

Work in Catheterization Laboratories in COVID-19 Times

Igor Kranjec*

Department of Cardiology, University Medical Centre, Ljubljana, Slovenia

***Corresponding Author:** Igor Kranjec, Associate Professor of Medicine/Cardiology, Department of Cardiology, University Medical Centre, Ljubljana, Slovenia.

Received: April 26, 2020; **Published:** May 14, 2020

Coronavirus disease (COVID-19) is a serious infection caused by recently discovered SARS-CoV-2 virus. While most infected individuals develop mild to moderate illness, approximately 14% require hospitalization, oxygen support, or even admission to an intensive care unit [1]. COVID-19 usually provokes symptoms (e.g. fever, cough, dyspnea) that cannot be distinguished from the common flu. Some patients experience only atypical symptoms (e.g. taste and smell disorders), or might even remain asymptomatic. COVID-19 spreads primarily through contact with an infected person. The virus can survive in droplets for up to 3 hours after being coughed out into the air; unfortunately, it could outlast 24 hours on cardboard and 2 - 3 days on plastic or metal surfaces [2]. Incubation period varies between 2 and 14 days, with possible outliers from 0 to 27 days. A median duration of viral RNA detection was shown to be 20 days in survivors, whereas the longest time of viral shedding was 37 days [3]. PCR technique is the mainstay of the COVID-19 diagnostic workup. The examination usually requires swabs from the back of the nose and throat, and takes about 3 hours to run through in the laboratory. False negatives can occur up to 30% depending on different PCR techniques. Some point-of-care tests have been developed, delivering positive results in as little as 5 minutes; two assays have recently received Food and Drug Administration approval [4]. However, their role remains to be established. In severe COVID-19 cases, the disease can be complicated by acute respiratory distress syndrome, sepsis, and multiorgan failure. Mortality estimates vary with an overall fatality between 1.4% and 2.3%; however, death rates are increased in those over 80 years, patients with comorbidities (e.g. cardiovascular diseases, diabetes, asthma), and those requiring invasive mechanical ventilation [1]. Regrettably, there is no effective causal treatment apart from supportive measures.

In addition to lung damage, many COVID-19 patients develop heart injury and die of cardiac arrest. In this March, Shi., *et al.* published a study that gave the first glimpse at how prevalent cardiac problems might be in the COVID-19 group [5]. Among 416 hospitalized patients, 19.7% showed signs of heart injury; 51% of those with the injury died vs. 4.5% ($p < 0.001$) who did not have it. Several pathophysiological mechanisms have been suggested, such as systemic or local inflammation (i.e. cytokinetic storm), virus-ACE₂ receptor interaction, hypoxemia, pro-coagulation state, and others. Consequently, cardiovascular injury may present as acute myocardial infarction (AMI), myocarditis, stress cardiomyopathy, pericarditis, arrhythmias, thrombotic complications, cardiogenic shock, and sudden death [6]. Elevated cardiac troponin concentrations are common in hospitalized COVID-19 patients and seem to be more likely due to non-ischemic causes (Type 2 myocardial infarction due to oxygen supply-demand imbalance). While the decision to undertake coronary angiography may be straightforward in ST-segment elevation myocardial infarction (STEMI), distinguishing pulmonary edema from acute respiratory distress is more challenging [7].

COVID-19 has shattered profoundly the contemporaneous way of life all over the world. Since its outbreak in Wuhan in December 2019, the virus has infected more than 2 million people and the death toll has risen to 157,847 victims. In Europe, as of 20 April 2020, there were 1,149,071 COVID-19 positive patients; 103,856 of them died, while 280,000 recovered [8]. As a result, Italy issued a nationwide lockdown on 9 March 2020; schools, universities, and all non-essential business were closed - with supermarkets, banks, pharmacies, post-offices

and, evidently, hospitals allowed to remain open. Most European countries have similarly curbed public life in order to slow the spread of the pandemic.

The fact that the healthcare workers may be at higher risk of the COVID-19 infection is quite disturbing; they can get infected in hospitals due to a shortage of personal protective equipment (PPE) and also in their homes or communities. Indeed, in Brescia province, the center of Italy's outbreak, 15% of all doctors and nurses were infected and put out of commission. Sadly, more than 30 healthcare professionals have recently died of coronavirus in Italy, France, and Spain [9].

