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LETTER TO THE EDITOR

Resuscitation in COVID-19 patients: What do we know and what should we do?

Ezgi Yilmaz, Ethem Murat Arsava, Mehmet Akif Topcuoglu

Hacettepe University Hospitals, Neurological Intensive Care Unit, Sıhhiye, Ankara, Turkey

Recent articles on cardiopulmonary resuscitation (CPR) in coronavirus disease 2019 (COVID-19) patients [1, 2] were read with great interest.

It was concurred herein, that automated chest compression devices (ACCD) should be added to cardiopulmonary resuscitation (CPR) protocols in pandemic and these data are welcomed [1]. However, presently it was not considered right to leave the decision of CPR for the elderly with initial non-shockable rhythms to individual therapeutic teams [2]. In addition to a self-fulfilling prophecy risk, the effect of self-protection behavior of decision makers on the decision-making process may create less aggressive medical management risk than it should be. The present article discusses both strategies proposed for the CPR decision and management after the return of spontaneous circulation.

Resistant hypoxemia secondary to viral pneumonia associated acute respiratory distress syndrome, primary viral or secondary myocardial injury, serious ventricular arrhythmias, and shock are considered among the leading reasons of in-hospital cardiac arrest and the resulting mortality [3]. In patients diagnosed with or suspected to have COVID-19, CPR poses a certain risk to healthcare professionals due to excessive air droplet scattering (aerosolization) during the procedure.

Reports during the pandemic period have indicated that the survival rate after CPR is lower and the neurological prognosis is worse in COVID-19 cases, in comparison to a non-pandemic era [4]. Reasons may include admission of patients with severe COVID-19 to regular floor beds due to the scarcity of intensive care beds and high ventilator occupancy, a delay in initiation of resuscitation due to time lost while wearing personal protective equipment, suboptimal quality of resuscitation, and a more predominant role of respiratory failure as the cause of arrest. Moreover, the prevalence of out-of-hospital cardiac arrest (OHCA) has also increased during the pandemic [5]. Rates of not only survival but also favorable prognosis have deteriorated in OHCA compared to the previous data, probably due to prolonged transport time of patients to hospitals and lower rate of resuscitation by lay persons at the scene.

The general principles of the recent resuscitation guidelines in pandemic, which highlight certain algorithmic adaptations to enhance the protection of the resuscitator during basic/advanced cardiovascular life support, are noteworthy. However, it is not known whether these adaptations would positively or negatively affect the survival rates observed after CPR in this era. In addition, there are insufficient data to support the use of extracorporeal CPR and targeted temperature management in COVID-19 patients. It is also known that induced hypothermia in severe sepsis is potentially harmful [6], and considering that these invasive methods are not widely applicable, it can be predicted that COVID-19 CPR survivors will not be amenable for these therapies in the current global resource-limiting setting.

As for all post-CPR patients, in comatose COVID-19 survivors, one of the main critical issues is the determination of neurological prognosis after the return of spontaneous circulation. However, recent interim guidelines do not address this issue. The present article shares opinions and concerns on neuroprognostication of patients who survived in a comatose state after CPR, also called as post-resuscitation encephalopathy (PRE).

First of all, "neurological examination" is crucial in establishing neuroprognostication in COVID-19 patients with PRE [7]. In theory, a bed-side neurological examination will assess the extent of the neuro-anatomical injury to some degree, especially if performed by an experienced neurointensivist. In the examination performed

Address for correspondence: Prof. Dr. Mehmet A. Topcuoglu, Hacettepe University Hospitals, Neurology Department, Neuro-ICU, 06230, Sıhhiye, Ankara, Turkey, tel: +90 312 3051990, e-mail: mat@hacettepe.edu.tr or matopcuoglu@yahoo.com
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72 h after return of spontaneous circulation, the absence of pupillary reactions and no better than decerebrating motor response to painful stimuli are highly reliable prognostic markers of poor prognosis [8]. During this period, an absence of the corneal reflex, presence of up-ward eye deviation and myoclonic jerks are also helpful in prognostification. However, in the last decade, problems related to performing prognostification with "only" neurological examination have repeatedly been emphasized. It is underlined that the examination may not be objective under confounding factors like hypothermia, sedation, muscle relaxants and hemodynamic instability, and estimations suggestive of poor outcomes could inadvertently lead to a self-fulfilling prophecy when making individual decisions for the patient. The lack of blinding in most of the studies focusing on prognosis, very low sensitivity of neurologic examination findings, and probably the not so high specificity of these measures in a real-life setting, probably underlie the cautious statements in this regard [7].

At this point, it should be noted that the majority of post-arrest deaths is due to the cessation or withdrawal of "active" of life-sustaining treatments, which is primarily driven by the decision of poor prognosis based on examination [7]. A chaotic setting like the current pandemic, might put more pressure on doctors experiencing difficulties for booking an intensive care unit bed, and might force them to stop life-sustaining treatments earlier. However, even leaving aside the discussions in the general population, it should not be forgotten that the accuracy of these prognostic models, and thereby the decisions for continuation or withdrawal of care, have not been investigated properly in COVID-19 patients. In addition, it is also not known how these patients would recover in the long run after appropriate care.

A multitude of questions are still unanswered regarding the prognostic models for COVID-19 patients. Could it be useful to incorporate biomarkers such as neuron-specific enolase, electrophysiology such as electroencephalographic reactivity, or imaging tools such as diffusion-weighted magnetic resonance imaging (DWI) to algorithms to increase the accuracy of decisions in COVID-19 patients with PRE? Can the presence of widespread ischemic damage detected in DWI be performed between the second and fifth days after successful CPR guide the prognosis [9]? Pure hypoxemia and global cerebral ischemia are also said to show different patterns in DWI, would it be helpful [10]? And the list goes on.

It should not be forgotten that albeit COVID-19 might follow a serious course, it is not a terminal disease, most patients can be saved with good critical care support, and these patients deserve the standard of care during and after cardiac arrest. It is without doubt that we need to study neuroprognostification in COVID-19 patients with PRE, within a short time and without further delay. Until this is achieved, physicians in the front-line, need precise expert opinions and guidelines, as they continue to employ prudent decisions without swerving from scientific principles, as always.

Conflict of interest: None declared

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