

Does Limiting PreHospital 12 Lead ECGs to Patients Who Complain of Chest Pain Delay Diagnosing AMI?

Lorissa Plis, DPN, RN, CNS, CCNS, CCPC, Michael Jorolemon, DO, Karen Sigona, and Robert Pikarsky *Crouse Hospital*

Background/Objectives: Studies have shown that emergency medical services (EMS) obtained prehospital 12 Lead electrocardiograms (ECGs) have a positive impact on the treatment and mortality of patients experiencing an acute myocardial infarction (AMI). Most EMS protocols focus on a complaint of chest pain as the indication for obtaining the 12 lead ECG. Review of the literature demonstrates that only about 67% of patients experiencing an AMI complain of chest pain.

Methods: All patients >18 years old, who were presented to a community hospital between July 1, 2010 and February 28, 2011 and who had a discharge diagnosis of AMI were reviewed. Analysis was performed to investigate relationships between presenting complaints, mode of arrival, and timing of first 12 Lead ECG.

Results: Of the AMI patients who arrived via EMS with a complaint of chest pain, 95.5% had a prehospital ECG (95% confidence interval, 87.3%–99.0%). Of that group, 42.4% were ST-segment elevated myocardial infarctions (STEMIs) and 53.0% were Non-ST elevation myocardial infarctions (NSTEMIs). For the AMI patients who arrived via EMS and who did not complain of chest pain only 50% had a prehospital 12 lead ECG (95% confidence interval, 29.9%–70.1%). Of the nonchest pain group, 30.8% were STEMIs and 69.2% NSTEMI. By limiting the acquisition of a prehospital 12 lead ECG to patients who had a complaint of chest pain would have delayed the diagnosis of 28.3% of all AMI patients arriving via EMS.

Conclusions: By limiting EMS protocols to only obtain 12 Lead prehospital ECGs to patients who complain of chest pain can significantly delay diagnosis of AMIs which negatively impacts treatment time. Development of an expanded selection protocol for the use of prehospital 12 Lead ECGs is expected to enhance the prehospital identification of AMIs.

STEMI Door-To-Balloon Times: EMS Transmitted 12 Lead EKGs to Geisinger Wyoming Valley Versus Other Arrival Modalities

Jack Lasky, EMT-P, EMS, Thomas Isaacson, MD, David Schoenwetter, DO, and Ronald Strony, MD, FACEP *Geisinger Wyoming Valley, Wilkes-Barre*

Background/Objectives: The goal was to observe the door-to-balloon times for ST-segment elevated myocardial infarction (STEMI) patients who arrive at Geisinger Wyoming Valley by: emergency medical services (EMS) with a 12 Lead electrocardiogram (EKG) transmitted; EMS with a 12 Lead EKG not transmitted; EMS no 12 Lead EKG; Emergency Department walk-in.

Starting January 2009, Geisinger Wyoming Valley (GWV) placed the Lifenet Receiving Station in the Emergency Department to receive 12 Lead EKGs from EMS Units. At that time, there was only 1 EMS Unit that could transmit 12 Lead EKGs. The EMS Department sponsored numerous 12 Lead classes for the area EMS Units. This led to a marked increase in the number of EMS Units transmitting 12 Lead EKGs. To evaluate the effectiveness of the Lifenet Receiving Station and the education provided to the EMS community, we began a review of STEMI patients' door-to-balloon times on January 1, 2011. The study reviewed door-to-balloon times for patients arriving at GWV by EMS with a 12 Lead EKG transmitted, and EMS arrivals with a 12 Lead EKG not transmitted, EMS arrivals with no 12 Lead EKG, and Emergency Department walk-in arrivals.

A total of 84 STEMI patients were included in the study between January 1, 2011 and March 31, 2012.

Methods: Door-to-balloon times were measured on all STEMI patients arriving at GWV. Of the 84 STEMI patients, 54 were transported by EMS and 30 were walk-ins to the Emergency Department. Of the 54 who were transported by EMS, 30 had 12 Lead EKGs done and transmitted, 19 had EKGs done, but not transmitted, and 5 had no 12 Lead EKG done at all.

Results: Results of the average door-to-balloon times for each of the 4 categories were: EMS with a 12 Lead EKG transmitted (30 patients): 46 minutes, EMS with a 12 Lead EKG (19 patients): 61 minutes, EMS no 12 Lead EKG (5 patients): 128 minutes, and Emergency Department walk-ins (30 patients): 76 minutes.

Conclusions: After collecting 15 months' data on 84 STEMI patients at GWV, results revealed that EMS transmissions of 12 Lead EKGs showing a STEMI statistically decreases door-to-balloon times. It also shows that, for a patient having chest pain with a STEMI, early activation of an EMS system that utilizes 12 Lead EKGs with transmission capabilities improves door-to-balloon times as compared to those of the same patient when arriving at the Emergency Department via other modes of transportation.

Creating a House-Wide Approach to Chest Pain Evaluation

Nicole Rauth, BSN(c), RN, CEN, and Barbara Roenfeld, BSN, RN, NE-BC *Alegent Health Mercy Hospital*

Background/Objectives: Alegent Health Mercy Hospital is a 248-bed community hospital servicing Council Bluffs, Iowa, and the surrounding Southwest Iowa communities. In 2005, Alegent Health Mercy Hospital implemented a Medical Emergency Team (MET) to respond to changes in inpatient conditions. This team comprises the primary nurse, an experienced critical care nurse, and a respiratory therapist. The expected outcomes of the MET are reducing incidence of cardiac/respiratory arrest, reducing incidence of failure to rescue, decreasing mortality rates, promoting appropriate level of care, and enhancing critical-thinking skills of staff. Specific criteria guide the inpatient staff on MET activation. A standardized order set empowers the team to respond to the patient's condition while awaiting the physician's response. The MET committee conducts bimonthly reviews of 100% of these calls. Through these reviews, a need to monitor the timely response to complaints of typical and atypical chest pain on the inpatient units, including our adolescent and adult Behavioral Health units, was identified.

