HeartBeat - Improving Heart Attack Care

Abstract

We aimed to save lives by assuring best practice in ST elevation myocardial infarction (STEMI) through initiating the Institute for Healthcare Improvement (IHI) methodology nationally. Following collection of a minimum dataset, annual change in indicators in the five initiating hospitals for the period Oct 2006 to Sept 2009 was assessed by analysing the percentage of patients receiving the eight components of evidenced based care on admission and discharge and in-hospital mortality rates. Performance on seven of the eight indicators of care exceeded 90% annually. Timely reperfusion therapy (thrombolysis, primary percutaneous coronary intervention (PPCI)) improved non-significantly from 68.2% (107 patients) in year 1 to 77.1% (118 patients) in year 3. In-hospital mortality declined significantly from 12.4% (24 deaths) in year 1 to 5% (9 deaths) in year 3. Evidence based STEMI care is followed to a high degree but timely reperfusion and PPCI provision remain a challenge nationally.

Introduction

Mortality from acute ST elevation myocardial infarction (STEMI) is on the decline in most countries. A national study noted an improvement in the in-hospital mortality rate for acute myocardial infarction (AMI) from 11% in 1994 to 9% in 2003 with the more recent CHAIR registry showing mortality rates of 8.4% for all AMIs and 10% for STEMI for admissions from 2003 to 2006. These data compare poorly with two international surveys in 2002 which showed an in-hospital mortality rate for STEMI at 7%. While international guidelines have clarified the evidence base for changing clinical practice in the care of patients with AMI many studies have established that a gap still exists between evidence and practice across hospital type and regions of world. This gap was highlighted in Ireland in 2003. In late 2005, an initiative to reduce mortality from AMI, known as the HeartBeat programme, was commenced based on the U.S. Institute for Healthcare Improvement (IHI) Saving 100,000 lives campaign. The purpose of the HeartBeat programme is to promote in the improvement in the process and outcome of care of STEMI patients in five pilot hospitals initially. Our aim was to assess the degree of change in the percentage of patients who received each of the eight components of evidenced based STEMI care and the trend in in-hospital mortality across the three years of the initiative.

Methods

Five of thirty seven Irish acute hospitals were invited to initiate the HeartBeat programme in October 2006. Two hospitals were city based teaching centres with either on-site or access to facilities for primary PCI (PPCI), one a general hospital in a large urban town and the remaining two general hospitals were at a distance from urban centres providing thrombolysis exclusively. We established that the IHI methodology for care of STEMI patients was in agreement with the ACC/AHA guidelines (2004), the ESC guidelines (2003) and the AHA/ACC Get With The Guidelines Programme.

Heartbeat focussed on key elements of the IHI approach: the agreement within the hospital of a clinical champion and the formation of a focussed team; awareness raising about change management techniques such as training in Plan, Do Study Act cycle; hospital prospective data collection with quarterly feedback of comparative data; and dialogue with hospitals when indicators fell below 90%. A multi-professional steering group committed time to data quality and addressing change management along with a dedicated national team which visited and liaised with hospitals, analysed data from hospitals and produced the feedback. Patients over 18 years with STEMI were included with the excluded data from hospitals and produced the feedback. Patients over 18 years with STEMI were included with the excluded.

A minimum data set was completed by the hospital on each patient. Validation of the numbers of STEMI was carried out for one hospital and found to be concordant. Individual hospitals reviewed the local requirements for ethical approval. Each indicator was calculated with the numerator being those treated and the denominator being the eligible patients minus those documented to have a contraindication. The resulting proportion, with 95% confidence intervals (CI), was presented for each hospital and for the aggregate of hospitals. Timely RT was taken as door to needle of 30 minutes and door to balloon as 90 minutes. The standard of 90% attainment was set. Inter-hospital variation was also examined using the maximum to the minimum percentage for each indicator as a measure of variation. Chi-square tests were used to compare differences in age, gender, time of admission and timely reperfusion between hospitals. Time of admission was categorised as in or out of normal working hours (Mon-Fri 9am-5pm). Significance at p=0.05 was assumed and SAS v9.1 (SAS Institute Inc) was used for analysis. Annual data is presented for the first 36 months in the programme from onset in October 2006.

