Diagnosing Acute Myocardial Infarction in the Emergency Department-An Educational Inservice

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Abstract

Chest pain is one of the top complaints of patients who present to Emergency Rooms (ER) across the world. Establishing the source of a patient’s chest pain is crucial, and must be done quickly to rule out a cardiac event. In most ER’s, a patient who presents with chest pain as their chief complaint receives an electrocardiogram (EKG) within ten minutes of arrival to determine if they are actively having a myocardial infarction (MI). However, there are many other diagnoses that can present as chest pain other than heart related issues. It is imperative for ER clinicians to be able to rule out a cardiac related problem when a patient is complaining of chest pain. According to research, performing serial EKG’s is one approach that can decrease the need to admit patient’s who are experiencing chest pain from a non-cardiac source. The current diagnostic tools used to determine if a patient is experiencing a cardiac event in an expedient manner are adequate, however by reviewing the most current evidence on diagnosis of chest pain could provide clinicians with ways to better diagnose the source of a patient’s chest pain. By disseminating the most current evidence surrounding the diagnosis of chest pain about serial EKG”s among other improved diagnostic tools, it could be the first step to help guide clinicians who treat patients with chest pain reassess current chest pain protocols being conducted in ER’s today.

Diagnosing Acute Myocardial Infarction in the Emergency Department-An Educational Inservice

**Introduction**

Chest pain is one of the top complaints of patients who present to the emergency department for treatment. The source of a patient’s chest pain is either cardiogenic or non-cardiogenic, and determining the source of a patient’s chest pain involves multiple tests that can be quite time consuming. To provide better care to patient’s who are experiencing chest pain it is important to decipher their type of chest pain quickly and provide appropriate care according to whether or not the chest pain is cardiac in nature.

The majority of patients who present to an emergency department with chest pain or symptoms that may be indicative of acute coronary syndrome (ACS) usually receive an electrocardiogram (EKG) within ten minutes of arrival to the emergency room (ER) (Kontos, Dierks & Kirk, 2010). These steps are part of a chest pain protocol that most emergency rooms have instituted to diagnose whether the patient is having an acute cardiac episode. Protocols are designed to address a certain symptom/symptoms a patient has upon arrival at triage in the ED. The protocol generally involves lab tests, medications and/or radiology depending on the patient’s complaint (Cayley, 2005). ER physicians, ER nurses and relevant department managers construct chest pain protocols by using recommendations from the American Heart Association (AHA), evidence from research studies and best practices.

Patients experiencing chest pain are usually triaged after receiving an EKG that has been shown to an ER physician to determine if the patient is having a cardiac event. If it is determined that a cardiac event is not taking place, the patient is either placed back in the waiting area or placed in an exam room, if one is available. If the patient is having a cardiac event, for example a ST segment elevated myocardial infarction (STEMI), the patient is immediately placed in an exam room, an IV line is started, labs are drawn, the physician comes in to examine the patient and take a medical history and the patient is on their way to having a cardiac catheterization in one to two hours. However, the patient who does not appear to be having a cardiac event on their EKG spends a minimum of three hours in the ER being worked up for a potential cardiac event, and will probably be admitted for observation and a stress test in the morning (Hess, et al, 2010). The purpose of this project is to determine if there are more efficient and effective steps in the protocol to differentiate cardiac vs. non-cardiac chest pain.

**PICO Question**

Among patients presenting to the Emergency Department with chest pain, will a customized chest pain algorithm provide more timely and accurate diagnosis versus a generalized cardiac protocol?

The general cardiac protocol in an emergency department consists of an initial electrocardiogram (EKG) within ten minutes of arrival followed by cardiac enzyme labs, chest radiography and assessment of the patient’s risk factors for a cardiac event. A chest pain algorithm would include all of those items with the addition of a second and possibly a third EKG while the patient is in the ER to further confirm or refute a cardiac diagnosis. In addition, considering current evidence on chest pain diagnosis could provide the basis for making changes to the current chest pain protocol. Also, by defining whether the patient’s complaint of chest pain has a non-cardiogenic source can alleviate the need to admit the patient for observation; opening more telemetry beds for patients who have true cardiac issues.

**Review of the Literature**

 To gain information about chest pain patients in the ER credible journal articles and studies were sought out via the worldwide web. The initial search was conducted through Auburn University’s library website using the Academic Search Premier engine to look for articles pertaining to chest pain. In addition to searching for chest pain articles, search terms like nitroglycerine, emergency room protocols, chest discomfort, cardiac, ACS were also used to search for journal articles. Several articles were located after narrowing the field by only including articles within the last ten years. The majority of the data found pertained to chest pain and interventions other than nitroglycerine as a predictor of a patient’s type of chest pain. However, there was enough data to support going forward with an evidence-based practice proposal about whether or not nitroglycerine therapy for chest pain patients is an indicator of the type of chest pain the patient is experiencing.

