



COVID-19 pandemic: usefulness of telemedicine in management of arrhythmias in elderly people

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In March 2020, the WHO defined the diffusion of novel coronavirus, Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) as pandemic.^[1–3] As a consequence, the Italian Government among others has enforced quarantine on the population to contain the diffusion of the infection. Quarantine refers to the separation of communities who have been exposed to an infectious disease.^[1–3] Elderly people's lives have been drastically affected by the lockdown and the fear related to the disease's potential effects and transmission. Fear of contracting COVID-19 is on the rise due to the death toll and alarming news reports in the media.^[2,3]

Quarantine is associated with several emotional disorders: depression, stress, sleep disorders, low mood, irritability, and, in the long term, post-traumatic stress.^[1–3] Moreover, elderly people are worried about the possibility of contracting the infection and the closure of schools and businesses, has exasperated this negative feeling. The previous experience on people quarantined as a result of having been in close contact with those who potentially have SARS, reported various negative responses: over 20% (230 out of 1057) reported fear, 18% (187) reported nervousness, 18% (186) reported sadness, and 10% (101) reported guilt. Few reported positive feelings: 5% (48) reported feelings of happiness and 4% (43) reported feelings of relief.^[1–3]

The aim of the present commentary is to analyze the potential impact of quarantine-induced stress on the development of arrhythmias and the usefulness of telemedicine in the management of events in elderly people.

Sudden catastrophic events, i.e., earthquake are associated with an increase in sudden cardiac deaths.^[4] Research shows that stress and anxiety act as a trigger for ventricular

arrhythmias, which are found to have increased significantly after an earthquake.^[4]

The acute stress response of an integrated cascade of physiological reactions has been well described. On contrary, little is known about chronic stress and arrhythmias. Quarantine induced a chronic stress, similar to that affecting workers during a major economic recession. Social isolation and loneliness accounted for more than 30% of the excess risk of mortality attributed to a 6.5 year follow-up period.^[5] In addition, an economic crisis and unhealthy behaviors contribute to increased health risk, with socially isolated and elderly individuals having a higher risk of developing depression.^[3,5] Stress activates the sympathetic system and induces a neuroendocrine dysregulation (i.e., hypothalamus–pituitary–adrenal responses); which might precipitate the occurrence of arrhythmias. Moreover, anxiety and panic attacks may induce symptoms that can mimic an arrhythmia, specifically a paroxysmal tachycardia or atrial fibrillation. Stress and anger may induce both sustained ventricular and atrial tachyarrhythmias.^[4–6]

Psychosocial factors contribute to an increase in the arrhythmic risk, as found by a systematic review of the literature, with 92% of 96 studies indicating a positive correlation between stressful psychosocial factors and arrhythmias.^[4,6]

COVID-19 outbreak, stress, atherosclerosis and immune function

Stress is a major factor that can alter the immune system. During the lockdown due to the pandemic, a huge number of elderly persons have developed relevant signs of psychological suffering, that can significantly affect the capacity of the organism to react to external stimuli like those represented by microorganisms. It has been known for a long

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time that the immune response is regulated by soluble factors which include not only numerous cytokines and chemokines, but also a large number of hormones and neurotransmitters, whose receptors are found both on cells of innate and acquired immunity. Among these molecules, glucocorticoids play a fundamental role, and are responsible for a variety of immunological effects. Psychological stress, as well as several proinflammatory cytokines, acts at the hypothalamus level, provoking the production and release of corticotropin-releasing hormone (CRH) and arginine vasopressin (AVP) that, in turn, induce the anterior pituitary gland to synthesize adrenocorticotropin hormone (ACTH), which is able to stimulate steroidogenesis in adrenocortical cells.^[5,6] This is crucial to give origin to cortisol, the main corticosteroid. In turn, glucocorticoids trigger a negative feedback, according to which the hypothalamic–pituitary–adrenal axis is inhibited. In general, it can be well stated that the main physiological effects of glucocorticoids go in the direction to suppress immune responses. However, these are not the only important effects described for these molecules. Atherosclerosis is a process in which ACTH and cortisol may play an important role. Acting on proinflammatory or anti-inflammatory cytokines, they can regulate vascular endothelial functionality and recruit monocytes, that can enter the wall and differentiate first into macrophages, second into foam cells. Their capability to modulate the capacity of macrophages to remove the excess free cholesterol from the atherosclerotic plaque is also crucial for maintaining an efficient endothelial functionality.^[6] The pathogenesis of COVID-19 is associated with elevation of several immune plays as well as inflammatory factors which contributes to cytokine storms.

Covid-19 outbreak and arrhythmias

Currently, little is known about the psychological impact and mental health of the general public during the peak of the COVID-19 epidemic.^[1–3] This is especially pertinent with the uncertainty surrounding an outbreak of such unparalleled magnitude.

Wang and coworkers analyzed the psychological impact of COVID 19 epidemic in China and suggest that with respect to the initial psychological responses of the general public between 31 January and 2 February 2020, just two weeks into the country's outbreak of COVID-19 and one day after the WHO declared a public health emergency of international concern, 53.8% of respondents rated the psychological impact of the outbreak as moderate or severe; 16.5% of respondents reported moderate to severe depressive symptoms; 28.8% of respondents reported moderate to

severe anxiety symptoms; and 8.1% reported moderate to severe stress levels.^[7]

Varshney M and coworkers reported a lower psychological impact of COVID-19. They found that 33.2% of respondents to the questionnaire showed significant (mild/moderate/severe) psychological impact regarding COVID-19. However, as these results were registered during the initial phase of the COVID-19 epidemic in the country, it is likely that they may have changed over time and should therefore be interpreted accordingly.^[8]

Depression, anxiety and post-traumatic stress symptoms are known risk factors for adverse events in patients with chronic heart disease. Interestingly, much less is known about the effect of stress on the incidence and course of arrhythmias.

