



Kids and COVID-19: They are Winning with their Immunity

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Abstract

As the COVID-19 pandemic evolves, many pediatricians and infants' parents have been left with renewed questions about the consequences of infection on children and steps to be taken if their child has symptoms of, or tests positive for, COVID-19. Literature reviews and recent studies revealed that children are better than adults at combating SARS-CoV-2. There was conflicting evidence on age-related differences in ACE2 expression in the nose and lungs. However, measurements of SARS-CoV-2 viral load have shown no clear difference. Strikingly, cross-reactive antibodies from previous exposure to coronavirus common cold do not offer any special protection in both children and adults. The kid's immune response against SARS-CoV-2 infection is initiated with low immunological tone to prevent overactive immunity and is characterized by rapid lung damage repair in contrast to stormy waves in adults. One of the few silver linings of the COVID-19 pandemic is that children are relatively spared.

Keywords: Kids; COVID-19; ACE2; Immunity; Cytokine storm

Introduction

The opinion that the infant immune system is weak compared to the adult immune system isn't quite fair. Early at the start of the COVID-19 pandemic, kids' parents and doctors have been scared about the consequences of infection and disoriented about the steps to be taken if their children test positive or are infected with COVID-19. With other viruses, adults have the advantage of prior exposure. Through prior infection or vaccination, their immune systems have been trained to contend with similar pathogens. The novelty of SARS-CoV-2 showed that children have an innate immunity against viral infections.

COVID-19 affects children and adults differently

Young children account for only a small percentage of COVID-19 infections- a trend that initially puzzled clinicians and researchers. Moreover, children are highly adapted-and very well-equipped-to respond to new viruses, and are most likely to experience mild or asymptomatic illness. On the other hand, kids who develop COVID-19 symptoms and antibodies specific to SARS-CoV-2 may not test positive on RT-PCR testing.

Children better than adults combat SARS-CoV-2

There is no clear evidence of age-related differences in ACE2 expression in the nose and lungs between both children and adults since scientists who measured the viral load in people's upper airways have seen no clear difference between children and adults. On the other hand, children with more exposure to coronavirus common cold with the existence of already protective antibodies to lock on to the pandemic coronavirus might not be a clue for better combating this novel virus. But the evidence suggests that adults also have this immunity. In eminently, these 'cross-reactive' antibodies don't offer any special protection against SARS-CoV-2 infections.

Innate immunity in children is well-trained

Research suggests that children have more robust innate immune systems than adults because of the numerous respiratory infections experienced within their first few years of life, which may prime their immune systems for subsequent attacks (trained non-specific immunity). A growing body of evidence suggests that the innate immune systems of children usually successfully prevent the virus from multiplying.

Pillars of innate immunity in children

The existence of potent dendritic cells and macrophages which are embedded and lining the

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Received Date: 30 Nov 2022

Accepted Date: 23 Dec 2022

Published Date: 30 Dec 2022

Citation:

Bayazed H. Kids and COVID-19: They are Winning with their Immunity. *Am J Clin Microbiol Antimicrob.* 2022; 5(1): 1062.

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nose and throat in children are prominent and represent a strong mucosal immunity that frequently encounters new viruses. These alert cells start to release proteins called chemokine-like interferons, which help to coordinate the body's immune response. Researchers declare that SARS-CoV-2 infected children have lower levels of inflammatory monocytes, which act to bridge between innate and adaptive immune responses. On the other hand, the presence of higher levels of innate lymphoid cells in children is prominent. These cells represent early line defense with a significant ability to regulate the innate and adaptive immune responses *via* early antibody response. In essence, other studies found higher levels of activated neutrophils, the front-line immune response cells to new or novel invaders, among infected children with SARS-CoV-2 compared with adults. Strikingly, pediatric hematologists found that children are less prone to clots forming in blood vessels, which could offer some protection after inflammation and tissue damage.

The major hallmark of COVID-19 is the systemic inflammatory immune response characterized by a cytokine storm. It is marked by elevated levels of inflammatory cytokines, mainly Interleukin-6 (IL-6), IL-8, IL-10, Tumor Necrosis Factor- α (TNF- α), and Interferon- γ (IFN- γ). IL-6 is found to be significantly associated with higher mortality.

The role of IL-6 as a pleiotropic cytokine, executing both pro- and anti-inflammatory activities is well documented. Studies revealed that a cytokine storm is less likely to occur in children, indicated by low circulating IL-6, which is the cornerstone of COVID-19 progression initiated by the aggressive inflammatory cascade in adults.

Immunity in children vs. adults

Children's immune response to SARS-CoV-2 infection is an early initiative with a low immunological tone, to prevent an overactive immune system and to rapidly repair damage to the lungs. In contrast, stormy waves are seen in adults, with exaggerated and overactive immunity, and with serious sequela.

Therefore, children who are at high risk of contracting SARS-CoV-2 tend to have pre-existing medical conditions. Indeed, studies have found that 30% to 70% of children hospitalized with COVID-19 had underlying conditions that increase their risks, including Down syndrome, obesity, lung disease, diabetes, and immune deficiency. Premature babies are also at higher risk, as are children who have undergone cancer treatment.

Multisystem Inflammatory Syndrome (MIS-C) in Children

In April 2022 first case of MIS-C was diagnosed among infected children with SARS-CoV-2 in the United States and the United Kingdom. The exact cause of MIS-C remains unknown; researchers suggest that viral particles may leak from the gut into the bloodstream, causing a systemic inflammatory reaction throughout the body. The symptoms usually appear between two and six weeks after COVID-19 infection, in spite majority being asymptomatic or with mild symptoms but children with MIS-C have antibodies to the SARS-CoV-2 virus.

Despite being uncommon, it can have serious consequences in infants and children, but it can make some children very ill and in need of urgent care. The syndrome is associated with a hyper-inflammatory immune process with severe extra-pulmonary organ dysfunction, particularly in the cardiovascular system.

In conclusion, Kids' innate immune response against SARS-CoV-2 infection is early initiative calm with low immunological tone to prevent an overactive immunity and with rapidly repair damage to the lungs in contrast to stormy waves in adults. Kids are at much lower risk of COVID-19 infection and sequels and they are still winning the battle against COVID-19 with their innate immunity.

SARS-CoV-2 typically causes less severe illness and fewer deaths in children compared to adults. Even so, children and adolescents remain susceptible to SARS-CoV-2 infection and may transmit the virus to others. To protect children, right now, the World Health Organization (WHO) has approved some COVID-19 vaccines for children over the age of 6 months old.

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