Results

Data on 635 patients with ST elevation AMI were included for analysis from October 2006 to September 2009 for the five hospitals (table 1). The mean age of patients was 62.4 years (SD= 14.5) ranging significantly from 56.5 years to 65.9 years between the hospitals (p<0.001). No significant difference amongst hospitals was observed between genders or time of admission. Smokers comprised 37.6% of patients ranging from 22.3% to 47.3% between hospitals. Contraindication to therapy varied considerably across each indicator with 17% and 13.17% contraindicated to aspirin on admission and early beta blocker therapy (BB) respectively. Fewer patients were contraindicated to discharge medications. Notably, the largest proportion of patients (19.8%) was contraindicated to RT with the majority (57%) presenting too late for thrombolysis.

<table>
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<tr>
<th>Indicator</th>
<th>Hospital 1</th>
<th>Hospital 2</th>
<th>Hospital 3</th>
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For each of the three years the standard of 90% attainment or greater was observed for seven of the eight indicators of AMI care, the exception being timely RT (Figure 1). This standard of 90% attainment was reached by four of the five hospitals consistently. Patients under 75 years were significantly more likely to obtain smoking cessation advice compared to their older counterparts (p=0.034). Most STEMI patients received RT (74.5%) or were contraindicated (19.8%). Though the majority of patients received timely RT (72%) significant inter hospital variation was found (52% to 84%, p<0.001) over all years. Hospitals with Cardiac Catheter Laboratory (Cath Lab) access had significantly lower rates of timely RT at the start compared to those without Cath Lab access, but this was non-significant by year 3. No significant difference in RT was found between in and out of hours care. Variation across hospitals was noted for ACE inhibitor therapy in years 2 and 3 as well as beta blocker on admission in year 3.

Figure 1: Indicators by year of audit

The mode of RT therapy changed over the three years (Table 2) with a reduction in thrombolysis and a significant increase in primary percutaneous coronary intervention (PPCI) (p=0.002). Overall PPCI reached 28.1% in year 3 but higher in the two urban hospitals with access to the Cath Lab achieving a rate of 64.2%. The median door to needle time improved significantly over the three years (Table 2, p= 0.02). There was no statistically significant difference in the age of the patient, gender or time of admission in receiving reperfusion or its timeliness. In-hospital mortality for patients with STEMI declined significantly from 12.4% (95% CI 7.8 - 17.1) in year one to 7.3% (95% CI 3.75 - 11.1) in year two (Figure 2). Subsequently, a non significant decline in year three was observed.

Reperfusion therapy, with the evidence base now firmly in favour of PPCI, however, has shown a different pattern. First, while considerable improvement has taken place in the proportion of patients receiving RT from 58% in 199412 and 44% in 2003 1 to 75% (thrombolysis and PPCI) in the third year of this initiative there is still improvement needed to reach the optimum of 92% achieved in the Czech Republic.14 Second, PPCI has increased from 4% in 2003 1 to 28% for year 3 in this hospital group. While two hospitals, with access to Cath Lab, achieved 44% PPCI in year 3 overall the rate of PPCI was low by comparison with other countries. With US and European guidelines recommending PPCI for some years now a resource, national PPCI protocol, currently in design, is now needed to deliver optimal treatment for all STEMI patients across Ireland. Lastly, the timeliness of thrombolysis within 30 minutes has improved from 35% in 2003 1 to (median time 45 minutes) to 63.3% in year 3 of Heartbeat (median time 19 minutes in 2008/9) compares favourably with international data. However, timeliness of PPCI, with 65% of patients receiving therapy within the 90 minute, first door to balloon time in year 3, shows that there is room for improvement by international standards.

