Door to Balloon Time and Clinical Outcomes

for ST-Segment Elevation Myocardial Infarction (STEMI) Patients

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The purpose of this paper is to analyze the current literature related to ST-segment elevation myocardial infarction (STEMI) and how time to reperfusion affects clinical outcomes for patients. Current evidence based practice suggests that STEMI patients who receive percutaneous coronary intervention (PCI) within 90 minutes of their arrival into the emergency department (ED) have the best outcomes (Lambert et al., 2010, p. 2148). In contrast, patients with door to balloon (D2B) times of greater than 90 minutes have an increased morbidity and mortality (Lambert et al., 2010, p. 2148).

Myocardial infarctions with ST-segment elevation have a high mortality rate and are “one of the most common causes of death worldwide” (Singer et al., 2007, p. 539). Thus, a patient presenting to the ED with STEMI must be treated quickly. Blockage of the coronary artery means that heart muscle being supplied by that artery is at risk for damage unless the blood flow is quickly returned to normal (Benitez Jr. & Pattillo, 2011, p. 128). Every minute that treatment is delayed results in greater damage and necrosis to cardiac tissues (Rathore et al., 2009, p. 6).

In 2007, the American College of Cardiology (ACC) and the American Heart Association (AHA) developed the D2B Alliance. The D2B Alliance suggested a goal of 90 minutes from the door to intervention to ensure the best outcome for STEMI patients (Benitez Jr. & Pattillo, 2011, p. 129). In order to achieve this goal, the alliance utilizes evidence-based practices like activation of the cardiac alert by the ED physician, using a single page system that alerts all necessary staff at once and requiring cardiac catheterization laboratory (CCL) staff that are located close to the hospital and always available (Benitez Jr. & Pattillo, 2011, p. 129).
The question at issue is whether STEMI patients with a D2B time of less than 90 minutes have better clinical outcomes than patients with a D2B time of greater than 90 minutes. This paper will answer that question through a review of the current literature about STEMI patients and reperfusion. The authors will present the most current evidence related to STEMI, D2B times and patient outcomes.

**Literature Review**

The five articles chosen for this project are peer reviewed and from reputable medical and nursing journals. The oldest date of publication is 2009, making these sources current and relevant to the topic investigated. The use of current information is crucial due to the constantly changing fields of cardiology and nursing. The databases CINAHL and PUBMED were searched for relevant information. The most current five articles and those that focused on nursing implications relevant to the topic were chosen.

“Achieving Door-to-Balloon Times in Less than 90 Minutes” by Benitez Jr. and Pattillo was published in Critical Care Quarterly in 2011. The article used 11 references, with 5 references less than 5 years old (Benitez Jr. & Pattillo, 2011, p. 133). The authors piloted a STEMI flow sheet in an ED and hypothesized that it would improve the flow of STEMI patients through the ED, decreasing their D2B time (Benitez Jr. & Pattillo, 2011, p. 128). The article’s literature review supported the findings that D2B times should be less than 90 minutes (Benitez Jr. & Pattillo, 2011, p. 131). Development of the flow sheet expedited STEMI patient movement through the ED and provided “an opportunity to showcase the role of a clinical nurse specialist in evaluating and advocating for best practices” (Benitez Jr. & Pattillo, 2011, p. 132).
“Association of Door-to-Balloon Time and Mortality in Patients Admitted to Hospital with ST Elevation Myocardial Infarction: National Cohort Study” by Rathore et al. was published in the British Medical Journal in 2009. The authors of this study utilized 34 references, of which 16 were published less than 5 years from the study’s publication date. The authors looked at how mortality rates of STEMI patients were affected by D2B times of greater or less than 90 minutes (Rathore et al., 2009, p. 1). This study followed 43,801 STEMI patients and found that any reduction in D2B time, even decreasing the time from the goal of 90 minutes, had a positive effect on mortality rates and resulted in better clinical outcomes (Rathore et al., 2009, p. 1).

