



Timely treatment for acute myocardial infarction and health outcomes: An integrative review of the literature



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ABSTRACT

Background: Coronary heart disease is the most common condition affecting Australians. The time sensitive nature of treating ST-segment elevation myocardial infarction (STEMI) has been the subject of extensive research for several years. Despite important advances in strategies to reduce time to treatment, time continues to represent a major determinant of mortality and morbidity. Door to balloon time (DTBT) is a key indicator of quality of care for STEMI. Nurses play a pivotal role in streamlining the care processes to influence timely management of STEMI.

Purpose: The aim of this paper is to review the evidence on the time to treat STEMI, the associated factors impacting upon health outcomes and explore systems of care that reduce time to treatment, using an integrative review approach.

Method: Established databases were searched from 2000 to 2012. The search terms 'myocardial infarction', 'emergency medicine', 'angioplasty balloon', 'time factors', 'treatment outcome', 'mortality', 'prognosis', 'female', 'age factors', and 'readmission', were used in various combinations. Research studies that addressed the aims of this paper were examined.

Findings: Twenty-nine papers were included in this integrative review. The literature demonstrates a strong relationship between shorter DTBT and reduced in-hospital mortality. Factors such as age, gender, time of presentation and co-morbid condition were associated with increased in-hospital mortality. There is sparse literature examining the effect timely reperfusion has on longer-term mortality and other longer-term outcomes such as readmission rates and occurrence of heart failure. Additionally, strategies that effectively reduced DTBT were identified, yet little has been reported on the impact reduced DTBT has had upon health outcomes and whether these improvements were sustained.

Conclusion: Whilst the importance of timely reperfusion is now well recognised, additional efforts to streamline the process of care and demonstrate sustained improvement for STEMI patients is required. Nurses in the areas of emergency medicine and cardiac care, play an essential role in facilitating this.

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Introduction

Cardiovascular disease (CVD) refers to all diseases of the heart and blood vessels.¹ Coronary heart disease (CHD) is the largest subset of CVD accounting for 14.6% of all deaths in Australia in 2011.² In terms of burden of disease, CVD was responsible for 18% of the total burden of disease and injury in Australia in 2003, second only to cancer.^{1,3} The Australian expenditure on CVD for 2004–2005 was recorded as \$5.94 billion, more than any other

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disease group, and accounted for 11% of the total health care expenditure.^{4,5}

Whilst mortality from CHD is decreasing, it remains the single largest cause of mortality in Australia for both men and women. Further, almost half of these deaths were attributed to acute myocardial infarction (AMI).² CHD spans the spectrum from clinical presentations with stable coronary disease to acute coronary syndromes (ACS). The focus of this paper will have particular emphasis on the subset of ACS known as ST-segment elevation myocardial infarction (STEMI).

It is recognised that gender and age are contributing factors to a presentation to hospital with STEMI. In Australia during 2007 there were 55,997 hospitalisations for STEMI; two thirds were male, with 40% aged 55–74 years and an additional 40% aged 75 and over.⁵ The prevalence of STEMI and costs attributed are likely to increase due to the ageing demographic of Australia.

It is clear that advancing treatments for CHD are having a direct impact on mortality rates; in particular for patients presenting with STEMI. In 2009 63% of people who suffered a STEMI survived, compared with 47% in 1997.³ Prompt reperfusion of the culprit coronary lesion using primary percutaneous coronary intervention (PPCI) is the preferred treatment, with national and international guidelines for STEMI management suggesting a timeframe of ≤ 90 min from presentation to first balloon inflation or door to balloon time (DTBT).^{6–8} The importance of time has become a key measure of quality of care. The past decade has seen an intense focus on systems of care that best deliver these treatments in a timely manner. However systems of care that reduce DTBT require first and foremost, institutional drive with active participation and leadership across multiple disciplines. Given the delicate balance of providing this timely management, a deeper understanding of the factors that influence time to treatment and their associated clinical health outcomes, along with strategies that reduce DTBT are worthy of further examination.

Aim

The aim of this paper is to review the literature that demonstrates the impact time to treatment has on determining health outcomes for STEMI patients, examine the associated factors that influence these clinical health outcomes and delivery of timely treatment, and outline the systems of care that can be applied in the clinical setting to reduce DTBT.

