Clinical paper

Characteristics and outcomes of maternal cardiac arrest: A descriptive analysis of Get with the guidelines data☆

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ABSTRACT

Background: Maternal mortality has risen in the United States in the twenty-first century, yet large cohort data of maternal cardiac arrest (MCA) are limited.

Objective: We sought to describe contemporary characteristics and outcomes of in-hospital MCA.

Methods: We queried the American Heart Association's Get with the Guidelines Resuscitation voluntary registry from 2000 to 2016 to identify cases of maternal cardiac arrest. All index cardiac arrests occurring in women aged 18–50 with a patient illness category designated as obstetric or location of arrest occurring in a delivery suite were included. Institutional review deemed that this research was exempt from ethical approval.

Results: A total of 462 index events met criteria for MCA, with a mean age of 31 ± 7 years and a racial distribution of: 49.4% White, 35.3% Black and 15.3% Other/Unknown. While 32% had no pre-existing conditions or physiologic disorders, respiratory insufficiency (36.1%) and hypotension/hypoperfusion (33.3%) were the most common antecedent conditions. In most cases, the first documented pulseless rhythm was non-shockable; pulseless electrical activity (50.8%) or asystole (25.6%). Only 11.7% presented with a shockable rhythm; ventricular fibrillation (6.5%) or pulseless ventricular tachycardia (5.2%) while the initial pulseless rhythm was unknown in 11.9% of cases. Return of spontaneous circulation occurred in 73.6% but 68 (14.7%) had more than one arrest. The rate of survival to discharge was 40.7% overall; 37.3% with non-shockable rhythms, 33% with shockable rhythms and 64.3% with unknown presenting rhythms.

Conclusions: Maternal survival at hospital discharge in this cohort was less than 50%, lower than rates reported in other epidemiological datasets. More research is required in maternal resuscitation science and translational medicine to continue to improve outcomes and understand maternal mortality.

Introduction

Maternal mortality in the United States has increased more than 50% between 1990 and 2015; current estimates suggest a ratio that exceeds one maternal death for every 4000 live births [1]. Explanations for this national crisis include: 1) social, economic and demographic disparities; 2) gaps in clinical care and team performance; and 3) increased maternal co-morbidities. Maternal cardiac arrest (MCA)

represents a final common pathway for a variety of maternal patho-physiologic insults including: hemorrhage, cardiovascular abnormalities, embolic events, sepsis and hypertensive disorders of pregnancy.

Despite the importance of MCA in characterizing maternal morbidity and mortality, large cohort studies detailing MCA remain limited. Einav et al. [2] reported a series in 2012 of 94 cases of MCA encompassing 1980–2010 with an overall maternal survival rate of 54.3%. Subsequently, utilizing data from the National Inpatient Sample from 1998 to 2011, Mhyre et al. [3] reported that MCA complicated 8.3/100,000 hospitalization admissions for delivery (99% CI, 7.7 to 9.3 per 100,000) with a maternal survival to discharge rate (N = 4843) of 58.9%. Most recently, a series of 66 women with MCA identified from the United Kingdom Obstetric Surveillance System (UK OSS) revealed a 58% maternal survival rate at discharge [4]. Analysis of the Canadian Perinatal Surveillance system data also reported in 2017 by Balki et al. [5] revealed that the incidence of cardiac arrest during pregnancy was 1: 12,500 deliveries, with a higher survival to discharge rate of 71.3% (204/286). We sought to further describe contemporary characteristics and outcomes of in-hospital MCA in the United States.

Methods

The American Heart Association's Get with the Guidelines-Resuscitation® (GWTG-R) is a voluntary national quality improvement program for in-hospital cardiac arrest including all adult, pediatric and obstetrical patients who undergo resuscitation for cardiopulmonary arrest in a participating hospital facility. The associated registry includes detailed data relevant to cardiopulmonary resuscitation. Individual sites are not reported to maintain confidentiality of the quality improvement process and avoid potential HIPAA violation. We queried the database to identify cases of MCA from 2000 to 2016. We included all index cardiac arrests occurring in women aged 18–50 with a patient illness categorized at the time of data abstraction as "obstetric" or an arrest location of "delivery suite". Fig. 1 depicts the identification process that was utilized to identify women sustaining one or more in-hospital MCA events from the entire GWTG dataset of cardiac arrests. Variables captured for each patient included demographic data, clinical resuscitation parameters and outcomes. The primary outcome was survival to hospital discharge. Secondary outcomes included: return of spontaneous circulation (ROSC) for at least 20 min and survival at 24 h. Survival outcomes were examined separately by initial pulseless rhythm. All patient and facility data were collected as part of a quality assurance program that is not specific to pregnancy; it contains no data on pregnancy-related diagnoses, pregnancy outcome or linkage to fetal or neonatal outcomes. The data repository is powered by Outcomes, an IQVIA Company in Parsippany, NJ. Institutional review deemed this research exempt from ethical approval.

