Cardiac Arrest Definition Using Administrative Codes and Outcomes in Acute Myocardial Infarction

To the Editor: Cardiac arrest (CA) complicates 5% to 10% of acute myocardial infarction (AMI) admissions and is associated with poor outcomes.1 Previous studies have leveraged administrative databases to understand the epidemiology and outcomes of CA.2,3 In administrative databases, CA is typically captured using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes, which have varying accuracy.3 In this study, we sought to assess the in-hospital mortality in CA complicating AMI on the basis of the specific ICD-9-CM codes used.

Using the National Inpatient Sample (NIS) data from January 1, 2000, to December 31, 2014, a retrospective cohort of admissions with a primary diagnosis of AMI (ICD-9-CM code 410.x) and secondary diagnosis of CA (ICD-9-CM code 427.5), cardiopulmonary resuscitation (CPR) (ICD-9-CM codes 99.60 and 99.63), or ventricular fibrillation (VF) (ICD-9-CM codes 427.4, 427.41, and 427.42) was identified.2,5 Admissions with ventricular tachycardia (VT) (ICD-9-CM code 427.1) without a concomitant diagnosis of CA, CPR, or VF were not included. The outcomes of interest were the prevalence and in-hospital mortality in the CA, VF, and CPR cohorts. Survey procedures using weighted discharges provided in the NIS database were used to generate national estimates. Statistical analyses were performed using SPSS version 25.0 (IBM Corporation).

Of the 9,747,034 admissions with a primary AMI diagnosis, the presence of CA, VF, or CPR codes was noted in 491,068 (5.0%) (Figure A). The mean age was 67.0±13.6 years; 35.6% were female; and 63% were white. Previous implantable cardiac defibrillator was present in 0.7%, 1.1%, and 1.3% of the CA, VF, and CPR cohorts, respectively. Concomitant VT was noted in 22.8%, 28.7%, and 22.7% of the CA, VF, and CPR cohorts, respectively. The 15-year study found a steady increase in temporal trends across all categories (Figure B). The all-cause in-hospital mortality was 45.1% in patients with AMI with any type of CA. Cohorts with a diagnosis of VF had lower in-hospital mortality, whereas cohorts with a diagnosis of CPR had the highest in-hospital mortality (Figure C and D).

In this 15-year study, 5.0% of AMI admissions had concomitant CA, with marked variability in the prevalence on the basis of the ICD-9-CM codes used. Isolated VF had the lowest in-hospital mortality. It is conceivable that patients with AMI may have received direct defibrillation without concomitant CPR contributing to lower in-hospital mortality in the VF cohort.2 Ventricular fibrillation CA is known to have a lower mortality risk than do other forms of CA, potentially explaining why patients with VF plus CPR had low in-hospital mortality, even though the performance of CPR (a surrogate for in-hospital CA) has been associated with poor prognosis.2,3 Previous data from our group have suggested that the receipt of CPR without a concomitant VF code is suggestive of a non-shockable rhythm and therefore associated with worse outcomes.2 Although not the focus of our study, we noted a temporal increase in the prevalence of all categories of CA. It is possible that higher comorbidities and acuity of illness may contribute to these trends, though the impact of systematic changes in coding practices cannot be ruled out.4 Our work expands on the existing CA literature and helps define the differences in outcomes on the basis of the ICD-9-CM codes used to define CA. It is crucial to consider these differences in the evaluation of epidemiological research in CA when using administrative data.2,3

This study has several limitations. Previous work has reported that these ICD-9-CM codes identify CA with varying accuracy.3,4 The NIS does not incorporate duration of no-flow state, bystander CPR, duration of CPR, echocardiographic data, angiographic variables, and hemodynamic parameters that are known to influence outcomes. Our study evaluated only admissions with a primary AMI diagnosis and is therefore not representative of all CA admissions. It is conceivable that admissions with pleomorphic, polymorphic, and monomorphic VT may have been represented as VF in this administrative database. Lastly, contemporary administrative data use International Classification of Diseases, Tenth Revision, Clinical Modification codes, which include a diagnosis code for CA due to an underlying cardiac cause that will require additional validation and examination regarding the association with outcomes.
In conclusion, the prevalence and outcomes of CA vary depending on the administrative definition used. Standardization of CA definition in epidemiological studies using administrative codes is needed to ensure accurate reporting.

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The Exercise Vital Sign as a Potential Alternative to Determining Cardiorespiratory Fitness

To the Editor: Ross1 makes a powerful argument for the measurement of cardiorespiratory fitness (CRF) in clinical care and challenges us to take action. Cardiorespiratory fitness is potentially a stronger predictor of mortality than are established risk factors such as smoking, hypertension, high cholesterol, and type 2 diabetes mellitus, and its routine measurement would certainly improve patient care.2 The routine measurement of CRF, however, is not feasible in most clinical settings because of logistics, cost, and time. The use of nonexercise estimates of CRF has been advocated as an alternative to CRF measurement. These CRF estimates are based on complex sex-specific formulas that are negatively affected by age, body mass index, and resting heart rate and positively affected by a physical activity score/index obtained from self-reported exercise intensity, duration, and frequency.3,4

The exercise vital sign (EVS) has been proposed to help health care systems and providers prioritize physical activity assessment, advice, and promotion during clinical encounters. The EVS is the product of the answer to 2 questions: “On average, how many days per week do you engage in moderate to strenuous exercise like a brisk walk?” and “On average how many minutes do you engage in exercise at this level?”5 The result can determine whether an individual is meeting current physical activity guidelines.6 The EVS includes 2 of the self-reported physical activity components (frequency and duration) that formulas use to estimate CRF. The EVS is easily obtained and calculated and is already included in many electronic medical records.

Until CRF can be more easily measured or estimated in clinical practice, health care providers should focus on promoting physical activity and CRF by routinely obtaining the EVS.

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In reply—The Exercise Vital Sign as a Potential Alternative to Determining Cardiorespiratory Fitness

To the Editor: In his letter, Langland1 acknowledges the importance of including cardiorespiratory fitness (CRF) as a routine measure in clinical practice, as CRF is a stronger predictor of mortality than are established risk factors, and consequently its routine measure would improve patient care.2,3 Langland agrees that direct measures of CRF in most clinical settings is not feasible because of logistics and cost. However, he posits that the alternative recommendation—to use nonexercise estimates of CRF—presents a challenge, as they are based on complex sex-specific formulas that incorporate age, body mass index, resting heart rate, and self-reported measures of physical activity to derive the CRF estimate. Alternatively, health care professionals are encouraged to assess physical activity levels using the exercise vital sign approach that determines physical activity on the basis of a response to 2 straightforward questions.4

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