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Are Children Essentially Immune to COVID? - A Review

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ABSTRACT

Aim: The study aims to find whether children are essentially immune to COVID-19.

Introduction: Immune is the resistance to a particular infection or toxin owing to the presence of antibodies or sensitized white blood cells. The novel coronavirus has been named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), whereas the disease associated with it is referred to as COVID-19. The diagnostic methods that are involved exclusively are RNA detection by reverse transcription-polymerase (RT-PCR) of secretions through nasopharyngeal and throat swabs and in stool samples.

Materials and Method: In this review, various articles were searched through search engines like Google Scholar and Pubmed using keywords like immunity in children, resistance, COVID-19 in adults, COVID-19 in children, asymptomatic, less susceptible and milder symptoms. Over 70 articles were collected and reviewed thoroughly.

Results and Discussion: Like adults, children exposed to the coronavirus can be infected with it and display signs of Covid-19. At the beginning of the pandemic, it was assumed that children are not getting infected with the coronavirus, but now it is clear that the amount of infection in children is the same as in adults. It is just when they do get the infection they show much milder symptoms. However, young children, particularly infants were vulnerable to infection. Children frequently do not have a notable disease, raising the possibility for facilitators of viral infection transmission.

Conclusion: From this review, we can conclude that children are also susceptible to COVID 19 on the exposure to the virus and they are not essentially immune to COVID-19.

Key Words: Immune, Resistance, COVID-19, Children, Less susceptible, Milder symptoms

INTRODUCTION

Immune is the resistance to a particular infection or toxin owing to the presence of antibodies or sensitized white blood cells. The outbreak of the coronavirus disease 2019 (COVID-19) emerged in Wuhan City, China, in late 2019 and has now reached pandemic status. The novel coronavirus has been named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), whereas the disease associated with it is referred to as COVID-19. The envelope has club-shaped glycoprotein spikes that give the virus a crown-like or coronal appearance. COVID-19 is primarily transmitted through respiratory droplets and contact routes. Coronaviruses typically cause mild upper respiratory tract infections; however, SARS-CoV-2, severe acute respiratory syndrome coronavirus (SARS-CoV), and Middle East respiratory syndrome coronavirus (MERS-CoV) have all been associated with severe illness and death. Common symptoms reported in adults with COVID-19 are fever, dry cough, and fatigue; severe cases have been associated with dyspnoea [1]. Laboratory observation of bilateral ground-glass opacities [2] on chest CT [3]. Symptoms in children include flu-like syndrome, fluctuating fever, pneumonia, and upper respiratory signs like cough, sore throat, stuffy nose, sneezing, and rhinorrhea [4].

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The basic reproduction number of SARS-CoV-2 in the early outbreak in China was estimated to be two [5]. The diagnostic methods that involved exclusively RNA detection by reverse transcription-polymerase (RT-PCR) of secretions through nasopharyngeal and throat swabs and in stool samples [6]. The RNA in nasopharyngeal and throat swab samples has been shown to become undetectable within 6–22 days of illness onset in children [7]. The shorter period of excretion of virus in asymptomatic patients and there is no available sampling series [8]. An analysis from China has shown that children younger than 10 years account for only 1% of COVID-19 cases, [9] which was similar to the proportion for SARS-CoV and MERS-CoV epidemics [10,11]. There have been reports about etiological treatment with the antiviral activity of chloroquine, a well-known antimalarial treatment [12], and remdesivir which had been tried against the Ebola virus [13]. According to the epidemiology of COVID-19 among children in China, young children particularly young infants were vulnerable to COVID 19 [14]. Compared with the adults' cases, the severity of children's COVID-19 cases was milder, and the case fatality rate was much lower [15].

Like adults, children exposed to the coronavirus can be infected with it and display signs of Covid-19. At the beginning of the pandemic, it was assumed that children are not getting infected with the coronavirus, but now it is clear that the amount of infection in children is the same as in adults [16]. It is just when they do get the infection they get much milder symptoms. The study aims to analyze whether children are essentially immune to COVID-19.

COVID-19 in adults

The clinical severity of COVID-19 was higher among adults aged greater 65 years old [17]. Almost half the 425 cases were in adults 60 years of age and 93% represented signs and symptoms reported in China [18]. Human pathogenic coronaviruses; severe acute respiratory syndrome coronavirus [SARS-CoV] and [SARS-CoV-2] bind to their target cells through angiotensin-converting enzyme 2 (ACE2), which is expressed by epithelial cells of the lung, intestine, kidney, and blood vessels[19,20]. The expression of ACE2 is substantially increased in patients with type 1 or type 2 diabetes [21], as they are treated with angiotensin II type-I receptor blockers (ARBs) and ACE inhibitors. Similarly, hypertension is also treated with ACE inhibitors and ARBs, which results in an upregulation of ACE2. In Consequence, the increased expression of ACE2 would facilitate infection with COVID-19. Hence the patients with diabetes, high blood pressure, and chronic illness are at higher risk [22]. In patients with severe disease, dyspnoea, central cyanosis, and oxygen saturation were observed [23]. In COVID-19 patients, increased liver enzymes, inflammatory markers [24], and hypocalcemia were observed clinical characteristics [25]. The C-reactive protein and procalcitonin were also increased. According to WHO, pregnancy was not a risk for severe COVID-19 disease, but there will be an impact on fetal distress [26]. Smoking [27] was not the major feature of the pathogenesis of COVID-19 in adults [28]. The high prevalence of comorbidities with confirmed cases was about 26% [29] and those who died from COVID-19 had a higher prevalence of about 67.2% [30].