The biggest challenge of the ER clinicians is determining whether a patient is experiencing an acute cardiac event when the patient presents with a complaint of chest pain. The goal of the clinical team is to tentatively diagnose the patient’s chest pain in the quickest time possible to achieve the best outcome for the patient. The way that most ER clinicians make this happen is through a chest pain protocol.

 The clinical practice guideline ("Chest pain of recent onset," 2010) for the recent onset of chest pain provides the basis for most ER chest pain protocols. According to the guideline, assessment of the patient’s pain from the time it began, to how long it lasts, to the location of the pain, and was the patient resting or active at the onset of the pain is the first step to take in evaluating a patient who is experiencing chest pain. Research shows that through a thorough assessment of the patient’s medical history, social history and family medical history can also identify risk factors for cardiac disease which is a valuable way of identifying the type of chest pain the patient may be experiencing (Achar, Kundu & Norcross, 2005). The guideline also suggests that an EKG should be performed as soon as possible from the time the patient presents with chest pain. Pain relief is also one of the first suggestions the guide includes in the steps to diagnosing and treating a patient with acute onset of chest pain. These are the initial steps that should be taken to establish a patient’s possibility of having ACS that can be fatal if not diagnosed swiftly.

The difference in presentation between males and females having a coronary event can be vastly diverse (Hess, et al, 2010). Males typically present with chest pressure, diaphoresis and nausea, whereas a female may present with symptoms like back pain, jaw pain or shortness of breath and can still be having an acute cardiac event. This presents a challenge for clinicians when attempting to diagnose patients. It also means that females are often not seen as having a cardiac related disorder and released without even exploring the option that the symptoms may be pointing to a cardiac issue.

A cohort study conducted in a teaching hospitals ER for almost a year centered on the differences associated between male and females experiencing chest pain (Hess, et al, 2010). The study included 970 patients over the age of 24 years of age with roughly forty percent of the participants being female. The study found that women had a lower incidence of coronary artery disease and usually did not present with typical chest pain symptoms. All the participants received and EKG, Troponin T levels and a stress test. The results of the tests showed a decrease in the prevalence of AMI in women as well as, lower prevalence of a positive stress test. The study concluded that treating patients with chest pain based on their gender was appropriate (Hess, et al, 2010).

Evidence-based projects require substantial amounts of research through reviewing literature. Chest pain is a common ER complaint and an enormous amount of literature exists on chest pain and its treatment, but little focus has been given to whether serial EKG’s can provide substantial information leading to a decrease in the need for admitting patient’s who are experiencing chest pain that does not have a cardiogenic source. Through further research of the literature the possibility of locating more information on serial EKG’s and the significance that they may play in determining whether a patient is having a true cardiac event will increase the knowledge base for this project.

Education of key players involved in the determination of a patient’s chest pain is crucial to a successful outcome for the patient. According to the American Heart Association’s most recent article on myocardial infarction, there are several diagnostic tools that improve the chances of the clinician making the correct diagnosis of a cardiac event. Exploring the options that are at the disposal of hospital clinicians can provide patients with the best outcome possible to live a long, prosperous life (Thygesen et al., 2012).

**Critical appraisal of the evidence**

 Literature included in this proposal was from studies dealing with chest pain and nitroglycerine therapy for chest pain. The evidence contained in the studies will be used to formulate a sound evidence-based practice project to support the question about the potential to determine a patient’s chest pain source through the efficacy of serial electrocardiograms. The knowledge gained from the literature is important, as well as, the validity of the information. For that reason the studies included in the literature review will be critiqued for the value of their evidence (See Appendix A).

**Study Methods/Design**

**ACE Star Model**

To effectively learn and gather evidence on a specific topic like chest pain protocols in the emergency department the ACE Star Model was chosen for this evidence-based practice project. The ACE Star Model focuses on five key points: Discovery, Summary, Translation, Integration, and Evaluation. This model provides a fluid approach to evidence based practice by using each point to build on the next. Discovery is the planning stage of an issue or problem you want to study. In the case of chest pain in the emergency department, discovery is the process of searching relevant literature for the best evidence related to chest pain protocols. The Evidence Summary stage of the model uses knowledge from previous studies, research trials and systematic reviews to develop a concise summary of the information needed to proceed to the next step, Translation. In the case of chest pain, you would want to look at various studies that determined the best door to EKG times, aspirin therapy in triage, and implementation of nitroglycerine therapy if the patient has a stable blood pressure among other factors (Kontos, Diercks & Kirk, 2010). In the translation stage, you use the information gathered from previous evidence based practice studies and the evidence summary to form your plan. When you move into the Integration phase of the model you will be implementing your plan into the medical arena and develop your protocol based on the best evidence. This is where you will assemble the majority of your knowledge to move forward to the Evaluation process. Evaluation has many areas that you will analyze to determine the success of your project and it will provide you with areas that may still need improvement (Stevens, 2004).

