Patient Care Algorithms

for the Identification, Admission and Investigation of Pregnant Persons with Suspected or Confirmed SARS-CoV2 Infection

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Clinician-Scientist, Lunenfeld-Tanenbaum Research Institute, Toronto
Assistant Professor, Obstetrics and Gynaecology, University of Toronto
Aims and objectives

• To become proficient at assessing, triaging and managing pregnant persons with suspected or confirmed SARS-CoV2 infection, based on standardized patient-care algorithms

• Disclaimer
  • These are ‘living documents’
  • Not meant to be prescriptive, and require the use of clinical judgement
  • Note ‘words of caution’ at the end of the presentation
Rationale

**COVID in pregnancy**
- 86%: mild
- 9.3%: severe
- 4.7%: critical

*Breslin case series (43)*

Can we identify the 14% that are likely to progress to severe/critical disease, and safely discharge the other 86%?

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### COVID-19 in pregnancy: early lessons

Noelle BRESLIN, M.D., Caitlin BAPTISTE, M.D., Russell MILLER, M.D., Karin FUCHS, M.D., Dena GOFFMAN, M.D., Cynthia GYAMFI-BANNERMAN, M.D, M.S., Mary D’ALTON, M.D.

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>GA</th>
<th>BMI</th>
<th>PMH</th>
<th>Chief Complaint</th>
<th>Review of systems on admission</th>
<th>Temp</th>
<th>WBC</th>
<th>Platelets</th>
<th>Dispo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38</td>
<td>38</td>
<td>37+0</td>
<td>T2DM</td>
<td>Labor induction</td>
<td>Fever, Cough, Myalgia, Dyspnea, Chest pain, Headache</td>
<td>36.9 - 38.1 C</td>
<td>7.4</td>
<td>216</td>
<td>ICU</td>
</tr>
<tr>
<td>2</td>
<td>33</td>
<td>47</td>
<td>37+5</td>
<td>T2DM, cHTN</td>
<td>Labor induction</td>
<td>Fever, Myalgia, Dyspnea, Headache</td>
<td>36.5-38.8 C</td>
<td>7.3</td>
<td>276</td>
<td>ICU</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>30</td>
<td>35+5</td>
<td>None</td>
<td>Tachycardia (pulse 130 bpm)</td>
<td>Fever, myalgias, cough</td>
<td>36.7 - 38.3 C</td>
<td>4.5</td>
<td>185</td>
<td>Admit^</td>
</tr>
<tr>
<td>4</td>
<td>32</td>
<td>29</td>
<td>32+5</td>
<td>None</td>
<td>Fever, myalgia, cough</td>
<td>None, None, None, None, None, None</td>
<td>36.6 - 37.6 C</td>
<td>6.5</td>
<td>180</td>
<td>Admit^</td>
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<tr>
<td>5</td>
<td>27</td>
<td>31</td>
<td>26+3</td>
<td>None</td>
<td>Chest pain</td>
<td>None, None, None, None, None, None</td>
<td>36.7 - 37.1 C</td>
<td>6.8</td>
<td>129</td>
<td>Home</td>
</tr>
<tr>
<td>6</td>
<td>38</td>
<td>34</td>
<td>28+0</td>
<td>Asthma</td>
<td>Fever, myalgia, cough</td>
<td>None, None, None, None, None, None</td>
<td>36.9 - 37.0 C</td>
<td>-</td>
<td>-</td>
<td>Home</td>
</tr>
<tr>
<td>7</td>
<td>39</td>
<td>23</td>
<td>34+6</td>
<td>None</td>
<td>Cough, HA, myalgia</td>
<td>None, None, None, None, None, None</td>
<td>36.4 - 37.2 C</td>
<td>5.4</td>
<td>255</td>
<td>Home</td>
</tr>
</tbody>
</table>

*GA = gestational age (weeks + days); PMH = past medical history; T2DM = type two diabetes mellitus; cHTN = chronic hypertension; HA = headache; WBC = white blood cell count; Dispo = initial disposition; ICU = intensive care unit

^ Cases 3 and 4 were each admitted for supportive care, and each was discharged home on hospital day three
Since December, 2019, Wuhan, China, has experienced an outbreak of coronavirus disease 2019 (COVID-19) in February, 2020, which was later designated SARS-CoV-2 pneumonia, and was transmitted outside China. The potential risk factors of older age, high SOFA score, and d-dimer greater than 1 µg/mL could help clinicians to identify patients with poor prognosis at an early stage. Prolonged viral shedding provides the rationale for the early antiviral treatment and isolation decision making and guidance around the length of isolation.

