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MINI REVIEW

COVID-19 in Children: A Review of Epidemiology, Mode of Transmission, Clinical Presentation, Diagnosis, and Management

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Abstract

COVID-19 disease is a primarily respiratory disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmitted by inhaling infected droplets. The primary animal reservoir for the coronavirus virus is the bat. For this review, we searched PubMed on April 30, 2023, with the search strategy: "COVID-19" OR "Coronavirus" AND "Children" AND "Clinical symptoms" AND "Diagnosis" AND "Management." We got 19 search results, including all types of the studies like narrative reviews, systematic reviews, meta-analyses, case reports, observational studies, and randomized control trials. We included 11 studies in this review after exclusion of some of these studies. Delta variant transmission has mean incubation of 4.3 days, whereas the Alpha and Beta variant has an incubation period of 5 days. Furthermore, Omicron has a mean incubation period of 3-4 days. Hence the incubation period depends on the variant of the virus. Although primarily asymptomatic, the clinical features in children are fever, cough, sore throat, breathlessness, fatigue, and malaise. Those with comorbidities like obesity, diabetes, cancer, or other preexisting cardiac and pulmonary conditions have an increased risk of complications. Following the recovery from COVID-19, respiratory complications include croup, bronchiolitis, and multisystem inflammatory syndrome in children (MIS-C). The diagnosis is confirmed by Reverse transcriptase – Polymerase chain reaction (RT-PCR) of the respiratory specimen from the oral cavity, nose, and pharynx. The primary management of mild COVID-19 is supportive care. This review discusses the epidemiology, mode of transmission, clinical presentation, diagnosis, management, and vaccination of COVID-19 among children.

Keywords

Coronavirus, Children, COVID-19, Epidemiology, Transmission, Diagnosis, Clinical presentation, Management, Vaccination

Introduction

COVID-19 disease is a primarily respiratory disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The spread of this SARS-CoV-2 led to a recent pandemic that originated in Wuhan, Hubei province, China. The bat is the primary animal reservoir for coronavirus and is admitted to humans through an unknown intermediary host in Wuhan. The transmission mode is through inhalation of infected droplets spread during coughing or sneezing and direct contact with infected surfaces. Hence wearing a mask, social distancing, and hand washing is the most straightforward measure of preventing the diseases. The coronavirus has been isolated from stool samples as well [1].

The mean incubation period of COVID-19 is around five days [1,2]. Though the incubation period for COVID-19 extends to 14 days, the Delta variant has mean incubation of 4.3 days. In contrast, the Alpha and Beta variant has an incubation period of 5 days, and Omicron has a mean incubation period of 3-4 days. Hence the incubation period depends on the virus variant [3].

According to WHO, on April 19, 2023, there were 763,740,140 confirmed cases of COVID-19 and 6,908,554 deaths. As of April 16, 2023, administering vaccine doses to 13,321,463,740 have been successfully done [1]. This review article aims to update the current understanding of the epidemiology, modes of transmission, clinical presentation, diagnosis, and management of COVID-19 among children.

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Methods

We searched PubMed on April 25, 2023, with search strategy: "COVID-19" OR "Coronavirus" AND "children" AND "Clinical symptoms" AND "Diagnosis" AND "Management." We got 19 search results, including all types of studies like narrative reviews, systematic reviews, meta-analyses, case reports, observational studies, and randomized control trials. Those studies that focused on managing other diseases during COVID-19 like measles encephalitis, diabetes, brain tumors, lower respiratory tract infection, hypertension, and the efficacy of traditional Chinese Medicine were excluded. We included 11 studies after the exclusion of these studies.

Clinical Presentation

In children, COVID-19 is primarily asymptomatic or has less severe symptoms. Children seem to have mild infections but could be a carrier for the spread of the virus in the community. The most common clinical presentation is fever, cough, sore throat, headache, nausea, vomiting, diarrhea, breathlessness, fatigue, malaise, or croup [3,4]. In a retrospective study from Saudi Arabia, fever and respiratory symptoms were reported as the most common clinical characteristics of COVID-19 in children [5]. Also, a survey conducted in northern Sierra Leone stated that most children were asymptomatic. Fever was the most common clinical presentation among those who had reported any symptoms [6]. A systematic review said most children were infected with COVID-19 from close familial contact and manifested milder clinical signs of fever and dry cough compared to infected adults [7].

