COVID-19 pandemic: preventing hospital myocardial infarction admissions or preventing acute myocardial infarction altogether?

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The COVID-19 pandemic has been a game changer worldwide, including for healthcare organisation, whatever the healthcare system in use. Understanding how it has impacted acute medical conditions such as acute myocardial infarction (AMI) and their management is of major importance for the future.

Since the beginning of the pandemic, numerous reports have described a decrease in the number of hospital admissions for AMI. The present meta-analysis by Rattka and colleagues summarises the data reported up to August 2020 on admissions and in-hospital mortality for ST-segment elevation myocardial infarction (STEMI) during the pandemic.[1] Ten studies were included, 2 from China and the rest from European countries. Overall, baseline characteristics did not differ between patients admitted in the pre-COVID era and during the first wave of the pandemic. A 25% reduction in daily admissions for STEMI was observed. Time from symptom onset to first medical contact remained unchanged, while door-to-balloon times, when reported, increased. The decrease in hospital admissions for STEMI was remarkably constant (around 25%), except for two small, single-centre series in Italy. Compared with the pre-COVID period, mortality in STEMI patients admitted during the pandemic was essentially unchanged.

Since last August, we and others reported similar findings,[2–5] and similar trends have been described for stroke.[6] In a survey including 21 hospitals in France and comparing data from the 4 weeks before institution of the nationwide lockdown and the 4 weeks following the date of the lockdown, we found a 24% decrease in STEMI admissions, similar baseline characteristics, similar use of reperfusion therapy and numerically higher but not significantly different in-hospital mortality. In England, however, percutaneous coronary intervention (PCI) was less frequently used at the acute stage in patients admitted during the pandemic.[4] Of note, the decrease in AMI admissions was found whatever the local prevalence of COVID-19.[2 7]

The reasons for this striking and, because of the consequences of COVID-19 on the endothelium,[8] somewhat counterintuitive worldwide decrease in hospital admissions for AMI during the pandemic are speculative. Two main causes are likely to have concurred in this general trend.

First, there may have been a true reluctance of the patients to be hospitalised during the COVID-19 period for symptoms suggestive of AMI, for fear of getting infected, for fear of disturbing overwhelmed medical personnel or both.[7] In support of this hypothesis is the fact that, when both types of AMI were studied, hospital admissions for STEMI decreased less than admissions for non-ST-elevation myocardial infarction (NSTEMI), a condition usually generating less intense and therefore less 'frightening' symptoms.[2 4 5] In our survey, we observed a 35% decrease in NSTEMI admissions compared with a 24% decrease in STEMI admissions; also, the decrease was more marked (−36%) in patients 80 years of age or more, who were more likely to fear contact with infected patients if hospitalised.[2] If true, this explanation would imply that a number of patients with AMI stayed at home, with the inherent risk of this behaviour. In fact, a survey of out-of-hospital cardiac arrests in the Paris area before and after institution of the lockdown in France showed an increase in cardiac arrests during the lockdown period.[9] Of note, however, this increase was limited to the first 2 weeks of the lockdown, whereas the decrease in AMI admissions appeared constant during the first 4 weeks (figure 1), and other causes of cardiac arrest, such as pulmonary embolism, which is a known complication of COVID-19, may have been present. In other words, the increase in out-of-hospital cardiac arrests did not directly mirror the decrease in AMI admissions.

