Targeted Temperature Management Therapy and Neurologic Outcomes

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Operational Definition

Targeted Temperature Management (TTM) is a temperature controlled treatment that reduces a patient's internal body temperature to 33-34 degrees Celsius by utilizing intravascular and external surface cooling devices.

Problem/PICO Question

Does Targeted Temperature Management (TTM) therapy improve neurologic outcomes (O) in unconscious patients after cardiac arrest (P) compared to those who did not receive TTM (C)?

Purpose

The purpose of this study is to determine the effectiveness of target temperature management on neurologic outcomes in patients after cardiac arrest.

Background & Significance

According to the World Health Organization (WHO), cardiovascular diseases are the leading cause of death in the United States. In 2015, WHO estimated that 14 million people die each year due to cardiac arrest (Amore et al., 2015). Targeted Temperature Management (TTM) has been studied and used in the acute care setting to help decrease neurologic outcomes in patients who suffered a cardiac arrest. TTM is a form of therapy where patients that have been resuscitated after cardiac arrest, and who are still unconscious after resuscitation, are cooled to 33-34°C for several hours. With TTM, neuronal cell metabolism is lowered, and the production of harmful substances that form during resuscitation is decreased (Brenner et al., 2015). One groundbreaking research study on TTM was conducted in Melbourne, Australia with a total of 275 patients; forty-three received TTM and two hundred and thirty-two received normothermia. The study concluded that the group who received TTM had a forty-nine percent survival rate, with good neurologic outcomes compared to twenty-six percent of those who received normothermia (Amore et al., 2015).

Methods

This is a translational research study utilizing a literature review design. All authors have completed the National Institute of Health (NIH) Office of Extramural Research's online training, "Protecting Human Research Participants", this semester and hold current certification. Databases used for research were CINHAL, PubMed, Medline, and the Cochrane Library. Applicable key words used to search included "target temperature management", "cardiac arrest", "neurological outcomes", "therapeutic hypothermia", and "normothermia". Search limitations included peer-reviewed articles within the last fifteen years with half of the articles within the last five years. Research articles were reviewed through proven critical appraisal methods and examined first based on the abstract to verify its relevance followed by methods, discussion, findings and reliable references. Every member of the group reviewed all articles.

Literature Review

TTM (C)?

TABLE 1

<table>
<thead>
<tr>
<th>Study</th>
<th>Date of Publication</th>
<th>Description</th>
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<tbody>
<tr>
<td>Bernard, S., Buist, M., Gray, T., Gutteride, G., Jones, B., Silver, W., &amp; Smith, K. (2002)</td>
<td>Treatment of coma after cardiac arrest in 137 patients with return of spontaneous circulation: randomized controlled trial.</td>
<td>In the study, 137 out of 275 patients underwent TTM and 48/169 did not receive TTM. Patients who received TTM had improved survival and neurological outcomes.</td>
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Strengths & Limitations

One key strength that was identified during this translational research study, is that the majority of researchers agreed with each other's findings that TTM improved neurologic outcomes. Another identified strength of the study includes the various types of participants that have been studied regarding this topic. While the PICO question focuses on adults, the studies that were found included TTM on swine, rabbits, children, and adult patients. There was also a wide range of locations where the studies were conducted including the United States, New Zealand, Australia, England, China, United Kingdom, Czech Republic, Italy, and Austria. Finally, the studies included a wide range of ethnicities with diverse backgrounds.

Limitations found within the research included the accuracy in reporting and estimating neurological status before and after treatment, the different timing of the Glasgow Coma Scale (GCS) and Cerebral Performance Category (CPC) scoring, and the different causes of cardiac arrest — whether it be caused by their lifestyle, co-morbidities, or trauma related. Also, most of the studies only included neurological outcomes at the time of discharge from the hospital and did not include any long-term follow-up. However, the

APA References

An additional twenty research articles were reviewed using proven critical appraisal methods with the majority finding significant results that TTM improved neurologic outcomes. It was concluded that TTM improved neurologic outcomes in unconscious cardiac arrest patients compared to those who received normothermia. It is recommended that TTM be integrated into hospital protocols for treatment following cardiac arrest in an effort to maintain neurologic function. Further research questions regarding TTM should include:

- Does TTM increase overall survival rates in patients after cardiac arrest?
- Would TTM be more effective if it were started in the field rather than a

Conclusion & Recommendations

Cardiac arrest is a life-threatening condition that requires immediate action in order to minimize damage to the brain. Initial treatment involves a combination of measures including cardio-pulmonary resuscitation (CPR), defibrillation, maintenance of electrolytes, and medication to stabilize the heart. The priority intervention after cardiac arrest is to restore blood flow to the brain so that neurological function is preserved. Without oxygen, the brain starts going through a process known as a chemical cascade; cells begin to die and release various harmful substances such as free radicals that can further damage nearby tissues. For over a decade, health care providers have been using TTM to slow down the metabolic rate of neurons after cardiac arrest. In theory, this procedure decreases the amount of oxygen needed by cells so that the chemical cascade is delayed. This study revealed that patients who received TTM had a higher rate of survival and neurological outcomes after cardiac arrest when compared to those who received normothermia. Additionally, studies show TTM to be independent, minimally invasively, easily performed with few supplies, with very few complications. Cardiac arrest can be a debilitating event in a person's life, but the use of TTM could help to significantly decrease the chance of neurological damage. It is suggested that further research be done to understand the mechanism for exactly how TTM improves neurologic function.