Comparative Analysis between Transferred and Self-Referred STEMI Patients Undergoing Primary Angioplasty

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Abstract

Background: Studies have shown the benefits of rapid reperfusion therapy in acute myocardial infarction. However, there are still delays during transport of patients to primary angioplasty.

Objective: To evaluate whether there is a difference in total ischemic time between patients transferred from other hospitals compared to self-referred patients in our institution.

Methods: Historical cohort study including patients with acute myocardial infarction treated between April 2014 and September 2015. Patients were divided into transferred patients (group A) and self-referred patients (group B). Clinical characteristics of the patients were obtained from our electronic database and the transfer time was estimated based on the time the e-mail requesting patient's transference was received by the emergency department.

Results: The sample included 621 patients, 215 in group A and 406 in group B. Population characteristics were similar in both groups. Time from symptom onset to arrival at the emergency department was significantly longer in group A (385 minutes vs. 307 minutes for group B, $p < 0.001$) with a transfer delay of 147 minutes. There was a significant relationship between the travel distance and increased transport time ($R = 0.55$, $p < 0.001$). However, no difference in mortality was found between the groups.

Conclusion: In patients transferred from other cities for treatment of infarction, transfer time was longer than that recommended, especially in longer travel distances. (Arq Bras Cardiol. 2019; 112(4):402-407)

Keywords: ST Elevation Myocardial Infarction/complications; Angioplasty, Balloon, Coronary/methods; Myocardial Reperfusion/methods; Fibrinolytic Agents; Intensive Care Units.

Introduction

For patients presented within 12 hours of ST-segment elevation acute myocardial infarction (STEMI), reperfusion therapy with thrombolytic agent or percutaneous transluminal coronary angioplasty (PTCA) should be provided as early as possible.[1] A shorter time-to-treatment in infarcted patients is associated with greater myocardial salvage and has a positive effect on ventricular function and mortality.[2,3]

PTCA is the therapy of choice for coronary reperfusion, if initiated within 90 minutes from AMI diagnosis or 120 minutes for patients referred for PTCA at another center.[4,5] Nevertheless, some factors contribute to increasing time-to-treatment: a) unawareness of AMI-related signs and symptoms by the patients; b) unawareness of the benefits of a rapid reperfusion therapy; c) lack of healthcare facilities adequately equipped to early detect patients with STEMI; d) delay in defining the most appropriate reperfusion therapy and patient transportation delay.[6]

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For example, in hospitals for less complex cases, PTCA is not available, and the use of thrombolytic therapy or the transfer of patients to more specialized hospitals cause a delay in AMI treatment.

In many countries, an integrated care system for STEMI is already available.[7] Strategies aimed at reducing the time to STEMI diagnosis and treatment are needed. However, data on inter-hospital transfer of patients in Brazil are scarce. The present study aimed at determining whether there are differences in total ischemic time between patients referred from other hospitals and those who self-referred, based on current guidelines' recommendations.[8-10]

Methods

Study design

This was a historical cohort study.

Characteristics of inter-hospital transfer of patients

The normal procedure for accepting a patient's transfer for treatment of STEMI involves the receipt of an electrocardiography report (ECG) confirming the diagnosis of STEMI (previously by fax, and recently by e-mail). This would avoid costs in the health system with incorrect diagnosis and unnecessary referral to the emergency department.

Subjects

Patients with diagnosis of STEMI registered in the database of the Institute of Cardiology of the University Foundation of Cardiology (IC-FUC) were assessed and allocated to one of two groups – Group A, patients whose names and electrocardiographic results were listed in the electronic mailbox of the emergency department, confirming the approximate time of contact and indicating the place of origin – and Group B, self-referred patients (all others).

Transfer time (min) was calculated by subtracting the time and the day the message (containing ECG result attached) was received from the time and day patients were admitted to the emergency department (according to medical records).

Ethical consideration

The study was registered at the research unit of the IC-FUC and approved by the local ethics committee.

