Society for Maternal-Fetal Medicine
High-risk pregnancy experts

Society for Maternal-Fetal Medicine
Management Considerations for Pregnant Patients With COVID-19
Developed with guidance from Torre Halscott, MD, MS and Jason Vaught, MD
4.29.20

The National Institutes of Health have recently published treatment guidelines for COVID-19. These guidelines can be found here.

The COVID-19 pandemic has placed extreme stress on the national health care system. As the epidemiology of COVID-19 evolves, obstetric care providers must manage pregnant patients with COVID-19 in the setting of little to no experience or rigorous data from which to develop protocols and guidance.

The recommendations provided here are not proscriptive and may not apply in your clinical setting. They are intended to introduce concepts to be considered in each setting and give examples of current practices from some centers that have seen a relatively higher volume of cases. These recommendations should be considered in the overall clinical context for each patient and center. This guidance will be updated as additional data and information emerge.

Identification of Mild, Moderate, and Severe Symptoms of COVID-19

The severity scale for COVID-19 is as follows (the decision for management may be different in the pregnant patient with COVID-19, especially regarding oxygen saturation; see Inpatient and Outpatient Care of Pregnant Patients With COVID-19):

- Asymptomatic or presymptomatic disease or presumptive infection is defined a positive COVID-19 test result with no symptoms.
- Mild disease is defined as flu-like symptoms, such as fever, cough, myalgias, and anosmia without dyspnea, shortness of breath, or abnormal chest imaging.
- Moderate disease is defined by evidence of lower respiratory tract disease with clinical assessment (dyspnea, pneumonia on imaging, abnormal blood gas. results, refractory fever of 39.0 °C /102.2 °F or greater not alleviated with

acetaminophen) while maintaining an oxygen saturation of greater than 93% on room air at sea level.

- Severe disease is defined by a respiratory rate greater than 30 breaths per minute (bpm), hypoxia with oxygen saturation less than or equal to 93%, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen of less than 300, or greater than 50% lung involvement on imaging.

- Critical disease is defined as multi-organ failure or dysfunction, shock, or respiratory failure requiring mechanical ventilation or high-flow nasal cannula.

Inpatient and Outpatient Care of Pregnant Patients With COVID-19

-Criteria for inpatient vs outpatient management

Many COVID-19 patients, including pregnant patients, have mild or no symptoms.

- Outpatient monitoring with a 14-day self-quarantine can be considered for pregnant patients with COVID-19 who have mild symptoms or are asymptomatic. Recommendations for outpatient monitoring is outlined below.

- Inpatient monitoring may be needed for the following categories of patients:

    - Pregnant COVID-19 patients with moderate to severe signs and symptoms or oxygen saturation less than 95%.

    - Pregnant COVID-19 patients with comorbid conditions, eg, uncontrolled hypertension, inadequately controlled gestational or pregestational diabetes, chronic renal disease, chronic cardiopulmonary disease, or immunosuppressive states (intrinsic or medication-related)

    - Pregnant COVID-19 patients with fevers greater than 39 °C despite acetaminophen, raising concern for secondary hemophagocytic lymphohistiocytosis (sHLH) or “cytokine storm syndrome.” sHLH is a fulminant and often fatal hypercytokinemia associated with multi-organ failure. The disease is defined by unremitting fever, cytopenia, and high ferritin levels. If a patient has an Hscore (see Table 1) indicating a high probability for sHLH, inpatient observation is warranted.[1] The Hscore has not been validated in pregnancy. If there is concern for sHLH in a pregnant patient, testing should be performed and interpreted by experienced providers (eg, intensivist, infectious disease expert).