**Cognitive continuum theory**

Clinical judgment is imperative to nursing practice when it comes to effectively diagnosing and treating patients. Nurses may not be the ones who ultimately make the decision on a patient’s diagnosis or treatment; however, they are key in gathering the evidence a provider needs to make decisions regarding a patient’s care. Through the cognitive continuum theory nurses can apply critical thinking processes to suit the best decision-making for their patients care (Standing, 2008).

The cognitive continuum theory was originally designed for psychology studies; however, it can be applied to different disciplines (Standing, 2008). In nursing, judgment related to patient care involves uncertainty that makes decision-making difficult. To better determine a solution to the patients issue the nurse must seek out more information and apply it through critical thinking to come to a decision for the patients care. By studying the cognitive continuum theory nurses can seek out ways to improve their clinical judgment and decision-making skills.

The cognitive continuum theory suggests that through intuitive/experiential knowledge nurses can make judgment calls that can lead to accurate decisions. For example, a patient who has symptoms that include: diaphoresis, collapsing, a weak pulse, chest pain with radiation down the left arm and abdominal pain; the symptoms alone can indicate several conditions; however, together they point to a possible myocardial infarction. Through repeated patterns it is easy to identify possible diagnoses according to Hammond. Though individual symptoms may need to be investigated further to determine their level of urgency. This leads us to conclude that clinical judgment includes observation, data collection, critical thinking, and determining if there is a correlation between symptoms and a diagnosis (Standing, 2008).

The cognitive continuum theory is important to understand in this project because emergency room nurses are on the front line, as they are usually the first to assess a patient, and clinical judgment plays a key role when assessing patients as they arrive at the ER. It is important for ER nurses to have excellent assessment skills, but more importantly the ability to use experience and a “gut feeling” about a patient’s presentation can make the difference between life and death.

**Study Subjects/Sample Size/Time Frame**

The study will involve the education of ER staff members, ER providers, Chest Pain Observation Unit Staff, and members of management that have interest in learning about the most current evidence on diagnosis of chest pain. The study will involve education by Andrea Payne, RN, BSN (Principal investigator) about the current evidence found in literature to better diagnose chest pain. The education was provided in the form of an inservice to interested individuals who meet the criteria discussed above. To evaluate the effectiveness of the education provided, it is estimated that data from at least 10 participants that attend the inservice complete the pre/post questionnaire. To assure that the necessary number of subjects are obtained the inservice will be offered at 1:00 p.m. on March 20, 2013. The inservice will take place at Memorial-Hixson in the ER staff lounge and will last approximately 30 minutes. Participants will be required to take a pre/post test to assess their understanding of the material. By conducting the inservice during the month of March will allow adequate time for analysis of the data to be presented at Auburn University’s research week beginning April 1, 2013.

**Data Collection/Data Handling/Data Analysis**

Data from the inservices will include age/sex of the employee participants, understanding of the material presented and comments from the participants on items they believe could be beneficial to better diagnosing a patient’s chest pain. The employee questionnaire data will be collected during the month of February designated for the study and will not require any personal identifiers. Data will be recorded on an excel spreadsheet that will be maintained on the primary investigators computer, and analysis of the data will take place using the program Statistical Package for Social Sciences (SPSS). The fact that there will be no patient or employee identifiers used for the study will alleviate the need for informed consent, and the study subjects HIPPA rights will not be violated.

**Strengths/Innovation**

Electrocardiograms are one of the tools that physicians use to assess if a patient is experiencing an acute cardiac event. EKG’s are an excellent source of identifying changes in a patient’s normal heart rhythm, however to catch an acute coronary event like a ST segment elevation the EKG would have to be performed at the exact moment that the heart was infarcting. There are times when patient’s present with chest pain that the initial EKG catches the change in the patient’s rhythm, but there also many instances where the initial EKG was normal, but during the patient’s stay in the ER they experience changes in their heart rhythm. The changes in their heart rhythm are usually seen on a cardiac monitor, however if there was a protocol that involved additional EKG’s at predetermined intervals during the patient’s time in the ER the healthcare providers could potentially see changes much sooner. Recognition of heart arrhythmia’s on a cardiac monitor by the nursing staff is an adequate way to detect alterations in a patient’s cardiac activity, but EKG’s are more comprehensive and are accepted as a diagnostic tool; whereas the cardiac monitor alone is not enough. Serial EKG’s are the basis of the inservice, but other diagnostic tools like cardiac computed tomography, radionuclide imaging will be discussed as improved diagnostic instruments.

**Limitations**

Limitations to this project include a lack of interest by staff members and time planned for the inservice. The limitations are minimal and should not interfere with the primary investigator obtaining the amount of data needed to effectively assess the participants understanding of the material or analyzing whether or not the data shows a definitive need for reassessment of the current chest pain protocol.

