was no significant difference in 4-hour survival between patients treated with the mechanical CPR algorithm or those treated with guideline-adherent manual CPR. The vast majority of survivors in both groups had good neurological outcomes by 6 months. In clinical practice, mechanical CPR using the presented algorithm did not result in improved effectiveness compared with manual CPR.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT00609778

JAMA. doi:10.1001/jama.2013.282538
Published online November 17, 2013.

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Sten Rubertsson, MD, PhD, Department of Surgical Sciences/Anaestesiology and Intensive Care, Uppsala University, Uppsala University Hospital, SE 75185 Uppsala, Sweden (sten.rubertsson @akademiska.se).

Leitthema

Anaesthesist 2014
DOI 10.1007/s00101-013-2265-8

M. Fischer[1] · M. Breil[2] · M. Ihli[3] · M. Messelken[1] · S. Rauch[1] · J.-C. Schewe[2]
[1] Klinik für Anästhesiologie, Operative Intensivmedizin, Notfallmedizin und Schmerztherapie, Klinik am Eichert der ALB FILS Kliniken, Göppingen
[2] Klinik und Poliklinik für Anästhesiologie und Operative Intensivmedizin, Universitätsklinikum Bonn (AöR)
[3] Medizinische Klinik, Helfenstein Klinik der ALB FILS Kliniken, Geislingen

Redaktion

Mechanische Reanimationshilfen

die „chronisch-ischämische Herzerkrankung" [International Statistical Classification of Diseases and Related Health Problems(ICD)-10 I25] mit 70.557, der „akute Myokardinfarkt" (ICD-10 I21) mit 52.113 und die „Herzinsuffizienz" (ICD-10 I50) mit 45.428, zusammen insgesamt 168.098 Sterbefälle kardialer Genese. Auf der Basis einzelner Studien aus kommunalen Gebietskörperschaften ergibt sich eine Inzidenz des plötzlichen Herztods von 120 bis über 200 Ereignissen/100.000 Einwohnern und Jahr [2, 3]. Diese Studien haben anhand der Utstein-Definitionen die plötzlichen Todesfälle in Bonn und Berlin erfasst, nachdem Trauma, Ertrinken und offensichtlich nichtkardiale Ursachen ausgeschlossen wurden. Anhand dieser Resultate lässt sich für Deutschland hochrechnen, dass pro Jahr zwischen 100.000 und 160.000 Menschen einen plötzlichen Herztod außerhalb eines Krankenhauses erleiden. Damit ist der plötzliche Herztod wahrscheinlich eine der häufigsten Todesursachen in Deutschland.

Im Deutschen Reanimationsregister und der internationalen Literatur wird die Häufigkeit einer begonnenen Reanimationsbehandlung nach plötzlichem Herztod mit 30–90 Fällen/100.000 Einwohner und Jahr angegeben [3–11]. Damit ist die Inzidenz der kardiopulmonalen Reanimation („cardiopulmonary resuscitation", CPR) im Vergleich zur Häufigkeit des plötzlichen Herztods deutlich geringer [2, 3]. Dies wiederum bedeutet, dass nur 25–50% der Patienten so rechtzeitig vom Notarzt- und Rettungsdienst erreicht werden, dass die Indikation zum Beginn der CPR-Behandlung besteht [8].

Innerhalb des Notarztdienstes stellt die CPR mit ca. 4% aller Einsätze nicht die häufigste Einsatzindikation dar [10]. Dabei ist der plötzliche Herztod mit CPR jedoch die Diagnose mit der höchsten Letalität sowie der größten medizinischen Dringlichkeit und benötigt die sachgerechte Behandlung durch die gesamte Rettungskette.

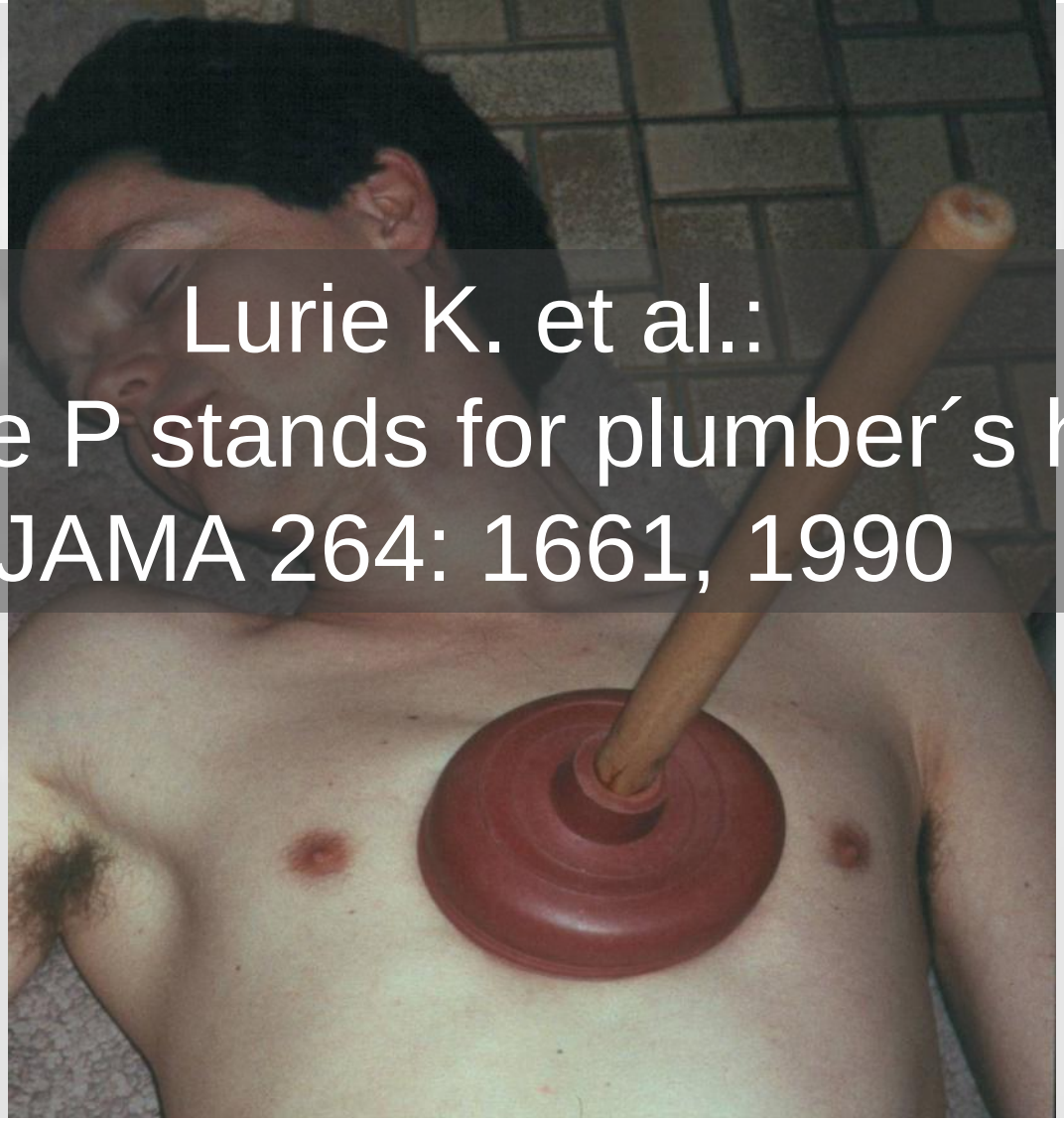
Manuelle Thoraxkompression

Unabhängig von der primären – meist kardialen – Ursache mündet ein Herz-Kreislauf-Stillstand in eine eigene pathophysiologische Endstrecke. In ◘ **Abb. 1** sind die pathophysiologischen Prozesse nach tierexperimentell elektrisch-induziertem Kammerflimmern dargestellt. Mit Einsetzen des Kammerflimmerns, aufgezeichnet im Elektrokardiogramm (EKG), sistiert umgehend die Spontanzirkulation. Dies ist am Abfall des aortalen (AoD) und linksventrikulären Blutdrucks (LVD) zu erkennen. Die Perfusion aller Organe bricht zusammen, auch die des Herzens. Mit Einsetzen der Ischämie degeneriert das Kammerflimmern über den dargestellten Zeitraum von 15 min zu einer Asystolie (markiert durch *3 Pfeile* nach einer ein-, 5- und 15-minütigen

Die vorliegende Arbeit „Mechanische Reanimationshilfen" ist als Aktualisierung und Update des Beitrags „Mechanische Reanimationsgeräte" (Notfall Rettungsmed 2010,13:189–196) zu verstehen.