Table 1. Hscore for Secondary Hemophagocytic Lymphohistiocytosis (sHLH)[a,1]

Parameters	Score
Temperature	
<38.4 °C	0
38.4-39.4 °C	33
≥39.5 °C	49
Organomegaly	
None	0
Hepatomegaly or splenomegaly	23
Hepatomegaly and splenomegaly	38
Number of cytopenias[b]	
1 lineage	0
2 lineages	24
3 lineages	34
Triglycerides	
<133 mg/dL	0
133–354 mg/dL	44
>354 mg/dL	64
Fibrinogen	
>250 mg/dL	0
≤250 mg/dL	30
Ferritin	
<2000 ng/mL	0
2000–6000 ng/mL	35
>6000 ng/mL	50
Serum aspartate aminotransferase	
<30 IU/L	0
≥30 IU/L	19
Hemophagocytosis on bone marrow aspirate	
No	0
Yes	35
Known immunosuppression	
No	0
Yes	18

[a]The Hscore generates a probability for the presence of sHLH. Scores greater than 169 are 93% sensitive and 86% specific for sHLH. This scoring system has not been validated in the pregnant population.
[b]Defined as hemoglobin ≤9.2 g/dL and/or leukocyte count of ≤5000/mm^3, and/or platelet count of ≤110,000/mm3.

Pregnant patients with clinical findings of COVID-19 that warrant pharmacologic treatments should be considered for inpatient monitoring. At this point in time, all pharmacologic agents (hydroxychloroquine, remdesivir, tocilizumab, convalescent plasma) used in COVID-19 are considered investigational, and drug efficacy in COVID-

19 remains unclear. At present, there are no drugs or other therapeutics approved by the U.S. Food and Drug Administration (FDA) to prevent or treat COVID-19. Hydroxychloroquine is the only investigational oral medication given in the outpatient setting commonly outside of COVID-19, i.e., lupus, rheumatic arthritis, and other autoimmune disorders. In patients receiving hydroxychloroquine on an outpatient basis, an electrocardiogram to assess baseline QT segment prolongation and arrhythmias should be considered. The U.S. Food and Drug Administration (FDA) cautions against the use of hydroxychloroquine in the outpatient setting outside of a clinical trial[2]. A detailed medication history should be taken to assess whether the patient is taking any other QT-prolonging agents (Box 1). Inpatient admission for medication administration with mild or no symptoms should be individualized and follow institutional standards.

Box 1. QT-Prolonging Agents

- **Antipsychotics:** Haloperidol, ziprasidone, quetiapine, thioridazine, olanzapine, risperidone
- **Antiarrhythmics:** Amiodarone, sotalol, dofetilide, procainamide, quinidine, flecainide
- **Antibiotics:** Macrolides, fluoroquinolones
- **Antidepressants:** Amitriptyline, imipramine, citalopram, amitriptyline
- **Others:** Methadone, sumatriptan, ondansetron, cisapride

-Protocols for outpatient care

- Pregnant outpatients with COVID-19 should be monitored closely by their obstetric care providers for worsening symptoms. Patients should perform daily self-assessments and should be given specific instructions about when to contact their health care providers outside of regularly scheduled visits. Telehealth is a reasonable option as it limits exposure to other patients and health care workers and may be more convenient for patients and those caring for patients with COVID-19. If an obstetric care provider recommends outpatient management, he or she should ensure that the institution has a reliable feedback mechanism for early detection of a worsening condition.

- Reasons to call a health care provider (or emergency medical services) for COVID-19 patients or caregivers for COVID-19 patients include the following:

    - Worsening shortness of breath

    - Tachypnea

    - Unremitting fever (greater than 39 °C) despite appropriate use of acetaminophen
    - Inability to tolerate oral hydration or needed medications
    - Oxygen saturation less than 95% either at rest or on exertion (if home pulse oximetry available)
    - Persistent pleuritic chest pain
    - New onset confusion or lethargy
    - Cyanotic lips, face, or fingertips
    - Obstetrical complaints, such as preterm contractions, vaginal bleeding, or decreased fetal movement

- There is no guidance about the timing of frequency for follow-up outpatient care; however, it is reasonable to have a follow-up visit at least once within 2 weeks of diagnosis of COVID-19. These visits can either be through telemedicine or specialized COVID-19 clinics where available. Obstetric care providers should remain involved in outpatient care to monitor for obstetric complications and maternal and fetal well-being.

- Antenatal testing (nonstress tests, biophysical profiles) should be performed for the usual indications, with consideration of consolidating these tests as feasible, eg, a once-weekly full or modified biophysical profile instead of twice-weekly nonstress tests.

