An Evaluation of Post-Cardiac Arrest Outcomes among Patients Eligible for Targeted Temperature Management (TTM) at a Community Hospital

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Introduction

- 500,000 patients suffer from cardiac arrest per year in the United States.
- Modern resuscitation measures ensure patients survive the initial event, but prolonged hypoxia and reperfusion cause post-cardiac arrest syndrome in many patients.
- Post-cardiac arrest syndrome can include central neurological injury, myocardial dysfunction, and system-wide ischemic responses.
- Central neurological injury has been deemed the primary cause of death in two-thirds of post-arrest patients.
- Targeted temperature management (TTM) is a therapy endorsed by national and international organizations, indicated for post-cardiac arrest neurological injury.
- Eligibility for TTM includes a full code status, Glasgow Coma scale of less than 8, and absence of conditions such as hemorrhage, sepsis and shock.

Problem Statement

- Presently, underutilization and ineffective implementation of TTM in the community hospital setting may affect outcomes of adult post-cardiac arrest patients.

Primary Objective

- The primary objective of this multiphase quality improvement project was to evaluate TTM utilization in the community hospital setting (initial phase was to evaluate TTM metrics and outcomes in the adult post-cardiac arrest population).

TTM

- Targeted Temperature Management is the intentional induction of core body temperature between 32 to 36 degrees Celsius for up to 24 hours.

Background

- TTM has been shown in randomized control trials to prevent permanent neurological dysfunction by as much as 50%.
- 13% of hospitals have a TTM protocol in place.
- Overall, up to 2% of all cardiac arrest patients receive the therapy in previous utilization studies.
- Community hospital settings are less likely to provide the treatment.
- Supportive therapies used during TTM, such as vasopressors and neuromuscular blockade (NMB) may effect the outcomes of TTM (evidence is inconclusive).
- Prolonged and abbreviated time ranges from return of spontaneous circulation (ROSC) to goal temperature have been shown to impact survival rates and neurological function.

Methods

A list of records with the following ICD codes of 427.5, I97 or I46 between January 2015 through December 2016 was provided by the project site's quality department.

A total of 424 records contained a code for cardiac arrest.

- Cardiac arrest records were screened for TTM eligibility criteria.

All records deemed eligible (n=61) were reviewed for TTM utilization and survival (primary outcomes of interest).

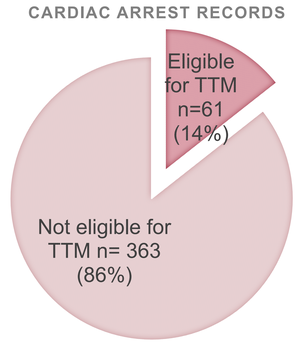
- Records with a recorded time of death were considered expired. Records without a recorded time of death were considered to have survived.
- Records that did not have a signed TTM order set were categorized as not receiving the therapy. Records containing a signed TTM order set were considered to have received the therapy.

All eligible records were also reviewed for vasopressor use, NMB use, and time (in minutes) from ROSC to goal temperature (secondary outcomes of interest).

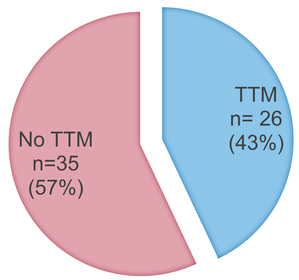
Time to goal temperature was calculated in minutes from time of ROSC to the first recorded temperature between 32.5 to 33.5 degrees Celsius.

Results

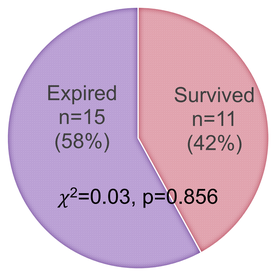
Eligible Records Receiving TTM



How frequently is TTM utilized within the study facility?



Does the use of TTM effect survival to discharge?



Relationship between Time to Goal Temperature and Survival

	Expired		Lived to discharge			
Variable	*M*	*SD*	*M*	*SD*	*p*	*d*
ROSC to goal temp time (minutes)	329.14	99.86	440.82	102.64	0.012	1.10

What are the utilization practices of this facility surrounding TTM?

Observed and Expected Frequencies by Receiving TTM and NMB

	NMB	
Receiving TTM	Did not receive	Received
Did not receive	34 [20.66]	1 [14.34]
Received	2 [15.34]	24 [10.66]

Note. $\chi^2 = 49.35$, $p < 0.001$. Items in brackets represent expected cell frequencies.

Discussion

- Considerable variability exists within the literature regarding TTM utilization within the post-cardiac arrest population.
  - Previous literature estimates utilization of TTM at 0.35-2% of all adult cardiac arrest patients.
  - This project found a 6% utilization rate amongst all records screened for eligibility.
  - Further screening for TTM eligibility was also performed and 43% in the eligible sample received TTM.
- Survival rates are lower than previous sentinel mortality figures regardless of receiving TTM or not.
  - Many factors, including NMB usage (92% in TTM group) and time to goal temperature, may have contributed to survival.
  - Significant differences in gender and survival were seen, favoring males, among all TTM eligible records.
    - No difference in survival was observed based upon gender in TTM vs non-TTM groups.

Recommendations

- Revise TTM protocol to remove possible contributors to inefficacy, such as unnecessary neuromuscular blockade use, vasopressor use, over-sedation, and consideration of time to goal temperature.
- Conduct further research regarding ROSC time to goal temperature, survival, and possible confounding factors for further policy development and practice modification.
- Introduction of objective shivering assessment tool in order to optimize NMB use

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