Cardiogenic shock is uncommon but remains a major driver of early mortality in patients with acute myocardial infarction (MI). To date, there are few studies characterizing the differences in shock in patients presenting with ST–segment-elevation MI (STEMI) versus non–ST-segment elevation MI (NSTEMI).

Methods and Results—We compared differences in care by the shock status of 235,541 patients with STEMI and NSTEMI treated at 392 US hospitals from 2007 to 2011. Cardiogenic shock occurred in 12.2% of patients with STEMI versus 4.3% of patients with NSTEMI. Compared with STEMI shock, NSTEMI shock was more likely in patients who were older and predominantly women; had diabetes mellitus, hypertension, previous heart failure, MI, or peripheral arterial disease; and who received coronary artery bypass grafting (11.6% versus 21.2%; P<0.0001) but less likely to have received percutaneous coronary intervention (84.2% versus 35.3%; P<0.0001). Compared with patients with STEMI presenting with shock at admission, patients with NSTEMI presenting with shock had longer delays to percutaneous coronary intervention (1.2 versus 3.2 hours) and coronary artery bypass grafting (7.9 versus 55.9 hours). Cardiogenic shock in patients with STEMI was associated with a lower mortality risk (33.1% shock versus 2.0% no shock; adjusted odds ratio, 14.1; 95% confidence interval, 13.0–15.4; interaction P value <0.0001) compared with patients with NSTEMI (40.8% shock versus 2.3% no shock, odds ratio, 19.0; 95% confidence interval, 17.1–21.2).

Conclusions—Cardiogenic shock is associated with high mortality in patients with STEMI and NSTEMI. However, urgent revascularization is more commonly pursued in patients with STEMI presenting with shock than in patients with NSTEMI. More research is needed to improve the outcomes for patients with MI presenting with shock, particularly those presenting with NSTEMI. (Circ Cardiovasc Qual Outcomes. 2013;6:708-715.)

Key Words: myocardial infarction ▫ outcome assessment ▫ shock, cardiogenic

specifically, we sought to understand how treatment patterns vary among patients with STEMI and NSTEMI in the presence of the American College of Cardiology/American Heart Association (ACC/AHA) guidelines that provide specific recommendations only for patients with STEMI shock.

Methods

Study Population

The National Cardiovascular Data Registry’s (NCDR’s) Acute Coronary Treatment and Intervention Outcomes Network Registry–Get With The Guidelines (ACTION Registry–GWTG) is an ongoing national database of patients with consecutive STEMI and NSTEMI from >600 hospitals across the United States, enrolling since January 2007. This manuscript was handled by Pamela Peterson, MD, as a Guest Editor. The Editors had no role in the evaluation of the manuscript or in the decision about its acceptance.

The online-only Data Supplement is available at http://circoutcomes.ahajournals.org/lookup/suppl/doi:10.1161/CIRCOUTCOMES.113.000262/-/DC1. Correspondence to Monique L. Anderson, MD, 7022 North Pavilion DUMC, PO Box 17969, Durham, NC 27715. E-mail monique.anderson@duke.edu © 2013 American Heart Association, Inc.
WHAT IS KNOWN

• Cardiogenic shock is uncommon but remains a deadly complication of acute myocardial infarction.
• Despite demonstrated high mortality rates for all patients with cardiogenic shock, no definitive guideline recommendations exist for the management of cardiogenic shock in non-ST-segment elevation myocardial infarction patients.

WHAT THE STUDY ADDS

• We found that although >95% of patients with ST-segment-elevation myocardial infarction-related cardiogenic shock undergo revascularization in the contemporary era, only slightly >50% of patients with non–ST-segment-elevation myocardial infarction cardiogenic shock undergo revascularization.
• Compared with patients with ST–segment-elevation myocardial infarction, the presence of cardiogenic shock disproportionately increased the risk of death for patients with non–ST-segment-elevation myocardial infarction.
• Given the continuously high mortality rates for patients with cardiogenic shock, new treatment strategies, support mechanisms, attention, and research (specific to cardiogenic shock) are needed to understand the impact of early cardiac catheterization and revascularization on cardiogenic shock outcomes for patients with non–ST-segment-elevation myocardial infarction.

1, 2007.¹² The institutional review board of each hospital approved participation in the ACTION Registry–GWTG.