- Efforts should be made to consolidate visits, eg, clinic and ultrasound on the same date and in the same location, as feasible, to mitigate risk to the patient, providers, and community.

-Oxygen saturation in pregnancy

- In general, the recommended oxygen saturation is 95% or greater in pregnancy. For nonpregnant patients with COVID-19, recommendations are to maintain an oxygen saturation of 92% or greater.[3] Obstetric care providers should look for changes not only in measured oxygen saturation by pulse oximeter but also the supplemental oxygen requirements (face mask, high-flow nasal cannula, etc) needed to maintain appropriate levels and will need to consider targeting an oxygen saturation that is higher than would be used for a non-pregnant patient.

- Exertional oxygen saturation should also be assessed with a walking oxygen saturation test. Patients whose oxygen saturation is less than or equal to 95% on room air with exertion should be considered for inpatient admission.

- Obstetric care providers should also follow trends in oxygen supplementation and work of breathing to maintain adequate oxygen saturation. Increases in work of breathing (respiratory rate greater than 30 bpm, use of accessory muscles, pursing of lips, and need for oxygen supplementation) could be a sign of worsening disease and signal a need for a higher level of support and care.

- Prior to discharge or downgrading of designated clinical severity, maternal oxygen saturation should be remeasured off oxygen and with ambulation or exertion.

-Protocols for inpatient care

- Frequency of vital sign assessment depends on the severity of illness and the corresponding level of nursing care required. For general ward patients with mild symptoms, vital signs including temperature, heart rate, respiratory rate, blood pressure, and pulse oximetry can be performed every 4 to 8 hours and as needed.

- For pregnant patients with severe disease, vital signs should be obtained every 2 to 4 hours. To reduce exposure to health care workers, continuous pulse oximetry and/or telemetry can be used to decrease patient contact and exposure risk.

- For patients with critical illness, continuous pulse oximetry and telemetry should be utilized. Noninvasive and invasive cardiovascular monitoring can be considered as indicated. Vital signs, including respiratory support as needed, should be recorded every 1 to 2 hours.

- Fetal and tocodynamometer monitoring should also be performed when fetal intervention, including delivery, would be considered based on gestational age, fetal and maternal status, and maternal preferences (see section on delivery recommendations.)

Management of Severe Disease

-Early warning signs

Early warning signs include the following:

- An increased sensation of dyspnea and/or work of breathing
- Inability to maintain adequate oxygen saturation
- Persistent or more frequent fevers
- Worsening of myalgias

