Available on: *http://nursingjurnal.respati.ac.id/index.php/JKRY/index*
Jurnal Keperawatan Respati Yogyakarta, 8(1), January 2021, 31 – 37

LITERATURE REVIEW: EFFECTIVENESS OF HYPOTHERMIC THERAPY IN PATIENTS STOP HEART POST

Madiana Madiana[1*)] & Alfian Mas'ud[1]
[1]Batari Toja Watampone Academy of Nursing
Jl. Majang No.17, Watampone, Tanete Riattang Barat., Kabupaten Bone, Sulawesi Selatan

Abstract

Cardiac arrest has become one of the most unexpected, dramatic and life threatening events in the world of health. The increase in the number of patients who survived after cardiac pulmonary resuscitation has increased as more cardiopulmonary resuscitation training and defibrillation equipment are becoming easier to carry to various locations, but brain damage begins within minutes of cardiac arrest with the consequence of patients having their hearts beating again. and hospitalized unable to leave the hospital or in a vegetative state. Hypothermic therapy has been used frequently in cardiac surgery for several years for neurological protection.The data based used in making this literature review are Google Scholar and Proquest. The keywords used in the search for articles on google scholar are "Therapeutic" and "Hypothermia" and "post" and "cardiac" and "arrest" and limit the publication year of 2011-2016. While the search on Proquest "Therapeutic" and "Hypothermia" and "after" and "cardiac" and "arrest".Based on the results of literature search on google scholar, there were 9730, pubmed 150 and proquest 2460. The screening results were 7,200 but only 9 journals were relevant to the topic. Hypothermic therapy can significantly improve neurological status in post cardiac arrest patients even after the patient has been discharged from the hospital.

Keywords:*Hypothermic Therapy; Post Cardiac Arrest*

**) Corresponding author:*
Email: dianaizzan@gmail.com

1. Intrudaction

Cardiac arrest has become one of the most unexpected, dramatic and life threatening events in the world of health (Scirica 2013). In 2014 the American Heart Association estimated that around 380,000 out of 424,000 (90%) each year had a heart attack and did not survive. Only 23% (97,520,000) of all heart attack victims entered health services and most were initially resuscitated then stopped in a state of brain ischemia and ischemia in other vital organs(Cherry, Sumien, and Mallet 2014).

The increase in the number of patients who survived after cardiac pulmonary resuscitation has increased as more cardiopulmonary resuscitation training and defibrillation equipment are becoming easier to carry to various locations, but brain damage begins within minutes of cardiac arrest with the consequence of patients having their hearts beating again. and hospitalized unable to leave the hospital or in a vegetative state(Rittenberger and Callaway 2013).

There are two principal areas of saving patients with cardiac arrest on a basis Scirica (2013) and Peberdy et al. (2010). The first area is increased education to improve perfusion after cardiac arrest through four rescue chains, namely immediately accessing a medical rescue center, immediate cardiopulmonary resuscitation, immediate defibrillation, and promptly undertaking further cardiac rescue measures. The second area emphasizes post-resuscitation measures, which include optimizing oxygenation and ventilation, preventing hypotension, promptly overcoming coronary artery ischaemia and initiating hypothermic therapy if necessary.

Hypothermia therapy has been used frequently in cardiac surgery for several years for neurological protection (Demirgan et al. 2014). Based onPeberdy et al., (2010) claiming hypothermic therapy and treatment based on the cause of cardiac arrest resulted in the number of patients surviving and neurological development.

Based on several studies, recent international guidelines recommend that comatose adult patients who have regained circulation after cardiac arrest outside the hospital should be cooled to 32º-34ºC within 12-24 hours(Cariou and Sunde 2014). For this literature review, we wanted to see the effectiveness of hypothermic therapy in patients who regained spontaneous circulation after cardiac arrest

The purpose of this literature is to see the effectiveness of the use of hypothermic therapy in cardiac arrest patients both outside the hospital and in the hospital.

2. Method

Literature review is carried out by searching the results of scientific publications in the period 2013-2020 using Google scholar, pubmed and Proquest.

