



Clinical paper

Awakening following cardiac arrest: Determined by the definitions used or the therapies delivered?☆

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ABSTRACT

Aims: To investigate patterns of neurologic “awakening” in out-of-hospital cardiac arrest (OHCA) patients using different criteria for prognostication post-arrest.

Methods: Data was collected on 194 OHCA survivors to hospital admission. Patients were assigned to one of two groups based on whether they received therapeutic hypothermia (TH). Three separate criteria were used to assess neurologic “awakening”: motor-GCS=6, total-GCS≥9, and CPC=1 or 2. Demographics, arrest characteristics and intensive care events were compared using unpaired *t*-test, Chi-square or nonparametric Wilcoxon rank-sum test as appropriate. Primary outcome was the time from arrest to neurologic awakening.

Results: Of 194 OHCA survivors, TH was implemented in 94 patients (48%). Compared to conventional care patients, hypothermia treated patients were more likely to be younger (58 vs. 69 years, $p < 0.01$), and have a shockable arrest rhythm (27% vs. 10%, $p < 0.01$). Using the three criteria (m-GCS = 6, t-GCS ≥ 9 & CPC = 1 or 2), median time to awakening for patients in the hypothermia group versus the conventional therapy group were 6 [4,9] vs. 3 [2,5] days, 3 [3,5] vs. 2 [2,3] days, and 3 [3,6] vs. 2 [2,4] days respectively (all $p < 0.01$) and prognostication using these criteria on day 3 yielded discordant results about which patients achieved awakening.

Conclusions: Patients undergoing therapeutic hypothermia achieve meaningful neurologic “awakening” beyond 72 h post-arrest. Use of different criteria for the assessment of neurologic “awakening” can yield different prognostication predictions which calls for standardization and validation of a single definition of “awakening” by the resuscitation community.

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Introduction

It is estimated that each year 424,000 Americans suffer from non-traumatic out-of-hospital cardiac arrest (OHCA) with only 10.4% surviving to hospital discharge.¹ Survivors often experience neurologic injury as a consequence of cerebral hypoperfusion and hypoxemia during resuscitation which results in cognitive deficits,² ranging from mild memory impairment to permanent brain damage.^{3,4} Thus, the ability to prognosticate neurological recovery is key in the management of post arrest patients

especially that all newer therapies have targeted neurological recovery. Despite such efforts and therapeutic advances, the fundamental questions that emerge are when do patients “awaken” following resuscitation, what exactly is awakening, how it is best defined, and can “awakening” be predicted?

In 2006, the American Academy of Neurology (AAN) guidelines on outcome prediction of comatose survivors of cardiac arrest recommended that the brainstem reflexes and the motor component of the Glasgow Coma Scale (GCS) be used for clinical evaluation of prognosis at 72 h and later if hypothermia therapy was used.⁵ However, neither the AAN guidelines nor the 2010 American Heart Association guidelines⁶ provided specific guidance on either the optimal timing or the best tool for assessing prognostication or neurologic “awakening”.

Only recently, an advisory statement from the European Resuscitation Council and the European Society of Intensive Care

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Medicine provided broad directions on *when* neurological assessment should be done.⁷ Studies tackling this dilemma have reported conflicting results on time to neurologic “awakening” using various neurologic scores ranging from functional scores such as the Glasgow–Pittsburgh Cerebral Performance Category (CPC),⁸ to the more traditional Glasgow Coma Scale^{9–11} or even the simple clinical exam of being awake, alert and oriented to person, place or time.¹²

The goal of this study was to investigate the patterns of neurologic recovery in patients receiving conventional care or therapeutic hypothermia post arrest and how the various definitions of neurologic “awakening” related to and impacted prognostication post arrest.

Materials and methods

Study setting, design and population

This is a retrospective, IRB approved, observational cohort study of all adult patients presenting to an academic medical center after resuscitated non-traumatic out-of-hospital cardiac arrest. Inclusion criteria were age >18 years, ROSC with ICU admission, and unconsciousness (GCS < 8)¹³ upon hospital admission. Patients were excluded if they were not comatose, had a traumatic cardiac arrest, died in the emergency room, or had missing data on outcome variables of interest.

Patients were then assigned to either the Conventional Therapy Group or Hypothermia Therapy Group based on therapies used. Conventional Therapy Group patients received therapy per the American Heart Association post-resuscitation care guidelines^{14,15} without any target temperature management. Hypothermia Therapy Group patients additionally received therapeutic hypothermia.

If a patient was febrile, routine clinical care and evaluation occurred including treatment with antipyretics.

