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Obstetric simulation for a pandemic

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ABSTRACT

Objective: In the middle of the COVID-19 pandemic, guidelines and recommendations are rapidly evolving. Providers strive to provide safe high-quality care for their patients in the already high-risk specialty of Obstetrics while also considering the risk that this virus adds to their patients and themselves. From other pandemics, evidence exists that simulation is the most effective way to prepare teams, build understanding and confidence, and increase patient and provider safety.

Finding: Practicing in-situ multidisciplinary simulations in the hospital setting has illustrated key opportunities for improvement that should be considered when caring for a patient with possible COVID-19.

Conclusion: In the current COVID-19 pandemic, simulating obstetrical patient care from presentation to the hospital triage through postpartum care can prepare teams for even the most complicated patients while increasing their ability to protect themselves and their patients.

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Introduction

The current COVID-19 pandemic has completely changed our lives and the healthcare environment we practice in. It is estimated that over 3.65 million patients have already tested positive and more than 250,000 people have died from the virus worldwide and these numbers continue to increase daily.¹ To combat this deadly virus, providers and clinicians are working overtime to care for their patients, oftentimes outside of

their trained specialty. Facilities are redirecting resources away from routine patient care to keep people out of the hospital unless necessary. The majority of hospital visits are now occurring via telehealth and elective surgeries have been postponed. A report at the end of March 2020 demonstrated that 99% of ICUs across the country are concerned about their ability to care for COVID-19 patients, yet 52% said they are already treating COVID positive patients.^{2,3} Groups like the Society of Critical Care Medicine are providing non-intensive care unit providers with courses to help prepare them to care

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for critically ill patients and top medical colleges are providing updated guidance and algorithms as more becomes known about this fatal disease. This situation is highly dynamic, and providers are forced to learn, adapt, and change protocols quickly as more information emerges with each passing hour.

Background

From prior pandemics and disasters, it is evident that simulation is one of the most effective ways to practice new protocols and identify gaps in knowledge and preparation.^{4–15} Communication, teamwork, and process efficiency are dramatically increased with simulations, which is why they are quickly being adapted as an essential part of medical training for small team events like codes and postpartum hemorrhages and large-scale, multi-hospital emergencies, disasters, and pandemics.

Medical simulation improves performance of medical teams and optimizes patient care by building a sense of control and understanding in an otherwise chaotic setting.¹² A large review of simulation studies demonstrated that these benefits resulted in improved patient safety by decreasing time to recognition and intervention in critical events.¹²

The Ebola outbreak in 2014–2016 was the most recent event that demonstrated a need for pandemic and disaster preparedness throughout the country, as hospitals quickly realized they did not have plans for admitting, transporting, and caring for these highly contagious patients.^{5,7,14,15} This was also one of the first times that simulations focused on protecting the providers from disease and not just improving patient care. Simulations initially focused only on donning and doffing personal protective equipment (PPE), as this was noted to be one of the most critical aspects of readiness for this threat.¹⁶ While the lessons learned in preparation for the Ebola outbreak were important to manage patients with a highly infectious virus, the virus never reached pandemic level in the United States and hospitals quickly returned to normal operating procedures. Now, facing a true global pandemic with COVID-19, it is essential to prepare healthcare teams across the country for a large-scale influx of complex and challenging patients, while protecting teams and non-infected patients from a highly contagious disease. Key components for pandemic simulation for COVID-19 include the following areas:

Personal Protective Equipment (PPE)

Given the highly infectious nature of COVID-19, simulation-based training should initiate with the arrival of the patient to the hospital. Hospitals need to be prepared to triage patients and identify all patients under investigation (PUI) as quickly as possible, isolating them and donning appropriate PPE while they undergo evaluation.

PPE has been a significant hurdle in this pandemic as many locations are facing shortages of PPE. Therefore, understanding protocols for extended use and reuse of PPE is critical to maintaining adequate protective measures. Identifying ways

to store N-95 masks or understanding the process for reprocessing them may be invaluable as a way to save resources when the supply chain is interrupted. Further, in these simulations, PPE use must either be simulated or items recycled to ensure valuable PPE is saved for use with patients only.

Initial Patient Screening

Incorporation of up-to-date screening questions for when patients present to the healthcare facility should be drilled and even scripted as these questions are the first line of protection for our staff and patients. These questions are constantly changing and frequently asked by those with little or no medical training. Once a PUI is identified, this patient needs to be isolated and potentially separated from their visitor, spouse, or partner depending on the institution's visitor policy. Immediately ensuring the staff and patient are in appropriate PPE is a priority. Most hospitals have designated screening areas and limited entry points. Therefore, the safest transportation method and route for a COVID positive/PUI patient from those specific points to Labor and Delivery should be identified early and practiced.

