COMMENTARY

Implementation of therapeutic hypothermia guidelines for post-cardiac arrest syndrome at a glacial pace: Seeking guidance from the knowledge translation literature

Steven C. Brooks*, Laurie J. Morrison

Division of Emergency Medicine, Department of Medicine, University of Toronto, Canada

Received 8 November 2007; received in revised form 13 December 2007; accepted 2 January 2008

KEYWORDS
Cardiac arrest; Guidelines; Hypothermia; Knowledge translation

Summary The 2005 International Liaison Committee on Resuscitation (ILCOR) Consensus on Science and Treatment Recommendations document represents the most extensive and rigorous systematic review of the resuscitation literature to date and included evidence-based recommendations for post-resuscitation care. A new recommendation for the induction of mild therapeutic hypothermia for comatose cardiac arrest survivors was included in this document. Accordingly, constituent national member associations of ILCOR, including the American Heart Association, incorporated the recommendation for therapeutic hypothermia into their respective guidelines. Despite these endorsements there is a concern that therapeutic hypothermia is not being used in practice. Data from a number of surveys in Europe and the United States suggest that rates of use among physicians may be as low as 30—40%. Despite the cost and effort associated with the production of these guidelines and the potential impact on patient care, current efforts in implementing the guideline have not achieved widespread success. This commentary explores the issue of underutilization of the American Heart Association guidelines for therapeutic hypothermia and looks to the knowledge translation literature to inform a new approach to implementation. We will review the underlying phenomenon of research implementation into practice, specific barriers to guideline implementation and interventions that may improve therapeutic hypothermia uptake.

© 2008 Elsevier Ireland Ltd. All rights reserved.

Introduction

The clinical application of therapeutic hypothermia in cardiac arrest victims has been recognized since the 1950s. Contemporary use is supported by three recent RCTs and a meta-analysis of individual patient data demonstrating improved neurologically intact survival to hospital...
discharge with the use of mild therapeutic hypothermia. As compared with no therapeutic hypothermia, the number needed to treat to allow one more patient to be discharged from hospital with a more favourable Cerebral Performance Category (CPC) of 1 or 2 is estimated to be between 4 and 13 with 95% confidence.

Convinced about the quality and potential impact of the data from these studies, the International Liaison Committee on Resuscitation (ILCOR) Advanced Life Support Task Force released an advisory statement 2 years ahead of the formal guidelines process recommending the use of therapeutic hypothermia for cardiac arrest patients who regain a pulse but remain comatose. In 2005, the ILCOR consensus on Science and Treatment Guidelines document was published. This represents the most extensive and rigorous systematic review of the resuscitation literature to date and included evidence-based recommendations for post-resuscitation care. Their formal recommendation echoed and included evidence-based recommendations for post-resuscitation hypothermia.

Theoretical processes of guideline implementation

The current implementation process for the AHA emergency cardiovascular care guidelines resonates with the model proposed by Haines and Jones. This linear model proposes that evidence is first produced with original research which is then synthesized into a variety of formats. Next, guidelines are developed based on the synthesized data, continuing medical education programs are developed from the guidelines and then general adoption of the guidelines occurs. However, this model of guideline implementation can be criticized for its oversimplification of a complex underlying knowledge translation phenomenon. We briefly discuss two alternative models of changing clinical behavior to highlight the potential impact of practitioner cognition and contextual influences.

Pathman proposes the awareness—agreement—adoption—adherence model. In his sequential model, the assumption is that a practitioner must be aware of the guideline before she agrees, must agree before she adopts, and similarly must adopt before she adheres. The framework suggests that implementation problems can be localized along this continuum and strategies can be tailored to that particular cognitive attribute. Pathman also discovers, however, that contextual factors such as peer pressure, malpractice fears, patient demand, community norms and practice organization policies can modify the link between cognitive processes of implementation and actual physician behavior.

In his analysis, Lomas elaborates on sources of influence which compete with guidelines in clinical decision-making. He demonstrates that even high quality, readily available, evidence-based guidelines are only a single contributor to the sum total of influence on a clinician when making decisions. Specific influences observed by Lomas include informal education through colleagues, contact with influencers, economic incentives and disincentives, patient pressure created by the mass media, and personal psychological issues.

These theoretical frameworks suggest that any comprehensive plan to implement clinical strategies must include a holistic consideration of potential organizational factors such as financial and legal incentives or disincentives, social networking factors such as clinician interaction and information-sharing, and the influence of patient, family or community pressures on individual clinicians.

