

Determining time of onset in patients with acute coronary syndromes: Agreement between medical record and interview data

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Abstract:

Background: Prehospital delay, the time of symptom onset until the time of hospital arrival, for patients with symptoms of acute coronary syndrome (ACS) is frequently used to determine the course of care. Total ischemic time (time for symptom onset until the time of first coronary artery balloon inflation) is another criterion for quality of care for patients experiencing ST-segment elevation myocardial infarction. However, obtaining the exact time of symptom onset, the starting point of both time intervals, is challenging. Currently 2 methods are used to obtain the time of symptom onset: abstraction of data from the medical record and structured interviews done after the acute event. It is not clear whether these methods are equally accurate.

Purpose: Using identified search terms, PubMed and the Cumulative Index to Nursing and Allied Health Literature were searched for articles published from 1990 to 2014 to identify studies that examined agreement between the 2 data sources to determine prehospital delay in patients with ACS.

Conclusions: Five studies examined the accuracy and/or agreement of prehospital delay by medical record review and structured patient interviews. In these studies, the percentage of missing/incomplete data in the medical record was higher compared with interviews (14%-40% vs 12%-13%). Three of the 4 studies that compared the 2 data sources reported more than 50% disagreement, with the time of symptom onset starting sooner when obtained by interview compared with the time recorded in their medical record at hospital presentation.

Clinical Implications: There is a need for a consistent, reliable method to assess the time of symptom onset in patients with ACS. To ensure the accuracy of data collected for the medical record, training of emergency and critical care clinicians should (1) emphasize the importance of

assessing symptoms broadly, (2) provide tips on interviewing techniques to help patients pinpoint the time of symptom onset, and (3) instill the value of complete documentation.

Keywords: Acute coronary syndromes | Concordance | Interview | Medical record | Symptom onset time

Article:

Patients with acute coronary syndromes (ACSs) include those with ST-segment elevation myocardial infarction (STEMI), non-STEMI, and unstable angina (UA).¹ Diagnosis for each type of ACS is based on presenting symptoms and diagnostic tests (eg, 12-lead electrocardiogram [ECG] and serum biomarkers [troponin I or troponin T]).¹ Delay in diagnosis and treatment for these patients has been shown to negatively impact mortality and morbidity.¹ In fact, 1 criterion of quality care for patients with ACS is door-to-balloon time: the time of hospital arrival to the time of first coronary artery balloon inflation.² Another quality-of-care benchmark measures total ischemic time (the time of symptom onset to first coronary artery balloon inflation time), which has been shown to correlate better with infarct size and mortality compared with the door-to-balloon time interval.² Thus, it is important to measure these time intervals accurately to monitor performance quality and maximize patient outcomes.

The times of hospital arrival and first coronary balloon inflation are relatively easy to define and obtain from the medical record. However, consistency in operationally defining the time of symptom onset within and across health care facilities has been a challenge. Therefore, the American College of Cardiology Foundation/American Heart Association Task Force on Clinical Data Standards advocates use of consistent clinical terms with reliable definitions for measuring timing of symptom onset.³ The American College of Cardiology Foundation/American Heart Association defines the time of symptom onset as the time when the patient first notes ischemic symptoms lasting 10 minutes or longer.³ These symptoms may include chest pain or pressure, shortness of breath, jaw or arm pain, nausea/vomiting, fatigue/malaise, or other symptoms of discomfort.³ If the patient has intermittent symptoms, the time of the most recent symptoms before hospital presentation is used.³ If symptoms are initially varying in quality or intensity (stuttering), the time of symptom onset is defined as the time when symptoms become constant.³

In addition to needing a consistent operational definition of the time of symptom onset, there should be consistency in how the data (time of symptom onset) are collected from the patient experiencing symptoms. Patient-related factors influence accurate assessment and documentation. For example, some patients minimize or overtly hide symptoms. Some patients are unable to pinpoint the time of symptom onset because of vague, intermittent, or less intense symptoms. Other times, patient instability may influence the ability of the patient to answer questions. Nurse-related factors, such as variation in assessment/interview technique, experience with patients with ACS, and nurse-patient staffing ratio, may also influence accurate assessment and documentation of the time of symptom onset. In addition, system-related factors, such as differences in documentation methods, ranging from using hard copies to computerized clinical documentation systems, may influence data completeness and accuracy.

