

A Middle-Aged Male with Witnessed Ventricular Fibrillation in the Emergency Department

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ABSTRACT

A middle-aged male with a past medical history significant for coronary artery disease and prior percutaneous coronary intervention was brought to the Emergency Department (ED) by EMS complaining of two days of chest pain. Initial electrocardiogram demonstrated acute myocardial infarction. Shortly after arrival the patient suffered a witnessed ventricular fibrillation (VF) cardiac arrest. ACLS was performed with return of spontaneous circulation (ROSC) after 22 minutes of CPR. The patient remained comatose and was treated with therapeutic hypothermia. Surface cooling was initiated in the ED and continued in the cardiac catheterization laboratory where angiography demonstrated 100% occlusion of the right coronary artery. This was treated with successful stent deployment. He was cooled to 33°C (91.4°F) for 24 hours, gradually rewarmed, and had steady return of neurologic function. He was discharged home on hospital day 10 with complete neurologic recovery.

Introduction

Cardiac arrest remains a major public health problem with limited therapeutic options and poor outcomes. There are approximately 300,000 out-of-hospital cardiac arrests (OHCA) and 100,000 in-hospital cardiac arrests in the United States annually¹. Survival varies between 1 and 5% for patients suffering OHCA, and between 10 and 20% for in-hospital arrest. For those having ROSC, approximately 40% survive to hospital discharge; however, only 40% of those have good neurologic recovery.

Until recently, therapeutic options for treating the post-cardiac arrest syndrome have been limited. Two randomized, controlled, clinical trials^{2,3} published in *The New England Journal of Medicine* in 2002 demonstrated the efficacy of therapeutic hypothermia in improving the outcomes of patients with ROSC after OHCA. One study, by Bernard et al², used surface cooling to lower core temperature to 33°C (91.4°F) within 2 hours of ROSC. This target temperature was maintained for 12 hours prior to gradual rewarming. They demonstrated a 23% absolute increase in patients with good neurologic outcome, from 26% in the normothermia group to 49% in those treated with hypothermia. In the second trial, by the HACA study group³, patients had surface cooling to a target temperature of 33°C (91.4°F) achieved at a median 8 hours of ROSC. This target temperature was maintained for 24 hours prior to gradual rewarming. They demonstrated a 16% absolute increase in patients with good neurologic outcome, from 39% in the normothermia group to 55% in those treated with hypothermia. They also demonstrated a 14% absolute improvement in survival at 6 months.

These findings led the International Liaison Committee On Resuscitation (ILCOR) to recommend mild therapeutic hypothermia for all out-of-hospital VF cardiac arrest victims with ROSC. Additionally, they recommend consideration of therapeutic hypothermia for all cardiac arrest victims with ROSC regardless of rhythm or patient location at the time of arrest⁴. Similarly, in the most recent revision of the guidelines



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MAW7037 Rev A 9/07

for cardiopulmonary resuscitation, the American Heart Association made similar recommendations⁵. Despite these data and recommendations, the adoption of therapeutic hypothermia has been sparse⁶. We present a case of cardiac arrest successfully treated with therapeutic hypothermia and goal-directed resuscitation.

Clinical Summary

A. Patient Demographics

A middle aged male with a past medical history significant for coronary artery disease and prior percutaneous coronary intervention was brought to the ED by EMS complaining of two days of intermittent chest pain, which had been constant for five hours prior to EMS arrival. He was placed on oxygen via nasal cannula and transported to the ED with stable vital signs.

B. ED Course

Initial electrocardiogram in the ED demonstrated acute myocardial infarction. While obtaining the EKG, the patient had a ventricular fibrillation (VF) cardiac arrest. ACLS was initiated immediately with chest compressions, bag-valve mask ventilation, and defibrillation. The patient was refractory to initial defibrillation and remained in VF. IV access was obtained, orotracheal intubation was performed, and ACLS medications were administered (3 1-mg boluses of epinephrine, 300 mg of amiodarone, and 100 mg of lidocaine). After the 5th defibrillation and 22 minutes of resuscitation, his rhythm converted to a wide complex bradycardia which evolved into a normal sinus rhythm with a stable blood pressure. The patient remained hemodynamically stable and did not require further vasoactive medications in the ED.

C. Initial Cooling Interventions

After ROSC, the patient remained comatose and was deemed a candidate for therapeutic hypothermia and goal-directed resuscitation. He had a continuous temperature probe urinary bladder catheter and a femoral arterial catheter placed. His initial post-arrest temperature was 35.5°C (95.9°F). Two liters of 4°C (40°F) saline were infused by peripheral IV over 30 minutes. Surface cooling using the Gaymar® Medi-Therm® III (MTA6900) and Gaymar Rapr•Round™ body wraps was initiated in the ED. He was paralyzed with vecuronium, sedated with midazolam, and given fentanyl for analgesia.

