

# World Journal of *Cardiology*

*World J Cardiol* 2021 April 26; 13(4): 68-116



**OPINION REVIEW**

- 68 Drug-induced gingival overgrowth in cardiovascular patients

*Bajkovec L, Mrzljak A, Likic R, Alajbeg I*

**EVIDENCE-BASED MEDICINE**

- 76 Challenges in managing ST elevation myocardial infarction during the COVID-19 pandemic

*Smith M, Singh A, McElroy D, Mittal S, Pham R*

**META-ANALYSIS**

- 82 Dabigatran, rivaroxaban, and apixaban are superior to warfarin in Asian patients with non-valvular atrial fibrillation: An updated meta-analysis

*Li WJ, Archontakis-Barakakis P, Palaiodimos L, Kalaitzoglou D, Tzelves L, Manolopoulos A, Wang YC, Giannopoulos S, Faillace R, Kokkinidis DG*

- 95 Intracoronary brachytherapy for the treatment of recurrent drug-eluting stent in-stent restenosis: A systematic review and meta-analysis

*Ilyas I, Kumar A, Adalja D, Shariff M, Desai R, Sattar Y, Vallabhajosyula S, Gullapalli N, Doshi R*

**CASE REPORT**

- 103 Pregnancy associated spontaneous coronary artery dissection: A case report and review of literature

*Prudhvi K, Jonnadula J, Rokkam VRP, Kutti Sridharan G*

- 111 Device closure of fistula from lower left pulmonary artery to left atrium using a vascular plug: A case report

*Mahapatra R, Mahanta D, Singh J, Acharya D, Barik R*

**ABOUT COVER**

Editorial Board Member of *World Journal of Cardiology*, Viktor Čulić, MD, MSc, PhD, Associate Professor, Senior Scientist, Department of Cardiology, University Hospital Centre Split, Split 21000, Croatia. viktor.culic@st.t-com.hr

**AIMS AND SCOPE**

The primary aim of *World Journal of Cardiology (WJC, World J Cardiol)* is to provide scholars and readers from various fields of cardiology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJC mainly publishes articles reporting research results and findings obtained in the field of cardiology and covering a wide range of topics including acute coronary syndromes, aneurysm, angina, arrhythmias, atherosclerosis, atrial fibrillation, cardiomyopathy, congenital heart disease, coronary artery disease, heart failure, hypertension, imaging, infection, myocardial infarction, pathology, peripheral vessels, public health, Raynaud's syndrome, stroke, thrombosis, and valvular disease.

**INDEXING/ABSTRACTING**

The WJC is now abstracted and indexed in Emerging Sources Citation Index (Web of Science), PubMed, PubMed Central, Scopus, China National Knowledge Infrastructure (CNKI), China Science and Technology Journal Database (CSTJ), and Superstar Journals Database.

**RESPONSIBLE EDITORS FOR THIS ISSUE**

Production Editor: Jia-Hui Li; Production Department Director: Xiang Li; Editorial Office Director: Ya-Juan Ma.

**NAME OF JOURNAL**

*World Journal of Cardiology*

**ISSN**

ISSN 1949-8462 (online)

**LAUNCH DATE**

December 31, 2009

**FREQUENCY**

Monthly

**EDITORS-IN-CHIEF**

Ramdas G Pai, Dimitrios Tousoulis, Marco Matteo Ciccone

**EDITORIAL BOARD MEMBERS**

<https://www.wjgnet.com/1949-8462/editorialboard.htm>

**PUBLICATION DATE**

April 26, 2021

**COPYRIGHT**

© 2021 Baishideng Publishing Group Inc

**INSTRUCTIONS TO AUTHORS**

<https://www.wjgnet.com/bpg/gerinfo/204>

**GUIDELINES FOR ETHICS DOCUMENTS**

<https://www.wjgnet.com/bpg/GerInfo/287>

**GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH**

<https://www.wjgnet.com/bpg/gerinfo/240>

**PUBLICATION ETHICS**

<https://www.wjgnet.com/bpg/GerInfo/288>

**PUBLICATION MISCONDUCT**

<https://www.wjgnet.com/bpg/gerinfo/208>

**ARTICLE PROCESSING CHARGE**

<https://www.wjgnet.com/bpg/gerinfo/242>

**STEPS FOR SUBMITTING MANUSCRIPTS**

<https://www.wjgnet.com/bpg/GerInfo/239>

**ONLINE SUBMISSION**

<https://www.f6publishing.com>

## Challenges in managing ST elevation myocardial infarction during the COVID-19 pandemic

Megan Smith, Aniruddha Singh, Douglas McElroy, Shilpi Mittal, Richard Pham

**ORCID number:** Megan Smith 0000-0003-0140-136X; Aniruddha Singh 0000-0001-6720-2465; Douglas McElroy 0000-0001-8312-5578; Shilpi Mittal 0000-0001-8482-0599; Richard Pham 0000-0001-8130-6164.