TOP-Paper Notfallmedizin
Prof. M. Fischer Klinik am Eichert

ALB FILS KLINIKEN
KOMPETENZ, QUALITÄT, ZUWENDUNG

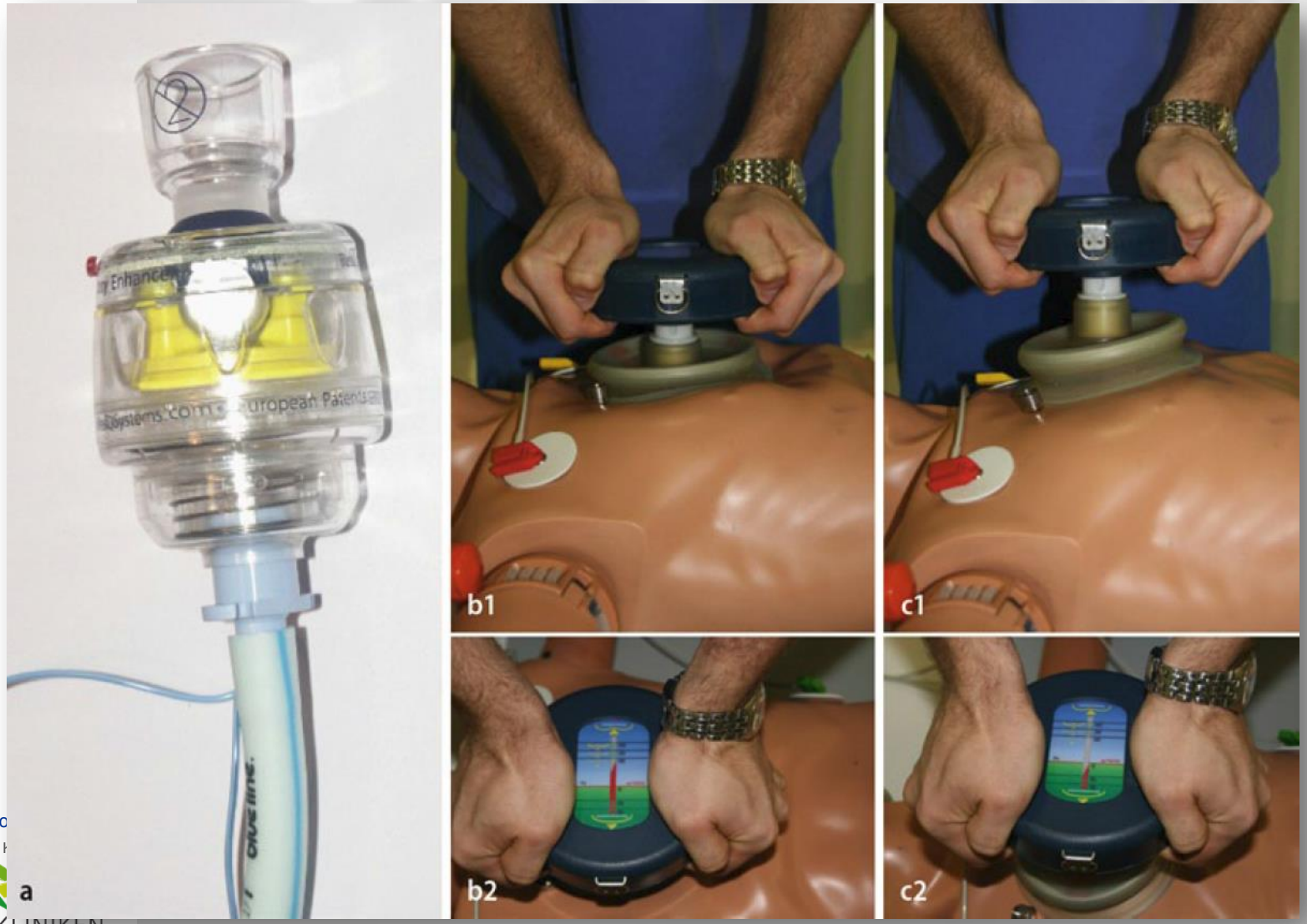


Lurie K. et al.:
CPR: The P stands for plumber´s helper.
JAMA 264: 1661, 1990

Active Compression Decompression (ACD) CPR

Reperfusion = Thoraxkompressionen

ACD + ITD Active Compression Decompression + Impedance threshold device



TOP-Paper No

Prof. M. Fischer

ALB FILS KLINIKEN

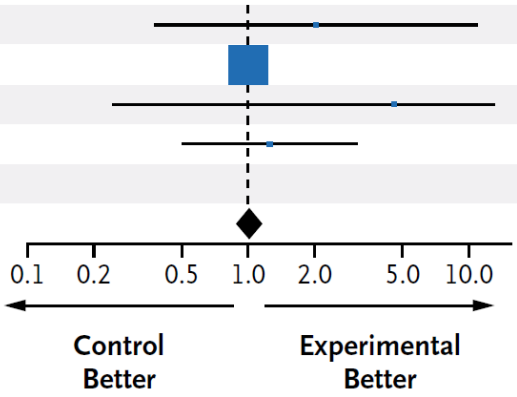
KOMPETENZ, QUALITÄT, ZUWENDUNG

Anaesthesist 2014; DOI 10.1007/s00101-013-2265-8

ACD + ITD Reanimation

Study or Subgroup	Experimental Intervention	Control Intervention	Experimental	Control	Study Weighting	Risk Ratio (95% CI)
			no. of events/total no.		(%)	
Aufderheide 2005[2]	CPR+ITD	CPR+sham ITD	4/114	2/116	0.5	2.04 (0.38–10.89)
ROC PRIMED	CPR+ITD	CPR+sham ITD	357/4373	355/4345	97.1	1.00 (0.87–1.15)
Plaisance 2000[3]	ACD+ITD	ACD+sham ITD	2/11	0/10	0.1	4.58 (0.25–85.33)
Plaisance 2004[4]	ACD+ITD	ACD+sham ITD	10/200	8/200	2.2	1.25 (0.50–3.10)
Total			373/4698	365/4671	100	1.02 (0.88–1.17)

Heterogeneity: chi²=1.93; 3 df, P=0.59; I²=0%
Test for overall effect: z=0.22; P=0.83

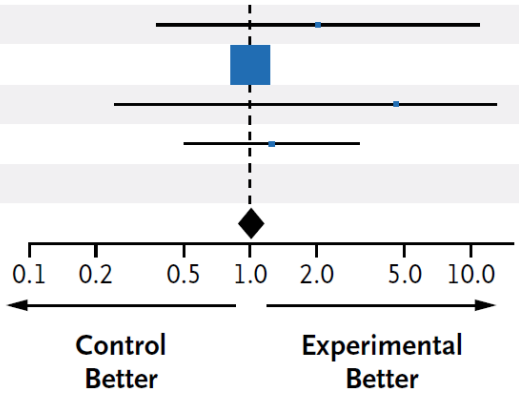


Greco M, Landoni G, Cabrini L (Letter to N ENGL J MED 366;2 NEJM.ORG JANUARY 12, 2012

ACD + ITD Reanimation

Study or Subgroup	Experimental Intervention	Control Intervention	Experimental	Control	Study Weighting	Risk Ratio (95% CI)
			no. of events/total no.		*(%)*	
Aufderheide 2005[2]	CPR+ITD	CPR+sham ITD	4/114	2/116	0.5	2.04 (0.38–10.89)
ROC PRIMED	CPR+ITD	CPR+sham ITD	357/4373	355/4345	97.1	1.00 (0.87–1.15)
Plaisance 2000[3]	ACD+ITD	ACD+sham ITD	2/11	0/10	0.1	4.58 (0.25–85.33)
Plaisance 2004[4]	ACD+ITD	ACD+sham ITD	10/200	8/200	2.2	1.25 (0.50–3.10)
Total			373/4698	365/4671	100	1.02 (0.88–1.17)

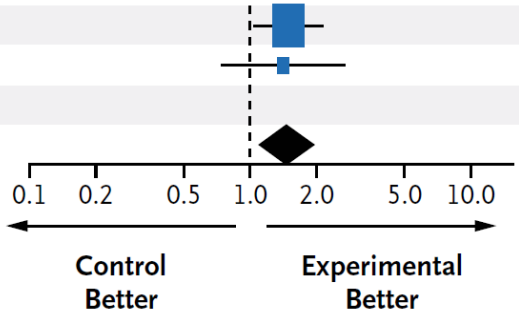
Heterogeneity: chi²=1.93; 3 df, P=0.59; I²=0%
Test for overall effect: z=0.22; P=0.83



B

Study or Subgroup	Experimental Intervention	Control Intervention	Experimental	Control	Study Weighting	Risk Ratio (95% CI)
			no. of events/total no.		*(%)*	
ResQTrial	ACD+ITD	CPR	74/840	48/813	78.0	1.49 (1.05–2.12)
Wolcke 2003[5]	ACD+ITD	CPR	19/103	14/107	22.0	1.41 (0.75–2.66)
Total			93/943	62/920	100	1.47 (1.08–2.00)

Heterogeneity: chi²=0.02; 1 df, P=0.88; I²=0%
Test for overall effect: z=2.48; P=0.01



Greco M, Landoni G, Cabrini L (Letter to N ENGL J MED 366;2 NEJM.ORG JANUARY 12, 2012

Treatment of non-traumatic out-of-hospital cardiac arrest with active compression decompression cardiopulmonary resuscitation plus an impedance threshold device

Ralph J. Frascone[a], Marvin A. Wayne[b], Robert A. Swor[c], Brian D. Mahoney[d], Robert M. Domeier[e], Michael L. Olinger[f], David E. Tupper[g], Cindy M. Setum[h], Nathan Burkhart[h], Lucinda Klann[h], Joshua G. Salzman[a,*], Sandi S. Wewerka[a], Demetris Yannopoulos[i], Keith G. Lurie[i], Brian J. O'Neil[j], Richard G. Holcomb[k], Tom P. Aufderheide[l]

[a] *Department of Emergency Medicine, Regions Hospital, St. Paul, MN, United States*
[b] *Whatcom County Emergency Medical Services, Department of Emergency Medicine, PeaceHealth St. Joseph Medical Center, Bellingham, WA, United States*
[c] *Department of Emergency Medicine, William Beaumont Hospital, Royal Oak, MI, United States*
[d] *Department of Emergency Medicine, Hennepin County Medical Center, Minneapolis, MN, United States*
[e] *Department of Emergency Medicine, St. Joseph Hospital, Ann Arbor, MI, United States*
[f] *Department of Emergency Medicine, Indiana University School of Medicine, Indianapolis, IN, United States*
[g] *Department of Neurology, University of Minnesota Medical Center, Minneapolis, MN, United States*
[h] *Advanced Circulatory Systems, Inc., Roseville, MN, United States*
[i] *Department of Medicine, Cardiovascular Division, University of Minnesota Medical Center, Minneapolis, MN, United States*
[j] *Department of Emergency Medicine, Wayne State University, School of Medicine Specialist-in-Chief, Detroit, MI, United States*
[k] *Quintiles Consulting, Rockville, MD, United States*
[l] *Department of Emergency Medicine, Medical College of Wisconsin, Milwaukee, WI, United States*

Resuscitation 84 (2013) 1214–1222

Treatment of non-traumatic out-of-hospital cardiac arrest with active compression decompression cardiopulmonary resuscitation plus an impedance threshold device

Background: A recent out-of-hospital cardiac arrest (OHCA) clinical trial showed improved survival to hospital discharge (HD) with favorable neurologic function for patients with cardiac arrest of cardiac origin treated with active compression decompression cardiopulmonary resuscitation (CPR) plus an impedance threshold device (ACD + ICD) versus standard (S) CPR. The current analysis examined whether treatment with ACD + ITD is more effective than standard (S-CPR) for all cardiac arrests of non-traumatic origin, regardless of the etiology.

Resuscitation 84 (2013) 1214–1222

Treatment of non-traumatic out-of-hospital cardiac arrest with active compression decompression cardiopulmonary resuscitation plus an impedance threshold device

Background: A recent out-of-hospital cardiac arrest (OHCA) clinical trial showed improved survival to hospital discharge (HD) with favorable neurologic function for patients with cardiac arrest of cardiac origin treated with active compression decompression cardiopulmonary resuscitation (CPR) plus an impedance threshold device (ACD + ICD) versus standard (S) CPR. The current analysis examined whether treatment with ACD + ITD is more effective than standard (S-CPR) for all cardiac arrests of non-traumatic origin, regardless of the etiology.

Methods: This is a secondary analysis of data from a randomized, prospective, multicenter, intention-to-treat, OHCA clinical trial. Adults with presumed non-traumatic cardiac arrest were enrolled and followed for one year post arrest. The primary endpoint was survival to hospital discharge (HD) with favorable neurologic function (Modified Rankin Scale score ≤ 3).

Resuscitation 84 (2013) 1214–1222

Treatment of non-traumatic out-of-hospital cardiac arrest with active compression decompression cardiopulmonary resuscitation plus an impedance threshold device

Background: A recent out-of-hospital cardiac arrest (OHCA) clinical trial showed improved survival to hospital discharge (HD) with favorable neurologic function for patients with cardiac arrest of cardiac origin treated with active compression decompression cardiopulmonary resuscitation (CPR) plus an impedance threshold device (ACD + ICD) versus standard (S) CPR. The current analysis examined whether treatment with ACD + ITD is more effective than standard (S-CPR) for all cardiac arrests of non-traumatic origin, regardless of the etiology.

Methods: This is a secondary analysis of data from a randomized, prospective, multicenter, intention-to-treat, OHCA clinical trial. Adults with presumed non-traumatic cardiac arrest were enrolled and followed for one year post arrest. The primary endpoint was survival to hospital discharge (HD) with favorable neurologic function (Modified Rankin Scale score ≤ 3).

Results: Between October 2005 and July 2009, 2738 patients were enrolled (S-CPR = 1335; ACD + ITD = 1403). Survival to HD with favorable neurologic function was greater with ACD + ITD compared with S-CPR: 7.9% versus 5.7%, (OR 1.42, 95% CI 1.04, 1.95, $p = 0.027$). One-year survival was also greater: 7.9% versus 5.7%, (OR 1.43, 95% CI 1.04, 1.96, $p = 0.026$). Nearly all survivors in both groups had returned to their baseline neurological function by one year. Major adverse event rates were similar between groups.

Resuscitation 84 (2013) 1214–1222

Treatment of non-traumatic out-of-hospital cardiac arrest with active compression decompression cardiopulmonary resuscitation plus an impedance threshold device

Background: A rec
pital discharge (H
treated with activ
threshold device
with ACD + ITD is
regardless of the

Methods: This is a
treat, OHCA clinic
for one year post
neurologic functi

Results: Betwee
ACD + ITD = 1403)
pared with S-CPR
greater: 7.9% vers
returned to their
between groups.