As each hospital will have their own plan for alerting the necessary staff and teams of a new PUI, details about which members of the patient's care team make those calls should be clearly identified and included in all simulations. The process of moving the patient to a pre-identified room should be carefully developed to decrease exposure to other patients and staff. Working through safely moving multiple patients at one time should also be practiced in case of mass presentation with a focus on protecting staff and patients from exposure. One important consideration is to have a "runner" who moves in advance of the transportation team to clear hallways of patients, visitors, and providers. The runner also opens and closes all doors allowing the "contaminated" personnel to touch nothing along the route.

Patient Evaluation Environment

A COVID-19 designated room should have limited quantities of PPE and relevant triage and labor and delivery supplies within the room to decrease providers entering and exiting the room and sharing of supplies between patients. However, plans should include limiting storage of supplies in these rooms as all room contents will have to be thrown away if an aerosolizing event occurs with a COVID/PUI patient. Hospitals must balance appropriate stocking of rooms with what is absolutely necessary. It is a fact that all supplies in the room will have to be wasted or terminally cleaned when the patient leaves this room. Prepackaged essential supply kits for specific tasks (triage, delivery) that can be taken into a room stocked with only essential single-use items may be incorporated into simulations. Storage of PPE and methods for safe donning and doffing are of the utmost importance for teams to protect themselves and patients.

Delivery Management

The second stage of delivery, is highly debated as a potentially aerosolizing event, making this possibly a high-risk for the spread of COVID-19.¹ Discussion about which personnel are in the room with the patient and which personnel are on stand-by should be outlined and practiced. All providers in the room should have full PPE for the delivery. Additional team members (anesthesiology, advanced pediatrics, an additional Obstetrician) may wait outside the room ready to don PPE and enter if required. The process for acquiring additional supplies or personnel should be simulated to identify any concerns. Additional simulations for contingency plans should be outlined and practiced, including emergency cesarean delivery with and without intubation/extubation, transfer of a patient to the ICU (including who and how to notify the receiving team), and management of a postpartum hemorrhage including procuring medications, potential transfer to OR, transport of blood from the blood bank, and transfer of specimen handling if necessary.

A multidisciplinary approach should be taken to incorporate pediatric, anesthesia, and ICU protocols into the care of these patients and their babies. Institutional protocols for handling mom and baby interactions should be included in the simulation. If mother and baby interaction will be handled through distancing, masking and careful hygiene the simulation should ensure room set up, supplies and equipment to facilitate this approach. Should the guidance be to separate mom and baby, and the patient agrees to that, it is vital to understand when and how this separation would occur and how to fully care for the baby in the postpartum period with this separation.

Obstetric Emergencies

Labor and delivery management inherently involves high-risk situations with rapidly changing events that must still be addressed during the COVID-19 pandemic. In obstetric team training, algorithms are heavily relied upon to care for patients in emergency situations and therefore, simulating these emergencies while incorporating the new protocols for caring for PUI and COVID-positive patients must be practiced.

Simulation Reviews

Finally, as soon as possible after each simulation and each actual patient encounter with the new protocols, a formal, multidisciplinary debrief should take place to review processes that are working well, areas for improvement, and concerns from the team. Specific action items to improve the process moving forward should be identified, assigned to individuals to work on, and implemented. In the current situation, guidance is changing rapidly, and teams will have to adapt and change quickly. Excellent patient care should always be the top priority which must not be changed by the COVID-19 pandemic. While using the least amount of personnel and interventions possible is desirable, it is important to

continuously consider what is safest for the COVID-positive patient, the providers, and the other patients.

