

Form "EAST Multicenter Study Proposal"

Study Title	Outcome of suicidal hanging patients and the role of targeted temperature management in hanging-induced cardiac arrest
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Co-primary investigator	Cindy H. Hsu, MD, PhD Hanging is the second most common suicide method behind firearms in the United States, resulting in over 10,000 annual deaths during the recent years. Globally, it is the most common suicide method in countries such as South Korea, Japan, and Australia. Suicidal hanging frequently affects the younger population with an estimated 77% - 88% mortality. To date, no specific treatment is available for hanging-induced cardiac arrest (CA).
Use this area to briefly (1-2 paragraphs only) outline the burden of the problem to be examined	Targeted temperature management (TTM) has been shown to improve the survival and neurologic outcome of CA survivors with shockable and nonshockable rhythms, but its effect on hanging-induced CA is unknown. Recent case reports and small retrospective studies have suggested that TTM may lead to good neurologic outcome for survivors who sustained asphyxial CA. Furthermore, studies in animals and newborns have demonstrated beneficial effects of TTM in reducing hypoxic encephalopathy caused by asphyxia. A retrospective study of 138 patients from our institution's trauma registry suggests that CA is associated with higher severity of injury and mortality in suicidal hanging survivors, and that TTM may improve the survival and functional outcome of hanging-induced CA patients at hospital discharge. We propose to conduct a multicenter retrospective study to determine the impact of TTM on the survival at hospital discharge, one-year survival, and functional outcome of hanging-induced anoxic injury and CA.
Primary aim	To determine whether TTM improves the overall survival of hanging-induced CA at hospital discharge. To determine whether TTM improves the neurologic outcome of hanging-induced CA survivors at hospital discharge.
Secondary aims	To determine whether TTM improves the one-year survival of hanging-induced CA survivors. Patients age 18 years or older with hanging as primary injury type.
Inclusion Criteria	Any above patients who received targeted temperature management during post-arrest care.
Exclusion Criteria	Patients with age less than 18 years, with asphyxia from other causes, or with cardiac arrests from other causes.

Therapeutic Interventions

Retrospective study only. Patients would have been managed according to the discretion of their surgeons and intensivists.

Primary Outcome

Survival at hospital discharge

Neurologic outcome at hospital discharge as measured by Cerebral Performance Category.**

Survival at 1-month, 6-month, and 1-year after hospital discharge

Secondary Outcomes

**Cerebral Performance Category (CPC) is one of the more widely used assessments of the functional status of patients who have undergone cardiac arrest. Its score ranges from 1 (good cerebral performance) to 5 (brain death), with CPC 1 and 2 generally categorized in earlier investigations as good neurologic outcome and 3–5 as poor outcome.

**Demographics/Injury Variables: Admission date and time, age, sex, race, pre-morbid conditions (coronary artery disease, diabetes, alcohol abuse, tobacco use, IV drug abuse, psychiatric disorder, prior suicidal attempt, unknown), ISS, AIS Head

**Prehospital Variables: Location of injury (home, public building, prison, psychiatric institution, others, unknown), total scene time, total transport time, prehospital GCS, cardiac arrest, initial cardiac arrest rhythm (ventricular fibrillation, pulseless ventricular tachycardia, PEA, asystole, unknown), bystander CPR, time to return of spontaneous circulation (ROSC), total hanging time

**Admission Variables: Admission GCS, admission vital signs, lowest systolic blood pressure during initial 5 hour, admission lab values (pH, lactate, base deficit)

**Diagnostic studies: Evidence of cerebral anoxia, cervical spine injury, spinal cord injury, blunt cerebrovascular injury, or airway injury on CT or MRI studies

List specific variables to be collected & analyzed

**Targeted Temperature Management (TTM) Variables: Date and time of TTM initiation, starting temperature (°C), goal temperature (°C), date and time of achieving goal temperature, TTM method (ice pack, external cooling device, intravascular catheter, cold lavage/irrigation, unknown), duration of TTM, rate of rewarming (°C/hour)

**TTM-related Complications: Seizure, arrhythmia, electrolyte derangement, bleeding, VAP, sepsis

**Operative procedures: Tracheostomy, surgical feeding access, others

**Discharge outcomes: Discharge GCS, hospital LOS, ICU LOS, ventilator days, mortality, organ donation, cause of death (brain death, withdrawal of life-sustaining measures, other), discharge date and time, discharge destination (home, long-term vent facility, rehab/SNF, prison, inpatient psychiatry, morgue), Cerebral Performance Category score at hospital discharge, alive after hospital discharge (1 year, unknown)

Continuous variables will be compared using Student's t-test or Wilcoxon rank-sum test. The Chi-squared tests or Fisher's exact test will be used to compare categorical variables. All variables with a p value <0.2 on univariate analysis will be entered into a multivariable logistic regression analysis to identify independent risk factors for in-hospital mortality and poor neurologic outcome. Multiple-logistic regression model analyses will be performed to estimate the odds ratios (ORs) of the neurologic outcomes with 95% confidence intervals (CIs). Data analysis will include comparisons between the patient characteristics, survival, and functional outcome of suicidal hanging patients who suffered out-of-hospital CA to those who did not suffer CA, and between CA patients who received TTM to those who did not receive TTM.

