The Journal of Emergency Medicine, Vol. 31, No. 3, pp. 241–245, 2006

0736-4679/06 $–see front matter

ELSEVIER

doi:10.1016/j.jemermed.2005.12.019

Original Contributions

PREDICTORS OF IN-HOSPITAL DELAY TO REPERFUSION IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION IN JAPAN

Yoshimi Fukuoka, RN, PhD,* Kathleen Dracup, RN, DNSc,* Miyoshi Ohno, MD, PhD,† Fumio Kobayashi, MD, PhD,‡ and Haruo Hirayama, MD, PhD§

*School of Nursing, University of California San Francisco, San Francisco, California, †Department of Cardiology, Japanese Red Cross Nagoya First Hospital, Nagoya, Japan, ‡Department of Health and Psychosocial Medicine, Aichi Medical University, Nagakute, Aichi, Japan, and §Department of Cardiology, Nagoya Daini Red Cross Hospital, Nagoya, Japan

Reprint Address: Yoshimi Fukuoka, RN, PhD, School of Nursing, University of California, San Francisco, 2 Koret Way, Box 0610, San Francisco, CA 94143-0604

□ **Abstract—The purpose of this study was to identify factors associated with in-hospital delay in patients with acute myocardial infarction (AMI) in Japan. In this observational study, 155 consecutive patients admitted with AMI to one of five urban hospitals were studied. The median door-to-needle time and door-to-catheterization-laboratory time was 19 min and 60 min, respectively. Three variables predicted door-to-catheterization-laboratory times ≥ 60 min: failing to call an ambulance, direct admission to the hospital, and absence of diaphoresis ($p < 0.05$). These findings support the need for public education emphasizing the importance of calling an ambulance for AMI symptoms. Moreover, Japanese physicians should be aware that admitting patients directly to the hospital and bypassing the Emergency Department might increase delay to treatment.**

□ **Keywords—acute myocardial infarction; in-hospital delay; emergency medical services; door-to-needle time; public education; Japan, ambulance; chest pain; diaphoresis**

INTRODUCTION

Reducing the time interval (total delay) from symptom onset to reperfusion therapy is critical to reducing mortality and morbidity from acute myocardial infarction (AMI) (1,2). The total delay to treatment time consists of two components: 1) prehospital delay time from onset of symptoms to hospital arrival, and 2) in-hospital delay time from hospital arrival to reperfusion therapy (3). To reduce total delay time, patients must not only promptly seek medical treatment, but also be diagnosed and treated expeditiously after admission to the hospital.

In-hospital delay time and its predictors have been extensively studied in the United States (U.S.) and Europe. Factors associated with prolonged in-hospital delay times include the mode of transportation (not accessing an Emergency Department [ED] by ambulance), transferring from another hospital for primary angioplasty, the date and time of access (longer on weekends and at night), atypical AMI presentation, prehospital delay > 2 h, anterior infarction, and high cardiac enzyme level (4–8). To date, little information exists regarding predictors of in-hospital delay in Asia, with nothing known about in-hospital delay in Japan.

In Japan, unlike the U.S., primary angioplasty for AMI patients has become the standard reperfusion therapy over thrombolysis since the 1990s (9). Only 15% of hospitals performed percutaneous coronary intervention (PCI) in 2002 (10). The majority of clinics and smaller-sized hospitals do not commonly carry thrombolytic drugs, such as tissue-type plasminogen activator (t-PA). Therefore, when Japanese patients are diagnosed with an

Original Contributions is coordinated by *John Marx*, MD, of Carolinas Medical Center, Charlotte, North Carolina

RECEIVED: 3 December 2004; FINAL SUBMISSION RECEIVED: 12 July 2005;
ACCEPTED: 2 December 2005

AMI at a clinic or at a small private hospital with no cardiac catheterization laboratory, they are usually transferred to a hospital with catheterization facilities. More than half of patients with an AMI in Japan are transferred for a primary PCI from a clinic or hospital without catheterization facilities to a hospital that has such facilities (11). Given the significant differences in the health care system between Japan and the U.S., different factors could be associated with in-hospital delay time. Therefore, we conducted a study to examine in-hospital delay time and predictors associated with delay to reperfusion in a group of Japanese patients with AMI.