Once health care providers obtain and document the time of symptom onset, monitoring for completeness and accuracy should be done. Currently, 2 primary methods are used to obtain the time of symptom onset for patients with ACS: abstraction of data from the medical record and structured interviews with the patient by personnel after the index event. It is not clear, however, whether these methods are equally accurate and interchangeable. Therefore, this review article examines the completeness and accuracy of both methods and the level of agreement between them.

METHODS

PubMed and CINAHL (Cumulative Index to Nursing and Allied Health Literature) were searched for articles published from 1990 to 2014 to identify studies that examined the accuracy and/or agreement between data obtained from medical records and structured interviews to determine the time of symptom onset and the overall prehospital delay for patients diagnosed with ACS. Search terms and key words included *agreement, concordance, medical record, self-report, and symptoms*. In addition, relevant citations from the articles in the review were examined. Studies were excluded if they did not include either information on the time of symptom onset or the time of overall prehospital delay in patients with ACS.

RESULTS

Five studies published between 1994 and 2005 examined the accuracy and/or agreement on prehospital delay time of medical record review and structured patient interviews.⁴⁻⁸ All 5 were descriptive, observational studies published in English (Table). Four of the 5 studies were conducted in the United States; the fifth was conducted in Japan.

TABLE CAN BE FOUND AT THE END OF THE ARTICLE

The first study, published in 1994, was part of the *Worcester Heart Attack Study*, which used retrospective chart review to examine prehospital delay among patients with a confirmed diagnosis of acute myocardial infarction (AMI) in 16 hospitals in Massachusetts.⁴ During the 3 years studied (1986, 1988, and 1990), 2142 medical records were reviewed from patients with confirmed AMI, defined as a *typical* history of prolonged chest pain (lasting >20 minutes) not relieved by rest or the use of nitrates, serum cardiac enzyme elevations, and evolutionary changes in the 12-lead ECG (ST segment or Q wave) consistent with a typical AMI. Symptom onset time was defined as the time when the patient reported becoming *acutely* and *severely ill*. Prehospital delay time was defined as the interval between the onset of symptoms suggestive of AMI and arrival at the emergency department. Patients with nonspecific or atypical symptoms or with prolonged prehospital delay (>24 hours) and those who died of coronary heart disease (CHD) in a pre-hospital setting were excluded from the analysis.

The researchers found that the time of symptom onset could not be determined in 863 of the patient records (40%) because of missing or incomplete data.⁴ Patients with incomplete data were more likely to be older, female, and admitted to a community hospital (rather than a teaching hospital); more likely to have a non-Q-wave AMI; and less likely to survive the hospitalization. Possible explanations for missing medical record data included patient-related

factors (vague, nonspecific, or atypical symptoms and/or poor recall of the time of symptom onset) and health care provider-related factors (inadequate questioning and/or inaccurate or incomplete documentation). This study was the first to report the challenges of using medical data on prehospital delay; however, the researchers did not conduct interviews for comparison.

The second study, published in 1998, was a population-based study from the *Minnesota Heart Survey* and included data from patients admitted to 6 hospitals in the Minneapolis-St Paul area in 1990 and 1991.⁵ In this study, trained staff nurses conducted brief, structured, face-to-face interviews with patients 25 years or older who had been admitted for symptoms of ACS. Most interviews (97%) were conducted in the coronary care unit within 24 hours of hospital admission. Interviewers asked several questions about the onset of acute cardiac symptoms that led the patient to seek medical care. One question was: “Did you have an acute episode of pain or discomfort in your chest leading up to this admission? If yes, what was the date and time of the chest pain?” Approximately a year later, data from medical records were abstracted from the patients interviewed about the onset of acute coronary-related pain or discomfort. Hospital arrival time was also abstracted from the medical record, although patients were not asked about this time point during the interviews. By convention, prehospital delay was defined as the length of time between symptom onset and presentation to the emergency department. By convention, patients with inaccurate dates or times (eg, negative delay times) and those with prehospital delay times greater than 48 hours (3.2% of cases based on interview data and 1.3% of cases based on medical record data) were excluded from the analysis.

