CoVID-19: Preparedness for OB/MFM

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Center for Fetal Medicine & Women’s Ultrasound
Vice Chair, SMFM Education Committee
“Know the enemy and know yourself; in a hundred battles you will never be in peril.”
- Sun Tzu

知己知彼 百戰百勝
Objectives

• Understand CoVID-19
• Summarize available guidance
• Review sample algorithm from UWash (Dr. Ma)
• Specific questions for your own unit
• Research efforts
• President’s address (Dr. Louis)

Slides will be released
Coronaviridae

• α, β, γ, δ
  • α: human coronaviruses
    • HCoVs: HCoV-229E and NL63
  • β: zoonotic coronavirus
    • A lineage - Embecovirus: OC43 and HKU1
    • B lineage - Sarbecovirus: SARS-CoV (‘03), SARS-CoV2 (’20)
    • C lineage - Merbecovirus: MERS
    • D lineage - Nobecovirus

nCoV-19
CoVID-19

Li, et al. J pharmaceutical analysis, 3/5/20
SARS-CoV2: Virology

- Host cell receptor:
  - ACE-2 receptor
- Sequence similarity
  - 79% to SARS-CoV
  - 50% to MERS-CoV
- $R_0$: Basic Reproduction Number
  - 2.2 (95% CI 1.4-3.9)

Li, et al. J pharmaceutical analysis, 3/5/20
Transmission

Seasonal Influenza

COVID-19 (Coronavirus)

SARS

Measles

R0 1 - 2

R0 2 - 3

R0 3 - 5

R0 12 - 18

= Infected person

= Person who may become infected

R0 ("R naught") **basic reproduction number** = how many people, on average, each infected person will in turn infect in a fully susceptible population.
SARS-CoV2: Virology

• Incubation:
  • Mean: ~5.2 days (95%CI 4.1-7.0 days)
  • Range: 2-14 days

• Viral Shedding
  • Median: 20 days (max 37 days)

CoVID-19: Patient characteristics

• Age:
  • Range: 10-89 years
  • Median: 59 years

• 56% M; 44% F

• Hospitalized patients: 49-56 years (average)
  • Underlying illness (1/3 to 1/2)
  • Men more frequent (54-73%)
  • Rarely children

COVID-19: Transmission

• Respiratory droplets
  • Prolonged unprotected contact between infector / infectee
  • Aerosol transmission is also possible in case of protracted exposure to elevated aerosol concentrations in closed spaces

• Fomites

• No reports of transmission via: Airborne*, Fecal-oral

CoVID-19: Signs & Symptoms

- Fever: 87.9%
- Dry cough: 67.7%
- Fatigue: 38.1%
- Sputum: 33.4%
- SOB: 18.6%
- Sore throat: 13.9%
- Headache: 13.6%
- Myalgia/arthralgia: 14.8%
- Chills: 11.4%
- Nausea or vomiting: 5.0%
- Nasal congestion: 4.8%
- Diarrhea: 3.7%
- Hemoptysis: 0.9%
- Conjunctival cong: 0.8%

CoVID-19: Signs & Symptoms

• Abnormal testing:
  • CXR (up to 100%)
  • Lymphopenia, Leukopenia, Thrombocytopenia

• Acute respiratory distress
  • 17-29% of hospitalized

### Clinical Characteristics of Coronavirus Disease 2019 in China

Wei-jie Guan, Ph.D., Zheng-yi Ni, M.D., Yu Hu, M.D., Wen-hua Liang, Ph.D., Chun-quan Ou, Ph.D., Jian-xing He, M.D., Lei Liu, M.D., Hong Shan, M.D., Chun-liang Lei, M.D., David S.C. Hui, M.D., Bin Du, M.D., Lan-juan Li, M.D., et al., for the China Medical Treatment Expert Group for Covid19

<table>
<thead>
<tr>
<th>Lab</th>
<th>Change</th>
<th>Incidence&lt;sup&gt;1,2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lymphopenia</td>
<td>&lt;1500/mm&lt;sup&gt;3&lt;/sup&gt;</td>
<td>35-70%</td>
</tr>
<tr>
<td>Leukopenia</td>
<td>4.7 median</td>
<td>9-33.7%</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>Decrease</td>
<td>41-50%</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>&lt;150/mm&lt;sup&gt;3&lt;/sup&gt;</td>
<td>4-35%</td>
</tr>
<tr>
<td>AST/ALT</td>
<td>Increase</td>
<td>4-22%</td>
</tr>
<tr>
<td>LDH</td>
<td>Increase</td>
<td>27-75%</td>
</tr>
<tr>
<td>CRP</td>
<td>Increase</td>
<td>61-85</td>
</tr>
<tr>
<td>Procalcitonin</td>
<td>Can be &gt; 0.5</td>
<td>5.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14% if severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24% if ICU</td>
</tr>
</tbody>
</table>