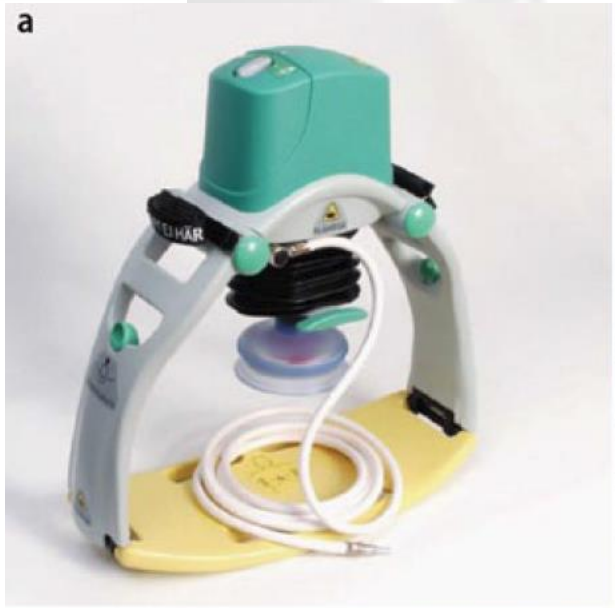
5. Conclusions

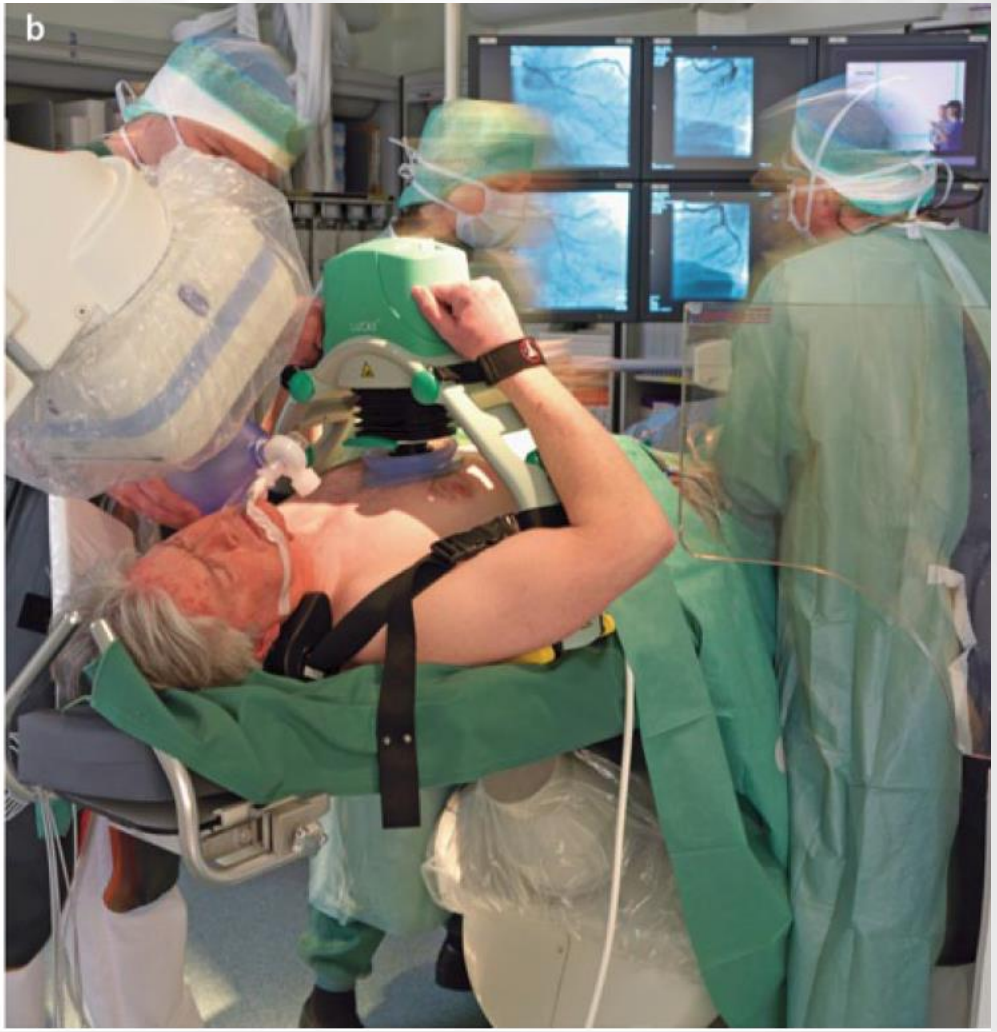
The expanded analysis with 2738 subjects represents one of the largest prospective interventional CPR trials to date evaluating one year survival and neurologic outcomes after non-traumatic cardiac arrest. Patients treated with ACD + ITD had a relative 38% increase in survival to hospital discharge with favorable neurologic function (MRS ≤ 3), compared with S-CPR, regardless of the etiology of their cardiac arrest. Survival to one year with favorable neurological function was also increased by a relative 39% in patients who had been treated with ACD + ITD. Nearly all survivors, regardless of the method of CPR, had returned to their baseline neurological function one year after OHCA. These findings provide the strongest evidence to date that application of ACD + ITD in a wide spectrum of patients with OHCA cardiac arrest can significantly increase long-term survival rates with restoration of baselines neurological function.

Resuscitation 84 (2013) 1214–1222

Reperfusion = Thoraxkompressionen

LUCAS Lund University Cardiac Arrest System





Anaesthesist 2014; DOI 10.1007/s00101-013-2265-8

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

The LINC Randomized Trial

Sten Rubertsson, MD, PhD; Erik Lindgren, MD; David Smekal, MD, PhD; Ollie Östlund, PhD; Johan Silfverstolpe, MD; Robert A. Lichtveld, MD, PhD; Rene Boomars, MPA; Björn Ahlstedt, MD; Gunnar Skoog, MD; Robert Kastberg, MD; David Halliwell, RN; Martyn Box, RN; Johan Herlitz, MD, PhD; Rolf Karlsten, MD, PhD

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

IMPORTANCE A strategy using mechanical chest compressions might improve the poor outcome in out-of-hospital cardiac arrest, but such a strategy has not been tested in large clinical trials.

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

IMPORTANCE A strategy using mechanical chest compressions might improve the poor outcome in out-of-hospital cardiac arrest, but such a strategy has not been tested in large clinical trials.

OBJECTIVE To determine whether administering mechanical chest compressions with defibrillation during ongoing compressions (mechanical CPR), compared with manual cardiopulmonary resuscitation (manual CPR), according to guidelines, would improve 4-hour survival.

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

IMPORTANCE A strategy using mechanical chest compressions might improve the poor outcome in out-of-hospital cardiac arrest, but such a strategy has not been tested in large clinical trials.

OBJECTIVE To determine whether administering mechanical chest compressions with defibrillation during ongoing compressions (mechanical CPR), compared with manual cardiopulmonary resuscitation (manual CPR), according to guidelines, would improve 4-hour survival.

DESIGN, SETTING, AND PARTICIPANTS Multicenter randomized clinical trial of 2589 patients with out-of-hospital cardiac arrest conducted between January 2008 and February 2013 in 4 Swedish, 1 British, and 1 Dutch ambulance services and their referring hospitals. Duration of follow-up was 6 months.

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

IMPORTANCE A strategy using mechanical chest compressions might improve the poor outcome in out-of-hospital cardiac arrest, but such a strategy has not been tested in large clinical trials.

OBJECTIVE To determine whether administering mechanical chest compressions with defibrillation during ongoing compressions (mechanical CPR), compared with manual cardiopulmonary resuscitation (manual CPR), according to guidelines, would improve 4-hour survival.

DESIGN, SETTING, AND PARTICIPANTS Multicenter randomized clinical trial of 2589 patients with out-of-hospital cardiac arrest conducted between January 2008 and February 2013 in 4 Swedish, 1 British, and 1 Dutch ambulance services and their referring hospitals. Duration of follow-up was 6 months.

INTERVENTIONS Patients were randomized to receive either mechanical chest compressions (LUCAS Chest Compression System, Physio-Control/Jolife AB) combined with defibrillation during ongoing compressions (n = 1300) or to manual CPR according to guidelines (n = 1289).

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

IMPORTANCE A strategy using mechanical chest compressions might improve the poor outcome in out-of-hospital cardiac arrest, but such a strategy has not been tested in large clinical trials.

OBJECTIVE To determine whether administering mechanical chest compressions with defibrillation during ongoing compressions (mechanical CPR), compared with manual cardiopulmonary resuscitation (manual CPR), according to guidelines, would improve 4-hour survival.

DESIGN, SETTING, AND PARTICIPANTS Multicenter randomized clinical trial of 2589 patients with out-of-hospital cardiac arrest conducted between January 2008 and February 2013 in 4 Swedish, 1 British, and 1 Dutch ambulance services and their referring hospitals. Duration of follow-up was 6 months.

INTERVENTIONS Patients were randomized to receive either mechanical chest compressions (LUCAS Chest Compression System, Physio-Control/Jolife AB) combined with defibrillation during ongoing compressions (n = 1300) or to manual CPR according to guidelines (n = 1289).

MAIN OUTCOMES AND MEASURES Four-hour survival, with secondary end points of survival up to 6 months with good neurological outcome using the Cerebral Performance Category (CPC) score. A CPC score of 1 or 2 was classified as a good outcome.

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

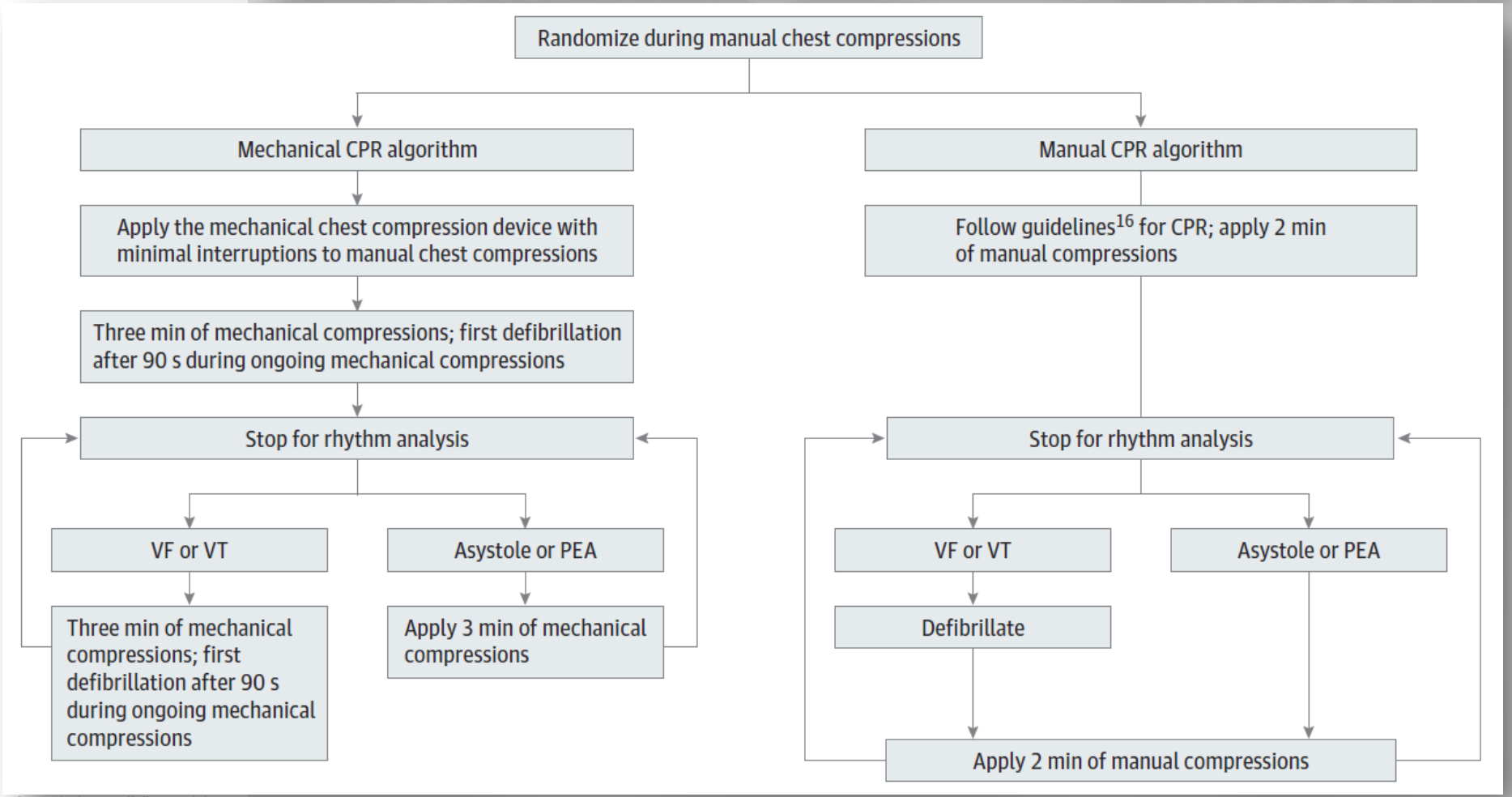
Table 1 Demographic data of the six participating EMS participating in the LINC-study

Site	Primary investigator	Population	Start with LINC	Number of stations	Number of hospitals	Number of paramedics
Uppsala, Sweden	Sten Rubertsson	128.000	20080115	2	1	85
Gävle, Sweden	Robert Kastberg/ Gunnar Skoog	127.000	20080115	4	1	106
Västerås, Sweden	Björn Ahlstedt	132.000	20080115	2	1	55
Malmö, Sweden	Johan Silfverstolpe	280.000	20081101	2	1	150
Dorset, England	Gillian Bryce/Dave Halliwell	400.000	20081210	5	2	100
Utrecht, The Netherlands	Rob Lichtveld	1.200.000	20081117	11	8	275

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest



JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

Randomize during manual chest compressions

LUCAS™ CPR

3 minutes compressions with one defibrillation (90s+1def+90s)

Stop LUCAS Analyze, VT/VF?