**Risks and Benefits to Human Subjects**

The fact that the project involves an inservice versus a hands-on project leaves little risk to the participants. Subjects will be invited to the inservice on a voluntary basis and will be provided with refreshments and seating. The subjects will benefit from the information provided because the material could have a direct impact on their practice. The information will also broaden the subject’s knowledge on chest pain and the best practices available to diagnose chest pain in an expedient manner.

**Budget/Research Environment**

The inservice will involve no cost to the participants. The primary investigator will absorb the cost of the flyers alerting staff to the inservice and the cost of any refreshments provided. The inservice will be performed in the ER staff lounge at Memorial Hospital-Hixson during working hours, so that will alleviate the need to pay the participants for any extra time being they can attend while they are already on the clock. If a participant decides to attend during the hours they are not scheduled to work they will be informed that this is not a paid inservice, unless approval has been obtained from their direct supervisor prior to attending.

**Small Test of Change**

Evidence based practice centers on the knowledge of prior successes in healthcare and what aspects of the prior success could benefit from change that would provide a higher level of care. The benefits of change could directly or indirectly benefit patients or healthcare as a whole. Through evidence based practice we can look at our existing protocols and find ways to improve them through the evidence obtained in credible literature and hands on trial and error research studies. To assess the value of performing serial EKG’s in the ED, a small test of change was implemented through education of the ED staff surrounding the current literature on serial EKG’s and diagnosing patients with chest pain.

Healthcare providers, registered nurses, nursing management and patient care technicians from the Memorial Hospital-Hixson ED attended a 30-minute inservice that provided information on myocardial infarctions, chest pain and serial electrocardiograms. Prior to the inservice each participant was asked to fill out a questionnaire to assess his or her individual knowledge on the subject matter to be presented. Following the presentation the participants took a follow-up questionnaire that included the same questions from the pre-inservice questionnaire and included any comments or suggestions about the material presented.

The inservice discussed material from the most current research on diagnosing AMI and pertained to the issue of patient’s who present to the ED with a complaint of chest pain. The current protocol in place in the ED at Memorial Hospital-Hixson includes a single EKG within 10 minutes of presentation to the ED with chest pain that is to be read by the ED physician within 5 minutes of completion. On occasion the physician orders an additional EKG, but it is only when either the nurse or healthcare provider observes a rhythm change while the patient is in the department for evaluation of their chest pain or there is a change in the patient’s symptoms that would warrant a second EKG.

Chest pain protocols have been developed to provide the best outcome for patient’s who experience chest pain, but including evidence from improved technology that has been found in the last decade has yet to be seen in most hospitals chest pain protocols. That is the reason for introducing this information to the key players in the ED. Awareness is crucial to initiating change in any aspect of healthcare. Through evidence based practice studies we can identify where change is necessary to provide improved outcomes. This particular study identified a potential need to review the current protocol on chest pain to potentially include serial EKG’s. Through further investigation and actual trials of serial EKG’s in the ED it can be determined if adding serial EKG’s could benefit the patient population in the ED.

**Sample Size/Outcomes**

The educational inservice was attended by 10 ED employee’s of varied levels of care, gender and age. The participants were presented with a letter that detailed the level of participation that was needed to be a part of the study (See Appendix B). They were informed that their participation was voluntary and that their identities would be completely anonymous. The participants provided feedback through pre and post inservice questionnaires and their personal comments/suggestions (See Appendices C & D). Participants completed their questionnaires and turned them into a box where the principal investigator was unaware of who completed the questionnaires.

Knowledge of the existing chest pain protocol was exhibited by 90% of the participants through the pre-inservice questionnaires. The same was found on the post-inservice questionnaires. The participants also added their own personal comments/suggestions to the post-inservice questionnaires. The suggestions included concern over the number of staff it would take to complete serial EKG’s and the time necessary to complete them. Overall the participants felt that the addition of serial EKG’s would be a benefit to the patients, but were cautious to agree that making the change to the existing protocol would be possible with the current staffing.

Throughout the process of designing this study there were several pitfalls met by the principal investigator. Originally, the plan was to conduct a trial of performing serial EKG’s in the ED at Memorial Hospital-Hixson, but buy-in from the staff, healthcare providers and hospital administration was met with concern. The concern was centered on the cost of the extra EKG’s and who would absorb the cost, in addition, getting each of the ED physicians to agree to order the additional EKG’s was an issue. These barriers created a need to adjust the project to an educational inservice of the ED staff with the outcome focus being on knowledge of the current testing suggested for the diagnosis of chest pain and whether or not the participants felt that reviewing the current chest pain protocol would be an appropriate course of action.