N=1099

<table>
<thead>
<tr>
<th>Lab</th>
<th>Non-severe</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC (Median)</td>
<td>4.9</td>
<td>3.7</td>
</tr>
<tr>
<td>High &gt;10</td>
<td>4.8%</td>
<td>11.4%</td>
</tr>
<tr>
<td>Low &lt;4</td>
<td>28.1%</td>
<td>61.1%</td>
</tr>
<tr>
<td>Lymphocyte (Median)</td>
<td>1000</td>
<td>800</td>
</tr>
<tr>
<td>&lt;1500</td>
<td>80.4%</td>
<td>96.1%</td>
</tr>
<tr>
<td>Platelet (Median)</td>
<td>172k</td>
<td>137.5k</td>
</tr>
<tr>
<td>&lt;150k</td>
<td>31.6%</td>
<td>57.7%</td>
</tr>
<tr>
<td>Hemoglobin (Median)</td>
<td>13.5 (IQR: 12-14.8)</td>
<td>12.8 (IQR: 11.2-14.1)</td>
</tr>
</tbody>
</table>

N=1099
CoVID-19: Progression of Disease

Onset

1 wk

Lab diagnostic

Mild

80%

Moderate

Isolation/hospitalization

Severe

6.1%

Critical

Isolation/hospitalization

Recovery

2 weeks

3-6 weeks

Onset

CoVID-19: Case Fatality Rates

- China (3.5%)
- China, excluding Hubei Province (0.8%)
- 82 countries, territories, and areas (4.2%)
- Cruise ship (0.6%)

- Broad range of 0.25%–3.0%

CoVID-19: Case Fatality Rates

EMERGING INFECTIOUS DISEASES®

Graph showing the risk for death, %, in Wuhan, Hubei Province (excluding Wuhan), and China (excluding Hubei).
# CoVID-19: RF for demise

Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study

Fei Zhou, MD †, Ting Yu, MD †, Ronghui Du, MD †, Guohui Fan, MS †, Ying Liu, MD †, Zhibo Liu, MD †, et al. 

<table>
<thead>
<tr>
<th>Demographics and clinical characteristics</th>
<th>Univariable OR (95% CI)</th>
<th>p value</th>
<th>Multivariable OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years*</td>
<td>1.14 (1.09-1.18)</td>
<td>&lt;0.0001</td>
<td>1.10 (1.03-1.17)</td>
<td>0.0043</td>
</tr>
<tr>
<td>Female sex (vs male)</td>
<td>0.61 (0.31-1.20)</td>
<td>0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoker (vs non-smoker)</td>
<td>2.23 (0.65-7.63)</td>
<td>0.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic obstructive lung disease</td>
<td>5.40 (0.96-30.40)</td>
<td>0.056</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>21.40 (4.64-98.76)</td>
<td>&lt;0.0001</td>
<td>2.14 (0.26-17.79)</td>
<td>0.48</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.85 (1.35-6.05)</td>
<td>0.0062</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>3.05 (1.57-5.92)</td>
<td>0.0010</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Respiratory rate, breaths per min</th>
<th>Univariable OR (95% CI)</th>
<th>p value</th>
<th>Multivariable OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤24</td>
<td>1 (ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;24</td>
<td>8.89 (4.49-18.19)</td>
<td>&lt;0.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOFA score</td>
<td>6.14 (3.48-10.85)</td>
<td>&lt;0.0001</td>
<td>5.65 (2.61-12.23)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>qSOFA score</td>
<td>12.00 (5.06-28.43)</td>
<td>&lt;0.0001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N=191
CoVID-19: Risk factors for demise

Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study

Fei Zhou, MD 1, Ting Yu, MD 1, Ronghui Du, MD 1, Guohui Fan, MS 1, Ying Liu, MD 1, Zhebo Liu, MD 1, et al. Show all authors

