For patients with ST-segment–elevation myocardial infarction (STEMI), primary percutaneous coronary intervention (PCI) is superior to fibrinolytic therapy if primary PCI is performed (1) in a timely manner with a door-to-balloon time <90 minutes; (2) by experienced operators and PCI hospitals; (3) and for patients who have high clinical risk, high bleeding risk, or delays in presentation from symptom onset. Current guidelines and the Centers for Medicare and Medicaid Services public reporting have focused on the timeliness of primary PCI, particularly door-to-balloon time as a process measure of quality. Given the better outcomes achievable with primary PCI, there is growing interest in regionalizing STEMI care to improve access to primary PCI. However, ≈25% of US hospitals have PCI capability, and observational registries demonstrate that <10% of patients who are transferred for primary PCI achieve a first door-to-balloon time <90 minutes. The American Heart Association “Mission: Lifeline” initiative is seeking to improve timely access to primary PCI for patients who present to non-PCI hospitals by engaging patients and communities, emergency medical services, hospital systems, emergency department physicians, cardiologists, health agencies, policy makers, and payers.

Although timeliness of and access to primary PCI are quality dimensions that have been the focus of measurement and quality improvement, much less is known about its “availability” at PCI-capable hospitals. Whereas “capability” refers to having the capital and human resources to perform PCI, availability refers to when those resources are on hand: some, most, or all of the time. Because more than one third of PCI-capable hospitals in the United States reported using fibrinolytic therapy, it is important to understand what factors contribute to choice of reperfusion therapy and how to improve the availability of PCI around the clock. In the present issue of Circulation, Fazel and colleagues report on the choice of reperfusion therapy for 39,911 patients with STEMI at 444 PCI hospitals from the National Registry of Myocardial Infarction. In this cohort, 64% of patients received primary PCI and 36% received fibrinolytic therapy during the study period from 2000 to 2006. After multivariable adjustment, patient factors associated with greater use of primary PCI included cardiogenic shock, delay in presentation >4 hours from symptom onset, anterior myocardial infarction, new left bundle-branch block, and prior PCI. High-risk STEMI patients, defined by having a Thrombolysis in Myocardial Infarction score ≥5, were not more likely to receive primary PCI. Hospital characteristics associated with greater use of primary PCI included being an urban teaching hospital and being located in the Northeast or Midwest census region. However, patient factors associated with lower use of primary PCI included older age, prior coronary artery bypass graft surgery, congestive heart failure, and right ventricular involvement in myocardial infarction. Notably, the factors with the greatest magnitude of effect on use of primary PCI were off-hours presentation (weekdays from 6 PM to 6 AM and weekends) and secular trend from 2000 to 2006. Patients presenting during “off” hours had a significantly lower likelihood of receiving primary PCI (odds ratio, 0.27; 95% confidence interval, 0.25 to 0.29; \( P<0.0001 \)). Secular trends demonstrated that use of primary PCI increased from 54% in the year 2000 to 86% in the year 2006, with a narrowing gap in use of primary PCI during regular hours and off hours.

The study by Fazel and colleagues exposes the gap between what guidelines recommend as the ideal reperfusion therapy for STEMI patients who present to PCI hospitals versus the routine, usual care that is provided every day and night. First, primary PCI provides the greatest benefit in outcomes for patients at the highest clinical risk or bleeding risk. Although patients with cardiogenic shock, anterior myocardial infarction, and delay in presentation >4 hours from symptom onset were more likely to be treated with primary PCI, patients with congestive heart failure and older age (≥85 years) were more likely to be treated with fibrinolytic therapy, even when those patients presented to a PCI-capable hospital. High-risk patients with Thrombolysis in Myocardial Infarction score ≥5 were not associated with greater or lower use of primary PCI. Furthermore, patients who were elderly, female, and of nonwhite race, all factors associated with increased bleeding risk after fibrinolytic therapy, were not associated with greater use of primary PCI. This suggests that a risk–treatment paradox exists with STEMI reperfusion therapy at some PCI-capable hospitals, in which those patients most likely to benefit from primary PCI did not receive it.
Second, what were the factors driving the choice of reperfusion therapy at PCI-capable hospitals? A striking finding was the lower likelihood of primary PCI being used when patients presented during off hours. This finding suggests that immediate availability of PCI resources was particularly limited during off hours, leading healthcare clinicians and systems to make implicit rationing decisions about reperfusion therapy based on time of day or week, rather than on assessment of individual, patient-centered risk and benefit. This limitation in resources during off hours highlights an important opportunity to improve patient outcomes at PCI-capable hospitals and regional STEMI-receiving centers. Furthermore, Fazel and colleagues found no interaction between clinical risk and off-hours presentation, which suggests that primary PCI was not being used selectively for high-risk patients who presented during off hours. In other words, primary PCI was largely unavailable during off hours at some PCI hospitals, regardless of the clinical or bleeding risk of STEMI patients who presented to the hospital. Although fibrinolytic therapy is appropriate when resources for primary PCI are not immediately available, the quality of reperfusion with fibrinolytic therapy (door-to-needle time) in those situations would have been informative but was not reported in this study.