The third article included in the project is “An Emergency Physician Activated Protocol, ‘Code STEMI’ Reduces Door-to-Balloon Time and Length of Stay of Patients Presenting with ST-Segment Elevation Myocardial Infarction” by Parikh et al. It was featured in the March, 2009, issue of the International Journal of Clinical Practice. According to the Wiley Online Library database, this article is used as a reference by three other cardiac journals and one clinical practice journal. This article references 26 other sources, 14 of which were published less than 5 years from the publication date.

The Parikh et al. study compares standard care to a newly designed “Code STEMI protocol” that was initiated in 660- bed acute tertiary care teaching hospital to patients presenting in the emergency room that were experiencing a STEMI (Parikh et al., 2009, p. 398). “The purpose of Code STEMI was to allow simultaneous and immediate activation of the CCL, interventional cardiologist on call and in-house cardiology fellow by the ED physician upon identification of an ST-segment elevation myocardial infarction as opposed to the usual serial activation of this primary angioplasty team” (Parikh et al., 2009, p. 399). This study concluded
that the activation of the Code STEMI protocol significantly reduced the D2B time as well as length of hospital stay in STEMI patients (Parikh et al., 2009, p. 398).

“An Association between Timeliness of Reperfusion Therapy and Clinical Outcomes in ST-Elevation Myocardial Infarction” by Lambert et al. is featured in the Journal of the American Medical Association (JAMA) in June of 2002. It uses 29 references, with 24 published less than five years from the publication date of the study. The majority of these references are from reputable medical journals. According to the Web of Knowledge database, this article is used as a reference in 15 other studies and articles. JAMA is a peer reviewed journal. The authors of this article have affiliations with Canadian hospitals; five out of the six authors are MD’s and two are PhD’s.

This study covers a 6-month period and takes place in Quebec. Data was collected to analyze the significance of timeliness of fibrinolysis and primary percutaneous coronary intervention (PPCI) in the STEMI patient (Lambert et al., 2010, p. 2149). Mortality rates for these patients were investigated at the 30-day and 1-year mark (Lambert et al., 2010, p. 2148). It was found that reperfusion delayed care in the STEMI patient and “significantly increased 30-day mortality, a statistically non-significant increase in 1-year mortality, and significantly increased risk of the composite of mortality or readmission for acute myocardial infarction or heart failure at 1 year” (Lambert et al., 2010, p. 2148).

The fifth article chosen for this project is “Prolonged Door-to-Balloon Time: Is Treatment Delayed Always Treatment Denied?” by Andrew Eisenhauer. Published in Progress in Cardiovascular Diseases in 2010, the article uses 33 references, with seven published less than
five years from the publication date of the article. The majority of the references used are from cardiology journals.

Eisenhauer’s study reports an investigation that took place in Brigham and Women’s Hospital in Boston, Massachusetts, where 12 data elements were collected for each STEMI patient and analyzed for compliance with performance standards (Eisenhauer, 2010, p. 197). These patients were then divided into two groups; one group received reperfusion within 90 minutes of hospital arrival and the second group, who did not meet the guidelines, fell outside of the 90 minute parameter (Eisenhauer, 2010, p.197). This data was analyzed by individuals in leadership positions of the departments involved to see where a breakdown in the system may have occurred and how it could have been prevented (Eisenhauer, 2010, p.197). This study also discusses that adverse outcomes may arise because of the pressure for caregivers to meet the recommended STEMI guidelines (Eisenhauer, 2010, p. 199). This could occur in patients with complicated medical histories, for example (Eisenhauer, 2010, p. 200).

