IJC Heart & Vasculature 30 (2020) 100546

Contents lists available at ScienceDirect

IJC Heart & Vasculature

journal homepage: www.journals.elsevier.com/ijc-heart-and-vasculature

COVID-19 and STEMI: A snapshot analysis of presentation patterns during a pandemic

The coronavirus disease 2019 (COVID-19) pandemic has emerged as a major global public health emergency [1]. Many countries, including the Republic of Ireland, have instituted restrictions on their citizens in order to reduce the transmission of the virus [2,3], colloquially referred to as 'lockdown'. Concern has been raised regarding an observed decrease in the number of ST elevation myocardial infarction (STEMI) presentations during this period [4,5]. Numerous theories have been proposed regarding this phenomenon [4]. The most concerning hypothesis is that patients with symptoms of acute myocardial ischemia may not be presenting to medical attention due to lockdown measures or concern regarding COVID-19.

The Republic of Ireland has a population of approximately 4.9 million [6] with over 1,100 primary percutaneous coronary intervention (PPCI) procedures performed annually [7]. Based on the latest published data, our center performs the third highest number of PPCI procedures and has the highest rate of 'timely' PPCI in the Republic of Ireland as defined by a first medical contact to balloon time of less than 120 min [7].

With this in mind, we analyzed the data for STEMI presentations at our center during the COVID-19 lockdown in order to determine any changes in the pattern of presentation compared to the same period in 2019. We have previously published data demonstrating an absence of seasonal or monthly variation in the pattern of STEMI presentations at our centre [8]. Therefore, any variation in the pattern of STEMI presentation was felt to likely be secondary to the current COVID-19 pandemic and resultant lockdown measures.

This study was performed in the Cardiology Department at University Hospital Limerick, a 24-hour primary percutaneous coronary intervention center in the Republic of Ireland. We analyzed STEMI presentations to our center for the first three weeks of lockdown in the Republic of Ireland, from 27/3/2020 until the 17/4/2020 [2,3]. We compared the data to the same period in 2019 (27/3/2019–17/4/2019). STEMI was diagnosed according to the European Society of Cardiology Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation [9]. Data have been published suggesting that patients with COVID-19 may present as STEMI calls [10]. Therefore, all STEMI patients were brought to the cardiac catheterization laboratory and treated by healthcare workers utilizing complete personal protective equipment (PPE) as recommended by the National Acute Coronary Syndrome subcommittee meeting on 18/3/2020. In our center, the usual unfractionated heparin dose given during PPCI is 70–100 units per kg to maintain an activated clotting time between 250 and 300 s; the same dosing protocol was utilized in both the reference group and the COVID-19 lockdown cohort. The Independent Samples *t* Test, Mann Whitney U Test and Fisher's Exact Test were utilized as appropriate. Analyses were performed using IBM SPSS Statistics version 20. P values were 2-tailed. P values <0.05 were considered significant. The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki. Expedited approval was received from the UL Hospital Group Research Ethics Committee.

The baseline demographics are demonstrated in Table 1 and the outcomes of interest in Table 2. There were numerically fewer STEMIs presenting per day during the lockdown period compared to the same period in 2019 but this did not reach statistical significance (0.4 vs 0.6, difference between means 0.2, 95% CI [−0.2 to 0.7], P = 0.308). The relative risk reduction of a patient presenting with STEMI during the lockdown as compared to the reference period was 36% (relative risk 0.64, 95% CI [0.36 to 1.15]). Total ischemic time was increased during the lockdown (1550 vs 485 min, difference between means 1066, 95% CI [16 to 2116], P = 0.047). Patient delay appeared to be the most important factor driving the increased total ischemic time. This was demonstrated by the increase in the time from symptoms to first medical contact (1450 vs 323 min, difference between means 1127, 95% CI [74 to 2180], P = 0.037). There was no significant difference in cath lab arrival to wire cross time (19 vs 18 min, difference between means 0.9, 95% CI [−10 to 12] P = 0.87). Numerically more patients presented greater than 24 h after the onset of chest pain in the COVID-19 lockdown group (3 [33%] vs 1 [7%], P = 0.1) with a numerically higher in-hospital mortality during this period which nearly met statistical significance (2 [22%] vs 0 [0%], P = 0.06). All STEMI patients during the lockdown period had negative PCR analyses for SARS-CoV-2.

Patients presenting to our service during lockdown had a longer total ischemic time, mainly driven by a delay from onset of symptom to first medical contact. Of note, one-third of patients during lockdown presented greater than 24 h after the onset of chest pain. Taken together, these data suggest that patients are delaying seeking medical contact during lockdown, potentially due to isolation or reluctance to engage with medical services due to fears regarding COVID-19. This is particularly concerning given that previously published research had demonstrated a 7.5% increase in 1-year mortality for each 30-minute delay in the treatment of patients with STEMI [11]. The relative risk reduction of 36% from our study is comparable to previous work which reported a 38% reduction in STEMI activations during the early phase of the COVID-19 pandemic in the United States [4]. Despite precautionary measures against COVID-19 with use of full PPE, there was no statistical significance demonstrated in the cath lab arrival to wire cross time.

https://doi.org/10.1016/j.ijcha.2020.100546
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Table 1
Baseline Characteristics.