Yes

3 minutes compressions with one defibrillation (90s+1def+90s)

No

3 minutes compressions

Medications

Patients with VT/VF
Adrenalin 1 mg i.v. or i.o.
After 3 defibrillations.
There after every 3rd minute.
(Alternatively 3 mg in the ET tube)

Amidarone 300 mg after 4 defibrillations, 150 mg after 7 defibrillations

Patients with asystoli / PEA
Adrenalin 1 mg i.v. or i.o.
as soon as possible, there after every 3rd minute.
(Alternatively 3mg in the ET tube)

Cardiacarrest witnessed by the ambulance crew, should if VT/VF be defibrillated x 1 as quick as possible.
See separate algorithm!

The LUCAS algorithm used in the LINC-study.

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

Table 2. Primary and Secondary Outcomes

Outcomes	No. (%) of Participants		*P* Value	Treatment Difference, % (95% CI)
	Mechanical CPR (n = 1300)	Manual CPR (n = 1289)		
4-Hour survival[a]	307 (23.6)	305 (23.7)	>.99	−0.05 (−3.3 to 3.2)
ROSC[b]	460 (35.4)	446 (34.6)	.68	0.78 (−2.9 to 4.5)
Arrival at emergency department with palpable pulse	366 (28.2)	357 (27.7)	.83	0.46 (−3.0 to 3.9)
Survival to discharge from ICU with CPC 1-2[c]	98 (7.5)	82 (6.4)	.25	1.18 (−0.8 to 3.1)
Survival to hospital discharge with CPC 1-2[c]	108 (8.3)	100 (7.8)	.61	0.55 (−1.5 to 2.6)

JAMA Published online November 17, 2013

Original Investigation

Mechanical Chest Compressions and Simultaneous Defibrillation vs Conventional Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest

Table 2. Primary and Secondary Outcomes

Outcomes
4-Hour survival[a]
ROSC[b]
Arrival at emergency with palpable pulse
Survival to discharge with CPC 1-2[c]
Survival to hospital d with CPC 1-2[c]

Conclusion

In patients with out-of-hospital cardiac arrest, mechanical chest compressions in combination with defibrillation during ongoing compressions provided no improved 4-hour survival vs manual CPR according to guidelines. There was a good neurological outcome in the vast majority of survivors in both groups, and neurological outcomes improved over time. Thus, in clinical practice, CPR with this mechanical device using the presented algorithm can be delivered without major complications but did not result in improved outcomes compared with manual chest compressions.

JAMA Published online November 17, 2013

agswn
28. Notfallmedizinische Jahrestagung

Mechanische Reanimationshilfen

M. Fischer[1] · M. Breil[2] · M. Ihli[3] · M. Messelken[1] · S. Rauch[1] · J.-C. Schewe[2]

[1] Klinik für Anästhesiologie, Operative Intensivmedizin, Notfallmedizin und Schmerztherapie, Klinik am Eichert der ALB FILS Kliniken, Göppingen

[2] Klinik und Poliklinik für Anästhesiologie und Operative Intensivmedizin, Universitätsklinikum Bonn (AöR)

[3] Medizinische Klinik, Helfenstein Klinik der ALB FILS Kliniken, Geislingen

TOP-Paper Notfallmedizin
Prof. M. Fischer Klinik am Eichert

ALB FILS KLINIKEN
KOMPETENZ, QUALITÄT, ZUWENDUNG

Anaesthesist 2014; DOI 10.1007/s00101-013-2265-8

Mechanische Reanimationshilfen

Fazit für die Praxis

- In jedem Fall bedarf die Anwendung mechanischer Reanimationsgeräte eines umfangreichen Anwendertrainings und flankierender qualitätssichernder Maßnahmen, um potenzielle Fehler und Risiken beim Einsatz frühzeitig zu erkennen und zu minimieren.

Anaesthesist 2014; DOI 10.1007/s00101-013-2265-8

Mechanische Reanimationshilfen

Fazit für die Praxis

- In jedem Fall bedarf die Anwendung mechanischer Reanimationsgeräte eines umfangreichen Anwendertrainings und flankierender qualitätssichernder Maßnahmen, um potenzielle Fehler und Risiken beim Einsatz frühzeitig zu erkennen und zu minimieren.
- Für die Geräte LUCAS™ und AutoPulse® kann eine generelle Empfehlung zum Einsatz anhand der derzeitig publizierten Datenlage nicht gegeben werden. Die vorläufigen Daten des CIRC Trial und die publizierten Daten des LINC Trial zeigen, dass die mechanische CPR der guten manuellen CPR anscheinend gleichwertig ist. Zur endgültigen Beurteilung sind weitere Publikationen großer randomisierter Untersuchungen abzuwarten.

Anaesthesist 2014; DOI 10.1007/s00101-013-2265-8

Mechanische Reanimationshilfen

Fazit für die Praxis

- In jedem Fall bedarf die Anwendung mechanischer Reanimationsgeräte eines umfangreichen Anwendertrainings und flankierender qualitätssichernder Maßnahmen, um potenzielle Fehler und Risiken beim Einsatz frühzeitig zu erkennen und zu minimieren.
- Für die Geräte LUCAS™ und AutoPulse® kann eine generelle Empfehlung zum Einsatz anhand der derzeitig publizierten Datenlage nicht gegeben werden. Die vorläufigen Daten des CIRC Trial und die publizierten Daten des LINC Trial zeigen, dass die mechanische CPR der guten manuellen CPR anscheinend gleichwertig ist. Zur endgültigen Beurteilung sind weitere Publikationen großer randomisierter Untersuchungen abzuwarten.
- Für die ACD-CPR in Kombination mit einem ITD liegen 3 prospektive randomisierte Studien und eine daraus abgeleitete Metaanalyse vor, die einen signifikanten Überlebensvorteil der ACD-ITD-CPR im Vergleich mit der Standard-CPR aufzeigen. Der Überlebensvorteil umfasst Kurz- und Langzeitergebnisse mit guter neurologischer Erholung.

Anaesthesist 2014; DOI 10.1007/s00101-013-2265-8

3. Hypothermie: Ja oder Nein?

Research

Original Investigation

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

Francis Kim, MD; Graham Nichol, MD, MPH; Charles Maynard, PhD; Al Hallstrom, PhD; Peter J.
Thomas Rea, MD, MPH; Michael K. Copass, MD; David Carlbom, MD; Steven Deem, MD; W. T. L
Michele Olsufka, RN; Leonard A. Cobb, MD

IMPORTANCE Hospital cooling improves outcome after cardiac arrest, but preho
immediately after return of spontaneous circulation may result in better outcon

OBJECTIVE To determine whether prehospital cooling improves outcomes after
from cardiac arrest in patients with ventricular fibrillation (VF) and without VF.

DESIGN, SETTING, AND PARTICIPANTS A randomized clinical trial that assigned ac
prehospital cardiac arrest to standard care with or without prehospital cooling,
by infusing up to 2 L of 4°C normal saline as soon as possible following return of
circulation. Adults in King County, Washington, with prehospital cardiac arrest a
resuscitated by paramedics were eligible and 1359 patients (583 with VF and 77
were randomized between December 15, 2007, and December 7, 2012. Patient
completed by May 1, 2013. Nearly all of the patients resuscitated from VF and ac
hospital received hospital cooling regardless of their randomization.

MAIN OUTCOMES AND MEASURES The primary outcomes were survival to hospit
and neurological status at discharge.

RESULTS The intervention decreased mean core temperature by 1.20°C (95% C
−1.07°C) in patients with VF and by 1.30°C (95% CI, −1.40°C to −1.20°C) in patier
by hospital arrival and reduced the time to achieve a temperature of less than 3
hour compared with the control group. However, survival to hospital discharge
among the intervention and control groups among patients with VF (62.7% [95
57.0%-68.0%] vs 64.3% [95% CI, 58.6%-69.5%], respectively; $P = .69$) and an
without VF (19.2% [95% CI, 15.6%-23.4%] vs 16.3% [95% CI, 12.9%-20.4%], res
$P = .30$). The intervention was also not associated with improved neurological s
recovery or mild impairment at discharge for either patients with VF (57.5% [95
51.8%-63.1%] of cases had full recovery or mild impairment vs 61.9% [95% CI, 5
of controls; $P = .69$) or those without VF (14.4% [95% CI, 11.3%-18.2%] of cases
[95% CI,10.4%-17.2%] of controls; $P = .30$). Overall, the intervention group expe
rearrest in the field more than the control group (26% [95% CI, 22%-29%] vs 2
18%-24%], respectively; $P = .008$), as well as increased diuretic use and pulmor
first chest x-ray, which resolved within 24 hours after admission.

CONCLUSION AND RELEVANCE Although use of prehospital cooling reduced core
by hospital arrival and reduced the time to reach a temperature of 34°C, it did n
survival or neurological status among patients resuscitated from prehospital VF
without VF.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT00391469

JAMA. doi:10.1001/jama.2013.282173
Published online November 17, 2013.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

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

Niklas Nielsen, M.D., Ph.D., Jørn Wetterslev, M.D., Ph.D., Tobias Cronberg, M.D., Ph.D., David Erlinge, M.D., Ph.D., Yvan Gasche, M.D., Christian Hassager, M.D., D.M.Sci., Janneke Horn, M.D., Ph.D., Jan Hovdenes, M.D., Ph.D., Jesper Kjaergaard, M.D., D.M.Sci., Michael Kuiper, M.D., Ph.D., Tommaso Pellis, M.D., Pascal Stammet, M.D., Michael Wanscher, M.D., Ph.D., Matt P. Wise, M.D., D.Phil., Anders Åneman, M.D., Ph.D., Nawaf Al-Subaie, M.D., Søren Boesgaard, M.D., D.M.Sci., John Bro-Jeppesen, M.D., Iole Brunetti, M.D., Jan Frederik Bugge, M.D., Ph.D., Christopher D. Hingston, M.D., Nicole P. Juffermans, M.D., Ph.D., Matty Koopmans, R.N., M.Sc., Lars Køber, M.D., D.M.Sci., Jørund Langørgen, M.D., Gisela Lilja, O.T., Jacob Eifer Møller, M.D., D.M.Sci., Malin Rundgren, M.D., Ph.D., Christian Rylander, M.D., Ph.D., Ondrej Smid, M.D., Christophe Werer, M.D., Per Winkel, M.D., D.M.Sci., and Hans Friberg, M.D., Ph.D., for the TTM Trial Investigators*

ABSTRACT

BACKGROUND
Unconscious survivors of out-of-hospital cardiac arrest have a high risk of death or poor neurologic function. Therapeutic hypothermia is recommended by international guidelines, but the supporting evidence is limited, and the target temperature associated with the best outcome is unknown. Our objective was to compare two target temperatures, both intended to prevent fever.

METHODS
In an international trial, we randomly assigned 950 unconscious adults after out-of-hospital cardiac arrest of presumed cardiac cause to targeted temperature management at either 33°C or 36°C. The primary outcome was all-cause mortality through the end of the trial. Secondary outcomes included a composite of poor neurologic function or death at 180 days, as evaluated with the Cerebral Performance Category (CPC) scale and the modified Rankin scale.

RESULTS
In total, 939 patients were included in the primary analysis. At the end of the trial, 50% of the patients in the 33°C group (235 of 473 patients) had died, as compared with 48% of the patients in the 36°C group (225 of 466 patients) (hazard ratio with a temperature of 33°C, 1.06; 95% confidence interval [CI], 0.89 to 1.28; P=0.51). At the 180-day follow-up, 54% of the patients in the 33°C group had died or had poor neurologic function according to the CPC, as compared with 52% of patients in the 36°C group (risk ratio, 1.02; 95% CI, 0.88 to 1.16; P=0.78). In the analysis using the modified Rankin scale, the comparable rate was 52% in both groups (risk ratio, 1.01; 95% CI, 0.89 to 1.14; P=0.87). The results of analyses adjusted for known prognostic factors were similar.

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.)