The second hypothesis is that the decrease in AMI admissions reflected an

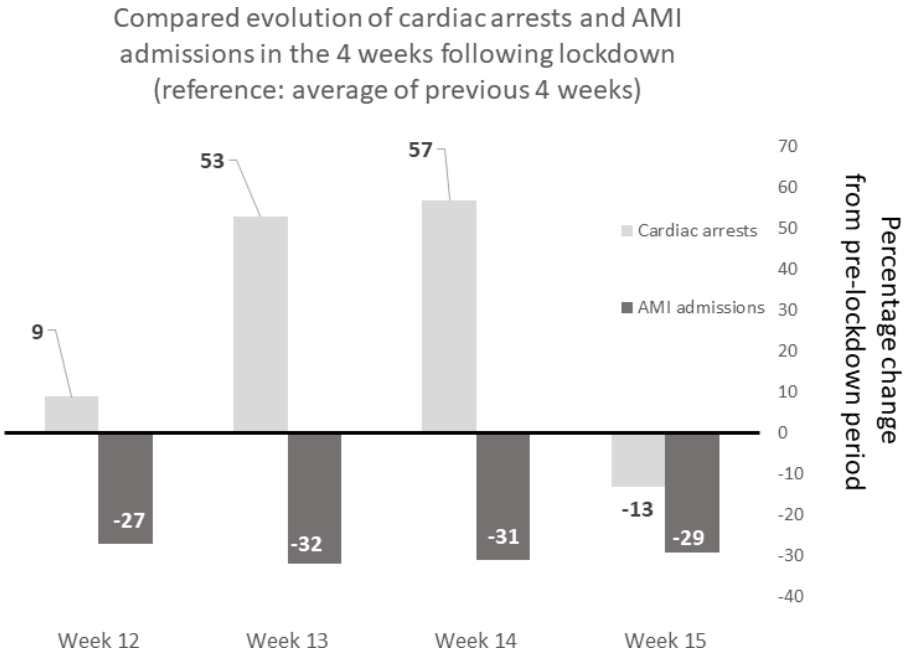

Figure 1 Compared evolution of cases of out-of-hospital cardiac arrests in the greater Paris area and of hospital admissions for AMI in a network of 21 French hospitals following initiation of the nationwide lockdown in France. The reference value is the average of cases or admissions in the 4 weeks preceding the lockdown. Source references: Messnier *et al*[2] and Marijon *et al*[9]. AMI, acute myocardial infarction.

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authentic decrease in the occurrence of acute coronary syndromes. Indeed, the lockdown may have had an impact on triggers of AMI, such as physical activity, air pollution, or acute stress and in particular work-related stress.[10] In fact, the general lockdown in France had a near-immediate effect on pollutants such as air particulate matters.[11] Conversely, other forms of psychological stress, such as its economic or direct financial consequences, might have been caused by the pandemic.

In reality, it is likely that both explanations may have contributed in the decrease in hospital admissions for AMI.

Only the future will tell us what has been the predominant mechanism: in the coming months, we will be able to determine whether the decrease in AMI admissions has persisted throughout the lockdown/stay-at-home periods and if there has been a form of rebound phenomenon at the end of these periods. Previous epidemiological observations have documented the importance of specific environmental circumstances that prematurely triggered acute cardiac events. As an illustration, the 1994 Northridge earthquake in Los Angeles, which occurred in the middle of the night, provoked a brutal increase in acute events in the following hours; in the following days, however, the number of events were lower than usual, suggesting that the earthquake simply precipitated events that would have occurred anyway, but a few days later.[12] Here, the period of lockdown might have prevented events to occur, and if so, a catch-up phenomenon should be observed after the end of the lockdown period; this has been described for patients with STEMI in Israel.[3] To date, however, there is no robust evidence that this is generally the case. Conversely, if the decrease was primarily due to fear of getting admitted in patients actually having had an AMI, we should observe an unusually increased rate in late complications potentially related to larger myocardial infarctions caused by the lack of appropriate management at the acute stage (eg, congestive heart failure or ventricular arrhythmias).

Whatever the case, we will likely learn quite a lot from this unheard-of epidemic. Meanwhile, it is important to deliver public health messages to the general population, to encourage them to react proactively in the case of symptoms potentially reflecting the onset of a heart attack.

Finally, the good news is that there was no apparent increase in early mortality in those patients who were admitted for AMI. Although in some instances time to primary PCI (door-to-balloon time) may have been longer that usual, this does not seem to have impacted early outcomes; it is possible that with the constant progress in the acute management of AMI over the recent years, losing a few minutes before reopening the culprit artery may have had little, if any, impact on mortality, as previously shown by Menees *et al* in an analysis of mortality trends in relation to door-to-balloon times in a large US registry of patients with STEMI.[13] Obviously though, this should not be viewed as an encouragement to accept delays in reperfusion therapy at the acute stage of STEMI.

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