Aggregate Vital Sign Monitoring Prior to Cardiac Arrest

Christopher G. Choukalas, MD, MS; Edward M. Galvan, RN, Arthur W. Wallace, MD, PhD

Introduction

Cardiac arrest in hospitalized patients carries a high mortality, but is rarely unanticipated. Patients frequently demonstrate alterations in mental, respiratory, and cardiac status in the hours leading up to these events. Much attention has been paid to identifying such decompensating patients, and data in emergency department and step-down patients suggests severity of illness scales1,2 or vital sign-based algorithms may have a role.3,4 Data are lacking for patients in intensive care units (ICU), presumably because they are monitored closely. We used a third-party algorithm-based software program (Visensia, OBS Medical, North Carolina) to identify retrospectively instability in a sample of adult ICU patients who suffered cardiac arrest.

Method

The study took place in a large, urban, tertiary-care, academic teaching hospital. We extracted data sufficient to calculate a Visensia Stability Index (VSI) at five-minute intervals for the 20 hours prior to arrest from the 20 most recent consecutive patients suffering cardiac arrest requiring advanced cardiac life support- (ACLS) level care in a mixed medical-surgical-cardiac ICU. The role of OBS Medical in the study was limited to calculating the VSI on de-identified data. The primary variable of interest was the lead-time between the first episode of instability (defined as a VSI ≥ 3.2) and cardiac arrest. We also reviewed patient records to identify the first point of nursing documentation of patient instability within the 20 hours prior to arrest.

Results

Of the 20 most recent cardiac arrests, six were excluded because they did not require ACLS-level care. Patients were mostly medical (9 of 14 were admitted to the medical or cardiology service; the remainder were a mix of cardiac and general surgery patients). Most arrests (9/14) were attributed to cardiac causes; the remainder were respiratory, and over half (8/14) were fatal. The mean lead-time of the VSI alert prior to arrest was 15.1 (sd = 6.6) hours. Nurses documented instability an average of 9.3 (sd = 7.1) hours prior to arrest. Figure 1 shows the lead-time for the VSI and nurse documentation by subject.

Discussion

Despite advances in ACLS and ICU care, recovery from cardiac arrest remains abysmal. Preventing cardiac arrest depends in part on early recognition of clinical instability. The VSI alert signaled clinical instability 15 hours prior to arrest, an amount of time that could reasonably be expected to allow assessment and stabilization, which may ultimately be sufficient to prevent arrest. Our study was small and included only patients who arrested. Although this limits the inferences that may be drawn, it suggests that clinical warning systems may detect clinical instability well in advance of a cardiac arrest.

Comments

In this pilot study of aggregate vital sign monitoring prior to cardiac arrest,

• The aggregate monitoring system generated a 15 hour lead time prior to arrest.

• A post-hoc examination of nursing documentation showed a 9 hour lead time by comparison.

• A large, case-matched, retrospective study is under way.

References:


