Status of Acute Myocardial Infarction in Southern India During COVID-19 Lockdown: A Multicentric Study

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Abstract

There has been a reduction in the reported cases of acute myocardial infarction (MI) across the globe during the outbreak of coronavirus disease 2019 (COVID-19) (severe acute respiratory distress syndrome coronavirus 2). An attempt was made to find out the number of acute MI cases treated during the COVID-19 lockdown period (April 2020) and highlight the possible reasons for the changes in the occurrence. A multicentric retrospective observational study was performed to collect the selected data from 12 private hospitals distributed in 4 cities—Madurai, Trichy (Thiruchirapalli), Erode, and Salem—of the Tamil Nadu state in southern India. There was a significant ($P < .001$) reduction in ST-segment elevation MI (STEMI), non-STEMI (NSTEMI), and total (STEMI and NSTEMI together) cases during the lockdown period (April 1 to 30, 2020) as compared with no-lockdown periods such as January and February 2020 and April 2019 and April 2018 in all cities, whereas the reduction was not significant for NSTEMI in Trichy when data for the lockdown period was compared with those for January and February 2020. Overall, there is a reduction in acute MI cases, which may be due to alterations in modifiable risk factors during the COVID-19 lockdown period. Hence, implementation of public education and polices on controlling modifiable risk factors is likely to pay dividends.

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January, February, and April 2020 as well as for April 2019 and April 2018. These data were classified as lockdown period (April 2020) and no-lockdown period (January and February 2020 and April 2019 and April 2018). Apart from that, the total number of cases presented to the emergency department of the respective hospitals was collected for the same period. The number of STEMI, NSTEMI, and total (STEMI and NSTEMI) cases treated during the COVID-19 lockdown period (April 2020) was compared with similar cases treated in the no-lockdown period by using the chi-square test. The 95% CI for the difference in proportion was calculated for each. A *P* value less than .05 was considered statistically significant. The statistical analysis was performed using R software version 4.0.0 (The R Foundation). Data for March 2020 were not considered, as they were a mixture for both no-lockdown and lockdown periods.

**RESULTS**

The median age of patients admitted during the lockdown and no-lockdown periods was 58 and 53 years, respectively. The sex ratio of male and female was 7:2, and there was no significant difference among them. Details of city-wise cases of acute MI and emergency department attendance are given in Table 1. The overall number of STEMI, NSTEMI, and total (STEMI and NSTEMI) cases treated during the COVID-19 lockdown period (April 2020) was compared with similar cases treated during the no-lockdown period of January and February 2020 and April 2019 and April 2018 independently of each. It was observed that cases treated during the COVID-19 lockdown period were significantly (*P* < .001) lower than those treated during the no-lockdown period irrespective of the months. The proportion of cases, *P* value, and 95% CI for the difference in proportion for STEMI, NSTEMI, and total (STEMI and NSTEMI) cases for each city and overall (all cities together) were calculated. The statistical data on acute MI cases treated during the COVID-19 lockdown and no-lockdown periods (city-wise and overall) are given in Table 2. The subanalysis for each city individually for STEMI, NSTEMI, and total cases treated during the COVID-19 lockdown period (April 2020) was significantly (*P* < .001) lower in Madurai, Erode, and Salem than that during the no-lockdown period. For Trichy, a significant reduction (*P* < .001) was noticed for STEMI and total cases during the lockdown period compared with the no-lockdown period whereas for NSTEMI cases the reduction was significant for only April 2020 compared with April 2019 and April 2018. When the NSTEMI data for April 2020 were compared with those for January and February 2020, the *P* value (95% CI) and difference in proportion were 0.153 (0.01 to 0.08) and 0.03 and 1.00 (0.04 to 0.04) and 0.002, respectively. Furthermore, when the statistical analysis was performed with pooled data for all cities for STEMI, NSTEMI, and total, there was a significant reduction in these cases (Table 2). The difference in proportion of acute MI cases treated during the COVID-19 lockdown and no-lockdown periods for each city is depicted in the Figure.

| Name of the city | No. of hospital(s) | Lockdown period | No-lockdown period |
|------------------|--------------------|-----------------|--------------------|
|                  |                    | April 2020      | Feb 2019 Jan 2019  |
|                  |                    | S  N  ET        | S  N  ET          |
| Madurai          | 2                  | 63  81 1416     | 155 203 2214 205 239 2786 |
| Trichy           | 1                  | 16  34 385      | 55  43 478 87 59 489 |
| Erode            | 4                  | 18  39 765      | 114 78 638 178 112 694 |
| Salem            | 5                  | 24  29 865      | 121 80 738 179 103 732 |
| Total            | 12                 | 121 183 3431    | 445 404 4068 649 513 4701 |