### Laboratory findings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Univariable OR (95% CI)</th>
<th>p value</th>
<th>Multivariable OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatinine, μmol/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤133</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>1.5</td>
</tr>
<tr>
<td>&gt;133</td>
<td>4.39</td>
<td>0.048</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Lactate dehydrogenase, U/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤245</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>&gt;245</td>
<td>45.43</td>
<td>0.0002</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Creatine kinase, U/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤185</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>&gt;185</td>
<td>2.56</td>
<td>0.043</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>High-sensitivity cardiac troponin I, pg/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤28</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>&gt;28</td>
<td>80.07</td>
<td>&lt;0.0001</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>D-dimer, μg/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤0.5</td>
<td>1 (ref)</td>
<td>...</td>
<td>1 (ref)</td>
<td>...</td>
</tr>
<tr>
<td>&gt;0.5</td>
<td>1.96</td>
<td>0.32</td>
<td>2.14</td>
<td>0.52</td>
</tr>
<tr>
<td>Prothrombin time, s</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤16</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>&gt;16</td>
<td>4.62</td>
<td>0.019</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Serum ferritin, μg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤300</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>&gt;300</td>
<td>9.10</td>
<td>0.0038</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>IL-6, pg/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤6</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>&gt;6</td>
<td>1.12</td>
<td>0.0080</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Procalcitonin, ng/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤0.5</td>
<td>13.75</td>
<td>0.011</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

(Continued from previous column)

**Laboratory findings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Univariable OR (95% CI)</th>
<th>p value</th>
<th>Multivariable OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell count, × 10^9 per L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;4</td>
<td>0.73</td>
<td>0.56</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>(0.26–2.10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4–10</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>(3.02–14.41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;10</td>
<td>6.60</td>
<td>&lt;0.0001</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>(0.01–0.08)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lymphocyte count, × 10^9 per L*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALT, U/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤40</td>
<td>1 (ref)</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>&gt;40</td>
<td>2.87</td>
<td>0.0018</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>(1.48–5.57)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 3 continues in next column*

Table 3: Risk factors associated with in-hospital death

Off=odds ratio. SOFA=Sequential Organ Failure Assessment. qSOFA=Quick SOFA.
ALT=alanine aminotransferase. IL-6=interleukin-6. *Per 1 unit increase.
Figure 1: Clinical courses of major symptoms and outcomes and duration of viral shedding from illness onset in patients hospitalised with COVID-19
Figure shows median duration of symptoms and onset of complications and outcomes. ICU=intensive care unit. SARS-CoV-2=severe acute respiratory syndrome coronavirus 2. ARDS=acute respiratory distress syndrome. COVID-19=coronavirus disease 2019.
Where are we in U.S. today?
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cases</td>
<td>7038</td>
</tr>
<tr>
<td>Total deaths</td>
<td>97</td>
</tr>
<tr>
<td>Jurisdictions reporting</td>
<td>54</td>
</tr>
</tbody>
</table>
# COVID-19: Source of Exposure

*(as of 3/18/20)*

<table>
<thead>
<tr>
<th>Source of Exposure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel</td>
<td>269</td>
</tr>
<tr>
<td>Close contact</td>
<td>276</td>
</tr>
<tr>
<td>Under investigation</td>
<td>6,493</td>
</tr>
<tr>
<td>Total</td>
<td>7,038</td>
</tr>
</tbody>
</table>
What do we know regarding CoVID-19 in pregnancy?
**CoVID-19 + Pregn: Liu, et al**

- SYS University, Guangzhou
- N=13
  - Age 22-36
  - GA: 2 = <28 weeks; 11 = 3rd trim
  - No underlying medical comorbidities

Clinical manifestations and outcome of SARS-CoV-2 infection during pregnancy

Yangli Liu, Haihong Chen, Kejing Tang, Yubiao Guo
CoVID-19 + Pregn: Liu, et al

- **Symptoms:**
  - Fever: 10 (77%)
  - Dyspnea: 3 (23%)
  - None: 1 (close contact)

- **Epidemiologic history:**
  - Close contact or Wuhan < 2 weeks before onset: 12 (92%)
CoVID-19 + Pregn: Liu, et al

- **Disposition**
  - Improved and discharged: 3 (23%)
  - Delivered: 10 (77%), all by CD
    - Emergent = 5 ➔ NRFHT = 3, PPROM = 1, IUFD = 1
  - Preterm labor 32-36 weeks = 6 (46%)
  - ICU admission = 1 ➔ MOD, including ARDS/ventilation, acute hepatic failure, ARF, septic shock ➔ ECMO