Alegent Health Mercy Hospital became an accredited Chest Pain Center (CPC) by the Society of Chest Pain Centers in 2006, with an ultimate aim to provide high-quality cardiac care to all patients in the hospital. After several years of work to improve the response time to typical and atypical chest pain in the Emergency Department (ED), staff has become effective in recognizing and treating patients with chest pain. The ED currently has a door-to-electrocardiogram (ECG) mean response time of 4 minutes with a 95% compliance rate (n = 172, range = 0–17). We suspected that the response to inpatient complaints of typical and atypical chest pain was not as hardwired as it was in the ED. Our goal was to ensure the response times for typical and atypical chest pain was addressed throughout the hospital to provide evidence-based care for inpatients that is consistent with the care provided to patients presenting to the ED with these symptoms.

Methods: A retrospective analysis of inpatient MET calls for new-onset chest pain over a 6-month period was completed. Despite the presence of a process being in place and an order set that addressed these incidents, analysis revealed a low percentage of electrocardiograms (ECGs) completed within the recommended 10-minute timeframe from the initiation of the call. Before implementation of process improvement, the call-to-ECG mean time was 9 minutes with a 57% compliance rate (n = 21, range = 0–16). Chest pain scenario mock drills were completed on the inpatient units by the CPC coordinator to determine the cause of delays and to develop process improvement strategies. Several opportunities were identified and addressed to improve the call-to-ECG time for inpatients and included the following: (1) staff recognition of atypical chest pain complaints, (2) staff recall of the number to call for MET activation, (3) lack of notification of the type of complaint alerting MET members to bring the ECG machine, (4) a delay in obtaining ECG until patient was fully assessed, and (5) confusion on roles of each team member. On-the-spot education provided by the CPC coordinator during mock drills stressed the importance of obtaining

an ECG in a timely fashion, and identifying atypical signs of chest pain. Identification badge-sized cards highlighting the MET process for inpatient complaints of typical and atypical chest pain were created and distributed to all nurses on all inpatient units. These cards defined the roles of each team member and continued on to outline the process should the ECG reveal a ST-segment elevated myocardial infarction. Ongoing audits of MET calls for typical and atypical chest pain have continued with feedback provided to the MET committee on progress. At Mercy Hospital's Operations Performance Improvement Council meetings, the feedback is shared with front-line staff representatives who disseminate the information to their respective departments.

Results: Since implementation of the process improvements in May 2011, chest pain MET call-to-ECG times have improved significantly. In the 3-month period immediately after the process improvement interventions, the call-to-ECG mean time remained at 9 minutes, but revealed an improved compliance rate of 67% (n = 12, range = 2–20). For the next 3-month period, mean call-to-ECG time has decreased to 6 minutes with an increased compliance rate of 71% (n = 17, range 0–18). These results are approaching the consistent outcomes achieved in the ED and as identified by the standards of the Society of Chest Pain Centers. Continuous quality improvement is ongoing and monitored to sustain the progress.

Conclusions: The time from initiation of a MET call to ECG completion has been significantly reduced for inpatient complaints of typical and atypical chest pain. The improvements have allowed the inpatient population to experience the same quality and timely attention as those patients who present to the ED with typical and atypical chest pain. Although the sample size is small, the outcomes achieved allow for continued improvement in quality care for all patients throughout the hospital. In addition to improving outcomes and care on our campus, the quality improvement strategies for responding to chest pain-related MET calls have been shared throughout the Alegen Health system, which comprises a total of 5 hospitals in the metropolitan area of Council Bluffs, Iowa and Omaha, Nebraska.

Exercise-Induced Nonsustained Ventricular Tachycardia

Samaneh Dowlatshahi, Maneharran Paulpillai, Korosh Sharain, Shahriar Dadkhah, and Roza Sharain *St. Francis Hospital*

Background/Objectives: Diagnostic stress echo testing is commonly performed in patients with known or suspected cardiovascular disease. The significance of an ischemic response, manifested as significant sinus tachycardia (ST)-segment depression, angina pectoris, wall motion abnormality, or combinations, is well established. However, the diagnostic implications of exercise-induced nonsustained ventricular tachyarrhythmia (NSVT) are uncertain, especially as an isolated finding. Ventricular tachycardia (VT) can originate from left ventricle. Exercise-induced ventricular tachycardia has been considered to be associated with a poor prognosis, although this has not been thoroughly studied. There has been considerable debate in management of exercise induced NSVT.

Methods: In this case report, we present our experience with a case of exercise induced NSVT, and subsequent angiographically significant left anterior descending coronary artery lesion.

Results: An asymptomatic 70-year-old female was referred for a treadmill stress echocardiogram after an episode of paroxysmal supraventricular tachyarrhythmia. She denied chest pain, dizziness, syncope, shortness of breath, or palpitation. Two months earlier, the patient had 1 episode of supraventricular arrhythmia with a rate of 150 beats/min, which happened during an emergency department visit for an allergic reaction. During that episode, the electrocardiogram showed a normal sinus tachycardia rhythm with nonspecific ST-T changes in inferior and lateral leads. This episode lasted for about 1 minute, during which patient felt nauseous, but denied chest pain, or shortness of breath. She had a history of treated hypertension. Patient used to smoke 1 pack per day for 20 years, and quit smoking 30

years ago. She had no family history of coronary artery disease. The physical examination revealed a resting blood pressure of 120/70 mm Hg and a heart rate of 70 beats/min. On cardiovascular examination there was no murmur, gallop, or rub. Peripheral pulses were equal and symmetrical. There was no carotid bruit. Lung fields were clear, and the abdomen was unremarkable.

Stress Echocardiogram: Baseline electrocardiogram showed normal sinus rhythm, with no ST-T changes. Resting echocardiogram showed left ventricular external dimension volume: 69.40 ml, IVS: 1.25 cm, left ventricular internal dimension at diastole: 3.99 cm, left ventricular internal dimension at systole: 2.64 cm, ESV: 25.61, EF: 63.09%, Sustained ventricular: 43.78 ml. During exercise, several episodes of NSVT developed; the longest run was during peak exercise with heart rate of 140 beats/min, and the blood pressure of 140/80 mm Hg, which lasted for 1 minute. The stress echocardiogram during VT episode showed left ventricular dilation (left ventricular internal dimension at diastole: 6.80 cm, left ventricular external dimension: 69.93 ml, left ventricular internal dimension at systole: 5.41 cm, LVESV: 29.35 ml, LVEF: 58.03%). The VT resolved spontaneously, and did not reappear at recovery. The recovery strip showed a normal sinus rhythm with a terminal heart rate of 76 beats/min. Patient had mild dyspnea during recovery. Patient was referred for an angiogram, which revealed 90% blockage on proximal left anterior descending coronary artery. A 2.5 mm × 18 mm Xience stent was inserted. At 4 week follow-up visit, the patient denied any chest pain, shortness of breath, dizziness, or palpitation. At 8 week follow-up visit, the stress echo showed hyperkinetic, hyperdynamic wall motion at peak exercise. There were no ST-T segment changes or arrhythmia during exercise and recovery parts of the test.

