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Therapeutic Hypothermia After Cardiac Arrest

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Every year, approximately 300,000 adults suffer a cardiac arrest (Mathiesen, McPherson, Ordway, & Smith, 2015). The effects on the brain after an ischemic episode can be tragic, leaving behind devastating neurological deficits, or even death. An initiative to try to prevent neurological deficits after cardiac arrest is called therapeutic hypothermia. Therapeutic hypothermia is an intervention that nurses have encouraged physicians to prescribe to reduce the effects of negative neurological outcomes. The process entails cooling the entire body to reach a core temperature of 32 to 34 degrees Celsius for 12 to 24 hours to slow down the metabolic demands of the body that it would normally need for survival (Mathiesen, McPherson, Ordway, & Smith, 2015). The most important hours to preserve brain function are in the first few hours after the cardiac episode (Rittenberg & Callaway, 2017). Also, hyperthermia and shivering should be avoided after a cardiac arrest because this increases intracranial pressure and assumes a worse neurological outcome for the patient, which means patients should be cooled and remain sedated (Rittenberg & Callaway, 2017). By giving the body a small vacation from its normal day to day demands, the hope is to preserve brain function for better long- term outcomes. The only patients that should not receive hypothermic care are those with advance directives (Rittenberg & Callaway, 2017). Therapeutic hypothermia can be an intervention to preserve brain function, quality of life, and prevent death (Rittenberg & Callaway, 2017). This paper will be a review of six research studies to show the implications of therapeutic hypothermia.

Research Problem

What effect does therapeutic hypothermia have on patient outcomes?

Review of Literature

In 2009, Nielsen, et al., collected data from four different countries that had used therapeutic hypothermia on patients after a cardiac arrest was noted. The data was taken from 2004 to 2008 from Intensive Care discharge, at hospital discharge, and at six to 12 months after discharge. This observational study used a Cerebral Performance Category scale to score patients on the outcome of the intervention. The goal was to have a lower rating to correlate with a better prognosis. Scoring one to three indicated a good outcome, and scoring a three to five on the scale indicated a bad outcome. The good outcome showed that the patient was now conscious and either no neurological deficits, or minor neurological deficits and could still work. The bad outcomes included having severe neurological deficits, remaining in a coma, or death. The study included data from 986 patients, who had out of hospital cardiac arrest and received treatment in an intensive care unit using therapeutic hypothermia. The results showed the patient had a better predictive outcome if the patient had a shockable rhythm at the time of the cardiac arrest, were younger, and had higher Glascow Coma Scales. About half of the patients that were treated received coronary angiography and less than a third received percutaneous coronary intervention. Another factor in the outcome of a patient was the amount of time before a spontaneous rhythm occurred during resuscitation. The longer the time it took to get a heart rhythm back, the lower percentage the patient had of a good recovery. Another interesting result from the study, was that the time of therapeutic hyperthermia initiation and the time it took to reach the goal temperature of 34 to 36 degrees Celsius had no clear effect on the patient's outcome. The limitations of this study were that there was only one tool used to determine a good or a bad outcome. Each case also followed the hospital's own protocol rather than using a standardized protocol for initiation time, how long the patient should be kept at goal temperature, and what is done during the rewarming phase. Another major difference between the hospitals

was what they used to keep the patient in the hypothermic state. It ranged from ice packs, to air cooling, to circulating water blankets. The same instruments should be used for a more reliable measurement of effectiveness.

The main reason for an intervention after cardiac arrest is to sustain life. A meta-analysis of six randomized controlled trials was performed by Arrich, et al. (2016). The studies totaled 1412 participants. The studies had two groups, the control group where no intervention was implemented and the intervention group, which were assigned to have therapeutic hypothermia implemented. The studies were from Brussels, Germany; Melbourne, Australia; five unspecified countries in Europe; Paris, France; and Sapporo, Japan. The findings from the reviews of these studies have shown that overall survival outcomes are more likely to happen if a cooling therapy is used. In addition, the patient's neurological status was more likely to be considered 'good,' if hypothermia was induced. Therapeutic hypothermia was also found to have a negative effect of a greater chance of developing pneumonia and hypokalemia (Arrich, et al., 2016). There was relatively low bias from the study, but in one of the studies, there was a deficit in the randomization. Another area of concern was that one study had to discontinue 14 patients' intervention because they died. In this particular meta-analysis, there was not a definition of what was considered to be a 'good' or 'bad' neurological function, and there is a risk when there is an integration of data from multiple sources.