Statistical analysis

Continuous variables were expressed as mean ± standard deviation or median and interquartile range, as appropriate. Categorical variables were presented as absolute number and percentage and compared by the chi-square test and Z-test. Continuous variables were analyzed using Student's t-test for independent samples or the Wilcoxon-Mann-Whitney test, as appropriate. Normality was tested by the D'Agostino-Pearson test. Our database was constructed using Microsoft Excel 2010 software and then transferred to the IBM Statistical Package for the Social Sciences (SPSS) version 19.0.0. The SPSS software version 18.0 was used for statistical analysis. Two-tailed p-values < 0.05 were considered statistically significant.

Results

E-mail messages received by the emergency department of the IC-FUC between April 2014 and September 2015 were reviewed. ECG results showing ST-segment elevation and identification data of patients were cross-checked with data registered in the AMI database of the hospital.

During the study period, 2,532 pieces of information were excluded – 68 messages in which patients' names could not be identified, 869 ECG results of patients with non-STEMI, 381 duplicate messages, 23 "unknown hard error" messages, 491 tomography reports, 408 internal messages, and 292 ECG results of patients with STEMI that had not been referred from other hospitals or patients not registered in the AMI database.

Final sample was composed of 621 patients, 215 transferred patients (group A) and 406 self-referred (group B).

Table 1 describes characteristics of groups A and B. Both groups had similar risk factors.

Figure 1 depicts mean variation in the time elapsed from symptom onset to arrival at emergency department (delta T) and the travel distance of patients, depending on the place of origin.

Mean delta T of all patients was 334 minutes. Mean delta T of patients transferred by emergency medical services of the Secretariat of Health (group A) was 385 minutes, with a delay in transfer time of 147 minutes. Mean delta T of group B was 307 minutes (Figure 2).

Figure 3 shows a scatter plot of delta T and travel distance, with a good correlation coefficient between these variables ($R = 0.55$ and $p < 0.001$). Despite that, the graphs shows a number of cities with shorter travel distances but higher transfer times (plots above diagonal), and cities with longer travel distances but shorter transfer time (plots below diagonal).

Despite the statistical difference in transfer time, no difference in mortality was observed between the groups.

Discussion

Treatment of STEMI is considered a medical emergency, with significant mortality even in well renowned centers.[11] The main objective of the therapy is restoration of blood flow in the culprit vessel. This is achieved by administration of fibrinolytic agents to dissolve intracoronary thrombus, or by PTCA, with percutaneous recanalization of the infarct artery with or without stent implantation. In the present study, we demonstrated the difference in delta T between STEMI patients referred for PTCA and self-referred STEMI patients to the emergency department of the IC-FUC

The finding that transferred patients have longer ischemia time and a longer time to coronary reperfusion therapy is not a surprise, since in these cases there are delays in contacting

Table 1 – Characteristics of patients referred from other hospitals (group A) and self-referred patients (group B). Porto Alegre, RS, Brazil

Variable	Group A (n = 215)	Group B (n = 406)	p
Age, years*	58 (28-87)	60 (18-98)	0.50
Male sex†	145 (67)	283 (69)	0.67
Risk factors†			
Hypertension	128 (59)	251 (61)	0.69
Smoking	148 (68)	249 (61)	0.10
Dyslipidemia	67 (31)	132 (32)	0.86
Diabetes	55 (25)	96 (23)	0.64
Family history	45 (20)	109 (26)	0.11