Variation in timeliness of RT declined over the three years due to improved timeliness in hospitals with Cath Lab access. We are aware of significant demand pressures on some EDs as well as factors associated with the change from thrombolysis to PPCI in others particularly the important place of clear communication between ED and Cath Lab. However, in order to reach international achievements and thus improve survival from this medical emergency the areas for significant change are those of rapid pre-hospital response, diagnosis and transport to 24 hour PPCI centres. Variation in beta blockers on admission, (year 3 only), may reflect recent uncertainty surrounding the evidence on their use in these patients. For ACE inhibitors, the variation in years 2 and 3 suggested hesitation in prescribing ACE inhibitors.

Heartbeat hospitals have reported improved communication between Emergency Department and Cardiology/Medicine, renewed awareness and training of Specialist Registrars, and regular study of feedback with adjustment in protocols. Progress was summed up as each person in the chain being more aware of their role in saving heart muscle. In-hospital mortality for STEMI in this series dropped significantly in the three years and in the last year compared well with international registry data. Improvements in the proportion and timeliness of treatment with evidenced based therapies could have played a part. We did not find time of presentation to hospital or gender differences affected performance as found in other studies. However, older patients have been found to receive poorer care as observed.

Discussion

Evidence based care is followed to a very high degree for seven out of the eight key care areas with little variation across the five hospitals initiating and maintaining this programme over 3 years. However, timely RT, though improved over the 36 months, remains a challenge as does the provision of PPCI nationally. In-hospital mortality declined significantly from 12.4% (95% CI 7.8 - 17.1) in year one to 7.3% (95% CI 3.75 - 11.1) in year two (Figure 2). Subsequently, a non significant decline in year three was observed.

*p=0.002 for difference in %PPCI vs %thrombolysis over time; NS=not significant
# Excluded cases includes those excluded due to late reperfusion due to hypertension, those who had PCI > 24 hours, were transferred, or non STEMI.
& Eligible patients = STEMI patients minus those excluded from reperfusion and contraindicated.

Figure 2: In-hospital mortality

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This study has a number of limitations: we do not compare progress against a control group, this series is not risk adjusted and data from hospitals were manually collected, so subject to possible ascertainment bias. We did not address patient delay in calling for help, a factor in more than half of those contraindicated to thrombolysis, in this series. This area of public awareness as well as pre-hospital response remains a major challenge for improvement in Ireland. In one of the studies in this paper, the median time to medical contact in 2003 was 65 minutes and 11 years later this has improved to 22 minutes. We are aware that the telemedicine aspect of our programme requires further development. However, with RT yet to reach international best practice, what is needed now is the implementation of a comprehensive regional strategy for rapid access to PCI and hospital services, together with the in a committed implementation of the new CVD policy so that more Irish lives and hearts can be saved. We believe that this initiative is unique in systematically using the IHI methodology on an ongoing basis nationally with many requests to join the programme.

Acknowledgements
The dedication of the five hospitals who participated in proving that this programme worked to improve patient care: Connolly Memorial Hospital Dublin; Cork University Hospital; Letterkenny General Hospital; Our Lady of Lourdes Hospital Drogheda; and Wexford General Hospital. We also wish to acknowledge the dedication of the members of both Steering Groups who provided wise oversight.

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References
1. Doyle F, De La Harpe D, McGee H, Shelley E, Walsh M, Daly K (Royal College of Surgeons in Ireland); CCU 2003 - National Survey of the Characteristics, Treatments and Outcomes of Patients with Acute Myocardial Infarction (AMI) and Other Acute Coronary Syndromes (ACS) in Irish Hospitals; 2004.
7. Institute for Healthcare Improvement (IHI). Saving 100,000 lives campaign. www.ih.org/IHI/Programs/Campaigns
18. 102, 113-116
27. 102, 113-116
29. SAS v9. SAS Institute Inc., Cary, USA