

A. General Counseling for COVID 19 in Pregnancy:

- a. What is known with regards to COVID-19 and pregnancy?
 - i. Data we have for COVID-19 in pregnancy is sparse at this time
 - ii. Limited evidence suggests that pregnant women are not at significantly higher risk of contracting Coronavirus or of becoming critically ill if they do become infected than the general population.
 - iii. This is in contrast to our experiences and evidence of other respiratory viruses, like Influenza, in pregnancy which can cause more severe illness than in the general population.
 - iv. There is some evidence that suggests a higher incidence of preterm birth in patients with COVID 19.
 - v. There is no evidence of vertical transmission at this time, however, neonatal and infant transmission is possible.
- b. What is not known with regards to COVID-19 and pregnancy?
 - i. Whether there is an increased risk of congenital malformations from maternal fever with COVID 19 infection is not known, however, this was not seen with SARS-CoV infection.
 - ii. Whether there is an increased risk of miscarriage or fetal growth restriction from maternal COVID 19 is not known, however, this has been seen with MERS & SARS-CoV infections.
 - iii. Whether women with preexisting co-morbidities in pregnancy (diabetes, hypertension, cardiac or pulmonary disease) are at increased risk of severe illness, however, data in non-pregnant population do show an increased risk of severe illness with COVID 19. It is likely prudent to consider pregnant women with pre-existing conditions as a higher risk population as well at this time.
- c. Priority Registry for COVID 19 infections in Pregnancy
 - i. Nationwide study to learn more about pregnancy and COVID 19
 - ii. Patients can elect to register, must give verbal consent to provider who can then enroll the patient
 - iii. www.priority.ucsf.edu

B. Assessment of Pregnant Patient with COVID 19 or Suspected COVID 19:

- a. Assessment should be consistent with that of non-pregnant patients with COVID 19 with the following additional considerations:
 - i. Fetal monitoring
 - 1. Reflects uteroplacental perfusion and maternal acid base status
 - a. Changes in fetal heart monitoring should prompt evaluation of maternal oxygenation, ventilation, acid base status, cardiac output.
 - b. First attempt to provide maternal resuscitation which will often correct fetal heart rate abnormalities
 - 2. Fetal monitoring should be performed, except in the circumstance that maternal illness would not support intervention for fetal benefit.
 - ii. Physiologic changes of pregnancy lead to:
 - 1. Altered VS parameters

- a. HR increases in pregnancy, 90-100s can be WNL
- b. BP elevated if >140/90, severely elevated if >160/110
 - i. Sustained severe elevation warrants acute antihypertensive treatment given risk of stroke
- c. Minute ventilation increases by 40%, but RR is the same as non-pregnancy (12-20)
 - i. RR >30 should prompt concern for impending respiratory failure

2. Altered Laboratory norms

- a. Hemoglobin >11 is normal in 1st and 3rd trimesters (<12 weeks, >28 weeks)
- b. Hemoglobin >10.5 is normal in 2nd trimester (12-28 weeks)
- c. WBC </= 15 generally considered normal, may be >20 in labor or post-C-section from physiologic inflammatory response
- d. D-dimer, CRP and ESR, and Alk Phos are elevated
- e. Cr may be low, Cr >0.9 considered abnormal unless baseline elevated known
- f. Fibrinogen levels are elevated (250-500), <200 should be a cause of concern and evaluation and treatment for coagulopathy should be considered
- g. Compensated respiratory alkalosis occurs
 - i. Normal pCO₂ 28-32, pCO₂ >40 should prompt concern for impending respiratory failure
 - ii. Normal pH 7.40-7.44, HcO₃ 18-22
- h. PaO₂ 72-104 mmHg, O₂ saturation should be >95%
 - i. Supplemental O₂ should be used to maintain >93-95%
- i. Normal Platelets >150

iii. Imaging

- 1. Plain films, CT with or without contrast, and non-contrast MRI should be first line
- 2. Appropriate abdominal shielding should be utilized whenever possible
- 3. MRI with gadolinium should be avoided given the prolonged exposure of gadolinium in amniotic fluid unless deemed critical to patient care after discussion with MFM

C. Management of Pregnant Patient with COVID 19 or Suspected COVID 19:

- a. In general maternal stabilization is the first priority.
- b. Optimization of maternal status is necessary for fetal well-being and therefore in general procedures, tests, and management necessary for maternal care should be pursued.
- c. Criteria for admission to hospital
 - i. Hypotension or tachycardia not responsive to hydration, altered mental status, tachypnea, dyspnea, orthopnea, e/o pulmonary edema