Table 1 Inclusion and exclusion criteria in research articles

Indicator	Inclusion criteria	Exclusion Criteria
Respondents	Post cardiac arrest patients	Post cardiac arrest patients who experience complications of the disease
Types of research	All internationally published research relevant to the title	International unpublished research
Publication date	Research published from 2013-2020	Research published under 2013
Result	This literature describes the effectiveness of hypothermic therapy in post cardiac arrest patients	Literature on hypotermyc in therapy in cardiac arrest patients whose result are not significant
Language	Research articles in English	English literature but not full text

This literature search database includes Google scholar, pubmed and Proquest (Table 1). A journal search was carried out through Proquest and entered the keywords "Therapeutic" and "Hypothermia" and "after" and "cardiac" and "arrest". Then more specifically in full text journals and limit the year published for the last 5 years, then 103 journals appeared, but only 13 journals relevant to the topic. Then a search through Google Scholar, using the keywords "Therapeutic" and "Hypothermia" and "post" and "cardiac" and "arrest" and limiting the published years from 2013 to 2020, then 17,300 results appeared but those relevant to the topic were only 25 journals. Journal searches were also conducted through pubmed using the keywords "Therapeutic" and "Hypothermia" and "after" and "cardiac" and "arrest". Search results of 1200 journals but after being filtered more specifically in the last 7 years. Based on the results of reading related journals, there are several journals that refer to the first source so that several journals are searched with keywords related to the first source. However, based on the results of reading related journals, there are several journals that refer to the first source so that several journals are searched with keywords related to the first source, so there are several journals whose publication years are below 2013.

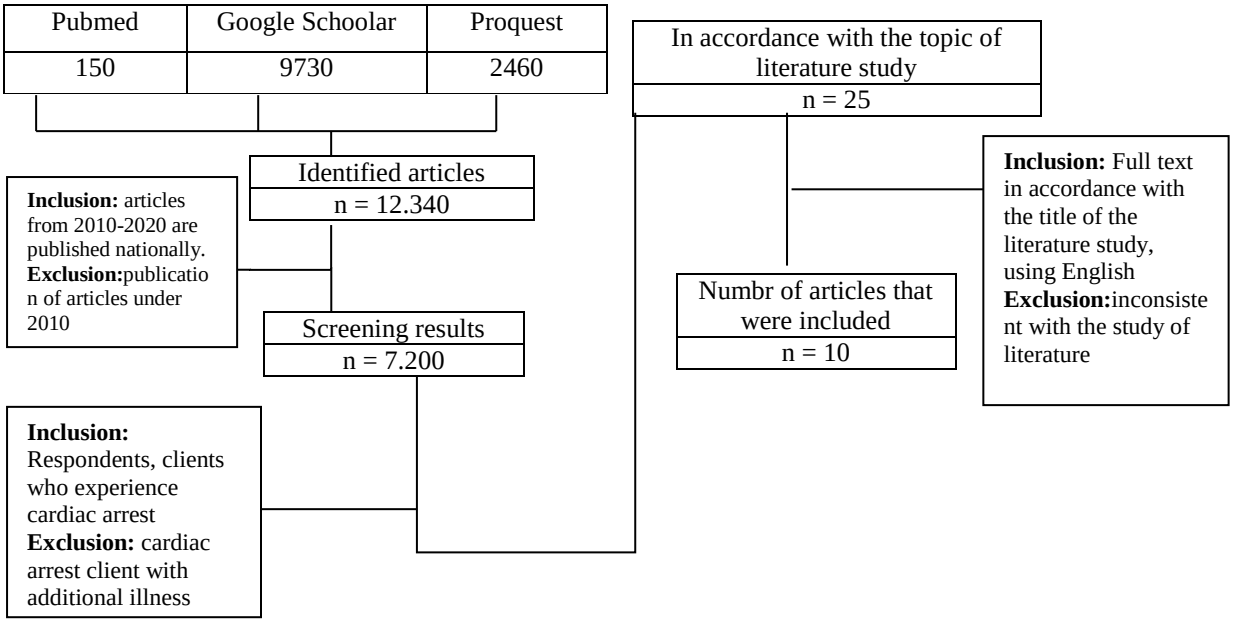

Figure 1. Flow diagram of literature search

3. Results

TheAmerican Heart Association (AHA), European Resuscitation Cuoncil and the International Liaison Committee on Resuscitation both provide post-resuscitation guidelines and recommendations that support the use of hypothermic therapy in ROSC patients who remain comatose after CA. this recommendation was originally based on 2 randomized trials in 352 patients. The results of this study indicate an improvement in neurological outcomes with hypothermic therapy compared to standard post-resuscitation care in patients who remain coma after ROSC after ventricular surgery (Calaway, 2015).

