Resuscitation (2007) **72**, 207—213

ELSEVIER

RESUSCITATION

www.elsevier.com/locate/resuscitation

CLINICAL PAPER

Mild therapeutic hypothermia after cardiac arrest—A nationwide survey on the implementation of the ILCOR guidelines in German intensive care units☆

Sebastian Wolfrum[a,*], Peter W. Radke[a], Tobias Pischon[b,c], Stefan N. Willich[c], Heribert Schunkert[a], Volkhard Kurowski[a]

[a] *Medical Clinic II, University of Schleswig-Holstein, Campus Lübeck, Ratzeburger Allee 160, 23538 Lübeck, Germany*
[b] *Department of Epidemiology, German Institute of Human Nutrition, Potsdam-Rehbruecke, Germany*
[c] *Institute of Social Medicine, Epidemiology, and Health Economics, Charité University Medical Centre, Berlin, Germany*

Received 23 February 2006; received in revised form 21 June 2006; accepted 21 June 2006

KEYWORDS
Advanced life support (ALS);
Cardiac arrest;
Cardiopulmonary resuscitation (CPR);
Out-of-hospital CPR;
Sudden cardiac death

Summary
Aim: To investigate the implementation of mild therapeutic hypothermia (MTH) after cardiac arrest into clinical practice.
Methods and results: A structured evaluation questionnaire was sent to all German hospitals registered to have ICUs; 58% completed the survey. A total of 93 ICUs (24%) reported to use MTH. Of those, 93% started MTH in patients after out-of-hospital resuscitation with observed ventricular fibrillation and 72% when other initial rhythms were observed. Only a minority of ICUs initiate MTH in patients after cardiac arrest with cardiogenic shock (28%), whereas 48% regarded cardiogenic shock as a contra-indication for MTH. On average, target temperature was $33.1 \pm 0.6\,^{\circ}C$ and duration of cooling 22.9 ± 4.9 h. Many centres used economically priced cold packs (82%) and cold infusions (80%) for cooling. The majority of the ICUs considered infection, hypotension and bleeding as relevant complications of hypothermia which was of therapeutic relevance in less than 25% of the cases.
Conclusions: MTH is underused in German ICUs. Centres which use MTH widely follow the recommendations of ILCOR with respect to the indication and timing of cooling. In hospitals that use MTH the technique is considered to be safe and inexpensive. More efforts are needed to promote this therapeutic option and hypothermia since MTH has now been included into European advanced cardiovascular life support protocols.

☆ A Spanish translated version of the summary of this article appears as Appendix in the final online version at 10.1016/j.resuscitation.2006.06.033.

* Corresponding author. Tel.: +49 451 500 2421; fax: +49 451 500 2363.
E-mail address: Sebastian.Wolfrum@uk-sh.de (S. Wolfrum).

0300-9572/$ — see front matter © 2006 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.resuscitation.2006.06.033

Introduction

Cardiac arrest is a major cause of death in industrialised countries.[1] In Europe, the incidence of cardiac arrest treated by emergency medical services (EMS) is 38 per 100,000 person years. This can be translated into 275,000 cardiac arrests treated annually by EMS in European countries. Overall survival was reported to be 10.7%.[2] Besides a high mortality, the neurological outcome of patients who were resuscitated successfully after cardiac arrest is poor. Two larger randomised studies have been conducted to evaluate the effects of mild therapeutic hypothermia on mortality and the neurological outcome in patients after cardiac arrest and ventricular fibrillation as the initial rhythm.[3,4]

In both studies (275 and 77 patients, respectively) patients who received hypothermia experienced a significantly better outcome. In the HACA trial[4] the odds ratio for a favourable neurological outcome after 6 months was 1.40 (95% confidence interval 1.08—1.81; $P = 0.009$) when the hypothermia group was compared to the normothermic control group. In the study by Bernard et al.[3] the odds ratio was 2.65 (95% confidence interval, 1.02—6.88; $P = 0.046$).

Based on these two studies, the Advanced Life Support Task Force of the International Liaison Committee on Resuscitation (ILCOR) published an advisory statement in 2003 recommending the use of mild therapeutic hypothermia in unconscious adult patients with spontaneous circulation after out-of-hospital cardiac arrest when the initial rhythm was ventricular fibrillation.[5]

However, so far there are no published data available on the implementation of these recommendations into clinical practice in European populations. We, therefore, conducted a nationwide survey in Germany to examine the use of MTH in German intensive care units (ICUs), to determine the reasons for non-use and to analyse the methods and side effects of MTH.

Methods

Addresses of all registered German hospitals providing intensive care units ($n = 735$) were obtained from the websites of the 16 federal hospital associations in Germany. A structured evaluation questionnaire addressed to the heads of the ICUs was sent by e-mail and fax. From August 2005 to November 2005 hospitals were approached up to five times in order to receive data on the use of MTH. Data collection ended in November 2005. The survey addressed the structure of the hospitals, the use of hypothermia after cardiac arrest and the methods employed, the side effects observed and the reasons why hypothermia was not used. At the request of the ICUs, analysis of the questionnaire was performed anonymously.

The characteristics of hospitals were compared between MTH users and non-users by the Chi-square test and by calculating odds ratios and 95% confidence intervals. All *P*-values presented are two-tailed and *P*-values below 0.05 were considered statistically significant. All analyses were performed using SAS 9.1 (SAS Institute, Cary, NC).

Results

Data retrieval

Completed data were obtained from 428 out of 735 hospitals (58%). Since some hospitals operated more than one ICU, a total of 453 questionnaires were returned. Fifty-eight ICUs declared that they did not treat resuscitated patients acutely after cardiac arrest and were therefore excluded from further analysis.

Use of MTH and reasons for non-use

From the remaining 395 ICUs, only 23.5% used MTH as a therapeutic option for patients after cardiac arrest. Results of the use of MTH after cardiac arrest in these hospitals and the reasons against the use are listed in Table 1.

Factors influencing the use of mild therapeutic hypothermia after cardiac arrest

The type of hospital had a significant impact on the use of MTH after cardiac arrest (Figure 1A). University and affiliated hospitals used MTH significantly more often than other hospitals (odds ratio 3.98; 95% confidence interval 2.35—6.72; $P < 0.001$).

As shown in Figure 1B the size of the ICU was related to the use of MTH after cardiac arrest. MTH was significantly underused in smaller ICUs (odds ratio 2.81; 95% confidence interval 1.73—4.57; $P < 0.001$).

Furthermore, the specialty of the ICU team was related to the use of MTH (Figure 1C), since internal medicine physicians applied this method significantly than often than anaesthesiologists (odds ratio 1.92; 95% confidence interval 1.17—3.14; $P < 0.001$).