

## SPECIAL REPORT

# Improving Stroke Care in Times of the COVID-19 Pandemic Through Simulation

## Practice Your Protocols!

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**ABSTRACT:** During the coronavirus disease 2019 (COVID-19) pandemic, infectious disease control is of utmost importance in acute stroke treatment. This is a new situation for most stroke teams that often leads to uncertainty among physicians, nurses, and technicians who are in immediate contact with patients. The situation is made even more complicated by numerous new regulations and protocols that are released in rapid succession. Herein, we are describing our experience with simulation training for COVID-19 stroke treatment protocols. One week of simulation training allowed us to identify numerous latent safety threats and to adjust our institution-specific protocols to mitigate them. It also helped our physicians and nurses to practice relevant tasks and behavioral patterns (eg, proper donning and doffing PPE, where to dispose potentially contaminated equipment) to minimize their infectious exposure and to adapt to the new situation. We therefore strongly encourage other hospitals to adopt simulation training to prepare their medical teams for code strokes during the COVID-19 pandemic.



**Key Words:** COVID-19 ■ pandemic ■ simulation training ■ stroke ■ uncertainty

In acute stroke treatment, every minute counts. Most hospitals have well-functioning protocols to optimize door to needle times for intravenous thrombolysis and door to groin puncture times for endovascular treatment. Until now, when treating patients with acute stroke, there was no need to put special emphasis on infectious disease control, personal protection, and patients' respiratory symptoms. During the coronavirus disease 2019 (COVID-19) pandemic, however, infectious disease control is of utmost importance. This often leads to uncertainty on the part of the physicians who manage the patient and among the nurses and technicians with immediate patient contact. The medical team might also be much larger with additional anesthesia and critical care staff with varying levels of information, experience with personal protection equipment, and with different levels of anxiety. The latter one is partly driven by the fact that healthcare workers themselves are at high risk of obtaining and transmitting the virus, and in many parts

of the world, this has already led to staff shortages. Thus, the remaining healthcare workers are often required to take on new responsibilities and tasks with which they are mostly unfamiliar and often uncomfortable.

### HOW CAN SIMULATION TRAINING HELP TO IMPROVE THIS SITUATION?

Simulation can help to (1) identify latent safety threats and (2) practice newly established protocols, thereby (3) reducing the mental strain of healthcare workers.<sup>1</sup> This has the potential to improve the safety for patients and healthcare workers themselves. The current American Heart Association protected code stroke protocol acknowledges this and states that "simulation training, especially in-situ, can alleviate the anxiety of the situation and reduce safety threats."<sup>2</sup> The Table provides specific examples of situations in which simulation training

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**Table. Examples for the Impact of Simulation Training in Overcoming Latent Safety Threats During the COVID-19 Pandemic\***

Latent Safety Threat	Example	Consequence	Impact of Simulation
Insufficient communication between paramedics/referring hospitals and the in-house medical team	Relevant screening questions (respiratory symptoms, travel history) are forgotten as they are not part of the routine acute stroke communication. In Stavanger, we realized during the simulation that the in-house medical team received no information on the patient's respiratory status from the paramedics, which was felt to be suboptimal, as signs of a COVID infection might have potentially been missed	Failure to initiate necessary code stroke <sup>2</sup> and other safety precautions to prevent infectious exposure and provide respiratory support	Practicing of acute stroke communication, including the patients' respiratory status, in a simulation setting raises awareness of first responders, initiates use of personal or public "cheat sheets"/ pocket cards, and creates a new paradigm for communication. In Stavanger, the paramedic report template at hospital was adapted as a result of the simulation training and now includes details on the patient's respiratory status.
Insufficient practice/experience with use of personal protection equipment (PPE)	Most healthcare workers involved in acute stroke care are not used to wearing PPE and might not know how to correctly wear it (eg, donning PPE without appropriate hand hygiene, touching one's face after donning gloves <sup>2</sup> )	Risk of infectious exposure despite available PPE	Practicing donning/doffing of PPE reduces the risk of infectious exposure and the need for additional equipment (eg, use of a second pair of gloves because one has touched a potentially contaminated area after donning the first pair)
Inefficient workflows and communication between teams inside and outside the CT room and angio suite	During the COVID-19 pandemic, medical teams have to be divided into those who wear PPE and in immediate contact with the patient and the teams that do not wear PPE and are involved in providing supplies, etc, without immediate patient contact. In Stavanger, neurologists enter the CT control room to review the stroke imaging with the neuroradiologist. In the first simulation cycle, it was recognized that this would lead to contamination of the CT control room.	Time delays and unnecessary contamination may occur due to confusion about individual roles and patient contact of non-PPE wearing medical personnel	Simulation can help to clarify individual team members' roles and to develop efficient communication strategies and workflows between both teams, including separation of "contaminated" and "contamination-free zones." In Stavanger, we adapted the spatial set-up of the CT area: a portable lead-protection wall was installed in the scanner room. The neurologist (in PPE) is now able to stay in the scanner room behind the lead wall and can communicate with the radiologist via microphone and eye contact but without contaminating the control room.
Suboptimal airway management	The AHA/ASA protected stroke protocol recommends to exclusively rely on closed-circuit ventilation and intubate early rather than later. <sup>2</sup> This differs from the standard approach in patients with acute stroke, and the medical team might not agree upon appropriate "thresholds" for early intubation. The decision to intubate may also be influenced by availability of ICU beds for COVID positive patients.	Time delays due to discussions on the necessity of intubation, risk of infectious exposure if manual ventilation is erroneously performed, potential pushback and delays when COVID-positive intubated patients have to be transferred to the ICU.	Simulation of "respiratory borderline cases" can help the medical team to find a common ground regarding indications for intubation, practicing management of closed-circuit ventilation gives all team members the opportunity to become familiar with the relevant parameters. Simulation can also help to clarify post-procedural care pathways and responsibilities for intubated COVID-positive patients.
Confusion with regard to responsibilities of individual team members	The current AHA/ASA protected code stroke protocol recommends assigning one team member the role of the "safety leader." <sup>2</sup> Many healthcare workers might feel insufficiently prepared to take on this role and do not know the specific tasks associated with it. Additionally, staff shortages might force healthcare workers to take on roles and responsibilities of colleagues in addition to their own.	Confusion and anxiety on the part of the team member who is asked to take on a new role, possible refusal to act in that role.	Simulation allows all team members to act in a specific role (eg, the safety leader) and become familiar with the tasks and responsibilities, <sup>1</sup> which increases the confidence and willingness of a particular team member to take on that role in a case of emergency.