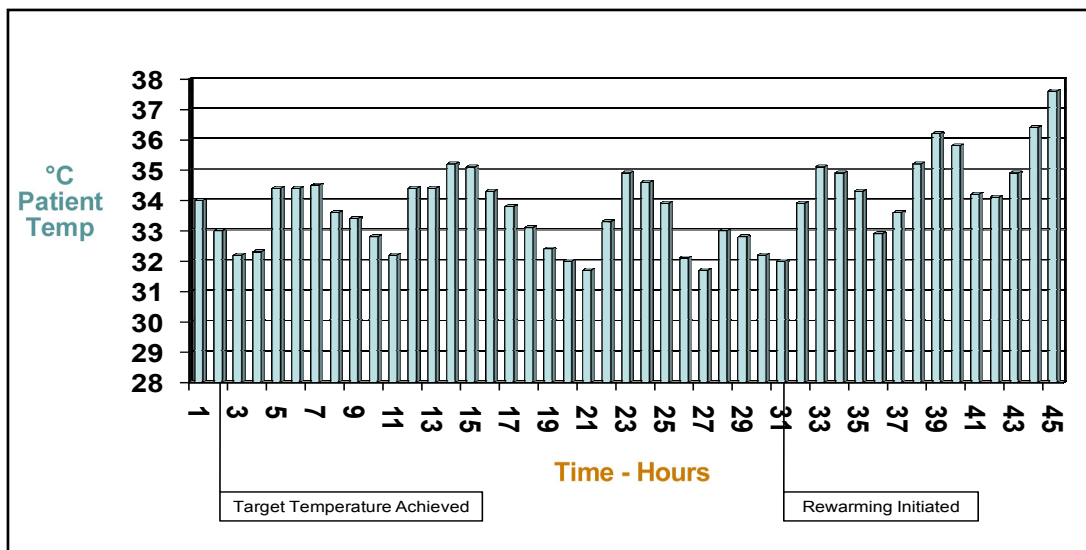
D. ED Resuscitation Interventions

After stabilization, a repeat EKG demonstrated an inferoposterior myocardial infarction. An emergent Cardiology consult was obtained and the patient was taken to the cardiac catheterization laboratory. The patient left the ED 55 minutes after initiation of cooling. At the time of transport, the patient was hemodynamically stable with a temperature of 34.0°C (93.2°F). Cooling was continued in the cardiac catheterization lab where angiography demonstrated 100% occlusion of the right coronary artery. This was treated with successful stent deployment.

E. In-House Cooling Course Summary

Target temperature of 33°C (91.4°F) was achieved less than three hours after cooling was initiated and was maintained between 31.7°C (89.1°F) and 35.1°C (95.2°F) for 29 hours. Ice packs were intermittently used when the surface cooling device was partially removed for catheterization site inspection. After 29 hours, the set point of the cooling device was increased by 0.5°C every two hours. The patient was gradually rewarmed to 36.4°C (97.5°F) over the next twelve hours at which time the Gaymar Rapr•Round body wraps were removed.

F. In-House Cooling and Rewarming Graph:



G. Summary of neurologic evaluation assessment

During cooling and rewarming phases, patient was maintained on continuous cisatracurium, fentanyl, and midazolam drips. Neurologic status was monitored with continuous single lead EEG and train of 4 neuromuscular monitoring. Two days after cardiac arrest, sedation and paralytics were weaned. The patient awoke and followed commands. He was discharged home on hospital day 10 with complete neurologic recovery.

Summary

We present a case of a middle aged male with coronary artery disease who suffered a witnessed VF cardiac arrest in the ED. After 22 minutes of ACLS resuscitation, the patient had ROSC. He was enrolled in therapeutic hypothermia using the Gaymar Medi-Therm III (MTA6900) and Gaymar Rapr•Round body wraps and goal-directed resuscitation. Target temperature was achieved less than three hours after surface cooling was initiated. Coronary angiography demonstrated 100% occlusion of the right coronary artery which was successfully stented. Cooling was maintained for 29 hours and the patient was gradually rewarmed. He was discharged home on hospital day 10 with complete neurologic recovery.

Arrest	0
CPR Initiated	0
ROSC	22m
Cooling Initiated	49m
Target Temperature Met	3h 39m
Rewarming Initiated	32h 40m
Cooling Completed	45h

References

- ¹ Peberdy MA, Kaye W, Ornato JP, Larkin JL, Nadkarni V, Mancini ME, Berg RA, Nichol G, and Lane-Trullt T for the NRCPR Investigators. “Cardiopulmonary resuscitation of adults in the hospital: A report of 14720 cardiac arrests from the National Registry of Cardiopulmonary Resuscitation.” *Resuscitation* 2003; 58: 297-308.
- ² Bernard SA, Gray TW, Buist MD, Jones BM, Silvester W, Gutteridge G, and Smith K. “Treatment of Comatose Survivors of Out-of-Hospital Cardiac Arrest with Induced Hypothermia.” *NEJM* 2002; 346: 557-563.
- ³ The Hypothermia After Cardiac Arrest Study Group. “Mild Hypothermia to Improve the Neurologic Outcome After Cardiac Arrest.” *NEJM* 2002; 346: 549-556.
- ⁴ Advanced Life Support Task Force. ILCOR Advisory Statement. “Therapeutic Hypothermia After Cardiac Arrest.” *Circulation* 2003; 108: 118-121.
- ⁵ AHA Guidelines. “Part 7.5: Post-Resuscitation Support. 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.” *Circulation* 2005; 112 (24)
- ⁶ Abella BS, Rhee JW, Huang KN, Vanden Hoek TL, and Becker L. “Induced hypothermia is underused after resuscitation from cardiac arrest: a current practice survey.” *Resuscitation* 2005; 64: 181-186.