Table 2 Review of Articles

No.	Autor	Research Title	Country	Method Research	Intrument	Results
1	Frei et al, 2019	Clinical characteristics and results of giving hypothermic therapy in cardiac arrest	Switzerland	Systematic review review	Literature Search	A total of 214 patients were involved in the systematic review. The survival rate for patients with cardiac arrest with hypothermic therapy who was discharged from the hospital was 73% (153 of 210 patients) and most of the patients who survived had good neurological outcomes (89%; 102 of 105 patients).
2	Dane et al, 2016	Hypothermic therapy in heart attacks caused by lightning strikes	Philadelphia	Case report	Assessment	Neurological recovery with hypothermic therapy after a cardiac arrest of pulseless electrical activity caused by lightning in an 18-year-old woman. We also reviewed the important ptophysiology of lightning-induced cardiac arrest and neurological sequelae.
3	Tomassi et al, 2014	Mild hypothermic cooling technique after heart attack	Italy	Systematic Review	Literature Search	Hypothermia therapy has been shown to reduce brain damage due to post cardiac cardiac arrest syndrome.
4	Villablanca et al, 2016	Mild hypothermic therapy in patients with mild heart attack outside the hospital	New York	RCT	Questionnaire	In 6 RCTs (n = 1400 patients), overall survival was 50.7% and favorable neurologic recovery was 45.5%. the data collected showed no significant all-cause death (OR = 0.81; 95% CI 0.55-1.21) or neurological recovery (OR = 0.77; 95% CI 0.47-1.24). No evidence of publication bias was observed.
5	Silverman et al, 2015	Hypothermia and cardiac arrest	Francis	Systematic Review	Literature Search	Hypothermic therapy for patients who remain in a coma after resuscitation from a heart attack can help improve survival and improve nerve function.
6	Sciria, 2013	Update on treatment of hypothermia after cardiac arrest	New York	RCT	Questionnaire	Hypothermic therapy should be started immediately after ROSC with a target temperature of 320C to 340C
7	Nielsen et al, 2013	Targeted temperature management at 33ºC and 36ºC after cardiac arrest	Sweden	RCT	Questionnaire	When 939 patients with ROSC (Return of Spontaneus Circulation) after cardiac-pulmonary resuscitation were then given targeted temperature management with two treatments, namely temperatures of 330C and 360C, 51% survived and experienced neurological improvement (47-48%) did not show a significant difference.
8	SA. Bernand et al, 2012	Prehospital induction of hypothermic hypothermia after resuscitation from nonventricular fibrillation cardiac arrest	New York	RCT	Questionnaire	an adult who had been resuscitated prior to admission using cold normal saline rapidly which lowered the tympanic temperature to <340C, showed good results after the patient was discharged from the hospital.
9	Mooney et al, 2011	Hypothermia therapy after cardiac arrest	English	RCT	Questionnaire	56% of patients survived and were discharged from the hospital and of the survivors, 92% showed a normal or near normal state of neurological function

10	Peberdy et al, 2010	Part 9: Post Cardiac Arrest	English	Systematic Review	Literature Search	Patients who are unconscious or unresponsive after cardiac arrest should be admitted to a critical care ward with a comprehensive plan including interventions for cardiovascular disorders, use of hypothermia therapy, standardized treatment according to goals and further monitoring and neurological care.

Patients who are unconscious or unresponsive after cardiac arrest should be admitted to a critical care ward with a comprehensive plan including interventions for cardiovascular disorders, use of hypothermia therapy, standardized treatment according to goals and further monitoring and neurological care(Peberdy et al. 2010).

