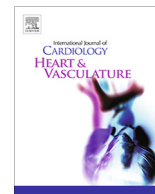




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## Correspondence

## Patient voluntarily delays call to emergency medical system for ST-elevation myocardial infarction during COVID-19 pandemic



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## ABSTRACT

**Background:** An increase in the time from the symptoms onset to first medical contact and to primary percutaneous coronary intervention (pPCI) has been observed in countries with high-incidence of COVID-19 cases. We aimed to verify if there was any change in the patient delay and in the EMS response times up to the pPCI for STEMI patients in Swiss Ticino Canton.

**Methods:** We assessed STEMI management including time from symptoms onset to EMS call, time of EMS response, time to pPCI in Swiss Canton Ticino. Data were retrieved from the Acute-Coronary-Syndrome-Ticino-Registry. We considered the patients included in the registry from March to May 2020 (pandemic period) and then from June to August 2020 (post-pandemic period) in whom a pPCI was performed. We compared these patients to those undergoing a pPCI in the same months in the year 2016–2019.

**Results:** During the pandemic period, the time from symptoms onset to pPCI significantly increased compared to non-pandemic periods. This was due to a significant prolongation of the time from symptoms onset to EMS call, that nearly tripled. In contrast, after the pandemic period, there was a significantly shorter time from symptom onset to EMS call compared to non-pandemic years, whereas all other times remained unchanged.

**Conclusion:** Patients delay the call to EMS despite symptoms of myocardial infarction during the COVID-19 pandemic also in a region with a relatively low incidence of COVID-19.

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## 1. Introduction

During the Coronavirus Disease 19 (COVID-19) pandemic, changes in the incidence and time to alert of Emergency Medical System (EMS) by patients with ST-segment elevation myocardial infarction (STEMI) have been consistently reported thus, resulting in a reduction in the number of STEMI [1–3], and an increase in the time from the symptoms onset to first medical contact and to primary percutaneous coronary intervention (pPCI) [4–7]. The

reported delay in EMS contact has been attributed to the fear of COVID-19 in-hospital transmission by patients living in regions with high disease incidence, possibly contributing to the out-of-hospital cardiac arrest increase observed in that regions [8]. Unknown is whether a similar clinical situation occurred in countries with a more moderate incidence of COVID-19 cases during the first pandemic wave. Furthermore, none of the previous studies reported all timings of the rescue chain starting from symptom onset to pPCI for STEMI patients. We aimed to verify if there was any change in the patient delay and in the EMS response times up to the pPCI for STEMI patients in Swiss Ticino Canton.

## 2. Methods

We assessed STEMI management including time from symptoms onset to call by the patients, time of EMS response, time to

**Abbreviations:** COVID-19, Coronavirus Disease 19; EMS, Emergency Medical System; STEMI, ST-segment elevation myocardial infarction; pPCI, primary percutaneous coronary intervention.

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**Table 1**

Patients characteristics, time from symptom onset to primary percutaneous coronary intervention during pandemic time and in comparison to previous years and non-pandemic time.

	Pandemic-period (n = 34)	Same period – years 2016–2019 (n = 109)	p-value	Post-pandemic period (n = 19)	Same period – years 2016–2019 (n = 92)	p-value
Age, median [IQR]	69 [58.2–77.7]	68 [57–75]	.469	61 [59–75]	67.5 [56.5–79.2]	.391
Male sex, n (%)	25 (73.5)	83 (76.1)	.820	15 (78.9)	63 (68.5)	.423
Symptoms onset to PCI (mins), median [IQR]	264 [157–542]	159 [107–342.5]	.046	119 [96–155]	152 [99.2–436.2]	.234
Symptoms onset to EMS call (mins), median [IQR]	371.2 [125.6–1895.4]	122.3 [62.6–527.1]	.026	58.1 [13.5–139]	111.2 [34.1–574.1]	.038
EMS call to EMS arrival (mins), median [IQR]	11.1 [8.2–16.4]	9.2 [6.9–12.4]	.107	10 [7.9–15]	9.1 [6.8–14]	.228
EMS arrival to patient's side (mins), median [IQR]	2 [1–2.7]	1 [1–3]	.818	2 [1–3]	2 [1–3]	.990
Patient's side-ECG recording (mins), median [IQR]	5.5 [4–7.2]	5 [3–9]	.578	5 [4–7]	5 [4–10]	.781
ECG-recording to pPCI (mins), median [IQR]	71 [59–122]	66 [55–78.5]	.145	74 [62–81]	64.5 [55.2–77.7]	.210

Categorical data are presented as number (percentage) and compared with a Fisher's exact test. Continuous variables are presented as median [IQR] and compared with the Mann-Whitney *U* test.

mins: minutes; Symptoms-pPCI: time from symptoms onset to primary percutaneous coronary intervention (pPCI); Symptoms-EMS call: time from symptoms onset to Emergency Medical System (EMS) call; EMS call-EMS arrival: time from EMS call to arrival of the first EMS vehicle at event location; EMS arrival-patient's side: time from arrival of the first EMS vehicle at event location to arrival at patient's side; Patient's side-ECG: time from arrival at patient's side to ECG acquisition; ECG-pPCI: time from ECG acquisition to pPCI.