Key points
1. Median duration of viral shedding was 20·0 days (IQR 17·0–24·0) in survivors, but SARS-CoV-2 was detectable until 37 days after illness onset in non-survivors.
2. The longest observed duration of viral shedding in survivors was 37 days.
3. Median duration of viral shedding was 16 days in non-survivors.
4. Viral shedding was not associated with increased mortality.
5. Risk factors for prolonged virus shedding included advanced age (> 65 years), high SOFA score (≥ 12), and d-dimer greater than 1 µg/mL.
6. Viral shedding was more common in patients with severe respiratory disease, but the role of viral shedding in disease severity remains unclear.
7. The clinical and virological course of illness have not yet been well described.
8. Viral shedding studies were not reported.
9. The level and duration of infectious virus replication are not well characterised.

Figure shows temporal changes in d-dimer (A), lymphocytes (B), IL-6 (C), serum ferritin (D), high-sensitivity cardiac troponin I (E), and lactate dehydrogenase (F). Differences between survivors and non-survivors were significant except for day 4 after illness onset for d-dimer, IL-6, and high-sensitivity cardiac troponin I. Data are shown as medians and interquartile ranges. Data were calculated from daily values after day 16 exceeded the upper limit of detection, as indicated by the dashed line. COVID-19-coronavirus disease 2019. IL-6-interleukin-6.
Outpatient/ Ambulatory Settings

• Aim: To determine which pregnant persons with suspected or confirmed SARS-CoV2 infection require inpatient management

• Version:5

• Sources
  • ACOG/SMFM Algorithm (22 Apr 2020)
  • Mount Sinai slide-deck [Dr. Wendy Whittle]
  • Other published evidence
  • Comments of clinicians that reviewed versions 1-3
Outpatient Algorithm

Assess Symptoms
Symptoms typically include fever ≥37.8°C or one or more of the following:
- Cough
- Difficulty breathing or shortness of breath
- Gastrointestinal symptoms
- Chills
- Repeated shaking with chills
- Muscle pain
- Headache
- Sore throat
- New loss of taste or smell

Conduct Illness Severity Assessment
- Difficulty completing a sentence without gasping for air or needing to stop to catch breath frequently when walking across the room
- Coughing more than 1 teaspoon of blood
- New pain or pressure in the chest other than pain with coughing
- Unable to keep liquids down
- Signs of dehydration such as dizziness when standing
- Less responsive than normal or does she become confused when talking to her
- Does she have decreased level of consciousness

Routine Prenatal Care
- Routine obstetric precautions
- Restart algorithm if symptoms present

Suspected or Confirmed COVID-19 Infection in Pregnancy Algorithm for OUTPATIENT settings

Assess Symptoms
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Low Risk
- If suitable for phone follow-up, symptomatic care at home including hydration, antipyretics and rest
- Report if any symptoms
- Routine obstetric advice

Moderate Risk
- Admit and consider additional investigations as outlined in inpatient algorithm

Elevated Risk
- Admit and follow inpatient algorithm

1. Presence of symptoms warrants testing, not admission
2. Assessment of severity of symptoms is a crucial step
3. Note: Temperature > 37.8 and not 38
Aim: To determine which pregnant patients with suspected or confirmed COVID infection require inpatient management. This algorithm is based on the SMFM algorithm, and is not intended to replace normal obstetrical triage.