CHARACTERISTIC	Reference Period (n = 14)	COVID-19 Lockdown (n = 9)	P Value
Male, No. (%)	14 (1 0 0)	5 (55)	0.014
Age, mean (SD), years	59 (10)	58 (17)	0.912
Hypertension, No. (%)	6 (43)	4 (44)	>0.99
Diabetes, No. (%)	0 (0)	2 (22)	0.142
Previous PCI or CABG, No. (%)	2 (14)	0 (0)	0.502
Smoker, No. (%)	5 (36)	5 (56)	0.417
Family History of Coronary Artery Disease, No. (%)	3 (21)	2 (22)	>0.99
Dyslipidaemia, No. (%)	6 (43)	2 (22)	0.4
PROCEDURAL CHARACTERISTICS			
Use of GPIIb/IIIa Inhibitors	2 (14)	1 (11)	>0.99
Use of Thrombectomy Catheter	0 (0)	1 (11)	0.391
TIMI 0 Flow	11 (79)	7 (78)	>0.99
TIMI 1 Flow	1 (7)	0 (0)	>0.99
TIMI 2 Flow	0 (0)	1 (11)	0.391
TIMI 3 Flow	2 (14)	1 (11)	>0.99
CULPRIT VESSEL			
Left Anterior Descending Artery, No. (%)	5 (36)	2 (22)	0.657
Second Diagonal Artery, No. (%)	1 (7)	0 (0)	>0.99
Left Circumflex Artery, No. (%)	1 (7)	0 (0)	>0.99
First Obtuse Marginal Artery, No. (%)	0 (0)	1 (11)	0.391
Right Coronary Artery, No. (%)	6 (43)	6 (67)	0.4
Triple Vessel Disease, No. (%)	1 (7)	0 (0)	>0.99

Abbreviations: GPIIb/IIIa, glycoprotein IIb/IIIa; TIMI, thrombolysis in myocardial infarction.

Table 2
Outcomes of Interest.

Outcome	Reference Period (n = 14)	COVID-19 Lockdown (n = 9)	P Value	Difference between means [95% CI]	Effect Sizes (Hedges g)
Number of STEMIs per day, mean	0.6	0.4	0.308	0.2, [−0.2,−0.7]	0.31
Symptoms to First Medical Contact, mean, minutes	323	1450	0.037	1127 [74, 2180]	0.95
Symptoms to First Medical Contact, median, minutes	143	357	0.123		
First Medical Contact to Cath Lab, mean, minutes	144	81	0.045	62, [2, 123]	0.92
First Medical Contact to Cath Lab, median, minutes	121	74	0.03		
Cath Lab Arrival to Wire Cross time, mean, minutes	18	19	0.87	0.9, [−10,12]	0.06
Cath Lab Arrival to Wire Cross time, median, minutes	16	20	0.41		
Total Ischemic time, mean, minutes	485	1550	0.047	1066, [16, 2116]	0.9
Total Ischemic time, median, minutes	374	424	0.29		
Patients Presenting > 24 h since Chest Pain, No. (%)	1 (7)	3 (33)	0.1		
In-hospital Mortality, No. (%)	0 (0)	2 (22)	0.06		

We observed a numerically lower number of STEMIs during lockdown compared to the reference period, although this did not reach statistical significance. This non-statistically significant difference could be due to the small sample size resulting from the short duration of the period examined. Another limitation was that our study only reported in-hospital mortality and lacked additional longer-term outcome data. This was a snapshot analysis and the long-term clinical sequelae of the delayed time to presentation of patients suffering from STEMI remains to be seen.

This single PPCI center study in the Republic of Ireland suggests that public restrictions to minimize the transmission of the SARS-CoV-2 virus during the COVID-19 pandemic are associated with a delay in patients seeking medical attention for STEMI. The need to maintain accessibility to a 24/7 PPCI service has been previously highlighted [12]. We would suggest that emphasis should be placed at a national level to inform the public that life-saving interventions such as 24/7 PPCI are still available during lockdown. This is particularly pertinent for time dependent treatment modalities like primary percutaneous coronary intervention for STEMI. Our cardiology department has attempted to advise the public of this through local radio, national news channel and our hospital's Twitter account. It is similarly important for public health officials to consider the effect of lockdown measures on established systems of care and ensure that the public are aware of the importance of seeking medical assistance if they have concerning symptoms during lockdown.

Grant supports: None.

Declaration of Competing Interest

The authors have no conflicts of interest to declare.

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Received 5 May 2020
Received in revised form 17 May 2020
Accepted 23 May 2020

Available online 26 May 2020

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