There are 4 stages of hypothermic therapy that determine the success of hypothermic therapy, namely initiation, maintenance phase, rewarming and returning to normal / normothermic temperature(Polderman 2009). Hypothermic therapy should be started immediately after ROSC with a target temperature of 32^0C to 34^0C(Scirica 2013).

Hypothermic therapy for individuals who remain comatose after successful ROSC after cardiac arrest has the potential to reduce neurological mortality and morbidity. Hypothermic therapy is now part of post-resuscitation care recommendations(Silverman and Scirica 2015).

Various methods are used to induce and maintain hypothermia. The use of ice packs and cold blankets is very simple and effective but difficult to titrate until it reaches the target temperature. The use of an endovascular catheter that circulates cold water can facilitate temperature control during the maintenance phase and avoids rapid temperature changes during the rewarming phase. During the maintenance phase, the fluctuation of temperature should be minimized <0.50C(Scirica 2013). The method used byVillablanca et al, (2016) also using invasive hypothermia induction, ie through endovascular catheters, which showed that cooling using the endovascular method maintained a better target temperature than conventional cooling.

Research conducted bySilverman and Scirica,(2015)about hypothermic therapy in cardiac arrest patients. The results of this study suggest that hypothermia therapy for patients who remain in a coma after resuscitation from a heart attack can help improve survival and improve neuronal function. Although this therapy has been included in the guidelines for routine post-resuscitation care and has been in clinical use for more than a decade.

Another study conducted by Frei et al, (2018), on the clinical characteristics of heart attack against hyothermic therapy. The results of this study indicated that 214 patients were included in this systematic review. Of the 206 hypothermic patients who underwent cardiac arrest with an average temperature of 23.9 ° C and 2.7 ° C, five patients (2.4%) had core body temperatures> 28°C. The highest temperature for a patient who survived cardiac aspiration without other risk factors associated with cardiac arrest was 29.4 ° C. The first heart rhythm recorded was asystole 33 in 12 patients (30%). The survival rate for hypothermic cardiac arrest patients discharged from the hospital was 73% (153 of 120 patients) and most of the survivors had a good neurological outcome 102 of 105 patients (89%).

Another study on hypothermic therapy in heart attacks caused by lightning strikes carried out byScantling et al. (2016). The results of this study indicate. The use of hypothermic therapy after PEA cardiac arrest and after cardiac arrest caused by lightning is a very recent phenomenon. A retrospective study conducted on 100 patients with unstockable heart attacks showed an almost threefold increase in neurological improvement. When intravascular hypothermia therapy is used in patients who have had cardiac arrest with attempted resuscitation.

While in research (Lee et al., 2018)attempted to compare the results between patients who were given hypothermic therapy with a temperature of 32ºC for 72 hours and patients who were given hypothermic therapy with a temperature of 33ºC for 24 hours. The results obtained from this study did not show a significant difference between the two.

Mooney et al., (2011),in a study of patients who were unconscious and unresponsive after their return to circulation or an ROSC condition outside the hospital and on their way to the hospital, received hypothermia therapy in an ambulance as a stage of initiating hypothermia. The nurse as the first responder has been given instructions to place an ice pack in the groin of the thigh, head, neck and chest as the first phase of initiation of hypothermia.

As soon as possible to maximize neuroprotection. And after arriving at the hospital, the patient's temperature was lowered to 330C in 2 to 4 hours by using a device that draws cold water through hydrogel pads that are placed on the body and lower extremities. Temperature monitoring is monitored by measuring the esophageal temperature. The results obtained from this study were that 56% of patients survived and were discharged from the hospital and among the survivors, 92% showed a normal or near normal state of neurological function.

In research SA Bernard et al., (2012) demonstrated that an adult who had been resuscitated

prior to admission to the use of cold normal saline rapidly which lowered the tympanic temperature to <34ºC, showed good results after the patient was discharged from the hospital.

Various randomized trials conducted by Nielsen et al. (2013),who questioned what temperature levels would actually be of greater benefit to patients after cardiac arrest. When 939 patients with ROSC (Return of Spontaneus Circulation) after cardiac-pulmonary resuscitation were then given targeted temperature management with two treatments, namely temperatures of 33ºC and 36ºC, 51% survived and experienced neurological improvement (47-48%) did not show a significant difference.