** Data presented as median and interquartile range; † Absolute and relative frequency.*

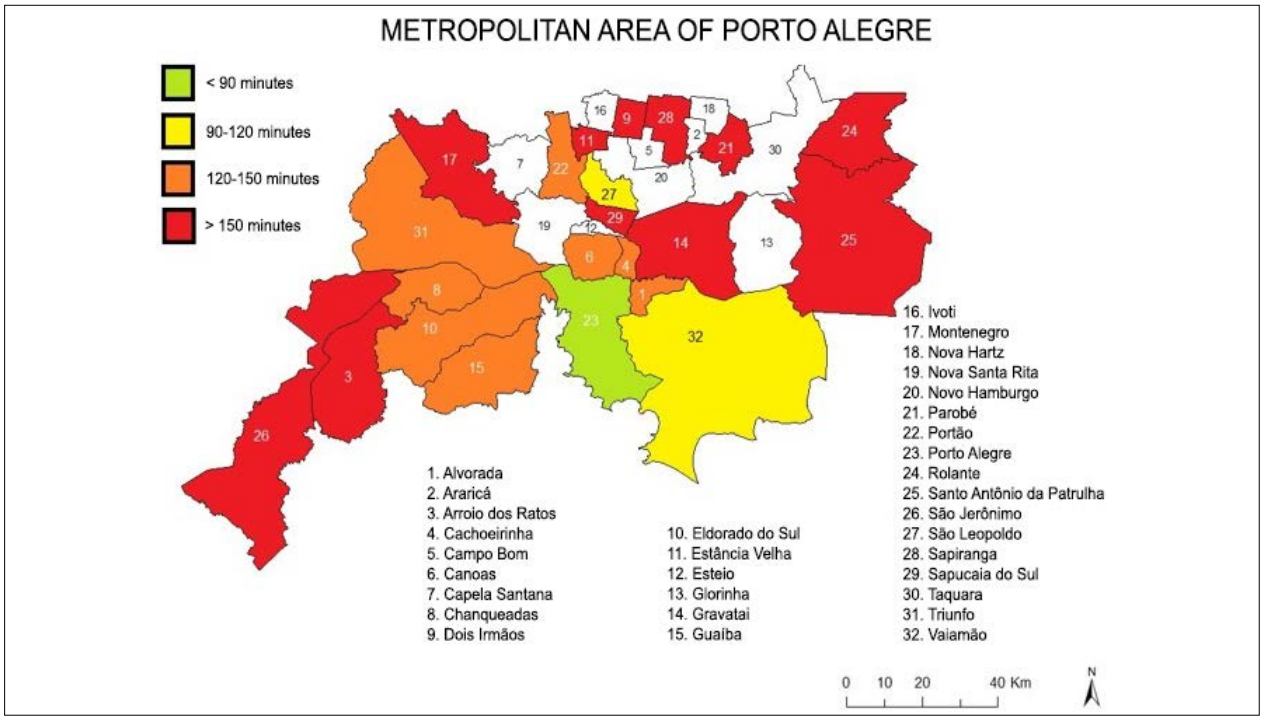

Figure 1 – *Map of the metropolitan area of Porto Alegre, illustrating the regions by names and mean patient transport time to the Institute of Cardiology, University Foundation of Cardiology (IC-FUC).*