Conclusions: We concluded that, left ventricle dilation in the setting of asymptomatic exercise induced NSVT should warrant further invasive investigations to reveal underlying coronary heart disease.

Impact of Point-of-Care Testing and a Physician in Triage on the Timely Assessment of Patients with Chest Pain

Eric Shappell, Joseph Venturini, Christine Stake, MS, Shahriar Dadkhah, and Mark Cichon, DO *Loyola University Chicago Stritch School of Medicine, Loyola University Health System Div. Emergency Medical Services*

Background/Objectives: Efficiency in the management of emergency department (ED) patients is important for both patient safety and quality of care. This study assessed the impact of utilizing a physician in triage and troponin point-of-care testing (POCT) on timeliness of management for patients presenting to the ED with chest pain.

Methods: A retrospective chart review was performed on 220 randomly selected patients presenting to the ED with chest pain. Times from presentation to important clinical events were compared between cases seen before and after implementation of physician in triage and troponin POCT. The primary endpoints were time from arrival to electrocardiogram (EKG) and time from arrival to first troponin assay result. Secondary endpoints included time from arrival to disposition and length of stay.

Results: There was a mean decrease of 21 minutes (95% confidence interval [CI], 1–40 minutes) in the time from arrival to troponin assay result after implementation of POCT and physician in triage. Time from arrival to disposition decreased 100 minutes (95% CI, 41–160 minutes) and length of stay was decreased by 188 minutes (95% CI, 107–269 minutes). There was no significant difference in the time from arrival to EKG between groups.

Conclusions: The use of POCT and a physician in triage significantly decreased the time from arrival to first troponin result but did not significantly effect on the time from arrival to EKG. Significant decreases in time to disposition and length of stay were also observed, suggesting a physician in triage and POCT impact more than first few minutes of care after a patient presents to the ED.

RN Discharge Clinic for Chest Pain Patients

Barbara Demagall, RN, BS, and Cynthia Bloam, RN *University Hospitals Harrington Heart & Vascular Institute*

Background/Objectives: Patients with a chief complaint of chest pain with initial nonischemic electrocardiogram and Troponin biomarker are often admitted from our emergency department (ED) to observations or inpatient status to rule out acute coronary syndrome (ACS). Our chest pain clinic coordinator works with the hospitalist team to identify appropriate patients to participate in our rapid referral RN Discharge Clinic for Chest Pain (RN-DCCP). Patients who are discharged with a diagnosis of angina or chest pain and ruled out ACS are offered an appointment in the clinic within 1 week of discharge. The goal of the RN-DCCP is to enhance the quality of care, improve clinical outcomes, and decrease ED and hospital readmissions by 20%.

Methods: An interdisciplinary group of cardiovascular physicians, fellows, nurses, and other healthcare professionals collaborated to develop patient selection criteria and clinical guidelines for the outpatient clinic visit. Patient selection is based on observations, and inpatients who have been ruled out for ACS or myocardial infarction during admission. Those patients selected were considered at higher risk for cardiovascular disease (CVD) or readmission due to recent clinical presentation along with personal medical history and comorbidities related to CVD such as hypertension, hypercholesterolemia, diabetes, tobacco use, diabetes, and obesity. These patients are good candidates for lifestyle modification and CVD education. The nurse-driven clinic is held during our cardiology fellows clinic hours to assure immediate access to cardiac intervention, referral, and evaluation as needed. Patient exclusions included chest pain origin ruled as noncardiac, that is, musculoskeletal, respiratory, or gastrointestinal causes; patients on dialysis; positive cocaine toxicology on admission; or follow up with a cardiologist scheduled.

Results: Through the implementation of patient selection and clinical criteria 98 patients agreed to participate in the RN-DCCP from March to December, 2011. Thirty-seven patients (38%) attended clinic and 61 (62%) did not show up for their appointment. Of the 37 who were seen in the RN-DCCP, all reviewed their inpatient test results, were assessed on current chest pain, and vital signs status, received individualized risk assessment and education, and completed a medication review and compliance evaluation. Eight (22%) have now established a cardiologist with an average of 2 office visits for further cardiovascular assessment, noninvasive evaluations, and pharmacologic therapy. Two (2) have continued follow-up care with prehospital cardiologist. Five (14%) were still experiencing chest pain at clinic visit and had electrocardiogram performed with STAT comparison and review. One patient was sent to ED for blood pressure reading 190/100; 1 to our Stress Lab; and another had a cardiac monitor applied. Nine (24%) agreed to recommendation referrals for smoking cessation or nutrition counseling. Complete clinic visit reports, along with referral recommendations were then forwarded to their primary care physicians. Readmission rates of these 98 patients were reviewed for chief complaint of chest pain after their initial hospitalization. Of the 37 RN-DCCP participants, 2 (5%) had an admission within 30 days and up to 90 days of discharge. Of the 61 patients who did not show for their RN-DCCP appointment, 7 (11%) had an admission during that same time period. Readmission rates were decrease by 55% overall.

Conclusions: The implementation of a rapid referral RN-DCCP patients has provided data outcomes which suggest that patients who participated in this one-time clinic visit are more likely to have a better understanding of CVD, a clearer perception of their personal risk of CVD along with recommended lifestyle modifications, increased compliance with outpatient interventions, and establishment of a cardiologist. Participating patients were 55% less likely to utilize the emergency department or be readmitted for chest pain within 30 days and up to 90 days from initial chest pain

admission. All of these factors indicate enhanced quality of care, improved clinical outcomes, and decrease emergency department utilization, and hospital readmissions. On the basis of these conclusions, we are expanding the clinic criteria to include chest pain treatment and release patients from our ED.

