

Mémoire de Maîtrise en médecine

Influence of socioeconomic factors on delays, management and outcome amongst patients with acute myocardial infarction undergoing primary percutaneous coronary intervention

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Influence of socioeconomic factors on delays, management and outcome amongst patients with acute myocardial infarction undergoing primary percutaneous coronary intervention

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Brief Title:

Influence of socioeconomic factors on delays, management and outcome amongst STEMI patients

Background

The outcome after primary percutaneous coronary intervention (pPCI) for ST-Elevation Myocardial Infarction (STEMI) is strongly affected by time delays. In the present study, we sought to identify the impact of specific socioeconomic factors on time delays, subsequent STEMI management and outcomes in STEMI patients from a well-defined region of the French part of Switzerland.

Method

A total of 402 consecutive patients undergoing pPCI for STEMI in a large tertiary hospital were retrospectively studied. Symptom-to-first-medical-contact time was analyzed for the following socioeconomic factors: level of education, gender, origin and marital status. Main exclusion criteria were: time delay beyond 12 hours, previous treatment by fibrinolysis or patients immediately referred for CABG. Therefore, 352 patients were finally included.

Results

At one year, there was no difference in mortality amongst the different socioeconomic groups. Furthermore, there was no difference in management characteristics between them. Symptom-to-first-medical-contact time was significantly higher for patients with a low level of education, Swiss citizens and non-married patients with median differences of 40 minutes, 48 minutes, and 60 minutes, respectively ($p < 0.05$). Nevertheless, no difference was found regarding in-hospital management and clinical outcome.

Conclusion

This study demonstrates that symptom-to-first-medical-contact time is higher amongst people with a lower educational level, Swiss-citizens, and non-married people. Because of the low mortality rate in general, these differences in time delays did not affect clinical outcomes. Still, primary prevention measures should particularly focus on these vulnerable populations.

Introduction

Primary PCI for ST-Elevation Myocardial Infarction (STEMI) is considered a life saving act with a Class 1A recommendation according to international scientific guidelines [1]. Moreover, it is well-known that in the management of STEMI, time from symptom onset to reperfusion therapy strongly affects the prognosis [2-5].

Large international clinical trials from the last decade demonstrate that, although door-to-needle times have decreased [6], the time between symptom onset and first medical contact has hardly changed. The Swiss AMIS (Acute Myocardial Infarction in Switzerland) registry of acute coronary syndrome (ACS) has collected data since 1977 amongst 106 hospitals treating ACS. At the end of the year 2010, the registry contained 33'040 patients' data. During the last decade, the door-to-balloon time amongst patients with STEMI in Switzerland decreased by 59.32% (from a median of 118 minutes in 1999 to 48 minutes in 2009) but the time between symptom onset and admission was only reduced by 15.77% (from a median of 260 minutes in 1999 to 219 minutes in 2009) [7].

To reduce the pre-hospital delay, a recent Swiss study showed that campaigns to raise patients' awareness are efficient [7]. In fact, a nation-wide public campaign allowed a reduction of 10% in the pre-hospital delay amongst patients with STEMI.

In the present study we sought to identify the impact of socioeconomic factors on time delays, STEMI management, and outcome in a well-defined region of the French part of Switzerland.