Methods

An integrative review was used to synthesise the literature identified. An integrative review uses a broad review method that incorporates simultaneous inclusion of experimental and non-experimental research in order to understand the area of concern.⁹ A multi-database search was carried out using Ovid Medline, CINAHL and Cochrane databases using the terms 'myocardial infarction', 'emergency medicine', 'angioplasty balloon', 'time factors', 'treatment outcome', 'mortality', 'prognosis', 'female', 'age factors' and 'patient readmission'. The inclusion criteria for this review were (1) articles published in English between 2000 and 2012, (2) studies that examined the impact time to treatment in STEMI had on mortality and other health outcomes, (3) studies that explored the associated factors that influenced health outcomes and delivery of timely management of STEMI, (4) studies that explored system based strategies that reduced time to treatment in STEMI. Exclusion criteria included (1) discussion papers and book chapters, and (2) small studies with fewer than 450 participants. These aforementioned search terms were used in various combinations using AND.

The electronic search strategy produced 624 potential studies. This list was read by title and abstract to confirm alignment of content to the purpose of this manuscript using the inclusion/exclusion criteria. A manual search of reference texts and other resources held in the university library was also undertaken, some of which fell outside the restriction of 2000–2012. The final number of relevant publications included in this review was 29 articles (refer to Fig. 1 for the study selection process).

Results

The synthesised literature was grouped into three themes: the impact time to treatment has on mortality and morbidity in STEMI, associated factors that influence mortality and timely treatment, and strategies to reduce DTBT. The primary research included in this review comprised both experimental and non-experimental studies (see Table 1).

The impact time to treatment has on mortality and morbidity

The time sensitive nature of achieving reperfusion of coronary vessels is well recognised and precedes the introduction of PPCI as front line treatment. A PPCI involves the urgent opening of the infarct related epicardial coronary artery with balloon angioplasty and/or insertion of a metal stent to maintain patency, restore blood flow and reduce the size of the infarct.¹⁰

A great deal of the initial evidence linking delay to treatment to higher mortality was generated prior to the wide spread acceptance of PPCI when thrombolytic therapy was considered the 'gold standard' in treatment.¹¹ This research gave credence to the concept of the 'golden hour' in offsetting damage from an acute myocardial infarction. The adage 'time is muscle' became a familiar axiom, drawing attention to the importance of expedited care, along with routine measurement of the time from Emergency Department presentation to the commencement of thrombolytic therapy referred to as the door-to-needle time.

Two landmark quantitative reviews contributed to a major shift in thinking on the best reperfusion strategy for STEMI patients.^{12,13} These reviews compared thrombolysis to PPCI and concluded that PPCI was better than thrombolytic therapy at reducing short-term major adverse cardiac events, resulting in an absolute decrease of approximately 2% risk of in-hospital and 30 day death with PPCI¹² and PPCI being associated with a 37% relative risk reduction in 30-day mortality.¹³

A plethora of literature followed the shift in reperfusion therapy strategy to PPCI, along with extensive examination of the relationship between time to reperfusion and patient mortality. De Luca and colleagues were able to show the risk of one-year mortality increased by 7.5% for every 30 min of delay to treatment.¹⁴ McNamara and colleagues also concluded that in-hospital mortality increased significantly with a longer DTBT, but went further breaking it down into timeframe categories. The in-hospital mortality was 3.0% for DTBT ≤ 90 min as compared to 7.4% for a DTBT ≥ 150 min.¹⁵ McNamara et al., also found each 15-min reduction in DTBT from 150 min to less than 90 min was associated with 6.3 fewer deaths per 1000 patients; this was seen regardless of the length of time from onset of symptoms. More recently a study by Rathore and colleagues concurred with previous studies, highlighting the independent association between a delay to the commencement of treatment and higher mortality.¹⁶ Results demonstrated a decrease in mortality of 0.8% with a reduction of DTBT from 90 min to 60 min, and a further decrease in mortality of 0.5% with a reduction of DTBT from 60 min to 30 min.¹⁶

Examples in the literature of mortality follow up outside the acute setting are few. Brodie and colleagues followed 2322

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