One of the effects that can occur in patients who are induced by hypothermia is shivering. Shivering is a natural reaction to the cooling effect, and should be recognized early and treated aggressively as this can increase the body's average metabolism and can slow down the attainment of the desired temperature. Shivering often appears when the temperature changes between 35ºC and 37ºC. When the patient's body temperature reaches 32ºC to 34ºC, the chills have disappeared. All patients receiving hypothermic therapy should be given a low dose of painkiller or sedation to avoid painful or uncomfortable sensations and suppress the shivering process. Nonpharmacological therapy that can be given to increase the temperature of the patient's cutaneous tissue, such as wrapping the face, hands and feet with a warm blanket to avoid shivering(Scirica 2013).

4. Discussion

Hypothermic therapy has been shown to reduce brain damage resulting from post cardiac arrest syndrome. Actually there is no agreement regarding the best tool for hypothermic therapy. The ideal device is not only capable of rapidly cooling patients to 33-34ºC. However, maintaining the temperature by providing hypothermic therapy. For heart attacks outside the hospital can be done if there are tools that allow for hypothermic therapy (prehospital hypothermia). On arrival at the hospital this pre-hospital device can be replaced quickly and easily with a device in the hospital that is more suitable for the management of therapeutic hypothermia in the ICU (hypothermia in the hospital)(Tommasi et al. 2014).

According to (Tommasi et al. 2014)indications and contra indications for patients who are given hypothermic therapy. Patients should be cooled, i.e. those who survived the drop out and those who survived a heart attack in the hospital. Patients who should not be refrigerated show rapid neurological recovery (eg, being able to follow commands such as wiggling toes, finger squeezing and active bleeding. Those at high risk of bleeding (eg postoperative or post-traumatic), terminal illness, coagulopathy and patients who do not want to be resuscitated.

The optimal time for initiation of hypothermic therapy as well as the time to reach the target temperature remains uncertain. Experimental data on animal models suggest that a delay in initiating cooling 15 minutes after RSOC is of little benefit after hypothermic therapy. optimal timing in human studies varies. According to Chitoa et.al (2011), showing that reaching the target temperature in 6 hours (initial group) was associated with a greater likelihood of favorable neurological outcomes when compared to individuals reaching the target temperature of 6 hours (delayed group). conversely, according to Haugk (2011), found that a shorter time to target temperature was associated with unfavorable neurological outcomes (good duration 158 min-209 min).

5. References

Bernard, AS, Smith, K., Cameron, P., Masci, K., Taylor, DM, Cooper, DJ,… Silvester, W. (2012). Induction of Prehospital Theraupetic Hypothermia After Rescucitation From Nonventricular Fibrillation Cardiac Arrest. Critical Care Medicine, 40 (3), 737–742.http://doi.org/10.1161/CIRCULATIONAHA.109.906859

Cariou, A., & Sunde, K. (2014). Cold fluids during cardiac arrest: faster cooling but not better outcome! Intensive Care Medicine, 40 (12), 1963–1965.http://doi.org/10.1007/s00134-014-3536-9

Cherry, BH, Sumien, N., & Mallet, RT (2014). Neuronal injury from cardiac arrest: aging years in minutes. Age (Dordrecht, Netherlands), 36 (4), 9680. http://doi.org/10.1007/s11357-014-9680-x

Demirgan, S., Erkalp, K., Sevdi, MS, Aydogmus, MT, Kutbay, N., Firincioglu, A.,… Alagol, A. (2014). Cardiac condition during cooling and rewarming periods of therapeutic hypothermia after cardiopulmonary resuscitation. BMC Anesthesiology, 14 (1), 78.http://doi.org/10.1186/1471-2253-14-78

Frei, C., T. Darocha, G. Debaty, F. Dami, and M. Blancher. nd "Clinical Characteristics and Outcomes of Witnessed Hypothermic Cardiac Arrest: A Systematic Review on Rescue Collapse." Resuscitation 137 (November 2018): 41–48.