Time is Muscle, Door-to-Troponin Results in <60 Minutes

Kyle Karajankovich, RN, BSN, CEN, Arlene Boelstler, RN, BSN, Jennifer Theoret, RN, BSN, and Margarita Pena, MD *St. John Hospital and Medical Center*

Background/Objectives: Early diagnosis and medical management of patients with acute coronary syndrome (ACS) improves the overall outcome in patients presenting to the emergency department (ED) with a complaint of chest pain. The purpose of this process improvement project was to improve the care of patients with ACS by decreasing the turn around time of door-to-troponin result. Specific workflows were developed to reduce order-to-draw times, draw-to-specimen received in laboratory times, and reduction of hemolytic rates. The goal is door-to-troponin result in less than 60 minutes.

Methods: A process improvement project was designed which included the use of Six Sigma techniques and evidence-based protocols to create processes and guidelines for the ACS patient who presents to the ED. A multidisciplinary team of physicians, Registered Nurses (RN), Emergency Room Technicians (ERT), phlebotomists, and leadership from laboratory, worked collaboratively to initiate change within the triage area. Evidence-based guidelines were developed for the initial treatment of the suspected ACS patient in triage. The triage RN quickly determines whether the patient meets Cardiac Enzymes guidelines and directs the ERT and phlebotomist accordingly. A phlebotomist is stationed in triage at all times. If Cardiac Enzymes guidelines are met, the specimens will be drawn by the phlebotomist while the ERT is performing an electrocardiogram. The ERT or RN will be responsible for the laboratory draw if there are multiple simultaneous draws. The introduction of a Mint Green laboratory tube was added to specifically identify troponin levels for the ED. Troponin specimens from this tube are processed immediately to help us meet the goal.

Results: Data were collected over a 4-month period from 1068 troponin draws, demonstrating significant improvement in the care of the ACS patient. Order-to-draw times has decreased from 56 minutes to 9 minutes. Draw-to-received specimen has decreased to 7 minutes. Door-to-troponin result time has decreased from 131 minutes to 59 minutes. Troponin hemolytic rates have decreased from 19% to 6%. Data continues to be collected and interpreted to assure we remain within the goal range.

Conclusions: Patients with ACS receive definitive treatment and risk stratification more rapidly based on reduced troponin turn around time results. A team approach to the care of the ACS patient improves both patient and associate satisfaction. The additional workflows and time-sensitive goals, developed during this process improvement initiative has provided further, measurable, quality markers for the ACS patient. As best-practice evidence is demonstrated, it can be shared to improve both medical and nursing management of ACS patients in other EDs.

Heart Failure Telephone Coaching Program Improves 30-Day Readmission Rate

Janisse Post, Carol Biggs, DHSc, MBA-HA, RN, Bibiana Vargas, ARNP, Anastasia Miller, BA, Elizabeth Vidal, MSN, and Luella Reyes, RN *South Miami Heart Center*

Background/Objectives: Approximately one-fifth of Medicare beneficiaries are rehospitalized within 30 days of discharge. Heart failure is the most common diagnosis associated with a 30-day readmission for Medicare beneficiaries, yet it is estimated that almost 90% of readmissions are potentially preventable. Studies have suggested that comprehensive

discharge planning in addition to postdischarge support can reduce readmission rates and improve patient outcomes. In an effort to reduce 30-day heart failure readmission rates, South Miami Hospital offered a telephone coaching program to all discharged heart failure patients. This program was modeled after the Care Transitions Program from the Florida Medical Quality Assurance Inc.

Methods: In 2009, Miami Dade County hospital heart failure readmission rates were 30.0% (383/1275), 4.0% points higher than the previous year. Miami Dade County heart failure readmission rates were higher than the statewide rate, 24.8% in 2008 and 24.9% in 2009. South Miami Hospital's unadjusted 30-day heart failure readmission rate for the 6-month period ending February 2010 was 29.7% (27/91). A telephone coaching program was implemented in March 2010, and approximately 385 patients were enrolled in the program. The program targeted patients with primary and secondary heart failure diagnoses. Before discharge, patients were seen by the heart failure educator to review the goals of the program, which included medication self-management, scheduling a timely physician follow-up appointment, recognizing symptom exacerbation, and maintaining a personal health record. Once enrolled in the program, patients received follow up phone calls on the second, seventh, fourteenth, and thirtieth day postdischarge. The purpose of the phone calls was to reinforce the importance of compliance with medication schedules, daily weights, and timely recognition of heart failure symptoms. Patients who reported a deterioration of heart failure symptoms were immediately flagged and nurses worked to resolve issues and prevent potential readmission to the hospital.

Results: South Miami Hospital was able to decrease heart failure readmission rates by 4.4% points over the next 8 months to a rate of 25.3.0% (21/83) in October 2010. The hospital decreased their heart failure readmissions at an average rate of 0.4% points per month, or an annualized rate of 5.1% points.

Conclusions: Implementation of a heart failure telephone coaching program is effective in reducing 30-day readmission rates.

Clopidogrel Provision for Indigent Patients with ST-Elevation

Sita Price, DNP, ARNP, FNP-BC, and Robert P. Dalton, MD *Orlando Regional Medical Center*

Background/Objectives: The Joint Commission in a joint effort with the Centers of Medicare and Medicaid Services has established certain "core measures" by which hospital performance is measured. One of these is the measure for patients with ST-elevation myocardial infarction (STEMI) recommending percutaneous coronary intervention within 90 minutes of presentation to the Emergency Department in institutions that are able to provide this service. This recommendation does not take into account the long-term use of clopidogrel that is recommended by the American College of Cardiology and American Heart Association for patients who are treated with coronary stents.

Methods: A retrospective pre- and posttest design was used. Data were collected on 200 subjects over a 15-month period to allow for evaluation of 90-day readmissions with repeat STEMI: 100 in the pretest group and 100 in the posttest group. A policy was created that provided uninsured STEMI patients with clopidogrel at discharge rather than a prescription. A social worker evaluated patients to determine whether they met criteria and arranged for medication delivery to the patient's bedside. Data were analyzed using χ^2 cross-tabulation and *t*-test for independent samples.

Results: Five uninsured patients in the pretest group were readmitted with STEMI. Two uninsured patients in the posttest group were readmitted with STEMI. This result was not statistically significant ($P = 0.191$), however, a decrease in readmissions was noted. A transition to increased utilization of bare metal stents in STEMI patients was noted in the posttest group ($P < 0.001$).

Conclusions: Providing clopidogrel to patients who experience STEMI may improve adherence and thereby decrease readmissions as a result of repeat

STEMI due to subacute thrombus formation. Patients who experience STEMI continue to be vulnerable after STEMI. Programs that provide medication to patients should be expanded within this facility and to other hospital systems to encompass all patients who are treated for STEMI. Multidisciplinary collaboration is necessary in developing and implementing a program that will address care for this population.