Method

Patient population

Between 01-01-2009 and 06-30-2010, 402 consecutive patients underwent pPCI for

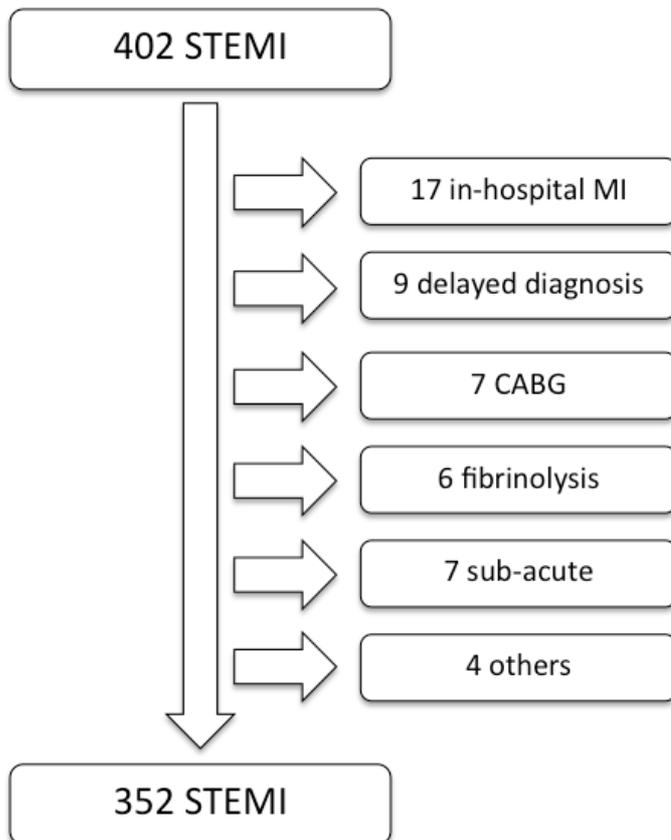


Figure 1 : Study Flow Chart

STEMI in a large tertiary hospital in the French part of Switzerland. This hospital is the only site in charge of pPCI in the state of Vaud hosting approximately 700'000 inhabitants. Patients with “symptom-to-first-medical-contact” time longer than 12 hours, patients with a previous treatment by fibrinolysis or patients directly referred for CABG were excluded. 352 patients were finally included

(**Figure 1**). Amongst them, symptom-to-first-medical-contact time was known for 222 patients. Laboratory, clinical, hemodynamic, and demographic data were collected from detailed hospital and catheter laboratory databases.

Study endpoints

Different socioeconomic factors, which might affect symptom-to-first-medical-contact time, were identified and investigated: “level of education” [8,12], “gender”[8,10-12], “origin”[9,11-13] and “marital status” [12,14]. Secondly, the impact of these factors on STEMI management and outcome was analyzed.

Definition

STEMI: STEMI was defined according to the universal definition of myocardial infarction of the Joint ESC/ACCF/AHA/WHF Task Force for the Redefinition of Myocardial Infarction ” [1].

Level of education: Patients were sent a written questionnaire in order to report their level of schooling. If needed, patients and/or their general practitioners were contacted by phone for additional information. The Swiss official education’s grading system was then used to classify patients into 2 educational levels: High Education Level (HEL) and Low Education Level (LEL).

Gender, origin, and marital status: These variables were analyzed from the administrative records at admission. In terms of origin, patients were classified as Swiss or non-Swiss citizen. For the variable marital status, we classified the patients into 2 groups: “married” or “not married” (single, divorced or widowed).

Statistical Analysis

The GraphPad Prism software 5.0d version was used to perform statistical analysis. Continuous variables are summarized as mean \pm SD, unless otherwise specified. Discrete variables are presented as frequencies and percentages. Group differences were tested using non-parametric unpaired t-test when the distribution of the variable

followed a Gaussian distribution (D'Agostino & Pearson omnibus normality test) or using the Mann Whitney test when the distribution of the variable did not follow a Gaussian distribution.

This study complied with the Declaration of Helsinki regarding investigations in humans and was approved by the Institutional Ethics Committee. The authors had full access to the data and take responsibility for its integrity.

Results

Baseline demographics

Characteristics of the patients enrolled in this study are summarized in **Table 1**. Median age was 65.8 years. Mean symptom-to-first-medical-contact time was 161 minutes while mean admission-to-needle time was 72 minutes. 72.7% of patients were male, 56.1% had a high education level, 35.8% were single and 65.1% were Swiss citizens.

Table 1. Baseline demographics

General & socioeconomic factors	
Male gender (n, %)	256 (72.7)
Age (mean \pm SD)	65.82 \pm 12.8
High Level of Education (%)	56.1
Not married (%)	35.8
Swiss Citizens (%)	65.1
Cardiovascular Risk Factors (%)	
Dyslipidemia	52.3
Diabetes	23.3
Hypertension	50.0
Family history	12.8
Obesity	25.0
Smoking	52.3
Delays	
Symptom to first medical contact time (mins \pm SD)	161.1 \pm 144
Admission to needle time (mins \pm SD)	72.36 \pm 83.6
Previous cardiovascular history	
Prior PCI	7.2
Prior MI	12.1

Symptom-to-first-medical-contact time based on socioeconomic factors.

The symptom-to-first-medical-contact times were calculated for each of the 4 sub-groups (**Figure 2**). A statistically significant difference was found in the mean symptom-to-first-medical-contact time for the factors “level of education”, “origin” and “marital status” but not for the factor “gender”. People with a high level of education had a mean symptom-to-first-medical-contact time of 146.7 ± 145.4 minutes versus 186.9 ± 152.3 minutes for people with a low level of education ($p < 0.05$). Non-Swiss citizens had a symptom-to-first-medical-contact time of 134.9 ± 128.7 minutes versus 183.1 ± 188.4 minutes for Swiss citizens ($p < 0.05$). Married people had a mean symptom-to-first-medical-contact time of 143.2 ± 122.1 minutes versus 202.8 ± 220.5 minutes for not married people ($p < 0.05$). In contrast, no difference was found regarding gender (174.0 minutes for men versus 150.0 minutes for women, $p = 0.3487$).

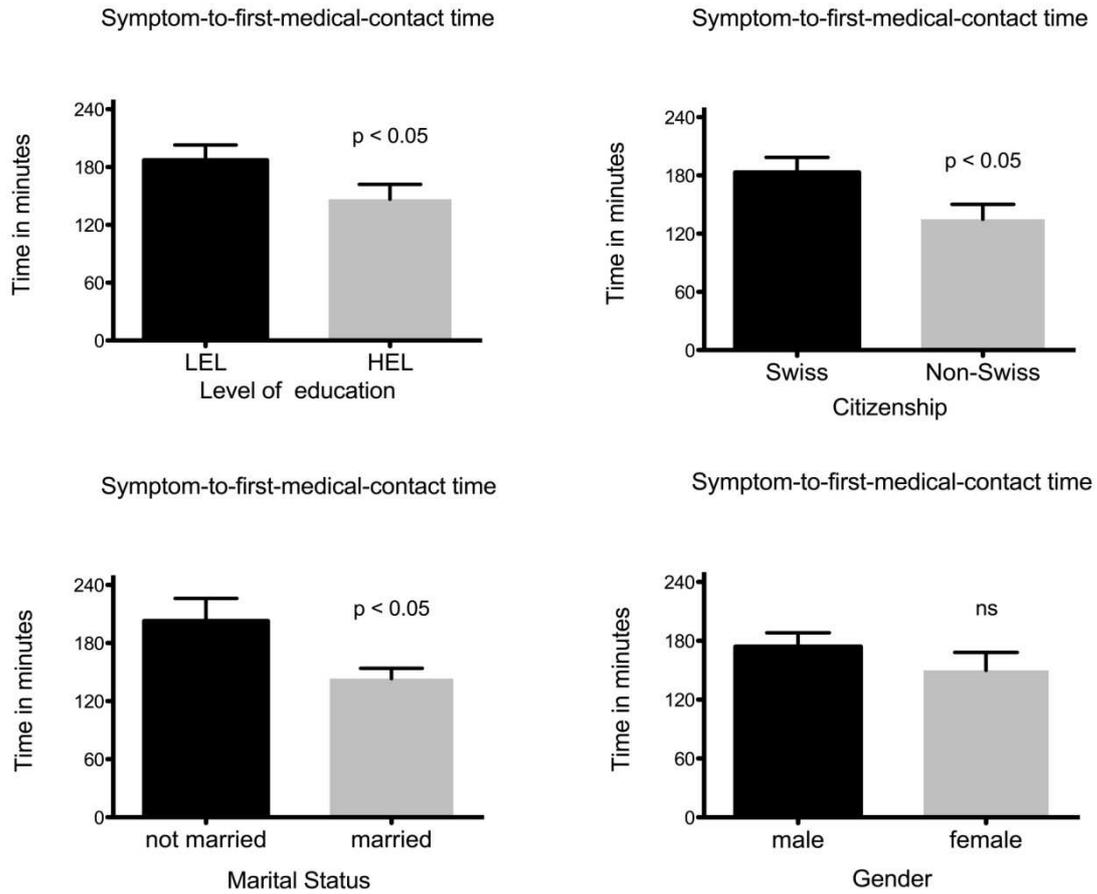


Figure 2 : Mean symptom-to-first-medical-contact time amongst the different socioeconomic groups. Patients with a low level of education, non-married patients and Swiss citizens had significant higher symptom-to-first-medical-contact time ($p < 0.05$). The difference between genders was not statistically different.

Clinical outcome & follow-up

Clinical outcome & follow-up are summarized in **Table 2**. Mean Peak CK level was 2511±2506 U/L and LVEF assessed by echocardiography at discharge was 48.5±11.43%. Clinical follow-up was obtained for 86% of the patients. At 1 year follow-up, all cause mortality rate was 3.65 %.

Table 2. Myocardial Infarction and percutaneous intervention characteristics & outcomes

<i>Myocardial infarction characteristics</i>	
Inferior (%)	49.28
Anterior (%)	47.83
Lateral (%)	2.90
Peak CK (mean ± SD)	2511 ± 2506
<i>PCI characteristics</i>	
Procedural time	68.8 ± 109.4
Stent length	25.23 ± 11.47
Stent diameter	3.35 ± 0.56
Number of stents	1.17 ± 0.38
<i>Outcome</i>	
LVEF (%)	48.49 ± 11.43
Mortality at one year (%)	3.65

All data presented are mean ± SD unless stated otherwise.

Management characteristics & outcome based on socioeconomic factors.

Management characteristics are summarized in **Table 3**. Regarding the studied socioeconomic factors, no statistically significant difference was found in terms of door-to-needle time, procedure time, number of stents, stent length or stent diameter. Clinical outcomes are summarized in **Table 4**. No statistically significant difference was found in terms of mortality at one year, mean peak CK level or mean LVEF at discharge.

Table 3. Management characteristics

Level of education	LEL	HEL	p
Door-to-needle time (mins)	63.29 ± 46.11	65.9 ± 60.41	0.4479
Procedure time (mins)	61.01 ± 22.90	62.81 ± 26.14	0.8765
Number of stents	1.161 ± 0.3926	1.183 ± 0.3886	0.5758
Stent length (mm)	24.85 ± 12.09	26.58 ± 12.21	0.3046
Stent diameter (mm)	3.272 ± 0.5973	3.281 ± 0.6214	0.8518
Citizenship :	Swiss	Non Swiss	p
Door-to-needle time (mins)	68.26 ± 68.24	58.81 ± 35.96	0.7123
Procedure time (mins)	60.83 ± 23.91	64.21 ± 25.62	0.4122
Number of stents	1.154 ± 0.3631	1.22 ± 0.4574	0.3702
Stent length (mm)	25.45 ± 11.51	26.27 ± 13.75	0.9074
Stent diameter (mm)	3.295 ± 0.5761	3.281 ± 0.6197	0.9524
Marital status :	Married	Not married	p
Door-to-needle time (mins)	62.38 ± 56.13	71.3 ± 67.79	0.4761
Procedure time (mins)	63.09 ± 24.65	59.37 ± 23.18	0.349
Number of stents	1.178 ± 0.4041	1.157 ± 0.3666	0.7934
Stent length (mm)	26.28 ± 12.85	24.58 ± 10.99	0.5236
Stent diameter (mm)	3.248 ± 0.6229	3.333 ± 0.5905	0.3779
Gender :	Male	Female	P
Door-to-needle time (mins)	67.22 ± 85.03	69.87 ± 44.32	0.0647
Procedure time (mins)	62.49 ± 24.1	60.07 ± 25.2	0.3671
Number of stents	1.179 ± 0.4014	1.148 ± 0.3586	0.6738
Stent length (mm)	25.33 ± 11.79	26.57 ± 13.22	0.5843
Stent diameter (mm)	3.313 ± 0.6198	3.167 ± 0.5586	0.1499

All data presented are mean ± SD unless stated otherwise.

LEL: low level of education, HEL: high level of education, mins: minutes

Table 4. Outcome characteristics

Level of education	LEL	HEL	p
CK	2777 ± 3032	2177 ± 1910	0.2781
LVEF	47.53 ± 11.78	50.57 ± 9.571	0.2418
Mortality	4 (3.05 %)	2 (1.83 %)	0.5472
Citizenship :	Swiss	Non Swiss	p
CK	2399 ± 2313	3068 ± 3306	0.2536
LVEF	47.93 ± 11.08	49.76 ± 11.4	0.3146
Mortality	6 (3.39 %)	2 (2.67 %)	0.7647
Marital status :	Married	Not married	p
CK	2598 ± 2721	2617 ± 2572	0.7762
LVEF	48.56 ± 11.52	48.53 ± 10.75	0.8668
Mortality	6 (3.7 %)	2 (2.35 %)	0.5689
Gender :	Male	Female	p
CK	2762 ± 2903	2189 ± 1832	0.3584
LVEF	48.78 ± 11.06	47.97 ± 11.58	0.6845
Mortality	7 (3.89 %)	1 (1.41 %)	0.3137

All data presented are mean ± SD unless stated otherwise.

