Preliminary Evidence on the Effectiveness of Prevention and the Role of Population Management in Acute Myocardial Infarction

Yeh RW, Sidney S, Chandra M, et al. Population trends in the incidence and outcomes of acute myocardial infarction. N Engl J Med 2010;362:2155–65.

Study Overview

Objective. To analyze population trends in the incidence and outcomes of acute myocardial infarction.

Design. Collected *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) codes found in hospital discharge information and billing claims from a large, integrated healthcare delivery system database.

Setting and participants. 46,086 hospitalized patients aged 30 and older with a primary diagnosis of acute myocardial infarction from 1998–2008 were identified via ICD-9-CM codes. Cases were further classified into ST-segment elevation myocardial infarction (STEMI) and non-STEMI myocardial infarction. The health plan database was also used to identify patients who underwent coronary revascularization with percutaneous coronary intervention or coronary artery bypass grafting up to 30 days after myocardial infarction, laboratory testing for the MB fraction of creatinine kinase (CK-MB), and patient characteristics such as age, sex, and self-reported ethnicity. Outpatient pharmacy records were used to identify medication use within 30 days prior to the first hospitalization for myocardial infarction.

Main outcome measures. Primary outcome measurements included the incidence of acute myocardial infarction overall, STEMI and non-STEMI specifically, and 30-day mortality. CK-MB levels were collected for each incident case to assess the severity of the infarct. While troponin levels were not used in the analysis to determine infarct severity, they were followed and recorded when available. A secondary outcome of interest was the proportion of patients who underwent revascularization 30 days after MI.

Main results. Of the 46,086 patients who met inclusion criteria, 15,271 patients (33.1%) presented with STEMI and 30,185 patients (66.9%) presented with non-STEMI. After adjusting for age and sex, the overall incidence of myocardial infarction displayed an initial increase between the years 1999 and 2000 (274 cases per 100,000 to 287 cases per 100,000) and then a subsequent decrease for the remainder of the study period (208 cases per 100,000 person-years in 2008). This represented a 24% relative decrease. Focusing specifically on the age- and sex-adjusted incidence of STEMI, an overall linear decrease was observed (133 per 100,000 to 50 per 100,000). The incidence of non-STEMI displayed an initial increase in 1999, then a decrease for the remainder of the time. CK-MB index levels were found to decrease significantly overall as well as for the non-STEMI patients. However, there was no clear pattern for CK-MB levels within the ST-elevation MI patient subset. Of note, troponin I testing became increasingly more popular between 1999–2008, rising from 53% to 84%, while CK-MB testing decreased during this time frame from 75% to 56%. This is important because it shows that although testing for myocardial infarction became more sensitive through the use of improved cardiac biomarkers, there was still a decrease in the overall diagnosis of myocardial infarction. The age- and sex-adjusted 30-day mortality remained largely unchanged for STEMI but demonstrated an overall decrease in mortality from 10.5% to 7.9% for non-STEMI. Finally, there was a statistically significant increase in the percentage of patients who underwent revascularization within 30 days after myocardial infarction from 40.7% to 47.2%.

Conclusion. Between the years 2000–2008, there was a decrease in the overall incidence of myocardial infarction. In particular, there was a dramatic reduction in the incidence of STEMI after 1999. This trend persisted in the midst of a shift in the use of diagnostic markers of myocardial infarction from CK-MB to troponin I. A decrease in 30-day mortality was also evident and is attributed largely to the lower case fatality rates among patients with non-STEMI.

Commentary

Over the years, much clinical effort has been expended on primary and secondary prevention of myocardial infarction. While the benefits of secondary prevention are clear, less compelling is the evidence on primary prevention. This is in part due to the difficulty of obtaining such data. Evidence

from randomized trials in the past (eg, MR FIT) have not been able to demonstrate such benefit [1].

This well-designed longitudinal observational study by Yeh et al is one of the first signals of the magnitude of health benefits of primary prevention. In this study, there was a 24% relative reduction in the incidence of myocardial infarction between the years 2000–2008, which occurred despite rising rates of obesity and diabetes. What remains to be seen is what approach, whether a treat-to-target approach (eg, trying to achieve LDL < 100 for all diabetic patients) vs. a tailored treatment approach (based on a calculated risk level for an individual patient, eg, using the Framingham risk score) will in aggregate provide more clinical benefit [2].

Applications for Clinical Practice

How should we approach primary prevention of myocardial infarction? While preliminary, the data suggest a compelling role for primary prevention in at-risk patients. This fits well with a "population management" approach for providers, designed to manage all patients at risk regardless of the severity of individual cases. By contrast, disease management programs manage only those with the most severe forms of the disease and only those who volunteer to participate. By managing an entire population with a given disease, population management programs can institute primary prevention measures for at-risk individuals while continuing to manage the existing disease burden of the more severely affected, higher-cost patients. Population management also emphasizes effective patient self-management through patient education and care support. Over time, the promise of this approach is a lower percentage of high-risk, high-cost patients in the population mix through alteration of the natural history of the disease for those with early or uncomplicated disease. When the study by Yeh et al is repeated in a decade, we hope to observe that the steep decline in myocardial infarction continues.

—Review by Pascale M. White, MD, and Nirav R. Shah, MD, MPH

References

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