ET = total number of patients attended the emergency department; N = non-ST-segment elevation myocardial infarction; S = ST-segment elevation myocardial infarction.
TABLE 2. Statistical Data on Acute Myocardial Infarction Cases Treated During COVID-19 Lockdown and No-Lockdown Periods (City-wise Overall)

| Variable                  | City name   | STEMI  | NSTEMI | Total (STEMI and NSTEMI) |
|---------------------------|-------------|--------|--------|--------------------------|
|                           |             | p1     | p2     | 95% CI | P value | p1     | p2     | 95% CI | P value  |
| STEMI (Apr 2020 vs Feb 2020) | Madurai     | 0.04   | 0.07   | 0.01-0.04 | <.001 | 0.02   | 0.09   | 0.02-0.05 | <.001 |
| STEMI (Apr 2020 vs Jan 2020) |             | 0.04   | 0.07   | 0.01-0.04 | <.001 | 0.06   | 0.09   | 0.01-0.05 | <.001 |
| STEMI (Apr 2020 vs Apr 2019) |             | 0.04   | 0.09   | 0.03-0.06 | <.001 | 0.06   | 0.09   | 0.01-0.05 | .001 |
| STEMI (Apr 2020 vs Apr 2018) |             | 0.04   | 0.11   | 0.05-0.09 | <.001 | 0.06   | 0.10   | 0.02-0.06 | <.001 |
| STEMI (Apr 2020 vs Feb 2020) | Trichy      | 0.04   | 0.12   | 0.04-0.11 | <.001 | 0.09   | 0.09   | 0.04-0.04 | 1.000 |
| STEMI (Apr 2020 vs Jan 2020) |             | 0.04   | 0.18   | 0.09-0.18 | <.001 | 0.09   | 0.12   | 0.01-0.08 | .153 |
| STEMI (Apr 2020 vs Apr 2019) |             | 0.04   | 0.24   | 0.15-0.24 | <.001 | 0.09   | 0.16   | 0.03-0.12 | .002 |
| STEMI (Apr 2020 vs Apr 2018) |             | 0.04   | 0.24   | 0.15-0.25 | <.001 | 0.09   | 0.14   | 0.02-0.09 | .041 |
| STEMI (Apr 2020 vs Apr 2018) | Erode       | 0.02   | 0.18   | 0.12-0.19 | <.001 | 0.05   | 0.12   | 0.04-0.10 | <.001 |
| STEMI (Apr 2020 vs Apr 2020) |             | 0.02   | 0.26   | 0.20-0.27 | <.001 | 0.05   | 0.16   | 0.08-0.14 | <.001 |
| STEMI (Apr 2020 vs Apr 2020) |             | 0.02   | 0.26   | 0.20-0.27 | <.001 | 0.05   | 0.16   | 0.08-0.14 | <.001 |
| STEMI (Apr 2020 vs Apr 2019) |             | 0.02   | 0.27   | 0.21-0.28 | <.001 | 0.05   | 0.15   | 0.07-0.13 | <.001 |
| STEMI (Apr 2020 vs Apr 2020) | Salem       | 0.03   | 0.16   | 0.11-0.17 | <.001 | 0.03   | 0.11   | 0.05-0.10 | <.001 |
| STEMI (Apr 2020 vs Apr 2020) |             | 0.03   | 0.24   | 0.18-0.25 | <.001 | 0.03   | 0.14   | 0.08-0.14 | <.001 |
| STEMI (Apr 2020 vs Apr 2020) |             | 0.03   | 0.23   | 0.17-0.24 | <.001 | 0.03   | 0.16   | 0.09-0.15 | <.001 |
| STEMI (Apr 2020 vs Apr 2019) |             | 0.03   | 0.25   | 0.19-0.26 | <.001 | 0.03   | 0.14   | 0.08-0.13 | <.001 |
| STEMI (Apr 2020 vs Apr 2020) | Overall     | 0.04   | 0.11   | 0.06-0.09 | <.001 | 0.03   | 0.10   | 0.03-0.06 | <.001 |
| STEMI (Apr 2020 vs Apr 2020) |             | 0.04   | 0.14   | 0.09-0.11 | <.001 | 0.05   | 0.11   | 0.04-0.07 | <.001 |
| STEMI (Apr 2020 vs Apr 2019) |             | 0.04   | 0.15   | 0.11-0.13 | <.001 | 0.05   | 0.12   | 0.05-0.08 | <.001 |
| STEMI (Apr 2020 vs Apr 2018) |             | 0.04   | 0.18   | 0.13-0.16 | <.001 | 0.05   | 0.12   | 0.05-0.08 | <.001 |