The authors' affiliations are listed in the Appendix. Address reprint requests to Dr. Nielsen at the Department of Anesthesia and Intensive Care, Intensive Care Unit, Helsingborg Hospital, S Vallgatan 5, 251 87, Helsingborg, Sweden, or at niklas.nielsen@med.lu.se.

*A complete list of investigators participating in the Target Temperature Management 33°C versus 36°C after Out-of-Hospital Cardiac Arrest (TTM) trial is provided listed in the Supplementary Appendix, available at NEJM.org.

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

N Engl J Med 2013.
DOI: 10.1056/NEJMoa1310519

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Targeted temperature management at 33°C versus 36°C after cardiac arrest.

Nielsen N, Wetterslev J, Cronberg T, et al.
N Engl J Med 2013; 369:2197-206
Department of Anesthesia and Intensive Care, Intensive Care Unit, Helsingborg Hospital, Helsingborg, Sweden.

BACKGROUND: Unconscious survivors of out-of-hospital cardiac arrest have a high risk of death or poor neurologic function. Therapeutic hypothermia is recommended by international guidelines, but the supporting evidence is limited, and the target temperature associated with the best outcome is unknown. Our objective was to compare two target temperatures, both intended to prevent fever.

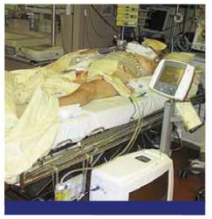
METHODS: In an international trial, we randomly assigned 950 unconscious adults after out-of-hospital cardiac arrest of presumed cardiac cause to targeted temperature management at either 33°C or 36°C. The primary outcome was all-cause mortality through the end of the trial. Secondary outcomes included a composite of poor neurologic function or death at 180 days, as evaluated with the Cerebral Performance Category (CPC) scale and the modified Rankin scale.

RESULTS: In total, 939 patients were included in the primary analysis. At the end of the trial, 50% of the patients in the 33°C group (235 of 473 patients) had died, as compared with 48% of the patients in the 36°C group (225 of 466 patients) (hazard ratio with a temperature of 33°C, 1.06; 95% confidence interval [CI], 0.89 to 1.28; P=0.51). At the 180-day follow-up, 54% of the patients in the 33°C group had died or had poor neurologic function according to the CPC, as compared with 52% of patients in the 36°C group (risk ratio, 1.02; 95% CI, 0.88 to 1.16; P=0.78).

In the analysis using the modified Rankin scale, the comparable rate was 52% in both groups (risk ratio, 1.01; 95% CI, 0.89 to 1.14; P=0.87). The results of analyses adjusted for known prognostic factors were similar.

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.

Therapeutische Hypothermiebehandlung (Targeted Temperature Management, TTM) nach dem Herz-Kreislauf-Stillstand ist auf vielen Intensivstationen bereits gelebter Standard *(Binks AC; Anaesthesia 2010; 65:260)*, da dies auch von Reanimationsleitlinien empfohlen wird *(Deakin; Resuscitation 2010; 81: 1305)*. Die Empfehlungen der Leitlinien beruhen mehr oder weniger auf den Ergebnissen von zwei Studien zur therapeutischen Hypothermie nach Herz-Kreislauf-Stillstand *(Bernard SA; N Engl Med 2002; 346:557, The Hypothermia After Cardiac Arrest Study Group; N Engl Med 2002; 346:549)*, die bereits vor mehr als 10 Jahren veröffentlicht wurden. Auch systematische Reviews, die weitere randomisierte Untersuchungen einschließen, bestätigten diese Vorgangsweise *(Arrich J; Cochrane Database Syst Rev 2012; 9:CD004128)*. Die nun von Nielsen et al. kürzlich im New England Journal of Medicine veröffentlichten Ergebnisse stellen diese Vorgangsweise jedoch scheinbar in Frage *(Nielsen N; N Engl J Med 2013; 369:2197)*.



In dieser bisher größten randomisierten Einzelstudie (n=939) zur TTM bei Patienten nach einem Herz-Kreislauf-Stillstand wurden diese entweder auf 33°C abgekühlt oder auf einer Temperatur von 36°C gehalten. Der primäre Outcome-Parameter war die Mortalität innerhalb eines Beobachtungszeitraums von sechs Monaten. Sekundärer Outcome-Parameter war die neurologische Erholung, gemessen mittels Cerebral Performance Category Score und modifiziertem Rankin-Skala.
Es zeigte sich dabei, dass zwischen den beiden Gruppen kein Unterschied im Hinblick auf die Mortalität und neurologische Erholung zu erfassen war. Interessanterweise traten Nebenwirkungen in der 33°C-Gruppe zahlenmäßig häufiger auf als in der moderat ge-

agswn
28. Notfallmedizinische Jahrestagung

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

A Randomized Clinical Trial

Francis Kim, MD; Graham Nichol, MD, MPH; Charles Maynard, PhD; Al Hallstrom, PhD; Peter J. Kudenchuk, MD; Thomas Rea, MD, MPH; Michael K. Copass, MD; David Carlbom, MD; Steven Deem, MD; W. T. Longstreth Jr, MD; Michele Olsufka, RN; Leonard A. Cobb, MD

Corresponding Author: Francis Kim, MD, Harborview Medical Center, 325 Ninth Ave, Seattle, WA 98104 (fkim@u.washington.edu).

JAMA Published online November 17, 2013

agswn
28. Notfallmedizinische Jahrestagung

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

A Randomized Clinical Trial

IMPORTANCE Hospital cooling improves outcome after cardiac arrest, but prehospital cooling immediately after return of spontaneous circulation may result in better outcomes.

TOP-Paper Notfallmedizin

Prof. M. Fischer Klinik am Eichert

ALB FILS KLINIKEN

KOMPETENZ, QUALITÄT, ZUWENDUNG

JAMA Published online November 17, 2013

agswn
28. Notfallmedizinische Jahrestagung

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

A Randomized Clinical Trial

IMPORTANCE Hospital cooling improves outcome after cardiac arrest, but prehospital cooling immediately after return of spontaneous circulation may result in better outcomes.

OBJECTIVE To determine whether prehospital cooling improves outcomes after resuscitation from cardiac arrest in patients with ventricular fibrillation (VF) and without VF.

JAMA Published online November 17, 2013

agswn
28. Notfallmedizinische Jahrestagung

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

A Randomized Clinical Trial

IMPORTANCE Hospital cooling improves outcome after cardiac arrest, but prehospital cooling immediately after return of spontaneous circulation may result in better outcomes.

OBJECTIVE To determine whether prehospital cooling improves outcomes after resuscitation from cardiac arrest in patients with ventricular fibrillation (VF) and without VF.

DESIGN, SETTING, AND PARTICIPANTS A randomized clinical trial that assigned adults with prehospital cardiac arrest to standard care with or without prehospital cooling, accomplished by infusing up to 2 L of 4°C normal saline as soon as possible following return of spontaneous circulation. Adults in King County, Washington, with prehospital cardiac arrest and resuscitated by paramedics were eligible and 1359 patients (583 with VF and 776 without VF) were randomized between December 15, 2007, and December 7, 2012. Patient follow-up was completed by May 1, 2013. Nearly all of the patients resuscitated from VF and admitted to the hospital received hospital cooling regardless of their randomization.

TOP-Paper Notfallmedizin

Prof. M. Fischer Klinik am Eichert

ALB FILS KLINIKEN

KOMPETENZ, QUALITÄT, ZUWENDUNG

JAMA Published online November 17, 2013

agswn
28. Notfallmedizinische Jahrestagung

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

A Randomized Clinical Trial

IMPORTANCE Hospital cooling improves outcome after cardiac arrest, but prehospital cooling immediately after return of spontaneous circulation may result in better outcomes.

OBJECTIVE To determine whether prehospital cooling improves outcomes after resuscitation from cardiac arrest in patients with ventricular fibrillation (VF) and without VF.

DESIGN, SETTING, AND PARTICIPANTS A randomized clinical trial that assigned adults with prehospital cardiac arrest to standard care with or without prehospital cooling, accomplished by infusing up to 2 L of 4°C normal saline as soon as possible following return of spontaneous circulation. Adults in King County, Washington, with prehospital cardiac arrest and resuscitated by paramedics were eligible and 1359 patients (583 with VF and 776 without VF) were randomized between December 15, 2007, and December 7, 2012. Patient follow-up was completed by May 1, 2013. Nearly all of the patients resuscitated from VF and admitted to the hospital received hospital cooling regardless of their randomization.

MAIN OUTCOMES AND MEASURES The primary outcomes were survival to hospital discharge and neurological status at discharge.

