SARS-CoV-2 and newborn

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Mount Sinai Hospital
University of Toronto, Canada

Goals

- Neonatal resuscitation
- Neonatal cases of positivity/infection – controversies and confusion
- Room-in or room-out
- Breastfeeding / expressed breast milk / alternatives
- Parental visitation / follow up
- Recent registry results

Neonatal Resuscitation and Postresuscitation Care of Infants Born to Mothers with Suspected or Confirmed SARS-CoV-2 Infection

Prakesh Shah, MD1, LM1, Martin Lo, MD2, Francyne V. Tom, DO3, Jumana Al-Aqeel, MD4, Adam Jarlow, MD5, Steven Palepu, MD6, Lisa A. Lieberman, MD6, Ivy Lehmann, MD6, and Shelly C. Sengupta, MD6

Mount Sinai Hospital, Toronto, Ontario, Canada

We report the resuscitation of an 18-week fetus of a woman who was admitted for COVID-19, with delivery performed via cesarean section. The neonatal intensive care unit (NICU) care for infants born to mothers who have COVID-19 is discussed.

GPL-3.0

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Neonatal cases of positivity/infection – controversies and confusion

Recent registry results

Breastfeeding / expressed breast milk / alternatives

Room-in or room-out

Parental visitation / follow up

Delivery room considerations for born to mothers with suspected or confirmed COVID-19

Resuscitation equipment

Prescreen pregnant woman and partner/visitor prior to arrival at the hospital

Special Report

COVID-19 pandemic

Concerning COVID-19

Natal Guidelines in the Management of an Obstetrical Patient on the Labor and Delivery Unit during the COVID-19 Pandemic

Hajimoradzadeh S, Spivak J, Shepherd, B, S, John R. Barker, B, S, Anne-F lain Arbuckle-Berlin, B, S, Jane W. Missarzadeh, B, S, Max H. T. To, B, S

NICU care for infants born to mothers with suspected or proven COVID-19

Delivery / Operating

Virtual interaction with partner

PAPR/N95 if aerosolization procedures are likely

Negative pressure room (preferred)

Mask (source-containment)

No skin-to-skin contact

Delayed cord clamping

Transport isle

Resuscitation equipment

Additional providers outside the room for backup

Prescreen pregnant woman and partner/visitor prior to arrival at the hospital

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Additional providers outside the room for backup
Characteristics and controversies of neonatal cases

The SARS-CoV-2 receptor ACE2 expression of maternal-fetal interface and fetal organs by single-cell transcriptome study

In neonatal mice at post-natal day 1-3. In summary, this study revealed that the SARS-CoV-2 receptor was widely spread in specific cell types of maternal-fetal interface and fetal organs. And thus, both the vertical transmission and the placenta dysfunction/abortion caused by SARS-CoV-2 need to be further carefully investigated in clinical practice.
Clinical features and obstetric and neonatal outcomes of pregnant patients with COVID-19 in Wuhan, China: a retrospective, single-centre, descriptive study

<table>
<thead>
<tr>
<th>Patient</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</thead>
<tbody>
<tr>
<td>Pregnancy outcome</td>
<td>Discharged</td>
<td>Discharged</td>
<td>Normal</td>
<td>Discharged</td>
<td>Normal</td>
<td>Discharged</td>
<td>Normal</td>
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<tr>
<td>Neonatal outcome</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>3.77</td>
<td>3.77</td>
<td>3.77</td>
<td>3.77</td>
<td>3.77</td>
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<tr>
<td>APGAR score (1 min)</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Admission to neonatology department</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>
<td>Neonatal complications</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Days of follow-up</td>
<td>40</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
</tr>
</tbody>
</table>

Table 1: Neonatal and obstetric outcomes of seven patients with COVID-19

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Vertical Transmission in Neonates Born to Mothers With Coronavirus Disease 2019 (COVID-19) Pneumonia

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Vertical Transmission in Neonates Born to Mothers With Coronavirus Disease 2019 (COVID-19) Pneumonia

Table 2: Clinical characteristics of the neonates

<table>
<thead>
<tr>
<th>Case No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational age (wk)</td>
<td>33</td>
<td>32</td>
<td>33</td>
<td>34</td>
<td>35</td>
<td>36</td>
<td>37</td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>2.5</td>
<td>2.6</td>
<td>2.7</td>
<td>2.8</td>
<td>2.9</td>
<td>3.0</td>
<td>3.1</td>
</tr>
<tr>
<td>1-min APGAR score</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Disease</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Neonatal complications</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