- **No vertical transmission**

Clinical manifestations and outcome of SARS-CoV-2 infection during pregnancy

Yangli Liu, Haihong Chen, Kejing Tang, Yubiao Guo
CoVID-19 + Pregn: Chen, et al

• Zhongnan Hospital, WuHan
• N = 9
  • Age = 26-40
  • GA = 36-39.7 weeks
  • No underlying medical comorbidities
CoVID-19 + Pregn: Chen, et al

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**Symptoms**
- Fever: On admission = 7 (78%); Postpartum fever = 6 (67%)
- Myalgia: 3 (33%); Malaise: 2 (22%); Rigor: 0
- Cough: 4 (44%); Dyspnea: 1 (11%); Sore throat: 2 (22%); CP: 0
- Diarrhea: 1 (11%)

**Epidemiologic history**
- All had contact via infected person or “relevant environment”
### Table 2: Maternal clinical and laboratory characteristics

<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
<th>Patient 5</th>
<th>Patient 6</th>
<th>Patient 7</th>
<th>Patient 8</th>
<th>Patient 9</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical signs of viral infection</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of delivery</td>
<td>C-section</td>
<td>C-section</td>
<td>C-section</td>
<td>C-section</td>
<td>C-section</td>
<td>C-section</td>
<td>C-section</td>
<td>C-section</td>
<td>C-section</td>
</tr>
<tr>
<td>Treatment after delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen support (nasal cannula)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Antiviral therapy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Antibiotic therapy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Use of corticosteroid</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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</tr>
</tbody>
</table>

*Premature rupture of membrane, NA: not applicable, ALT: alanine transaminase, AST: aspartate transaminase, COVID-19: 2019 novel coronavirus disease, C-section: caesarean section, SARS-CoV-2: severe acute respiratory syndrome coronavirus 2. * Exposure to Hankou, the area in Wuhan where the epidemic was first detected. * A university where the patient works, and a gathering of people. 4 Data missing for one patient.
<table>
<thead>
<tr>
<th>Laboratory characteristics</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>No</th>
<th>No</th>
<th>Yes</th>
<th>7 (78%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell count (x 10^9 cells per L)</td>
<td>6.15</td>
<td>5.07</td>
<td>8.78</td>
<td>7.63</td>
<td>9.34</td>
<td>5.57</td>
<td>10.61</td>
<td>9.96</td>
<td>7.08</td>
<td></td>
</tr>
<tr>
<td>Low or normal leucocyte count (&lt;9.5 x 10^9 cells per L)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>7 (78%)</td>
</tr>
<tr>
<td>Lymphocyte count (x 10^9 cells per L)</td>
<td>1.59</td>
<td>0.56</td>
<td>0.46</td>
<td>2.83</td>
<td>0.69</td>
<td>0.66</td>
<td>0.87</td>
<td>1.53</td>
<td>1.47</td>
<td></td>
</tr>
<tr>
<td>Lymphopenia (&lt;10^9 cells per L)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>5 (56%)</td>
</tr>
<tr>
<td>C-reactive protein concentration (mg/L)</td>
<td>20.3</td>
<td>14.4</td>
<td>33.4</td>
<td>33</td>
<td>28.2</td>
<td>18.2</td>
<td>NA</td>
<td>6.2</td>
<td>24.9</td>
<td></td>
</tr>
<tr>
<td>Elevated C-reactive protein (&gt;10 mg/L)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
<td>6 (75%)</td>
</tr>
<tr>
<td>Elevated ALT (&gt;45 U/L) or AST (&gt;35 U/L)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>3 (33%)</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>2093</td>
<td>9</td>
<td>62</td>
<td>54</td>
<td>18</td>
<td>14</td>
<td>6</td>
<td>16</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>1263</td>
<td>24</td>
<td>71</td>
<td>67</td>
<td>24</td>
<td>23</td>
<td>15</td>
<td>22</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Confirmatory test done (SARS-CoV-2 quantitative RT-PCR)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>9 (100%)</td>
</tr>
</tbody>
</table>

(Table 1 continues on next page)
CoVID-19 + Pregn: Chen, et al

• Delivery
  • Cesarean delivery = 9
    • NRFHT = 2
  • Late preterm = 4 (44%)
• No vertical transmission
• N = 9 pregnancies → 10 neonates
• Symptom onset:
  • Before delivery = 4; Day of = 2; After = 3
  • Fever and cough; 1 with diarrhea
• Term = 4; Preterm = 6
  • SOB = 6; Fever = 2; Thrombocytopenia = 2; Tachycardia = 1, Pneumothorax = 1, Vomiting = 1
• Negative SARS-CoV2 swabs = 9
• 1 death (34+5/7, DOL #8 multiorgan failure, DIC, Shock)
Similar viruses in Pregnancy

