



Short paper

Categorization of survival and death after cardiac arrest[☆]

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ABSTRACT

Background: Most cardiac arrest (CA) patients remain comatose post-resuscitation, prompting goals-of-care (GOC) conversations. The impact of these conversations on patient outcomes has not been well described.

Methods: Patients (n = 385) treated for CA in Columbia University ICUs between 2008–2015 were retrospectively categorized into various modes of survival and death based on documented GOC discussions. Patients were deemed “medically unstable” if there was evidence of hemodynamic instability at the time of discussion. Cerebral performance category (CPC) greater than 2 was defined as poor outcome at discharge and one-year post-arrest.

Results: The survival rate was 31% (n = 118); most commonly after early recovery without any discussions (57%, n = 67), followed by survival due to family wishes despite physicians predicting poor neurological prognosis (20%, n = 24), and then survival after physician/family agreement of favorable prognosis (17%, n = 20). The survivors due to family wishes had significantly worse outcomes compared to the early recovery group (discharge: p = 0.01; one-year: p = 0.06) and agreement group (p < 0.001; p < 0.001), though 2 patients did achieve favorable recovery. Among nonsurvivors (n = 267), withdrawal of life-sustaining therapy (WLST) while medically unstable was most common (31%; n = 83), followed by death after care was capped (24%, n = 65), then WLST while medically stable (17%, n = 45). Death despite full support, brain death and WLST due to advanced directives were less common causes.

Conclusions: Most survivors due to family wishes despite poor neurological prognosis die or have poor outcomes at one-year. However, a small number achieve favorable recovery, demonstrating limitations with current prognostication methods. Among nonsurvivors, most WLST occurs while medically unstable, suggesting an overestimation of WLST due to unfavorable neurological prognosis.

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Introduction

The majority of cardiac arrest survivors remain comatose post-resuscitation,¹ prompting goals-of-care (GOC) conversations with medical providers. Based on prognostication given during these conversations, families may choose to continue care, sign do-not-resuscitate (DNR) orders, or may elect for withdrawal of life-sustaining therapy (WLST).

Effective GOC conversations have been shown to shorten ICU stays, reduce the time from identification of multi-organ system failure to DNR status and improve family satisfaction in medical ICU

patients.^{1–5} The impact of GOC conversations on patient's short- and long-term outcomes following cardiac arrest has not been well studied.

GOC conversations are particularly important when they inform decisions regarding WLST, because this accounts for over 50% of deaths following CA.⁶ Recent studies have demonstrated that WLST due to unfavorable neurological prognosis by a physician (WLST-N) is the most common cause of death.^{7,8} A thorough assessment of the GOC conversations among all patients, specifically focusing on whether consensus was reached, has not been studied. We sought to address these issues by creating a detailed categorization system for modes of survival and death based on documented GOC conversations.

Methods

Electronic medical records of 385 patients admitted for CA in Columbia University ICUs between January 2008 and March