Validation of High-Sensitivity Troponin I Method in ACS Patients

Chad Moretz, ScD, Scott B. Robinson, MA, MPH, and Bernadette Johnson, MBA *Premier Research Services*

Background/Objectives: Patients with chest pain or suspected acute coronary syndrome continually visit emergency departments, where they rely on the medical staff to quickly risk stratify, diagnose, and treat their condition. Physicians routinely rely on cardiac biomarkers to accurately diagnose and treat patients with chest pain or acute coronary syndrome. Stratus Coronary Syndrome (CS) is an acute care diagnostics instrument for measuring troponin I levels in patients presenting with suspected myocardial ischemia. The objective of this research study was to determine whether the differences in length of stay (LOS) and mortality exist between patients for whom the Stratus CS was used and patients for whom it was not used.

Methods: Data from 3 hospitals within the Premier Database, a U.S. nationally representative hospital database, were used. The study population included adult inpatients aged 18 and older, discharged between January 2003 and May 2011, having a principal diagnosis code for myocardial infarction (ICD-9-CM 410.xx), or Intermediate Coronary Syndrome (ICD-9-CM 411.1) with an emergency admission. A Stratus CS user was defined as a person who had an inpatient visit where the Stratus CS device was billed. *T*-test analysis was used to evaluate differences in unadjusted LOS. A multivariate gamma regression model for LOS was run adjusting for gender, all patient refine (APR) severity of illness, hospital bed size, diabetes, acute renal failure, chronic renal failure, and heart failure. χ^2 tests were used to evaluate unadjusted differences in mortality, and logistic regression was used to model mortality adjusting for APR severity of illness, diabetes, acute renal failure, and chronic renal failure.

Results: A total of 3561 Stratus CS users and 2256 non-Stratus CS users were included in the study. The mean age of both the Stratus CS user and non-Stratus CS user groups was 67.5 (standard deviation = 14.7) years. The Stratus CS user sample was 63.5% male and the non-Stratus CS user sample was 61.8% male. There was an even distribution (approximately 55%) of patients across both Stratus CS users and non-Stratus CS users with Medicare coverage. There was also an even distribution between APR severity of illness levels and risk of mortality between Stratus CS users and non-Stratus CS users. The most frequently occurring physician specialty for both groups was internal medicine, followed by cardiovascular physicians. Unadjusted mean LOS was significantly shorter for Stratus CS users than non-Stratus CS users (mean 4.8 \hat{A} ± 5.5 days vs 5.4 \hat{A} ± 6.6 days, $P = 0.0002$). Shorter LOS for Stratus CS users was supported by regression analysis results ($P < 0.0001$). Unadjusted mortality was lower for Stratus CS users as well (5.1% vs 7.4%, $P = 0.0004$). Adjusted odds of mortality was estimated to be 52% greater for non-Stratus CS users than for Stratus CS users (odds ratio, 1.52; 95% confidence interval, 1.182–1.944; $P = 0.0010$).

Conclusions: Patients for whom Stratus CS was used during their inpatient treatment experienced shorter LOS and lower mortality in both unadjusted and adjusted analyses. This research supports the proposition that the quicker the biomarkers are returned to the physician, the faster they can make a diagnosis and treatment decision, which then may improve outcomes for these patients.

Cost Analysis in Acute Coronary Syndrome Patients Using a High-Sensitivity Troponin I Method

Chad Moretz, ScD, Scott B. Robinson, MA, MPH, and Bernadette Johnson, MBA Premier Research Services

Background/Objectives: Patients who present to a hospital emergency department with vague symptoms, such as shortness of breath or chest pain are often admitted as an inpatient. This is done without appropriate triage, which can often lead to placement in a cardiac unit. In three-quarters of these patients, tests later reveal a noncardiac diagnosis. At this point during the visit, the hospital has already conducted thousands of dollars of nonreimbursable tests and treatments. The objective of this research study was to determine whether the differences in cost exist between patients for whom the Stratus Coronary Syndrome (CS) was used and patients for whom it was not used.

Methods: Data from three hospitals within the Premier Database, a U.S. nationally representative hospital database, were used. The study population included adult inpatients aged 18 and older, discharged between January 2003 and May 2011, having a principal diagnosis code for myocardial infarction (ICD-9-CM 410.xx), or intermediate coronary syndrome (ICD-9-CM 411.1) with an emergency admission. A Stratus CS user was defined as a person who had an inpatient visit where the Stratus CS device was billed. Total cost data was adjusted for inflation by using the 2006–2011 Milliman Medical Index annual trend rate of 7.7%. T-test analysis was used to evaluate differences in unadjusted total hospitalization cost. A multivariate gamma regression model for total cost, adjusting for gender, all patient refined (APR) severity of illness, hospital bed size, diabetes, acute renal failure, chronic renal failure, and heart failure was utilized.

Results: A total of 3561 Stratus CS users and 2256 non-Stratus CS users were included in the study. The mean age of both the Stratus CS user and non-Stratus CS user groups was 67.5 (standard deviation 14.7) years. The Stratus CS user sample was 63.5% male and the non-Stratus CS user sample was 61.8% male. There was an even distribution (approximately 55%) of patients across both Stratus CS users and non-Stratus CS users with Medicare coverage. There was also an even distribution between APR severity of illness levels and risk of mortality between Stratus CS users and non-Stratus CS users. Noninflation adjusted mean total cost was significantly lower for non-Stratus CS users than Stratus CS users (mean \$20,022 $\hat{A}\pm$ \$21,938 vs \$23,796 $\hat{A}\pm$ \$23,238, $P = 0.001$). After inflation adjustment the mean total cost was significantly lower for the Stratus CS user than the non-Stratus CS user (mean \$30,582 $\hat{A}\pm$ \$30,390 vs \$32,485 $\hat{A}\pm$ \$36,639, $P = 0.0395$). The non-Stratus CS users were found to be statistically significantly more expensive than Stratus CS users using γ regression ($P < 0.0001$) adjusting for gender, APR severity of illness, bed size group, diabetes, acute renal failure, chronic renal failure, and heart failure.

