At the heart of COVID-19

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During the past few months, we have learned that the coronavirus disease 2019 (COVID-19) is not just an infection of the lungs or a bad flu-like illness, as many initially thought, but it might also attack other organs, including the heart and blood vessels. Preliminary reports suggested that cardiovascular risk factors like hypertension, diabetes and obesity, but surprisingly not smoking, and established cardiovascular disease, were common amongst hospitalised patients with COVID-19, and associated with a high risk of in-hospital death (1-4). Subsequently, other researchers reported that plasma concentrations of biomarkers of myocardial injury (ie: troponin) or stress (NT-proBNP) were often elevated in inpatients with COVID-19; high baseline levels, or their progressive rise, identified those more likely to die (5). Cases of worsening heart failure or acute myocarditis due to COVID-19 have also been described (6). Therefore, cardiac involvement might be common in patients with COVID-19, but it is still poorly defined. Another editorial in this issue considers the significance of increases in cardiac troponin in patients with a COVID-19 infection in great detail (7).

The first case of COVID-19 in Italy was diagnosed in a young and healthy man on the 20th of February 2020, in Codogno, a small town in Lombardy. In the ensuing weeks, the disease spread rapidly in the North of Italy, overwhelming the healthcare system and leading to a national emergency, still ongoing at the time of writing. Dr. Metra and his team from Brescia were at the centre of Italy's COVID-19 outbreak. In the current issue of this journal, they describe the demographic characteristics and clinical presentation of 99 patients with a confirmed diagnosis of COVID-19 admitted to their hospital in March 2020 (8). Of these, 53 had history of cardiac disease, including heart failure (40%), atrial fibrillation (36%) and coronary artery disease (30%); the main reasons for hospitalisation were the need for specialist cardiology care (n=28, 53%), usually for worsening heart failure (57%), and pneumonia (n=25, 47%). Overall, the mean age of patients was 67 years and most were men (81%). Patients with cardiac disease were also more likely to have chronic kidney disease (28%) and a history of cancer (24%). As expected, those with history of cardiac disease had higher plasma concentrations of high-sensitivity troponin and NT-proBNP. However, about 50% of those without cardiac disease also had increased plasma concentrations of troponin and NT-proBNP. Unfortunately, resources were not available to collect detailed echocardiographic data. However, Dr. Metra's team provided other interesting insights. Particularly, they reported an increased rate of adverse clinical outcomes (57% versus 21%), including need for treatment in an intensive care unit (19% vs 0%), development of acute respiratory distress syndrome (23% vs 15%), septic shock (11% vs 0%) and venous or arterial thrombo-embolic events (23% vs 6%) amongst patients with pre-existing cardiac disease compared to those without. More importantly, 1 in 3 patients with cardiac disease and infection with COVID-19 died in hospital, with a risk ratio ~2.5 times higher than those without cardiac disease.

It is likely that patients with pre-existing cardiac disease have a poor outcome after COVID-19 for diverse reasons. Patients with underlying cardiac disease and any serious infection are at greater risk, because the cardiovascular system has less reserve capacity to deal with increased metabolic demands. Metra and colleagues report that plasma concentrations of troponin and NT-proBNP were more likely to be elevated in patients with cardiac disease. However, patients with cardiac disease often have chronically elevated plasma troponin and raised NT-proBNP, so these differences are not surprising and do not constitute strong evidence for a specific myocarditis, although cardiac myocytes may not be spared from the

widespread cellular damage caused by systemic inflammation. Nevertheless, COVID-19 may cause acute myocardial injury due to hypoxia and tachycardia in the presence of fixed coronary stenoses (ie:- disruption of myocardial oxygen supply/demand), micro-vascular obstruction (9), pulmonary hypertension or epicardial coronary artery thrombosis. Both cardiac dysfunction and COVID-19 infection might increase pro-thrombotic risk (10). Atrial and ventricular arrhythmias have also been reported (2, 5, 6). Moreover, medications such as hydroxychloroquine or azithromycin, widely prescribed to patients with COVID-19, are known to prolong the QT interval. Around 6% of patients with COVID-19 have a corrected QT >500 msec (11), therefore indiscriminate use of these drugs might potentially lead to life-threatening arrhythmias, particularly in the presence of important electrolyte abnormalities.

However, factors other than COVID-19 infection itself might have much more serious effects on the outcome of people with cardiac disease. This pandemic has disrupted routine patient care. Many healthcare professionals have been unable to work because of suspected or confirmed COVID-19 infection with the need for long periods of self-isolation. Others were unable to cope with the emotional consequences of the clinical pressure, the risk of spreading a severe infection to, or the thought of isolating themselves from, their own family. Additionally, doctors and nurses have been diverted from cardiology services to deal with COVID-19. Face-to-face visits in both primary and secondary care have been hugely reduced or cancelled altogether and telephone consultations restricted only for more complex cases. In many hospitals, elective cardiac operations have been cancelled. Patients with severe valve or coronary artery disease are at risk of deterioration and death, either sudden or due to worsening heart failure. Fear of catching COVID-19 has caused patients to delay seeking help for symptoms of myocardial infarction, stroke or other serious medical problems (12). Some patients will consequently die at home and others will present to hospital late, only after irreversible damage has occurred. Some Governments locked down entire Countries, and advised physical distancing and shielding to prevent further spreading of COVID-19 in the community and protect the more vulnerable, but these strong measures might have limited access to important services and caused additional distress, to patients and their relatives. A huge amount of resources has been pumped into COVID-19 research, which is progressing at a speed that I have never seen in my relatively short research career. On the other hand, for cardiovascular disease, initiation of new trials and enrolment of additional patients in ongoing trials has been suspended and follow-up of existing patients has been modified to minimise the risk of infecting both trial participants and research staff. Slowing the pace of research into heart disease will have consequences for patients now and in the future.

Until effective measures other than social-distancing are available to prevent both patients and healthcare professionals from getting COVID-19 infections, clinical services must find innovative ways of delivering healthcare. Telemonitoring has the potential to deliver treatment that is as good as or better than traditional services, whilst greatly reducing face-to-face contacts and costs (13). The ‘silver-lining’ in the dark cloud of the COVID-19 pandemic is that it may provoke new, better patterns of care that make the healthcare system more resilient to future shocks. Cardiology services must now be rapidly and creatively re-organised to protect the large number of vulnerable people with or at high risk of cardiac disease.

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