pPCI in Swiss Canton Ticino, a region with a relatively low incidence of COVID-19 cases during the first pandemic wave. Data were retrieved from the Acute Coronary Syndrome-Ticino-Registry, a prospective longitudinal registry that enrolls consecutive patients treated by EMS presenting with a STEMI diagnosis. We considered all the patients included in the registry in the months from March to May 2020 (pandemic period) and then from June to August 2020 (post-pandemic period) in whom a pPCI was performed. We compared these patients to those undergoing a pPCI in the same months in the year 2016 to 2019. The registry is approved by local Ethic Committee and all patients signed an informed consent. All data were entered in anonymous form into a database (Microsoft Excel 2019) and all analyses was performed using Stata 15.1 (StataCorp, College Station, TX, USA). Categorical variables were presented as number and percentage and compared with Fisher test. Continuous variables were tested for normality with the D'Agostino-Pearson's test. Non-normally distributed continuous variables were presented as median and interquartile range [IQR] and compared with Mann-Whitney's test. A 2-sided  $p < 0.05$  was considered statistically significant.

### 3. Results

The clinical characteristics of the patients were similar in the different periods. During the pandemic period, the time from symptoms onset to pPCI significantly increased compared to non-pandemic periods (264 mins [157–542] vs 159 mins [107–342.5] respectively;  $p = 0.046$ ). This was due to a significant prolongation of the time from symptoms onset to EMS call, that nearly tripled (371.2 mins [125.6–1895.4] during pandemic vs 122.3 mins [62.6–527.1] in non-pandemic periods,  $p = 0.026$ ), whilst the other times did not change (Table 1). In contrast, after the pandemic period, there was a significantly shorter time from symptom onset to EMS call compared to non-pandemic years (58.1 mins [13.5–139] vs 111.2 [34.1–574.1] mins respectively,  $p = 0.038$ ), whereas all other times remained unchanged, included the total time from symptoms onset to pPCI.

### 4. Discussion

Our study shows that patients considerably delay the call to EMS during the pandemic period resulting in a huge prolongation of the time to coronary reperfusion that ultimately will affect the extension of myocardial injury. It is reasonable to assume that this have also played a key role in the increase in fatality and complica-

tion rates of patients admitted for acute myocardial infarction during the first pandemic wave [9], especially considering that a delay in reperfusion deeply affects infarct size and clinical outcome [10]. As in other countries, an increase in mortality compared to past years has been noted in Switzerland due to multiple causes including cardiovascular deaths [11]. The significant delay – up to 6 h – in the time to alert EMS is most likely due to a major fear to be hospitalized during the pandemic time even in a European region where infection burden (363 patients per 100.000 inhabitants hospitalized due to COVID-19 up to 31st May in Ticino Canton) was much lower compared to Lombardy (708/100.000 inhabitants) or New York City (617/100.000). Indirect confirmation of the voluntary delay in calling EMS by the patients during the pandemic is given by the impressive short time elapsed from symptoms onset and call to EMS – about 1 h – observed in the post-pandemic period; this time was even shorter when compared to previous years (2016 – 2019). This finding calls for action to develop awareness campaign about early STEMI symptoms recognition and management during COVID pandemic; at the same time, our observation shows that it is possible to achieve a very short reperfusion time (<120 min from symptoms onset) when a population is sensitive to the matter. Media campaign launched by the Swiss Heart Foundation [12] and other Cardiology Societies during the pandemic to keep patient informed about the importance to call EMS in case of suspected cardiac symptoms have possibly influenced patient's behavior. It highlights the importance to carry out these campaigns to avoid delay in reperfusion therapy in STEMI patients during pandemic. Although highly speculative, it is entirely possible that immediately after the first pandemic peak the level of attention of the general population about healthcare in general, and about symptoms preceding or accompanying acute coronary syndrome has been significantly higher thus resulting, in an early call for help. Finally, the time between arrival at patient's side and ECG acquisition and from ECG acquisition to pPCI remained unchanged during pandemic, and it is well below the time recommended by guidelines (10 min and 90 min respectively) thus, indicating an unaltered well-performing EMS, without needing to re-organize the EMS network, differently as it was necessary in the regions more affected by COVID-19 [13].

Our study has limitations. The main limitation is that Swiss Canton Ticino is a relatively small region with a population of about 350.000, and this lead to small sample size. However, the strength is that all the STEMI occurred in that Region were involved. Analysis of larger areas would be useful to confirm our results. Another limitation is that our registry does not include patients presenting directly to the emergency department. Despite

it is reasonable to assume that the delay to seek for medical help during first pandemic wave would be present also in that population, as already highlighted in Hong Kong during the early phase of the pandemic [14], it cannot be confirmed in our region according to our data.

In conclusion, patients voluntarily delay the call to EMS despite typical symptoms of myocardial infarction during the COVID-19 pandemic. However, when appropriately informed by media campaign about symptoms and the importance to seek for help, they are acting accordingly and result in a very short EMS-balloon time. During pandemic, EMS showed an unchanged performance despite a significantly more challenging health-care situation, which requires far more complex protection and emergency management protocols.

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## CRediT authorship contribution statement

**Enrico Baldi:** Conceptualization, Methodology, Resources, Visualization, Writing - original draft. **Angelo Auricchio:** Project administration, Conceptualization, Methodology, Writing - original draft. **Ruggero Cresta:** Data curation, Software. **Chiara Vanetta:** Formal analysis. **Luciano Anselmi:** Writing - review & editing. **Giovanni Pedrazzini:** Writing - review & editing. **Claudio Benvenuti:** Supervision, Validation.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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