Conclusion: Stratus CS use during inpatient treatment was associated with lower overall cost of care. This research shows that hospitals and patients can experience potential cost savings from the utilization of the High-Sensitivity Troponin I Method.

Allowing EMS to Activate the Cath Lab from the Field will Decrease D2B Times

Brenda Lane Bishop Maury Regional Medical Center

Background/Objectives: Maury Regional Medical Center (MRMC) in Columbia, TN, is a regional hospital serving an eight (8) county rural area in southern middle Tennessee. Since becoming an accredited Chest Pain Center (CPC) in 2008, MRMC is continually reviewing current ST Elevated Myocardial Infarction (STEMI) processes and protocols looking for areas of opportunity to reduce Door-to-balloon (D2B) times. Emergency Medical Services (EMS) can play a key role in the overall reduction of D2B times by performing a 12 lead ECG in the field and calling a STEMI alert, thereby activating the cardiac catheterization (cath) team before EMS arrival in the

emergency department (ED). The ultimate goal is bypassing the ED and taking the patient directly to the cardiac cath lab from the ambulance reducing the overall D2B time.

Methods: In reviewing the process used to call STEMI's from the field, the chest pain center (CPC) committee, directed by staff cardiologist Dr. Kevin Maquiling, realized the need for a faster activation of the cath team when EMS recognized a STEMI on an electrocardiogram (ECG) performed in the field. The process steps included a 12 lead ECG performed by EMS in the field on all patients with a complaint of chest pain; if STEMI is recognized on the ECG, the paramedic would notify the ED charge nurse that they were transmitting a STEMI ECG. The charge nurse would notify the ED physician to review the transmitted ECG and if it was confirmed to be a STEMI, the ED physician would then activate the cardiac cath team. Due to the topography of southern middle Tennessee, the ability for timely transmission of the ECG from the field is inconsistent and, on occasion, EMS would arrive in the ED before the physician had reviewed the transmitted ECG and activated the cath team. The CPC committee revised the process to allow EMS to initiate activation of the cath team by eliminating the step requiring the ED physician to confirm the ECG before cath team activation. With the revised process, EMS is encouraged to perform the ECG in the field within 5 minutes of patient contact on all patients with complaint of chest pain. Once the STEMI is recognized by EMS, the ED charge nurse is notified to activate the cath team. On arrival to the hospital, EMS transports the patient directly to the cath lab, bypassing the ED. The revised process was communicated to EMS services in the 8 county area.

Results: By allowing EMS to call a STEMI alert on the basis of field ECGs, D2B times of EMS patients with field activation of the cath team has been reduced by 18 minutes, from a mean time of 62 minutes in 2009 to a mean of 44 minutes in 2011. The EMS to balloon time was also reduced from a mean time of 86 minutes in 2010 (lowest D2B time 20 minutes) to a mean of 79 minutes in 2011 (lowest D2B time 14 minutes) for all EMS STEMI's.

Conclusions: A collaborative, interdisciplinary approach to STEMI care is what drives ongoing process improvements. The relationship among EMS, ED physicians and staff, the cath team and cardiologists has greatly improved over the past 3 years. In addition, MRMCs median D2B for 2011 for all STEMI's (EMS and walk-in) was 49 minutes down from a median of 64 minutes in 2010.

There is No Level of cTnI that is Safe to Discharge from the ED

Dave Milzman, MD, Anthony Napoli, MD, FACEP, Erwin Wang, George Ibrahim, and Sam Klatman Brown U School of Medicine, Georgetown U School of Medicine

Background/Objectives: Rapid biomarkers to rule out non-ST elevated myocardial infarction (NSTEMI) have been based solely on Troponin I, for almost a decade. There are many articles reporting various testing protocols with regard to timing of cardiac marker draws. No study has identified a level of below detection on first marker as a prognosticator to rule out any infarction NSTEMI.

To determine whether a single negative marker, negative as in nondetected (cTnI < 0.012 ng/dL, reported 0.0, but many assay cannot measure 0.0 ng/dL) on initial blood draw) can safely predict no NSTEMI on emergency department presentation irregardless of timing of chest pain before arrival.

Methods: Retrospective chart review over 5 years and 4 hospitals for all patients arriving with a complaint of chest pain and no ST-segment elevated myocardial infarction on initial electrocardiogram. Inclusion emergency department workup of CP with at least 2 consecutive cTnI drawn within 8 hours of arrival and follow up obtained. The modern assay (Ortho-Clinical Diagnostics VITROS Troponin I ES) at our institution has a lower limit of detection of 0.012 ng/mL. The timing of chest pain onset, and interventions including PTCA, CABG, and other interventions were reviewed. Inhospital and all cause 30-day mortality are also noted.

Noncardiac causes on ICD-9 discharge were excluded from analysis. (PE, Pneumonia).

Results: A total of 5409 patients with at least 2 consecutive cTnI were entered in study for patients presenting with chest pain and an initial cTnI <0.012 ng/dL: (lowest level of detection) 72.1% black, 57% male mean age 62.7 (standard deviation 5.3). Of these, 241 patients (4.4% of no detectable cTnI on initial blood draw) had a second or third elevated cTnI: 34.3% had NSTEMI, 37% went to PTCA, 14.2% had CABG inhospital, and 4.8% suffered inhospital mortality. This compares to a cohort of chest pain patients admitted to similar protocol, but with a nonelevated (first cTnI >0.012 but <0.10) on first draw rates of NSTEMI at 2.8%. Rule in for nondetectable first cTnI was increased ($P > 0.03$).

Conclusions: There is no level, not even 0.0 ng/dL, that a single cTnI can safely rule out an NSTEMI and send a patient home. Even in this low-risk chest pain population, nondetectable first cTnI value is more likely to rule in for NSTEMI, than a usual low-level first draw for chest pain patients.

Utility of Lactate Determination to Identify Occult Perfusion Deficits in Heart Failure Patients

Dave Milzman, MD, FACEP, Anthony Napoli, MD, FACEP, Sam Klatman, and George Ibrahim *Brown U School of Medicine, Georgetown U School of Medicine*

Background/Objectives: Serum lactate has been established as a marker of inadequate perfusion and the resultant tissue hypoxia. Earlier reports have used lactate to gauge the adequacy of resuscitation in critically ill patients. To determine whether lactate levels identify heart failure patients requiring intensive care unit (ICU) stay and/or longer hospital stays compared with arrival vital signs and clinician assessment.

