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Management of COVID-19 in Children

Developed by Dr. Gauri Shah and Dr. Joan Robinson for PedsCases.com.
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Introduction:

Hello, I am Dr Gauri Shah and welcome to PedsCases. Today's topic is a timely and relevant topic for all pediatricians – the management of COVID-19 in children. No one is left untouched by the pandemic. As more and more youth and adults are vaccinated in the Western world, the focus is gradually but surely turning toward the unvaccinated children. There are so many questions regarding COVID19 in children and today I hope to outline some management strategies.

As I mentioned earlier, my name is Dr Gauri Shah, I am a pediatrician and I trained in pediatrics in India and then did a Pediatric Infectious Diseases fellowship at the Stollery Hospital, at the University of Alberta in Edmonton, Canada. I closely worked with Dr Joan Robinson, a pediatric infectious diseases specialist at the university of Alberta, Stollery Children's hospital, Edmonton, Alberta, to make this podcast.

After listening to this podcast the learner should be able to:

- 1) Describe the clinical presentation of COVID-19 infection in children
- 2) Understand different testing modalities for COVID-19 infection
- 3) Appreciate current management strategies for COVID-19 infection in children.

On March 11, 2020, the World Health Organization declared COVID-19 due to the virus SARS-CoV-2 to be a global pandemic. This indicated the significant global spread of an infectious disease (1) . China was the first country with a widespread outbreak in January, rapidly followed by South Korea, Iran and Italy with their own outbreaks. And within a few weeks, the virus was isolated on all continents and all countries. COVID-19 is a contagious pathogen and has increased morbidity and mortality especially in those older than 65 years, living in long-term care facilities and those with underlying or pre-existing medical conditions.

As the death rate rose in the early weeks and months, and with no definitive treatment or vaccine on the horizon, there was a general panic in society worldwide. Along with the economic cost of people losing jobs and livelihood, there was a cost to the mental well-being of all and especially children. Kids suffered significant mental health challenges coming to terms with masking, social distancing and online education with minimal peer-to-peer interactions. The addiction crisis worsened. On the positive side, however, the pandemic sparked a revolution in health care with intense and focused

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research conducted in all fields especially - diagnostics, surveillance, therapeutics, and vaccines.

This is the perfect segue to the topic at hand; that is, COVID-19 in Pediatrics.

At present, there is no vaccination available for children <12 years, although a vaccine for children aged 5-11 may be approved shortly. We must remain vigilant for the disease, especially in not-yet-vaccinated children and youth. In the Spring of 2021 the Canadian Pediatric Society published a position statement on the acute management of COVID19 in Pediatrics. We will review their advice today.

Let's begin with a case and I will try and highlight the CPS recommendations (2) as we go along managing the case.

Lily Smith is a 6-year-old girl who presented to the emergency with persistent rhinorrhea and dry cough but no fever, vomiting, or diarrhea. She was tachypneic and oxygen saturation was only 89% on room air. Chest x-ray showed patchy bilateral infiltrates in both lungs. Her mother recently tested positive for COVID-19 and had a viral pneumonia. How should you manage this child with suspected COVID-19?

Clinical Presentation

Luckily, for the most part, COVID-19 is a relatively mild infection in children. Most present with mild symptoms and do not need hospital care. Data from CDC suggests hospitalization rates of only 8 per 100,000 children. Children may in fact be more likely to require hospitalization for Multisystem Inflammatory Syndrome in Children or MIS-C which presents with fever and other symptoms and will be described in more detail later.

The CPS guidelines discuss the presenting symptoms according to severity of presentation such as

- Asymptomatic ; present with no symptoms but test positive by RT-PCR for SARS-COV2
- Mild illness – Have mild symptoms like fever, sore throat, vomiting, diarrhoea, headaches but no dysneas or desturations
- Moderate illness – shows Clinical and radiologic evidence of lower respiratory tract disease – Monitoring for progression and supportive care is all that is required in above two catogories
- Severe illness – show signs of respiratory disease like tachypnea, hypoximia and may also have s/o organ dysfunction involving the cardiovascular, central nervous, GI and hematologic systems . Hospitalization, oxygen and specific therapies are required.