Initial Lessons Learned

In order to provide resources for conducting obstetric COVID-19 simulation, the ACOG Simulation Working Group created a standardized simulation instruction manual which is available online at: <https://www.acog.org/education-and-events/simulations/covid-19-obstetric-preparedness-manual>¹⁶. This manual includes general instructions as well as four standardized simulation exercises that involve the following scenarios:

- Simulation #1: Obstetric patient with suspected Coronavirus (COVID-19) presenting to hospital in active labor
- Simulation #2: Obstetric patient with suspected Coronavirus (COVID-19) in labor who progresses to have a spontaneous vaginal delivery
- Simulation #3: Obstetric patient with suspected Coronavirus (COVID-19) in labor who requires cesarean delivery
- Simulation #4: Obstetric patient with suspected Coronavirus (COVID-19) in labor with worsening respiratory status requiring transfer to ICU then vaginal delivery in ICU

These simulations are meant to be used and adapted to the local hospital guidelines. The authors of this article have run them many times at different hospitals and there are several lessons which have been learned that should be considered. Some of these include the following:

1. Practice simulations should be done on a continuing basis:
 - a. While initial simulations can help to create protocols, it is important to practice with different shifts and also whenever the procedures change. As more information is available with regards to triage, PPE and treatment, it is critical to run them at least weekly, if not more often, to keep the team up to date.
2. Have a triage and management plan of a patient in her second or third trimester with COVID symptoms:
 - a. Traditionally, a patient over 20 weeks of gestation would go to an acute care clinic or the Labor and Delivery triage. If the patient has symptoms concerning for COVID, this initial triage should be performed in a safe, designated area, with attention to limiting exposure to other patients and staff. Each institution should have outlined approaches that allow for addressing obstetrical concerns and safe transport in appropriate PPE to isolation rooms on Labor & Delivery when indicated.
3. Educate patients and staff about changes in policy:
 - a. All providers and patients must be educated on any policy developed to divert symptomatic patients to be screened and tested. All patients with planned visits (required/non-telehealth appointments) and planned admissions may be called the day prior to their appointment or admission and screened over the phone. They should be given updates on new guidance

and a way to ask questions should they develop concerns before their planned arrival.

- b. It also became clear that patients were arriving to the hospital with their own masks and those without one were given one by the hospital. This can be reviewed in the pre-screening phone calls.
 - c. The pre-screening phone calls were also the opportunity to educate the patients on the visitor policies for Labor and Delivery.
4. Standardize protocols for how to notify the Maternal Fetal Medicine (MFM) service and the hospital COVID teams:
 - a. Each hospital will have specific protocols and require involvement of different departments with the admission of a PUI/COVID patient. Teams should outline which staff member will be responsible for calling the respective administrative/departmental personnel, possibly including: Infectious Disease, Maternal Fetal Medicine, Infection Control, Nursing Administration, Pediatrics, Anesthesiology, and/or Obstetric Leadership.
 5. Multidisciplinary team preparedness is necessary:
 - a. It is vital to involve anesthesiology, pediatrics, infectious diseases, and critical care in all planning and simulations as these specialties have quickly changing guidelines, as well. It was also clear that there were smaller, but still important gaps, in planning that simulation revealed:
 - b. Pediatric Considerations:
 - i. The use of simulation was found to be highly effective for planning of handoff for the newborn. Guidelines from national organizations such as ACOG provides information regarding the suspension of common practices such as the use of late-preterm maternal steroids, oxygen administration for non-reassuring fetal heart tracings, delayed cord-clamping, and skin-to-skin maternal-infant bonding. Simulation debriefing provided for sharing of information regarding these guidelines and for establishing institutional policies with interdisciplinary teams. For the pediatric teams, simulation provided for workflow refining of infant resuscitations either in the OR or in an isolation room outside of the OR given that these infants are PUIs or that resuscitative efforts may be aerosolizing. Safe donning and doffing of pediatric teams was achieved through practice provided through simulation. Finally, decontamination procedures of infant transport equipment was established.
 - c. Intensive Care Considerations:
 - ii. The logistics of ICU deliveries (both vaginal and Cesarean) presented new challenges to interdisciplinary teams. Through simulation we formed new collaborations and different perspectives during preparation for these scenarios. Obstetric teams developed new processes and minimal equipment supply lists while intensivists modified their room setup and procedures to accommodate for a delivery. Pediatric teams also practiced and planned for

the resuscitation and transfer of a newborn in the ICU.