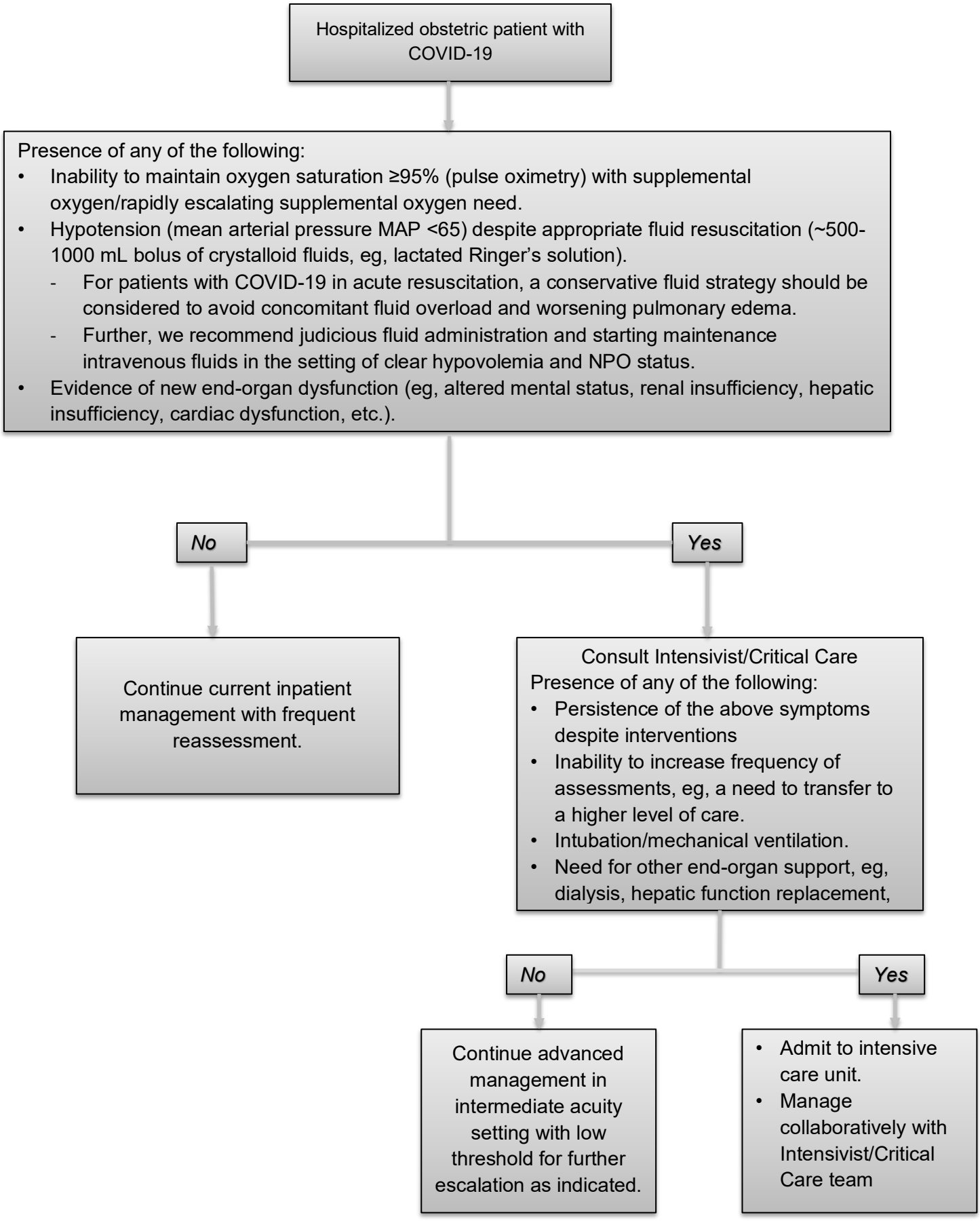
-Scoring systems

Scoring systems may be utilized to aid in the assessment of severe disease, such as modifications of the Sequential Organ Failure Assessment (SOFA) score,[4] the "quick" qSOFA,[5] and the modified Early Warning Signs score.[6] However, data are limited or inconclusive on the effectiveness of early warning signs in pregnancy, and these scoring systems may not consistently reflect who will become the most critically ill with COVID-19. The Society for Maternal-Fetal Medicine has published guidance on the diagnosis and management of sepsis in pregnancy that discusses important considerations for the use of the SOFA and qSOFA scores in pregnancy.[7]

-Admission to Intensive Care

The following algorithm (Figure 1 on next page) can be used when considering the admission of a COVID-19 patient to intensive care.

Figure 1. Algorithm for Intensive Care Unit Admission



-*Timing of intubation*

- Intubation timing should be individualized. Maternal status, preexisting comorbidities, presence of multi-organ failure, required oxygen supplementation, and need for transport to a facility with a higher level of care should be considered when placing a definitive airway.

- Typically, intubation is considered when oxygen requirements are as follows (consultation with Intensivist/Critical Care specialist or Anesthesiologist is recommended as these criteria are rapidly evolving):

    - Greater than 15 L per minute (by common nasal cannula or mask), or

    - Greater than 40 to 50 L per minute by high-flow nasal cannula, or

    - Greater than 60% fraction of inspired oxygen (FiO_2) by Venturi mask to maintain an oxygen saturation of 95% or greater by transcutaneous pulse oximeter.

- The inability of a patient to protect the airway due to altered mental status (Glasgow coma scale of less than 8) is a consideration for intubation as well.

