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Original research article

Analysis of time intervals related to STEMI management in 2008–2016

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ABSTRACT

Introduction: A modern treatment of patients with ST segment elevation myocardial infarction (STEMI) is based on a rapid primary percutaneous coronary intervention with direct recanalization of the affected coronary artery (dPCI). The outcome of the treatment depends largely on the pre-hospital care management, which can reduce the total ischaemic time and subsequently improve patient's outlook.

Aims: The principal aims of this retrospective study were to assess the development of time intervals related to the pre-hospital care and the effect of the mode of transportation to the cathlab (primary vs secondary) on these intervals in patients with acute STEMI treated by primary PCI in 2008, 2010, 2012, 2014 and 2016.

Methods: We have analysed patients with STEMI treated using PCI within 12 h of symptoms onset. In total, 1250 patients were included. To evaluate the development over the last 8 years, uni- and multivariate analyses were used. Categorical variables were analysed using chi-squared tests while continuous variables were analysed using one-way ANOVA and general linear models. The effect of the year and of mode of transportation on time intervals were studied.

Results: The time intervals did not significantly differ among years with the exception of 2014 where the reason of the deviation was however not related to the quality of the pre-hospital care. The 120 min limit from the first medical contact to unblocking the affected artery (FMCTB) was met in more than 80% patients (80.8), the recommended limit of 90 min in 55.2% of patients. The key factor affecting the total ischaemic time was however the patients' choice of the mode of transportation – in patients who opted for the primary route of transportation, i.e., called the ambulance, the intervals were significantly shorter (FMCTB on average by 38.2 min and total ischaemic time by 92.9 min). The principal delays were detected in the patients' delay (103 min inpatients with primary transportation route, 131 in patients with secondary route) as well as, unfortunately, in the intervals between reporting the patients' problem to the system and ECG-confirmed diagnosis (26 min if the patient calls ambulance vs 52 min if they present at a general practitioner or outpatient clinic) and subsequent transportation to the cathlab (60 min for primary route, 97 for secondary). The latter two should be in particular targeted and we can see a significant room for improvement here.

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Conclusion: The time intervals do not vary among individual years (with some exceptions). The route of transportation, which is a patient's choice, on the total ischaemic time is however a crucial and predominant factor affecting the total ischaemic time as well as individual intervals.

Introduction

Modern treatment of patients with ST segment elevation myocardial infarction (STEMI) is based on the soonest possible unblocking the infarction artery by direct angioplasty. The period between the first clinical signs and treatment at the cathlab is the critical time interval posing the greatest risk to the patient. Hence, it is of utmost importance to pay attention to the pre-hospital care for STEMI patients and the above mentioned time intervals are considered a crucial parameter of quality of the healthcare system in the field of cardiac care. This study presents an analysis of the development of time intervals in STEMI patients over the last 8 years.

The transportation route is the key to a timely treatment of the patient. The primary transportation route is a situation where the patient with clinical signs calls an ambulance by phone, the ambulance arrives at the patient and performs ECG. The ECG record is subsequently transmitted to a coronary unit and interpreted by the doctor on duty (along with problems reported by the patient over the phone and clinical picture of the patient) and if STEMI is diagnosed, the patient is directly transferred by the ambulance to a cathlab for direct angioplasty. This type of transport is the best option for the patient as it involves a minimum number of subjects and the patient arrives to the cathlab usually very quickly. All other routes of transportation of the patient to the theatre are considered secondary and less favourable. Most often, the patient personally presents either to an outpatient clinic at a department of internal medicine or to a general practitioner nearest to patient's home. If this is the case, ECG is performed and assessed by the doctor on duty at the outpatient clinic, GP or only the crew of ambulance called in by the doctor. Establishing correct diagnosis and organizing patient's transportation to the cathlab is then more complicated and the period from onset of the clinical signs till treatment is naturally longer.

From the moment when the patient reports his difficulties to the system (whether by calling ambulance or personally attending a doctor), the further management of the case is taken over by the healthcare system. This system delay can be further analysed using the time from reporting to ECG, ECG to cathlab and cathlab to balloon (or to thromboaspiration catheter) times.

The principal ''system delay'' factor is the time taken from performing diagnostic ECG to the first balloon inflation (or insertion of the thromboaspiration catheter). ESC guidelines on myocardial revascularization (2014) [1] as well as ESC recommendation for STEMI treatment (2012) [2] denote that interval as First-medical-contact-to-balloon time (FMCTB) and set an acceptable time limit for performing dPCI of 120 min with a preferred time of 90 min.

To assess trends in the STEMI treatment, we analysed various time intervals related to STEMI treatment over the last 8 years with the intention to find out if the process has improved over time. As a supplementary analysis, we investigated the effect of patients' primary or secondary route to cathlab on these times.

Material and methods

Analyses were performed in a group of patients treated with STEMI diagnosis at cathlab of the 1st Department of Internal Medicine – Cardioangiology Clinic of St. Anne's University Hospital, Brno, Czech Republic, in 2008, 2010, 2012, 2014 and 2016. The dataset included patients with ECG-confirmed STEMI or new bundle branch block who were treated using direct percutaneous coronary intervention (dPCI) in less than 12 h from the first manifestation of clinical signs. Patients needing cardio-pulmonary resuscitation (CPR) or mechanical ventilation (MV) and patients who died during the procedure or during hospitalization were excluded from the study.

Detailed information about the time intervals in individual patients were acquired from the Time interval reports, which are a mandatory part of documentation of all patients undergoing dPCI at our department. Besides the time data, basic characteristics of the patient dataset were also investigated, such as sex, age, and transportation route (primary vs secondary). For continuous data, arithmetic mean and standard deviations were calculated while frequencies and percentages were calculated for categorized variables. Data were analysed with respect to a given probability distribution. For continuous variables, the population means in individual years were tested using single factor ANOVA while for categorized variables, data were analysed using chi-square test. A multivariate linear model was also used where particular time intervals represented the dependent variables. F statistics with appropriate degrees of freedom was used to test hypotheses of individual regression coefficients. Statistical software SAS 9.4. (SAS Institute, NC, USA) was used for analyses.

Results

Study group

As shown in Table 1, 1250 patients in total were included in the study, of which 234 (18.7%) patients were treated in 2008, 276 (22.1%) in 2010, 272 (21.8%) in 2012, 232 (18.6%) in 2014 and 236 (18.9%) patients in 2016. 364 (29.1%) patients were female and 886 (70.9%) male. As far as transportation is concerned, 756

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