They also postulated a gender-related susceptibility, given the fact that all the cases in their literature review were females [3]. The association of RCVS and Bickerstaff’s brain stem encephalitis was reported in a 75 year old woman who presented with headache, new-onset hypertension, and the association of left eyelid ptosis and limitation of extraocular movements in the left eye [4]. Computed tomography angiography ruled out cerebral aneurysm. MRI showed stigmata consistent with RCVS. She subsequently developed right side ptosis and bilateral oculomotor and trochlear nerve palsy, followed by clinical and laboratory stigmata of peripheral demyelinating neuropathy. A subsequent complication was the development of impaired consciousness and euvoletic hyponatremia, the latter attributable to the syndrome of inappropriate antidiuretic hormone secretion. Her conscious level and ophthalmoplegia improved after plasmapheresis. The hyponatremia was also gradually corrected. Two months later she had completely recovered [4]. Conversely, however, reversible cerebral vasoconstriction syndrome can develop as a complication of the use of intravenous immunoglobulin for treatment of Bickerstaff brain stem encephalitis [5]. The latter complication occurred in a 25 year old woman who had been admitted with typical neurological stigmata of brain stem encephalitis, followed by clinical and laboratory stigmata of demyelinating peripher neuropathy, in association with a cerebrospinal fluid protein content of 80.2 mg/dL. The MRI study performed on admission was normal. Due to rapid progression of her disease she was treated with intravenous immunoglobulin. Forty eight hours after initiation of that treatment she experienced further neurological deterioration, and also subsequently became comatose. A second MRI study showed stigmata of RCVS in the cerebral hemispheres, vertebral artery vasospasm, and brainstem edema. At no stage of her hospital stay did she experience hypertension. She improved markedly after plasmapheresis, and the MRI showed a decrease in the RCVS–associated bitemporal lesions, with only a small parieto-occipital infarction. By contrast brainstem edema persisted. After 3 months intense rehabilitation she was completely orientated and she could walk, although binocular ptosis, ocular palsy, and dysphagia persisted [5].

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total ED-related charges of $4.2 billion in 2013. For reference, the ED charge for chronic obstructive pulmonary disease was $3.1 billion in 2012 [5].
Heart rate variability (HRV) is a physiologic parameter that is altered in many conditions including heart disease, hypertension, hyperlipidemia, obesity, smoking and diabetes and is associated with increased mortality in patients following myocardial infarction [6–15]. Based on these findings, HRV presents a promising strategy to differentiate chest pain patients who will be diagnosed with ACS. We conducted a prospective observational study of patients presenting to a 65,000-visit academic Midwestern ED with a chief complaint of chest pain. The objective of our study was to measure the diagnostic utility of HRV in diagnosing ACS among ED patients with chest pain. Using a 10-min heart tracing performed in the ED, we assessed the correlation between HRV with 30-day MACE, HEART score, and cardiovascular risk factors. Inclusion criteria included age > 30, no obvious traumatic or non-cardiac cause of chest pain, and sinus rhythm. Those with ST-elevation myocardial infarction (STEMI) were excluded from the study.

Our hypothesis was that lower HRV in the ED is associated with ACS measured by 30-day MACE, higher HEART score, and more cardiovascular (CV) risk factors. Our primary endpoint was MACE diagnosed during index hospitalization or within 30 days of ED visit. Secondary endpoints included associations between HRV and HEART score and CV risk factors. HRV is measured and analyzed in many ways, we used frequency domain measures including low frequency (LF), high frequency (HF), LF/HF ratio, and total power (TP). Sixty patients were included in the final analysis. Our sample population was 58% percent women with mean age of 55 (Table 1). 92% of participants had at least one cardiovascular risk factor. Admission rate was 65%. Six participants experienced the primary endpoint of MACE: three patients were diagnosed with non-ST-elevation myocardial infarction and one patient underwent PCI for an unstable angina during the index hospitalization. Two additional patients experienced MACE in the subsequent 30 days. One patient died due to unknown causes, and 1 additional patient underwent PCI for a critical coronary stenosis found on coronary angiogram. There were no significant associations found between HRV and the primary outcome MACE (all p > 0.05), Table 2.

Table 1 shows the results of univariate regression analysis of the association between HEART score and HRV. Table 4 shows the results of univariate regression analysis between the five HEART score parameters and HRV. Notably, significant associations were found between HEART score and heart rate variability. Lower HRV was associated with higher heart score. Within the Risk Factors category (Table 5), diabetes and hypertension appeared to drive the association between increased risk factors and less heart rate viability. In this observational prospective study measuring HRV in patients presenting to the ED with chest pain, we found a significant

Heart rate variability in the risk stratification of emergency department patients with chest pain

Chest pain is the second most common presenting complaint in the emergency department (ED), accounting for 8–10 million ED visits per year and between $10–13 billion dollars per year in ED costs [1, 2]. Several scoring systems developed recently have attempted to stratify patients based on their risk for major adverse cardiac events. The HEART score is a prospectively studied scoring system designed to identify patients who are at highest risk of a major adverse cardiac event (MACE) in the next 6 weeks [3–5], and this score is used as a part of chest pain management protocols in many hospitals. Heart rate variability (HRV) is a physiologic parameter that is altered in many conditions including heart disease, hypertension, hyperlipidemia, obesity, smoking and diabetes and is associated with increased mortality in patients following myocardial infarction [6–15]. Based on these findings, HRV presents a promising strategy to differentiate chest pain patients who will be diagnosed with ACS. We conducted a prospective observational study of patients presenting to a 65,000-visit academic Midwestern ED with a chief complaint of chest pain. The objective of our study was to measure the diagnostic utility of HRV in diagnosing ACS among ED patients with chest pain. Using a 10-min heart tracing performed in the ED, we assessed the correlation between HRV with 30-day MACE, HEART score, and cardiovascular risk factors. Inclusion criteria included age > 30, no obvious traumatic or non-cardiac cause of chest pain, and sinus rhythm. Those with ST-elevation myocardial infarction (STEMI) were excluded from the study.

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Table 3 shows the results of univariate regression analysis of the association between HEART score and HRV. Table 4 shows the results of univariate regression analysis between the five HEART score parameters and HRV. Notably, significant associations were found between HEART score and heart rate variability. Lower HRV was associated with higher heart score. Within the Risk Factors category (Table 5), diabetes and hypertension appeared to drive the association between increased risk factors and less heart rate viability. In this observational prospective study measuring HRV in patients presenting to the ED with chest pain, we found a significant