-Alternatives to intubation for safe oxygen delivery

- Common nasal cannula (maximum of 15 L per minute deliverable)

- Face mask: “Non-rebreather” type; maximum dependent on source, typically up to 15 L per minute (LPN) from wall supply; may be increased to ~50 LPM with an additional source

- Venturi face mask: Supplies support via fraction of inspired oxygen (FiO_2); maximum of 100% oxygen delivery

- Use of noninvasive positive-pressure ventilation, eg, bilevel positive airway pressure (BiPAP) or continuous positive airway pressure (CPAP)

BiPAP and CPAP use are controversial due to the concern for aerosolizing infectious particles, although some institutions have employed these modalities in attempts to avoid intubation. We recommend adhering to common practice in each institution. Health care providers should follow hospital policy and guidance about wearing personal protective equipment when caring for these patients.

- Prone positioning

- Prone positioning is feasible in pregnant as well as postpartum patients, including the recently delivered. Padding and/or support devices (eg, pillows, padding from the operating room, etc) may need to be utilized to position the patient properly. The most important aspect of this maneuver is to ensure that the endotracheal tube remains in place throughout rotation and positioning and that it is secured afterward.

- "Passive prone positioning," in which the patient is not intubated and positions herself in either the lateral decubitus (typically for ~2 hours in each position) or fully prone position, may aid in patient comfort and theoretically help avoid intubation.

-*Therapeutic anticoagulation in critically ill pregnant patients: antenatal and postpartum*

- Critical illness, including severe COVID-19 infection, increases the risk of thromboembolic events. Patients who are critically ill or mechanically ventilated should receive prophylactic heparin or low-molecular-weight heparin if there are no contraindications to its use. There are limited, low-level data on the use of therapeutic anticoagulation for severe COVID-19 disease. Some experts have advocated for utilizing measurement of c-reactive protein and/or D-dimer to guide management; however, there are no clinical data to suggest that early, full-dose anticoagulation is beneficial in these patients.[8]

  The potential benefit of therapeutic anticoagulation in patients with severe COVID-19 disease has been discussed due to the observed high rates of thrombosis in these patients. However, expert opinion from the American Society of Hematology recommends prophylactic dosing unless otherwise indicated for common conditions, eg, concomitant confirmed venous thromboembolism.[9] Approaches to full anticoagulation should be individualized and in accordance with current practice and protocols at each institution. Furthermore, the increased risk of preterm birth in inflammatory illness (spontaneous or iatrogenic) also places a pregnant patient at elevated risk of peripartum bleeding, which may be worsened by therapeutic anticoagulation. An institution or intensive care unit may have clinical and biomarker criteria for starting full anticoagulation in severely ill patients.

- For therapeutic anticoagulation without confirmed thrombosis in a critically ill pregnant patient, unfractionated heparin should be considered due to its short half-life and reversibility with protamine sulfate. A standardized protocol enables the infusion to be held, discontinued, or mitigated as appropriate in patients at

risk for delivery. The known potential risks of therapeutic anticoagulation compared with the unproven theoretical benefit in this cohort of patients should be discussed with the decision-maker for the patient, and informed consent should be subsequently documented. Further, unfractionated heparin should be considered for prophylaxis in patients at high risk for preterm birth secondary to the aforementioned safety profile.

- If a heparin infusion is used, clinicians should follow their institutional protocol for unfractionated heparin infusion, with standardized dosing adjustments and activated partial thromboplastin time and/or anti-Xa monitoring.

- For patients receiving prophylactic dosing, low-molecular-weight heparin may be preferred due to the once-daily dosing to limit exposures to health care personnel.

- For patients on unfractionated heparin who develop new-onset thrombocytopenia, heparin-induced thrombocytopenia (HIT) should remain on the differential, despite the potential overlap in laboratory findings with COVID-19. The “4Ts” scoring system or HIT antibodies can be used to differentiate between the two potential etiologies of thrombocytopenia. The “4Ts” scoring system assigns 0-2 points each for thrombocytopenia, timing of platelet count change, thrombosis or other sequelae, and presence of other causes for thrombocytopenia is not evidence.

-Treatment options

- Treatment options are largely supportive for COVID-19 disease, including strategies to optimize ventilation. Although observational studies show some clinical improvement in cohorts treated with medication, there are no completed and published randomized clinical trials at this time.