Lee, BK, Lee, SJ, Jeung, KW, Lee, HY, Heo, T., & Min, Y. Il. (2014). Outcome and adverse events with 72-hour cooling at 32 ?? C as compared to 24-hour cooling at 33 ?? C in comatose asphyxial arrest survivors. American Journal of Emergency Medicine, 32 (4), 297–301. http://doi.org/10.1016/j.ajem.2013.11.046

Mooney, MR, Unger, BT, Boland, LL, Burke, MN, Kebed, KY, Graham, KJ,… Parham, WM

(2011). Therapeutic hypothermia after out-of-hospital cardiac arrest: Evaluation of a regional system to increase access to cooling. Circulation, 124 (2), 206–214. http://doi.org/10.1161/CIRCULATIONAHA.110.986257

Nielsen, N., Wetterslev, J., Cronberg, T., Erlinge, D., Gasche, Y., Hassager, C.,… Investigators, TTMT (2013). Targeted temperature management at 33degreeC versus 36degreeC after cardiac arrest. The New England Journal of Medicine, 369 (23), 2197–2206. http://doi.org/10.1056/NEJMoa1310519

Peberdy, MA, Callaway, CW, Neumar, RW, Geocadin, RG, Zimmerman, JL, Donnino, M.,… Kronick, SL (2010). Part 9: Post-cardiac arrest care: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation, 122 (SUPPL. 3). http://doi.org/10.1161/CIRCULATIONAHA.110.971002

Polderman, KH (2008). Induced hypothermia and fever control for prevention and treatment of neurological injuries. Lancet, 371 (9628), 1955–1969. http://doi.org/10.1016/S0140-6736(08)60837-5

Polderman, KH (2009). Mechanisms of action, physiological effects, and complications of hypothermia. Critical Care Medicine, 37 (7). http://doi.org/10.1097/CCM.0b013e3181aa5241

Rittenberger, JC, & Callaway, CW (2013).Temperature Management and Modern Post-Cardiac Arrest Care. The New England Journal of Medicine, 369 (23), 131117131833001. http://doi.org/10.1056/NEJMe1312700

Scirica, BM (2013). C linician U pdate Therapeutic Hypothermia After Cardiac Arrest, 244–250. http://doi.org/10.1161/CIRCULATIONAHA.111.076851

Silverman, MG, & Scirica, BM (2015). Cardiac arrest and therapeutic hypothermia. Trends in Cardiovascular Medicine, 26 (4), 337–344. http://doi.org/10.1016/j.tcm.2015.10.002

Tan, MC, & Coursin, DB (2014). Complete neurologic recovery in an out-of-hospital cardiac arrest facilitated by initiation of therapeutic hypothermia in a young athlete with an anomalous right coronary artery. Journal of Clinical Anesthesia, 26 (3), 227–230.http://doi.org/10.1016/j.jclinane.2013.11.014

Bernard, A. Stephen, Karen Smith, Peter Cameron, Kevin Masci, David M. Taylor, D. James Cooper, Anne Maree Kelly, and William Silvester. 2012. "Induction of Prehospital Theraupetic Hypothermia After Rescucitation From Nonventricular Fibrillation Cardiac Arrest." Critical Care Medicine 40 (3): 737–42.

Cariou, Alain, and Kjetil Sunde. 2014. "Cold Fluids during Cardiac Arrest: Faster Cooling but Not Better Outcome!" Intensive Care Medicine 40 (12): 1963–65.

Cherry, Brandon H., Nathalie Sumien, and Robert T. Mallet. 2014. "Neuronal Injury from Cardiac Arrest: Aging Years in Minutes." Age (Dordrecht, Netherlands) 36 (4): 9680.

Demirgan, Serdar, Kerem Erkalp, M. Salih Sevdi, Meltem Turkay Aydogmus, Numan Kutbay, Aydin Firincioglu, Ali Ozalp, and Aysin Alagol. 2014. "Cardiac Condition during Cooling and Rewarming Periods of Therapeutic Hypothermia after Cardiopulmonary Resuscitation." BMC Anesthesiology 14 (1): 78.