### Comorbidities

<table>
<thead>
<tr>
<th>Any significant medical illness, especially:</th>
</tr>
</thead>
<tbody>
<tr>
<td>🟢 Obesity (BMI&gt;30)</td>
</tr>
<tr>
<td>🟢 Hypertension</td>
</tr>
<tr>
<td>🟢 Diabetes</td>
</tr>
<tr>
<td>🟢 Serious pre-existing cardiac disease</td>
</tr>
<tr>
<td>🟢 Reactive airway or chronic lung disease</td>
</tr>
<tr>
<td>🟢 Imunosuppressed</td>
</tr>
<tr>
<td>🟢 Imunosuppressive treatment</td>
</tr>
<tr>
<td>🟢 Chronic liver or kidney disease</td>
</tr>
<tr>
<td>🟢 Sickle cell disease</td>
</tr>
<tr>
<td>🟢 Blood dyscrasia</td>
</tr>
</tbody>
</table>

### Examination

<table>
<thead>
<tr>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (HR)</td>
</tr>
<tr>
<td>Blood pressure (BP)</td>
</tr>
<tr>
<td>Respiratory rate (RR)</td>
</tr>
<tr>
<td>O₂ Saturation (O₂ sats)</td>
</tr>
<tr>
<td>Jugular venous pressure (JVP)</td>
</tr>
</tbody>
</table>

### Other Considerations

<table>
<thead>
<tr>
<th>Obstetric issues e.g. preterm labour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inability to care for self or arrange follow-up if necessary</td>
</tr>
<tr>
<td>Mild to severe symptoms (cough, fatigue, diarrhoea, body pain)</td>
</tr>
</tbody>
</table>

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- Headache
- Sore throat
- New loss of taste or smell

### Conduct Illness Severity Assessment

- No
- Elevated Risk

### Any Positive Signs

- All Results
- Normal

### Baseline Investigations

<table>
<thead>
<tr>
<th>CBC, lytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactate</td>
</tr>
<tr>
<td>Venous Blood gas</td>
</tr>
<tr>
<td>BUN, creatine</td>
</tr>
</tbody>
</table>

### Abnormal chest X-ray findings

### Abnormal Investigations

| PT, aPTT, d-dimer, fibrinogen |
| ALT, AST, Urea, Creat |
| CRP, Ferritin, d-dimer, LDH |

Comments: Rohan.Dsouza@sinaihealthsystem.ca

29 April 2020; Version 4

1. List of comorbidities is not exhaustive – use clinical judgement
2. The examination must include RR and oxygen saturations on room air
3. JVP should be assessed to determine judicious fluid management
4. Do not forget about
   - The ability of the patient to care for self and arrange follow up
   - Routine obstetrics and non-obstetric/ non-COVID conditions

Obstetrics & Gynaecology
UNIVERSITY OF TORONTO
1. Respiratory concerns to be taken seriously, even in the absence of comorbidities or normal other findings
2. Comorbidities in pregnancy to be taken seriously
3. “Other concerning vital signs” – deliberate attempt at not being prescriptive
1. Chest X-ray findings warrant special attention
2. ‘Baseline’ investigations deemed sufficient in the first instance
Inpatient Setting

• Aim: To determine which pregnant persons with suspected or confirmed SARS-CoV2 infection are likely to have severe or critical illness, and institute early supportive treatment

• Version:4

• Sources
  • Evidence from non-pregnant populations
  • Correspondence with colleagues around the world (Dr. Whittle)
  • Multidisciplinary team involvement at Mt. Sinai (MFM, obstetrics, obstetric medicine, haematology, cardiology, obstetric anaesthesia, respirology, ICU, family practice)
  • Comments of those that reviewed versions 1-3

• Disclaimer
  • SMFM "Considerations” document (29/Apr) are currently being evaluated
### Cardinal symptoms – assess daily

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No (0)</th>
<th>Mild (1)</th>
<th>Moderate (2)</th>
<th>Severe (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
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<tr>
<td>Shortness of breath</td>
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<td></td>
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<tr>
<td>Fatigue</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

1. Must be assessed daily – good clinical practice
2. Worsening symptoms should trigger appropriate clinical response

### General Management

Start empiric **thromboprophylaxis** (enoxaparin) for the entire duration of hospitalization

For anticipated preterm birth: administer **antenatal corticosteroids**

Judicious use of **intravenous fluids**, based on clinical presentation

Low-dose aspirin can be continued

Currently no restriction on **Indomethacin** for tocolysis & **NSAIDs** post-childbirth

Consider limiting **MagSulf** to a 4gm bolus over 1 hour in those with respiratory depression

### Suspected or Confirmed COVID-19 Infection in Pregnancy

**Algorithm for INPATIENT management**

This algorithm is intended for COVID-positive pregnant patients who are deemed unwell enough to require INPATIENT management. The aim is to use clinical signs, laboratory markers, and radiologic findings to identify those at risk for serious maternal morbidity/no death. Please adapt to your center.