- Ongoing clinical trials are investigating several pharmacologic treatment strategies in non-pregnant populations, including hydroxychloroquine, azithromycin, remdesivir, tocilizumab, Bacillus Calmette–Guérin vaccine, and convalescent plasma. None of these therapies are contraindicated in pregnancy. As of the date of this publication, pregnancy remains an exclusion criterion for clinical trials of many of the therapies, but obstetric providers should inquire about compassionate use protocols and criteria at their institution. As of this date, none of these therapies has been demonstrated to improve outcomes of COVID-19.

- Although most COVID-19 treatment clinical trials currently do not allow enrollment of pregnant patients, the Society for Maternal-Fetal Medicine is actively advocating for inclusion of this critical population.

-Use of antibiotics

- If clinicians suspect community-acquired pneumonia co-infection, the use of antibiotics is reasonable. Clinicians should obtain culture data when possible before initiating antibiotics, although empirical antibiotic treatment may be given while awaiting these results. If antibiotics are indicated, clinicians should not wait more than 45 minutes to start antibiotic therapy. Ceftriaxone plus azithromycin or ceftriaxone alone are commonly used to treat community-acquired pneumonia and are not contraindicated in pregnancy. For patients with severe disease or who have risk factors for hospital-acquired, ventilator-acquired, and/or drug-resistant types of pneumonia, broad-spectrum agents should be employed, such as cefepime, meropenem, piperacillin-tazobactam, linezolid, and vancomycin, all of which are acceptable in pregnancy.

- Although a procalcitonin level is not required in the assessment of COVID-19, it can be used to help delineate superimposed bacterial pneumonia. Many COVID-19 patients without bacterial pneumonia will have normal procalcitonin levels (less than 0.1 ng/mL). Patients with elevated levels may have a superimposed bacterial infection. Although an elevated procalcitonin level is suspicious of bacterial infection, culture data (eg, sputum, blood, urine) should also be collected with the implementation of antibiotics. It should be noted that a high procalcitonin level does not rule out COVID-19 infection.[10, 11]

Timing of Delivery for Critically Ill Pregnant Patients

Timing of delivery in critically ill pregnant women should be individualized. Decisions should be based on maternal status, concurrent pulmonary disease (eg, cystic fibrosis, asthma, sarcoidosis), critical illness, ability to wean off the ventilator and ventilator mechanics, gestational age at time of delivery, and shared decision-making with the patient or healthcare proxy.

- The timing of delivery requires carefully weighing the benefits and risks for the patient and fetus, and the decision to deliver requires close communication between the maternal-fetal medicine and critical care teams. Improvement in lung mechanics gained by early delivery is theoretical. In the third trimester, the pressure of the uterus can decrease expiratory reserve volume, inspiratory reserve volume, and functional residual capacity, which can increase the risk of severe hypoxemia in pregnant patients, especially those who are critically ill.[12]

Although data regarding delivery timing and acute respiratory distress syndrome are limited, it is reasonable to consider delivery in the setting of worsening critical illness.

- Disease progression in COVID-19 can be protracted, and maternal-fetal medicine and critical care teams should discuss individualized delivery criteria in the setting of worsening maternal status, worsening fetal status, or limited or no improvement in maternal status.

- Although the late third-trimester uterus may account for some mechanical restriction in ventilation, it is unclear whether delivery provides a substantial improvement in every case.

- Mechanical ventilation alone is not an indication for delivery.

- If delivery is considered based on severe hypoxemia, other options should also be discussed, including prone positioning, extracorporeal membrane oxygenation (ECMO), and the use of other advanced ventilator methods, especially if the gestational age is less than 30 to 32 weeks.

Timing of Delivery in Asymptomatic or Mildly Symptomatic Pregnant Patients

- COVID-19-positive status is not an indication for delivery, and delivery should be reserved for routine obstetrical indications.

- In an asymptomatic or mildly symptomatic woman positive for COVID-19 at 37 to 38 6/7 weeks of gestation without other indications for delivery, expectant management can be considered until 14 days after the polymerase chain reaction (PCR) result was noted to be positive OR until 7 days after onset of symptoms and 3 days after resolution of symptoms. This option allows for decreased exposure of health care workers and the neonate to SARS-CoV-2 and decreased PPE utilization in areas with supply-chain limitations.

