

## **Appendix 1. Supplemental COVID-19 Patient Care Protocols**

Here we describe our current COVID-19 safety protocols, however these are rapidly evolving with new updates about the disease and epidemiological patterns.

### *1.1 Supplemental case report details on cesarean section*

Once the decision was made to proceed with delivery, there were multiple logistical elements to consider. In order to safely transport the patient from the ICU to the designated COVID-19 obstetric operating room, we first ensured that all hallways and elevators to the operating room were cleared of non-essential personnel and physical obstructions. Providers in the hallways were prepared to open doors and push buttons to prevent personnel who were physically transporting the patient from contaminating hospital surfaces. The patient was then covered with a clean sheet and all team members transporting the patient wore novel respiratory personal protective equipment (PPE), including an N95 respirator plus face shield or a powered-air-purifying respirator (PAPR) as well as gown and gloves. The patient's ventilator was transitioned to a portable model with a high-quality viral filter and a closed system.

Upon arrival to the operating room, the patient was moved to the surgical bed and the transport bed was kept in the operating room for cleaning and transfer back to ICU. All personnel in the operating room wore novel respiratory PPE, gown and gloves. The operating room was a positive pressure environment. Patient was prepped and draped in the usual sterile manner. The cesarean section was then performed in the usual manner, with only two surgeons involved in the case to minimize physician exposure.

Once the surgery was completed, the patient was transferred back to her bed, covered with a clean sheet, and transported back to the ICU using the same transport pathway used to come to the operating room. The surgical teams and support staff doffed their lower body PPE prior to leaving the operating room and donned clean PPE for the transport. Nursing staff ensured proper donning and doffing of PPE at each stage.

### *1.2 Supplemental case report details on neonatal resuscitation*

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The neonatal delivery team was limited to the most experienced neonatologist, neonatal intensive care unit (NICU) nurse and respiratory therapist available. All wore novel respiratory personal protective equipment, including N95 respirators plus face shields. The attending neonatologist donned PPE except gloves and gown, then performed a surgical scrub and covered with sterile surgical gown and gloves to receive the baby. A “clean team” consisting of a second neonatologist, NICU nurse, and respiratory therapist were also donned in novel respiratory PPE and prepared to step into the operating room to assist in resuscitation if needed.

The infant was delivered apneic under general anesthesia and was placed under the warmer of an open canopy-topped isolette (GE Giraffe Omnibed), to facilitate later transport to the NICU. Once endotracheal tube, lines and monitors were secured, canopy isolette top was closed and transfer was made at the threshold of the operating room to the waiting “clean team” to maintain isolation. The infant was transported into a negative pressure isolation room in the NICU.

### *1.3 COVID-19 labor and delivery patient care protocols*

At our institution, we have developed labor and delivery patient care protocols based on available research and guidance from the Centers for Disease Control and Prevention (CDC), Society for Maternal-Fetal Medicine (SMFM), American College of Obstetricians and Gynecologists (ACOG), and American Academy of Pediatrics (AAP) Committee on Fetus and Newborn.<sup>1-4</sup>

All admitted patients with confirmed or suspected COVID-19 are placed in an isolation room identified by a “Novel Respiratory Isolation” sign. Patients must wear a surgical mask and gown, and they are restricted to their room at all times. Patients are allowed one support person who cannot change over the duration of the hospital admission. The support person must wear protective gear at all times (gown, gloves, surgical mask, and eye protection) and is restricted to the patient’s room at all times. If the support person develops symptoms including cough or fever, they are asked to leave the hospital immediately. With regards to daily rounding, only the attending physician enters the room with other team members using tele-health or phone as needed. Direct contact with the patient only occurs if the provider will perform a direct physical exam or in-room procedure that will provide clinical information to impact

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patient assessment and clinical care in the next 24-48 hours. If the patient goes into labor or is induced, the patient is not transported to a new labor room in order to minimize contamination of multiple spaces.

COVID-19 patients in labor must wear a gown and surgical mask throughout their labor course. For labor pain control, nitrous oxide and remifentanil patient-controlled analgesia (PCA) are not permitted. Moreover, supplemental oxygen is only used for maternal hypoxia but not for intrauterine resuscitation. The delivery team is restricted to one attending physician, one bedside nurse, and only essential neonatology team members. One additional senior resident physician may also be at the delivery as needed. All members of the delivery team wear novel respiratory personal protective equipment (PPE), including an N95 respirator plus face shield or a powered-air-purifying respirator (PAPR) as well as gown and gloves. Skin-to-skin and delayed cord clamping are not performed to minimize neonatal exposure to COVID-19.