Making changes in healthcare involves using our prior knowledge of what works best with the inclusion of evidence based studies to further identify the need for a change. Evidence based studies include research of literature on the subject matter that is the basis for the study, but also involves many key people in the healthcare field to support the need for a change. Gaining the necessary individuals to be involved in such a project can prove to be quite difficult, as in the study that was proposed in this paper. The ability to get the essential players on board requires many hours of research to substantiate the change you wish to implement, but also includes persuasiveness to get the needed persons to buy-in to the change. Change is going into unknown territory which is scary to most people which is what makes getting a change accepted a difficult proposition; however, change is a necessary evil if you want to see improvements made in any field of study.

Despite the fact that the evidence supports looking further into serial EKG’s in the ED as a benefit to patients; the staff in the ED at Memorial Hospital-Hixson that were involved in this study, feel that it would take too much time and effort to implement. However, what the inservice participants fail to appreciate is that the possibility of investigating further the value of serial EKG’s on their patient population could provide an increase in revenue, a decrease in unnecessary admissions, and potentially save more lives through earlier detection of a cardiac event.

**Conclusion**

 According to the literature, chest pain is a symptom of many different illnesses and diagnosing whether the pain is from a cardiac source should be timely and involve a protocol that aids the healthcare professional in the diagnosis. Many instances of chest pain presentation in the ED are from gastrointestinal disorders, psychological disorders or musculoskeletal chest wall pain. Sifting through the evidence to determine the nature of the patient’s chest pain is a tedious task where even a simple error in reading a patient’s EKG can be the difference between life and death. Performing serial EKG’s in the ER could play an integral role in the determination of the source of a patient’s chest pain and aide in alleviating the need to admit patients to the hospital for non-cardiac chest paint.

 Healthcare as a whole relies on evidence based practice to improve the manner in which we practice medicine in a myriad of medical venues. As an advanced practice nurse, understanding the need for change through evidence is crucial to advancing your own personal practice. Through current literature and research studies an advanced practice nurse can provide the highest level of care to their patients, but also stands to gain a vast realization of the process it takes to make changes even at the lowest level of care. Going forward in practice versus always doing things the way they have always been done involves the identification of processes that are broken or need re-evaluation for potential modification. Comprehending that an alteration needs to be made is only the first step, but following through the entire course to make the transformation will involve a tremendous amount of planning and effort to make a change.

Advance practice nurses are at the forefront of healthcare today with the decrease in the number of physicians to care for patients primary care needs. It will be vital for advance practice nurses to stay abreast of what is going on in the realm of research to improve the care we deliver. Healthcare, in general, is going through many changes and by being an active member in the healthcare field one must continue to educate themselves on best practices. The only way to improve the way we practice is through evidence derived from research and continued evaluation and re-evaluation of how and why we practice in a particular manner. The future of healthcare and advance practice nursing relies on our ability to identify a need for adjustment in practice, the strength of the literature to support change, and the power to create a difference.