COVID-19 in children

Children showed relatively milder illness and a better prognosis than adults [31]. The deaths in children were extremely rare. More than 90% of the children diagnosed showed mild or were asymptomatic. Only one child died in the age group 10-19 years and no child aged 0-9 years died [32], in China. In the U.S 1.6%-2.5% were children in COVID-19 cases but no child needed intensive care as they showed milder symptoms [33]. In the neonatal cases, the youngest to be diagnosed was a 30 hours old baby [34]. According to Simon, the immune system undergoes substantial changes from birth to adulthood [35]. Angiotensin-converting enzyme 2 (ACE 2) was known as a cell receptor for SARS-CoV. Recent evidence indicates that children were less sensitive to 2019-nCoV because of the maturity and function of ACE 2 in children may be lower than that in adults [36]. Additionally, children often experience respiratory infection Respiratory Syncytial Virus (RSV), that may have increased the levels of antibody against the virus than adults [37]. The immature immune system creates cytokine storms that help in fighting against the viral disease [38]. The inflammatory markers in children with COVID 19 were low [39]. Many children diagnosed did not have any symptoms or radiographic features [40]. Children were less susceptible as they were involved in fewer outdoor activities or international travel [41]. The number of confirmed cases in the United States, China, Italy, and Spain among persons aged <18 were 2% [33], 2.2% [42],1.2% [43], and 0.8% [44] respectively. Among the cases in children reported from China, most had exposure to household members with confirmed COVID-19. Mother-to-child transmission of COVID-19 during pregnancy is uncommon. However, after birth, a newborn can be infected [45] after being in close contact with an infected mother or other caregivers [46]. Several problems, such as preterm birth, have been reported in babies born to mothers with COVID-19 positive late during their pregnancy [47].

Table 1: The given table shows the percentage of children less than 18 years of age affected by COVID 19 in different countries. From the table, it is evident that children are less susceptible than adults.

Countries	% of Children Affected from Covid 19
United States	2%
China	2.2%
Italy	1.2%
Spain	0.8%

Asymptomatic carriers

Children show mild symptoms to COVID [48] and only a few children were hospitalized [49]. Patients with less serious illness play an important role in the transmission of the disease [50]. Incubation time for onset of symptoms is 3 days but it can be as long as 24 hours [51]. The asymptomatic carriers from initial and throughout disease exhibit disease transmission [13].

SARS in children

Compared to adults, teenagers SARS was less aggressive during the clinical course in children [52]. The children were observed with abnormal chest radiographs [37]. Children had mild symptoms [53] as young children had higher lymphocytes than adults [54]. The constitutional symptoms were chills and myalgia [55]. There were no fatal cases reported in children [56] but the children showed mild abnormalities [57]. From positive children, there was no transmission to parents [58]. Osteonecrosis was reported in children who had treatment with steroids [59].

Children immunity to viral diseases

Infants and young children are typically at high risk for admission to hospital after respiratory tract infection with viruses such as respiratory syncytial virus and influenza virus [60]. Immaturity of the respiratory tract and immune system is thought to contribute to severe viral respiratory disease in this age group [61]. Acute Lower Respiratory Tract Infection (ALTI) is also one of the common infections and it is the leading cause of morbidity and mortality in children aged less than 5 years worldwide [62]. In children, Influenza A virus attains innate immunity during their childhood [63]. An immune response is adapted in all stages of life to maximize survival [64]. Deficient immune system response to viral infections causes the prognosis of the disease in children [65]. Therefore the absence of pediatric patients [66] severe COVID-19 has perplexed clinicians, epidemiologists, and scientists.

CONCLUSION

The review demonstrates whether children are essentially immune to Covid-19. But children of all ages were sensitive to COVID-19, and there was no significant gender difference. Clinical manifestations of children's COVID-19 cases were less severe than those of adult patients. However, young children, particularly infants, were more vulnerable to 2019-nCoV infection. Children frequently do not have a notable disease, raising the possibility that children could be facilitators of viral transmission. It is important to be safe by staying at home, maintaining social distance, and proper hygiene. It is also important to boost the immune system and follow a proper diet. The future scope of this research is to create awareness among people of all age group are susceptible to COVID 19 and to understand that there no age and sex differences in transmission of COVID 19.

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