

Effectiveness and Cost-Effectiveness of Facilitated Percutaneous Coronary Intervention Compared with Primary Percutaneous Coronary Intervention in Patients with ST-Segment Elevation Myocardial Infarction Transferred from Community Hospitals

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ABSTRACT

Background: Primary percutaneous coronary intervention ([PCI], percutaneous transluminal coronary angioplasty + stenting) for ST-segment elevation myocardial infarction (STEMI) is regarded as superior to fibrinolysis even if it means that patients need to be transferred from one center to another to undergo the procedure. However, this inevitable delay between symptom onset and PCI, caused by the time required to travel, might increase the occurrence of cardiac events. A hybrid method called *facilitated PCI* uses fibrinolysis and/or glycoprotein (GP) IIb/IIIa inhibitors before transfer to a tertiary medical center where urgent PCI might be performed. This approach, however, has not been systematically evaluated.

Objective: The purpose of this study was to compare the effectiveness (combined end point of in-hospital mortality, reinfarction, stroke, or emergency revascularization) and cost-effectiveness of utilizing a bolus thrombolytic agent with GP IIb/IIIa inhibitor followed by transfer to a tertiary institution for facilitated PCI or standard of care transfer without primary PCI drugs among patients presenting to a community hospital with STEMI.

Methods: This was a prospective, single-center, cohort study comprising data from STEMI patients transferred from community hospitals to Hartford Hospital, Hartford, Connecticut, from the years 2000 to 2003. At the time of analysis, patients receiving primary PCI were matched (1:1) with those receiving facilitated PCI, utilizing propensity scores to assure similar demographics. The combined incidence of major adverse cardiac end points (MACE) and total hospital costs was compared between groups. Non-parametric bootstrapping was conducted to calculate

CIs for the incremental cost-effectiveness ratio and generate a quadrant analysis.

Results: Based on 254 propensity score-matched patients (127 facilitated PCI and 127 primary PCI), in-hospital MACE and total hospital costs were reduced by 61.3% and US \$4563 (2005), respectively, in patients receiving facilitated compared with primary PCI ($P = 0.021$ and $P = \text{NS}$, respectively). Patients receiving facilitated PCI were more likely to have target lesion Thrombolysis in Myocardial Infarction (TIMI) III (normal) blood flow on cardiac catheterization than those receiving primary PCI (49.6% vs 30.7%; $P = 0.002$). However, the rate of TIMI bleeding was similar in both groups (21.3% in the facilitated PCI group vs 18.9% in the primary PCI group). Nonsignificant reductions were observed in both intensive care unit (ICU) and total length of stay (LOS) (0.8 day and 1.0 day, respectively) compared with the primary PCI group. Bootstrap analysis revealed that of 25,000 samplings, facilitated PCI would likely be both more effective and less costly 94.6% of the time.

Conclusions: The use of facilitated PCI in STEMI patients who initially presented to community hospitals and were transferred for PCI appeared to significantly reduce the incidence of MACE, and increase the likelihood of having baseline TIMI III blood flow at time of catheterization. Nonsignificant reductions were observed in total ICU and hospital LOS. However, there did not appear to be a significant effect on

Accepted for publication May 17, 2006.

doi:10.1016/j.clinthera.2006.07.007

0149-2918/06/\$19.00

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the incidence of bleeding in patients receiving facilitated PCI. Bootstrap analysis confirmed that facilitated PCI would be both a more effective and less costly strategy. (*Clin Ther.* 2006;28:1054–1062) Copyright © 2006 Excerpta Medica, Inc.

Key words: facilitated percutaneous coronary intervention, thrombolytics, acute myocardial infarction, angioplasty.