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- ii. Inability to maintain PO hydration, need for supplemental O₂, mild symptoms with significant co-morbidities, obstetric complaints (r/o PTL, Pre-E, etc), inability to follow up, quarantine, provide self-care
 - iii. Abnormal LFTs, platelets, BPs – COVID 19 and Pre-E have some overlapping clinical and laboratory findings that can make diagnosis challenging, close monitoring inpatient is warranted while diagnosis is being determined
 - d. Consideration for admission to ICU
 - i. Hypotension or tachycardia not responsive to hydration, altered mental status, tachypnea, dyspnea, orthopnea, e/o pulmonary edema
 - e. Fetal monitoring
 - i. Initial response to non-reassuring fetal HR monitoring should be to correct any maternal VS/lab abnormalities which will often correct fetal heart rate abnormalities
 - ii. Fetal monitoring should be performed regularly, except in the circumstance that maternal illness would not support intervention for fetal benefit.
 - iii. Consider the following fetal monitoring plan:
 - 1. Previable (<23 weeks): Spot FHR 1-2x/day for hospitalized patients
 - 2. Periviable (23-24 weeks): spot FHR vs NST after discussion between MFM, NICU, and patient/family
 - 3. Viable (>24 weeks): NST 1-2x/day for hospitalized patients, continuous monitoring should be considered in consultation with MFM for ICU patients, hypoxic patients, or patients with obstetric indications (Preterm labor, preeclampsia, labor, etc)
 - f. Hypertension
 - i. Hypertension can occur with COVID-19, complicating preeclampsia diagnosis
 - ii. Please contact MFM on-call immediately for newly elevated blood pressures (mild range >140/90) or newly severe if known mild range
 - iii. PO antihypertensives can be used – Nifedipine IR or XR, Labetalol, Hydralazine,
 - 1. ACE-I and ARB are contraindicated
 - iv. Immediate treatment with short-acting BP agents (e.g. Hydralazine 5 mg IV, Labetalol 20 mg IV, Nifedipine IR 10 mg PO) is indicated for sustained (>15 minutes) severe range blood pressures (SBP \geq 160 or DBP \geq 110 mmHg) due to the risk of eclampsia seizure and stroke.
 - v. Assessment for preeclampsia with CBC, CMP, LDH, Urine Protein/Creatinine should be ordered if new/worsening severe range BPs.
 - g. Hypotension
 - i. A MAP < 65 maybe reasonable in pregnancy as long as there is no evidence of end organ dysfunction, including changes in the fetal heart tracing (late decelerations, decreased variability)
 - ii. If hypotension is encountered, a leftward displacement of the uterus to avoid aortocaval compression should be taken.
 - iii. Pregnant women are at higher risk of pulmonary edema. Given this, care should be taken to identify women who are not fluid responsive.

1. In general 1-2 L is an appropriate amount of fluid resuscitation, women should certainly respond to 30 cc/kg if they are fluid responsive.
2. Passive leg raising in the third trimester is not accurate to assess fluid responsiveness
3. Measuring the diameter of the vena cava has not been validated in pregnancy.
- iv. If vasopressor support is needed, norepinephrine is the recommended first line agent in pregnant women generally.
- v. Dobutamine is the most studied inotrope in pregnancy.
- h. Respiratory Failure
 - i. Airway management can be challenging in pregnancy
 - ii. Hypoxemia occurs quickly after apnea due to the decreased FRC (25% reduced) and increased minute ventilation.
 - iii. The risk of failed intubation is much higher than the non-pregnant population due to multiple factors including visualization and laryngeal edema.
 1. Mallampati scores can worsen in labor.
 2. Consider use of a smaller ET tube and consultation with OB Anesthesia
 3. Pre-oxygenation and suction on hand are recommended.
 4. H2 blockers and PPIs can be safely used in women undergoing prolonged ventilation.
 5. The optimal settings for ventilation have not been studied in pregnant women.
 6. Permissive hypercapnia does not appear to adversely affect the fetus (CO₂ level 60 mmHg)
 7. High levels of positive end expiratory pressure maybe indicated in the third trimester
 8. Maternal acidemia will impact fetal acid base status which may be signaled by the fetal heart rate tracing.
 - a. If changes in fetal heart tracing are encountered, we will recommend considering changes associated with increased maternal pH and decreased P_cCO₂ (increase in minute ventilation)
 9. In the case of critical decompensation, immediate delivery may be indicated to improve maternal status
- i. ARDS
 - i. There are no pregnancy specific data with regards to optimal mechanical ventilation strategies in women with ARDS
 - ii. Corticosteroids can be utilized in pregnancy
 1. There is a small possible increased risk of cleft lip/palate, and therefore, discussion of risks and benefits is warranted in the first trimester
 - iii. While pulmonary vasodilators have not been studied in pregnancy and are controversial in terms of improving mortality in ARDS, adverse fetal effects are not anticipated from inhaled epoprostenol or nitric oxide.

