COVID-19 Seminar Series: Pediatric Cases

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Disclosures

- Nothing to disclose

- Note: Very little pediatric literature to date, evolving topic; most of the literature has come from China
Objectives:

Discuss COVID-19 from the pediatric perspective:

- Transmission
- Clinical Characteristics
- Infection-Prevention Control Considerations
- Lab Testing
- Anti-virals and other medications
- Supportive Care in Hospital

- And any other questions you may have along the way
Transmission\textsuperscript{1,2}

- Droplet: Person-to-person spread when an infected individual coughs, speaks, or sneezes > droplets make contact with mucous membranes (eyes, nose, mouth)
- Contact: from contaminated surfaces to self (auto-inoculation)
- Possible airborne transmission?
- Virus is present in other body fluids (i.e. feces)

- Limited information about transmission patterns (2-3 published reports)
- What is available suggests that most transmission occurs within the household
- Predominantly transmission occurs from infected adults to children
- The reason for this is not clear... weaker cough? Staying at home more? Receptors?

Clinical Characteristics

- Approximately ~1-2% of cases will be among children\(^1\)
- Overlap with other common viral respiratory tract infections
- Symptoms reported among confirmed cases\(^1,3\):
  - Fever (50%), 1-3 days, longest up to 16 days
  - Cough (42%), mostly non-productive
  - Pharyngeal redness/congestion (32%)
  - Shortness of breath (14%)
  - Rhinorrhea (6%)
  - Diarrhea, vomiting (5%)
- Other non-specific s/s: headache, fatigue, myalgia, poor appetite
- Note: A large proportion of children will be asymptomatic

Case Categories: Asymptomatic\(^1,\(^4\)

- Positive nucleic acid test for SARS-CoV-2
- No signs of symptoms of COVID-19
- Normal chest imaging
- Younger age group less likely to be asymptomatic
- Overall predict this to be ~4.4% of pediatric cases

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Case Categories: Mild¹,⁴

Symptoms of upper respiratory tract infection (i.e. cough, sore throat, runny nose etc.) or mild gastrointestinal symptoms (diarrhea, vomiting etc.)³

Normal auscultation of chest

Largest proportion of patients, around half of all pediatric cases

Management considerations: Oral fluids (electrolyte) and fever/pain control?

Case Categories: Moderate\textsuperscript{1,4}

<table>
<thead>
<tr>
<th>Age Group, y\textsuperscript{a}</th>
<th>Asymptomatic, (n) (%)</th>
<th>Mild, (n) (%)</th>
<th>Moderate, (n) (%)</th>
<th>Severe, (n) (%)</th>
<th>Critical, (n) (%)</th>
<th>Total, (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>7 (1.9)</td>
<td>204 (54.2)</td>
<td>125 (33.2)</td>
<td>33 (8.8)</td>
<td>7 (1.9)</td>
<td>376</td>
</tr>
<tr>
<td>1–5</td>
<td>15 (5.1)</td>
<td>245 (49.9)</td>
<td>195 (39.7)</td>
<td>34 (6.9)</td>
<td>2 (0.4)</td>
<td>491</td>
</tr>
<tr>
<td>6–10</td>
<td>30 (5.8)</td>
<td>277 (53.3)</td>
<td>191 (36.7)</td>
<td>22 (4.2)</td>
<td>0 (0.0)</td>
<td>520</td>
</tr>
<tr>
<td>11–15</td>
<td>27 (6.5)</td>
<td>198 (48.1)</td>
<td>170 (41.3)</td>
<td>14 (3.4)</td>
<td>3 (0.7)</td>
<td>412</td>
</tr>
<tr>
<td>&gt;15</td>
<td>15 (4.6)</td>
<td>164 (49.1)</td>
<td>145 (43.4)</td>
<td>9 (2.7)</td>
<td>1 (0.3)</td>
<td>334</td>
</tr>
<tr>
<td>Total</td>
<td>94 (4.4)</td>
<td>1088 (51.0)</td>
<td>826 (38.7)</td>
<td>112 (5.3)</td>
<td>13 (0.6)</td>
<td>2133</td>
</tr>
</tbody>
</table>

- Signs/symptoms of pneumonia\textsuperscript{1,3}: coughing (productive and non-productive), fever, possible wheezing
- Not hypoxic
- Auscultation of chest abnormal
- Abnormal chest imaging
- Second largest group of patients (~40%)
- Management considerations: Hydration status of child, underlying co-morbid conditions, distance to medical attention, trajectory of illness (getting worse or getting better?)