Methods: A convenience study of all heart failure patients presenting in acute decompensation to the E.D. of a busy, urban E.D.

All patients consented to additional blood draw for this minimally invasive, IRB -approved study. Treating physicians were blinded to lactate values until patient disposition was made. T-test and χ^2 were used to compare lactate values with arrival vital signs and final disposition with a = 0.05.

Results: Forty-seven patients presenting in acute heart failure with the following means: age 67.7 years; 58% male; heart rate 95 bpm; systolic blood pressure 148 mm Hg; and a mean lactate of $3.9 + 3.6$ mmol/L. For those patients requiring ICU admission compared to non-ICU hospital admission, only lactate not any vital sign had a difference between values: 4.8 mmol/L versus 2.9 mmol/L ($P < 0.03$), respectively. Repeat lactate values obtained after E.D. resuscitation that failed to decrease in value were 100% sensitive for identifying patients requiring ICU admission and increased hospital stays compared with patients who achieved E.D. reduction in lactate levels. Treating physicians had a positive prediction rate of 72% for identifying patients with perfusion deficits on the basis of initial examination.

Conclusions: Blood lactate values obtained on E.D. arrival identify heart failure patients with more critical illness than presenting vital signs and the judgment of the treating physician. Although the results are preliminary, the importance of utilizing better markers of resuscitation, beginning with the acute E.D. arrival may allow for improved treatment and hospital outcomes of heart failure.

An Educational Process Improvement Improves Quality in Patients Requiring an ECG

Karl G. Ambroz, MD, and Marc A. Dorfman, MD *Resurrection Medical Center*

Background/Objectives: Our busy urban emergency department (ED) treats 40,000 patients annually, and includes residents from our emergency medicine residency (ER residents), rotating residents from family practice, and transitional residencies and rotating medical students from

multiple schools (rotators). In keeping with continued improvement as a certified chest pain center, a process was established for the education and improvement of electrocardiogram (ECG) completion and interpretation across all staff involved in patient care in our ED. Our goal was to establish consistent, timely, and accurate evaluation for those patients requiring ECG testing.

Methods: A collaborative team was formed and developed triage and bedside criteria for immediate ECG in appropriate patients using chief complaint, presentation, and vital signs. Patient care technicians (techs), responsible for performing the majority of studies, were given basic instruction on recognition of infarct patterns and tachy/brady dysrhythmia. In addition, they were made responsible for obtaining previous ECGs when available and presenting both to a physician immediately upon completion. Nurses underwent competency training in triage selection and for more advanced ECG evaluation, and a video was created for rotators to insure competency in more advanced patterns before their first shift. Attending physicians and ER residents developed a continuous educational cycle including expert ischemic pattern recognition and creation of a core ECG file with monthly teach back by the physician involved. Objective and subjective data was collected to evaluate improvement.

Results: Three months after initiation of the process, the collaboration team reviewed collected data, performed random chart audits, and surveyed the attending physicians. Ninety-five percentage (352/372) of appropriate patients had ECG performed within 5 minutes of presentation by screening criteria, and 99% (368/372) were reviewed by a physician within 2 minutes of completion. Over 80% of ECGs were presented with a previous one for comparison. Forty-nine percentage (19/39) of acute infarcts were identified by nursing or techs before physician review, 100% (26/26) by ER residents and rotators, and initial nonpowered data indicates improvement in door-to-balloon times. Attending physicians and nursing directors surveyed universally felt that patient care and quality were improved, and that ER residents and rotators were better prepared for ECG interpretation.

Conclusions: In our ED, a simple educational process initiative across all staff involved with patient care improved the timeliness, accuracy, and quality of obtaining and interpreting the ECG in those patients requiring one by established criteria. Ongoing data collection continues to occur to evaluate effect on time to treatment and outcome.

An Opportunity for Improved Treatment of Patients Presenting with CHF Through Medication Reconciliation

Karl G. Ambroz, MD, and Jeff Gordon, MD *Resurrection Medical Center*

Background/Objectives: Angiotensin converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARB), and beta adrenergic receptor (beta) blockers have been studied extensively in all phases of congestive heart failure (CHF), and found to improve both quality of life and mortality. Patients presenting to the emergency department (ED) for decompensated CHF are rarely screened for adequacy and appropriateness of chronic outpatient treatment, when medication reconciliation could create opportunity for improved therapy.

Methods: A 6-month retrospective chart review was performed on all patients presenting to an urban community hospital ED with 40,000 annual visits. Patients were included with an admission or discharge diagnosis of CHF, decompensated CHF, and/or pulmonary edema. The physician and nursing notes and medication reconciliation were reviewed for current ACE inhibitor, ARB, or β blocker therapy, any listed or potential contraindications to treatment, and/or discussions with primary care with regards to alteration or addition of medication. Discharged patients were further reviewed for recent cardiac function testing where available. Charts were excluded if the patient was incapable of providing history or for indication of "first time" diagnosis.

Results: Two hundred and thirty-three charts were reviewed and 213 patients met inclusion criteria; 18 patients (8%) were excluded for inability to communicate and 2 (0.86%) for initial diagnosis. One hundred and seventy-two patients (81%) were admitted or placed in observation and 41 patients (19%) were discharged from the ED. Forty-nine patients (23%) were on duo regimen with both an ACE or ARB and β blocker therapy. One hundred and eighteen patients (55%) were on either ACE/ARB therapy or β blocker; 46 patients (22%) were on neither therapy. For all charts reviewed, apparent contraindication to either regimen not prescribed (known allergy, history of pulmonary disease, history of angioedema, debilitating cough, bradycardia, hypotension, renal disease, etc.) was found in only 29 patients (14%) and only 17 (41%) of discharged patients were found to have an echocardiogram on record in the previous 2 years. No discussion of therapy alteration with primary or specialty care was discovered.

Conclusions: A retrospective chart review of patients presenting to the ED with CHF demonstrates opportunity to improve therapy through medication reconciliation and consultation with primary and specialty care. As more patients continue to use the ED as their source of care, emergency physicians may positively effect mortality and quality of life through this simple process. More study is warranted.