Specific strategies for changing clinical practice

There are many approaches to changing clinical practice. Table 1 summarizes a selection of these approaches and some specific intervention types typically associated with each approach. The most recent systematic review of strategies for changing clinical practice identified 235 studies making 309 comparisons. The majority of interventions were found to have a modest to moderate improvement in performance. The most effective single interventions with respect to performance improvement were reminders (14.1%), dissemination of educational materials (8.1%), audit and feedback (7%) and educational outreach (6%).

Knowing that most interventions have consistently shown at least a modest effect, and that contextual issues are important in determining the success of implementation, it seems that a situation-specific, tailored approach to choosing interventions is reasonable. In the next section, we apply this approach to the specific problem of the AHA guideline for therapeutic hypothermia and create an intervention strategy, targeting multiple potential barriers with multiple interventions.
Table 1  Theoretical approaches to changing clinical behavior

<table>
<thead>
<tr>
<th>Approach</th>
<th>Fundamental premise</th>
<th>Typical intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Educational</td>
<td>• Change is driven from practitioner’s internal striving for professional competence</td>
<td>• Problem-based learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Traditional didactic sessions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dissemination of educational materials</td>
</tr>
<tr>
<td>2. Epidemiological</td>
<td>• Humans are rational beings who will make decisions based on consideration of existing evidence</td>
<td>• Synthesis of evidence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Creation and dissemination of systematic reviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Guideline development from a credible source</td>
</tr>
<tr>
<td>3. Marketing</td>
<td>• Attractive knowledge products tailored to the needs of the user will encourage behavior change</td>
<td>• Mass media campaigns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Opinion leaders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Manipulation of the social network</td>
</tr>
<tr>
<td>4. Behavioral</td>
<td>• All behavior change is due to external stimuli which occur before or after an action</td>
<td>• Audit and performance review</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Immediate feedback</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reminders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monetary sanctions or incentives</td>
</tr>
<tr>
<td>5. Social interaction</td>
<td>• Interaction with important people in the social network is influential</td>
<td>• Opinion leaders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Outreach educational visits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Peer review</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Support in small interprofessional groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Creating pressure for change from within the patient group</td>
</tr>
<tr>
<td>6. Organizational</td>
<td>• Lack of quality care is a systems issue, not a problem with the individual practitioner</td>
<td>• Identify and modify systems issues that hinder quality care and improvement</td>
</tr>
<tr>
<td>7. Coercive</td>
<td>• Enforced rules and incentives change behavior</td>
<td>• Laws, by-laws</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regulations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Licensing requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Accreditation requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Financial pressures (incentive or disincentive)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Utilization reviews</td>
</tr>
</tbody>
</table>

Linking interventions with specific barriers for therapeutic hypothermia

Cabana et al.²² propose a useful framework to identify and address barriers to guideline implementation and conceptualize barrier-specific strategies to improve therapeutic hypothermia implementation. These are discussed in the paragraphs below and summarized in Table 2.

Barriers to changing knowledge

Lack of awareness and familiarity

Taking advantage of the educational approach and the well-established CPR training courses, the therapeutic hypothermia component of the guidelines should be a highlighted, core component of the curriculum. A stepwise post-cardiac arrest algorithm, similar to those currently in use for cardiac arrest and pre-arrest conditions (e.g. pulseless arrest algorithm, tachycardia algorithm, bradycardia algorithm), should be created with therapeutic hypothermia as a central feature. Marketing and behavioral strategies might include the use of reminder posters in strategic locations (crash carts, resuscitation rooms, critical care units, etc.), standardized order sheets with integrated cooling protocols, and the targeted distribution of algorithm cards to acute care practitioners. An effort to recruit local champions to tailor small group and interactive education seminars as well as learning opportunities with credible experts could improve awareness and give meaning to therapeutic hypothermia algorithms and reminders.

Barriers to changing attitudes

Lack of agreement

Survey data show that lack of agreement with the guidelines is a factor in underutilization.¹¹,¹²,²³ The reason for lack of agreement is not clear, but may pertain to the relatively small number of patients studied within randomized controlled trials (N = 384 patients),⁴ to the paucity of data on long-term outcomes,⁵ concerns over adverse effects,⁷ and questions over the generalizability of the guidelines for non-VF and in-hospital cardiac arrest survivors. Addressing
## Table 2: Barriers and knowledge translation interventions to improve therapeutic hypothermia implementation for post-cardiac arrest syndrome