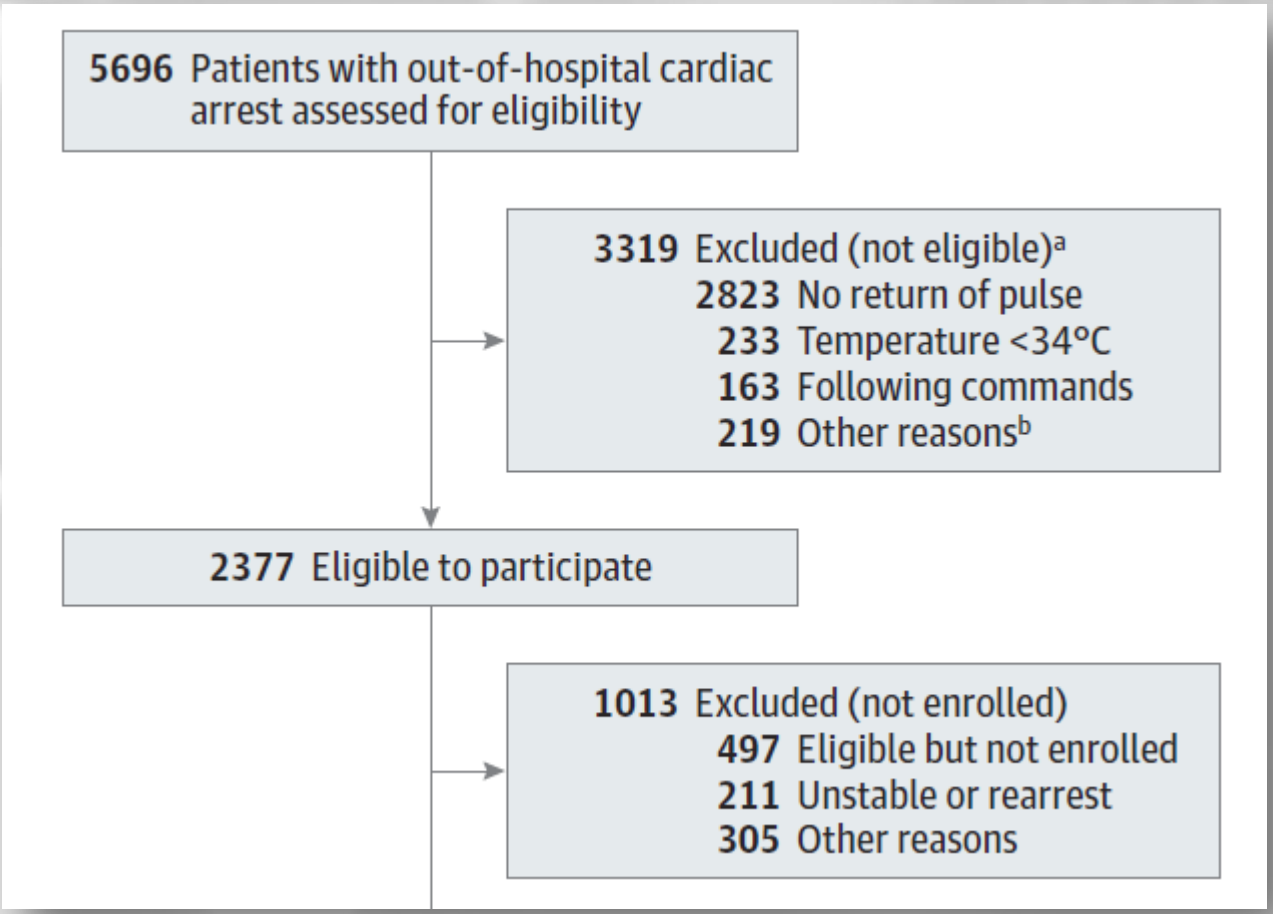
TOP-Paper
Prof. M. Fischer

ALB FILS KLINIKEN
KOMPETENZ, QUALITÄT, ZUWENDUNG

JAMA Published online November 17, 2013

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

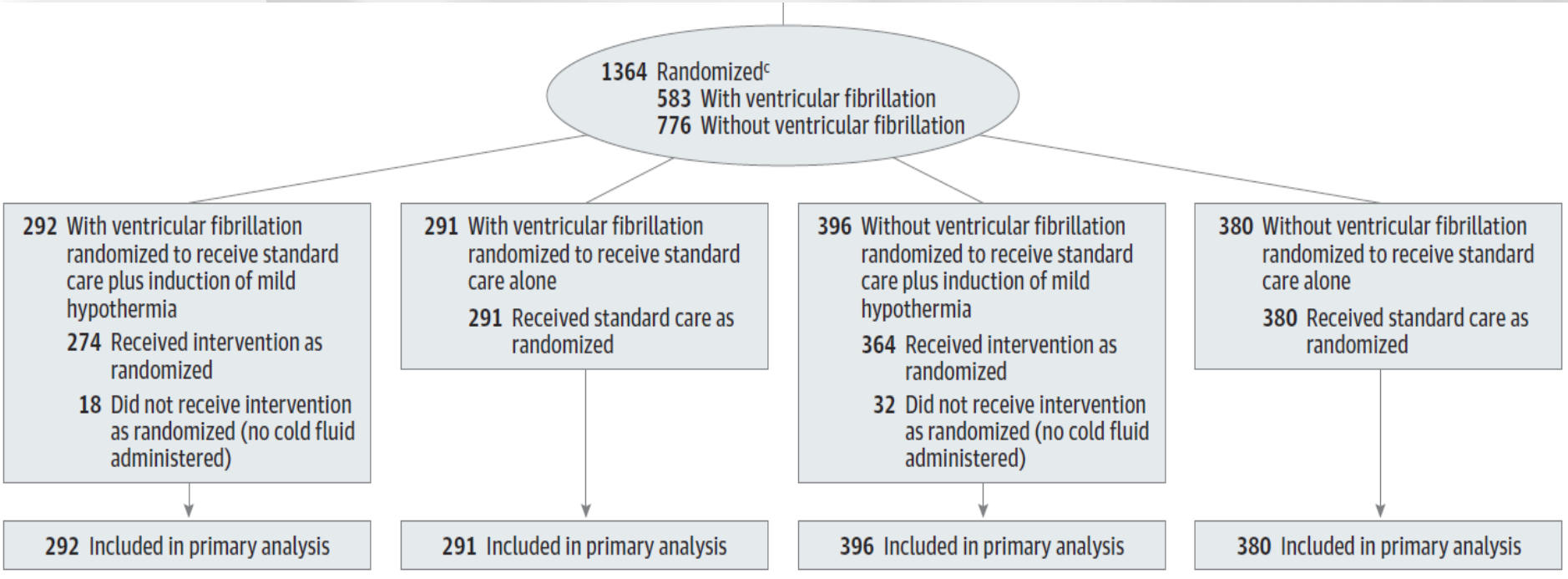
A Randomized Clinical Trial



JAMA Published online November 17, 2013

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

A Randomized Clinical Trial



JAMA Published online November 17, 2013

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

A Randomized Clinical Trial

Study Intervention

For patients randomized to the intervention group, paramedics gave up to 2 L of 4°C normal saline, 7 to 10 mg of pancuronium, and 1 to 2 mg of diazepam.[12] The saline was infused through a peripheral intravenous line, 18-gauge or larger, using a pressure bag inflated to 300 mm Hg, with a goal temperature of less than 34°C. If the patient had recurrent arrest during transport, standard resuscitation protocols were started, and the saline infusion was stopped until circulation again returned. The intervention and control groups were otherwise treated the same according to standard prehospital resuscitation protocols.

JAMA Published online November 17, 2013

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

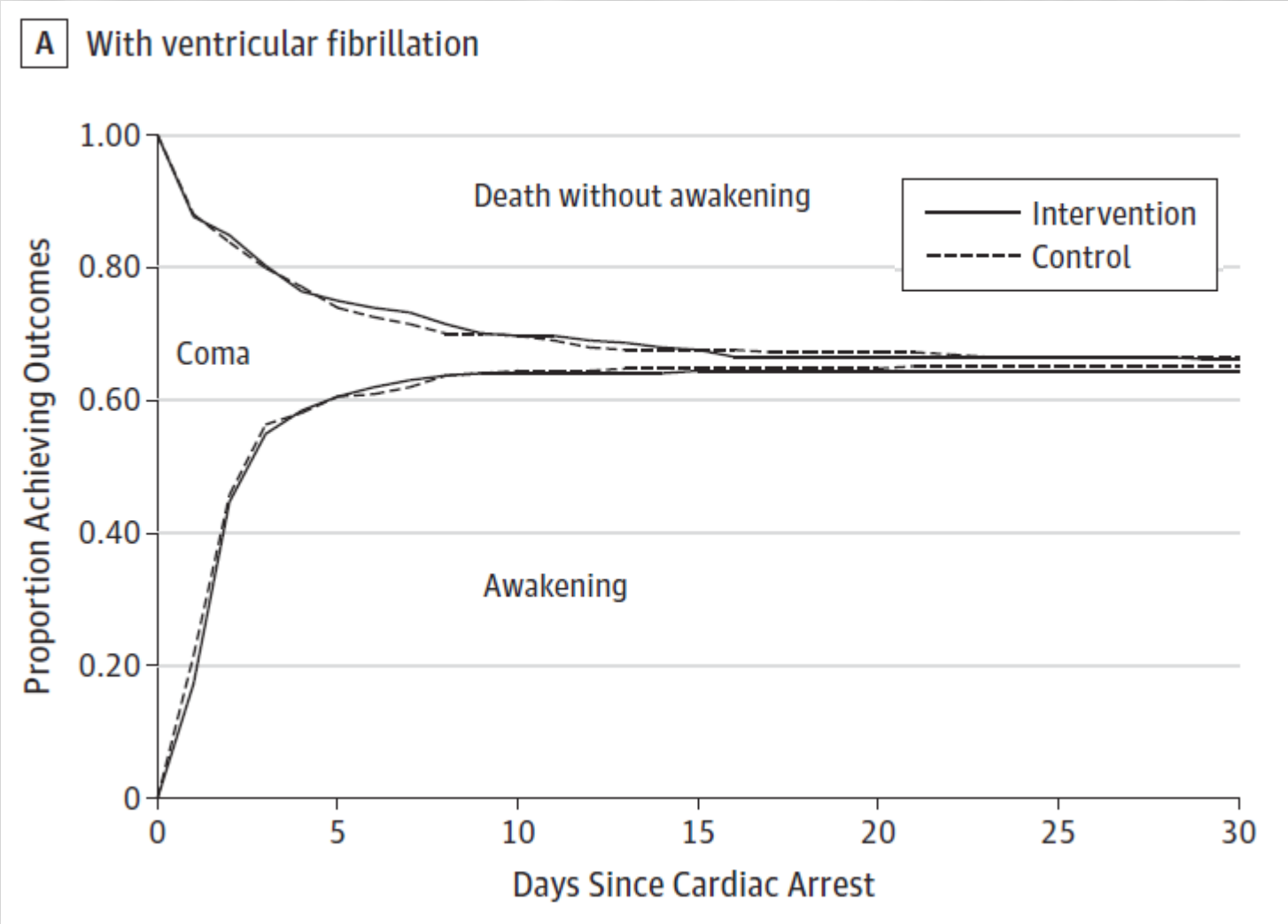
A Randomized Clinical Trial

Table 1. Baseline Characteristics of Randomized Eligible Patients (n=1359)[a]

	With Ventricular Fibrillation		Without Ventricular Fibrillation	
	Intervention (n = 292)	Control (n = 291)	Intervention (n = 396)	Control (n = 380)
Age, y	62.1 (14.2)	62.1 (15.6)	68.3 (16.3)	67.5 (16.5)
Men, No. (%)	227 (78)	217 (75)	216 (55)	205 (54)
Witnessed cardiac arrest, No. (%)	208 (71)	215 (74)	212 (54)	196 (52)
CPR before EMS arrival, No. (%)	199 (68)	186 (64)	196 (50)	200 (53)
Time from call to randomization, min	(n = 288) 32.9 (10.6)	(n = 286) 32.5 (9.5)	(n = 389) 34.4 (10.6)	(n = 373) 35.2 (12.6)
Time from call to first responder arrival, min	(n = 290) 5.3 (2.0)	(n = 291) 5.2 (2.1)	(n = 395) 5.4 (2.1)	(n = 379) 5.2 (2.1)
Sustained ROSC, No. (%)	273 (94)	274 (94)	354 (89)	343 (90)
Time from call to sustained ROSC, min	(n = 142) 25 (14)	(n = 146) 24 (13)	(n = 178) 28 (14)	(n = 159) 27 (14)
Time to first shock, min[b]	(n = 175) 9.4 (3.3)	(n = 179) 9.2 (2.5)	NA	NA
Heart rate at randomization, beats/min	(n = 284) 109 (28)	(n = 285) 113 (28)	(n = 389) 110 (30)	(n = 370) 106 (31)
Systolic blood pressure at randomization, mm Hg	(n = 271) 140 (37)	(n = 275) 144 (39)	(n = 374) 130 (43)	(n = 354) 131 (41)