METHODS

A detailed description of the study methods has been published elsewhere (11,12). In brief, we consecutively recruited patients from January to August 2002 at one of five urban hospitals in Japan. All hospitals were able to provide cardiac catheterization 24 h/day and coronary artery bypass surgery. To be recruited for the study, patients needed to be: 1) mentally alert, 2) able to speak Japanese, 3) hemodynamically stable, 4) living independently (e.g., not hospitalized or in a nursing home), 5) with no history of advanced malignancy or other debilitating illness, and 6) diagnosed with AMI. Investigators obtained approval from the Institutional Review Board at all clinical sites and the University of California, San Francisco before contact was made with any patients.

In-hospital delay time was categorized into "door-to-needle time" or "door-to-catheterization-laboratory time." Door-to-needle time was defined as the period from hospital arrival to the initiation of thrombolytic therapy. Door-to-catheterization-laboratory time was defined as the period from hospital arrival to the time the patient entered the cardiac catheterization laboratory. These time points were obtained from the medical record. Patients were interviewed during their hospitalization about the time of symptom onset and the symptoms they experienced, using a structured questionnaire. Prehospital delay time was defined as from symptom onset time to arrival at a hospital and categorized into two groups, > 2 h or ≤ 2 h. Severity of chest pain was evaluated on a scale of 0 to 10, with 0 being no pain and 10 being the most pain imaginable.

Statistical Analysis

Mean, median and percentiles were used to describe in-hospital delay time (door-to-needle time or door-to-catheterization-laboratory time). Using median door-to-catheterization-laboratory time, patients were categorized into either early or late treatment groups. The chi-square test was used to examine categorical data, and the independent *t*-test was used to examine continuous data in relation to the early treatment vs. late treatment groups. A stepwise logistic regression analysis was performed to identify predictors of late treatment group membership. Variables showing marginal association with $p < 0.25$ in univariate analyses were forwarded to the regression analysis. The Hosmer-Lemeshow statistic was used to evaluate goodness-of-fit of the model (ability to assign the correct probabilities of late treatment to individual patients). The level of significance was set at $p < .05$. SPSS version 11.0 for Windows (SPSS Inc., Chicago, IL) was used for data analysis.

RESULTS

In-Hospital Delay Time

Of these 155 patients, 23.9% (n = 37) received a single intravenous bolus of t-PA in the ED and then all patients except one were brought to a catheterization laboratory for PCI. Median and mean door-to-needle time was 19 min (interquartile range 12 to 32) and 26 ± (SD 21) min, respectively. For those patients who were brought to a catheterization laboratory from the ED, the median and mean door-to-catheterization-laboratory time was 60 min (interquartile range 45 to 94) and 80 ± (SD 62) min, respectively.

Predictors of Delay in Door-to-Catheterization-Laboratory Time

Table 1 displays the results of the univariate analysis. With the criteria of $p < 0.25$, transfer from another clinic/hospital, ambulance use, admission date and time, diaphoresis, and peak creatinine kinase were forwarded for the stepwise multivariate logistic regression. Of these selected variables, direct admission to the hospital, no ambulance use, and absence of diaphoresis were associated with delayed treatment (Table 2). Patients who experienced their symptoms on the weekend were more likely to experience delay, but the difference was only marginally significant ($p = 0.052$). The Hosmer-Lemeshow statistic was not significant (chi-square = 3.48, degrees of freedom 7, $p = 0.84$), thus supporting the good fit of the model.

DISCUSSION

In our study, the median door-to-needle time was 19 min. This finding is similar to those reported in previous