The authors reviewed an additional five articles that were not chosen for this paper. “Emergency Department Activation of an Interventional Cardiology Team Reduces Door-to-Balloon Times in ST-Segment Elevation Myocardial Infarction” by Singer et al. was not chosen, because it was an outdated publication. An article titled “Pharmacological and Mechanical Revascularization Strategies in STEMI: Integration of the Two Approaches” was analyzed but found not be supportive enough of our PICO. “Time Delay to Treatment and Mortality in Primary Angioplasty for Acute Myocardial Infarction: Every Minute of Delay Counts,” with a publication date of 2004, was not current enough for this project, and the information did not support our PICO. “A Comparison of Coronary Angioplasty with Fibrinolytic Therapy in Acute Myocardial Infarction” was not chosen because of its publication date of 2003. The last article,
“A Review of Interventions and System Changes to Improve Time to Reperfusion for ST-Segment Elevated Myocardial Infarctions” by McDermott et al., was not chosen because articles that were more supportive of our PICO were found.

Evidence Analysis

The articles chosen for analysis were pertinent to the stated PICO question developed, as all addressed the practice delivery of PCI within 90 minutes of presentation to the hospital. These articles highlighted the known increased mortality risks when D2B times near and exceed this 90 minute window. Findings also suggest increased risk of reinfarction and development of heart failure in STEMI patients with delayed reperfusion.

The impact on patient outcomes related to timely PCI is well documented in the current literature. To this end, the Centers for Medicare and Medicaid Services (CMS) and the Joint Commission (TJC) have identified this specific aspect of care by including it in the National Hospital Inpatient Quality Measures (Spec. Manual, 2011, p. AMI-8-1). These measures are used to assess the care provided to patients by participating facilities with the goal of improving the healthcare delivery process. “Measures are based on scientific evidence and can reflect guidelines, standards of care, or practice parameters” (CMS, n.d., “Process Care,” para. 1).

Acute Myocardial Infarction (AMI) Core Measure-8a suggests that STEMI patients receive PCI within 90 minutes of arrival at the ED (Spec. Manual, 2011, p. AMI-8-1). Hospitals that participate with CMS and receive reimbursement from them must report their rate of compliance with this standard. CMS reiterates that the earlier that this intervention is provided, “the more effective it is” (Spec. Manual, 2011, p. AMI-8-1).
The literature used in this analysis are Level II. The authors used current and relevant resources in addition to statistical analyses to present the data collected. The studies chosen addressed current practice and outcome concerns for STEMI patients. The conclusions reached were consistent with the data presented. The findings clearly demonstrated cause and effect between D2B times and patient outcomes. These studies reinforced the existing knowledge base and highlighted the need for a closer examination into current nursing practice in the identification of STEMI patients and the expedition of their care.

The articles chosen for review provided valid, pertinent data, making a correlation between reduced D2B times, improved patient outcomes, and the importance of streamlining the delivered care. The literature presented a realistic and valid representation of current practice. The findings of these studies clearly make the case for a hospital to have protocols in place to provide timely care for patients who arrive with STEMI. The reviewed literature strongly reinforces the fact that a well developed systematic approach to care delivery of the specific population leads to reduced D2B times.

The implications for nursing practice is inferred, but not clearly stated in the literature. Only one of the sources provided a specific plan to reduce D2B times in the form of a flow-chart. The evidence proves that any minutes saved from D2B will provide long term benefits to patients. Nurses in the ED play an integral role in the identification of these patients upon arrival. Another vital task is ensuring that the initial electrocardiogram (EKG) is obtained quickly. Nurses provide the ongoing hemodynamic monitoring and physical assessments that proves invaluable in the time from identification to catheterization lab.
Evidence Application

As nurses, we need to critically review the literature to determine what evidence is available in research for our best practice. Policies and procedures for direct nursing care must be based on this research. Knowing that a 90 minute window for the best outcome in STEMI patients is what current research suggests, we need to ensure that patients are given the best evidence-based care. According to Benitez Jr. & Pattillo (2011), the ACC “launched a national door-to-ballon (D2B) initiative to take the extraordinary performance of a few hospitals and make it ordinary performance of every hospital” (p.129). Although the ED physician is most often the healthcare professional to initiate the call to the CCL, the ED triage nurse is the one who would have first contact with the patient. In order to reduce the D2B time and have this “ordinary practice” transpire, the triage nurse must have the knowledge of what type of procedure to follow if a patient presents with signs and symptoms of a STEMI.