Informed consent is not required because all data are abstracted anonymously. The inclusion and exclusion criteria, data collection, and standardized definitions for the registry have been previously described.¹³ Consecutive data were collected by trained personnel at each site through a web-based data entry system. The starting population for this analysis included 267,605 patients enrolled in the ACTION Registry–GWTG from January 1, 2007, to March 31, 2011, at 532 hospitals. Because of privacy laws that prohibited data capture after interhospital transfer, we excluded patients who were initially admitted to hospitals without percutaneous coronary intervention (PCI) capabilities (n=30,336), as well as those patients with missing information on shock (n=1,272) or revascularization status (n=456). After applying these exclusions, the study population consisted of 235,541 patients from 392 sites.

Definitions

The inclusion criteria for STEMI and NSTEMI have been previously published¹⁴ and are available at http://www.ncdr.com/WebNCDR/NCDRDictionaries/ACTION_v2_CodersDictionary_2.2.pdf.

Cardiogenic shock was defined as sustained (>30 minutes) systolic blood pressure <90 mm Hg or cardiac index <2.2 L/min per m² secondary to cardiac dysfunction or use of vasopressor or inotropic agents or mechanical support (intra-aortic balloon pump, extracorporeal circulation, or ventricular assist devices) to maintain blood pressure and cardiac index. Cardiogenic shock was categorized as present on admission or occurring during hospitalization. To be classified as present on admission, shock had to be present between first medical contact and arrival at an ACTION Registry–GWTG hospital. If classified to have developed during hospitalization, shock should have developed after the initial presentation at an ACTION Registry–GWTG hospital but before discharge. Patients who were listed as having shock both on presentation and in-hospital (n=1967; 0.8%) were classified as having shock on presentation.

Revascularization was achieved with either PCI or coronary artery bypass grafting (CABG). Patients who received both interventions were categorized as receiving CABG because of higher perioperative mortality rates in high-risk patients undergoing CABG.¹⁷ Time from arrival to revascularization was only assessed for patients who presented with shock on admission to reliably evaluate whether guidelines for timing of revascularization were achieved (18 hours from shock onset to revascularization). The primary outcome was in-hospital death.

Statistical Analysis

Baseline demographics, clinical characteristics, and outcomes were displayed by MI type or by the presence or absence of shock. These variables were further stratified by the timing of shock for each MI subtype. Continuous variables were reported as median with interquartile (IQR) range; categorical variables were reported as percentages. P values were based on Pearson χ² tests for all categorical variables and Wilcoxon rank-sum tests for continuous or ordinal variables.

To evaluate the relationship between in-hospital mortality and shock, a logistic generalized estimating equation method with exchangeable working correlation matrix was used to account for within-hospital clustering because patients at the same hospital are more likely to have similar outcomes relative to patients at other hospitals (ie, within-center correlation for responses).¹⁴ This method produced estimates similar to those from ordinary logistic regression, but variances were adjusted for the correlation of outcomes within a hospital. Two separate multivariable models were fitted (1 for each acute MI subtype) to determine mortality risk for patients with cardiogenic shock versus those without shock. Variables included in the model were from our full ACTION Registry–GWTG in-hospital mortality model¹⁵ and based on previous literature and clinical relevance (online-only Data Supplement A). The discriminative performance of both models was evaluated with c-statistic. These variables were included in the model regardless of their statistical significance.

A test for interaction between MI subtype and shock status was performed in the modeling using the entire cohort and stratified by in-hospital revascularization. Adjusted associations for outcomes were displayed as odds ratios (ORs) with 95% confidence intervals (CIs). For all tests, a P value <0.05 was considered significant. All analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC).

