Variability in Interpretation of Cardiac Standstill Among Physician Sonographers

Kevin Hu, MD; Nachi Gupta, MD, PhD; Felipe Teran, MD; Turandot Saul, MD; Bret P. Nelson, MD; Phillip Andrus, MD*

*Corresponding Author. E-mail: pandrus@gmail.com, Twitter: @pandrus.

Study objective: Cardiac standstill on point-of-care ultrasonography has been widely studied as a marker of prognosis in cardiac arrest. Return of spontaneous circulation has been reported in as few as 0% and as many as 45% of patients with cardiac standstill. When explicitly documented, the definition of cardiac activity in these studies varied from any slight change in echogenicity of the myocardium to any kinetic cardiac activity. We hypothesize that the variability in research definitions of cardiac activity may affect interpretation of video clips of patients in cardiac arrest. The goal of this study is to assess the variability in interpretation of standstill among physician sonographers.

Methods: We surveyed physician sonographers at 6 conferences held at 3 academic medical centers in the Greater New York area. Survey respondents were allotted 20 seconds per slide to determine whether each of 15 video clips of patients in cardiac arrest were standstill or not. Data were collected anonymously with radio frequency remotes.

Results: There were 127 total participants, including faculty, fellows, and resident physicians specializing in emergency medicine, critical care, and cardiology. There was only moderate interrater agreement among all participants (α=0.47). This lack of agreement persisted across specialties, self-reported training levels, and self-reported ultrasonographic expertise.

Conclusion: According to the results of our study, there appears to be considerable variability in interpretation of cardiac standstill among physician sonographers. Consensus definitions of cardiac activity and standstill would improve the quality of cardiac arrest ultrasonographic research and standardize the use of this technology at the bedside. [Ann Emerg Med. 2017;■:1-6.]

Please see page XX for the Editor's Capsule Summary of this article.

0196-0644/$-see front matter

http://dx.doi.org/10.1016/j.annemergmed.2017.07.476

SEE EDITORIAL, P. XXX.

INTRODUCTION

Background

Because early studies showed no survivors of cardiac standstill on point-of-care ultrasonography, it has been widely adopted for prognostic use in arrest as an alternative to end tidal CO_2 ($ETCO_2$) monitoring, duration of cardiopulmonary resuscitation (CPR), and clinical gestalt, each of which has limitations.[1,2] The 2010 American Society of Echocardiography and American College of Emergency Physician consensus statement explicitly recommends point-of-care echocardiography to guide termination or continuation of resuscitative efforts.[3] Out-of-hospital providers are increasingly using ultrasonography for futility determination.[4] Although a recent meta-analysis questioned the utility of cardiac standstill, studies to date have had widely varying outcomes and have not used a uniform definition (Table 1), and none have reported survivors to discharge or neurologic outcomes.[5,6]

Importance

Delineating the utility of cardiac standstill in cardiac arrest is critically important. Objective measures of prognosis in arrest allow focus of limited resources on where they are most likely to benefit patients. Imprecise definitions in previous studies may have led to variability in the interpretation of standstill and the resultant reported outcomes.

Goals of This Investigation

In this study, we sought to determine the degree of variability in interpretation of cardiac standstill among physicians who have access to point-of-care ultrasonography in their practice.

MATERIALS AND METHODS

Study Design and Setting

This was a cross-sectional convenience sample survey of physicians who have access to point-of-care

Editor's Capsule Summary

What is already known on this topic

Emergency physicians often use bedside ultrasonography to guide termination or continuation of cardiopulmonary resuscitation. Its utility may be limited by variability in the interpretation of cardiac standstill.

What question this study addressed

Using 6-second sonographic clips from a convenience sample of 15 pulseless arrests, the authors examined the interrater reliability of 124 physician ultrasonographers in detecting or excluding cardiac standstill. Physicians were not told the rhythm.

What this study adds to our knowledge

Physicians exhibited only moderate agreement in their assessments of cardiac standstill. Disagreement was greatest in cases with valve flutter with weak or no cardiac contraction, cardiac movement caused by mechanical ventilation, and profound bradycardia. Agreement was greatest in cases with strong or absent contractions, or with ventricular fibrillation.

How this is relevant to clinical practice

Variability in interpretation potentially undermines the use of sonographic assessment of cardiac standstill and suggests the need for clarification on the definitions and assessment of cardiac arrest.

ultrasonography in their practice. All study procedures were reviewed and exempted by the institutional review board of participating medical centers.

Selection of Participants

Survey respondents were recruited during a 9-month period at 6 conferences held at 3 Greater New York area academic medical centers: the Icahn School of Medicine at Mount Sinai, Beth Israel Medical Center, and St. Luke's–Roosevelt Hospital. The conferences were emergency medicine weekly conferences at each of these centers, the Icahn School of Medicine ED-ICU combined ultrasonographic rounds, the St. Luke's–Roosevelt City Wide Ultrasound Rounds, and the NYC Resuscitative Ultrasound rounds at Beth Israel Medical Center. Attending these conferences were physicians who practice in public and private academic hospitals who had access to ultrasonography at the point of care in their practices. Eligible residents, fellows, and faculty from the specialties of emergency medicine, critical care, and cardiology were invited to participate. Attendees who had participated at an earlier conference were excluded. We did not collect data on conference attendees who elected not to participate.

Methods of Measurement

At each of 6 meetings, a study investigator introduced the study with a brief presentation on the existing literature on the prognostic use of cardiac standstill on point-of-care ultrasonography. Cardiac standstill was defined only as the absence of cardiac activity. No definition of cardiac activity was given, but participants were made aware of the variability of definitions that appear in the literature. Physicians who agreed to participate were given remote polling devices (RCRF-02; TurningPoint ResponseCard RF; Turning Technologies, Youngstown, OH), and several multiple-choice primer slides were presented to familiarize participants with the audience response system used to collect data. Responses were transmitted wirelessly from these remotes to a receiver and collected in a TurningPoint database (versions 5.2 and 5.3; Turning Technologies) on the computer used for the presentation. No identifying information was transmitted or collected during this study, other than specialty (emergency medicine, critical care, and cardiology), training level (resident, fellow, and attending physician), and self-reported ultrasonographic skill level (none, basic, advanced, and expert).

Data collection with the remote polling devices was performed on subsequent slides in the same presentation. Slides with multiple-choice questions collected the following demographics: specialty, level of training, and self-reported level of ultrasonographic proficiency. Participants were then given this clinical scenario for the final 15 slides: "Your patient is a 55-year-old man in cardiac arrest who remains pulseless after 20 minutes of CPR." These question slides (Appendix E1, available online at http://www.annemergmed.com) consisted of 6-second deidentified clips of patients in pulseless arrest, obtained from our quality assurance database. Fifteen clips were chosen to reflect a range of sonographic cardiac findings that may be observed in arrest (Videos E1 to E15, available online at http://www.annemergmed.com). This was the cohort of clips we intended to analyze, understanding that there would be variability in that group, including absent cardiac activity, weak cardiac activity, strong cardiac activity, valve flutter, ventricular fibrillation, and even simply motion caused by bag-valve-mask ventilation. The clips used for this study were obtained from either a SonoSite M-Turbo with P21 phased-array or C60 curvilinear probes (SonoSite, Inc., Bothell, WA) or Mindray M7 Machine with the P4-2s phased-array probe (Mindray DS USA Inc, Mahwah, NJ).