Of the 1523 patients who had symptom onset times elicited during the interview, nearly a fourth (24%) had missing data in the medical record.⁵ The percentage of missing data in the record was higher for patients with UA (30.5%) than for those with chronic CHD (25.7%) or AMI (18.6%). Overall agreement between the 2 sources on delay, defined as within 20% of each other, was 49%. The percentage of disagreement increased as delay times became longer and was also greater when the patient’s final discharge diagnosis was AMI. Delay times determined by interview were longer than those calculated by times in the medical record for all discharge diagnoses.

A third study, published in 2002, reported data collected over a 4-month period between December 1995 and March 1996, from 43 hospitals in 5 regions of the United States as part of the *Rapid Early Action for Coronary Treatment* study.⁶ Data were collected in standardized phone interviews, with probes as necessary, conducted by trained research staff approximately 2 months after hospital discharge (median, 61 days) with patients 30 years or older who had been admitted for suspected cardiac ischemia and discharged with a CHD-related diagnosis. Researchers asked patients about their perceptions and actions taken at the time of symptoms and specifically when they remembered symptoms starting. The interview data were then compared with data documented in the medical record by the emergency nurses and physicians at the time of the index event. The emergency nurses’ notes were used as the primary data source for data abstraction from the medical record. Prehospital delay was defined as the length of time between ACS symptom onset and presentation to the emergency department. If the time of symptom onset was unavailable in the medical record, then information about symptom duration was used to calculate the time of symptom onset. If patients reported symptoms that were initially intermittent and then became constant, the *acute onset time* was defined as the time of change in

symptoms from intermittent to constant. In addition, if the patient reported that initial symptoms were mild and changed in severity, *symptom onset* was defined as time of change in symptom severity. Patients with prehospital delay times greater than 48 hours were excluded from the analysis.

Of the 448 patients interviewed by phone, 58 (13%) were unable to recall the time of symptom onset; 86 (19%) had missing or unavailable data in the medical records.⁶ A total of 316 patients had delay times available from both sources, including 165 patients with a discharge diagnosis of AMI and 151 with UA. The overall agreement of the 2 sources on delay was 47%; 19% of the cases had perfect agreement, and 56% were within an hour's difference. However, the percentage of disagreement was higher for patients in the UA group than for those in the AMI group (60% and 47% respectively). Furthermore, the data obtained by phone interview ranged more widely, with longer median delay times, than data collected at the time of presentation to the emergency department for the medical record, regardless of discharge diagnosis.

A fourth, published in 2004, was an observational study of a sample of convenience from 2 inner-city and 1 suburban hospital in the Midwest in the years 2001 to 2003.⁷ Participants included adults 21 years or older who had an out-of-hospital AMI, were able to speak and understand English, and were cognitively intact. An AMI was defined as positive cardiac enzymes (CK-MB twice the upper limit of normal or a positive troponin level per the institution), or 12-lead ECG findings deemed positive by a cardiologist. Women and African Americans were oversampled to ensure that the final sample included at least 40% women and 25% African Americans. Trained cardiovascular research nurses conducted structured interviews lasting 45 to 90 minutes using the *Myocardial Infarction Symptoms Profile* to obtain information about the symptom experience, including the time of symptom onset. Interviews were conducted within 14 days of hospital admission; 69% were within 72 hours, and 90% were within 6 days (some were interviewed later in the hospitalization because of stability issues or revascularization procedures). Data from the medical records were used to confirm information about the symptom experience, including the time of symptom onset and the time of admission.

Of the 270 patients who were eligible to participate, 31 (11%) refused because of fatigue or lack of interest, and 24 (8%) did not have medical records available because they were not accessible or the patients refused to let them be examined for the study.⁷ Of the 215 participants interviewed by researchers, 26 (12.1%) were unable to identify the time of symptom onset; 85 (39.5%) did not have symptom onset time documented in the medical record. A total of 123 patients (57.2%) had delay time available from both sources. Fifty cases (40.7%) had delay times that differed by 15 minutes or less between the 2 sources; 85 cases (69%) were within 45 minutes of each other.