Results

Our study population included 93,229 (39.6%) patients with STEMI and 142,312 (60.4%) patients with NSTEMI. The overall incidence of cardiogenic shock was 7.4%. Cardiogenic shock occurred in 12.2% (n=11,406) of patients with STEMI and 4.3% of (n=6,130) patients with NSTEMI. In both MI subtypes, patients who developed shock were older and more frequently had comorbid conditions, such as previous congestive heart failure (CHF), peripheral arterial disease, dialysis dependence, and chronic lung disease, compared with patients with no shock (Table 1). Patients with shock also had higher baseline troponin levels compared with patients with no shock. Significant differences in shock were found between patients with STEMI and those with NSTEMI. Compared with STEMI patients with shock, NSTEMI patients with shock were significantly older and more likely to be women and to have diabetes mellitus, previous CHF, MI, revascularization, and peripheral artery disease (Table 1; P values for this comparison are shown in footnote of table). The median time from symptom onset to arrival for STEMI shock versus
NSTEMI shock was 2.3 (IQR, 1.1–4.7) hours versus 4.2 (IQR, 1.5–9.9) hours, respectively. Compared with STEMI patients with shock, baseline troponin level was significantly greater for those with NSTEMI.

Among STEMI patients with shock, 59.9% presented with shock whereas 40.1% developed shock during hospitalization. Among NSTEMI patients with shock, 43.2% presented with shock whereas 56.8% developed shock during hospitalization. Compared with patients who developed shock during hospitalization, STEMI patients with shock on admission were slightly younger (64.0 versus 66.0 years; \(P=0.0001\)) and had similar comorbidities, including previous CHF, MI, and revascularization; NSTEMI patients with shock on admission were slightly younger (70.0 versus 71.0 years; \(P=0.0002\)) and had similar rates of hypertension, diabetes mellitus, previous MI, and revascularization compared with patients with NSTEMI who developed shock during hospitalization.

Acute 24-hour medication use and in-hospital procedures differed significantly between STEMI and NSTEMI patients with shock. Compared with STEMI patients with shock, NSTEMI patients with shock were less likely to receive aspirin, a thienopyridine, or anticoagulation (Table 2); were nearly half as likely to receive a glycoprotein IIb-IIIa inhibitor (34.5% versus 66.3%; \(P<0.0001\)); and were more likely to have a median ejection fraction that was significantly lower (40% versus 35%; \(P<0.0001\)). Most patients with STEMI underwent diagnostic coronary angiography, whereas slightly >70% of patients with NSTEMI underwent this procedure.

### Table 1. Baseline Characteristics in Patients According to Presence or Absence of Shock, by MI Subtypes

<table>
<thead>
<tr>
<th>Baseline Characteristics</th>
<th>Patients With STEMI</th>
<th>(P) Value</th>
<th>Patients With NSTEMI</th>
<th>(P) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, y†</td>
<td>60 (51–70)</td>
<td>&lt;0.0001</td>
<td>66 (56–78)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Women, %</td>
<td>29.0</td>
<td>&lt;0.0001</td>
<td>38.1</td>
<td>0.08</td>
</tr>
<tr>
<td>Race, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>84.5</td>
<td>&lt;0.0001</td>
<td>82.8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Black</td>
<td>8.1</td>
<td></td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>1.5</td>
<td></td>
<td>1.3</td>
<td>2.2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4.1</td>
<td></td>
<td>3.8</td>
<td>4.5</td>
</tr>
<tr>
<td>Other</td>
<td>1.2</td>
<td></td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Length of stay, d†</td>
<td>3.0 (2.0–4.0)</td>
<td>&lt;0.0001</td>
<td>4.0 (2.0–6.0)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Symptom onset to arrival, d†</td>
<td>2.5 (1.3–4.9)</td>
<td>&lt;0.0001</td>
<td>4.5 (1.8–10.8)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Medical history</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoking, %</td>
<td>44.3</td>
<td>&lt;0.0001</td>
<td>30.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Hypertension, %</td>
<td>62.7</td>
<td>&lt;0.0001</td>
<td>76.5</td>
<td>0.11</td>
</tr>
<tr>
<td>Dyslipidemia, %</td>
<td>52.4</td>
<td>&lt;0.0001</td>
<td>62.9</td>
<td>0.001</td>
</tr>
<tr>
<td>Chronic lung disease, %</td>
<td>9.4</td>
<td>&lt;0.0001</td>
<td>16.7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Diabetes mellitus, %</td>
<td>22.7</td>
<td>&lt;0.0001</td>
<td>35.1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Dialysis dependence, %</td>
<td>0.8</td>
<td>&lt;0.0001</td>
<td>2.9</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Chronic warfarin use, %</td>
<td>2.8</td>
<td>&lt;0.0001</td>
<td>6.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Previous MI, %</td>
<td>19.0</td>
<td>&lt;0.0001</td>
<td>28.7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Previous CHF, %</td>
<td>4.7</td>
<td>&lt;0.0001</td>
<td>16.3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Previous PCI, %</td>
<td>19.9</td>
<td>&lt;0.0001</td>
<td>25.7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Previous CABG, %</td>
<td>6.9</td>
<td></td>
<td>19.1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>PAD, %</td>
<td>5.4</td>
<td>&lt;0.0001</td>
<td>12.1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Initial laboratory values</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemoglobin, g/dL†</td>
<td>14.4 (13.2–15.6)</td>
<td>&lt;0.0001</td>
<td>13.7 (12.2–15.0)</td>
<td>12.9 (11.4–14.5)</td>
</tr>
<tr>
<td>CrCl, mL/min†</td>
<td>88.8 (64.6–115.6)</td>
<td>&lt;0.0001</td>
<td>75.4 (48.7–106.6)</td>
<td>54.9 (35.7–79.2)</td>
</tr>
<tr>
<td>Baseline troponin ratio, xULN†</td>
<td>1.0 (0.2–10.9)</td>
<td>&lt;0.0001</td>
<td>2.2 (0.5–11.0)</td>
<td>4.6 (0.9–29.6)</td>
</tr>
<tr>
<td>Vital signs at presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admission HR, bpm†</td>
<td>78 (66–92)</td>
<td>&lt;0.0001</td>
<td>83 (70–98)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Admission systolic BP, mmHg†</td>
<td>142 (122–161)</td>
<td>&lt;0.0001</td>
<td>146 (127–167)</td>
<td>120 (96–146)</td>
</tr>
</tbody>
</table>