The complications following COVID-19 infection are associated with being immunocompromised and having comorbidities like obesity, diabetes, cancer, or other preexisting cardiac and pulmonary conditions. Following the recovery from COVID-19, respiratory complications include croup, bronchiolitis, and multisystem inflammatory syndrome in children (MIS-C) [3]. MIS-C presents with fever, multisystem organ involvement, and elevated laboratory markers of inflammation 2-6 weeks following the COVID-19 infection requiring hospitalization. This presentation overlaps with conditions like Kawasaki Disease and Toxic Shock Syndrome [3].

There is higher hospitalization among adolescents aged 12-17 years for COVID-19 disease compared to children aged 5-11 years [4]. The case fatality rate is higher in the older age group of children [3]. Some of the factors that might offer protection to the children include 1) Innate differing from adaptive immunity; 2) Recurrent and concurrent infections; 3) Previous immunity to coronaviruses; 4) Presence of different microbiota; 5) High melatonin; 6) Vaccination and 7) Lower intensity of exposure to the virus [7,8].

Diagnosis

Diagnostic tests

Nucleic acid amplification tests (NAATs) and antigen tests are the recommended diagnostic tests of identifying acute infection with SARS-CoV-2. The diagnosis is confirmed by Reverse transcriptase - Polymerase chain reaction (RT-PCR) which is a NAATs. The respiratory specimen from the oral cavity, nose, and pharynx is tested using this test. The American Academy of Pediatrics recommends testing once before discharge of all healthy infants born to those infected with COVID-19. Newborns and Children with clinical presentation of COVID-19 should be tested immediately [3].

Laboratory findings

A study conducted in the pediatric population in the United Arab Emirates showed a mean concentration of neutrophils higher in clinically suspected COVID-19 patients. C-reactive protein was higher in clinically suspected compared to confirmed patients. Lymphocyte, Lactate Dehydrogenase (LDH), D-dimer, ferritin levels after 24-36 hours, and Serum Glutamic Pyruvic Transaminase (SGPT) were associated with disease severity [9]. Also, a study that included over 10,000 hospitalized children found that abnormal markers of inflammation, including D-dimers and ferritin, were associated with severe disease in children [3].

Radiologic diagnostic imaging findings

A multicenter study showed that Computed Tomography (CT) or chest radiographs were often negative among children. However, positive CT findings in children included ground-glass opacities on the peripheral lung and patchy infiltrates. There was a positive correlation between increasing age and increasing severity of findings radiologically [10].

Management and Treatment

Those with mild symptoms of COVID-19 can be provided supportive care. In severe pneumonia and critically ill children, steroids can be used. Antiviral treatments prevent severe illness and death among older children who have comorbidities, have other risk factors for the disease, or cannot get vaccinated. Some antiviral agents, including Remdesivir, can be used for severely ill children [3]. Convalescent plasma can be a treatment for immunocompromised patients or immunosuppressive therapy.

Vaccination

COVID-19 vaccination prevents deaths among children likely to suffer from severe illness due to comorbidities or immunocompromised status. Vaccination effectively reduces the risk of hospitalization and Intensive Care Unit (ICU) admission among children and adolescents. Studies have shown that a 2-dose

mRNA vaccine decreased symptomatic infection drastically. Among infants (< 6 years of age), those who have completed 2-dose mRNA COVID-19 vaccination series during pregnancy were associated with a reduced risk of hospitalization [3].

Conclusion

Through this study, we studied epidemiology, transmission, clinical presentation, diagnosis, laboratory findings, radiological findings, management, and vaccination available for COVID-19. The limitation of this article is that only the PubMed database is used for retrieving articles. The strength of this study is that we compiled the literature available to update current COVID-19 information. This study is helpful to those who are looking for a rapid review on this topic.

In conclusion, vaccination, social distancing, wearing masks, and handwashing will decrease the transmission of COVID-19 among children, adults and in turn communities. Early diagnosis and treatment of the COVID-19 would prevent morbidity and mortality among children with comorbidities. Further research using systematic review protocols would strengthen the study findings.

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