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Clinical paper

Determining witnessed status for out-of-hospital cardiac arrest☆

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ABSTRACT

Objective: Witnessed status is considered a core variable in reporting cardiac arrest data and can be ascertained from either the emergency dispatch recording or the pre-hospital record. The purpose of this study is to compare and assess the quality and consistency of these information sources.
Methods: This retrospective analysis included 1896 cases of out-of-hospital cardiac arrest occurring between September 1, 2012 and December 31, 2014.
Results: We found that there was minimal (kappa = 0.30, 95% CI 0.27–0.33) to moderate (kappa = 0.64, 95% CI 0.59–0.69) agreement between the pre-hospital record and the emergency dispatch recording when these sources of information are used to determine witnessed status. Witnessed status could not be determined from the emergency dispatch recording in 36.2% (n = 684) of eligible cases. Survival was similar regardless of the method used to determine witnessed status. Using a combination of the pre-hospital record and the emergency dispatch recording yielded the highest number of witnessed cases.
Conclusion: The determination of witnessed status in out-of-hospital cardiac arrest may be challenging, as evidenced by the discrepancies in witnessed status when comparing different sources of information. The large number of cases where the witnessed status could not be determined from the emergency dispatch recording precludes its use as the sole source of information. It is reasonable to use the patient care record alone, however it should be recognized that there is misclassification of witnessed status regardless of the method used and this may affect the strength of association between witnessed status and survival.

Introduction

Out-of-hospital cardiac arrest (OHCA) is a major cause of mortality in the United States with substantial survival variability among communities.[1,2] Twenty-five years ago, the Utstein guidelines were created to standardize reporting of cardiac arrest data and to facilitate comparison of outcomes between communities. The first Utstein guidelines,[3] created in 1991, considered witnessed status a core element in reporting cardiac arrest data as it is strongly associated with survival.[4] The importance of witnessed status was reaffirmed in subsequent revisions to the Utstein guidelines, including the most recent 2014 revision.[5,6] In this update, witnessed arrest is defined as "a cardiac arrest that is seen or heard by another person or is monitored".[6] In most emergency medical services (EMS) systems, witnessed status is determined from the pre-hospital record alone. The emergency dispatch recording, which is reviewed by some agencies for quality assurance purposes, is another source of information that may be used to determine witnessed status. To date, no study has compared these two sources of information for determining witnessed status.

The purpose of this study is to examine and compare the data sources used to establish witnessed status in OHCA and to characterize the challenges associated with determining this variable.

Methods

This retrospective study included cases of OHCA occurring in King County, Washington, excluding Seattle (population 1,300,000), between September 1, 2012 and December 31, 2014. Cases of confirmed EMS treated cardiac arrest in patients aged >17 years were included in the study. Cardiac arrests secondary to trauma and those that occurred after the arrival of EMS were excluded from the study.

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King County EMS is a two-tiered system serving urban, suburban, and rural communities. The first tier consists of EMTs equipped with automated external defibrillators (AEDs). The second tier is paramedics who provide advanced cardiac life support. Both groups of responders are activated for suspected cardiac arrests and arrive on scene approximately 5 and 10 min respectively after dispatch.

King County EMS maintains a database of OHCA for quality assurance purposes. A data coder routinely abstracts data from pre-hospital records and dispatch recordings for each cardiac arrest occurring within the county. In most cases, BLS and ALS providers completed separate patient care reports and all available reports were reviewed. BLS and ALS providers were trained to specifically note the witnessed status for cardiac arrests using the Utstein definition of a witnessed arrest as one that is seen or heard. During the study period, approximately 40% of cases were documented using electronic patient care records, which contained a dropdown menu to indicate whether the arrest was witnessed as well as a narrative section. The coder verified that the witnessed status checkbox agreed with the information contained in the narrative. When there was disagreement, information from the narrative was given precedence as the narrative provides a more detailed description of arrest events. For cases documented without an electronic patient care record, the narrative was used to determine witnessed status because paper records did not contain a checkbox for this variable. When there was disagreement between the BLS and ALS patient care records, the BLS report was given preference, as BLS responders are typically the first on scene. One of the study authors (MML) reviewed a subset of 404 cases in detail to assess the calls qualitatively. Both dispatch calls and pre-hospital records were reviewed for these cases and discrepancies between the ALS and BLS reports were specifically noted.