- iv. Prone positioning can be done, but will require support of the gravid abdomen with pillows/blankets under chest/thighs to off-load direct pressure from the abdomen and accommodation for fetal monitoring as indicated
- v. Delivery does not seem to improve maternal survival with ARDS, but fetal survival is associated with gestational age at delivery so delivery is an individualized decision in critically ill patients
- j. ECMO
 - i. Has and can be utilized in pregnant patients with significant coordinated discussion regarding impact on fetus.
 - ii. Fetal survival on ECMO is reported at 65%, thus, consideration of delivery should be made prior to consideration of ECMO in viable fetuses in consultation with MFM/NICU
- k. Cardiac Arrest
 - i. In the setting of a cardiac arrest resuscitative, hysterotomy is associated with 50% maternal and fetal survival without significant sequelae and should be pursued by 4 minutes of resuscitation if ROSC is not achieved
 - a. Can be considered after prolonged resuscitation and has been used with success up to 25 minutes after onset of CPR.

A. Medications:

- a. **COVID 19 Investigational Drugs**
 - i. There are current studies ongoing at UNM, however, at this time none are open to pregnant patients and off-study use is not permitted.
- b. Anticoagulation
 - i. Heparinoids do not cross the placenta and can be used safely in pregnancy
 - ii. Warfarin is generally contraindicated, other oral agents are not studied and therefore, not recommended
 - iii. Consider prophylactic anticoagulation for hospitalized patients
 - iv. Therapeutic anticoagulation can be considered with severely ill ICU patients as there is evidence of a microthrombi phenomenon with COVID- 19.
 - v. Anticoagulation management should be decided with the MFM/Anesthesia teams if delivery is anticipated.
 - vi. Agatroban has been reported in a few case series without clear adverse fetal effects and may be considered a second line agent if necessary in case of HIT.
- c. Antibiotics
 - i. In the septic pregnant patient, it is important to begin empiric broad spectrum antibiotics.
 - ii. Most antibiotics are safe in pregnancy.
 - iii. Fluoroquinolones and tetracycline should be avoided, however, doxycycline can be considered in specific situations, please consult with MFM
 - iv. Bactrim is not recommended in 1st and 3rd trimester, however, may be used in 2nd trimester of pregnancy
- d. Analgesics

maturity vs. maternal wellbeing should be discussed and decision made in consultation with ICU/Medicine team

- ii. Tocolysis
 1. Indocin can be used, however, Nifedipine is a reasonable alternative given some controversy over NSAID use worsening COVID-19 course.
- iii. Magnesium
 1. Recommended for neuroprotection and/or seizure prophylaxis, however, close monitoring for renal dysfunction and magnesium toxicity should be done, particularly in severely ill patients.
- iv. Hemabate
 1. Based on limited case reports, recommend avoiding use of hemabate for management of postpartum hemorrhage due to theoretical concern of bronchospasm

References and Resources:

1. Vincenzo Berghella, Maternal-Fetal Evidence Based Guidelines Third Edition
2. SMFM Critical Care in Obstetrics Series:
 - a. Dena Goffman Acute Respiratory Failure in Pregnancy or the Peripartum Period
 - b. Sonya Abdel-Razeq Respiratory Distress Syndrome and Pulmonary Edema
 - c. Leslie Moroz, Respiratory Failure
3. SMFM Consult Series #47 Sepsis during Pregnancy - April 2019
4. SMFM: Covid-19 & Pregnancy : What MFM Specialists Need to Know - 4/11/2020
5. SMFM and Society for Obstetric Anesthesia and Perinatology: Labor & Delivery COVID – 19 Considerations Posted 3/27/2020
6. Outpatient Assessment and Management for Pregnant Women with Suspected or Confirmed Novel Coronavirus. SMFM and ACOG. March 2020.

Please also refer to UNM SOPs and protocols from non-OB departments for additional COVID-19 guidelines, PPE, and further outpatient & prenatal care recommendations.