

Factors Affecting Survival and Neurologic Outcome of Patient with Perioperative Cardiac Arrest

To the Editor:

In an interesting retrospective study including 2,524 perioperative cardiac arrest cases from Get With The Guidelines-Resuscitation (GWTG-R) registry, findings by Ramachandran *et al.*¹ that one in three patients survives to hospital discharge and two of three survivors have neurologically intact survival are encouraging. The power of this study is its use of a large dataset that includes and adjusts for most of the known factors that can affect final outcomes after in-hospital cardiac arrest (IHCA), such as patients' age, race, preexisting morbidities, time and location of cardiac arrest, initial pulseless rhythm, and many more. The authors have used appropriate methods for building predictors of survival from perioperative cardiac arrests and openly discussed the limitations of their work. However, this study is a retrospective analysis using observational designs that are inevitably subject to uncontrolled and unmeasured confounding.

First, this study cohort comprised 2,524 patients with perioperative cardiac arrests from 234 hospitals within GWTG-R registry between February 24, 2000 and August 3, 2008. American Heart Association GWTG-R registry is a large, hospital-based, clinical registry of IHCA that has been enrolling patients since January 2000.² A retrospective analysis of 104,732 IHCA cases from 362 hospitals within GWTG-R registry between 2000 and 2009 shows that duration of hospital participation in GWTG-R registry is significantly associated with increased survival of the IHCA cases.³ Moreover, Merchant *et al.*⁴ find that the case-mix-adjusted IHCA event rate is highly variable across hospitals within GWTG-R registry, and hospital measures of volume and demographic features may explain the variation in case-mix-adjusted IHCA event rates. In the study by Girotra *et al.*⁵ including 84,625 patients with IHCA events from 374 hospitals within GWTG-R registry, survival improves significantly, and the rates of neurologic disability decrease significantly over time during the past decade. Thus, other than adjustments of potentially confounding patient-related and event-related factors, hospital characteristics and survival variability over time should also be considered when identifying independent predictors of survival and neurologically intact survival of patients with IHCA using multivariable logistic regression models. Otherwise, sensitivity and specificity of identified predictors would be decreased.

Second, this study showed that cardiac telemetry was significantly associated with improved survival to hospital discharge and neurological outcomes. We would like to know whether

patients receiving cardiac telemetry have simultaneously used other monitoring measures (*i.e.*, pulse oximetry and capnography) and whether there is any imbalance in other monitoring measures between patients with and without telemetry. Cardiac telemetry is the only continuous monitoring measure of a patient's heart rate and rhythm. However, respiratory compromise is one of the leading causes of the IHCA events.^{6,7} The common sequences of the IHCA events after respiratory compromise probably are the following: hypoxia leading to fatigue/hypercarbia or hypercarbia leading to hypoxia-respiratory compromise-tachycardia-bradycardia and cardiac arrest. That is, cardiac monitoring detects only the terminal IHCA events caused by respiratory compromise. Thus, efforts to improve the outcomes of perioperative cardiac arrests may also need to focus on preventing respiratory compromise, which deteriorates into cardiac arrests, by increasing the respiratory monitoring. Brady *et al.*⁸ showed that monitored (*i.e.*, electrocardiography, pulse oximetry, apnea, or bradycardia monitoring) and/or witnessed IHCA patients were more likely to be discharged with favorable neurologic outcome, but cardiac monitoring conferred no additional outcome benefit over direct observation of patients having IHCA.

Finally, overall survival-to-discharge rate in this study (31.7%) was double that in previous reports of IHCA on general hospital floors from GWTG-R database (15.3 to 17%). It is generally believed that survival and neurologic recovery of IHCA patients are closely associated with uninterrupted compressions, high-quality cardiopulmonary resuscitation, and basic life support interventions.⁹ In a retrospective analysis including 118,387 adult IHCA cases entered into GWTG-R database from January 1, 2000, to August 26, 2008,¹⁰ incidence of resuscitation system errors was shown as high as 26.8 to 40.4%. The most frequent errors were related to delay in medication administration, defibrillation, airway management, and chest compression performance errors. Resuscitation system errors occurred in the highest percentage of IHCA events in nonintensive care unit inpatient areas (40.4%) and were least frequently noted on IHCA events occurring in intensive care unit (25.8%), emergency department (27.2%), or operating room/postanesthesia care units (23.5%) ($P = 0.0001$). Furthermore, the presence of resuscitation system errors was associated with a decreased survival of IHCA. Other than the reasons deduced by authors in Discussion, therefore, we cannot exclude the possibility that decreased resuscitation system errors would have contributed to an improved overall survival of perioperative cardiac arrests in this study.

Competing Interests

The authors declare no competing interests.

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Data on the Anesthetic Procedure or Surgical Risk Are Still Necessary

To the Editor:

I have read the very interesting and detailed article by Ramachandran *et al.* recently published in *ANESTHESIOLOGY*,¹ dealing with perioperative cardiopulmonary arrest and the possibility of its prediction through a retrospective database analysis. The authors showed results on the influence (predictors) of perioperative diseases, type of cardiac rhythm when pulseless activity was detected, event location (operating room, postanesthesia care unit, intensive care area, telemetry,

or general ward), and other patient characteristics. Although designed to study the survival to hospital discharge as the primary outcome, and the neurological outcome (intact or affected by neurological disability) as the secondary one, I was surprised by the fact that several items usually (and in my opinion obligatory) included in anesthesia-related mortality and morbidity studies, as those cited by the authors^{2–4} and others,^{5–8} as are the surgical procedure (even grossly classified), any kind of risk stratification or score (American Society of Anesthesiologists' physical status, *etc.*), and, perhaps the most important, the type of anesthetic procedure the patient was subjected to, were not included in the analysis or not showed. Otherwise, the exclusion of these informative data was not clearly explained. These are important because it could explain some of the findings of the study, as the relatively high survival rates, with good neurological outcomes of asystolic arrests, and, in part, the better outcome of cardiac arrests occurring in the operating room or in the postanesthesia care unit: for instance, asystolic cardiac arrests due to spinal anesthesia have been described as with easier resuscitation and good outcomes,^{2,9} and those can occur in younger patients having better physical status. Another example would be that general anesthesia is frequently chosen in the more severe patients and in high-risk surgeries, and consequently, worse prognostic should be expected if a cardiopulmonary arrest occurs.²

Competing Interests

The author declares no competing interests.

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