Figure 1. Clinical severity, features, management and treatment of COVID-19

	Asymptomatic or presymptomatic	Mild illness	Moderate illness	Severe illness	Critical illness
Features	Positive, SARS-CoV-2 RT-PCR test; no symptoms	Mild symptoms (e.g., fever, cough, sore throat, vomiting, diarrhea, headache) No dyspnea Normal O ₂ saturations	Clinical or radiographic evidence of lower respiratory tract disease	Respiratory disease (tachypnea, hypoxemia) Organ dysfunction (CVS, CNS, GI, hematology)	Respiratory failure Septic shock Multi-organ dysfunction
Management	Monitoring for symptoms	Monitoring for symptoms, supportive care	Monitoring for symptoms, supportive care	Hospitalization, oxygen therapy, specific therapy (dexamethasone)	Critical care and specific therapy (dexamethasone)
Potential treatment			Antiviral therapy (e.g., remdesivir)		Anti-inflammatory therapy (e.g., dexamethasone)

CNS: Central Nervous System
 CVS: Cardiovascular System
 GI: Gastrointestinal
 RT-PCR: Reverse transcriptase polymerase chain reaction
 SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2

Adapted from references 15-17

Lily had very few of the long list of possible symptoms but that is the case for most children with COVID-19. Children may be asymptomatic from COVID-19 infection.

Children with pre-existing medical conditions may be at higher risk for severe disease. Some of the conditions which may be perceived as high risk include

- conditions like congenital heart disease, chronic lung disease, sickle cell disease,
- Obesity, diabetes, moderate to severe asthma
- Disorders of coagulation - which may have higher risk of thrombosis.

However, most children do not require hospitalization even if they have multiple underlying conditions.

Infection Prevention and Control

Times have changed so much in this last year! Now every potential patient encounter is fraught with risk of inadvertent spread of COVID-19 within the facility and hence strict attention to all the recommended precautions to prevent and limit the spread of the disease become crucial.

CPS statements and the Public Health Authority of Canada have some guidance to help us care for Lily safely while protecting ourselves and others.

- All healthcare professionals should receive education and training for compliance with Infection Prevention and Control guidelines.
- All patients with suspected/confirmed COVID-19 should at minimum be placed on droplet & contact precautions with a surgical mask, eye protection, single use gown and gloves.

Do you need an N95 mask for every patient interaction?

- The guidelines recommend that N95 or equivalent masks should be used for aerosol-generating procedures along with an eye-shield. Such procedures should be performed in an airborne infection isolation room (a private room with a closed door)
- Common aerosol-generating procedures are intubation and CPAP.

Given the high rate of transmission of COVID - CPS also recommends

- Minimizing inter-personal contact between the suspect case and uninfected family members if practical. They suggest using virtual communication methods to talk to family members and other healthcare professionals. However, these recommendations may change as more people become vaccinated.
- Limiting the number of HCPs entering the patient's room (preferably limited to just those doing the physical exam or administering treatment).
- All people entering the patient's rooms are to leave their personal devices like cell phones, laptops, and other such items outside of the room.
- If an item needs to be taken into a patient area, then it should be properly sanitized both before and after use.
- So, you follow the Donning and Doffing techniques outlined by your hospital guided by these CPS statements and IPC and wear the N95 if there may be an "Aerosol Generating Medical Procedure". You then go into the room and examine Lily.

Investigations

You strongly suspect COVID-19 for Lily given the presentation and you have examined her safely. You step out of the room (and doff safely and wash your hands between all steps!) and plan your diagnostic strategy.

COVID-19 is diagnosed with Polymerase Chain Reactino (PCR) testing. There are two indications for diagnostic testing: first when you suspect COVID-19 infection in the symptomatic patient like Lily and the other for asymptomatic testing of close contacts of a case.

The most common samples collected are nasopharyngeal (NP) swabs. Other potential samples include the throat and saliva swabs. NP swabs are preferred due to higher specificity of 99.2% and sensitivity of 83.2% in the diagnosis of COVID19.

Unwell children may need further evaluation for the rest of the differential diagnosis.

A quick word on some of the advances in the diagnosis of COVID 19 - beyond the guidelines (3,4)

- Rapid Antigen Testing (RATs) are now available for screening. These antigen immunoassays can be performed quickly by unskilled personnel. However, they are only 60-75% sensitive so negative specimens should still be tested by PCR. Some basic training and use of PPE is recommended while collecting samples (References)
- Genomic sequencing of the virus is done for public health purposes. This is currently done on positive specimens in most Canadian labs to look for variants of concern.
- Serology is performed to detect antibodies to the virus and will become positive approximately 10-21 days following vaccine or infection. One can look for antibodies to various components of the virus.. Wild infection usually generates antibodies to both spike and nucleocapsid antigens, while the vaccines used in Canada lead to antibodies to the spike protein alone. We do not know how long antibodies persist following infection or vaccine. Serology is mainly used to diagnosis MIS-C and to study a whole population to see how many people had undiagnosed infection. Serological tests for the virus have no role in diagnosis of acute infection.