Case Categories: Severe\(^1,4\)

- Respiratory symptoms (fever, cough) +/- gastrointestinal symptoms
- Central cyanosis and shortness of breath
- Oxygen saturation < 92%
- Abnormal chest imaging
- Highest proportion in the youngest age groups

Management considerations: in-patient admission, more details to come...

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Case Categories: Critical\textsuperscript{1,4}

- Acute respiratory distress syndrome, respiratory failure
- Other possible manifestations: shock, end-organ failure (acute kidney injury, encephalopathy etc.)
- Abnormal chest imaging
- Highest proportion in the youngest age group

Management considerations: in-patient admission, more details to come...

Multisystem Inflammatory Syndrome in Children: “MIS-C”

Case definition:
- Age <= 21 yo
- Fever
- Lab evidence of inflammation (CRP, ESR, ferritin, LDH etc.)
- Need for hospitalization for severe illness and >= end organ systems involved
- No other alternative diagnosis
- Positive for SARS-CoV-2 infection OR exposure to confirmed or suspected COVID-19 case within the previous four weeks
- **Can look similar to and fulfill criteria for Kawasaki Disease**

Infection Prevention Control

- Safest assumption is that everyone is infected = Standard Precautions
- Overall Goals:
  - Quick diagnosis of those who are infected - appropriate triage and isolation
  - Protection of healthcare workers
- Children will need a caregiver to accompany them, always assume both are infected (safest)
- If possible both the child and the caregiver should be masked
  - Limitations: young age, altered mental status, PPE availability
- Patients often don’t realize they’re sick, do not be falsely reassured by them
- If a sick patient needs to come into your facility, try to limit movement and contact prevent nosocomial spread
  - Ward and room restrictions
  - Limit number of personnel contacts in contact with this group

Laboratory Testing for COVID-19

- Basic labs

- SARS-CoV-2/COVID-19 specific testing:
  - RT-PCR
  - Point of Care Testing (POCT)
  - Serology
Basic Labs

- CBC, electrolytes, renal function all appropriate for more sick patients
- May observe lymphopenia/leukopenia, mild hepatitis, elevated inflammatory markers:
  - None are specific to COVID-19 (can be seen in many different viral processes)
SARS-CoV-2 RT-PCR

- Several different genes from SARS-CoV-2 to target; all targets very similar sensitivity and specificity
- So what IS the sensitivity/specificity of these tests?
- It depends on:
  - quality of specimen
  - NP vs throat vs LRT
  - When specimen is taken in disease course
  - Community prevalence of COVID-19
- Ideally, Sensitivity 95-99%, Specificity 99-100%

Does RT-PCR positivity predict SARS-CoV-2 infectivity?

- Positivity does not equal infectivity!
- Viral transmission is unlikely beyond 8-10 days of symptoms in mild to moderate disease; may be longer in more severe disease
- Ct value from RT-PCR may help predict infectious SARS-CoV-2:
  - Ct values >24 are increasingly less likely to represent infectiousness

SARS-CoV-2 POCT
Key points of COVID-19 POCT

Pros:
- Excellent performance when compared to laboratory developed tests (LDTs) and commercial assays
- Excellent turnaround time (results in under an hour)
- Dead sexy looking!

Cons:
- Typically more expensive
- Considered low throughput
Serology

- All target a few key SARS-CoV-2 viral proteins
- Some viral proteins predict neutralization (Spike/S protein) better than others (Nucleocapsid/N protein)
- Many options through the FDA!!
- Fairly good specificity (~80-100%)
- Sensitivity varies by timing symptom onset:
  - 3-7 days: ~25-50%
  - 8-14 days: ~50-80%
  - >14 days: ~65-90%
Important points about SARS-CoV-2 serology

What it’s likely good for:
- Seroprevalence studies
- MIS-C

What it’s likely NOT good for:
- Predicting immunity
- Acute clinical diagnostics
Treatment Options

- Supportive care will be the normal for almost all cases of COVID-19 in children!
  - Mild/moderate disease (no oxygen required)
- Antivirals rarely recommended but can be determined on a case-by-case basis in those with confirmed virological COVID-19 AND if enrolled in a clinical trial
  - Severe/Critical (oxygen required +/- mechanical ventilation support)
- Suggest use of remdesivir (targets RdRP) if available
- Lopinavir-Ritonavir (Kaletra)
- Please don’t use hydroxychloroquine...