#### Clinical symptoms – assess daily

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<thead>
<tr>
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<th>No (0)</th>
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<th>Moderate (2)</th>
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<tbody>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
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<td></td>
<td></td>
</tr>
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#### Laboratory

- **CRP, Ferritin, d-dimer, LDH**
- **Lactate, Venous Blood Gas**
- **ALT, AST, Urea, Creat**

#### Radiology

- **ECG**
- **X-ray chest**
- **POCUS** (if available)

#### Observations

- **Fib <4 OR platelets <80**
- **Delivery NOT Anticipated During Visit**
- **Delivery Anticipated During Visit**

#### Consult

- **Medicine/ID/ICU**
- **Cardiology**
- **Vascular POCUS**

#### Follow-up

- **Repeat**

#### Anticipated & if symptomatic

- **Prognostic marker for SMM - Repeat Day 4 & 7**
- **e adapt to your center.**

#### Other

- **Antibiotics; Supportive care**

#### Algorithm Notes

- New use (if sats ≤94%, start O2 to keep ≥94%)
- ≤50% increase in O2 demands over 1-2 hours
- +4 O2 by facemask
- RR increases despite normal O2 sats
- Increased O2 need to maintain sats ≥94%

### Abbreviations

- BNP: Brain natriuretic peptide
- HR, BP, RR, O2 sats
- ALT, AST, Urea, Creat
- CRP, Ferritin, d-dimer, LDH
- CBC, aPTT
- CBC, platelets, INR, aPTT
- ECG
- POCUS (if available)
- CT scan
- Echo cardiogram

Echocardiography ASEcho.org

**This algorithm is updated on a regular basis. Please consult your center’s guidelines and local guidelines before use.**

**COVID-19 and a prothrombotic state. A unilateral DVT study performed by a sonographer is recommended.**

**For Echo indications:**

- **DVT, PE, MV, ASD, PDA, Patent foramen ovale**
- **Pulmonary embolism**
- **Right heart failure**
- **Right heart strain**
- **Right heart dilatation**
- **Right heart dysfunction**
- **Hypoxia or hypercapnia, O2 set ≤94% on room air**
1. Temp ≥ 37.8 and O₂ sats < 94% always concerning
2. Use clinical judgement and overall picture; not absolute values in determining “significant change”
3. Change in oxygen requirements must be taken seriously
4. Pathway (ICU vs ID vs Medicine) to be determined by individual sites

1. Haematologic changes could be profound, and are among the earliest prognostic markers of severe disease
2. CRP and d-dimers although not traditionally used in obstetrics, are among the most important early markers of disease severity
3. Interpretation of abnormal values should be done in conjunction with specialists, and may depend on whether birth is imminent or not
4. Abnormal blood gases, regardless of symptom severity, should prompt referral/escalation
5. Severe COVID can mimic other obstetric and medical emergencies
Table 1. ASE POCUS Protocol in Suspected or Confirmed COVID-19 Infection. A modified POCUS protocol to assist in the assessment of COVID-19 patients includes heart, chest and vessel views.

<table>
<thead>
<tr>
<th>COVID19 POCUS Protocol</th>
<th>Structure Imaged</th>
<th>Assessment</th>
<th>Disease Associations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Ventricle</td>
<td>Size, Global and Regional Function</td>
<td>Myocarditis</td>
<td>ACS Cardiomyopathy Shock</td>
</tr>
<tr>
<td>Right Ventricle</td>
<td>Size and Function, TRF for PAP if available</td>
<td>FE</td>
<td>Cardiomyopathy</td>
</tr>
<tr>
<td>Pericardium</td>
<td>Effusion</td>
<td>Tamponade</td>
<td></td>
</tr>
<tr>
<td>Valves</td>
<td>Gross Regurgulation or stenosis</td>
<td>Pre-existing CV disease</td>
<td></td>
</tr>
<tr>
<td>Lung</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 or 12 point exam</td>
<td>B Lines (A lines, pleural sliding are normal)</td>
<td>Edema or Pneumonia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sub-pleural Consolidation</td>
<td>Pneumonia ARDS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thickened Pleura</td>
<td></td>
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<tr>
<td></td>
<td>Lobar consolidation with air Branches</td>
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<td></td>
<td>Effusion</td>
<td>CHF</td>
<td></td>
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<tr>
<td>JVP or Subcostal IVC</td>
<td>Fluid Status</td>
<td>CHF, hyponatremia</td>
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<td>29-Artery</td>
<td>2 point compression</td>
<td>DVT</td>
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</tbody>
</table>