**Author contributions:** Singh A and Smith M contributed equally to this work; Singh A, Smith M, Mittal S, McElroy D and Pham R designed the study and contributed to the manuscript; Smith M and Pham R performed data extraction; McElroy D performed statistics and wrote the methods and results section; all authors have read the original and revised copy of the manuscript and approve the final version.

**Conflict-of-interest statement:** All the authors of this study report no potential conflict of interest related to any aspect of the study.

**PRISMA 2009 Checklist statement:** The authors have read the PRISMA 2009 Checklist, and the manuscript was prepared and revised according to the PRISMA 2009 Checklist.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution

**Megan Smith, Aniruddha Singh, Richard Pham,** Department of Cardiology, University of Kentucky College of Medicine, Bowling Green, KY 42101, United States

**Aniruddha Singh,** Department of Cardiology, Western Kentucky Heart and Lung Research Foundation, Bowling Green, KY 42101, United States

**Aniruddha Singh,** Department of Cardiology, The Medical Center, Bowling Green, KY 42101, United States

**Douglas McElroy,** Department of Biology, Western Kentucky University, Bowling Green, KY 42101, United States

**Shilpi Mittal,** Department of Neurology, Vanderbilt University Medical Center, Nashville, TN 37232, United States

**Corresponding author:** Aniruddha Singh, FACC, MBBS, Assistant Professor, Department of Cardiology, University of Kentucky College of Medicine, 399 US 31W Bypass, Bowling Green, KY 42101, United States. [aniruddha.singh@uky.edu](mailto:aniruddha.singh@uky.edu)

### Abstract

#### BACKGROUND

Coronavirus disease 2019 (COVID-19) may contribute to delayed presentations of acute myocardial infarction. Delayed presentation with late reperfusion is often associated with an increased risk of mechanical complications and adverse outcomes. Inherent delays are possible as every patient who is acutely sick is being considered a potential case or a carrier of COVID-19. Also, standardized personal protective equipment precautions are established for all members of the team, regardless of pending COVID-19 testing which might further add to delays.

#### AIM

To compare performance measures and clinical outcomes of all patients who presented to our facility with ST elevation myocardial infarction (STEMI) during the COVID-19 pandemic to same time cohort from 2019.

#### METHODS

All patients who presented to our facility with STEMI during the pandemic were compared to a matched cohort during the same time period in 2019. STEMI with unknown time of symptom onset and inpatient STEMI patients were excluded. Primary outcome was major adverse cardiac events (MACE) in-hospital and up to

NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

**Manuscript source:** Unsolicited manuscript

**Specialty type:** Cardiac and cardiovascular systems

**Country/Territory of origin:** United States

**Peer-review report's scientific quality classification**

Grade A (Excellent): 0  
Grade B (Very good): B  
Grade C (Good): C  
Grade D (Fair): 0  
Grade E (Poor): 0

**Received:** October 20, 2020

**Peer-review started:** October 20, 2020

**First decision:** December 24, 2020

**Revised:** January 4, 2021

**Accepted:** March 7, 2021

**Article in press:** March 7, 2021

**Published online:** April 26, 2021

**P-Reviewer:** Li XP

**S-Editor:** Fan JR

**L-Editor:** A

**P-Editor:** Li JH



14 d after STEMI, including death, myocardial infarction, cardiac arrest, or stroke. Significant differences among groups for continuous variables were tested through ANOVA, using SYSTAT, version 13. Chi-square tests of association were used to compare patient characteristics among groups using SYSTAT. Relative risk scores and associated tests for significance were calculated for discrete variables using MedCalc (MedCalc Software, Ostend, Belgium).