For all COVID-19 patients undergoing cesarean section whether planned or urgent/emergent, the surgery takes place in a designated COVID-19 obstetric operating room in order to minimize contamination of our other operating rooms. The personnel involved in the surgery is restricted to the minimum necessary in order to reduce healthcare worker exposure and PPE usage. All personnel in the operating room wear novel respiratory personal protective equipment (PPE), including an N95 respirator plus face shield or a powered-air-purifying respirator (PAPR) as well as gown and gloves. If the patient needs to be intubated prior to starting the surgery, only the anesthesia team and the operating room nurse are present in the operating room, and will give an “all clear” signal when it is safe for other personnel to enter the room. All providers besides the anesthesia team are also asked to leave the room during extubation and for at least 15 minutes after, based on average air circulation time.

Our institution has also begun universal screening for SARS-CoV-2 of patients admitted to our labor and delivery unit. Patients with planned admissions – including inductions of labor, cesarean deliveries and cerclages – are tested 3-4 days prior to their planned admission date. Patients who test positive for COVID-19 and have non-urgent admission indications may be asked to postpone to a later date. Swab testing is considered an aerosolizing procedure, thus healthcare professionals collecting the

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specimen wear novel respiratory personal protective equipment (PPE), including an N95 respirator plus face shield or a powered-air-purifying respirator (PAPR) as well as gown and gloves. Patients are kept in an isolated room during testing.

Postpartum we are recommending early discharge 24 hours after vaginal delivery or 48 hours after cesarean delivery, with exceptions for mothers with a postpartum hemorrhage requiring a blood transfusion, third or fourth degree lacerations, gestational hypertension or preeclampsia, endomyometritis, type I diabetes mellitus, maternal cardiac disease, patients requiring intravenous narcotics for pain management, psychiatric concerns, or other major medical comorbidities.

#### *1.4 COVID-19 neonatology patient care protocols*

Mothers with a history of suspected or confirmed COVID-19 in pregnancy are counseled regarding two approaches to neonatal management: 1) Conservative approach involving immediate separation of the baby from the mother to minimize infection risk, bathing with soap and water, and placement of the baby in respiratory isolation, or 2) Colocalization approach which still includes bathing with soap and water but allows for skin-to-skin, breastfeeding (with the mother wearing a mask), and colocalization of baby and mother in the same room. Except while breastfeeding, we recommend that the baby is kept in a bassinet at least six feet from the mother, preferably behind a screen or curtain, with routine infant care provided by the mother's support person as much as possible.

In the case of either the mother or neonate having severe illness, prematurity, critical congenital anomalies or other indications requiring continued inpatient care beyond the normal postpartum period, a conservative approach taken by default. Otherwise shared decision-making is used in choosing a conservative or co-localization approach, with consideration to family values and timing and severity of maternal COVID-19. In both approaches, delayed cord clamping can be performed per routine protocol. All exposed neonates have combined nasopharyngeal, oropharyngeal, and rectal swabs for SARS-CoV-2 at 24 and 48 hours of life and cord blood testing for COVID-19 IgG and IgM.

SARS-CoV-2 has not been detected in the breast milk of COVID-19 mothers to date, though risk of transmission of SARS-CoV-2 after birth via contact with infectious respiratory secretions is a concern.

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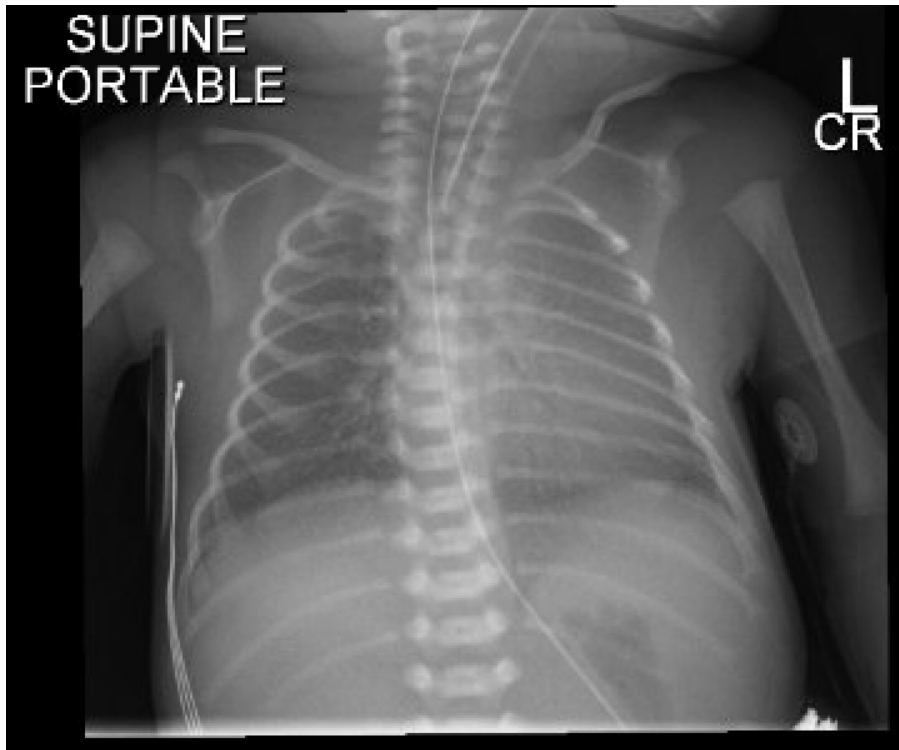
The benefits of breastfeeding and skin-to-skin contact are well understood for mother-infant bonding, increased likelihood of breastfeeding, stabilization of glucose levels, and maintaining infant body temperature. At our institution, breastfeeding is permitted in mothers with suspected or confirmed COVID-19 but mothers are advised to wash their chest with water and soap prior to feeding and to follow guidelines for proper hygiene before touching any pump or bottle parts. Pumped maternal milk is stored in the refrigerators in each baby's isolation room to avoid cross-contamination.