BP indicates blood pressure; CABG, coronary artery bypass grafting; CHF, congestive heart failure; CrCl, creatinine clearance; HR, heart rate; IQR, interquartile range; MI, myocardial infarction; NSTEMI, non–ST-segment elevation myocardial infarction; PAD, peripheral arterial disease; PCI, percutaneous coronary intervention; STEMI, ST-segment elevation myocardial infarction; and ULN, upper limit of normal.

*STEMI shock was also compared directly with NSTEMI shock. All \(P\) values are significant with a \(P<0.0001\), except women (\(P=0.0007\)) and race (\(P=0.0003\)).

†Data reported as median (IQR).
Compared with STEMI patients with shock, NSTEMI patients with shock were more likely to have 3-vessel disease (55.2% versus 37.1%; \( P < 0.0001 \)).

Revascularization patterns by MI type were different among shock patients (Table 2). Of the STEMI patients with shock who underwent coronary angiography, 79.1% underwent PCI, 12.3% received CABG, and 8.7% were medically managed. Of NSTEMI with shock who underwent coronary angiography, 45.6% underwent PCI, 28.9% received CABG, and 25.5% were medically managed (Figure 1). For STEMI patients presenting in cardiogenic shock, the median time from arrival to PCI and CABG was within guideline recommendations for early revascularization (Figure 2). For NSTEMI patients presenting with shock, the median time from arrival to PCI was 3.2 hours and to CABG was 55.9 hours (Figure 2).

Overall, in-hospital death rates from STEMI and NSTEMI patients with shock were high. Mortality was 33.1% among STEMI patients with shock compared with 2.0% in patients without shock. In the NSTEMI group, in-hospital death was 40.8% in patients with shock and 2.3% in patients without shock (Figure 3). Of the 3648 deaths in the STEMI shock group, 70.5% of patients had undergone revascularization before death. Of the 2401 deaths in the NSTEMI shock group, only 36.7% had revascularization before death. Death rates were significantly higher for unrevascularized shock patients in both MI subtypes (STEMI: 66.8% versus 27.3%; NSTEMI: 56.7% versus 27.5%; both \( P < 0.0001 \)) compared with patients who underwent revascularization. Patients with STEMI had only slightly higher death rates when shock was present on admission (34.2% versus 31.5%; \( P = 0.003 \)) compared with shock that developed during hospitalization, but the converse was true for NSTEMI patients (39.2% versus 42.1%; \( P = 0.03 \)).