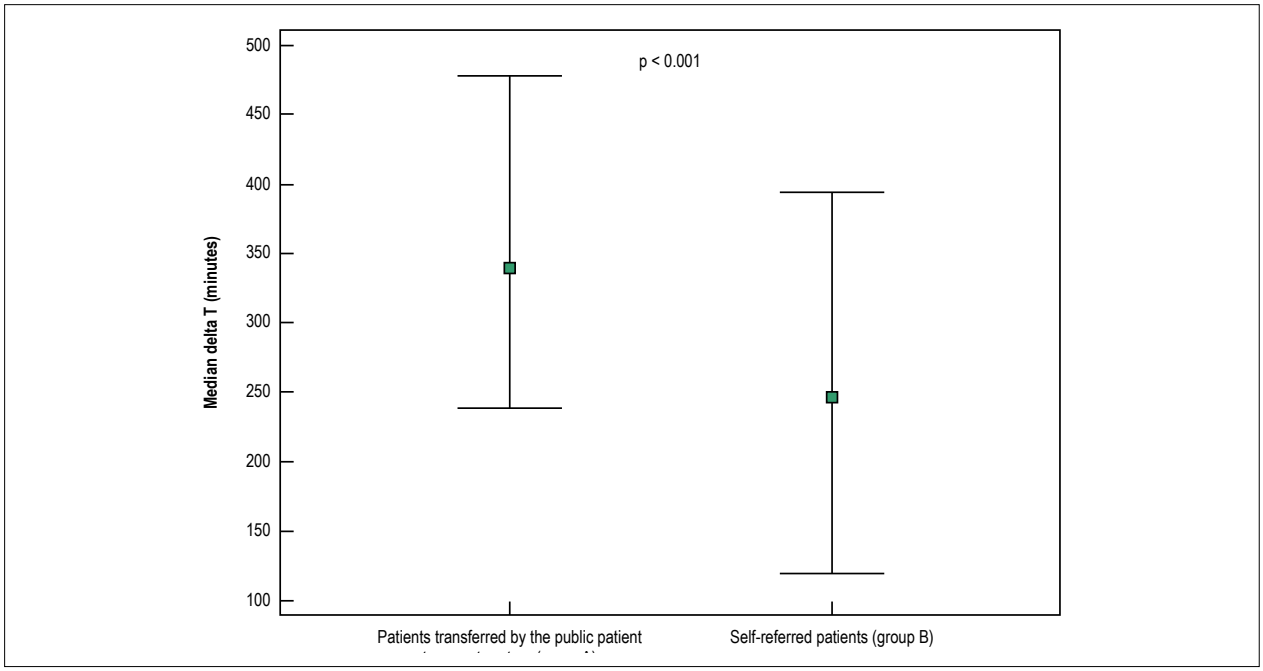

Figure 2 – *Comparison of median delta T between patients transferred from other institutions and self-referred patients.*

medical and transport services, in obtaining authorization from the emergency medical services for ambulance services and in patients' transportation itself.

According to the Brazilian guidelines, PTCA is the preferred option for coronary reperfusion, if initiated within 90 minutes from diagnosis of STEMI or within 120 minutes in case of patients referred for therapy at other centers.[8] It is worth pointing out that, in patients treated with PTCA, for each 30 minutes of delay, relative risk for mortality increases 7.5%.[12]

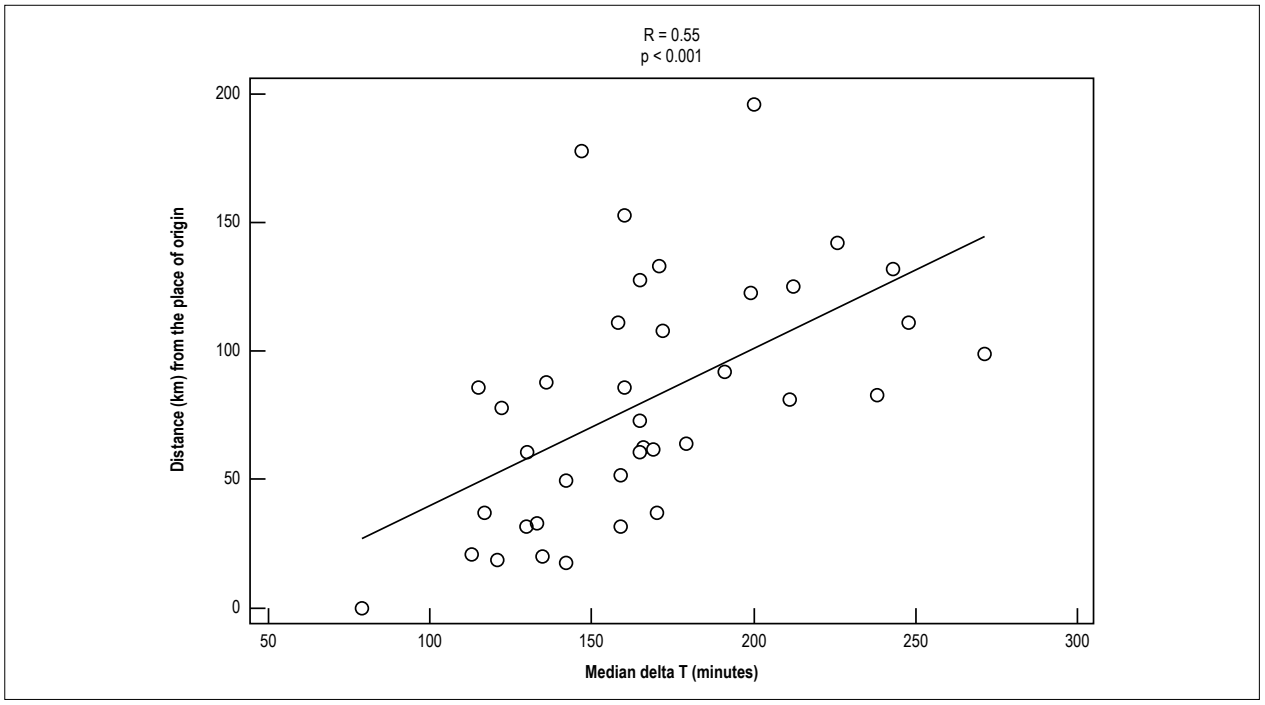

Figure 3 – *Correlation between distance from the place of origin and mean delta T (minutes).*

