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In Situ Simulation Enables Operating Room Agility in the COVID-19 Pandemic

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As COVID-19 infections soar worldwide, surgical teams must quickly adapt to care for the COVID-19-positive patient in the operating room (OR). This challenge comes in the face of constant change in data and conditions, reliable evidence yet to emerge, shortages of personal protective equipment (PPE), uncertainty due to lack of testing equipment and capacity, and unprecedented strain on caregivers, hospital systems, and resources.[1]

Agility is essential not only to resilience when environmental threats arise, but also to the expeditious design and launch of a new process itself.[2]

We sought to create an agile process to optimize teamwork and care, and to proactively identify and mitigate risks for patients and staff. Further, we needed a process that could undergo rapid change, enhance safe and effective team performance, and be adapted and replicated across a large healthcare system that serves nearly 75,000 inpatients a year.

Immersive, high-fidelity simulation conducted in situ in the actual clinical environment can be used to train interprofessional teams and to enhance safety through design, testing, and error-proofing new processes, devices, and facilities.[2,3] We aimed to use an iterative, collaborative approach integrating in situ simulation and rapid cycle quality improvement to confront the COVID-19 outbreak for the COVID-19-positive patient in the OR.

APPROACH

We initiated a 10-day process to organize teams and design, prototype, execute, and replicate a simulation-based process and tools to optimize safety and procedures and enable OR agility in caring for the COVID-19 surgical patient (Supplemental Digital Content 1, Timeline, http://links.lww.com/SLA/C243).

Assemble an Interdisciplinary Team

A senior quality leader (J.S.) with experience as an American College of Surgeons National Surgical Quality Improvement Program champion and trained simulation facilitator created a core team of clinical leaders and simulation specialists from surgery, anesthesiology, and nursing; a larger team including additional frontline staff, administrators, and subject matter experts (eg, Infection Prevention officer); and a data team whose members systematically scanned daily changes and aggregated local and national data, peer-reviewed literature, professional society guidance, and governmental agency website postings.

In assembling the core team, we capitalized on a well-established group of surgeons, anesthesiologists, and nurses who have served for 4 years as trained faculty for the Co-management of Operating Room Emergencies (CORE) simulation program for the Emory University School of Medicine and Emory Healthcare. CORE provides half-day, immersive sessions for interdisciplinary OR teams in the mock OR of a simulation center. CORE focuses on increasing patient safety through use of checklists, closed loop communication, and crew resource management techniques. These faculty became ideal facilitators and coaches for in situ simulation and pre-briefings for actual cases with COVID-19-positive patients.

The core team leader conducts daily 2-way briefings with institutional leaders in COVID-19 healthcare system management meetings via a video-audio conferencing platform.

Establish Design Principles

Our key design principles were simplicity, clarity, and agility. In addition, following high reliability organization theory, we strived to:

1. Create and maintain a strong culture of safety;
2. Test for and use optimal processes and procedures;
3. Provide intensive and continuing training of individuals, teams, and larger units;
4. Conduct thorough prospective and retrospective organizational learning and safety management.[2, p. S42]

Create Team Guides to Outline Processes for Managing the COVID-19-Positive Patient in the OR

Inspired by a graphic illustrating an infection control workflow developed by leaders in Singapore,[4] we experimented with various designs to incorporate current evidence-based practices. After several iterations (eg, process flow map with swim lanes and decision trees; detailed instructions for every role; multi-page, multicolored versions) we chose a simple, 1-page, printable, black-and-white Word document format that can be updated quickly and easily. The Team Guide highlights roles that require significant changes from routine practice (Table 1). This format proved to be