## RESULTS

There was a significantly longer time interval from symptom onset to first medical contact (FMC) in the COVID-19 group ( $P < 0.02$ ). Time to first electrocardiogram, door-to-balloon time, and FMC to balloon time were not significantly affected. The right coronary artery was the most common culprit for STEMI in both the cohorts. Over 60% of patients had one or more obstructive (> 50%) lesion(s) remote from the culprit site. In-hospital and 14 d MACE were more prevalent in the COVID-19 group ( $P < 0.01$  and  $P < 0.001$ ).

## CONCLUSION

This single academic center study in the United States suggests that there is a delay in patients with STEMI seeking medical attention during the COVID-19 pandemic which could be translating into worse clinical outcomes.

**Key Words:** COVID-19; ST elevation myocardial infarction; First medical contact to balloon; Major adverse cardiac events; Cardiac arrest; Death

©The Author(s) 2021. Published by Baishideng Publishing Group Inc. All rights reserved.

**Core Tip:** The coronavirus disease 2019 (COVID-19) pandemic has affected every aspect of healthcare and has created multiple challenges in treatment of time sensitive conditions like ST elevation myocardial infarction (STEMI). We aimed to assess the behavior of presentation and outcomes of all the STEMI admissions at our facility between March 16, 2020 and August 31, 2020. We found a significantly delay from symptom onset to first medical contact in the COVID-19 group which likely resulted in significantly higher in-hospital major adverse cardiac events (MACE) and MACE at 14 d in this cohort.

**Citation:** Smith M, Singh A, McElroy D, Mittal S, Pham R. Challenges in managing ST elevation myocardial infarction during the COVID-19 pandemic. *World J Cardiol* 2021; 13(4): 76-81

**URL:** <https://www.wjgnet.com/1949-8462/full/v13/i4/76.htm>

**DOI:** <https://dx.doi.org/10.4330/wjc.v13.i4.76>

## INTRODUCTION

The pandemic caused by the coronavirus disease 2019 (COVID-19) has caused a complete global shutdown and greatly affected every aspect of life, especially in the healthcare field. This has created multiple challenges in treatment of time sensitive and potentially lethal conditions like acute ST elevation myocardial infarction (STEMI). The consensus from the American College of Cardiology for management of STEMI recommends maintaining the standard of care with primary percutaneous coronary intervention, as long as there is adequate supply of resources, personal protective equipment availability, and cardiac catheterization staff. In absence of these resources, fibrinolysis should be first line treatment. Patients who are felt to be high risk for COVID-19 are recommended to be evaluated with additional cardiac studies, COVID-19 testing, and may require respiratory support, all of which may delay door-to-balloon times<sup>[1]</sup>.

Over 85% of the hospitals in the United States are considered community hospitals, yet the majority of studies are represented by university hospital systems<sup>[2]</sup>. In April 2020, Bowling Green, Kentucky was named one of the top ten COVID-19 hotspots in the United States<sup>[3]</sup>. Medical Center Health is a community hospital system in Bowling

Green, Kentucky with six hospitals covering ten counties in south central Kentucky, serving a population of more than 300000, and treating over 100 STEMI patients *per* year.

Given the limited observational studies guiding management of critical patients with STEMI during this pandemic, our study reports a United States community hospital's experience of management and outcomes of adult patients presenting with STEMI. One report from Hong Kong found large delays in patients seeking medical help and delays in evaluating patients with STEMI after hospital arrival but was limited by small sample size<sup>[4]</sup>. Extensive literature review revealed no such reports from United States hospitals as of yet.

---

## MATERIALS AND METHODS

---

We compared performance measures and outcomes of all patients who presented to our facility with STEMI between March 16, 2020 (when Kentucky began incorporating emergency infection protocols, mandating stay-at-home orders, and halting all elective procedures) and August 31, 2020. This study period was compared to a matched cohort during the same time period in 2019. Every patient in the 2020 group was considered a possible COVID-19 carrier, although none of our patients tested positive for COVID-19. STEMI with unknown time of symptom onset and inpatient STEMI patients were excluded. Primary outcome was major adverse cardiac events (MACE) in-hospital and up to 14 d after STEMI, including death, myocardial infarction, cardiac arrest, or stroke.

Significant differences among groups for continuous variables were tested through ANOVA, using SYSTAT, version 13. Chi-square tests of association were used to compare patient characteristics among groups using SYSTAT. Relative risk scores and associated tests for significance were calculated for discrete variables using MedCalc (MedCalc Software, Ostend, Belgium).