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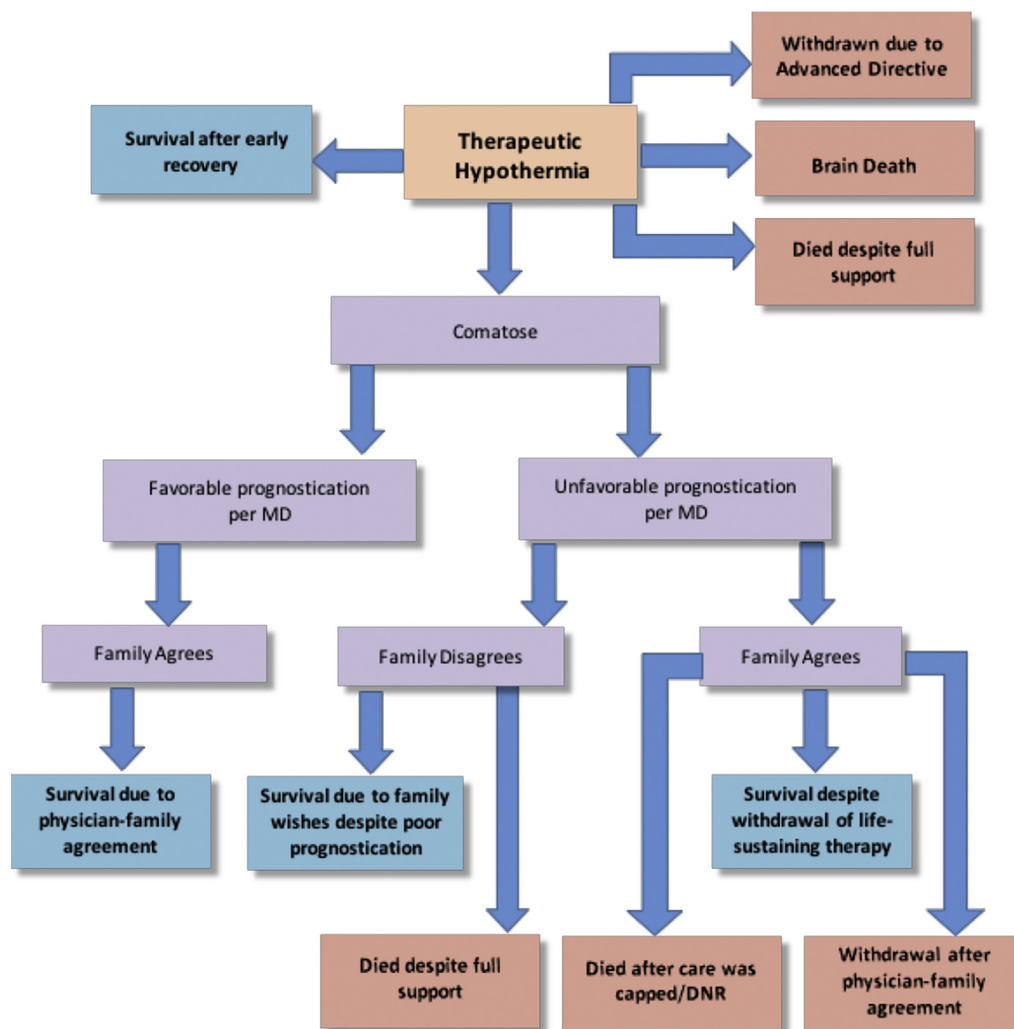


Fig. 1. Patient categorization.

2015 were retrospectively reviewed. Daily notes from critical care providers, events, family meetings, social worker and ethics consultation notes were utilized to collect information on GOC conversations, physician prognostication and families' subsequent decision.

Patients were then categorized into: (1) Survival after early recovery without any GOC discussions, (2) Survival due to physician-family agreement of good prognosis, (3) Survival due to family wishes despite the physician predicting poor neurological prognosis, (4) Survival despite WLST, (5) WLST due to advanced directives, (6) WLST after physician-family agreement, (7) Death after care was capped, (8) Death despite full support before any GOC conversation, (9) Death despite full support after GOC conversation, and (10) Brain death, as shown in Fig. 1.

Two patients were categorized as other because they did not have family or friends and thus had no opportunity for possible family discussions (one required court-appointed guardianship, and the other had care capped based on two-physician agreement with the involvement of the ethics department and patient care services).

WLST was defined as terminal extubation and then further categorized based on medical stability at the time of decision. Patients were deemed “medically unstable” if there was evidence of hemodynamic instability (refractory hypotension, need for vasopressors/inotropes, cardiovascular assist devices such as intra-aortic balloon pumps or veno-arterial ECMO), while the

remaining patients were categorized as “medically stable.” “Medically stable” patients had documented poor neurological prognosis in all GOC conversations. Thus, we redefined these patients as WLST due to poor neurological prognosis (WLST-N), consistent with several recent studies.^{7,8}

The category “death after care was capped” included patients whose families either chose no escalation of care (i.e. no further vasopressors/inotropes, antibiotics, mechanical circulatory assistance such as veno-arterial extracorporeal membrane oxygenation (ECMO), etc), or signed DNR and/or do-not-intubate (DNI) orders with subsequent respiratory or circulatory arrest.

Cerebral performance category (CPC) was calculated at hospital discharge based on neurological exam documented in discharge summaries, physical and occupational therapy notes.⁹ CPC was calculated at one-year post-arrest based on detailed phone interviews with patients or family members. A CPC of 1–2 was considered a good neurological recovery and z-test for proportions was used to compare various groups.

Results

Among the 385 CA patients, 72% required GOC conversations. There were 118 survivors and 267 nonsurvivors. The survivor group was younger, with lower CPC scores at baseline, less incidence of out-of-hospital cardiac arrests, shorter time to ROSC, and higher incidence of ventricular tachycardia/fibrillation on presentation

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