The study by Fazel and colleagues has important implications for future research into the manner in which the healthcare system can improve the quality of reperfusion therapy in the dimensions of timeliness, access, and availability. First, 2 intriguing subgroups were excluded from the analysis by Fazel et al. A total of 26,670 patients (24.5%) were excluded because they did not receive any reperfusion therapy, and 39,010 patients (24.9%) were excluded because they were transferred from another hospital. Patients who do not receive any reperfusion are opaque to current measurement and public reporting of timeliness of reperfusion therapy (door-to-balloon or door-to-needle times). Additional studies are needed to understand why, in 4 patients does not receive any reperfusion therapy, as well as to develop potential interventions to close this gap and provide better short- and long-term management strategies. It would also be important to understand the choice of reperfusion therapy for patients who are transferred to a PCI-capable hospital as well as the impact of variables such as time of presentation, clinical risk, and bleeding risk on use of primary PCI. A particularly concerning scenario would occur if any transferred patients were treated with fibrinolytic therapy or no reperfusion at a STEMI-receiving center. These data would be important to the further development of regional systems of STEMI care and to the differentiation of a PCI-capable hospital from a STEMI-receiving center where PCI is available around the clock.

Second, the study provides some insights into the context and settings (hospital settings and volumes) where primary PCI is being performed in the United States. Fazel and colleagues performed a sensitivity analysis restricted to PCI hospitals that performed at least 10 off-hours primary PCIs per year during the study period. This criterion excluded 209 hospitals (47%) and suggests that in up to 47% of hospitals, primary PCI was rarely performed or available during off hours. The annual volumes of primary PCI at these hospitals would have been informative because a prior study has found that hospitals that perform >50 primary PCIs per year have lower risk-adjusted mortality rates.

An ideal, patient-centered system of care for patients with STEMI would achieve timely primary PCI, with door-to-balloon times <90 minutes, access for a regional population and network of non-PCI hospitals, and immediate availability of an experienced PCI team and resources around the clock. American Heart Association Mission: Lifeline has promoted the development of regional networks for STEMI-referral and STEMI-receiving hospitals to provide timely access to primary PCI for the majority of the US population. In fact, an analysis of US census data and hospitals in calendar year 2000 showed that 90% of the population lived within 60 minutes of a PCI-capable hospital. This number has likely increased in the past decade as the number of PCI-capable hospitals has increased. Nevertheless, the study of Fazel and colleagues illustrates that although timeliness, access, and capability of providing primary PCI are mandatory requirements for a STEMI-receiving center, availability around the clock cannot be overlooked in the effort to achieve optimal patient outcomes. American Heart Association Mission: Lifeline has endorsed the principle that a STEMI-receiving hospital should provide primary PCI around the clock and should never be on diversion. An unfortunate and unintended consequence of regionalized STEMI care would be for a STEMI patient to be transferred to a PCI-capable hospital and receive delayed fibrinolytic therapy or no reperfusion at all.

Disclosures

None.

References

7. Thune JJ, Hoefsten DE, Lindholm MG, Mortensen LS, Andersen HR, Nielsen TT, Kober L, Kelbaek H, for the Danish Multicenter Randomized Study on Fibrinolytic Therapy Versus Acute Coronary Angioplasty in Acute Myocardial Infarction I. Simple risk stratification at admission to...


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Quality Dimensions of Primary Percutaneous Coronary Intervention: Timeliness, Access, and Availability

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