---

## RESULTS

---

A total of 52 patients from 2019 and 48 patients from 2020 were included. Baseline demographics and comorbidities are presented in [Table 1](#). Age, gender, comorbidities, Killip score, and ejection fraction were well matched between the two groups. There was a significantly longer time interval from symptom onset to first medical contact (FMC) in the COVID-19 group ( $P < 0.02$ ). Time to first electrocardiogram (ECG), door-to-balloon time, and FMC to balloon time were not significantly affected. The location of myocardial infarction and the state of culprit and non-culprit artery at the time of cardiac catheterization is detailed in [Table 1](#). The right coronary artery was the most common culprit for STEMI in both the cohorts. Over 60% of patients had one or more obstructive ( $> 50\%$ ) lesion(s) remote from the culprit site. In-hospital and 14 d MACE were more prevalent in the COVID-19 group ( $P < 0.01$  and  $P < 0.001$ ).

---

## DISCUSSION

---

Our study describes a United States acute care teaching hospital's experience in STEMI care utilizing emergency COVID-19 infection protocol. Contrary to reports out of major cities citing a decrease in STEMI patients, we noted a stable number of total STEMI cases compared with years prior<sup>[5]</sup>. The time interval from symptom onset to FMC was significantly longer in the COVID-19 group, which was likely due to the general fear of contracting COVID-19 in the healthcare setting. Triage (time to first ECG) and performance measures (door-to-balloon time and FMC to balloon time) were not significantly different. We suspect that this was due to the long-standing efficient systems in place to triage and treat STEMI patients, as well as lower overall cardiac catheterization case volume allowing readily available personnel and staff for a faster throughput, despite the additional infection control protocol in triaging patients during this pandemic. MACE in-hospital and at 14 d was significantly higher in the COVID-19 group. In the 2019 group, in-hospital MACE was composed of 25% cardiac arrests (2 out of 8 patients), in contrast to the COVID-19 group, where in-hospital MACE was composed of 89% cardiac arrests (16 out of 18 patients). More cardiac arrests in the COVID-19 era could be due to late presentation to a medical facility,

**Table 1 Characteristics and outcomes of patients presenting with ST elevation myocardial infarction during March-August 2019 (2019 Match Group) and March-August 2020 (coronavirus disease group)**

	2019 Match		2020 COVID		P value
<b>Patient characteristics</b>					
Age (yr), mean $\pm$ SE	n = 52	60.23 $\pm$ 1.77	n = 48	62.73 $\pm$ 1.80	0.45
Females, n (%)	n = 52	43 (82.7)	n = 48	33 (68.8)	0.10
Comorbidities, mean $\pm$ SE	n = 47	2.67 $\pm$ 0.22	n = 44	2.74 $\pm$ 0.22	0.83
Hypertension, n (%)	n = 52	36 (69.2)	n = 48	35 (72.9)	
Hyperlipidemia, n (%)	n = 52	30 (57.7)	n = 48	28 (58.3)	
Diabetes, n (%)	n = 52	14 (26.9)	n = 48	18 (37.5)	
Coronary artery disease, n (%)	n = 52	21 (40.4)	n = 48	15 (31.3)	
Obesity, n (%)	n = 52	15 (28.8)	n = 48	19 (39.6)	
Smoking, n (%)	n = 47	20 (42.6)	n = 44	19 (43.2)	
Killip score (mean $\pm$ SE), n (%)	n = 52	1.10 $\pm$ 0.08	n = 48	1.27 $\pm$ 0.13	0.25
0		1 (1.9)		1 (2.1)	
1		49 (94.2)		42 (87.5)	
2		0 (0.0)		0 (0.00)	
3		0 (0.0)		1 (2.1)	
4		2 (3.9)		4 (8.3)	
Initial troponin level (ng/mL), mean $\pm$ SE	n = 43	2.22 $\pm$ 0.98	n = 45	2.38 $\pm$ 1.52	0.88
Peak troponin level (ng/mL), mean $\pm$ SE	n = 47	47.75 $\pm$ 7.07	n = 42	74.31 $\pm$ 14.25	0.20
Ejection fraction < 40, relative risk				1.99	
n (%)	n = 52	5 (9.6)	n = 47	9 (19.1)	0.17
<b>Location and vessel involvement</b>					
Location	n = 51		n = 48		
Anterior/anteroseptal, n (%)		11 (21.6)		16 (33.3)	
Anterolateral, n (%)		2 (3.9)		3 (6.2)	
Inferior/inferoposterior, n (%)		33 (64.7)		20 (41.7)	
Lateral, n (%)		5 (9.8)		9 (18.7)	
Culprit vessel, n (%)	n = 51		n = 48		0.28
LM		0		0	
RCA		31 (60.8)		22 (45.8)	
LAD		13 (25.5)		19 (39.6)	
LCx		7 (13.7)		7 (14.6)	
Non-culprit vessel stenosis $\geq$ 50%, n (%)	n = 32		n = 32		
RCA		7 (33.3)	n = 26	16 (61.5)	0.05
LAD		18 (47.4)	n = 29	17 (58.6)	0.36
LCx		16 (36.4)	n = 41	18 (43.9)	0.48
<b>Patient outcomes</b>					
Symptom onset to FMC (min), mean $\pm$ SE	n = 41	189.71 $\pm$ 70.18	n = 44	530.00 $\pm$ 143.53	0.02
Time to EKG (min), mean $\pm$ SE	n = 38	7.66 $\pm$ 2.31	n = 35	8.26 $\pm$ 2.54	0.81
Door to balloon (min), mean $\pm$ SE	n = 50	56.78 $\pm$ 5.65	n = 46	53.67 $\pm$ 3.43	0.73
FMC to balloon (min), mean $\pm$ SE	n = 50	89.14 $\pm$ 5.55	n = 42	90.02 $\pm$ 6.49	0.99