*Leg veins may be assessed if the operator has training in this technique, clinical suspicion exists, and the sonographer is available.

ACS, acute coronary syndrome; TR, tricuspid regurgitation; PAP, pulmonary artery systolic pressure; PE, pulmonary embolus; SR, sinus rhythm; CTV, central venous access; Echocardiogram-ARDS, acute respiratory distress syndrome; LRTI, lower respiratory tract infection; HIV, human immunodeficiency virus; H1N1, pandemic influenza; COVID, coronavirus disease 2019; HR, heart rate; RR, respiratory rate; O₂, oxygen; PT, prothrombin time; aPTT, activated partial thromboplastin time; WBC, white blood cell count; ATP, anion gap; BNP, brain natriuretic peptide; DCST, direct current shock therapy; ASA, aspirin; N, normal; bN, below normal; abN, abnormal; DVT, deep vein thrombosis.

Abbreviations
- BNP: B-type natriuretic peptide
- MRP: Most Responsible Physician
- POCUS: Point of care ultrasound

Comments: Rohan.Dsouza@sinahealthsystem.ca

29-April-2020; Version 4
(Hocus) POCUS

1. Depends on training/ availability
2. Could potentially avoid unnecessary contact between infected person and care providers/ resource use
   - Echocardiography
   - Leg Dopplers
   - CT scans
3. If not possible, may need alternate investigative pathways

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</tr>
<tr>
<td>△/ Leg Veins*</td>
<td>2 point compression*</td>
<td>DVT</td>
<td></td>
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ACS, acute coronary syndrome; TR, tricuspid regurgitation; PASP, pulmonary artery systolic pressure; PE, pulmonary embolism; CV, cardiovascular; ARDS, acute respiratory distress syndrome; JVP, jugular venous pulsation; IVC, inferior vena cava; CHF, congestive heart failure; DVT, deep vein thrombosis.
Words of caution!

- Use the most up-to-date algorithm
  - Posted on the OBGYN UofT / SOON - COVID-resource page
  - SMFM recommendations on H-Score etc. (29 April) being considered by multi-disciplinary team
- Feedback
- Careful about site-specific modifications
  - This is a novel disease and care pathways must reflect that

OK
1. Consider alternate referral pathways
2. Modify investigative pathways in consultation with a local multidisciplinary team
3. Consult referral centres in case of any doubts/ questions

NOT OK
1. Changing thresholds
2. Setting absolute values
3. Ignoring a sudden change in symptoms
4. Replacing parts of the algorithm with prediction models not validated in pregnancy or for COVID
Anticipated benefits

• Standardized and safe approach towards
  • Identifying early, the 14% at increased risk for serious/critical disease
  • Reducing hospital admissions and the length of hospital stay
  • Reducing unnecessary investigations and resource utilization
• Protecting healthcare professionals and other patients
• Other benefits
  • Quality Improvement, Patient Safety
  • Research implications
  • Framework for regional/ provincial/ national collaboration
Acknowledgements

• Wendy Whittle
• Ann Kinga Malinowski
• Nimrah Abbasi
• John Snelgrove
• Cynthia Maxwell
• Tim Van Mieghem
• Mathew Sermer
• Kellie E Murphy

• Shital Gandhi (Obstetric Medicine)
• Nadine Shehata (Haematology)
• Candice Silversides (Cardiology)
• Stephen Lapinsky (Respirology/ ICU)
• Cristian Arzola (Ob Anaesthesia)
• Kristina Khanduja (Ob Anaesthesia)
• Sabrina Kolker (Family Practice)
• Lauren Clarfield (Medical Student)