The witnessed status information obtained from the pre-hospital record is recorded as the "document variable", while the information obtained from the dispatch audio recording is stored as the "audio variable". Criteria for coding witnessed status based on the pre-hospital records and audio recordings were as follows: An arrest was considered witnessed if the bystander saw or heard the arrest, if the bystander described events of the collapse, or if the bystander was made aware of the arrest due to agonal respirations. In cases where the patient was not initially in arrest at the time of the call but became unresponsive during the course of the call, the arrest was considered witnessed. If the call was terminated prior to the patient collapse and a bystander was present, the arrest was considered witnessed. In cases where the witnessed status was not apparent on review of the dispatch recording or pre-hospital record, the witnessed status was classified as unknown.

For both database variables, witnessed status was coded as yes, no, or unknown. We constructed a 3×3 table to show the coding of witnessed status based on the audio variable compared to the document variable and calculated a Cohen's kappa[7] to assess the agreement between the two data sources in relation to what would be expected by chance.

Information from the two witnessed status variables was analyzed using four strategies. First, the dispatch recording was used as the sole source of information. Second, the pre-hospital record was used as the sole source of information. The third strategy for determining witnessed status incorporated data abstracted from the dispatch recording and the pre-hospital record into a decision tree algorithm. If the audio variable was coded as yes or no, witnessed status was coded to match this variable. However, if the audio variable was coded as unknown, the coding from the document variable was used. In the final strategy, both the dispatch recording and the pre-hospital record were used to determine witnessed status using an either/or algorithm. If either the recording or the pre-hospital record indicated that the arrest was witnessed, then the arrest was coded as witnessed. All other cases were coded as unwitnessed.

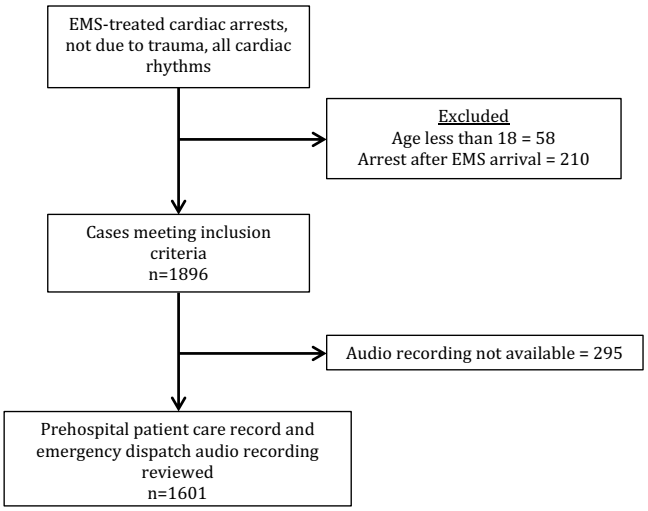

Fig. 1. Case selection and availability of data used to code witnessed status.

Data were analyzed using SPSS version 20.0. Patient characteristics and outcomes were described using means for continuous variables and counts for categorical variables. Differences across groups were assessed using the Student's t test or the Pearson chi squared test. A two-sided alpha level of less than 0.05 was considered statistically significant.

This study was approved by the University of Washington Institutional Review Board.

Results

There were 2164 out-of-hospital cardiac arrests that occurred from September 1, 2012 to December 31, 2014 (Fig. 1). Fifty-eight cases were excluded because the patient age was less than 18 and 210 cases were excluded because the arrest occurred after EMS arrival, leaving 1896 cases that met the inclusion criteria for this study. Pre-hospital records were available for all cases meeting the inclusion criteria. There were 295 cases (15.6%) for which the dispatch recording was unavailable.

Table 1 compares patient characteristics for cases in which the dispatch recording was available to those cases in which the recording was unavailable for review. For those cases in which the recording was not available for review, survival to hospital discharge was higher (21.7% compared to 16.5%, $p = 0.03$), the mean age was lower (62.6 vs. 65.1, $p = 0.02$), bystander CPR rate was higher (72.5% vs. 66.5%, $p = 0.04$) and the arrest was more likely to occur in a public place (21.7% vs. 15.7%, $p = 0.03$) compared to cases in which the recording was available.

Table 2 shows the classification of witnessed status according to the pre-hospital record and the dispatch recording. The Cohen's kappa[8] for all 1896 eligible cases, accounting for cases that were not reviewed was 0.30 (95% confidence interval [CI] 0.27–0.33), indicating minimal agreement.

There were 165 cases in which the witnessed status on the pre-hospital record and dispatch recording were in disagreement, representing 18% of all cases in which witnessed status was not unknown based on both sources of information and 9% of all eligible cases. Considering only the 918 cases for which witnessed status could be determined from both sources, Cohen's kappa was 0.64 (95% CI 0.59–0.69), indicating moderate agreement. Of the subset of 404 cases that were reviewed qualitatively, there were 22 cases (5.4%) in which there was disagreement between the ALS and BLS patient care record.

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