**SARS-CoV:**
- Largest series of 12 pregnancies
- Complications: ARDS, DIC, ARF, Bacterial pneumonia, Sepsis, Mechanical ventilation, Sab (4/7)
- 25% fatality

**MERS-CoV:**
- 13 case reports
- 2 asymptomatic
- IUFD, preterm delivery
- 23% fatality
Current Pregnancy Data Summary

• Available data are reassuring but are limited to small case series.

• Limited information about:
  • Susceptibility of pregnant women to COVID-19
  • Severity of infection

• Denominator unknown
Vertical Transmission?

- Spread mainly by respiratory droplets
- Vertical transmission: unknown / presumed no.
  - None of the infants have tested positive
  - Virus was not detected in amniotic fluid or breastmilk.
- MERS-CoV & SARS-CoV:
  - Limited; has not been reported for these infections.
Vertical Transmission?

• 2/6/2020: China
  • Neonate tested positive at 36h after birth
  • Swab performed at 30 hours
  • No direct testing of AF, cord blood placenta

• 3/14/2020: UK
  • Swabbed immediately after Cesarean birth
What do our guidelines say?
CoVID-19: Who to Test?

• “Clinician judgment to determine if a patient has signs/symptoms compatible with COVID-19 “

• Priorities for testing may include:
  • Signs/symptoms + Hospitalized
  • Signs/symptoms + At-risk individuals
  • Signs/symptoms + epidemiologic RF within 14 days of symptoms
    • Contact with PUI/confirmed CoVID-19 (including healthcare personnel)
    • H/o travel from affected geographic areas
## CoVID-19: Who to Test?

- **Find your regional criteria**

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>Epidemiologic Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever or signs/symptoms of lower respiratory illness (e.g. cough or shortness of breath)</td>
<td>Any person (including healthcare workers) who in the last 14 days before symptom onset has had close contact with a laboratory-confirmed COVID-19 patient</td>
</tr>
<tr>
<td>Fever and signs/symptoms of lower respiratory illness (e.g. cough, shortness of breath)</td>
<td>Any healthcare worker without an alternative diagnosis (e.g., negative molecular respiratory panel)</td>
</tr>
<tr>
<td>Fever and signs/symptoms of a community-acquired lower respiratory illness (e.g. cough or shortness of breath) requiring hospitalization</td>
<td>A history of travel from affected geographic areas* in the last 14 days before symptom onset -or- Radiographic findings compatible with a viral pneumonia and no alternative diagnosis</td>
</tr>
<tr>
<td>Part of a cluster of 2 or more cases of an acute respiratory illness within a 72-hour period</td>
<td>Congregate living setting with a large proportion of older adults and persons with comorbid medical conditions (e.g. skilled-nursing facility, senior assisted-living facility, homeless shelters)</td>
</tr>
</tbody>
</table>

*Affected Geographic Areas* with Widespread or Sustained Community Transmission: China, Iran, Italy, Japan, and South Korea. Last updated March 11, 2020.
Guidance
Assess Patient’s Symptoms
Symptoms typically include fever ≥38°C (100.4°F) or one or more of the following:
- Cough
- Difficulty breathing or shortness of breath
- Gastrointestinal symptoms

Yes

Conduct Illness Severity Assessment
- Does she have difficulty breathing or shortness of breath?
- Does she have difficulty completing a sentence without gasping for air or needing to stop to catch breath frequently when walking across the room?
- Does patient cough more than 1 teaspoon of blood?
- Does she have new pain or pressure in the chest other than pain with coughing?
- Is she unable to keep liquids down?
- Does she show signs of dehydration such as dizziness when standing?
- Is she less responsive than normal or does she become confused when talking to her?

Any Positive Answers

Elevated Risk
Recommend she immediately seek care in an emergency department or equivalent unit that treats pregnant women. When possible, send patient to a setting where she can be isolated.
Notifying the facility that you are referring a PUI is recommended to minimize the chance of spreading infection to other patients and/or healthcare workers at the facility.
Adhere to local infection control practices including personal protective equipment.