COVID-19 = coronavirus disease 2019; NSTEMI = non-ST-segment elevation myocardial infarction; Overall = all cities together; p1 = proportion of cases treated during the COVID-19 lockdown period; p2 = proportion of cases treated in the no-lockdown period; STEMI = ST-segment elevation myocardial infarction; CI = confidence interval; Apr = April; Feb = February; Jan = January.

DISCUSSION

Cardiovascular disease is the major cause of mortality and morbidity across the globe. Although the burden of cardiovascular disease has declined in some regions, overall there was no change globally as reported in a multicentric prospective cohort study over the period from 1990 to 2015.6 Risk factors for cardiovascular disease are already well known. Extreme temperature, change in weather condition, and air pollution have been found to be associated with an increased risk of MI.7-9 The toxic effect of pollutants has been found to be higher during summer, thereby increasing the risk of cardiopulmonary diseases.10,11 In Tamil Nadu, this study was conducted in the month of April, which is summer with daytime temperature generally above 30°C and nighttime temperature going down up to 25°C.

During the COVID-19 lockdown period, cases of injuries, infections, illnesses related to behavior, and so on, have reduced in private and government hospitals in the state of Tamil Nadu. In this study, we are limiting to acute MI only. From Table 1, it is clear that the number of cases treated for acute MI was almost consistent during the no-lockdown period of 2020 (January and February) as well as April 2019 and April 2018, whereas it was significantly lower in all the cities during the lockdown period. A similar significant reduction in MI admissions during the lockdown period was noted in recent publications.12-14 Although the reasons remain unclear, we attribute various factors such as unwillingness to visit hospital owing to fear of COVID-19 infection4,12; reduced noise13 and air pollution,14,15 reduction in occupational stress in the susceptible population, and avoidance of travel; least or no exposure to tobacco smoke, alcohol, pollution, and junk foods; adherence to relaxation and recreation via audio-visual means, integration with family members, engaging in activities of interest, long hours of...
sleep, and practicing exercise, yoga, and meditation; limiting to homemade food items, adoption to healthy lifestyle, and overall less physical and mental strain. Moreover, during the lockdown, the pollution index has significantly decreased in India\textsuperscript{14} and many other nations\textsuperscript{15} which has a direct relationship with MI.

In summary, the reduction in the number of cases of acute MI during the lockdown period may be due to alterations in modifiable risk factors. Hence, implementation of public education and policies on controlling modifiable risk factors will pay dividends. However, we do not have a city-based registry for acute MI at the moment to state confidently on population-based MI or out-of-hospital deaths due to MI or missed MI due to avoidance of hospital by the public during this COVID-19 pandemic\textsuperscript{1,16} More studies from different cities are warranted to ascertain the changing epidemiology of illnesses during the pandemic and find out the health advantages of containment activities. During World War II, there was a dramatic reduction in mortality from vascular diseases,\textsuperscript{17} which suggested a link for the low occurrence of certain diseases in extraordinary situations such as health crisis or war.

It is the time for the physicians to act in concert with clinical equipoise\textsuperscript{18} and find out the reasons for the change in the epidemiology of various illnesses during the COVID-19 outbreak in an unprejudiced manner. These new findings likely pave ways for the prevention of illnesses and find out new methods toward the promotion of health. Also, it is mandatory to educate the public to seek medical attention for worrying symptoms and encourage them for adherence to safety precautions for COVID-19.\textsuperscript{19} As the fear of
COVID-19 is a major deterrent for emergency visits, hospitals shall develop community-minded communications to provide risk-free and reassuring environment for patients. The limitations of the study are retrospective and confining to a few selected centers located in a few cities.

CONCLUSION

The number of acute myocardial infarction cases was decreased during COVID-19 lockdown in our study population, as noted elsewhere. There are many reasons for the change in occurrence including patient’s deferral to seek medical attention because of fear of the infection of COVID-19. Hence, mandatory public health education and reassurance are required to prevent mortality from life-threatening illness. In addition, promotion of tele or virtual health consultation is required during such crisis. Also, reduction in the environmental risk factors may be a reason for the reduced occurrence of MI and hence, policies on the environmental health are regulated and monitored periodically.

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