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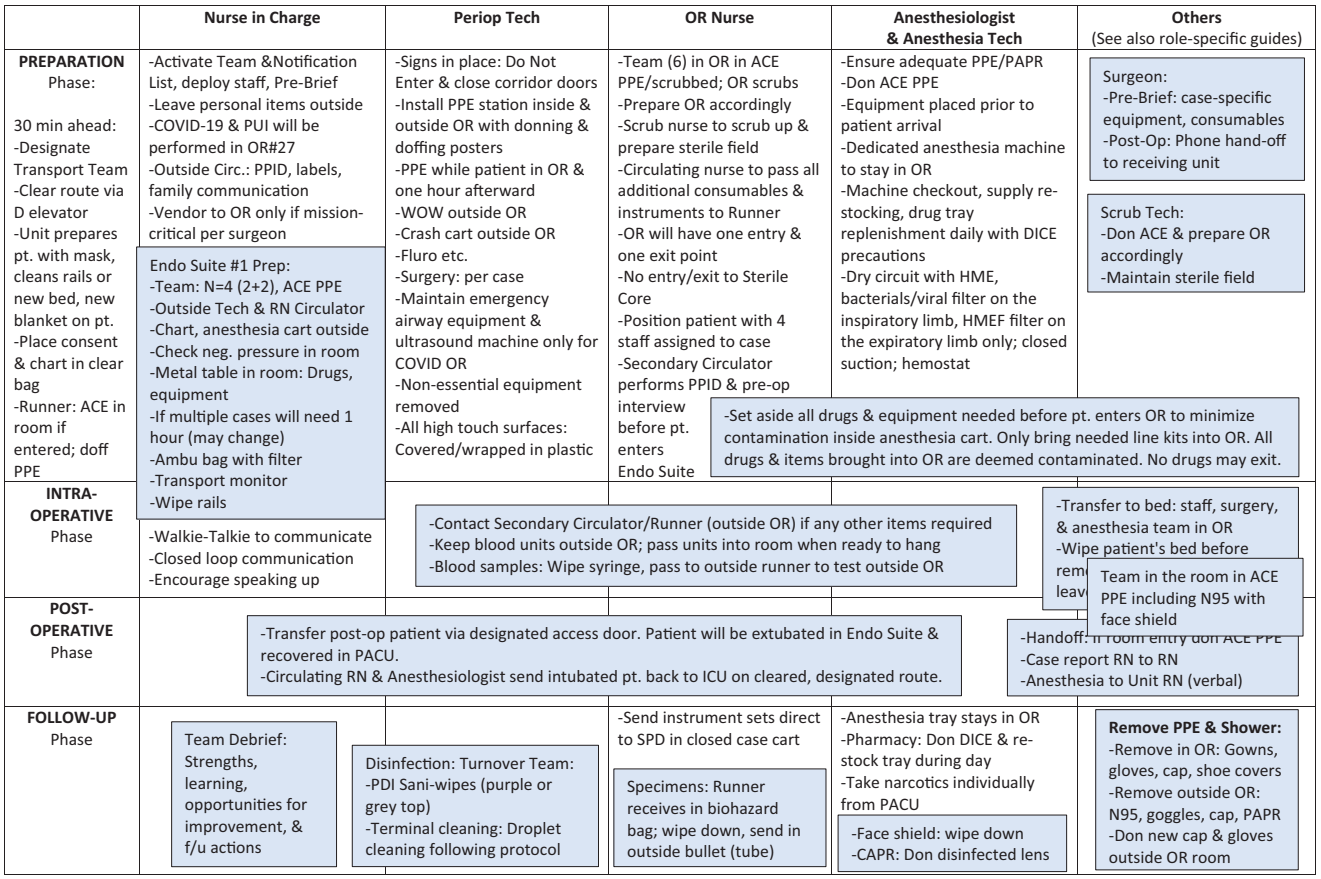
TABLE 1. Team Guide: Management of the Nonintubated, Non-aerosol-generating Procedure COVID-19-positive Patient – Updated April 8, 2020



Emory University Hospital/Emory University School of Medicine/Emory Healthcare.

necessary and sufficient as we made changes as often as 3 times a day as we progressed through simulations, learning, and reviews. The Team Guide is intended to promote situation awareness and a shared mental model of the care process among all team members.

We reasoned that a prototype of a Team Guide and in situ simulation process for a single type of case (the nonintubated, non-aerosol-generating procedure COVID-19-positive patient) at a single hospital would be most effective to enable rapid testing, learning, and revision before disseminating more widely and creating Team Guides for additional types of patients.