Unadjusted OR for death was 23.9 (95% CI, 22.1–25.7) in STEMI shock versus no-shock group, and 29.2 (95% CI, 26.6–32.1) in the NSTEMI cohort. After adjustment, patients with shock remained at significantly increased risk of death compared with patients with no shock for patients with both STEMI (adjusted OR, 14.1; 95% CI, 13.0–15.4) and NSTEMI (adjusted OR, 19.0; 95% CI, 17.1–21.2). A significant interaction was found between MI subtype and shock for mortality.
the OR associated with shock being higher in NSTEMI compared with STEMI (interaction $P$ value $<0.0001$). This disproportionate relationship for NSTEMI shock versus no shock (compared with STEMI shock versus no shock) held for patients who underwent revascularization (interaction $P$ value $<0.0001$) and for those who did not undergo revascularization (interaction $P$ value 0.0002). The mortality models demonstrated good discrimination with a $c$-statistic of 0.889 and 0.920 for NSTEMI and STEMI models, respectively.

**Discussion**

To our knowledge, our study is the largest to report outcomes on cardiogenic shock by MI type to date. We found significant differences in the incidence and patient characteristics for shock versus no shock by MI classification. We also found significant differences in treatments, revascularization, and outcomes in the presence or absence of shock by MI classification. Compared with STEMI patients with shock, NSTEMI patients with shock experienced significantly higher mortality risk.

When compared with STEMI, cardiogenic shock seems to be distinct for NSTEMI because shock was observed in nearly 3 times as many patients with STEMI as patients with NSTEMI. Patients who developed shock were older and carried a greater burden of comorbidities irrespective of MI subtype. Within MI subtypes, NSTEMI patients with shock were significantly older and also carried a greater burden of morbidities. For patients with STEMI, shock was more likely to be present on admission, whereas patients with NSTEMI were more likely to develop shock during hospitalization. Baseline characteristics were similar for patients with both STEMI and NSTEMI with shock on admission and those who developed shock during hospitalization.

In our study, significant differences in the use of cardiac catheterization and revascularization were present in shock by MI classification. Although almost all STEMI patients with shock underwent early cardiac catheterization and revascularization, only about half of NSTEMI patients with shock underwent these procedures. Even if data from previous studies have shown little to no benefit of early revascularization for low- and moderate-risk groups, these data have demonstrated significant improvement with early revascularization for high-risk patients with NSTEMI.\(^{20,21}\) Despite these findings, subsequent publications have confirmed that the highest-risk patients with NSTEMI tend to be the least likely group to undergo an early revascularization strategy.\(^{22-25}\) In our study, when compared with STEMI patients with shock, NSTEMI patients with shock represented the most extreme risk and were significantly less likely to undergo coronary angiography and subsequent revascularization.

Although clear guidelines for early revascularization exist for STEMI patients with shock, recommendations are more ambiguous and at provider discretion for patients with NSTEMI.\(^{26-28}\) The lower use of medical and revascularization treatments among NSTEMI patients with shock in our study is likely related to the perceived higher risk–benefit ratio in the setting of a greater burden of comorbidities (online-only Data Supplement B), increasing age, and presence of multi-vessel disease. Nevertheless, even in the setting of these characteristics, data support early revascularization for high-risk patients with NSTEMI. Specifically for the elderly patients, AHA/ACC guidelines provide precise recommendations (class IIa) for early revascularization in STEMI patients with shock.\(^{7,27,29,30}\) The greatest use of CABG in our patients with shock was in the NSTEMI cohort, which likely corresponds to the high prevalence of 3-vessel disease. Despite a higher use of CABG, the timing of surgery for patients with NSTEMI
presenting with shock was significantly delayed and outside of the ACC guidelines for early revascularization (ACC guidelines for STEMI recommend early revascularization 18 hours from the onset of shock).