Management

Lily was COVID-19 positive on the NP swab results.

Management of a COVID19 positive pediatric patient is broken down according to the severity of illness

- The majority of children have mild to moderate illness and most commonly managed with supportive care alone namely -
 - Acetaminophen or Ibuprofen - A quick word about Ibuprofen - Evidence does not show increased morbidity or mortality with ibuprofen use as was debated earlier.
 - Iv fluids and NG feeds as needed
- Severe Cases are thankfully few and far between

- In these cases non-invasive and if needed invasive ventilation may be needed.
- CPS recommends that endotracheal intubation should be done by the most experienced provider with the fewest possible number of people in the room.
- Antibiotics are not recommended for routine management unless the disease is complicated by secondary bacterial infection.

Let's talk a little bit about specific treatments for COVID19. This is a new disease and the evidence for most therapeutic options is limited and evolving. It is always prudent to consult your local Pediatric ID teams for the best current advice to decide on a case-to-case basis.

Specific medications have emergency use authorization and are currently approved -

- Dexamethasone is recommended for all cases that require supplemental oxygen. The evidence for this recommendation is derived from clinical trials in adults. The recommended dose 0.15 mg/kg IV or PO to maximum of 6 mg once a day for 10 days. One can stop earlier if the child is ready for hospital discharge.
- Remdesivir is a nucleotide analog pro-drug that inhibits viral RNA polymerase. It is approved in Canada to treat severe COVID – 19 in children older than 12 yrs and weighing at least 40 kg. The suggested dose is 200 mg on day 1 and 100mg on day 2 to 5. In children younger than 12, the decision should be made on a case to case basis in consultation with infectious diseases. This drug is only effective if started early in the course of COVID-19 - before the patient goes to the ICU. Because it is not apparent which children are at high risk of progression, remdesivir is hardly ever used in children.
- Bamlanivimab - is a monoclonal neutralizing IgG antibody that acts by targeting the spike protein of the SARS-COV 2 virus and hence blocking its attachment to ACE 2 receptors. There is increasing concern that this drug is not effective for circulating variants of concern so it may no longer be useful.
- Tocilizumab - This IL-6 inhibitor may have efficacy for severe disease so should be considered for children who are in ICU with severe COVID-19. You will want to consult with experts about the indications and availability in your center.

Many other drugs tried in the adult population, across the world, have had limited success so will not be discussed. Of note, Ivermectin has not been shown to be effective in treating COVID-19 in adults or children and should not be used.

For patients with Asthma in particular CPS recommends (5) that –

- Children with asthma should remain on their regular medications as before
- Acute exacerbations should be treated aggressively

- There is no evidence to prove that wearing a mask worsens the asthma symptoms
- Nebulization should be avoided as it is an aerosol generating procedure and hence has a higher risk of transmission.

MIS-C

Now for a word on MIS-C/PIMs – Multisystem Inflammatory Syndrome in Children (6)

- It is a post infectious hyperinflammatory syndrome post SARS COV 2 infection seen in the pediatric age group.

There will be a separate podcast to discuss this in detail

Prevention

Finally we come to Prevention - and I am sure everyone of us has done this diligently but to explain and encourage these guidelines to school going children is so difficult -

- Among the Public health measures that have been in force for most of the pandemic include
 - active surveillance of cases and contacts
 - Isolation and quarantine on case-to-case basis
 - Regular hand washing and mask in public /indoor places
 - Physical distancing of 2 meters
 - Restrictions on outdoor and no indoor gatherings depending on the stage of pandemic

And last but not the least are the Vaccines

- Vaccines are the game changer, the light at the end of the tunnel.
- They are so important that they have a separate podcast of their own - so stay tuned

Some Take-Home Points

1. Children are very rarely very sick when infected with COVID -19

2. It is very important to follow the infection control guidelines while examining and treating these patients
 3. Those with underlying conditions are at a higher risk and should be managed in consultation with infectious diseases
 4. Prevention plays a significant role in combating the pandemic
 5. Finally, there is a definite light at the end of the tunnel with vaccines being used and approved for SARS- COV2 infection
- Last but not the least mental health support is the key especially with children to pull them through these unprecedented times

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