Outline the data collection plan and statistical analysis plan succinctly

For long-term outcome analysis, the 1-month, 6-month, and 12-month survival after hospital of CA patients will be determined by reviewing hospital records. Survival time will be calculated as the difference between date of death and discharge date. Nonparametric Kaplan-Meier survival analysis will be used to compare survival between the groups. The association of unadjusted and adjusted long-term survival with TTM will be calculated. For the adjusted model, we will adjust for age, sex, race, shockable rhythm, hanging time, time to TTM initiation, time to ROSC, and withdrawal of life-sustaining measures. Data will be reported as adjusted odds ratios with 95% confidence intervals. Statistical significance will be set at a p<0.05.

Outline consent procedures here, if applicable

N/A - retrospective chart review with de-identified data collection

Succinctly outline a risk/benefit analysis

The incidence and natural history of suicidal hanging and hanging-induced cardiac arrest remain largely unknown. There is no benefit for the subjects who have undergone treatment; however, information learned from this analysis has potential to benefit future patients in helping to understand the impact of targeted temperature management on hanging-induced anoxic brain injury and cardiac arrest. This study qualifies as minimal risk research.

1. CDC's WISQARS™ (Web-based Injury Statistics Query and Reporting System). Centers for Disease Control and Prevention.
2. Baldursdottir S, Sigvaldason K, Karason S, et al. Induced hypothermia in comatose survivors of asphyxia: a case series of 14 consecutive cases. *Acta Anaesthesiol Scand* 2010;54:821–826.
3. Borgquist O, Friberg H. Therapeutic hypothermia for comatose survivors after near-hanging—a retrospective analysis. *Resuscitation* 2009;80:210–212.
4. Lee BK, Jeung KW, Lee HY, Lim JH. Outcomes of therapeutic hypothermia in unconscious patients after near-hanging. *Emerg Med J* 2012;29:748–752.
5. Wee JH, You YH, Lim H, et al; Korean Hypothermia Network Investigators. Outcomes of asphyxial cardiac arrest patients who were treated with therapeutic hypothermia: a multicentre retrospective cohort study.
6. Shin J, Lee H, Kim J, et al. Outcomes of hanging-induced cardiac arrest patients who underwent therapeutic hypothermia: a multicenter retrospective cohort study. *Resuscitation*. 2014 Aug;85(8):1047-51.
7. Salim A, Martin M, Sangthong B, et al. Near-hanging injuries: a 10-year experience. *Injury* 2006;37:435–439.
8. Azzopardi DV, Strohm B, Edwards AD, et al. Moderate hypothermia to treat perinatal asphyxial encephalopathy. *N Engl J Med* 2009;361:1349–58.
9. Logue ES, McMichael MJ, Callaway CW. Comparison of the effects of hypothermia at 33 degrees C or 35 degrees C after cardiac arrest in rats.
10. Hypothermia after Cardiac Arrest Study Group: Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. *N Engl J Med* 2002; 346:549–556
11. Bernard SA, Gray TW, Buist MD, et al: Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *N Engl J Med* 2002; 346:557–563
12. Nielsen N, Wetterslev J, Cronberg T, et al; TTM Trial Investigators: Targeted temperature management at 33°C versus 36°C after cardiac arrest. *N Engl J Med* 2013; 369:2197–2206
13. Nolan JP, Hazinski MF, Aickin R, et al. Part 1: Executive summary: 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. *Resuscitation*. 2015 Sep 12. pii: S0300-9572(15)00360-3.
14. Jennett B, Bond M: Assessment of outcome after severe brain damage. *Lancet* 1975; 1:480–484
15. Cummins RO, Chamberlain DA, Abramson NS, et al: Recommended guidelines for uniform reporting of data from out-of-hospital cardiac arrest: The Utstein Style. A statement for health professionals from a task force of the American Heart Association, the European Resuscitation Council, the Heart and Stroke Foundation of Canada, and the Australian Resuscitation Council. *Circulation* 1991; 84:960–975

Include a brief listing of key references