- In an asymptomatic or mildly symptomatic woman positive for COVID-19 at 39 weeks of gestation or later, delivery can be considered to decrease the risk of worsening maternal status.

- Mode of delivery should remain per routine indications. During delivery, COVID-19 patients should be instructed to wear a mask throughout labor, delivery, and postpartum, and appropriate personal protective equipment should be utilized by health care workers. [See "Coronavirus (COVID-19) and Pregnancy: What Maternal-Fetal Medicine Subspecialists Need to Know."]

Other Obstetric Considerations

- ***Fetal concerns in pregnant patients with COVID-19.*** Limited data are currently reassuring regarding fetal risks in the setting of maternal COVID-19 infection. There is no definitive evidence of fetal transmission despite over 3 million cases of COVID-19 worldwide[13]. Thus far, there is one reported fetal death, to a woman with critical illness and multi-organ dysfunction in several reported series.[14-16] We recommend antenatal surveillance for the usual obstetrical indications and testing for COVID-19 per local protocols.

- ***Intrapartum or postpartum fever without a clear cause.*** A fever that is unexplained by another cause during labor or immediately postpartum should be evaluated as usual. However, it is recommended that the patient also be tested and/or screened for COVID-19 according to the obstetric care provider's institutional policy and guidelines.

- ***Preterm labor.*** Preterm delivery has been reported among infants born to women positive for COVID-19 during pregnancy. However, it appears that many cases are iatrogenic and not due to spontaneous preterm labor.[11, 17, 18] Other severe systemic illnesses appear to increase the risk of preterm birth by approximately two-fold to three-fold.[19] Decisions regarding the use of magnesium sulfate for neuroprotection in patients with COVID-19 should be individualized based on at risk of preterm birth at less than 32 weeks of gestation. With severe respiratory compromise or COVID-19-related acute renal injury, it is reasonable to consider withholding or dose-adjusting magnesium sulfate, particularly in the intubated patient already receiving benzodiazepine. Intake and output of fluids should be strictly monitored to avoid hypervolemia, and magnesium should be discontinued or deferred if the risk of preterm birth is low. In COVID-19 pregnant patients, it is unclear whether the use of magnesium sulfate increases the risk of pulmonary edema due to limited data and potential confounding of disease process overlap.

- ***Preeclampsia.*** Laboratory findings for COVID-19 can overlap with those found in HELLP syndrome and preeclampsia with severe features. The diagnostic criteria for preeclampsia remain unchanged during the pandemic, and management should be dictated by established guidelines. However, it is reasonable to consider PCR testing for SARS-CoV-2 if a patient with transaminitis and thrombocytopenia has additional risk factors for COVID-19.

- ***Antenatal corticosteroids.*** Antenatal corticosteroids have been associated with potential worsening of pulmonary status and viral shedding in other respiratory viral illnesses, and some infectious disease and pulmonary medicine subspecialists advocate for caution in its use. We recommend consideration of use for fetal benefit in patients at risk of preterm birth, with an upper limit of 34 weeks of gestation. The benefits of late preterm steroids after 34 weeks of gestation may not outweigh the potential risks in a COVID-19 patient with moderate to severe pulmonary manifestations.

- ***Timing of thromboprophylaxis—antenatal vs labor vs postpartum.*** See the above discussion about anticoagulation in COVID-19 patient. Anesthesiology services should be consulted about the timing of anticoagulation if regional anesthesia is utilized. Aspirin and indomethacin may be used for their respective common obstetrical indications. The presence of COVID-19 should not modify their use as there is no convincing evidence of harmful interactions between these medications and the COVID-19 disease process (https://www.hematology.org/covid-19/covid-19-and-vte-anticoagulation).

References

1. Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ, et al. COVID-19: consider cytokine storm syndromes and immunosuppression. Lancet 2020 Mar 28;395(10229):1033-4.