Lee, Byung Kook, Seung Joon Lee, Kyung Woon Jeung, Hyoung Youn Lee, Tag Heo, and Yong Il Min. 2014. "Outcome and Adverse Events with 72-Hour Cooling at 32 ?? C as Compared to 24-Hour Cooling at 33 ?? C in Comatose Asphyxial Arrest Survivors." American Journal of Emergency Medicine 32 (4): 297–301.

Mooney, Michael R., Barbara T. Unger, Lori L. Boland, M. Nicholas Burke, Kalie Y. Kebed, Kevin J. Graham, Timothy D. Henry, William T. Katsiyiannis, Paul A. Satterlee, Sue Sendelbach, James S. Hodges, and William M. Parham. 2011. "Therapeutic Hypothermia after Out-of-Hospital Cardiac Arrest: Evaluation of a Regional System to Increase Access to Cooling." Circulation 124 (2): 206–14.

Nielsen, N., J. Wetterslev, T. Cronberg, D. Erlinge, Y. Gasche, C. Hassager, J. Horn, J. Hovdenes, J. Kjaergaard, M. Kuiper, T. Pellis, P. Stammet, M Wanscher, MP Wise, A. Aneman, N. Al-Subaie, S. Boesgaard, J. Bro-Jeppesen, I. Brunetti, JF Bugge, CD Hingston, NP Juffermans, M. Koopmans, L. Kober, J. Langorgen , G. Lilja, JE Moller, M. Rundgren, C. Rylander, O. Smid, C. Werer, P. Winkel, H. Friberg, and TTMT Investigators. 2013. "Targeted Temperature Management at 33degreeC versus 36degreeC after Cardiac Arrest." The New England Journal of Medicine 369 (23): 2197–2206.

Peberdy, Mary Ann, Clifton W. Callaway, Robert W. Neumar, Romergryko G. Geocadin, Janice L. Zimmerman, Michael Donnino, Andrea Gabrielli, Scott M. Silvers, Arno L. Zaritsky, Raina Merchant, Terry L. Vanden Hoek, and Steven L. Kronick. 2010. "Part 9: Post-Cardiac Arrest Care: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care." Circulation 122 (SUPPL. 3).

Polderman, Kees H. 2009. "Mechanisms of Action, Physiological Effects, and Complications of Hypothermia." Critical Care Medicine 37 (7).

Rittenberger, Jon C., and Clifton W. Callaway. 2013. "Temperature Management and Modern Post-Cardiac Arrest Care." The New England Journal of Medicine 369 (23): 131117131833001.

Scantling, Dane, Brian Frank, Mathew E. Pontell, and Sandra Medinilla. 2016. "Inducing Therapeutic Hypothermia in Cardiac Arrest Caused by Lightning Strike." Wilderness and Environmental Medicine 27 (3): 401–4.

Scirica, Benjamin M. 2013. "C Linician U Pdate Therapeutic Hypothermia After Cardiac Arrest." 244–50.

Silverman, Michael G., and Benjamin M. Scirica. 2015. "Cardiac Arrest and Therapeutic Hypothermia." Trends in Cardiovascular Medicine 1–8.

Tommasi, Eleonora, Chiara Lazzeri, Pasquale Bernardo, Andrea Sori, Marco Chiostri, Gian F. Gensini, and Serafina Valente. 2014. "Cooling Techniques in Mild Hypothermia after Cardiac Arrest."

Villablanca, Pedro A., Mohammed Makkiya, Evann Einsenberg, David F. Briceno, Christia Panagiota, Mark Menegus, Mario Garcia, Daniel Sims, and Harish Ramakrishna. 2016. "Mild Therapeutic Hypothermia in Patients Resuscitated from Out-of-Hospital Cardiac Arrest: A Meta-Analysis of Randomized Controlled Trials." Annals of Cardiac Anesthesia 19 (1): 4–14.

Villablanca, PA, Makkiya, M., Einsenberg, E., Briceno, DF, Panagiota, C., Menegus, M.,… Ramakrishna, H. (2016). Mild therapeutic hypothermia in patients resuscitated from out-of-hospital cardiac arrest: A meta-analysis of randomized controlled trials. Annals of Cardiac Anesthesia, 19 (1), 4–14. http://doi.org/10.4103/0971-9784.17301