Hospital LOS (days), mean $\pm$ SE	<i>n</i> = 52	4.40 $\pm$ 0.88	<i>n</i> = 47	4.57 $\pm$ 0.50	0.87
Cardiogenic shock, relative risk				1.81	
<i>n</i> (%)	<i>n</i> = 52	3 (5.8)	<i>n</i> = 48	5 (10.4)	0.23
In-hospital MACE (death, MI, cardiac arrest, stroke), relative risk				2.49	
<i>n</i> (%)	<i>n</i> = 52	8 (15.4)	<i>n</i> = 47	18 (38.3)	0.01
MACE < 14 d from admission, relative risk				3.03	
<i>n</i> (%)	<i>n</i> = 52	8 (15.4)	<i>n</i> = 45	21 (46.7)	< 0.001

SE: Standard error; LM: Left main; RCA: Right coronary artery; LAD: Left anterior descending; LCx: Left circumflex; FMC: First medical contact; EKG: Electrocardiogram; MACE: Major adverse cardiac events; LOS: Length of stay; COVID: Coronavirus disease.

which was reflected by the significantly higher symptom onset to FMC time in the COVID-19 group.

Although we noticed significantly delayed presentation of patients with STEMI and higher MACE during the COVID-19 pandemic, we found that STEMI clinical performance and quality measures were maintained at the system level despite following extra infection protocol measures.

Our study has inherent limitations of a retrospective study and moreover the small sample size limits generalization of our results. While we could expect the time from symptom onset to FMC to hold, we should be cautious in assuming that the degree of delay and clinical outcomes can be generalized to healthcare facilities globally.

## CONCLUSION

This study provides insight into quality control and performance metrics of an acute medical condition like STEMI during the unprecedented pandemic that has largely affected every aspect of healthcare. At our academic institute, we found that there is a delay in STEMI patients seeking medical attention during the COVID-19 pandemic which could be translating into worse clinical outcomes. Our study allows for an early experience of how this pandemic could affect treatment of acute medical conditions like STEMI.

## ARTICLE HIGHLIGHTS

### Research background

Treatment of time sensitive medical conditions like ST elevation myocardial infarction (STEMI) could have been adversely affected during the coronavirus disease 2019 (COVID-19) pandemic. This could be due to fear of contracting COVID-19 in the hospital setting, along with healthcare challenges such as lack of personal protective equipment and shifting policies on rapid COVID-19 testing in these acutely sick patients. All of these factors could prolong symptom onset to first medical contact (FMC) and FMC to balloon times. Prolonged time to coronary reperfusion has been shown to be related to increased mechanical complications and worse outcomes.

### Research motivation

Currently no data from an academic United States institute exist on STEMI performance measures such as time to electrocardiogram, FMC to balloon, etc. during the current pandemic. There is also lack of STEMI outcomes data during the pandemic which could have been adversely affected.

### Research objectives

We evaluated STEMI performance benchmarks and clinical outcomes of all patients who presented to our facility during the COVID-19 pandemic. These were compared to the same time cohort from 2019. Knowing, whether these standards are preserved currently during the pandemic is critical as it allows us to further investigate the mechanistic aspect of it and offer solution.