The last study, published in 2005, was an observational study of a convenience sample of 155 patients with AMI from 5 hospitals in Japan between January and August 2002.⁸ Participants included adults diagnosed with AMI who were hemodynamically stable, able to speak Japanese, and mentally alert. A trained interviewer conducted structured interviews with participants, who consented as soon as possible after they were hemodynamically stable (mean time, 3.6 ± 1.7 days from hospital admission). Questions asked about the symptom experience included atypical symptoms and information about when the participants first noticed symptoms. A sample

question was: “People can experience many different symptoms when they have a problem with their heart; by symptom I mean any feeling that is unusual or out of ordinary” (with examples given). If participants had difficulty pinpointing an exact time, the interviewer helped them recall the timing of symptom onset in relation to activities of daily living in a 24-hour day (eg, before breakfast, after lunch). Data from medical records were then reviewed by 1 of the 2 researchers who conducted the interviews. The time of symptom onset was obtained from the emergency department records, nursing and physician notes, and discharge notes from the hospitalization. If there was a discrepancy, the time noted that was closest to the time of hospital arrival was used. As with the other studies, prehospital delay was defined as the time from symptom onset to the time of hospital arrival.

Of the 155 participants interviewed, 22 (14.2%) did not have a time of symptom onset documented in the medical record.⁸ However, 14 of these participants had approximations of times (eg “after lunch” or “evening”) recorded. The median time for the 22 participants who did not have a documented time of symptom onset was much longer (18.1 hours) than for the 133 participants who had the time of symptom onset recorded (3.5 hours). Of the 133 participants who had data from both sources, there was perfect agreement in 66 of the cases (42.6%); another 34 cases (21.9%) had times within 30 minutes of each other. The median prehospital delay time collected from the structured interview was significantly longer than that in the medical record (3.5 vs 3.15 hours). Symptom severity was an independent predictor of disagreement between the 2 sources. Participants with a symptom severity greater than 8 on a scale of 0-10 had 2.3 times the odds to be in the disagreement group (odds ratio, 2.3; 95% confidence interval for odds ratio, 1.04-4.88) than in the agreement group. A possible explanation for disagreement were that emergency nurses and physician may have focused their assessment and documentation on classic AMI symptoms, particularly chest pain, whereas the structured interview included questions about the onset of a variety of AMI symptoms, not simply chest pain.

DISCUSSION

These studies confirm that the 2 primary methods of obtaining the time of symptom onset for patients with ACS are abstraction of data from the medical record and structured interviews with patients. In these studies, the percentage of missing or incomplete data in the medical record ranged from 14% to 40%.⁴⁻⁸ The authors of 1 study noted that in some cases symptoms were documented, but not the time of symptom onset.⁷ Also, the authors of 2 studies suggested that the type of symptoms patients have may have influenced whether time of symptom onset was documented.^{4,7} That is, patients with vague and less typical symptoms of AMI were more likely to have incomplete or missing data.^{4,7} One explanation for this may be that emergency nurses and physicians place emphasis on identifying signs/symptoms that confirm a diagnosis quickly, such as classic or typical symptoms. In 1 study, the authors found that patients were more likely to have missing or incomplete data in the medical record if they were older, were female, had a non-Q-wave MI, and were seen in a nonteaching hospital.⁴ The authors of another study noted that patients with UA were more likely to have data missing from the medical record than patients with CHD or AMI (30.5%, 26%, and 19%, respectively).⁵ One explanation for this may be that providers have an urgent need to document the time of symptom

onset in patients with STEMI to determine eligibility for reperfusion therapy (as opposed to patients with non-STEMI, UA, or chronic angina).

In these studies, missing data were also found in patient interviews used to ascertain the time of symptom onset. However, the percentage of missing data from interviews (in the 2 studies reporting this) was markedly less (12%-13%) than the percentage of missing data in the medical record.^{7,8} The medical record may have had a higher percentage of missing data because patients were experiencing the symptoms during the time of data collection. Patients may have been in pain, uncomfortable, and/or anxious, which can affect recall or ability to articulate their experience.⁹ By the time the interview was conducted, patients were probably asymptomatic, and they may have been asked to repeat their symptom history to more than 1 health care provider. Moreover, the interviews were conducted by trained researchers, lasting longer on average than questioning by emergency nurses and physicians at the time of the index event in the emergency department.