d. Anesthesia Considerations

- iii. The anesthesia teams carefully evaluated the OR set-up to limit the exposure of aerosolizing events like intubation. Recovery location options for these patients were explored and through simulation, changes to room setup, intubation/extubation safety, and post-operative recovery was reviewed.
6. Overall Preparation of Labor and Delivery, OR and PACU Units:
 - a. Simulation demonstrated the importance of workflow for these units for COVID positive or PUIs. Preparing a "COVID Cart" with PPE as well as a list of designated COVID team members trained and fitted for specialized PPE was essential. Ideally negative pressure labor and delivery rooms should be allocated and if these are not available then planning for isolation of these patients from other laboring patients is essential. As well, preparing a designated operating room for Cesarean Sections by removing all extra supplies or equipment, covering or plastic wrapping all keyboards and equipment necessary for the pediatrics, anesthesia and obstetrical teams to prevent needless contamination. Assignment of clearly labeled donning and doffing areas with sufficient supplies of PPE, hand sanitizer, disinfecting wipes and containers as well as designated "Dofficers" for assisting healthcare workers were found to be essential. Assigning runners outside of the OR with direct communication with the OR personnel helped prevent breach of isolation. Designating a PACU room with negative pressure was found to be ideal, however if these are not available then designating a PACU strategically based on the institution was important in the planning process. Clear communication between the OR and PACU should be established. Optimally planning for maximizing the use of regional anesthesia for Cesarean Sections (whether planned or urgent) should be initiated. The greatest risk to healthcare workers occurs during the intubation and extubation procedures when a general anesthetic becomes necessary. Simulation was found to be invaluable for this preparation in order to minimize healthcare worker exposure. Institutions have various protocols for these procedures, and it is essential for obstetric teams to work with their anesthesia colleagues regarding PPE and process for these events (especially if unplanned general anesthesia needs to take place intraoperatively). Active management of the third stage is essential in all patients, but particularly in patients with COVID to ensure that fluid shifts and bleeding patterns are safely monitored.
 - b. Missing materials/equipment in patient rooms
 - i. While usually, leaving the room to grab an extra cord for an intrauterine pressure catheter (IUPC) would not normally be a problem, to limit entry and exiting the room and limit amount of PPE used, it can be convenient to have kits of just essential supplies in the room. However, equipment that is exposed to COVID patient and not used increases waste and therefore

keeping excess supplies like extra IUPC and monitoring cords, saline flushes, suture and lidocaine for repairs, forceps, vacuums, and extra delivery kits ensured ease of access while limiting waste.

ii. This can be expanded to include making kits to use for deliveries or care on other units. In some settings, multidisciplinary drills to teach the collaborating units where these were located, and what they contained which increased preparation and eased anxiety.

7. Review Postpartum Recovery Considerations:

a. Patient flow from the OR to the PACU was established through simulation workflow processes. Institutions will be able to allocate specific areas for these patients to recover. The logistics involved during doffing of each team member required multiple simulations in order for these members to become comfortable with these vital steps when healthcare workers are at greatest risk for self-contamination. In order to prevent a "bottleneck" of healthcare members doffing at the same time we established several doffing stations with "Doffers". As well as our PACU teams, we worked with our critical care and ICU teams to prepare for the event that a pregnant COVID patient should need to deliver in the ICU or recover there.

b. Management and handling of the placenta

i. In many of our initial simulations, we found there was no plan for management of a placenta from a PUI/COVID patient that we desired to have the pathology department evaluate. In some institutions practicing these simulations, a sterile processing plan, along with the ability to notify the receiving pathology team of the specimen, was developed to send some or all placentas for research analysis or pathologic evaluation. While in other institutions, made a blanket rule to discard all placentas in hazardous waste.

c. Management of scrubs after an aerosolizing event with a COVID patient

i. While a plan for changing scrubs was outlined early in this process, simulation demonstrated that there was no plan for safely disposing of soiled scrubs that did not put the housekeeping/laundry team at risk. Organization of a separate bin for COVID soiled scrubs with a decontamination process should be considered.

d. Transport and storage of breastmilk for an isolated mother and baby

i. Should a mother agree to be separated from her infant but desire to pump for her baby, lactation desired a safe collection and storage process for this breast milk. A separate pump and refrigerator for these patients can be placed in respective rooms.

Summary: Pregnancy and birth are defining moments for a woman and her family. They can also be one of the most stressful events in a woman's life. In the middle of a new pandemic, women and their practitioners are frequently in uncharted territory and plans that have been made are having to be altered in ways most could never have foreseen. It is vital that practitioners are prepared to care for their patients' physical and emotional needs with the highest level of care

while remaining current on ever-changing new information on the disease, protocols, patient safety practices and personal protection strategies. Simulation allows for continuous practice that builds confidence and teamwork and increases patient safety. Given the unknowns that accompany this pandemic, protocols are rapidly changing, and recurring simulation events allow for incorporation of new guidelines and hospital-wide changes. Facing this pandemic with the maximum preparation and knowledge is vital to the care for our patients and ourselves.

Resources available: <https://www.acog.org/education-and-events/simulations/covid-19-obstetric-preparedness-manual>

Disclosures

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