General safety policies and measures in COVID-19 times

Given the exponential growth of the disease along with potential recurrent waves, COVID-19 patients may overwhelm critical healthcare capacities [4]. Therefore, an infectious disease preparedness and response plan that can help guide protective actions against COVID-19 must be developed. The plan should consider the level of risk with various regions, worksites, and jobs. The common goal of all undertaken measures is to slow down the spread of infection to a limit where a healthcare can handle the pandemic. It is assumed that COVID-19 symptoms are not specific or even missing, absence of contact or travel history unreliable, and therefore everybody potentially infected. It is vital to decrease unnecessary migrations, particularly from heavily infected regions. Safety first culture, social-distancing, appropriate personal hygiene, and use of PPE are indispensable. Flexible work teams, work hours, and worksites are recommended along with the possible tele-commuting and video-conferencing.

Hospitals should take into account a need for unrestrained urgent admissions of the COVID-19 patients as well as an admission/discharge gap. Therefore, additional regular and intensive care units should be opened and skilled medical staff redeployed from other medical departments. Outpatients appointments should be rescheduled, elective procedures postponed, and telehealth communications engaged. Finally, resource restrictions should be considered and medical strategy prioritized.

Selection of cardiovascular interventions in catheterization laboratories in COVID-19 times

Catheterization laboratories are busy and fast developing medical units. Today, they are still the sites of diagnostic examinations, but also sites where treatment procedures (e.g. coronary artery disease, valvular and structural heart diseases, disorders of heart rhythm, peripheral and venous diseases, invasive cardiovascular support) are being performed. However, in the COVID-19 times, the interventional caseload has exceedingly diminished. For example, in 81 Spanish medical centers, invasive diagnostic procedures decreased by 56%, elective percutaneous coronary interventions (PCI) by 48%, primary PCI by 40% and structural interventions by 81% [10]. Moreover, many interventional cardiologists and nurses were transferred to hospital departments. Some concerns have been arising that those negative trends will eventually come at a price of more complex procedures later or even unnecessary clinical adverse events.

All things considered, there is a general agreement that most elective PCI procedures will be deferred until the end of the pandemic. The exceptions are the cases with anticipated prognostic impact within the next 3 months (e.g. crescendo angina pectoris, significant stenosis of the left main coronary artery, symptomatic multivessel disease). All critical coronary stenosis will be addressed, while other lesions will be planned for staged PCI.

Acute coronary syndromes pose a challenge as we have to weigh the imminent cardiac risk to the patient and the danger of COVID-19 spread among healthcare workers and hospital units. Nevertheless, primary PCI remains the standard of care for STEMI patients at PCI capable hospitals when it can be provided in a timely fashion, with an expert team outfitted with PPE in a dedicated catheterization laboratory room [4]. Thrombolysis will be used in selective cases (e.g. severe pneumonia, anticipated transfer > 120 minutes to primary

PCI center). For patients who have an unclear diagnosis of STEMI (e.g. atypical symptoms, diffuse ST-segment elevation or atypical electrocardiographic [ECG] findings), additional noninvasive evaluation in the emergency department is recommended. A point-of-care ultrasound of the heart to assess wall motion abnormalities may provide valuable information. Coronary computer tomography angiography may be considered in cases where the ECG findings and echocardiography are divergent [4]. In COVID-19 patients with severe pulmonary decompensation or pneumonia who are intubated and seem to have an excessive high mortality, consideration for compassionate medical care may be appropriate [4]. Patients with resuscitated cardiac arrest will continue to be the highest subgroup of AMI patients. These patients will also be the highest risk for droplet-based spread of the infection. They should be selectively considered for catheterization laboratory activation in the presence of persistent ST-segment elevation and a concomitant wall motion abnormality on ultrasound evaluation [4].

In non-STEMI patients, careful interpretation of troponin levels is required to exclude the non-ischemic myocardial injuries. Those patients with high-risk clinical features (i.e. GRACE score > 140) or hemodynamic instability are taken for urgent coronary angiography and possible PCI [4]. Comparably to the STEMI patient, sensible coronary revascularization is to be performed. No-STEMI patients without high-risk features can be managed with medical therapies.