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

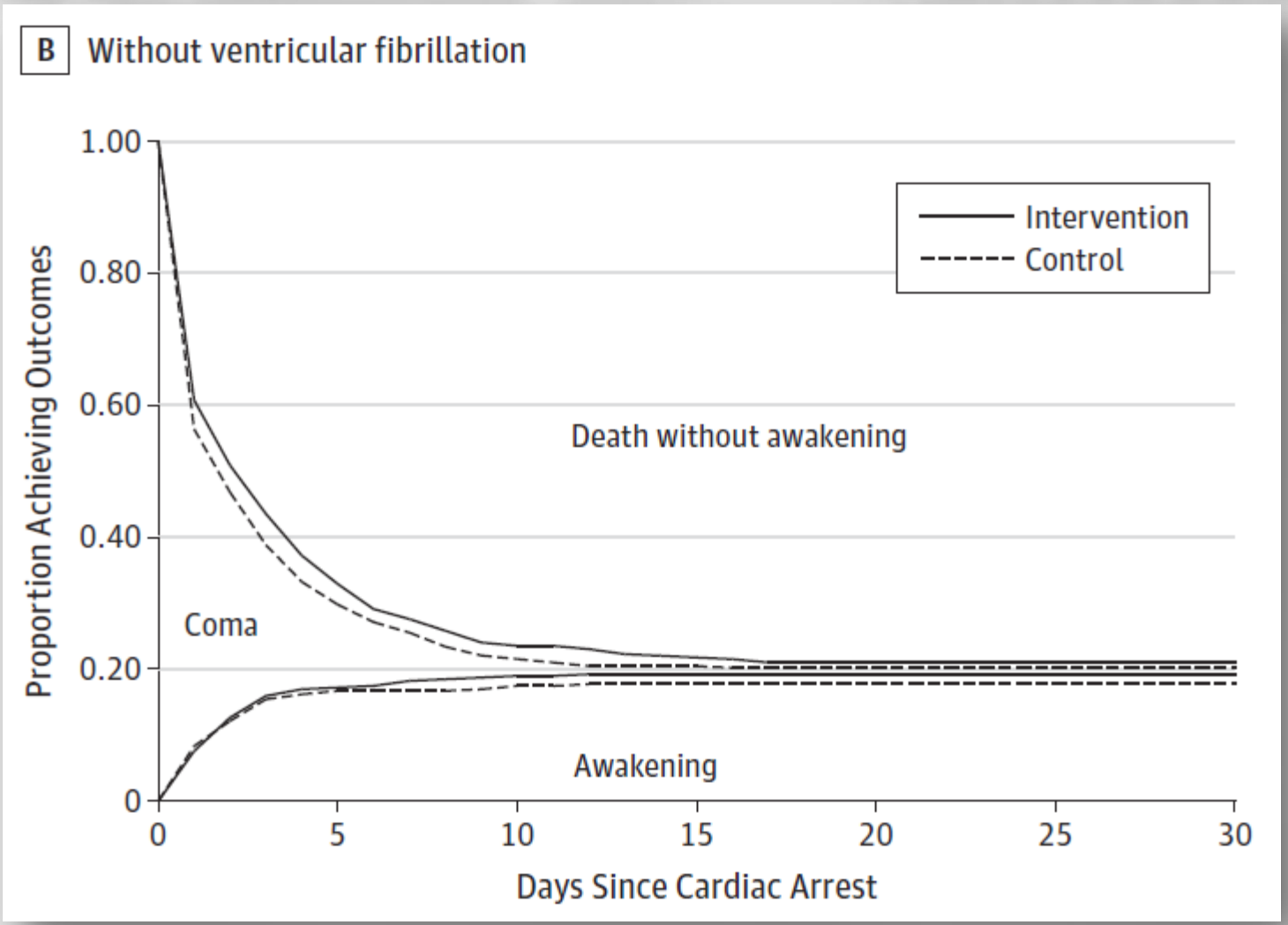
A Randomized Clinical Trial



JAMA Published online November 17, 2013

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

A Randomized Clinical Trial

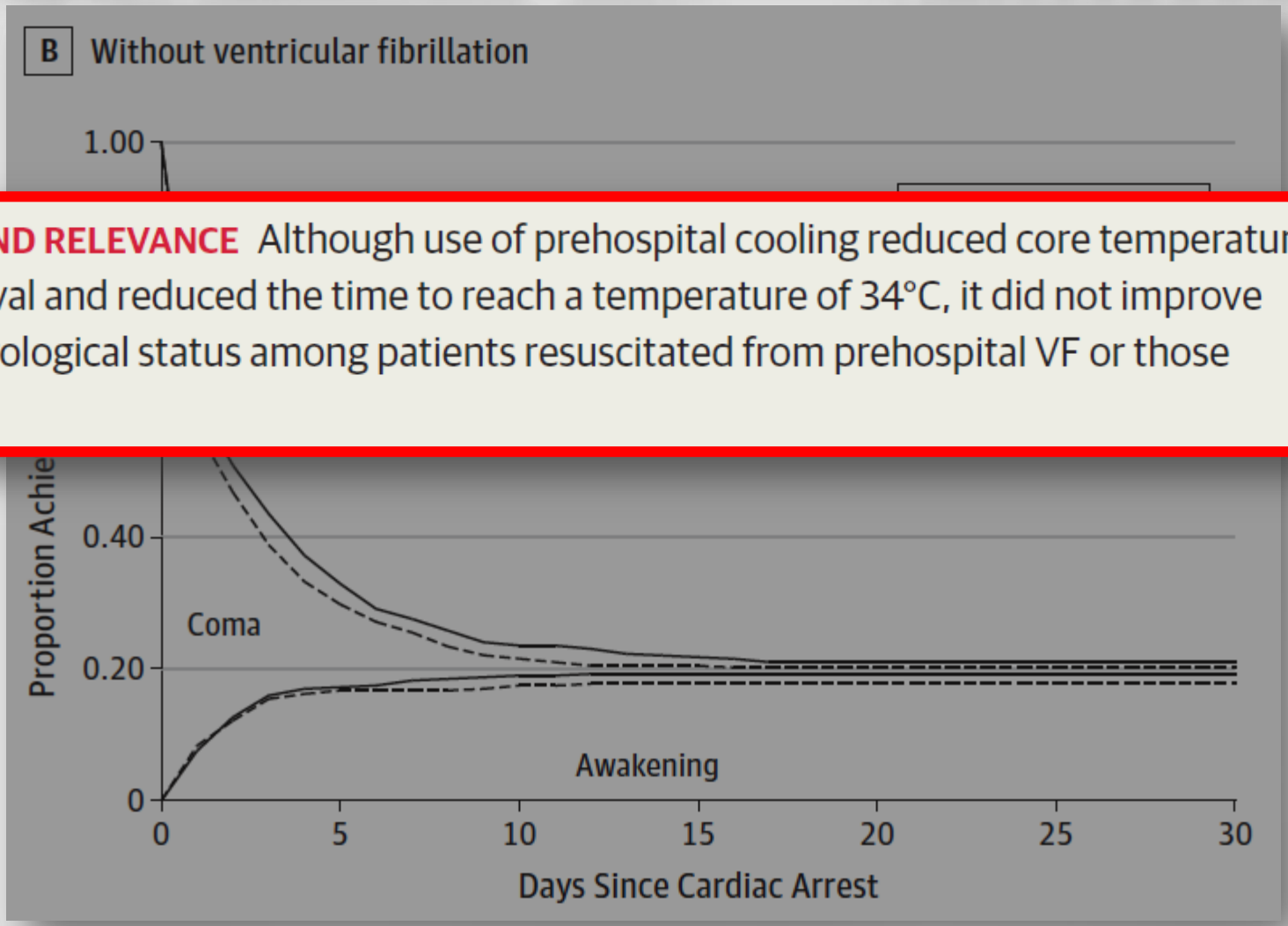


JAMA Published online November 17, 2013

agswn
28. Notfallmedizinische Jahrestagung

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

A Randomized Clinical Trial



CONCLUSION AND RELEVANCE Although use of prehospital cooling reduced core temperature by hospital arrival and reduced the time to reach a temperature of 34°C, it did not improve survival or neurological status among patients resuscitated from prehospital VF or those without VF.

JAMA Published online November 17, 2013

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., David Erlinge, M.D., Ph.D., Yvan Gasche, M.D., Christian Hassager, M.D., D.M.Sci., Janneke Horn, M.D., Ph.D., Jan Hovdenes, M.D., Ph.D., Jesper Kjaergaard, M.D., D.M.Sci., Michael Kuiper, M.D., Ph.D., Tommaso Pellis, M.D., Pascal Stammet, M.D., Michael Wanscher, M.D., Ph.D., Matt P. Wise, M.D., D.Phil., Anders Åneman, M.D., Ph.D., Nawaf Al-Subaie, M.D., Søren Boesgaard, M.D., D.M.Sci., John Bro-Jeppesen, M.D., Iole Brunetti, M.D., Jan Frederik Bugge, M.D., Ph.D., Christopher D. Hingston, M.D., Nicole P. Juffermans, M.D., Ph.D., Matty Koopmans, R.N., M.Sc., Lars Køber, M.D., D.M.Sci., Jørund Langørgen, M.D., Gisela Lilja, O.T., Jacob Eifer Møller, M.D., D.M.Sci., Malin Rundgren, M.D., Ph.D., Christian Rylander, M.D., Ph.D., Ondrej Smid, M.D., Christophe Werer, M.D., Per Winkel, M.D., D.M.Sci., and Hans Friberg, M.D., Ph.D., for the TTM Trial Investigators*

The authors' affiliations are listed in the Appendix. Address reprint requests to Dr. Nielsen at the Department of Anesthesia and Intensive Care, Intensive Care Unit, Helsingborg Hospital, S Vallgatan 5, 251 87, Helsingborg, Sweden, or at niklas.nielsen@med.lu.se.

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

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

BACKGROUND

Unconscious survivors of out-of-hospital cardiac arrest have a high risk of death or poor neurologic function. Therapeutic hypothermia is recommended by international guidelines, but the supporting evidence is limited, and the target temperature associated with the best outcome is unknown. Our objective was to compare two target temperatures, both intended to prevent fever.

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

agswn
28. Notfallmedizinische Jahrestagung

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

BACKGROUND

Unconscious survivors of out-of-hospital cardiac arrest have a high risk of death or poor neurologic function. Therapeutic hypothermia is recommended by international guidelines, but the supporting evidence is limited, and the target temperature associated with the best outcome is unknown. Our objective was to compare two target temperatures, both intended to prevent fever.

METHODS

In an international trial, we randomly assigned 950 unconscious adults after out-of-hospital cardiac arrest of presumed cardiac cause to targeted temperature management at either 33°C or 36°C. The primary outcome was all-cause mortality through the end of the trial. Secondary outcomes included a composite of poor neurologic function or death at 180 days, as evaluated with the Cerebral Performance Category (CPC) scale and the modified Rankin scale.

TOP-Paper Notfallmedizin

Prof. M. Fischer Klinik am Eichert

ALB FILS KLINIKEN

KOMPETENZ, QUALITÄT, ZUWENDUNG

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

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

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

	33°C Group (N=473)	36°C Group (N=466)
Characteristics of the cardiac arrest		

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

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

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

Characteristics of the cardiac arrest	33°C Group (N = 473)	36°C Group (N = 466)
Bystander witnessed cardiac arrest — no. (%)	420 (89)	418 (90)
Bystander performed CPR — no. (%)	344 (73)	339 (73)

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

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

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

Characteristics of the cardiac arrest	33°C Group (N = 473)	36°C Group (N = 466)
Bystander witnessed cardiac arrest — no. (%)	420 (89)	418 (90)
Bystander performed CPR — no. (%)	344 (73)	339 (73)
Time from cardiac arrest to event — min†		
Start of basic life support		
Median	1	1
Interquartile range	0–2	0–2

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

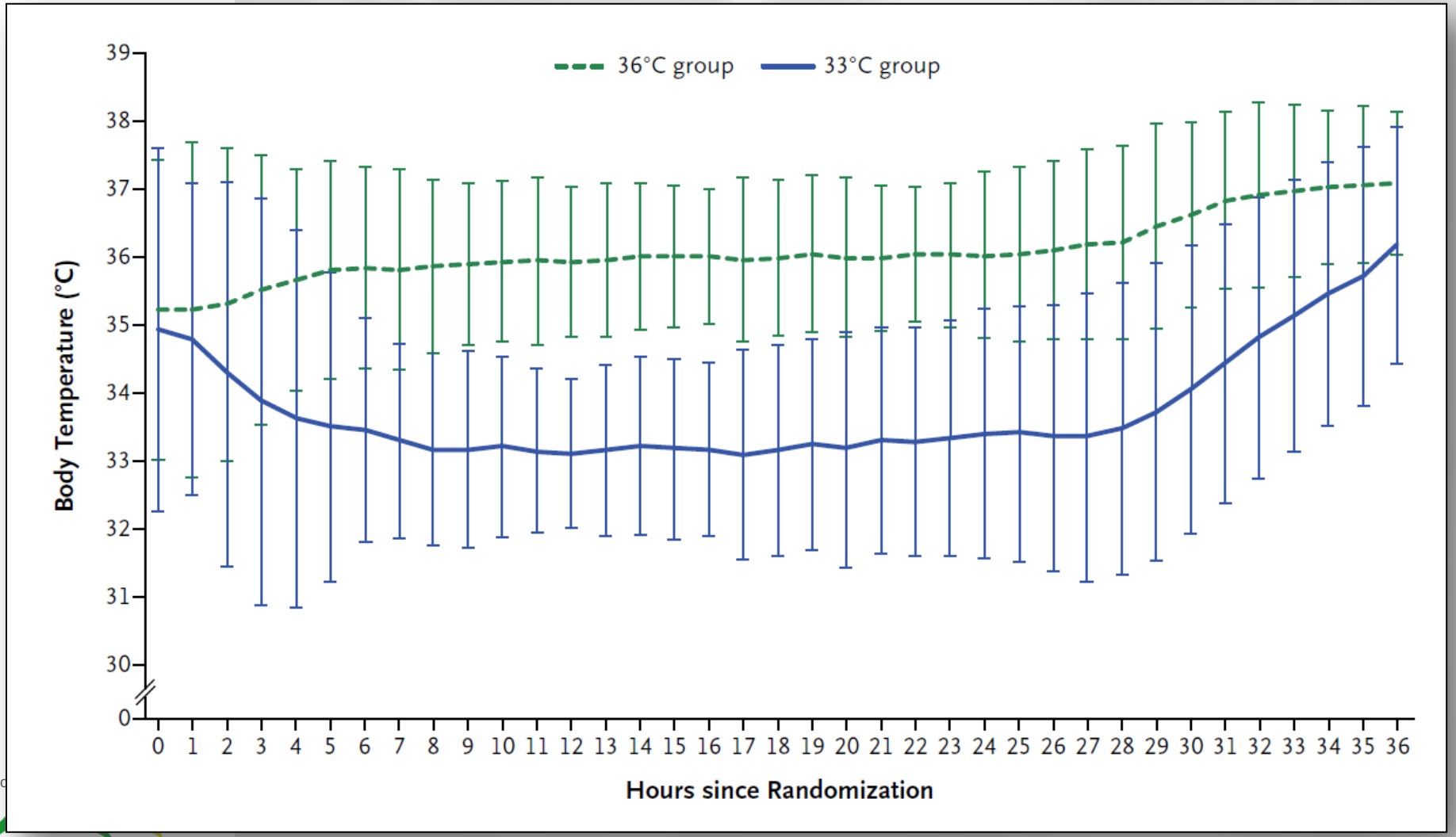
Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest

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

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)

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

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



November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

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

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

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

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

Table 2. Outcomes.