Baldi and coworkers found an increased number of out of hospital cardiac arrests in northern Italy that matched the same geographical areas most harshly affected by the pandemic.^[9] A significant increase in SCD events (58%) was reported in this region and these investigators attribute this spike to late complications of myocardial infarct or ischemia, as patients were more likely to remain at home and avoid hospitalization for fear of COVID-19 infection.^[9]

Similarly, a significant reduction in the overall number of hospital admissions in patients presenting with acute coronary syndromes has been reported.^[10,11]

The responses to chronic stress also include a number of modifying lifestyle behaviors such as increased alcohol consumption, heavier smoking, and diet high in sugar and fat.^[2,12,13] Together with sedentary lifestyle these unhealthy changes in diet contribute to excess energy intakes and weight gain. Unhealthy lifestyle increases oxidative stress and inflammation.^[2,12] When subjects respond to stress by eating more, substantial anecdotal evidence suggests the foods selected are typically high in sugar and fat. This phenomenon has been described as “Food craving”. Food craving has been defined as a multidimensional experience since it includes cognitive (e.g., thinking about food), emotional (e.g., desire to eat), behavioral (e.g., seeking and consuming food), and physiological (e.g., salivation) aspects.^[12,14] Food craving can be associated with a reduced intake of fruit and vegetables. However, a plant-based diet, rich in anti-inflammatory and anti-oxidative components, has been shown to significantly affect the most common cardiovascular risk factors in a positive way.

Sedentary life also contributes to an increase in cardiovascular risk. While the positive effects of exercise are well studied also in the elderly less attention was dedicated to the impact of detraining in the elderly, although the worsening of dynamic balance found in patients aged 75 as a conse-

quence of a 3-month period of detraining may have an impact not only on quality of life but also on exercise-induced cardiovascular adaptations and probably stress-induced arrhythmogenesis.^[2,15]

Telemedicine as a useful tool for management of arrhythmias

The current healthcare dilemma around the world is how to support the capacity for quality services not only for COVID-19 patients but also for non-COVID-19 patients. A recent update from Cardiologic Societies underlines that in light of the current pandemic, monitoring strategies should focus on selecting high-risk patients in need of close surveillance and using alternative remote recording devices could help to preserve personal protective equipment and protect healthcare workers from potential contagious harm.^[16]

During quarantine, we performed home-monitoring of frail elderly patients in an Italian region and we found that self-monitoring were useful not only for early detection of arrhythmias but even for psychological status. Self-monitoring increases consciousness and make subjects feel they are “doing something” for their own health and well-being.^[17,18] All of these factors could reduce stress-related illnesses, acting positively on patients' mood. In addition, monitoring of arrhythmias allows an early diagnosis of disease and could consequently relieve the burden on intensive care units.

The principles of remote patient management, crossing geographic, social, and cultural barriers, can be extended to outpatient care and are important to maintain continuity of care for non-COVID-19 patients. Virtual clinics move far beyond simple telephone contacts by integrating information from photos, video, mobile heart rhythm, and mobile health devices recording ECG. Patients can benefit from telemedicine through video-conferences that allow them not to lose personal contact with their doctor. Many healthcare centers have expanded use of telemedicine-based visits to maintain care for outpatients, thus obviating their need to come to the hospital.^[16]

We expect an increase in arrhythmic phenomena in elderly people during and following quarantine due to higher stress levels and an unhealthy lifestyle that heightens the overall cardiovascular risk factor. In addition, stress related to quarantine induces a change in lifestyle and nutritional habits: which is mainly due to reduced availability of goods, limited access to food, and reduction of outdoor physical activity (Figure 1). Telemedicine could provide a useful link between elderly patients and clinicians.

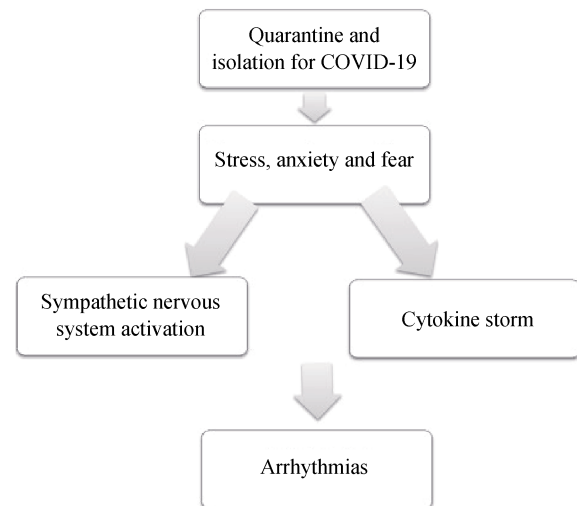


Figure 1. Mechanisms involved in the relationship between quarantine-induced stress and COVID-19.

In conclusion, we need to be prepared to confront the likely increase in arrhythmias risk burden following the pandemic. Following quarantine period we must promote going back to a healthy lifestyle that includes a healthy diet and physical activity. Selected patients may benefit from psychological support and evaluation for persisting anxiety disorders. In addition, elderly patients' arrhythmogenic risk will need to be re-evaluated to prevent the sudden development of arrhythmias. Telemedicine should be implemented in order to reduce clinical visits and provide support for elderly patients in home quarantine.

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