One type of procedure found in our literature review was a flow chart. Standard of practice for patients with signs and symptoms of an acute MI presenting into the ED would be to obtain a 12-lead EKG. Once the EKG is done and confirms STEMI, the next step needs to be readily available for the patient to receive the best quality care. Nurses in the ED are usually trained to work in many areas, including triage. Knowing what to do for different types of patients is part of the nurse’s education, but the use of policies and procedures found in manuals or online can be time consuming. Benitez Jr. & Pattillo (2011) created a flow chart “that could easily illustrate the steps needed to take in order to accomplish the goal of having that patient to the cardiac catheterization laboratory (CCL) in less than 80 minutes” (p.130). Once the EKG is obtained, it is given to the ED physician within 10 minutes (Benitez, Jr. & Patillo, 2011, p. 130). If STEMI is confirmed on the EKG, the flow chart included the use of an ED physician
activation of the PCI/CCL (Benitez, Jr. & Patillo, 2011, p. 130). With the activation of the CCL and interventionalist in the hands of the ED physician, the ED nurse can concentrate on initiating treatment, obtaining consent and transporting the patient to the cath lab.

One of the barriers to this type of procedure is making sure that the flow chart is readily available in the triage area. Another possible barrier is having all departments involved aware of the flow chart. “Time from symptom onset to reperfusion is an important predictor of patient outcomes“ (Eisenhauer, 2010, p.196). All departments should be a part of the planning process and recognize that the flow chart is the hospital’s standard of care for STEMI patients.

After hour delays can also be associated with prolonged D2B time. According to Eisenhauer,

As expected, a larger percentage of patients in the delayed group was treated “after hours” when the major impediment to rapid reperfusion was believed to be the need to have on-call staff come to the hospital as opposed to regular work hours when the staff was present in the hospital. (2010, p.198)

Members of the team must be able to arrive at the hospital within 30 minutes. This can be achieved by the attending ED physician calling the operator. The operator then can simultaneously call the CCL personnel and interventional cardiologist on-call.

**Summary Statement**

It is important for nurses to understand the significance of patients receiving PCI within the 90 minute window that is suggested. The research has proven better patient outcomes when this guideline is followed. After careful review of current literature, the authors support the use of a 90 minute D2B time for STEMI patients as evidence based practice. The literature states,
“the use of PCI for patients presenting with a STEMI in less than 90 minutes has shown to significantly reduce mortality and morbidity” (Benitez Jr. & Pattillo, 2011, p.128). The bedside nurse needs to be cognizant of the signs and symptoms of an acute MI and understand the protocols for their department to ensure this guideline is met.

Further research needs to be developed to set standard nursing protocols that can be used throughout the hospital settings to decrease the door to balloon time interventions. Physician roles are clearly stated in the research articles, as they are the ones who activate the chain of command. The STEMI flow chart that was discussed earlier in this paper would allow the nurse to follow step by step to ensure the patient is ready for PCI in a timely manner. The use of a flow chart allows the nurse to care for the patient in an organized and systematic way, which will allow time to perform diagnostic studies, notify family members, and care for the patient with medications.

The flow sheet should be available online; possibly as a tab on the electronic chart, which would ensure the proper procedures are followed in order and also the information, such as nothing by mouth status, labs, and vital signs, can be accessed by the interventional radiology team. Having immediate access to this information will assist the patient receiving PCI in a timely manner.

**Conclusion**

A STEMI is a life threatening condition that must be treated in a timely manner. Higher rates of death and permanent damage occur when door to balloon time for STEMI patients exceeds 90 minutes. The review of the literature related to STEMI patients and D2B times
support continuing the current evidence based practice. Hospital policies and protocols that are in place to facilitate timely reperfusion are a valuable tool to achieve the 90 minute D2B goal.
References


