2018

The Neuroprotective Effects of Targeted Temperature Management on Post-Cardiac Arrest Patients

Timothy Hovde
University of North Dakota

Follow this and additional works at: https://commons.und.edu/pas-grad-posters
Part of the Cardiology Commons, and the Cardiovascular Diseases Commons

Recommended Citation
https://commons.und.edu/pas-grad-posters/14

This Poster is brought to you for free and open access by the Department of Physician Studies at UND Scholarly Commons. It has been accepted for inclusion in Physician Assistant Scholarly Project Posters by an authorized administrator of UND Scholarly Commons. For more information, please contact zeinebyousif@library.und.edu.
The Neuroprotective Effects of Targeted Temperature Management in Post Cardiac Arrest Patients

Timothy Hovde PA-S
Department of Physician Assistant Studies, University of North Dakota School of Medicine & Health Sciences
Grand Forks, ND

Abstract

- Novel methods of ensuring survival following cardiac arrest and resuscitation are of supreme importance to the medical community.
- Targeted temperature management (TTM) has been increasingly utilized pre-hospital, in emergency departments, and within intensive care units to increase the hospital discharge. TTM has further been used to attempt to improve neurological functioning. The efficacy and mechanism behind TTM remains poorly understood.
- In several patient populations it also remains unproven. The purpose of this study is to assess the physiological mechanism, survival, neurological recovery and methodology behind TTM.
- Literature review was utilized to assess the physiological mechanism by which TTM elicits its effects on neurological outcomes and survival rates were further examined. Finally, the proposed method to safely and efficiently induce and maintain TTM in appropriate patients was also assessed through literature review.

Methods

- To acquire relevant research PubMed, Clinical Key, Cochrane review and Clinical Evidence databases were referenced.
- Search terms included targeted temperature management, therapeutic hypothermia, cardiac arrest, return of spontaneous circulation (ROSC) and their terms were used in several combinations to obtain appropriate research materials.
- Dynam and the American Heart Association (AHA) were further assessed for recommendations on patient selection, implementation, and methodology behind TTM.
- Study inclusion was any in-hospital cardiac arrest (OHCA) as well as out-of-hospital cardiac arrest (OHCA) were included to assess the use of TTM pre-hospital. Furthermore, TTM use in pediatric patients as well as in-hospital and non-shockable rhythms was assessed through literature review.

Literature Review

- Pathophysiology
  - Fan et al. (2017) utilized a rat model to show increased DRP-1 and cytC as TTM. Finally, serum assay of antioxidants demonstrates a decrease in oxidative damage and increase in antioxidant protection following reperfusion.
- Proponents further suggest that implementation improves survival to hospital discharge.
- Targetable homeostatic mechanism, improvements in survival and neurological functioning, and recommendations for implementation were assessed through literature review.

Statement of Problem

- Targeted temperature management is a poorly understood intervention. It is believed to confer benefit to survival and neurological outcome, though the mechanism is still under research. The magnitude of potential benefit to survival and neurological functioning also remains unclear. Finally, the method of TTM induction remains poorly standardized. Assessment into the methods and procedures of several studies may yield insight into optimal and efficacious methods to confer the greatest benefit to survival and neurological function.

Research Questions

- What methods of ensuring survival following cardiac arrest and resuscitation are of supreme importance to the medical community?
- Targeted temperature management (TTM) has been increasingly utilized pre-hospital, in emergency departments, and within intensive care units to increase the hospital discharge. TTM has further been used to attempt to improve neurological functioning. The efficacy and mechanism behind TTM remains poorly understood. In several patient populations it also remains unproven. The purpose of this study is to assess the physiological mechanism, survival, neurological recovery and methodology behind TTM.
- Literature review was utilized to assess the physiological mechanism by which TTM elicits its effects on neurological outcomes and survival rates were further examined. Finally, the proposed method to safely and efficiently induce and maintain TTM in appropriate patients was also assessed through literature review.

Clinical Applicability

- TTM is most effectively accomplished by rapidly decreasing core body temperature to 33-36.6°C, though fever and shivering are more effective for temperatures >36.5°C. P = 0.19. The likelihood of adverse effects was higher in the 48-hour cohort (P = 0.03).
- Aschner, Star, Loggen, and Bihlmann (2015) assessed the cost-effectiveness of TTM. Total cost per 100 patients was found to be between 3.7 and 4.1 million euros. A cost-effectiveness ratio of 3.867 euros per QALY was discovered.

Discussion

- Animal studies performed by Fan et al. (2017) and Chan et al. (2017) demonstrate inhibition of mitochondrial induced cellular apoptosis through alterations of mediators of mitochondrial pore opening such as cytC, Opa1 and Bassoon.
- Further protection is observed due to the increase in anti-apoptotic factors such as Bcl2. This interferes with neuronal apoptosis as well as ensuring the continuous function of microvascular endothelium. As a result, further injury due to damage to the BBB and subsequent free radical damage and cerebral edema was prevented.
- There is a clear benefit to survival and neurological recovery when TTM is applied to adults undergoing OHCA and OHCA with an initially shockable rhythm.
- Improvement noted not only in survival, and in neurological functioning as measured by automatic reflexes and operationally defined observation for 24-72 hours post resuscitation in animal studies. Improvement in survivability and neurological outcome has also been noted in retrospective assessment of patient records.
- While the benefit to survival and neurological outcome is supported in patients with a non-shockable cardiac rhythm. Pernar, Gassmoller, Wobbe, and Abeles (2015) found significant improvements in patient survival with TTM vs normothermia when the initial presenting rhythm is non-shockable. (29% vs 15% P = 0.01) Continued assessment found patients are more likely to be discharged neurologically intact if TTM is utilized following resuscitation in patients with a non-shockable rhythm.
- The studies do not currently support the use of TTM in pediatric patients and currently require further study to the different causative factors of a pediatric cardiac arrest.
- Evidence of TTM is associated with improved likelihood of neurological improvement. TTM application prior to ED arrival however, is controversial. TTM appears to elicit its effects during reperfusion, potentially altering the time period until TTM application is likely to diminish the potential benefit.

Acknowledgements

- I would like to extend my gratitude to the staff of the University of North Dakota’s Physician Assistant Program. Of special note is my advisor Prof. Jay Metzger. I would further like to acknowledge the contributions of Prof Barry McQuarrie, Joshua Fischer and Athanasios Allamino made toward the completion of this project.

References