The Team Guide is backed up by detailed instructions for each profession and role. For example, a group of senior residents was tasked with developing such a plan coached by the program director. Additionally, all frontline providers received separate training in donning and doffing PPE.

We also created a pre-brief readiness checklist for clinical teams to use in 30-minute case pre-briefings for all staff involved in a case (Supplemental Digital Content 2, http://links.lww.com/SLA/C243).[5]

Create a Simulation Facilitator Guide and Packet

We created a Facilitator Guide (Supplemental Digital Content 3, http://links.lww.com/SLA/C243) to outline a chronological process, and provided a turnkey packet for instructors consisting of the Facilitator Guide; the Team Guide (Table 1); a sign-in sheet; a door sign indicating ''Simulation in Progress;'' a Pre-Brief Readiness Checklist for clinical cases; an in situ simulation safety checklist to mitigate risks of carrying out simulation in a dynamic, high risk clinical environment (Supplemental Digital Content 4, http://links.lww.com/SLA/C243)[6]; and a failure modes and effects analysis template (Supplementary Digital Content 5, http://links.lww.com/SLA/C243).[7] We distributed these materials to our CORE simulation faculty and others with simulation experience, and iteratively refined the materials based on facilitator and participant feedback and debriefings from actual cases that emerged in the interim. We conducted planning calls and coached the first team to replicate the process, and distributed packets and offers of support to leaders at additional hospitals.

Implement the Prototype Simulation Process in the OR of the First Hospital

The core leader (J.S.) facilitated the first simulation session with an interdisciplinary OR team as participants and with others as observers, including the larger team, subject matter experts, and CORE faculty who would facilitate future COVID-19 OR simulations.

Through simulation, interdisciplinary participants and observers learned together and provided extensive input regarding gaps. These were captured on a failure modes and effects analysis template during the session. We were able to identify and immediately fix several high priority issues that arose. For example, we made plans to provide a PPE Champion to monitor and coach participants in every case, in lieu of a "Buddy system"[5] in this early phase when buddies themselves, while trained in donning and doffing, may not yet be fully confident. We take the lists of identified gaps back to our team to calculate risk profile numbers, prioritize failure modes, and carry out further action plans to mitigate risks. Within 14 days of the Day 1 initial assemblage of a design team, the process and tools were prototyped, tested in the first hospital, replicated, adapted, and used in an additional 5 hospitals.

Incorporate Findings and Learnings From Each Simulation and Actual Clinical Case Into the Process and Tools

We continue to maintain adaptability, to communicate systematically among teams in multiple hospitals and with senior healthcare system leaders, and to update simulation and clinical processes and tools continuously.

Although the steps above seem linear, the process in fact is iterative and recursive, at times with parallel processes. We know that conditions, data, and best available evidence will continue to change and we must remain agile.

DISCUSSION

We continue to learn and adapt as we use in situ simulation to support the agile care of COVID-19 patients in the OR. We have condensed a process that typically takes 14–18 months[3] into a 10-day first phase, with spread of simulation and improvements to an additional 5 hospitals within another 4 days.

In a prescient address to the European Surgical Association in 2019, Dr. Carlos Pellegrini cited the ability to develop and lead a high performing team as the first of 10 principles in achieving mastery in the modern-day practice of surgery.[8] He noted that "the team must...develop a shared mental model. . .situation awareness, and all members must communicate efficiently, and must provide support for each other. Essential to the success of the group is mutual respect. . .and repeated practice (real or via simulation)."[p.735] We have attempted to translate this advice into practical terms to deliver care better, faster, and safer each day for the COVID-19-positive patient.

In summary, we have demonstrated feasibility and replicability of capitalizing on in situ simulation and agile improvement methods in a tightly compressed timeframe to develop, use, and spread best practices in a rising pandemic. We consider the Team Guide and tools as models to adapt and not final products as we know that these will change as more evidence emerges and as the environment changes. It is our hope that our process will be a helpful catalyst for other interdisciplinary surgical teams in accelerating their development of effective ways to safely manage the COVID-19 patient in the OR.

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