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Appendix A

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| **Article citation in APA format** | **Purpose of study/research questions** | **Design type and methods (sampling method/sample size, description of interventions (if any), and outcomes measured** | **Major findings/findings relevant to project**  | **Critique of validity, bias and significance** |
| Hess, E.P., Perry, J.J., Calder, L.A., Thiruganasambandamoorthy, V., Roger, V.L., Wells, G.A., & Stiell, I.G. (2010). Sex differences in clinical presentation, management and outcome in emergency department patients with chest pain. *CJEM: The Journal of the Canadian Association of Emergency Physicians, 12(5),* 405-413.**Quality/Level of Evidence:****Level IV** | The purpose of this study is to evaluate the differences between men and women who present to the emergency department with chest pain based on their symptoms, treatment and outcome. This study also measures the association between female sex and cardiac angiography within 30 days. | This was a prospective cohort study that took place in an urban teaching hospital’s emergency room. The study was conducted over a 9-month period between July 2007-April 2008. Patients that were included in the study had to be older than 24 years of age and have a potential diagnosis of ACS. There were 970 patients included in the study with 584 being men. Patients were considered eligible if they presented to the ED with chest pain and were considered to be at a low to moderate risk for ACS. Patient outcomes were defined as AMI, PCI, cardiac death, 70% stenosis in a major coronary artery and changes in a patient’s nuclear stress test. | The study showed that women had a significantly lower incidence of CAD. Women were tested for AMI via ECG, troponin T level, and stress tests at the same rate as men, but were still found to have a significantly lower percentage of AMI or positive stress test findings. The findings of this study suggest that on the basis of sex as a tool for disease management was appropriate in the instance of chest pain. Also, women lower frequency of typical chest pain; less referral for cardiac angiography. | This study is credible. Patients were assessed on the basis of low to moderate risk. The sample size was 970, which is a significant amount of patients. The study incorporated a 2-month trial period to further improve their data collection forms and processes. Significance to project: 1.) This study leads to me to ask does there need to be an algorithm for men and one for women when it comes to chest pain? |
| Steele, R., McNaughton, T., McConahy, M., & Lam, J. (2006).Chest pain in emergency department patients: If the pain is relieved by nitroglycerin, is it more likely to be cardiac chest pain? *CJEM: The Journal of the Canadian Association of Emergency Physicians, 8(3),* 164-169.**Quality/Level of Evidence: Level IV** | The purpose of this study is to evaluate the use of nitroglycerin as a diagnostic test for determining whether a patient’s chest pain is cardiac or non-cardiac. | This is a prospective observational cohort study was conducted over a 9 month period of time. The study took place in an urban emergency room affiliated with an academic institution. **Outcome Measures:** Patients initial chest pain score was recorded and subsequently after each dose of nitroglycerin. The pain scale used was 1-10 and the visual analog score with happy to sad faces.  | 270 patients participated in the study. Of those 270 patients, 66% had their chest pain relieved by nitroglycerin. Patients were followed up with via telephone 4 weeks after being in the ED. 257 patients participated in follow- up phone calls. Patients received nitroglycerin based on their presentation at triage of chest pain. It was determined through this study that chest pain relief through nitroglycerin dosing may not be a reliable determining factor of whether a patient’s chest pain is cardiac related or not. There were 177 patients who responded positively to nitroglycerin treatment. Of those 177 patients, 60 felt a decrease in their chest pain and were diagnosed with having cardiac chest pain. However, 117 of the 177 patients who experienced relief from their chest pain with nitro were found to be having non-cardiac chest pain. There were 93 patients who did experience any relief by using nitroglycerin, and of those patients 23 were found to have true cardiac chest pain. Thirty-five of the participants had an AMI based on their troponin level, however 20 of those patients had relief of their chest pain when using nitro. Nine people died during this study with 3 of those that died experiencing relief from the nitroglycerin. | Weaknesses: 1.) The study excluded patients who had a low risk for cardiac issues. 2.) The study took place over a 9-month period. 3.) The study involved only a small patient population. 4.) The ECG was read only by the ED physician.Strengths: 1.) The study used the TIMI score to classify patients. 2.) The patient’s relief from nitroglycerin was measured within 5 minutes of receiving the medication. 3.) The study determined that chest pain relief from nitro is ambivalent to whether the patient is having cardiac or non-cardiac chest pain.Significance to project: 1.) This study questions the need for using nitroglycerin as part of a chest pain algorithm. 2.) Is there a medicine that can provide chest pain relief and be relative to whether a patient’s chest pain is cardiogenic or not? |
| Laudon, D.A., Behrenbeck, T.R., Wood, C.M., Bailey, K.R., Callahan, C.M., Breen, J.F., &Vukov, L.F. (2009). Computed tomographic coronary artery calcium assessment for evaluating chest pin the emergency department: Long-term outcome of a prospective blind study. *Mayo Clinic Proceedings, 85(4),* 314-322.**Quality/Level of Evidence: Level II** | The purpose of this study was to evaluate using CT (computed tomography) of coronary artery calcium on patients presenting to the ER with chest pain as an assessment tool and to determine if it has any long-term value in regards to the patient’s outcome at 30 days, 1 year and at 5 years.  | This was a prospective blinded study conducted in the emergency department of Saint Mary’s Hospital in Rochester, MN. The study was sponsored by a grant from the Mayo Foundation. The study enrolled 270 patients, but excluded 7 of those patients based on their CAC (coronary artery calcium) level being 0. Patients were determined to be eligible if they were between the ages of 30-62 for males and 30-65 for females. Patient’s participation in the study was based on them having at least one cardiac marker that was non-significant and an ECG (electrocardiogram) that did not indicate an acute cardiac event. All patients in the study received a CT to detect CAC.