INTRODUCTION

Nearly 1 million acute myocardial infarctions (AMIs) occur annually in the United States.¹ In clinical trials, use of either a bolus thrombolytic agent, with or without a glycoprotein (GP) IIb/IIIa inhibitor, or primary percutaneous coronary intervention (PCI), percutaneous transluminal coronary angioplasty [PTCA] + stenting) reduces mortality and improves outcomes. However, in a meta-analysis of 10 trials (N = 2606), primary PCI was associated with lower 30-day mortality (4.4% [57/1290] vs 6.5% [86/1316]; $P = 0.02$), in-hospital death or recurrent myocardial infarction (MI) (7.2% [93/1290] vs 11.9% [157/1316]; $P < 0.001$), and intracranial hemorrhage (0.1% [1/1290] vs 1.1% [14/1316]; $P < 0.001$) versus thrombolytics.² Clinical benefits might be associated with a better attainment of normal blood flow, based on the Thrombolysis in Myocardial Infarction (TIMI) risk classification (0 or I, no flow; II, slow flow; III, normal flow).^{3,4} A patent infarct-related artery is the most powerful predictor of survival after AMI, and normal (TIMI III) blood flow at 90 minutes correlates with both reduced short-term and long-term mortality.^{3,4}

The Danish Multicenter Randomized Trial on Thrombolytic Therapy vs Acute Coronary Angioplasty in Acute Myocardial Infarction (DANAMI)-2 trial⁵ suggested that primary PCI was superior to fibrinolytic treatment even when patients needed to be transferred to a different hospital to undergo intervention. Patients undergoing transfer from the referral centers for primary PCI showed a significant reduction in the 30-day composite end point of death, reinfarction, and stroke (8.5% [48/567] vs 14.2% [80/562]; $P = 0.002$) compared with those receiving thrombolytics.⁵ Unfortunately, the incidence of death, MI, and stroke in patients treated with primary PCI increased as the time from the onset of symptoms requiring primary PCI increased. If >90 minutes elapsed between hospital entry and primary PCI, the administration

of thrombolytics produced significantly better results ($P < 0.001$).

The Seventh American College of Chest Physicians' Antithrombotic and Thrombolytic Therapy guidelines⁶ recommend that PCI with stenting plus a GP IIb/IIIa inhibitor is optimal treatment for patients with AMI, but only if PCI can be accomplished within a 90-minute window. Currently, in the United States, the median time from arrival at the first hospital until primary PCI at the second hospital is 183 minutes, with a range from <60 minutes to >7 hours (120 minutes from door to door and 53 additional minutes before PCI). Only 4.2% (180/4278) of people were transferred and administered primary PCI within 90 minutes.⁷

A hybrid method called *facilitated PCI* might offer the advantages of early reperfusion while optimizing cardiac catheterization results.^{1,8,9} In this approach, patients with an ST-segment elevation myocardial infarction (STEMI) who are slated for transfer from a community hospital to a tertiary medical center for PCI are administered fibrinolytics and/or GP IIb/IIIa inhibitors in the local community hospital or during the transfer at initial presentation. Although this might enhance effectiveness, bleeding might also be increased with facilitated PCI.^{10–12} de Lemos et al⁹ presented data on 105 (12%) patients in the TIMI-14 trial who underwent PCI, which included rescue PTCA + stenting, after fibrinolysis. In patients who received this form of PCI, a greater rate of ST-segment resolution was observed in those who had received combination treatment with alteplase + abciximab compared with those who had received fibrinolytics alone (55% [16/29] vs 8% [5/63]; $P = 0.002$). These data are preliminary and intriguing but were not derived using hard end points.

Based on an Ovid MEDLINE search (key terms: *facilitated, percutaneous coronary intervention, PCI, thrombolytics, thrombolysis*; years: 1966–present), at the time of this study, there was no published comparison of facilitated PCI and primary PCI in community hospital STEMI patients presenting within 12 hours of symptom onset who were transferred for urgent PCI.

The primary objective of the present study was to compare the effectiveness (combined incidence of major adverse cardiac end points [MACE] of in-hospital mortality, reinfarction, stroke, or emergency revascularization) and cost-effectiveness of utilizing a thrombolytic with GP IIb/IIIa inhibitor followed by transfer

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