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Appendix 2. Neonatal chest radiography on day of life one.



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### Appendix 3. Neonatal Clinical Laboratory Results

Measure	Reference range	DOL 1*	DOL 2	DOL 3	DOL 4	DOL 5	DOL 6
Hemoglobin, g/dL	14.5 – 22.5	14.7	NA <sup>†</sup>	NA	NA	NA	NA
Hematocrit, %	45 – 67	44.1	NA	NA	NA	NA	NA
White blood cell count, x10 <sup>9</sup> /L	9.0 – 38.0	6.2	NA	NA	NA	NA	NA
Lymphocyte count, x10 <sup>9</sup> /L	2.0 – 12.0	1.36	NA	NA	NA	NA	NA
Neutrophil count, x10 <sup>9</sup> /L							
Absolute count	5 – 28	3.60	NA	NA	NA	NA	NA
Segmented count	4.9 – 27.9	3.60	NA	NA	NA	NA	NA
Platelet count, x10 <sup>9</sup> /L	140 – 450	299	NA	NA	NA	NA	NA
Serum lactate, mmol/L	0.5 – 2.0	1.1	2.0	1.5	NA	NA	NA
Blood gas							
pH	7.35 – 7.45	7.24	7.39	7.33	7.27	7.34	7.30
pCO <sub>2</sub> , mmHg	27 – 41	55	38	44	56	47	55
pO <sub>2</sub> , mmHg	80 – 100	73	74	44	36	41	44
HCO <sub>3</sub> , mmol/L	22 – 27	22	22	23	25	24	26
Base excess, mmol/L	–	- 4	- 2	- 3	- 2	- 1	0
Blood culture	No growth	No growth	NA	NA	NA	NA	NA
Oral/Nasopharyngeal Swab for SARS-CoV-2	Not detected	NA	Not detected	Not detected	NA	NA	NA
Rectal Swab for SARS-CoV-2	Not detected	NA	NA	Not detected	NA	NA	NA
COVID-19 IgG	<1.00 AU/mL	NA	NA	NA	NA	<0.02 AU/mL	NA
COVID-19 IgG	<1.00 AU/mL	NA	NA	NA	NA	<1.00 AU/mL	NA

\*DOL=Day of life

†NA=Not applicable

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<sup>1</sup> Society for Maternal-Fetal Medicine and Society for Obstetric and Anesthesia and Perinatology. Labor and Delivery COVID-19 Considerations. Accessed April 7, 2020.

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<sup>2</sup> American College of Obstetricians and Gynecologists. COVID-19 FAQs for Obstetrician-Gynecologists, Obstetrics. Accessed April 11, 2020. <https://www.acog.org/clinical-information/physician-faqs/covid-19-faqs-for-ob-gyns-obstetrics>

<sup>3</sup> Puopolo KM, Hudak ML, Kimberlin DW, et al. Management of Infants Born to Mothers with COVID-19. American Academy of Pediatrics Committee on Fetus and Newborn, Section on Neonatal Perinatal Medicine, and Committee on Infectious Diseases. Published online April 2, 2020.

<sup>4</sup> Boelig RC, Manuck R, Oliver, EA, et al. Labor and Delivery Guidance for COVID-19. American Journal of Obstetrics & Gynecology MFM. Published online March 25, 2020.

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