**Outcome Measures**Primary outcome: ACS, death, non-fatal AMISecondary outcomes: CABG, PCI (or combination) 30 days, 1 & 5 years | The study found that 49% of the patients CT scan detected CAC. This group of patients was further subdivided into four groups based on their CAC score. The score ranges were 0, 1-10, 11-50 and greater than or equal to 51. Of the patients in the highest score range of greater than or equal to 51, 44% had chest pain that could be traced to a cardiac cause. It was shown that cardiac chest pain was relative to a patients having CAC. Significantly, of the patients in the study, 13 patients that were hospitalized with chest pain and no cardiac event indicators had a heart attack. Of those 13 patients, 100% had CAC. Conversely, patients who were found to not have CAC were diagnosed as having non-cardiac chest pain. Only one patient out of 133 that had no CAC found on CT was determined to have chest pain related to a cardiac issue. Through this study CAC levels were analyzed in relation to cardiogenic chest pain and a threshold was derived for testing purposes. A CAC greater than or equal to 37 was identified as a positive marker for chest pain. Sixty-three patients fell into the positive category with this marker and 44% were found to have cardiac chest pain. However, there were 3 patients who fell below the 37 score threshold that were determined to have cardiac chest pain. Patients were followed at 30 days, 1 year and five years. Follow-up at 30 days showed no cardiac events in 99% of the patients, the other 1 % is unknown. At 1 year 98% of the patients reported data and only 2% had had cardiac catheterizations with 50% having to have PCI. Five years out only 212 participants provided follow-up data. Of those 212, 9 had had cardiac angiography with the need for interventions. 100% of those patients had a positive CAC score at their initial evaluation. | Weaknesses: 1.) The study involves a test that can be time consuming and may not be available at all institutions 24/7. 2.) The study excluded patients under the age of 30. 3.) The study involved only one hospital. 4.) It was not stated the timeframe in which the study was conducted.Strengths: 1.) The study focused on patients who had no significant indication of an acute cardiac event with conventional chest pain assessment. 2.) The study involved patients with a varied medical history. 3.) The test used to assess CAC was predictive of a patients risk for ACS at 30 days, 1 year and 5 years. 4.) The study had a high percentage of follow-up participants. 5.) The study showed the advantages of using CT to assess CAC in patients who present to the ED with chest pain as a diagnostic tool that could increase the number of patients who are shown to need further testing, and those patients who are experiencing noncardiogenic chest pain.Significance to project:1.) This study could be incorporated into the algorithm for determining a patient’s source of their chest pain. 2.) It causes you to ask the question of why this is not being used in ED now. 3.) This study shows that there could be an increase in patient flow in the ED by using this to rule out cardiac chest pain. 4.) Patient satisfaction rates could increase by using this method of testing for chest pain patients. |
| Hess, E.P., Perry, J.J., Ladouceur, P., Wells, G.A., & Stiell, I.G. (2010). Derivation of a clinical decision rule for chest radiography in emergency department patients with chest pain and possible acute coronary syndrome. *CJEM: The Journal of the Canadian Association of Emergency Physicians, 12(2),*128-134.**Quality/Level of Evidence: II** | The purpose of this study was to determine which patients that presented to the emergency department with either chest pain or potentially ACS needed chest radiography. | This was a study that was part of an ongoing cohort study to determine whether a clinical decision rule regarding chest radiography needed to be in place for patients who present to triage with chest pain. The study was conducted at a Canadian university affiliate hospitals emergency department over a six month period in 2007. Patients were enrolled if they met the criteria of being over the age of 24 years and their primary complaint at triage was chest pain. 529 patients were enrolled in the study and over 60% were males. Also of the 529 patients, 21 had a history of CHF (congestive heart failure) and 116 had a history of AMI (acute myocardial infarction). Patients assessment was performed by the ED physician and chest radiographs were ordered if appropriate. The chest radiographs were read by two blinded emergency department clinicians that categorized the results as normal, abnormal-not requiring intervention, and abnormal-requiring intervention according to the radiology findings and the patient’s assessment.**Outcome Measure:**Abnormal chest radiograph among patients needing acute intervention | The study found that patients who did not have a history of smoking, CHF or lung abnormalities on assessment did not need a chest x-ray when they presented with chest pain to the ED. Of the 529 patients in the study only 2.1% had a chest x-ray that showed a need for intervention. This study has shown that by using a patient’s medical history and physical assessment a decrease in costs and time can be obtained in the ED when caring for patients who present with chest pain. | Weaknesses: 1.) The study was only 6 months. 2.) Patients that were eligible were not enrolled due to lack of attention to detail by nurses and registration clerks. 3.) A low number of chest x-rays showed an abnormality needing acute treatment.Strengths: 1.) The study showed that ED could decrease their use of chest radiography in patients with chest pain. 2.) ED patient flow could experience an increase if a rule was in place defining which patients with chest pain required a chest x-ray. 3.) Patients would have a decreased exposure to radiation. 4.) Healthcare costs could be decreased.Significance for Project: 1.) The study could be used as a tool in the chest pain diagnosis algorithm. 2.) The information in the study will enhance my PICO question. 3.) Observed a decrease in healthcare costs and an increase in patient flow in the ED. 4.) Showed that patients with a significant cardiac history or specific risk factors need further evaluation. |