Outcome	33°C Group	36°C Group	Hazard Ratio or Risk Ratio (95% CI)*	P Value
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

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.)

November 17, N Engl J Med 2013; DOI: 10.1056/NEJMoa1310519

agswn
28. Notfallmedizinische Jahrestagung

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Prof. Dr. Michael Holzer
PD. Dr. Jasmin Arrich
Prof. Dr. Wilhelm Behringer
Prof. Dr. MSc. Harald Herkner
Prof. Dr. Fritz Sterz
Universitätsklinik für Notfallmedizin
Medizinische Universität Wien
michael.holzer@meduniwien.ac.at

INTENSIV-NEWS Nr. 1, 2014

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Tabelle 1: Unterschiede in den Ein-/Auschlusskriterien zwischen der HACA-Studie *(The Hypothermia after Cardiac Arrest Study Group, N Engl J Med 2002; 346:549)* **und dem TTM-Trial** *(Nielsen N; N Engl J Med 2013; 369:2197)*

	HACA	TTM
Alter <75 Jahre	Y	n
Schockbarer Rhythmus	Y	n
Beobachteter Kreislaufstillstand	y	n
Zeit vom Kollaps bis zum Beginn erster CPR-Maßnahmen 5-15 min	y	n
Zeit vom Kollaps bis zum Wiedererlangen des Kreislaufs nicht länger als 60 min	y	n
Zeit von ROSC bis Screening nicht mehr als 240 min	n	y
MAP unter 60 mmHg mehr als 30 min vor Beginn der Kühlung	y	n
SaO_2 unter 85% mehr als 15 min vor Beginn der Kühlung	y	n

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Tabelle 2: Baseline-Unterschiede zwischen der HACA-Studie *(The Hypothermia after Cardiac Arrest Study Group, N Engl J Med 2002; 346:549)* **und dem TTM-Trial** *(Nielsen N; N Engl J Med 2013; 369:2197)*

	HACA		TTM	
	Hypothermie	Normothermie	33°C	36°C
Basisreanimation (%)	43	49	73	73
Kammerflimmern (%)	97	96	74	77
Kollaps bis Start CPR (min)	5 (2-7)	5 (2-8)	1 (0-2)	1 (0-2)
Zeit bis ROSC (min)	21 (15-28)	22 (17-33)	25 (18-40)	25 (16-40)
Laktat (mmol/l)	8.1 ± 4.2	9.1 ± 4.1	6.7 ± 4.5	6.7 ± 4.5
Pupillen reaktiv (%)	53	47	75	79

CPR, Cardiopulmonale Reanimation; ROSC, Wiedererlangen eines Spontankreislaufs

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Tabelle 2: Baseline-Unterschiede zwischen der HACA-Studie *(The Hypothermia after Cardiac Arrest Study Group, N Engl J Med 2002; 346:549)* **und dem TTM-Trial** *(Nielsen N; N Engl J Med 2013; 369:2197)*

	HACA		TTM	
	Hypothermie	Normothermie	33°C	36°C
Basisreanimation (%)	43	49	73	73
Kammerflimmern (%)	97	96	74	77
Kollaps bis Start CPR (min)	5 (2-7)	5 (2-8)	1 (0-2)	1 (0-2)
Zeit bis ROSC (min)	21 (15-28)	22 (17-33)	25 (18-40)	25 (16-40)
Laktat (mmol/l)	8.1 ± 4.2	9.1 ± 4.1	6.7 ± 4.5	6.7 ± 4.5
Pupillen reaktiv (%)	53	47	75	79

CPR, Cardiopulmonale Reanimation; ROSC, Wiedererlangen eines Spontankreislaufs

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Tabelle 2: Baseline-Unterschiede zwischen der HACA-Studie *(The Hypothermia after Cardiac Arrest Study Group, N Engl J Med 2002; 346:549)* **und dem TTM-Trial** *(Nielsen N; N Engl J Med 2013; 369:2197)*

	HACA		TTM	
	Hypothermie	Normothermie	33°C	36°C
Basisreanimation (%)	43	49	73	73
Kammerflimmern (%)	97	96	74	77
Kollaps bis Start CPR (min)	5 (2-7)	5 (2-8)	1 (0-2)	1 (0-2)
Zeit bis ROSC (min)	21 (15-28)	22 (17-33)	25 (18-40)	25 (16-40)
Laktat (mmol/l)	8.1 ± 4.2	9.1 ± 4.1	6.7 ± 4.5	6.7 ± 4.5
Pupillen reaktiv (%)	53	47	75	79

CPR, Cardiopulmonale Reanimation; ROSC, Wiedererlangen eines Spontankreislaufs

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Tabelle 2: Baseline-Unterschiede zwischen der HACA-Studie *(The Hypothermia after Cardiac Arrest Study Group, N Engl J Med 2002; 346:549)* **und dem TTM-Trial** *(Nielsen N; N Engl J Med 2013; 369:2197)*

	HACA		TTM	
	Hypothermie	Normothermie	33°C	36°C
Basisreanimation (%)	43	49	73	73
Kammerflimmern (%)	97	96	74	77
Kollaps bis Start CPR (min)	5 (2-7)	5 (2-8)	1 (0-2)	1 (0-2)
Zeit bis ROSC (min)	21 (15-28)	22 (17-33)	25 (18-40)	25 (16-40)
Laktat (mmol/l)	8.1 ± 4.2	9.1 ± 4.1	6.7 ± 4.5	6.7 ± 4.5
Pupillen reaktiv (%)	53	47	75	79

CPR, Cardiopulmonale Reanimation; ROSC, Wiedererlangen eines Spontankreislaufs

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Tabelle 2: Baseline-Unterschiede zwischen der HACA-Studie
(The Hypothermia after Cardiac Arrest Study Group, N Engl J Med 2002; 346:549)
und dem TTM-Trial *(Nielsen N; N Engl J Med 2013; 369:2197)*

Die Patienten in der TTM-Studie waren offensichtlich durch den Herz-Kreislauf-Stillstand weniger geschädigt, was auch die höhere Rate an gutem neurologischen Outcome von 48% in der 36°C-Gruppe im Vergleich zur Normothermiegruppe der HACAStudie zeigt (39%).

Patienten mit einem sehr kurzen Zeitintervall zwischen Kollaps und Reanimation scheinen eben weniger von TTM zu profitieren als Patienten mit längeren Stillstandszeiten *(Testori C; Resuscitation 2012; 83:596)*.

CPR, Cardiopulmonale Reanimation; ROSC, Wiedererlangen eines Spontankreislaufs

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Tabelle 2: Baseline-Unterschiede zwischen der HACA-Studie *(The Hypothermia after Cardiac Arrest Study Group, N Engl J Med 2002; 346:549)* und dem TTM-Trial *(Nielsen N; N Engl J Med 2013; 369:2197)*

Durch die fehlende Standardisierung der Kühltherapie und nur in geringem Maße Verwendung eines modernen Kühlgeräts wurde die geplante Therapie (36°C vs. 33°C) nur sehr mangelhaft umgesetzt.

Das 95%-Konfidenzintervall der Temperaturkurven lag zwischen 2°C und 6°C, die Temperaturkurven separierten sich erst etwa 8 Stunden nach Beginn der Kühlung. Wenn man nun einberechnet, dass ein Einschluss in die Studie bis zu 4 Stunden nach Wiedererlangung eines Spontankreislaufs möglich war, hatten die Patienten in beiden Gruppen während der ersten 10 bis 12 Stunden keine unterschiedlichen Temperaturen.

Dass durch diese fehlende Differenzierung keine großen Unterschiede im Outcome zu erwarten sind, liegt auf der Hand.

Sollen wir komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin kühlen?

Tabelle 2: Baseline-Unterschiede zwischen der HACA-Studie *(The Hypothermia after Cardiac Arrest Study Group, N Engl J Med 2002; 346:549)* und dem TTM-Trial *(Nielsen N; N Engl J Med 2013; 369:2197)*

Zusammenfassend sind wir der Meinung, dass komatöse Patienten nach einem Herz-Kreislauf-Stillstand weiterhin aktiv gekühlt werden sollen.

Dies sollte insbesondere dann erfolgen, wenn der Kreislaufstillstand beobachtet außerhalb des Krankenhauses aufgetreten ist, der primäre Rhythmus Kammerflimmern war, oder eine lange Zeitdauer vom Kollaps bis zum Einsetzen der ersten Reanimationsmaßnahmen erhoben wurde.

Unter Berücksichtigung der unterschiedlichen Ein- und Ausschlusskriterien des TTM-Trials und der HACA-Studie sollten diese Patienten auf eine Zieltemperatur von 33°C über 12 bis 24 Stunden gekühlt werden.

Alle anderen komatösen Patienten nach einem Herz-Kreislauf-Stillstand sollten bis zum Vorliegen weiterer Daten zumindest auf 36°C über 24 Stunden gekühlt werden.

Pressemitteilung der DGIIN zum Temperaturmanagement nach Reanimation

Im Jahre 2002 wurden im *New England Journal of Medicine* 2 Studien publiziert, die zeigten dass eine milde therapeutische Hypothermie das Outcome nach einer überlebten Reanimation außerhalb des Krankenhauses verbessert. Daraufhin wurde die milde Hypothermietherapie in die entsprechenden Leitlinien als Empfehlung aufgenommen.
In einer von Nielsen et al. publizierten multizentrischen Studie wurden 939 Patienten nach einem Herz-Kreislauf-Stillstand außerhalb des Krankenhauses auf 33°C abgekühlt oder auf einer Temperatur von 36°C gehalten. Bezüglich der untersuchten Endpunkte Mortalität und neurologische Defizite unterschieden sich die beiden Gruppen zum Ende des Beobachtungszeitraumes nicht signifikant. Nach 180 Tagen waren 54% der 33°C Gruppe und 52% der 36°C Gruppe verstorben oder hatten eine schlechte neurologische Funktion (risk ratio 1,02; 95% CI, 0,88-1,16; p=0,78).
Die Ergebnisse der Studie haben zu Diskussion bezüglich des Stellenwertes der Hypothermietherapie bei reanimierten Patienten geführt. Es muss jedoch beachtet werden, dass die untersuchten Populationen in den Studien deutlich different sind. So lag der Anteil von Patienten mit stattgehabter Laienreanimation in der neueren Studie bei über 70% und der Beginn der Reanimationsmaßnahmen erfolgte im Median nach 1 Minute.

Die Deutsche Gesellschaft für Internistische Intensivmedizin und Notfallmedizin (DGIIN) empfiehlt bis zum Vorliegen weiterer Studienergebnisse, bewusstlose Erwachsene mit spontaner Zirkulation nach präklinischem Kammerflimmern nach wie vor für 12–24 Stunden auf 32–34°C zu kühlen.
Zudem sollte bei allen bewusstlosen Patienten nach einem Herzkreislaufstillstand eine Zieltemperatur von 36 °C aktiv angestrebt werden. Erhöhte Temperaturen sind in jedem Fall zu vermeiden.

REANIMATIONSREGISTER.DE

Login ONLINE-DATENERFASSUNG | Demo ONLINE-DATENERFASSUNG

Direktlinks
- DGAI
- Online-Datenerfassung
- Demo Online-Datenerfassung
- Bad Boller Reanimationsgespräche

Organisation
- Information
- Geschichte
- Geschäftsordnung
- Teilnehmer
- Partner/Unterstützer

Anmeldung
- Information
- Anmeldeformulare

Datenerfassung
- Information
- Papiererfassung
- Web-Eingabe
- Import/Export
- FAQ

Notfallteam Dokumentation
- Information
- Protokoll Download

Datensätze

10 Thesen für 10.000 Leben - Bad Boller Reanimationsgespräche

22. Januar 2014, Bad Boll: Wie kann man die Notfallversorgung für Patienten mit Herzstillstand so optimieren, dass in Zukunft jährlich 10.000 Patienten mehr nach einer Reanimation überleben? Dieser Frage gingen 52 Experten Anfang des Jahres gemeinsam in Bad Boll nach. In Gesprächsrunden und Diskussionen erarbeiteten sie die Antworten und fassten diese in 10 Thesen für 10.000 Leben zusammen.