In this review, 3 of the 4 studies reported more than 50% disagreement between the sources, indicating that the methods are not interchangeable. To evaluate disagreement between the 2 sources, it is necessary to examine the nature and extent of the discrepancies reported. One study reported that the more extreme the prehospital delay times were, the more the 2 sources disagreed.⁵ Whether this is due to a patient-related factor (inability to pinpoint an accurate starting time) versus a nursing-related factor (defining the start time differently than the interviewers did later) is unknown.

The study conducted in Japan reported that pain intensity was related to the percentage of agreement between the 2 sources.⁸ In this study, for patients who rated their pain intensity higher than an “8” on a numeric rating scale of 0 to 10 had 2.3 times the odds of being in the disagreement group after controlling for age, gender, education level, symptom onset time, peak cardiac enzyme values, or calling for the emergency medical services. These findings are counterintuitive: it would seem that the more intense symptoms are, the more likely the patient would be able to recall the time of symptom onset. However, patients who have more painful symptoms may also have more anxiety or fear at the time of the event, and this may influence their ability to report accurate symptom onset time at the time of the index event.⁹

A final factor to consider in examining accuracy of data collected is whether either method introduces a systematic bias. In 3 studies, when patients were interviewed later after the index event by researchers, they reported that symptom onset started much sooner than the time recorded in their medical record at hospital presentation.^{5,6,8} Whether interviews produce an overestimation (or medical records produce an underestimation) of the true time is unknown. Nonetheless, when and how the interviews are conducted may help to explain discrepancies between the 2 sources. For example, the study that conducted subject interviews face-to-face within a few days of the index event had a much higher percentage of perfect agreement between the 2 sources than the study that conducted phone interviews approximately 2 months after hospitalization (43% vs 19%).^{6,8} This suggests that interview data may be more accurate when obtained in person closer to the time of the index event.

LIMITATIONS

All 5 studies discussed were observational studies that had variation in purpose, setting, sample, time period for collecting data, and data analysis methods for comparing the 2 data sources. Furthermore, all of the studies used retrospective data. Nonetheless, these findings are helpful in generating hypotheses to assist in designing future prospective studies to compare the accuracy of both sources when collecting quality-of-care data.

IMPLICATIONS

Accuracy in obtaining the time of symptom onset depends on the patients' recall, which may vary based on the timing and type of questions asked by nurses and physicians, and the degree of probing by staff. In addition, precision in identifying the time of symptom onset assumes that the patient's symptoms have a discrete onset, and the patient recognizes a change from usual baseline, accurately interprets the symptoms as cardiac, and can recall the events when asked by others – whether at the time of presentation or later. This review of 5 studies has shown discrepancies between data documented in the medical record versus interview data collected after the index event. Clearly, there is a need for a consistent, reliable method to assess and document the time of symptom onset in patients who have experienced ACS symptoms.

To ensure the accuracy of data collected for the medical record, training of nurses and physicians should emphasize the importance of assessing symptoms broadly, provide interviewing techniques to help patients pinpoint the time of symptom onset, and emphasize the value of complete documentation. A comprehensive interview guide to capture the full symptom experience, including atypical symptoms, the time the patient first noted symptoms lasting 10 minutes or longer, and the time when symptoms became constant prior to hospital presentation, would be helpful to nurses and physicians who have first contact with these patients. The interview guide should be user friendly and efficient for patients and providers, and be seamless with the medical record, to avoid delaying timely assessment, diagnosis, and treatment of ACS. Also, the use of quality improvement initiatives (eg, the ACTION Registry-GWTG for patients with ACS developed by the National Cardiovascular Data Registry¹⁰) by hospitals to track documentation of symptom onset time for patients with ACS may help to increase data completeness. In addition, observational studies in real time could be used to evaluate whether patient responses are accurately documented in the record.

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