In contrast, our study found that the vast majority of STEMI patients with shock received coronary angiography and revascularization, thereby following the ACC/AHA guidelines. Among patients with STEMI, those with shock had slightly higher rates of revascularization (>95%) compared with those without shock. Median time to revascularization for patients with shock on admission was only slightly shorter than that of patients presenting without shock (1.2 versus 1.3 hours), but both were within the guideline recommendation for emergent revascularization for both STEMI and shock.27

In our analysis, compared with patients with STEMI, the presence of shock disproportionately increased the chance of death for patients with NSTEMI. Previous historical data on outcomes of shock by acute coronary syndrome subtype have produced conflicting results.1,2,31 Data from the Should We Emergently Revascularize Occluded Coronaries for Cardiogenic Shock (SHOCK) Registry on 152 NSTEMI patients with shock revealed no difference in unadjusted or adjusted inhospital mortality rates for patients with NSTEMI compared with patients with STEMI.2 The Global Utilization of Streptokinase and TPA for Occluded Arteries (GUSTO)-I trial with 200 NSTEMI patients with shock revealed a nonsignificant trend toward higher rates of mortality in the NSTEMI group (72.5% versus 63.0%; P=0.05) compared with the STEMI group, but it did find a higher adjusted 30-day mortality in the NSTEMI group (P=0.048).1 Data from the Acute Myocardial Infarction in Switzerland (AMIS) Registry, which included >500 NSTEMI patients with shock, did reveal higher unadjusted mortality rates in patients with NSTEMI (58.0% versus 52.5%; P=0.041) compared with patients with STEMI.31 In our study, compared with STEMI patients with shock, the reasons for increased mortality among patients NSTEMI patients with shock may be related to several factors, including overall origin of shock, lower use of revascularization, and increased use of CABG. In STEMI, shock is more likely to be caused by epicardial infarct-related arterial occlusion with a resultant large zone of acutely damaged MI leading to left ventricular pump failure. With patients with NSTEMI, the cause of shock is delayed (as evident in the timing of shock for this population) and likely multifactorial with a larger burden of comorbidities (including older age, previous MI and revascularization procedures, and a high prevalence of previous CHF), less available myocardial reserve to handle acute infarction in the setting of worse ejection fractions and greater burden of previous coronary disease, and greater difficulty reversing shock once it occurs. These factors are likely compounded by the lower use of recommended medical or invasive therapies for revascularization in patients with NSTEMI. Finally, compared with STEMI patients with shock, NSTEMI patients with shock more frequently received CABG. The associated increased perioperative mortality risk of CABG may be a significant contributor to the increased risk of death in patients with NSTEMI.

Our study had several limitations. First, our study is observational in nature; therefore, it is possible that unmeasured confounders may have played a role in the observed outcomes. Second, hemodynamic data (which may have more accurately categorized shock) were not recorded for most patients in the ACTION Registry–GWTG; rather, shock was based primarily on a clinical definition. Therefore, the true prevalence of shock may have been over- or underestimated. Third, our database could not determine whether shock was because of predominant left ventricular pump failure versus mechanical complications, such as ventricular septal defect and papillary muscle or free wall rupture. Although a mechanical cause for cardiogenic shock would warrant immediate surgical intervention with revascularization, mortality rates are significantly higher for mechanical causes versus left ventricular pump failure. Nevertheless, we do not have any data suggesting that mechanical complications could have a disproportionate impact on NSTEMI patients with shock compared with STEMI group. Fourth, our database could not distinguish shock from other causes that may have been coded as such, such as distributive or septic shock. Fifth, data on intra-aortic balloon pump or other mechanical support devices were not collected in the ACTION Registry–GWTG, which may have confounded the relationship with observed outcomes. Finally, detailed angiographic characteristics, including infarct-related artery, were not collected in this registry. As a result, we were not able to comment on a patient’s suitability for revascularization.

In summary, although >95% of STEMI patients with shock undergo revascularization in the contemporary era, only slightly >50% of NSTEMI patients with shock undergo revascularization. Compared with STEMI, greater delays in time to revascularization and significantly greater adjusted mortality risk were observed in NSTEMI patients with shock. Given the continuously high mortality rates, we need new treatment strategies and support mechanisms specific to shock, as well as more attention and research geared toward exploring the acute and long-term impact of early cardiac catheterization and revascularization on outcomes NSTEMI patients with shock.

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References


Differences in the Profile, Treatment, and Prognosis of Patients With Cardiogenic Shock by Myocardial Infarction Classification: A Report From NCDR
Monique L. Anderson, Eric D. Peterson, S. Andrew Peng, Tracy Y. Wang, E. Magnus Ohman, Deepak L. Bhatt, Jorge F. Saucedo and Matthew T. Roe

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