In a time period lower than 2 hours, primary PTCA was superior to fibrinolytic therapy in terms of severe adverse effects (death, stroke and reinfarction;[13] event rates were 8.5% vs 14.2%, respectively; p = 0.02).

The benefit of transferring STEMI patients for PTCA on in-hospital mortality, compared with onsite fibrinolytic therapy, decreased as transfer time increased. In-hospital mortality was 2.7%, 3.6% and 5.7% in PTCA group and 7.4%, 5.5% and 6.1% in fibrinolytic therapy group for delays of 0-60 minutes, 60-90 minutes and longer than 90 minutes, respectively.[14]

In our study, mean transfer time was 141 minutes, with wide variation according to patients' place of origin. In the cities of Porto Alegre, Viamão and São Leopoldo, transfer time was shorter than 120 minutes. In all other cities, however, it was longer than recommended, reducing the benefits of the immediate transport of patients for primary angioplasty.

Figure 1 more clearly illustrates the relationship between travel distance and prolonged transfer time. White areas in the map correspond to cities where no transfer of STEMI patients for primary angioplasty was registered. Therefore, patients from these areas were not included for analysis, although it is likely that their transfer times were similar to those in the cities nearby, and higher than predicted.

An arm of the GRACE study with 3,959 patients compared fibrinolytic therapy with primary angioplasty, and showed a door-to-needle time of 35 minutes and door-to-balloon time of 78 minutes. Treatment delays were associated with an increase in 6-month mortality for both therapies. For each 10-min delay in door-to-needle, mortality increased by 0.30% for patients who underwent thrombolysis, and 0.18% for those who underwent primary PCI.[15]

In patients with chest pain treated within 3 hours of symptom onset, no difference in mortality was observed between PTCA and fibrinolysis (7.2% *vs*. 7.4%). Nevertheless, in those treated between 3–12 h after symptom onset, mortality significantly increased in fibrinolysis group compared with PTCA (6.0% vs. 15.3%).[16]

In centers without catheterization facilities, i.e., when patient transfer is required, thrombolysis should be performed, since, if carried out within 3 hours of STEMI, both angioplasty and thrombolytic therapy have similar benefit on mortality. Besides, between 3 hours and 12 hours of pain onset, in places where transfer time is expected to be longer than ideal transfer time, thrombolysis should be strongly considered.

For calculation of the total ischemic time, one should consider the delay in seeking medical care, the time until AMI diagnosis, delays in patients' transfer to the catheterization laboratory, and internal delays of the referral system, from patients' enrollment to the opening of the infarct-related artery. In a previous study performed in our institution, the mean time from symptom onset to hospital admission was 90 minutes during business hours and 133 minutes outside this period.[17]

Limitations of the study

Despite the quantitative nature of delta T, this variable can be difficult to be evaluated, resulting in measurement errors. In addition, since this study consisted in a database review, there are potential biases, inherent to this type of analysis.

Conclusion

The present study shows that AMI patients transferred from other institutions have prolonged ischemic time, exceeding that recommended by the Brazilians guidelines. However, ischemic time varied largely between the cities, in a direct proportion to the distance covered. These findings can help health managers in identifying how to improve patient transport system, leading to earlier reperfusion therapy and mortality reduction.

Author contributions

Conception and design of the research: Balk M. Acquisition of data: Balk M, Gomes HB. Statistical analysis: Saffi MAL, Leiria TLL. Writing of the manuscript: Saffi MAL, Leiria TLL. Critical revision of the manuscript for intellectual content: Gomes HB, Quadros AS, Leiria TLL.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Instituto de Cardiologia - Fundação Universitária de Cardiologia (IC/FUC), under the protocol number 5565/18. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

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