Yeung Wai Tak, et. al, (2013) conducted a survey of six different intensive care units from 2007 to 2012 that used therapeutic hypothermia. The study considered the demographics of the patients, data around the cardiac arrest, cooling characteristics, and neurological outcomes. All the hospitals were in Hong Kong. Of the 117 participants, most of the cardiac arrests occurred outside of the hospital. Many of the patients were male and the median age was 59.

This indicates that the pool of participants were males over the age of 60. In over half, there was a shockable rhythm present when the patient was found. Only 32% of the patients were found to have a good neurological outcome because, unfortunately, just over half of the participants died in the hospital setting. The limited findings of this study may be because therapeutic hypothermia may not be a well-known practice in Hong Kong. In their experiences, a tighter control of the temperature regulation and blood sugars might yield better results (Yeung Wai Tak, et. al, 2013). The barriers to this study included a low patient roster and a small geographical area. There was also not a regulation on the temperature control and the means of cooling.

The initiation of cooling can be started in the field, or can wait until the patient is stabilized in the hospital. Arrich et. al (2016), conducted a study regarding the initiation of cooling to find out which would benefit the patient and the outcomes the most. The researchers looked through randomized control trials (RCTs) and looked at survival rates, neurological outcomes, quality of life, length of stay, and adverse events. 2,396 patients in seven different RCTs had hypothermia induced in either the field or the hospital. Most of the participants were over the age of 55 and male. The settings of the different RCTs was not specified. There was not a clear result in which option would be better for the patient and their outcomes. In fact, there was suspicion of the patients not receiving the cooling according the guidelines set forth for the studies. The negative side to the initiation of therapeutic hypothermia before being admitted to the hospital is that the heart was more likely to stop again before reaching the hospital than if the emergency responders had just maintained a heart rate and rhythm. Considering that the guidelines were not completely followed, it is hard to decide whether pre-hospital initiation of hypothermia should be implemented. The study should be repeated with closer guidelines and

stricter monitoring of neurological outcomes. The study did not mention the outcomes of the neurological outcomes, adverse effects, length of stay, quality of life, or survival rates. Instead, the results focused on how most of the evidence would be discredited because of how they were not properly treated according to the guidelines.

Another issue to address when inducing therapeutic hypothermia, is how long the patient should remain hypothermic. A common time frame is 24 to 48 hours, but there is a randomized control trial performed by Kirkegaard, et. al, (2017) to determine whether the patient would benefit the longer cooling period. The study took place in 10 different intensive care units across 6 different European countries, with about 350 participants. The clients were randomly places into two groups: hypothermia induction for 24 hours or hypothermia induction for 48 hours. There was no control group of no intervention. To determine which intervention time was more effective, the researchers gathered data six months post discharge regarding neurological outcome and if the patient died after discharge, with information regarding resuscitation attempt. Approximately 99% of the participants were able to complete the trial. While it was not statistically significant, the group with more favorable outcomes was the group who remained under hypothermia protocol for 48 hours. There was no difference between the two groups in terms of mortality rate; however, the 48-hour group was more likely to have an adverse event, such as another cardiac arrest. The length of stay in the intensive care unit, but no the hospital, was longer for the 48-hour group. All in all, the study does not suggest a major difference in six-month post discharge neurological outcome between the two groups.