<table>
<thead>
<tr>
<th>General barrier category</th>
<th>Specific barriers in therapeutic hypothermia implementation</th>
<th>Barrier-specific interventions</th>
</tr>
</thead>
</table>
| Lack of awareness and familiarity | • Lack of awareness of guidelines and protocols for therapeutic hypothermia | • Add post-resuscitation protocol highlighting hypothermia to currently available advanced cardiac life support algorithms  
• Reminder posters and standard order sheets  
• Tailored education by local champions |
| Lack of agreement | • Skepticism of supporting evidence  
• Small numbers of patients in RCTs  
• Paucity of data on long-term outcomes  
• Concerns over adverse effects  
• Unclear generalizability to all cardiac arrest patients | • Identify sources of disagreement  
• Gather more evidence  
• Target misconceptions with evidence-based commentary  
• Incorporate corrective information into CPR course material  
• Local opinion leaders  
• Educational outreach |
| Lack of self-efficacy | • Physicians do not believe they can effectively cool patients within a reasonable time  
• Uncertainty over procedural steps  
• Perceived lack of time and resources | • Create and use simple cooling algorithms embedded in clinical practice (e.g. standard order sheets)  
• Simulations training with local champions  
• Provide troubleshooting support  
• Showcase examples of successful cooling to local groups  
• Organizational facilitation of cooling |
| Lack of outcome expectancy | • Lack of belief that therapeutic hypothermia will improve outcome for individual patients  
• General attitude of futility for comatose cardiac arrest patients | • Foster attitudinal change  
• Educational outreach  
• Local champions  
• Case presentation of locally treated patients with good outcome |
| Inertia of previous practice | • Entrenched behavior with respect to post-resuscitative care is difficult to change  
• Individual clinician stage of behavior change may affect impact of implementation interventions | • Acknowledge and incorporate stages of behavior stage into any implementation roll-out strategy  
• Recognize some individuals may be more or less responsive to certain interventions depending on their stage of behavior change |
| Guideline-related barriers | • Hypothermia guidelines lack concrete cooling protocols | • Incorporate basic cooling algorithms into guidelines and guidelines-related course material |
| Interprofessional barriers | • Multiple clinical groups must "buy in" and collaborate for therapeutic hypothermia to be successfully implemented | • Interprofessional education  
• Interprofessional simulation training  
• Local champions and opinion leaders from a variety of clinical backgrounds (e.g. emergency medicine, critical care, nursing) |

The issue of agreement is complicated in that it requires a judgment on whether the existing evidence is sufficient. Is the lack of agreement based on a real deficiency of supportive evidence or is it based on a flawed perception of the sufficient existing evidence? If the former is true, then the general strategy would be to acquire more evidence, whereas if the latter is true, the issue is one of knowledge transfer. Major goals of knowledge transfer to improve agreement would include characterizing the source of disagreement and then targeting efforts at any misconceptions with the use of broad publication of supportive commentary, adding highlighted corrective information in CPR course material, local opinion leaders, educational outreach and marketing strategies such as focused distribution of tailored educational materials and small group seminars.

### Lack of self-efficacy

Self-efficacy is the individual’s belief that they can actually perform the task. Survey data demonstrates that practi-
tioners have concerns over being able to cool patients effectively within a reasonable time period. Sentiments of poor self-efficacy may arise from personal uncertainty regarding necessary procedural steps involved in therapeutic hypothermia mixed with a perceived lack of time and access to resources needed for success. Issues of competing responsibilities and demands in critical care areas require that equipment be accessible and tactile tasks be easy to institute. Lack of clarity in protocol, difficulty assembling equipment, or overly demanding monitoring requirements may contribute to poor self-efficacy.

Interventions aimed at poor self-efficacy include the creation of simple cooling algorithms which can be embedded within the clinical context as reminders and guides. The availability of the protocols at the bedside or on the crash cart, perhaps in the form of pre-printed physician order forms, may increase the self-efficacy of practitioners. Using high fidelity on-site simulation training, local champions and opinion leaders to facilitate the process, providing troubleshooting support and real-world examples of success may also be beneficial.

Lack of outcome expectancy

Outcome expectancy is the expectation that a given behavior will lead to a particular result. It becomes a barrier when there is lack of belief that the intervention is effective. Previously, a culture of hope did not exist for cardiac arrest; in other words, most victims were not expected to survive. This belief system is being challenged by the cumulative evidence in the 2005 AHA guidelines that suggests survival will rise with improving resuscitation quality and prehospital care. Educational outreach, small group sessions and local champions or opinion leaders can be helpful to change attitudes and beliefs to be more reflective of the truth. Also, regular presentation of locally treated cases with good outcome may change perceptions of futility.