No Positive Answers

Assess Clinical and Social Risks
- Comorbidities (hypertension, diabetes, asthma, HIV, chronic heart disease, chronic liver disease, chronic lung disease, chronic kidney disease, blood dyscrasia, and people on immunosuppressive medications)
- Obstetric issues (eg, preterm labor)
- Inability to care for self or arrange follow-up if necessary

Any Positive Answers

Moderate Risk
See patient as soon as possible in an ambulatory setting with resources to determine severity of illness.
When possible, send patient to a setting where she can be isolated. Clinical assessment for respiratory compromise includes physical examination and tests such as pulse oximetry, chest X-ray, or ABG as clinically indicated.
Pregnant women (with abdominal shielding) should not be excluded from chest CT if clinically recommended.

No Positive Answers

Low Risk
- Refer patient for symptomatic care at home including hydration and rest
- Monitor for development of any symptoms above and re-start algorithm if new symptoms present
- Routine obstetric precautions

If no respiratory compromise or complications
Admit patient for further evaluation and treatment.
Review hospital or health system guidance on isolation, negative pressure and other infection control measures to minimize patient and provider exposure

If yes to respiratory compromise or complications
If no respiratory compromise or complications and able to follow-up with care

Abbreviations: ABG, arterial blood gases; CDC, Centers for Disease Control and Prevention; HIV, human immunodeficiency virus.
Healthcare providers should immediately notify their local or state health department in the event of a PUI for COVID-19 and should contact and consult with their local and/or state health department for recommendations on testing PUIs for COVID-19.
Guidance

Coronavirus (COVID-19) and Pregnancy: What Maternal-Fetal Medicine Subspecialists Need to Know

The Society for Maternal-Fetal Medicine (SMFM); Sarah Dotters-Katz, MD, MMHPE; and Brenna L. Hughes, MD, MSc

Coronavirus Disease 2019 (COVID-19) and Pregnancy: What obstetricians need to know

Sonja A. Rasmussen, MD, MS, John C. Smulian, MD, MPH, John A. Lednicky, PhD, Tony S. Wen, MD, Denise J. Jamieson, MD, MPH
General principles: PUI / confirmed

• **Prevention of spread**
  • Wait in a separate, well-ventilated area, > 6 feet from others
  • Respiratory hygiene: Face mask
  • Rapid triage
  • Isolated ASAP in **AIIR (**)**
  • CDC Infection prevention and control procedures
  • Limit visitor and HCP access to patient rooms
  • Contact Hospital ID
General principles: PUI / confirmed

• Testing
  • Collect and send relevant specimens*
  • Screen for other viral respiratory infections and bacterial infections
  • Fetal heart rate and contraction monitoring if appropriate

• Management
  • Early oxygen therapy (target > 95%; pO2 > 70 mmHg)
  • Early mechanical ventilation with evidence of advancing respiratory failure
Testing

• **Swabs**
  • Upper respiratory nasopharyngeal swab ONLY
    (Oropharyngeal less important; conserve supplies)
    • Both nares, All the way back

• **Sputum**
  • Only for those with productive cough
  • Induced samples not recommended

Testing

• Swabs
  • Synthetic fiber swabs with plastic shafts.
  • Do not use calcium alginate swabs or swabs with wooden shafts, as they may contain substances that inactivate some viruses and inhibit PCR testing
• Maintain proper infection control while collecting specimen
• Place swabs immediately into sterile tubes containing 2-3 ml of viral transport media

Example of a swab used by providers

Example of a CDC diagnostic panel
General principles: PUI / confirmed

• Management
  • IVF: Be conservative, unless cardiovascular instability is present
  • Antibiotics: Consider empiric antimicrobial therapy
  • Oseltamivir: Consider empiric oseltamivir
  • If septic shock ➔ prompt, targeted management
  • Steroids: DO NOT routinely use corticosteroids; individual basis for ACS
General principles: PUI / confirmed

- Notify/consult:
  - MFM, Neonatology, ICU, Anesthesia, Nursing

- Delivery
  - Based on GA, maternal condition, fetal stability, maternal wishes

- Communicate with family
Guidance on Infection Prevention

Interim Considerations for Infection Prevention and Control of Coronavirus Disease 2019 (COVID-19) in Inpatient Obstetric Healthcare Settings
Recommended considerations:

- **PPE**:
  - Basic and refresher training on PPE use and handling
  - Sufficient and appropriate PPE supplies positioned at all points of care
- **Processes to protect newborns** from risk of COVID-19.
Pre-hospital considerations