The mother was delivered vaginally and had a confirmed diagnosis of COVID-19 infection.
Severe COVID-19 during Pregnancy and Possible Vertical Transmission

Maria Claudia Alcamo, MD1,2; Tania Paredes, MD2; David Caceres, MD1; Camille M. Webb, MD1,3; Luis M. Valdez, MD1,2; Mauricio Roa, MD1,2,6

Fig. 2 Schematic diagram of SARS-CoV-2 spread. Red circles indicate mother and infants. Ig, immunoglobulin. RT-PCR, reverse transcription polymerase chain reaction.

RESEARCH LETTER

Antibodies in Infants Born to Mothers With COVID-19 Pneumonia

Table 1. Antibody Levels in Infant Serum Samples

<table>
<thead>
<tr>
<th>Antibody</th>
<th>Reference range</th>
<th>Infant</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgM, units/mL</td>
<td>&lt;100</td>
<td>25.6 ± 11.7</td>
<td></td>
</tr>
<tr>
<td>IgG, units/mL</td>
<td>&lt;35</td>
<td>10.5 ± 6.8</td>
<td></td>
</tr>
<tr>
<td>IgA, units/mL</td>
<td>&lt;100</td>
<td>0.3 ± 0.2</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Antibody Levels in Mother Serum Samples

<table>
<thead>
<tr>
<th>Antibody</th>
<th>Reference range</th>
<th>Mother</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgM, units/mL</td>
<td>&lt;100</td>
<td>33.2 ± 22.3</td>
<td></td>
</tr>
<tr>
<td>IgG, units/mL</td>
<td>&lt;100</td>
<td>164.17 ± 120.4</td>
<td></td>
</tr>
<tr>
<td>IgA, units/mL</td>
<td>&lt;100</td>
<td>12.73 ± 8.17</td>
<td></td>
</tr>
</tbody>
</table>

A Case Report of Neonatal 2019 Coronavirus Disease in China

Sheenbao Wang, Li Gao, Liu Chen, W.O. Yang, C. Xing, Z. Zhang, and Ling Feng

In December 2019, the coronavirus disease (COVID-19)-caused pneumonia caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in China and now has spread in many countries. Pregnant women are a population susceptible to COVID-19 and are more likely to have complications and even go on to severe illness. We report a case of neonatal COVID-19 in China with pharyngeal swabs testing positive by real-time reverse-transcription polymerase chain reaction assay 36 hours after birth. However, whether the case is a vertical transmission from mother to child remains to be confirmed.

Clinical Infectious Diseases
SARS-CoV-2 infection with gastrointestinal symptoms as the first manifestation in a neonate

WANG Xu, WANG Dan, CHEN Guo-Qi, TAO Xin-Yu, ZENG Ling-Kong. Wuhan Children's Hospital/Wuhan Methodist and Child Healthcare Hospital, Tongji Medical College, Huazhong University of Science & Technology, Wuhan 430016, China (Zeng L.K., Email: zeng.lk@163.com)

Abstract: Since December 2019, the outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has occurred in Wuhan, Hubei province, China. The infected cases were mostly in adults, but newly reported in children, especially neonates. Most children with SARS-CoV-2 infection present rapidly with respiratory symptoms, but less commonly with gastrointestinal symptoms, and tend to have mild clinical symptoms. A neonate with SARS-CoV-2 infection, who had vomiting and milk refusal as the first symptoms, was recently admitted to Wuhan Children's Hospital. After two weeks of treatment, the patient recovered gradually and was discharged now. Here, this case is reported to improve the understanding of SARS-CoV-2 infection in neonates.