Data collection and neurological assessment

Data were gathered using Utstein guidelines.^{16,17} In addition, a standardized data collection tool was used to record daily neurologic findings, Glasgow Coma Scale (GCS), and Glasgow–Pittsburgh Cerebral Performance Category (CPC) scale (good neurologic outcome: CPC = 1–2, bad neurologic outcome: CPC = 3–5).¹⁸ Outcome prediction as determined by the neurology consultant was also recorded. The CPC score and calculation of other scores were performed by physicians and based on the evaluation of the multidisciplinary care team including neurology as documented in the medical record. In the few cases of discrepancy between observers, the report of the attending/neurologist was selected to reflect the status of the patient.

We have previously reported on how neurological assessment is commonly performed in cardiac arrest patients.¹⁹ Neurologic examinations are performed every four hours by ACLS trained skilled nursing staff, resident physicians, the ICU attending physician and often the consulting neurologist. This multidisciplinary approach guides care and prognostication. In patients who are sedated, sedation is interrupted each morning to perform accurate neurologic assessments.²⁰

Therapeutic hypothermia and sedation

Therapeutic hypothermia (TH) was utilized using a standardized protocol based on the AHA guidelines. The decision to initiate such a protocol was at the discretion of the emergency department and intensive care unit attending. Cooling was to a target core

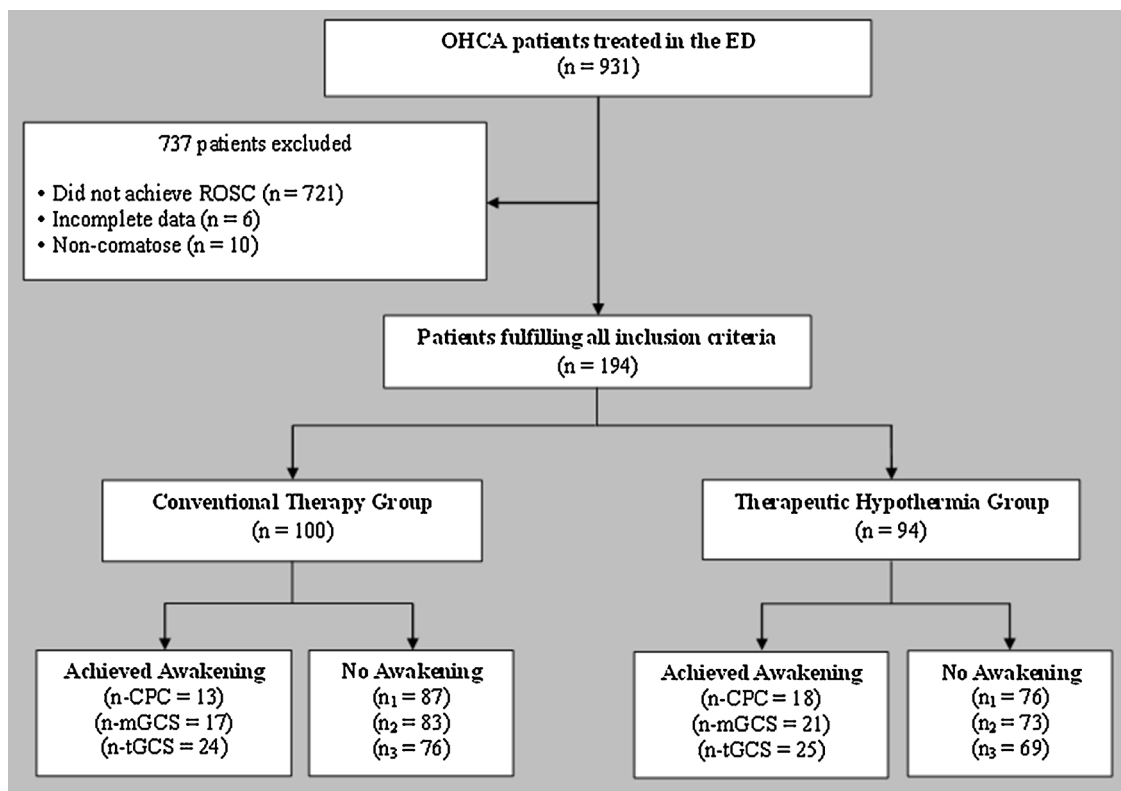


Fig. 1. Study flow diagram. Data are (n). OHCA=out-of-hospital cardiac arrest, ED=emergency department, ROSC=return of spontaneous circulation, CPC=Glasgow–Pittsburgh cerebral performance category, GCS=Glasgow coma score. n-CPC, n-mGCS and n-tGCS denote the number of patients who achieved neurologic awakening as defined by CPC 1–2, motor-GCS=6 and total-GCS \geq 9, respectively. n_1 , n_2 and n_3 denote the respective number of patients who did not achieve neurologic awakening.

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