Door to Balloon Time in Patients With ST-Segment Elevation Myocardial Infarction

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1. Introduction

An important parameter in order to study mortality for patients with ST-segment elevation myocardial infarction (STEMI) is the time between admittance in hospital and balloon angioplasty, the so called Door to Balloon time. Usefulness of telemedicine has been already widely demonstrated in practice for the acute coronary syndromes, due to the possibility to make an early diagnosis and therefore to reduce the intervention time. The purpose of this work is to verify the usefulness of pre-hospital electrocardiogram (ECG) transmission of patients with STEMI, and to detect the most significant prognostic factors on the basis of data collected in the complex urban area of Milan.

2. In-hospital mortality and door to balloon time

We analyse the data collected in a capillary observational study during four months period surveys in the urban area of Milan in 2006–2007. Information concerning demographic features (sex, age), clinical appearance (presenting symptoms, Killip class at admittance), way of admittance in hospital (spontaneous, with BLS (Basic Life Support), with ALS (Advanced Life Support) with or without ECG teletransmission), symptom onset times, in–hospital times (first ECG times, DB (Door to Balloon) times), hospital organization (alert, Fast Track) and clinical outcomes (in-hospital mortality, ST-elevation reduction) have been listed and studied for patients treated with primary angioplasty. A multivariate analysis, by means of a logistic regression model selected by a forward/backward stepwise algorithms based on Akaike’s AIC (cfr. Venables and Ripley 2002), confirms that the Killip class and the symptom onset–to–balloon time are jointly significant prognostic factors of in-hospital mortality, whereas symptom onset to door and door to balloon times are jointly significant prognostic factors of successful ST–elevation reduction; this is in accordance with similar studies conducted by Cannon et al. 2000.

These results suggest to study the dependence between the DB time and potential covariates we can act on in order to improve the time gain in the riperfusion therapy (cfr. Grieco et al. 2008). Nonparametric Kruskal Wallis analysis supports the hypothesis
that the distributions of the DB time depend on the way of hospital admittance. Wilcoxon sum rank tests support the evidence of stochastic order between DB time distributions stratified with respect to emergency department alert, time of the first transmitted ECG, Fast Track admittance, and time of hospital admittance (on vs off hours).

A random forest analysis (Breiman 2001) applied to CART predictors has been performed in order to assess the discriminatory power of covariates. In fact a CART analysis using Gini’s impurity index splits groups satisfying or not the limit of 90 min for DB time set by the AHA/ACC guidelines, in terms of way and hospital of admittance. The dependence on hospital of admittance is probably due to a strong difference of proportion of self-presented patients in the different hospitals, masking mixtures of different DB time distributions. A logistic regression model provides also quantitative estimations of probability of in-hospital mortality and of reduction of ST elevation in terms of pre-hospital, hospital times and Killip class of admittance (see Figure 1), together with exact confidence intervals on the odds ratios for different risk categories (Gart 1962).

**Figure 1:** Left: Confidence band of estimated probability of in-hospital survival. Right: Level curves of probability of successful ST elevation reduction

![Figure 1](image)

**References**