Along with a positive neurological outcome, the point of therapeutic hypothermia is to increase the rate of survival after a cardiac arrest. Chan, et. al (2016), gathered data on patients who suffered from in-hospital cardiac arrest and received or did not receive therapeutic

hypothermia. The primary goal of the study was to examine the survival rates to hospital discharge. The secondary goal of the study was to examine the neurological outcomes based on the Cerebral Performance Category scale. A one or a two on the scale indicated a good outcome. Anything higher revealed a neurological disability. The study was composed of 26,183 participants and 1,568 suffered in-hospital cardiac arrests and received therapeutic hypothermia. In addition, 3,714 people suffered in-hospital cardiac arrest and did not receive any form of hypothermia. Unfortunately, therapeutic hypothermia was associated with a lower survival rate than the group that did not receive any hypothermia. In addition, the intervention was also associated with a higher score on the Cerebral Performance Category scale, which indicated a neurological disability. These findings were unexpected, but may have been due to inappropriate patients being placed in the intervention group. For example, the group could have had patients that were down for a significant time period. The researchers requested further studies with strict guidelines and randomization to further evaluate the effectiveness of therapeutic hypothermia on patients with in-hospital cardiac arrest.

Therapeutic hypothermia is not a new idea when used to protect the neurological status of patients after they have suffered from a cardiac arrest. In fact, it was started in the mid-twentieth century (Rittenberg & Callaway, 2017). According to the research, it is an intervention that is appropriate when compared to patients who did not receive any treatment. There was not a difference related to when and where the treatment was initiated or how long the treatment lasted. The studies found that most participants in the interventions were over fifty and male. There should be further research on the outcomes of women. The health care team should always weigh the risks and benefits of initiating an intervention on a patient. Brain preservation

is essential to restore normal body function for the patient, and therapeutic hypothermia is an intervention that can potentially preserve brain function, quality of life, and even prevent death.

References

Arrich, J., Holzer, M., Havel, C., Mullner, M., & Herkner, H. (2016). Hypothermia for neuroprotection in adults aftercardiopulmonary resuscitation. *Cochrane Database of Systematic Reviews,* (2). doi:10.1002/14651858.CD004128.pub4.

Arrich, J., Holzer, M., Havel, C., Warentis, A., & Herkner, H. (2016). Pre-hospital versus in-hospital initiation of cooling for survival and neuroprotection after out-of-hospital cardiac arrest. *The Cochrane Library,* (3). doi:10.1002/14651858.CD010570.pub2

Chan, P., Berg, R., Tang, Y., Curtis, L., & Spertus, J. (2016). Association between therapeutic hypothermia and survival after in-hospital cardiac arrest. *JAMA, 316*(13). doi:10.1001/jama.2016.14380

Kirkegaard, H., Søreide, E., Haas, I., Pettilä, V., Taccone, F., Ares, U., . . . Skrifvars, M. (2017). Targeted temperature management for 48 vs 24 hours and neurologic outcome after out-of-hospital cardiac arrest: A randomized clinical trial. *Jama, 318*(4). doi:10.1001/jama.2017.8978

Mathiesen, C., McPherson, D., Ordway, C., & Smith, M. (2015). Caring for patients treated with therapeutic hypothermia. *Critical Care Nurse, 35*(5), e1-e13. doi:10.4037/ccn2015168

Nielsen, N., Hovdenes, J., Nilsson, F., Rubertsson, S., Stammet, P., Sunde, K., & ... Friberg, H. (2009). Outcome, timing and adverse events in therapeutic hypothermia after out-of-hospital cardiac arrest. *Acta Anaesthesiologica Scandinavica*, *53*(7), 926-934. doi:10.1111/j.1399-6576.2009.02021.x

Rittenberg, J., & Callaway, C. (2017). Post-cardiac arrest management in adults. *Up To Date*. Retrieved February 18, 2018.

Yeung Wai Tak, A., Yan Wing, W., Leung Kit Hung, A., Chow Fu, L., Tsai, P., Chan Hok, S., & Luk Ming, C. (2013). Therapeutic hypothermia after cardiac arrest: A survey of practice in the intensive care units (ICU) in Hong Kong. *Critical Care & Shock, 16*(3), 90-99.