**Research methods**

All patients who presented to our facility with STEMI during the pandemic were compared to a matched cohort from 2019. STEMI with unknown time of symptom onset and inpatient STEMI patients were excluded. Primary outcome was major adverse cardiac events (MACE) in-hospital and up to 14 d after STEMI, including death, myocardial infarction, cardiac arrest, or stroke. Significant differences among groups for continuous variables were tested through ANOVA, using SYSTAT, version 13. Chi-square tests of association were used to compare patient characteristics among groups using SYSTAT. Relative risk scores and associated tests for significance were calculated for discrete variables using MedCalc (MedCalc Software, Ostend, Belgium).

**Research results**

Symptom onset to FMC time interval was significantly longer in the COVID-19 group ( $P < 0.02$ ) when compared to 2019 cohort. Time to first electrocardiogram, door-to-balloon time, and FMC to balloon time were not significantly affected. The right coronary artery was the most common culprit for STEMI in both the cohorts. Over 60% of patients had one or more obstructive ( $> 50\%$ ) lesion(s) remote from the culprit site. In-hospital and 14 d MACE were more prevalent in the COVID-19 group ( $P < 0.01$  and  $P < 0.001$ ).

**Research conclusions**

This single academic center study conducted in the United States during the current pandemic reports longer time interval from symptom onset to first medical contact in patients presenting with STEMI. This is likely resulting in worse MACE outcomes when compared to the pre-COVID era as reflected from this report.

**Research perspectives**

Although a 'randomized control study' to assess the potential adverse impact on STEMI outcomes during the pandemic is not practical, our study provides observations from a teaching center during the 'natural experiment' conditions created by the current pandemic. Our findings suggest a need for data from bigger studies to confirm our study's pattern and outcomes.

---

**ACKNOWLEDGEMENTS**

---

We would like to thank Mr. Habeeb F Kazimuddin, Erin Wallace, Patrick Jones and Matthew McCurdy, do for their assistance gathering data.

---

**REFERENCES**

---

- 1 **Mahmud E**, Dauerman HL, Welt FGP, Messenger JC, Rao SV, Grines C, Mattu A, Kirtane AJ, Jauhar R, Meraj P, Rokos IC, Rumsfeld JS, Henry TD. Management of Acute Myocardial Infarction During the COVID-19 Pandemic: A Position Statement From the Society for Cardiovascular Angiography and Interventions (SCAI), the American College of Cardiology (ACC), and the American College of Emergency Physicians (ACEP). *J Am Coll Cardiol* 2020; **76**: 1375-1384 [PMID: 32330544 DOI: 10.1016/j.jacc.2020.04.039]
- 2 **American Hospital Association**. Fast Facts on U.S. Hospitals, 2020. March 2020. [cited 12 December 2020]. Available from: <https://www.aha.org/statistics/fast-facts-us-hospitals>
- 3 **The New York Times**. Five Ways to Monitor the Coronavirus Outbreak in the U.S. April 26, 2020. [cited 12 December 2020]. Available from: <https://www.nytimes.com/interactive/2020/04/23/upshot/five-ways-to-monitor-coronavirus-outbreak-us.html>
- 4 **Tam CF**, Cheung KS, Lam S, Wong A, Yung A, Sze M, Lam YM, Chan C, Tsang TC, Tsui M, Tse HF, Siu CW. Impact of Coronavirus Disease 2019 (COVID-19) Outbreak on ST-Segment-Elevation Myocardial Infarction Care in Hong Kong, China. *Circ Cardiovasc Qual Outcomes* 2020; **13**: e006631 [PMID: 32182131 DOI: 10.1161/CIRCOUTCOMES.120.006631]
- 5 **Garcia S**, Albaghdadi MS, Meraj PM, Schmidt C, Garberich R, Jaffer FA, Dixon S, Rade JJ, Tannenbaum M, Chambers J, Huang PP, Henry TD. Reduction in ST-Segment Elevation Cardiac Catheterization Laboratory Activations in the United States During COVID-19 Pandemic. *J Am Coll Cardiol* 2020; **75**: 2871-2872 [PMID: 32283124 DOI: 10.1016/j.jacc.2020.04.011]



Published by **Baishideng Publishing Group Inc**  
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

**Telephone:** +1-925-3991568

**E-mail:** [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)

**Help Desk:** <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