2. U.S. Food and Drug Administration. FDA cautions against use of hydroxychloroquine or chloroquine for COVID-19 outside of the hospital setting or a clinical trial due to risk of heart rhythm problems. April 24, 2020 [cited 2020 April 27]; Available from: https://www.fda.gov/drugs/drug-safety-and-availability/fda-cautions-against-use-hydroxychloroquine-or-chloroquine-covid-19-outside-hospital-setting-or

3. Alhazzani W, Moller MH, Arabi YM, Loeb M, Gong MN, Fan E, et al. Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19). Critical care medicine 2020 Mar 27.

4. Grissom CK, Brown SM, Kuttler KG, Boltax JP, Jones J, Jephson AR, et al. A modified sequential organ failure assessment score for critical care triage. Disaster Med Public Health Prep 2010 Dec;4(4):277-84.

5. CRISMA. quick Sepsis Related Organ Failure Assessment. [cited 2020 April 27]; Available from: https://qsofa.org/index.php#whatis

6. van der Woude SW, van Doormaal FF, Hutten BA, F JN, Holleman F. Classifying sepsis patients in the emergency department using SIRS, qSOFA or MEWS. Neth J Med 2018 May;76(4):158-66.

7. Society for Maternal-Fetal Medicine . Electronic address pso, Plante LA, Pacheco LD, Louis JM. SMFM Consult Series #47: Sepsis during pregnancy and the puerperium. American journal of obstetrics and gynecology 2019 Apr;220(4):B2-B10.

8. Barrett CD, Moore HB, Yaffe MB, Moore EE. ISTH interim guidance on recognition and management of coagulopathy in COVID-19: A Comment. J Thromb Haemost 2020 Apr 17.

9. Kreuziger L, Lee A, Garcia D, Cuker A, Cushman M, Connors J. COVID-19 and VTE/Anticoagulation: Frequently Asked Questions. April 17, 2020 [cited 2020 April 22]; Available from: https://www.hematology.org/covid-19/covid-19-and-vte-anticoagulation

10. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020 Feb 15;395(10223):497-506.

11. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 2020 Feb 15;395(10223):507-13.

12. Oxford CM, Ludmir J. Trauma in pregnancy. Clin Obstet Gynecol 2009 Dec;52(4):611-29.

13. Society for Maternal Fetal Medicine. Coronavirus (COVID-19) and Pregnancy: What Maternal-Fetal Medicine Subspecialists Need to Know. April 11, 2020 [cited 2020 April 28]; Available from: https://s3.amazonaws.com/cdn.smfm.org/media/2322/COVID19-What_MFMs_need_to_know_revision_4-11-20_(final)_highlighted_changes._PDF.pdf

14. Zaigham M, Andersson O. Maternal and perinatal outcomes with COVID-19: A systematic review of 108 pregnancies. Acta Obstet Gynecol Scand;n/a(n/a).

15. Yan J, Guo J, Fan C, Juan J, Yu X, Li J, et al. Coronavirus disease 2019 (COVID-19) in pregnant women: A report based on 116 cases. American journal of obstetrics and gynecology 2020 Apr 23.

16. Breslin N, Baptiste C, Gyamfi-Bannerman C, Miller R, Martinez R, Bernstein K, et al. COVID-19 infection among asymptomatic and symptomatic pregnant women: Two weeks of confirmed presentations to an affiliated pair of New York City hospitals. Am J Obstet Gynecol: Elsevier/Am J Obstet Gynecol-MFM; 2020.

17. Schwartz DA. An Analysis of 38 Pregnant Women with COVID-19, Their Newborn Infants, and Maternal-Fetal Transmission of SARS-CoV-2: Maternal Coronavirus Infections and Pregnancy Outcomes. Arch Pathol Lab Med 2020 Mar 17.

18. Breslin N, Baptiste C, Miller R, Fuchs K, Goffman D, Gyamfi-Bannerman C, et al. COVID-19 in Pregnancy: Early lessons. In press journal, pre-proof; March 27, 2020 [cited 2020 April 27]; Available from: https://www.sciencedirect.com/journal/american-journal-of-obstetrics-and-gynecology-mfm/articles-in-press

19. Auger N, Le TU, Park AL, Luo ZC. Association between maternal comorbidity and preterm birth by severity and clinical subtype: retrospective cohort study. BMC pregnancy and childbirth 2011 Oct 4;11:67.