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Impact of COVID-19 on acute coronary syndrome-related hospitalizations: A pooled analysis

The COVID-19 pandemic has completely changed the way health care can be delivered to the patients worldwide. The unprecedented surge in the infection rate led policymakers to containment measures ranging from social distancing to complete lockdown to contain the disease. However, nothing comes without paying a cost. These measures themselves have completely changed the delivery and acceptance of health care from the provider and patients' perspective respectively. The impact of this shift can be seen clearly by the sudden change in the incidence of cardiovascular emergencies during pre-COVID-19 compared to the COVID-19 duration.

Reports from various part of the world like Europe and the United States (USA) have suggested a substantial decline in hospitalizations for acute myocardial infarction (AMI)/acute coronary syndrome (ACS). Upcoming studies suggest a reduced admission rate for both ST-segment elevation myocardial infarction (STEMI) and non–ST-segment elevation myocardial infarction (NSTEMI) [1–3]. There are various factors assumed behind this decline. The major hypothesis is patients' reluctance to seek medical attention owing to the fear of contracting coronavirus infection during their hospital visit. Although, after the first wave infection-rates declined in some parts of the world, these are increasing currently in some parts of Europe like the Netherlands, Belgium, France, Italy and the United Kingdom (UK). The ACS-related hospitalization rate of decline varies over the world. Existing reports suggest an estimated 38–40% reduction in cardiac catheterization laboratory STEMI activation [4].

To have a clear insight into the impact of COVID-19 on a large-scale, we sought to evaluate how large is the ACS-related hospitalization Incidence rate ratio (IRR) reduction during the pandemic and also whether there are subgroups with larger or smaller IRRs using the published literature. We searched PubMed/Medline, Web of Science and SCOPUS until September 29th, 2020 using keywords "COVID-19, SARS-CoV-2,2019-nCov, Acute coronary syndrome, Cardiac Catheterization, ACS, Myocardial infarction, MI, STEMI, NSTEMI, ST-Segment-Elevation, Reduced, Reduction, Decrease, Decline". Our search identified 1570 studies in total. After title screening and removing the duplicates, there were 63 studies for further screening. A full-text screening of 63 studies was performed. Also, 2 studies were searched from reference search. Finally, 38 studies were included in the final analysis list and characteristics of the studies included in the paper are given in Supplementary Table 1. Only studies reporting comparison of ACS hospitalization rates in 2020 to the previous year, or were defining such comparison in the form of a pre-pandemic with a pandemic period were included. Case reports and reviews articles were excluded. Microsoft Excel was used for the analyses. First, we calculated the Log rate of hospitalization per day and the standard error of the log rate of hospitalization. Then we calculated the Log incidence rate ratio (IRR) and standard error of Log (IRR). From the IRR of individual studies, we calculated the Pooled log (IRR) by random-effects meta-analysis and then calculated IRR by anti-log transform. Percentage reduction in the ACS related hospitalization was (1-IRR) with a 95% confidence interval.

A total of 38 studies comprised of 161,663 patients in pre-COVID-19 period and 84,947 patients during COVID-19 duration were incorporated in this analysis. Of these, 22 studies were from Europe, 8 from the USA, 3 China, 2 UK and 1 each from Canada and Australia. Pooled incidence rate ratio (95% CI) for ACS-related hospitalization was 0.73 (0.72–0.73) (Table 1). On country-wise subgroup analysis, the pooled IRR for Europe was 0.65 (0.64–0.70) whereas for the USA it was 0.76 (0.76–0.77). During the COVID-19 period, a 27.3% of reduction in ACS related hospitalizations was reported globally and 34.6% and 23.5% in Europe and the USA respectively. Besides, IRR for STEMI was 0.74 (0.73–0.75), NSTEMI was 0.73 (0.71–0.75) and unstable angina was 0.44 (0.42–0.46). Gender-wise comparison demonstrated that the IRR for ACS-related hospitalizations was 0.78 (0.77–0.80) for males and 0.75 (0.73–0.76) for females.

This pooled analysis of the impact of the COVID-19 pandemic on ACS-related hospitalization has some important findings. Firstly, there was an overall decline of 27% in the ACS-related hospitalizations during the pandemic period. Secondly, a gender-related decline in admission has been reported as well. Furthermore, a decline in the ACS-related hospitalization was noticed in all geographical regions across the globe. However, the decline in the European region was higher compared to the USA. According to the existing reports, a decline of more than 40% has been reported for ACS related hospitalization from various small series of studies [1,2,4–7]. Several potential reasons have been sought in the existing studies towards these findings, which indicated the reluctance from the patients to visit hospitals to avoid the risk of COVID-19 exposure could be the major contributor to the observed decline in admissions. In addition, stay home campaigning to contain the infection from the government and media would have delayed the presentation to the hospital for acute cardiovascular conditions. Not seeking the medical attention in acute cardiovascular conditions could lead to life-threatening consequences. For example, a sudden surge in out of hospital cardiac arrest (OHCA) has been reported from the various part of the world during the COVID-19 pandemic [8–10]. Furthermore, Gluckman et al reported that patients hospitalized during the pandemic period were 1 to 3 years younger [11]. This could hint towards another possibility namely that the geriatric population might be taking fewer visit compared to the younger population. The rate of decline was more pronounced in the European region compared to the USA which need to be further explored.

Table 1

Comparison of Hospital Admissions for Acute Coronary Syndrome (ACS) in Covid-19 Outbreak period compared to the pre-COVID period.

	Incidence rate ratio (IRR) (95% CI)	SE	Percentage reduction
ACS	0.73 (0.72–0.73)	0.0035	27.3%
ACS Subgroup			
STEMI	0.74 (0.73–0.75)	0.0077	25.9%
NSTEMI	0.73 (0.71–0.75)	0.0139	26.9%
Unstable angina	0.44 (0.42–0.46)	0.0232	56.1%
Gender			
Male	0.78 (0.77–0.80)	0.0097	21.6%
Female	0.75 (0.73–0.76)*	0.0102	25.5%
Country			
USA	0.76 (0.76–0.77)	0.003	23.5%
Europe	0.65 (0.64–0.70)*	0.022	34.6%

SE = standard error; ACS = acute coronary syndrome; STEMI = ST-segment elevation myocardial infarction; NSTEMI = non-ST segment elevation myocardial infarction; IRR has been rounded off to 2 decimal point, hence percentage reduction will not be exactly (1-IRR)*100; *$p < 0.05$.

Furthermore, this drastic decline in the encounters for ACS in the pandemic period could be an alarm towards the possible intensified influx of patients after the normalization of the COVID-19 situation and potentiation of long-term post-MI related complications like heart failure, cardiogenic shock and other infarct related mechanical complications in high-risk ACS patients. Gluckman and colleagues interestingly reported that the early decline in the rate of ACS hospitalizations was followed by a steady increase in the AMI-related cases in the late COVID-19 phase with a lower survival rate. Thus, with a growing concern regarding the uncertainty of successful vaccine development and the second wave, it is critical to address declining admissions for ACS and strengthen screening measures utilizing advancing telemedicine to provide timely care to high-risk ACS/AMI patient patients amid this pandemic.

Declaration of Competing Interest

The authors report no relationships that could be construed as a conflict of interest.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcha.2021.100718.

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