CLINICAL RESEARCH STUDY

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# Outcomes of Acute Myocardial Infarction in Patients with Hypertrophic Cardiomyopathy

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## ABSTRACT

**BACKGROUND:** Acute myocardial infarction is a recognized complication in patients with hypertrophic cardiomyopathy. However, limited data are available on outcomes of patients with hypertrophic cardiomyopathy and acute myocardial infarction.

**METHODS:** We analyzed the 2003-2011 Nationwide Inpatient Sample databases to identify all patients aged ≥18 years with a principal diagnosis of acute myocardial infarction. Patients with a concomitant diagnosis of hypertrophic cardiomyopathy were then identified and analyzed as a separate cohort. Multivariate logistic regression was used to compare outcomes in patients with acute myocardial infarction with and without hypertrophic cardiomyopathy.

**RESULTS:** Of 5,901,827 patients with acute myocardial infarction, 5688 (0.1%) had a diagnosis of hypertrophic cardiomyopathy. Patients with hypertrophic cardiomyopathy were older, more likely to be female, and less likely to have traditional cardiovascular risk factors. Compared with patients without hypertrophic cardiomyopathy, patients with hypertrophic cardiomyopathy were less likely to present with ST-elevation myocardial infarction and more likely to present with non-ST-elevation myocardial infarction. Patients with hypertrophic cardiomyopathy with ST-elevation myocardial infarction or non-ST-elevation myocardial infarction were less likely to receive revascularization. In the overall population with acute myocardial infarction, there was no difference in risk-adjusted in-hospital mortality between patients with and without hypertrophic cardiomyopathy (odds ratio [OR], 0.96; 95% confidence interval [CI], 0.84-1.11; $P = .59$). In the population with ST-elevation myocardial infarction, patients with hypertrophic cardiomyopathy had lower risk-adjusted in-hospital mortality than those without hypertrophic cardiomyopathy (OR, 0.75; 95% CI, 0.63-0.91; $P = .003$), whereas in the population with non−ST-elevation myocardial infarction, there was no difference in risk-adjusted in-hospital mortality between patients with and without hypertrophic cardiomyopathy (OR, 0.97; 95% CI, 0.84-1.11; $P = .63$).

**CONCLUSIONS:** Patients with hypertrophic cardiomyopathy represent a small proportion of patients with acute myocardial infarction and are less likely to receive revascularization. Compared with patients without hypertrophic cardiomyopathy, patients with hypertrophic cardiomyopathy with ST-elevation myocardial infarction have lower risk-adjusted in-hospital mortality.

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**KEYWORDS:** Acute myocardial infarction; Hypertrophic cardiomyopathy; In-hospital mortality; Revascularization

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TG, PH, DK, and SK have contributed equally to this study.

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Hypertrophic cardiomyopathy is a disease state characterized by left ventricular hypertrophy associated with nondilated ventricular chambers in the absence of another cardiac or systemic disease to explain the magnitude of observed hypertrophy.[1-4] It is the most common genetic cardiovascular disease, with an estimated prevalence in the general population of 1:500 (0.2%), which extrapolates to approximately 600,000 affected people in the United States.[5] Hypertrophic cardiomyopathy is characterized by extreme heterogeneity in clinical course, with arrhythmic sudden death, progressive heart failure, and atrial fibrillation being the most well-recognized clinical sequelae.[1-3,6] Myocardial ischemia due to small vessel disease is an established pathophysiologic feature in hypertrophic cardiomyopathy and may be associated with important disease-related complications, including adverse left ventricular remodeling and systolic dysfunction.[7] However, compared with the better understood mechanisms of left ventricular outflow tract obstruction[8-10] and diastolic dysfunction,[11] myocardial ischemia due to epicardial coronary artery disease has been an underappreciated component of the hypertrophic cardiomyopathy disease process.[12] Reports on the burden of epicardial coronary artery disease in patients with hypertrophic cardiomyopathy have varied, but up to 20% of adult patients with hypertrophic cardiomyopathy have been shown to have coexistent epicardial coronary artery disease.[13-16] Although acute myocardial infarction in hypertrophic cardiomyopathy has been described before in the literature,[17-19] there is a paucity of data on the outcomes of acute myocardial infarction in patients with hypertrophic cardiomyopathy.

The main objectives of this study were to examine the differences in baseline characteristics, comorbid conditions, treatment patterns, and outcomes among patients with acute myocardial infarction with and without hypertrophic cardiomyopathy using the Nationwide Inpatient Sample (NIS) database. We also conducted subgroup analyses to determine differences in in-hospital mortality between patients with hypertrophic cardiomyopathy and patients with non-hypertrophic cardiomyopathy with ST-elevation myocardial infarction and non-ST-elevation myocardial infarction, as well as those receiving and not receiving revascularization.

## CLINICAL SIGNIFICANCE

- To the best of our knowledge, this is the first observational study to examine the outcomes of acute myocardial infarction in patients with hypertrophic cardiomyopathy.
- Compared with the general population, patients with hypertrophic cardiomyopathy and acute myocardial infarction were less likely to receive revascularization therapy.
- Among the population with ST-elevation myocardial infarction, patients with hypertrophic cardiomyopathy had lower risk-adjusted in-hospital mortality compared with patients without hypertrophic cardiomyopathy.
- Revascularization therapy was not associated with a reduction in in-hospital mortality in patients with hypertrophic cardiomyopathy with ST-elevation myocardial infarction or non-ST-elevation myocardial infarction.

## MATERIALS AND METHODS

### Data Source

Data were obtained from the 2003-2011 NIS databases. The NIS, sponsored by the Agency for Healthcare Research and Quality as a part of the Healthcare Cost and Utilization Project, is the largest publicly available all-payer inpatient care database in the United States. It contains discharge-level data provided by states (n = 46 in 2011) that participate in the Healthcare Cost and Utilization Project. The NIS includes data from approximately 8 million hospital stays each year from approximately 1000 hospitals designed to approximate a 20% stratified sample of all community hospitals (defined as "all nonfederal, short-term, general, and other specialty hospitals, excluding hospital units of institutions") in the United States. Criteria used for stratified sampling of hospitals include hospital ownership, patient volume, teaching status, urban or rural location, and geographic region. Discharge weights are provided for each patient discharge record and were used to obtain national estimates.

### Study Population

We used the International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM) diagnosis codes 410.xx to identify all patients aged ≥18 years with the principal diagnosis of acute myocardial infarction. We chose the principal diagnosis because it is considered the primary reason for hospital admission. In administrative databases, the diagnosis of acute myocardial infarction using ICD-9-CM codes has been shown to have a specificity of 99.5% with a sensitivity of 72.4%, a negative predictive value of 96.1%, and a positive predictive value of 95.9%.[20,21] Patients with a concomitant diagnosis of hypertrophic cardiomyopathy were then identified using ICD-9-CM code 425.1. Patients with a principal diagnosis of ST-elevation myocardial infarction (ICD-9-CM codes 410.0x, 410.1x, 410.2x, 410.3x, 410.4x, 410.5x, 410.6x, 410.8x, and 410.9x) and non-ST-elevation myocardial infarction (410.7x) were identified using respective ICD-9-CM codes.

### Outcomes Measured

We used ICD-9-CM codes to identify whether patients received thrombolysis (V45.88, 99.10), percutaneous