A Protocol for Definitive Therapy with Flecainide in Patients with Rapid Atrial Fibrillation: Pill in the Pocket

Karl G. Ambroz, MD, and Cynthia Fisch, RN, MPH *Resurrection Medical Center*

Background/Objectives: Patients presenting to the emergency department (ED) in acute atrial fibrillation with rapid ventricular response are typically admitted to the hospital for treatment or may undergo cardioversion in the ED requiring sedation and extensive nursing resources. We present our initial case series of patients treated with oral Flecainide, a class 1C antiarrhythmic, in our urban community hospital with 40,000 ED visits. The goal of this protocol was safe and cost-effective care of patients and hopeful discharge from the ED.

Methods: A protocol was developed in collaboration with the cardiac electrophysiology specialist. Patients presenting to the ED were considered eligible if (1) their electrocardiogram demonstrated atrial fibrillation with a ventricular rate greater than 120 bpm, (2) they could accurately identify onset of symptoms (palpitations, racing heart, light headedness, etc.) in the previous 48 hours, and (3) they had no previous history of hypercoagulability, venous thrombosis, pulmonary embolism, or cerebral vascular event. After routine cardiac work-up including cardiac isoenzymes, patients were given 150 mg of flecainide orally and were monitored for rhythm change. If there was no response at 2 hours, they were given a second 150 mg dose. A positive response was conversion and maintenance of sinus rhythm. These patients were discharged with a prescription for flecainide with instruction to repeat dosing outpatient if symptoms reoccurred and follow up was scheduled with the electro physiologist.

Results: Since protocol inception in March 2011, 9 patients have met criteria for protocol inclusion. The average age was 67 (range 44–81), 6 males/3 females, and average heart rate on initial electrocardiogram was 144 bpm (range 123–177). Seven of 9 (78%) converted to sinus rhythm after a single dose and 1 (11%) converted with the second dose. Eight of these patients maintained sinus rhythm and were discharged home from the ED. One patient converted after each dose, but spontaneously returned to atrial fibrillation, and required admission. On follow up, 1 of the discharged patients (12%) reverted to atrial fibrillation within 7 days, but converted back to sinus rhythm with a single dose of prescribed Flecainide. All of the discharge patients were seen in follow up within 30 days and all continued to maintain sinus rhythm. Estimated cost savings compared to an observation status admission

or ED cardioversion based on nationally published averages was 3160.00 and 1245.00, respectively.

Conclusions: In selected patients presenting with acute atrial fibrillation with rapid ventricular response, oral Flecainide may represent a safe and effective therapy with significant cost benefit and the opportunity to discharge the patient from the ED in sinus rhythm. This protocol could significantly improve hospital reimbursement in a pay for performance marketplace, which rewards outpatient therapy and customer satisfaction. Further study is warranted.

Qualitative Analysis of Chest Pain Center Education

Jonathan Howard, RN *University of Virginia*

Background/Objectives: The University of Virginia (UVA) Health System Emergency Department has had an orientation process for nurses and patient care technicians (PCTs) in caring for chest pain patients since 2006. The orientation process currently consists of a class, computerized learning modules, the Project Upstart online module (www.projectupstart.com), journal articles, an orientation checklist, and other materials, with the articles, checklist, and other materials given to participants in a binder. The class is cotaught by the medical director of the Chest Pain Center and a nurse from the Chest Pain Center Steering Committee (the Steering Committee). The orientation checklist introduces providers to the Chest Pain Center, a group of rooms optimized for caring for chest pain patients, and providers must be checked off by a member of the Steering Committee. The process has been refined and added to over time.

How useful are the various parts of the Chest Pain Center orientation process to its recent participants?

Methods: We asked all participants from the last 2 years to take a survey about the process and how useful each part was to them. The survey had 1 question asking whether the participant was a Registered nurse/LPN or a PCT. There were 7 questions using a 5-point Likert scale about each of the parts of the orientation process (the class, the Project Upstart online module, the computerized learning modules, journal articles, clinical checklist, and other materials). There was one question about how much of the binder the participant read. There were then 3 open-ended questions, asking what part of the orientation was most useful and why, what part was least useful and why, and what we should add to the orientation.

A waiver of need for consent was provided by the UVA Institutional Review Board. We sent the survey to all current employees of UVA who went through the orientation process in 2010 or 2011 (earlier participants did not go through all the currently used parts of orientation), including 3 float nurses who went through the process, for a total of 53 surveys. We sent a paper copy of the survey to participants' mailboxes (except for the 3 float nurses and 1 wage nurse who don't have mailboxes in the emergency department), and sending an electronic copy to every participants' email accounts.

We asked that participants not put their name or any identifying information on the surveys. For those who wanted to return the survey on paper, we put a collection box in the staff lounge and only collected the surveys at the end of the collection period. For those who wanted to return the survey electronically, we asked them to send the completed surveys to an undergraduate student working for the medical director, who does not know the participants, and asked the student to give the survey to us without any identifying information at the end of the collection period.

To give the participants an incentive to participate, we offered a drawing for a \$25 gift card. The participants put their name on a separate entry blank that had no link to the surveys, and were asked to return the entry blanks to a member of the Steering Committee's mailbox, not to the survey collection box. One participant was chosen at random and received the gift card.

Results: Of the 53 surveys, 26 were returned, for a response rate of 49%. Not all questions were answered on every survey. Seventeen Registered nurses/LPNs and 9 PCTs returned the survey. Individual question responses are summarized in the Table. For the Likert scale questions, the averages were

between 3 and 4, with 4 as the median answer. Respondents report they read between 50 and 75% of the binder.

Fourteen respondents answered the “what was most useful” open-ended question. Many of them involved the process for initial care of a patient, and care for a ST-segment elevated myocardial infarction patient. A few involved the open and relaxed atmosphere of the class.

Nine respondents answered the “what was least useful” open-ended question. Two involved self-identified PCTs learning about processes that can only be performed by nurses. Several commented on length of the process: the class seemed repetitive or nothing new was taught in the class, the Project Upstart was repetitive, the binder had too much material in it. One commented on the class dynamics.

Eleven respondents answered the “what should we add” question. Some commented on using more hands-on learning and more scenario-based learning. Some asked for more information on electrocardiograms, and especially the bedside monitors, and more chances for additional education in general. Two responded with, “Nothing that I can think of.”

Conclusions: Overall, participants thought that the orientation process was reasonably helpful, as evidenced by the medians and modes for the Likert scale questions. However, there are areas for improvement, including: improving and being more selective about the materials in the binder; tightening up the class instruction; improving the clinical check-off; and offering more education, possibly in addition to (and not part of) the orientation process.