Statistical analysis was performed using Statistical Package for the Social Sciences (IBM/SPSS; 19.1). Descriptive statistics were utilized to report both the demographic features and the outcomes of the MCA cohort. These included frequency distributions for categorical data, and mean with standard deviation and range for age, which was the only continuous variable. Proportions were calculated using the denominator of MCA cases (women) with available data.

Results

A total of 462 women met criteria for MCA. Table 1 presents the information provided at the time of reporting regarding prearrest data including: maternal age, race and pre-existing conditions of the women experiencing MCA. Respiratory insufficiency and hypotension/hypoperfusion were common antecedents to MCA. While 32% had no pre-existing conditions or physiologic disorders, 36.1% had respiratory insufficiency, 33.3% had hypotension/hypoperfusion, 12.6% had diabetes, 9.1% had renal insufficiency, 8.4% acute CNS non-stroke events and 7.4% had cardiac disease.
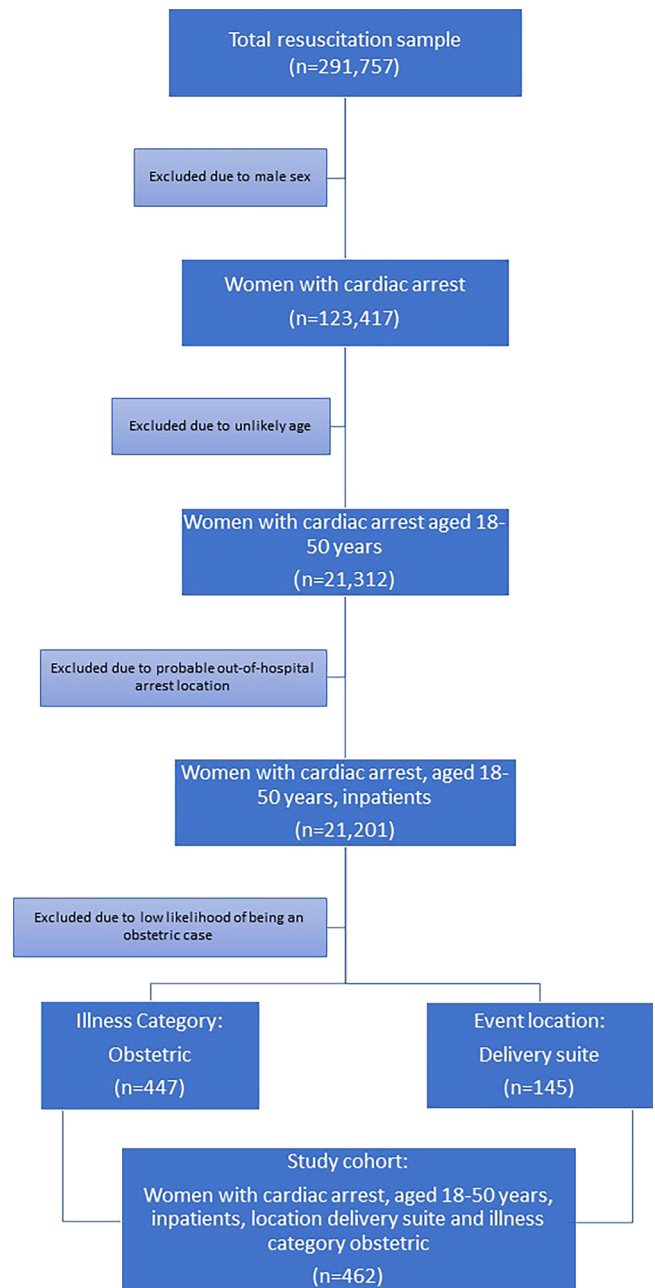

Fig. 1. Identification of Maternal Cardiac Arrest Cohort.

Characteristics of the arrests were also analyzed. The index event was witnessed in 93.7% and a hospital-wide resuscitation response was activated in 77.0% of events. Table 2 depicts the locations of maternal cardiac arrest with most occurring in the delivery suite. In most cases, the first documented pulseless rhythm was non-shockable: pulseless electrical activity (50.8%) or asystole (25.6%). Only 11.7% presented with a shockable rhythm: ventricular fibrillation (6.5%) or pulseless ventricular tachycardia (5.2%). The initial pulseless rhythm was unknown in 11.9% of MCA cases. See Table 3.

Treatment and management characteristics of the MCAs were also analyzed. An AED was applied in 21.6% of cases. The observed rate of ventilatory support was high (99.4%) with endotracheal intubation utilized in (416/462) (90.0%) of MCA cases. Our data did not allow us to identify which patients were intubated prearrest. Epinephrine was administered in 86.8% of the cases. The medications utilized for resuscitation in this cohort are reported in Table 3.

Outcomes for this cohort of women sustaining MCA were also