Key words: Severe acute respiratory syndrome coronavirus 2; Gastrointestinal symptoms; Neonate

新型冠状病毒感染专题・病例报告

中国首例新生儿新型冠状病毒肺炎

曾凌空 1 潘会军 1 赵若瑶 1 陈家文 1 三 于伯超 2 何志雄 2 乔玉蕾 3

1 华中科技大学同济医学院附属武汉儿童医院新生儿内科，武汉 430060，2 华中科技大学同济医学院附属武汉儿童医院呼吸科，武汉 430060

通讯作者：胡艳艳，Email：huyan128.com

首例case of neonate infected with novel coronavirus pneumonia in China

Jing Zhang, Ya Sun, Fan Yan, Wei Zhang, Huali Zhang, Jun Yin, Lu Zheng, Department of Paeonatology, Wuhan Children's Hospital of Tongji Medical College, Huazhong University of Science & Technology, Wuhan 430016, China; Department of Paediatrics, Wuhan Children's Hospital of Tongji Medical College, Huazhong University of Science & Technology, Wuhan 430016, China.

Corresponding author: Liu Zheng, Email: huyan128.com

首例case of neonate infected with novel coronavirus pneumonia in China
What is the confusion?

- Testing guidelines are "inconsistent and not evidence informed".
- Majority suggest testing at 24 hours but then discounts cases based on delayed testing.
- Antibody testing lacks validity.
- If we do not test – we will not know.

Skin-to-skin

- The virus is known to transmit with direct contact.
- Discussion would need to happen with mothers prior to birth as to preference.
- Immediate skin-to-skin is important for many parents.
- Advised to not continue especially if mother is having cough/sneezing.

Classification system and case definition for SARS-CoV-2 infection in pregnant women, fetuses, and neonates

<table>
<thead>
<tr>
<th>Case by case: Switzerland</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Co-location: South Africa, Sweden, UK, USA (AAP), Canada, Italy</td>
</tr>
<tr>
<td>Separation: Spain, USA (CDC), USA (AAP), China, Saudi Arabia, Singapore, South Korea</td>
</tr>
</tbody>
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Separation: Spain, USA (CDC), USA (AAP), China, Saudi Arabia, Singapore, South Korea

Room-in or Room-out?

- Skin-to-skin
  - The virus is known to transmit with direct contact.
  - Discussion would need to happen with mothers prior to birth as to preference.
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What do we offer?

**Suggest mother and baby not be separated**

- Mask
- Hand and breast hygiene
- Keep baby 6 feet away in-between feeds
- Watch for signs and symptoms of infection

**Precautions:**

- **If mother is unwell** — needs to be admitted to medicine ward or ICU
- **If chosen by mother** — separate, non-contact alternate care provider in hospital and home

**EBM after precautions / formula**

**Separation**

**If mother is unwell — needs to be admitted to medicine ward or ICU**

**If chosen by mother — separate, non-contact alternate care provider in hospital and home**

**Is virus or antibody present in breastmilk?**

- So far samples have been negative
- No one has reported presence of antibody in breast milk yet — active area of research

**Breastfeeding / EBM / Alternatives**

- **Allow BF, EBM**: Australia, Canada, France, India, Italy, Spain, Sweden, Switzerland, UK, USA (CDC)
- **Allow EBM but no BF**: USA (AAP), Japan, Saudi Arabia
- **Pasteurized EBM, No BF**: China
- **No BF, No EBM**: Singapore, South Africa, China

**Management in NICU**

- Endotracheal intubation, including during cardiopulmonary resuscitation
- Open airway suctioning of intubated patients (bronchoscopy diagnostic or therapeutic)
- Autopsy
- Non-invasive positive pressure ventilation for acute respiratory failure (CPAP, BiPAP) *
- High-flow oxygen therapy (includes heated high flow)

* Adapted from Public Health Ontario. Updated IPC measures for COVID-19, April 6th, 2020
Visitation

Positive parents – not allowed in NICU

NICU visitation:
- Only one parent allowed in a given day – door screening
- No restriction on timing
- Facilitate contact by the use of electronic medium

Discharge

Follow up

Negative or non-suspect – community follow up

Positive mother (irrespective of baby status)
- Follow up recommended at 48-72 hours if going home (face to face)
- Hospitals encouraged to organize follow up
- Isolation till clearance by public health

What are we doing to get some answers?

Registry
- Website
- Patient recruitment from PRIORITY
  - USA only
- COVI-Preg
  - International
- PAN COVID
  - International
- MFMU
  - USA sites only
- CHOPAN
  - Australia, New Zealand & Pacific region
- UKOSS
  - UK only
- ROI COVID-19
  - Ireland only
- NethOSS
  - Netherlands only
- CAN COVID-Preg
  - Canada only
US – SONPM registry - data so far

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