Appendix B

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| **INFORMATION LETTER****for an Evidence-based Project Study entitled***Diagnosing Acute Myocardial Infarction in the Emergency Department-An Educational Inservice* |
| **Attention Physicians, Nurses and Clinical Support Staff of the ER and Chest Pain Observation Unit, and any other interested clinical staff at Memorial-Hixson,** You are invited to participate in an evidence-based practice project surrounding the chief complaint of chest pain and current research that supports alternative methods for diagnosing chest pain as either cardiogenic or non-cardiogenic. This project is being conducted by Andrea Payne, graduate student in nursing, under the direction of faculty advisor Bonnie Sanderson, PhD, RN at the Auburn University School of Nursing. You are invited since you are a staff member at Memorial-Hixson. Your presence is requested at an in-service to be held Wednesday, March 20, 2013 at 1:00 pm. in the Memorial-Hixson Emergency Department staff lounge. You will be asked to take a pre-test, attend the in-service, and then follow-up with a post -test. No personal identifying information will be collected. We will protect your privacy and the data you provide will be only reported as summary, group data. Information collected through your participation will be used to fulfill a master’s degree project requirement and potentially presented as a professional meeting or published in a professional journal. While participation is entirely voluntary, your attendance is important to fulfill the requirements of not only my evidence-based project, but to provide you with the information that could be considered when Memorial Hospital’s current chest pain protocol is up for review. No RSVP is required. If you have questions about this project, please contact me via email, alb0054@auburn.edu, or Faculty advisor- Bonnie Sanderson, PhD, RN, Associate Professor at (334) 844-6756 or bks0010@auburn.edu.**If you have questions about your rights as a research participant,** you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.107 Miller HallAuburn, AL 36849-5505Telephone:334-844-5665Fax:334-844-5654HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS PROJECT. IF YOU DECIDE TO PARTICIPATE, THE DATA YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO. THIS LETTER IS YOURS TO KEEP.Thank you for your cooperation!Andrea Payne, Principal Investigator |

Appendix C

**Inservice Questionnaire**

**Diagnosing Chest Pain in the Emergency Department- The Most Comprehensive/Expedient Testing To Rule Out a Cardiac Event**

**Demographics**

Age: 18-24 25-40 41-65 over 65

Gender: M F

Position: Clinician RN/LPN PCT

Shift: Day Mid Night

**Pre-Inservice Questionnaire**

1. What is the door to EKG time, according to Memorial Hospital’s current protocol?
2. 5 minutes
3. 7 minutes
4. 10 minutes
5. 13 minutes

1. What lab tests are currently used to determine if a patient with chest pain is having a cardiac event?
2. Troponin levels, BNP, CKMB
3. CBC (Complete Blood Count)
4. CMP (Comprehensive Metabolic Panel)
5. CBC, CMP, Amylase, Lipase, BNP
6. In addition to blood work and EKG, what other standard tests are ordered for a patient who is experiencing chest pain?
7. CT of the chest
8. Chest X-ray
9. MRI
10. ABG (Arterial Blood Gas)
11. According to current research, what other testing available in the ER is suggested as a means of diagnosing ACS (Acute Coronary Syndrome)?
12. Serial EKG (more than one EKG at predetermined intervals)
13. MRI
14. CT
15. Ultrasound
16. Quick diagnosis of the source of a patient’s chest pain is of the utmost importance due to the fact that, literally minutes can mean the difference between life and death.
17. True
18. False

Appendix D

**Inservice Questionnaire**

**Diagnosing Chest Pain in the Emergency Department- The Most Comprehensive/Expedient Testing To Rule Out a Cardiac Event**

**Demographics**

Age: 18-24 25-40 41-65 over 65

Gender: M F

Position: Clinician RN/LPN PCT

Shift: Day Mid Night

**Post-Inservice Questionnaire**

1. What is the door to EKG time, according to Memorial Hospital’s current protocol?
2. 5 minutes
3. 7 minutes
4. 10 minutes
5. 13 minutes

1. What lab tests are currently used to determine if a patient with chest pain is having a cardiac event?
2. Troponin levels, BNP, CKMB
3. CBC (Complete Blood Count)
4. CMP (Comprehensive Metabolic Panel)
5. CBC, CMP, Amylase, Lipase, BNP
6. In addition to blood work and EKG, what other standard tests are ordered for a patient who is experiencing chest pain?
7. CT of the chest
8. Chest X-ray
9. MRI
10. ABG (Arterial Blood Gas)
11. According to current research, what other testing available in the ER is suggested as a means of diagnosing ACS (Acute Coronary Syndrome)?
12. Serial EKG (more than one EKG at predetermined intervals)
13. MRI
14. CT
15. Ultrasound
16. Quick diagnosis of the source of a patient’s chest pain is of the utmost importance due to the fact that, literally minutes can mean the difference between life and death.
17. True
18. False

**Evaluation of the Inservice**

Was the information provided useful to your current position?

Did the information presented suggest that review of the current chest pain protocol would be beneficial? If yes, what kinds of changes do you think would be beneficial to the patient’s seen in the ER who present with chest pain?

Statistics show that chest pain is one of the top complaints in the ER, however several diagnoses other than ACS can include chest pain as a symptom. Could we avoid unnecessary 23- hour observation admissions for patients with negative cardiac labs if we incorporated serial EKG into the chest pain protocol?

If yes, how would that benefit the patient and the hospital, in your opinion?