COVID-19 indicates coronavirus 2019.

\*Please note that these specific examples might not be generalizable to every hospital setup.

can help to identify safety threats and initiate necessary workflow modifications to mitigate those.

## CODE-STROKE SIMULATION IN A PATIENT WITH COVID-19 EXPOSURE: THE STAVANGER EXPERIENCE

In Stavanger, we have conducted regular simulation-based team-training for intravenous thrombolysis and endovascular stroke treatment for >3 years.<sup>3</sup> In reaction to the COVID-19 pandemic, we created a simulation scenario that involved a patient with COVID-19 positive code stroke with left-sided paresis and dysarthria and an underlying large vessel occlusion (for a detailed scenario description, see the [Data Supplement](#)). All participating healthcare workers received a brief explanation

on the use of personal protective equipment, the current local COVID-19 code stroke protocol, and specific information about implemented infection control safeguards. We repeated this simulation scenario on a daily basis for 1 week. During the simulation cycles, we detected numerous latent safety threats, for example, potential contamination of the CT control room, risk of infectious exposure during intravenous alteplase administration, and lack of detail in assessing the patient's respiratory status (Table). The workflow protocol was then adjusted. Protocol adjustments ranged from small changes (eg, defining where PPE donning should be done, and change of communication details), to more comprehensive changes such as planning and effectuating a lead wall in the CT scan room. The new and adapted protocol was then used for the following simulation sessions. We continuously communicated

protocol changes to all relevant personnel. The focus of the simulation training was to get all relevant personnel through at least one simulation training before standing at the front line with a real patient. There was no final “examination,” but a debrief after the simulation run addressed points of improvement. Our presimulation assessment showed that initially, only 15% of the simulation participants were completely comfortable with their role in the local COVID-19 stroke treatment workflow. After one simulation cycle, this number increased to 80%. Additionally, over 60% of the participants stated that they identified at least one latent safety threat that would have led to infectious exposure of themselves or a team member. Although we are still training and adapting the protocols, after 1 week of simulation training, we were much better organized when our first patient with COVID-19 positive stroke arrived. We therefore strongly recommend every stroke center to go through this exercise. It does not take much of equipment: a simulation mannequin or a team member acting as the patient and a video camera or an attentive observer is all that is needed.

We do realize that there are several limitations of this experience, and each institution will have its own bottlenecks, protocols, and practical limitations. However, although it is hard to address all these unique circumstances in a “universal” protocol, simulation can help hospitals identify latent safety threats that are specific to their institution and to develop and optimize individually tailored, institution-specific protocols. But not only can simulation training improve performance of healthcare workers on the frontlines, it also helps them to get familiar with their new tasks, thereby

alleviating the tremendous mental strain that each and every one of us has to face during these challenging times.

## ARTICLE INFORMATION

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