LEL: low level of education, HEL: high level of education, mins: minutes

Discussion

In this study, conducted in 402 consecutive patients with STEMI undergoing pPCI in a well-defined region of the French part of Switzerland, a significant impact of different socioeconomic factors on symptom-to-first-medical-contact times was observed. People with a higher educational level, non-Swiss citizens and married people had significantly shorter symptom-to-first-medical-contact times with median differences of 40, 48 and 60 minutes, respectively. This delay could be expected to result in adverse outcomes for this group of patients however we did not demonstrate this in our group of patients, with no difference in mortality at one year.

A number of studies have analyzed the impact of socioeconomic factors on the treatment of patients with STEMI by pPCI [7-18]. Contrary to previous publications where the level of education was analyzed qualitatively only [15], our study also shows the existence of a quantitative difference. Indeed, people with a high level of education had significantly shorter symptom-to-first-medical contact times. Furthermore, in contrast to several observations in the U.S. population, the present paper highlights that Swiss citizens had significantly longer symptom-to-first-medical-contact times than non-Swiss citizens [9,16,18]. Moreover, in accordance with trends over the last decade suggesting that gender differences appear to be regressing [10], no statistically significant difference was found between men and women. Finally, this study confirmed that married people have significantly shorter symptom-to-first-medical-contact times.

Different publications have demonstrated the existence of a strong correlation between the patients' subjective feeling of symptom severity and delay in seeking medical treatment [15]. We hypothesize that a high level of education may allow

better awareness of symptoms and knowledge of myocardial infarction and therefore reduces symptom-to-first-medical-contact time, explaining our results.

Switzerland is a multi-cultural country with approximately 20% of the population being foreign inhabitants. It is surprising that Swiss citizens, who are supposed to be well acquainted with their health system, have a higher symptom-to-first-medical-contact time than non-Swiss citizens. However, in the study population area, multinational and startup companies are predominantly present and the proportion of people with high education level was not statistically different between Swiss-citizens and non Swiss-citizens; therefore it may be assumed that the health awareness of these employees is high. On the other hand, different studies in Western countries have shown a higher rate of emergency room visits for vulnerable socioeconomic groups [17], such as migrants. The observations in Europe contrast to findings in the United States where racial and ethnic disparities exist putting parts of the black and hispanic populations at risk.

In the past, gender differences tended to exist with women presenting later with STEMI. Our study seems to confirm recent work by Kaul *et al.* [10], indicating that during the last decade, there have been significant reductions in symptom-to-first-medical-contact time amongst women.

In our study married people had shorter symptom-to-first-medical-contact time than non married. This difference has previously been reported was found in miscellaneous studies such as the REACT trial and most logically is due to the presence of the husband/wife accelerating the decision to call an ambulance or to go to the hospital.

Finally, as in the present study, a recent publication focusing on the link between management/outcomes and socioeconomic factors amongst STEMI patients [19] found no difference in mortality at one year. The absence of difference in management characteristics is not surprising in the setting of a large tertiary referral center with an organized STEMI program. The overall mortality at one-year follow-up was only 3.65% and therefore no impact of these socioeconomic factors on late clinical outcome was found.

Limitations

The number of patients included in this study remains relatively small, however the hospital where this study was performed is the only centre for pPCI of STEMI in this well-defined region of the French part of Switzerland, with excellent data quality. Whilst our findings are likely to be applicable to other Western countries, different ethnic mixes, socioeconomic settings and healthcare systems produce different sources of treatment differences.

Conclusion

This retrospective study shows that symptom-to-first-medical-contact time amongst STEMI patients relates significantly to different socioeconomic factors including level of education, origin, and marital status. In particular, non married Swiss citizens with a low level of education seem to be particularly vulnerable, and primary prevention campaigns should focus on this group of patients.

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