- Confirmed or PUIs should notify the OB unit prior to arrival. Facility can make appropriate infection control preparations:
  - ID appropriate room
  - Ensure infection prevention and control supplies and PPE are correctly positioned
  - Inform all healthcare personnel who will be involved in the patient’s care
• Arriving by EMS
  • EMS clinicians should notify the receiving healthcare facility
  • Keep patient separated from other people as much as possible.
  • Family members and contacts should not ride in the transport vehicle, if possible. If riding in the transport vehicle, they should wear a facemask.
  • Follow routine procedures for a transfer of the patient to the receiving healthcare facility (e.g., wheel the patient directly into an examination room).
Mother/Baby Contact

Temporary separation

Separate isolation room for the infant while they remain a PUI

Discuss risks/benefits of temporary separation

Consider in the confirmed or PUI COVID-19 until the mother’s transmission-based precautions are discontinued
Mother/Baby Contact

Decision to discontinue separation:

- Made on a case-by-case basis in consultation with clinicians, infection prevention and control specialists, and public health officials
- Account for disease severity, illness signs and symptoms, and results of laboratory testing
Mother/Baby Contact

Visitors:
- Limit visitors, except healthy parent or caregiver
- Visitors should be wear appropriate PP
- If another healthy family or staff member is present to provide care (e.g., diapering, bathing) and feeding for the newborn, they should use appropriate PPE.
• **Mother/Baby Contact**
  
  • **Colocation / “Rooming In”**
    
    • Based on mother’s wishes or unavoidable due to facility limitations
    • Measures to reduce exposure of the newborn to the virus
      
      • Physical *barriers* / curtain
      • Keep newborn ≥6 feet away from the ill mother
      • Put on a *facemask* and practice *hand hygiene* before each feeding or other close contact with her newborn. The facemask should remain in place during contact with the newborn.
• **Breastfeeding**
  
  • Limited studies:
    • Women with SARS-CoV2 and SARS-CoV
    • Virus has not been detected in breast milk
Breastfeeding

• Temporary separation
  • Encourage to express milk; dedicated breast pump
  • Practice hand hygiene.
  • All parts that come into contact with breast milk should be thoroughly washed and the entire pump should be appropriately disinfected per the manufacturer’s instructions.
• **Breastfeeding**
  
  • Direct feeding:
    • If the mother wishes, she should put on a facemask and practice hand hygiene before each feeding.
  
  • Expressed breast milk should be fed to the newborn by a healthy caregiver.
Specific queries re: CoVID-19
Specific questions for your units

**ADMINISTRATIVE**
- Antenatal testing & Ultrasounds
- Operating room procedures
- Immunocompromised staff
- Fomites
- Elective procedures
- Trainees
- CoVID-19 positive tracking
- Staffing

**CLINICAL**
- Therapeutic options
- Nitrous oxide
- Steroid use
- Elective inductions
- Blood conservation & Cell salvage
- NSAIDS
Specific questions for your units

ADMINISTRATIVE

- Antenatal testing & Ultrasounds

- Continue to provide all necessary care for high-risk patients.
- Community mitigation: May decrease foot traffic through medical offices
- Depend on local practice and population factors and resources.
- Telehealth (including telephonic and other remote services) can be a tool leveraged to allow access to care for these patients while
Specific questions for your units

ADMINISTRATIVE

• OR procedures
Specific questions for your units

ADMINISTRATIVE

- Follow CDC guidelines for infection prev
- May continue to work
- Facilities may want to consider limiting their exposure to patients with confirmed or suspected COVID19, especially during higher risk procedures (e.g., aerosol-generating procedures)
- Balance with community burden of disease and staffing
Specific questions for your units

**ADMINISTRATIVE**

- Fomites

---

Respiratory viruses on personal protective equipment and bodies of healthcare workers.

Phan LT¹, Sweeney D², Malta D³, Moritz DC³, Bleasdale SC³, Jones RM¹; CDC Prevention Epicenters Program.
Specific questions for your units

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**ADMINISTRATIVE**

- Antenatal testing & Ultrasounds
- Operating room procedures
- Immunocompromised staff
- Fomites
- Elective procedures

“The ACOG, ABOG, together with the AAGL, AGOS, ASRM, SASGOG, SFP and SMFM do not support COVID-19 responses that cancel or delay abortion procedures. Community-based and hospital-based clinicians should consider collaboration to ensure abortion access is not compromised during this time.”
Specific questions for your units