Inertia of previous practice

This barrier relates to changing the entrenched behavior of physicians and other practitioners as it relates to post-resuscitative care. Prochaska and DiClemente describe stages of behavior change on a continuum. These steps include pre-contemplation, contemplation, preparation, action, and maintenance. Individual practitioner position on this continuum may have a significant impact on the utilization of therapeutic hypothermia guidelines and also which interventions may have an effect. For example, audit and feedback techniques may only be appropriate for those individuals who are motivated to change and are beyond the pre-contemplation stage.

The simplest approach would be to assume all members of a group are at the pre-contemplative stage at the beginning of any implementation effort. A staged approach to intervention beginning with simple didactic lectures, dissemination of information and passive information techniques may encourage members of the group to progress to the contemplation stage. Other techniques such as reminders and audit and feedback may then have more of an effect.

Barriers to changing behavior

Guideline related barriers

Attributes of the guideline itself may have a significant impact on its own uptake and utilization. Guidelines are more likely to be followed if they are non-controversial, clearly defined, simple, trialable, have a concrete description of what actions are required and are evidence-based.

The AHA therapeutic hypothermia guideline has several strengths from this perspective including transparency, scientific rigor, and source credibility. However, the guideline lacks a concrete description of exactly how to cool patients. Although scientific controversy exists over the best method for cooling patients, perhaps the incorporation of a protocol using simple and widely available cooling techniques would improve uptake. This could easily be incorporated into currently available cardiac arrest algorithm pocket cards.

Environmental and organizational barriers

Implementation of therapeutic hypothermia will require site-specific consideration of environmental barriers by a team of clinicians, managers and hospital administrators. Many of these barriers are beyond individual clinician control and reflect systems issues. Adequate human resources and the equipment needed to monitor, induce and maintain hypothermic patients need to be accessible in the emergency department and intensive care unit. The classic example of this type of barrier is the hospital where the only ice machine is in the cafeteria. Ability to induce hypothermia after hours may be seriously impaired if the cafeteria gets locked in the evening. The simple solution to a problem like this would be to acquire an ice machine in a clinical area.

Interprofessional barriers

Therapeutic hypothermia is different from the other more traditional components of the AHA guidelines in that it is relatively long-lasting intervention which requires significant interprofessional collaboration over this period of time. Providers from a variety of clinical cultures including prehospital medicine, family medicine, general internal medicine, critical care, respirology, anesthesiology, surgery, and emergency medicine may participate in the care of the patient after cardiac arrest. If one group or individual within this continuum does not “buy-in” to the therapeutic hypothermia guideline, then efforts aimed at the others may be pointless. Implementation efforts to address the interprofessional barriers will include interprofessional education and small group work. Local access to high fidelity resuscitation simulators for interprofessional simulations may be an ideal method for education and team building. Opinion leaders and champions derived from the constituents of the team can optimize the messaging to their respective audiences and encourage a collaborative approach.
Implementation at a glacial pace

Conclusions

The AHA guidelines for therapeutic hypothermia have been rigorously developed and have the potential to improve patient outcomes after cardiac arrest; however, these guidelines may be underutilized in clinical practice. We have summarized several theoretical frameworks and general implementation approaches which allow us to appreciate the underlying complexity of the phenomenon, foresee potential barriers, and design effective interventions.

Based on our analysis of barriers in therapeutic hypothermia, interventions that are likely to have a positive impact on guideline implementation will be increasing the visibility of the therapeutic hypothermia guideline within the AHA documents, adding a cooling protocol to the guideline, using clinically embedded reminders, optimizing organizational factors to facilitate therapeutic hypothermia delivery and encouraging interprofessional involvement to promote guideline implementation. Consideration of local contextual factors should guide selection of these interventions for maximum impact.

Specific therapeutic hypothermia implementation research is desperately needed to guide future efforts. Currently, the resuscitation community is limited to theory and data derived from unrelated clinical problems in trying to implement this clinically important therapy. In the future, we need to measure and report our theory-based implementation efforts to identify the most successful implementation strategies for post-resuscitation therapies.

Conflict of interest

Dr. Brooks has no financial conflicts of interest to declare. He is an ex-officio volunteer member of the American Heart Association Advanced Cardiac Life Support Committee and is a Co-Investigator on an unrestricted grant from the Canadian Institute of Health Research and Heart and Stroke Foundation of Canada for a multi-centre knowledge translation project in therapeutic hypothermia. Dr. Morrison has no financial conflicts of interest related to therapeutic hypothermia. She is the chair of the American Heart Association Advanced Cardiac Life Support Committee and the principal investigator on the grant mentioned above.

References


