Cardiovascular emergencies in COVID-19 times are mainly acute coronary syndromes (ACS). In general, treatment of ACS should follow current European Society of Cardiology (ESC) guidelines for ST-elevation myocardial infarction (STEMI) and non-ST-elevation acute coronary syndromes (NSTEMI; [1, 2]). However, in the COVID-19 pandemic, special considerations need to be applied to cardiovascular emergencies, which mainly involves protection of healthcare personnel and other patients in the hospital.

In general, patients should be considered as COVID-19 negative, possibly positive, or definitively positive. Since treatment of cardiovascular emergencies is often time-dependent, testing for COVID-19 and waiting for negative results is often not possible, and some advocate to consider all STEMI and NSTEMI patients as possibly COVID-19 positive. However, this may depend on the overall number of COVID-19-positive patients in the specific region and others consider patients only possibly positive if they display infectious symptoms or have been traveling to high-risk regions.

In general, the Society for Cardiac Angiography and Interventions (SCAI) and the American College of Cardiology (ACC) as well as the ESC (http://www.escardio.org) continue to recommend primary percutaneous coronary intervention (PCI) as the standard treatment of STEMI patients during the current pandemic [3]. However, in regions with a high disease rate of COVID-19, such as in Lombardy, all patients may be considered to be infective and the procedure should be performed in a dedicated COVID-19 cath lab. This may be possible because most of the European hospitals have significantly reduced or suspended elective procedures to preserve resources and avoid potential exposure of stable patients to the risk of COVID-19 infection. If timely reperfusion is not possible, some advocate fibrinolysis in this setting (Fig. 1; http://www.escardio.org). However, all efforts should be made to deliver timely reperfusion even when taking all precautions to protect healthcare workers.

For NSTEMI the management of patients should be guided by risk stratification. Based on COVID-19 infection rates in the specific region, either only patients with suggestive symptoms or all patients with NSTEMI should undergo testing for COVID-19 as soon as possible following the initial medical contact in order to allow healthcare personnel to implement adequate protective measures and management pathways. Risk stratification should be based on the criteria as provided by ESC guidelines on NSTE-ACS [2]. Patients should be categorized into three risk groups (i.e., very high risk, high risk, and intermediate to low risk) and managed accordingly. For patients at very high risk, an immediate invasive strategy as in STEMI is required, whereas for high risk an invasive strategy within 24 h is appropriate. In this case, negative or even positive test results may already be available leading to strategies in different cath lab environments. For intermediate-to-low-risk patients, a medical strategy with early discharge may be more appropriate and these intermediate-risk patients should also be carefully evaluated taking into consideration alternative diagnoses to type 1 myocardial infarction, such as type 2 infarction, myocarditis, or myocardial injury due to respiratory distress or multiorgan failure or Takotsubo syndrome. In the event that any of the differential diagnoses seem plausible, a noninvasive strategy should be considered and coronary computed tomography angiography should be favored, if equipment and expertise are available.

In general, epidemic infectious situations such as influenza together with heightened environmental and psychosocial stressors lead to an increase in ACS. However, several reports have shown a significant decrease of STEMI patients admitted to cardiac catheterization laboratories in the range of 40% during the COVID-19 pandemic. In addition, times from symptom onset to reperfusion were four times longer in Hong Kong, China [4]. These observations may be understandable because people are reluctant to go to a hospital during the COVID-19 outbreak. This would explain the potential delays in seeking special cardiological care. Another concern is that patients with ACS do not seek care at all. This is very likely to have a detrimental impact on outcomes in COVID-19 times, which induces collateral damage whose extent cannot be estimated at the current time.

In a recent case series of patients with COVID-19 who had ST-segment elevation, there was a huge variability in presentation, a high prevalence of nonobstructive disease, and poor prognosis. Of note, all these patients had elevated D-dimer levels. This suggests that myocardial injury in patients with COVID-19 is frequent and could be due to plaque rupture, cytokine storm, hypoxic injury, coronary spasm, microthrombi, or direct endothelial or vascular injury [5].

In summary, ACS treatment in COVID-19 pandemic times is chal-
Letters to the editor

Fig. 1 A recommended treatment pathway for ST-elevation myocardial infarction (STEMI) patients in the COVID-19 pandemic in a region with a very high prevalence of COVID-19. PCI percutaneous coronary intervention. (Adapted from www.escardio.org)

Challenging and we should take care to treat the patients as well as possible in order to avoid significant collateral damage.

Corresponding address
Univ.-Prof. Dr. med. Holger Thiele
Herzzentrum Leipzig, Universität Leipzig
Strümpellstraße 39, 04289 Leipzig, Germany
holger.thiele@medizin.uni-leipzig.de

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References
1. Ibanez B, James S, Agewall S et al (2018) 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). Eur Heart J 39:119–177
2. Roffi M, Patrono C, Collet J-P et al (2016) 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). Eur Heart J 37:267–315
3. Welt FG, Shah PB, Aronow HD et al (2020) Catheterization laboratory considerations during the Coronavirus (COVID-19) pandemic. From ACC’s interventional council and SCAI. J Am Coll Cardiol. https://doi.org/10.1016/j.jacc.2020.03.021
4. C-CFT, Cheung K-S, Lam S et al (2020) Impact of coronavirus disease 2019 (COVID-19) outbreak on ST-segment elevation myocardial infarction care in Hong Kong, China. Circ Cardiovasc Qual Outcomes. https://doi.org/10.1161/CIRCOUTCOMES.120.006631
5. Bangalore S, Sharma A, Slotwiner A et al (2020) ST-segment elevation in patients with Covid-19—A case series. N Engl J Med. https://doi.org/10.1056/NEJMc2009020