Most non-coronary interventions have been greatly reduced since the beginning of the COVID-19 pandemic. Selected patients will be scheduled for transcatheter aortic valve implantation, namely those already hospitalized due to severe aortic stenosis, syncope, and NYHA stage III to IV. For other candidates, extensive use of telehealth for disease assessment, counseling, symptoms surveillance, and followup is recommended.

Setup of catheterization laboratories in COVID times

Until the prevalence of the COVID-19 in the general population of the country is firmly established, all patients presenting with a suspected AMI should be considered COVID-19 possible [4]. In many catheterization laboratories, therefore, dedicated operating rooms are being established. In these rooms, the positive pressure is turned off, a stock material for COVID-19 positive procedures and lead aprons are kept inside, while clean material remains outside. Operating personnel is organized in teams, alternating in shifts or days, and kept at minimum; circulating nurses are avoided. The doors to the room are kept shut most of the time. The interventional procedures are performed without any rush. At the end, ventilation rates are increased and terminal environment cleaning is performed [11].

A good coordination between emergency medical services, emergency departments in catheterization laboratories is warranted. All patients entering the fast track wear surgical masks and are transferred straight to the catheterization laboratory without getting into contact with other healthcare workers or patients. Initially, they are tested and are admitted to the operating room as probable COVID-19 positives. Anesthesiologists are alerted to consider elective intubation. After the PCI, they are sent to the appropriate hospital unit according to the test results.

At the operating rooms, only the personnel involved is allowed to remain. Personal hygiene (e.g. hand washing, safe distancing, disinfection) is respected at all times. PPE (e.g. gowns, nitril gloves, goggles or face shields, caps, boots, FFP 2-3 or N95 respirators) are carefully used. Correct donning sequence of PPE outside and doffing inside is requested.

How to get around the COVID-19-related obstacles

The crisis caused by the COVID-19 pandemic has certainly been the most unexpected and unfortunate event in our professional as well as private lives. Professionally, it may be seen as disruption of core business, possible redeployment of the standard staff, risk of infection and quarantine, cancellation of trials, workshops and conferences, psycho-social disruption, and others. It is certainly frustrating

to manage critically ill patients that may not benefit from standard interventions. However, as sir Winston Churchill is supposed to say in the mid-1940s: „Never let a good crisis go to waste“, this troublesome period might even serve as an opportunity to reset and modernize our professional work and the health service as a whole. It is the best time to run through our working habits and reestablish the good practice. Understandably, cancelled procedures are very difficult to replace. However, interim training can be alternatively provided by specialized websites, webinars, e-books, youtube videos from societies or manufacturers, virtual reality, and tele-conferences. Most importantly, let's keep ourselves healthy and stay safe.

Bibliography

1. Team NCPERE. "Vital surveillances: the epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) - China". *China CDC Weekly* 2.8 (2020): 113-122.
2. van Doremalen N., *et al.* "Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1". *New England Journal of Medicine* 382.16 (2020): 1564-1567.
3. Huang C., *et al.* "Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China". *Lancet* 395.10223 (2020): 497-506.
4. Mahmud E., *et al.* "Management of Acute Myocardial Infarction During the COVID-19 Pandemic. A Consensus Statement from the Society for Cardiovascular Angiography and Interventions (SCAI), American College of Cardiology (ACC), and the American College of Emergency Physicians (ACEP)". *Catheterization and Cardiovascular Interventions* (2020).
5. Shi S., *et al.* "Association of Cardiac Injury with Mortality in Hospitalized Patients With COVID-19 in Wuhan, China". *JAMA Cardiology* (2020).
6. Chapman RA., *et al.* "High-sensitivity cardiac troponin can be an ally in the fight against COVID-19". *Circulation* (2020).
7. American College of Cardiology: Troponin and BNP Use in COVID-19 (2020).
8. Coronavirus disease (COVID-2019) situation reports.
9. Virus Knocks Thousands of Health Workers Out of Action in Europe (2020).
10. <https://icomgroup.eventsair.com/current-worldwide-status-and-lessons-learned-from-hina-italy-spain-gulf/gis-webinar/Site/>
11. <https://www.youtube.com/watch?v=quwzg7Vixsw>
12. Winston Churchill.

Volume 7 Issue 6 June 2020

© All rights reserved by Igor Kranjec.