ADMINISTRATIVE

- Determine trainee schedule and work flow to minimize risk of group exposure and quarantine.
- PDs sharing resources
- Fellowship Aff Comm reaching out to ABOG/ACGME

- Trainees
Specific questions for your units

ADMINISTRATIVE

- Modality via division/department, EMR, or hospital ID to track all COVID-19 positive patients and f/u

• CoVID-19 positive tracking
Specific questions for your units

ADMINISTRATIVE

- Antenatal testing & Ultrasounds
- Operating room procedures
- Immunocompromised staff
- Fomites
- Elective procedures
- Trainees
- Staffing preparations
- Jeopardy system
- Teams: Inpatient / Outpatient / Home
- Minimize risk of group exposures
Specific questions for your units

CLINICAL

• Therapeutic options

• Plaquenil
  • Raoult, France, n=24, unpublished

• Lopinavir / ritonavir
  • Cao, China = n=199, no benefit

• Tocilizumab
  • China, ongoing

• Sarilumab (Kevzara)
Specific questions for your units

CLINICAL

• Nitrous oxide

• In PUI/confirmed?
• In general use?
Specific questions for your units

CLINICAL

- SARS-CoV: “possible harm including avascular necrosis, psychosis, diabetes and delayed viral clearance”
  - Gardner, Plos Med, 2006
- Steroid use
- Influenza: more secondary infections, less ventilator free days, ? Higher mortality
- WHO: “DO NOT give systemic corticosteroids for treatment of viral pneumonia of ARDS unless indicated for another indication”
<table>
<thead>
<tr>
<th>Outcomes of corticosteroid therapy</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MERS-CoV</td>
<td>Delayed clearance of viral RNA from respiratory tract&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>SARS-CoV</td>
<td>Delayed clearance of viral RNA from blood&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td>SARS-CoV</td>
<td>Complication: psychosis&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td>SARS-CoV</td>
<td>Complication: diabetes&lt;sup&gt;7&lt;/sup&gt;</td>
</tr>
<tr>
<td>SARS-CoV</td>
<td>Complication: avascular necrosis in survivors&lt;sup&gt;8&lt;/sup&gt;</td>
</tr>
<tr>
<td>Influenza</td>
<td>Increased mortality&lt;sup&gt;9&lt;/sup&gt;</td>
</tr>
<tr>
<td>RSV</td>
<td>No clinical benefit in children&lt;sup&gt;10,11&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

CoV=coronavirus. MERS=Middle East respiratory syndrome. RSV=respiratory syncytial virus. SARS=severe acute respiratory syndrome. *Hydrocortisone, methylprednisolone, dexamethasone, and prednisolone.

**Table: Summary of clinical evidence to date**
Specific questions for your units

CLINICAL

• **PROS:** Deliver patients now in order to decrease patient load, before burden of disease increases in next few weeks

• **CONS:** Increased time in medical setting, load on L&D now

• **Elective inductions**

• **Outpatient induction?**
Specific questions for your units

CLINICAL

• Blood conservation & Cell salvage

• Readily available?
Specific questions for your units

CLINICAL

• NSAIDS

World Health Organization (WHO)

@WHO

Q: Could #ibuprofen worsen disease for people with #COVID19?

A: Based on currently available information, WHO does not recommend against the use of ibuprofen.

At present, based on currently available information, WHO does not recommend against the use of ibuprofen. We are also consulting with physicians treating COVID-19 patients and are not aware of reports of any negative effects of ibuprofen, beyond the usual known side effects that limit its use in certain populations. WHO is not aware of published clinical or population-based data on this topic.

18 March 2020
Specific questions for your units

Wellness
Research
Research

• **PRIORITY (Pregnancy Coronavirus Outcomes Registry)**
  - Prospective Nationwide Registry, UCLA / UCSF
  - PUI or confirmed
  - Anticipated enrollment start date: 3/23/20
  - Yalda Afshar, MD, PhD – yafshar@mednet.ucla.edu

• **MFM-U**
  - The MFMU is also considering a protocol to evaluate the effect of the COVID pandemic on pregnant and postpartum women
“Don’t worry alone.”

Dr. Beth Karlan
SMFM Free Resources

- Pulmonary critical care lecture
  - Dr. Cornelia Graves
  - Wednesday 3/25/2020 @ 9 PT / 12 ET
  - https://www.smfm.org/covid19
- Pulmonary critical care bundle

References

In Dropbox:
- Dr. Judette Louis
  - President of SMFM