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CHILDHOOD VACCINATION: A DETERRENT TO COVID-19 IN CHILDREN?

Ophthalmology

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ABSTRACT

Coronavirus disease 2019 (COVID-19) caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) first identified at Wuhan, China has rapidly spread worldwide to become a Public Health Emergency of International Concern (PHEIC). Despite the increasing number of COVID-19 cases during the pandemic, the number of pediatric cases reported remained low as per the existing reports. Clinical presentation of COVID-19 in children is found to be milder and prognosis better when compared to adult population. Though multiple theories are in vogue but the exact reason for the low incidence and milder clinical manifestations of COVID-19 among children remains obscure. This literature, discusses the possibility of cross reactivity between routine childhood vaccines and SARS-CoV-2, as a plausible explanation for the low incidence and milder clinical presentation of COVID-19 in children.

KEYWORDS

Coronavirus; COVID-19; cross reactivity; SARS-CoV-2; vaccination

Background

Since December 2019, an outbreak of Coronavirus disease 2019 (COVID-19) caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was first reported in Wuhan, China and has rapidly spread worldwide to become a pandemic (1,2,3). As on 28 October, 2022, total number of confirmed cases of COVID-19 were 626,337,158 and death of 6,566,610 was reported by World Health Organisation (4). In China, where the outbreak started, among the 44,672 confirmed cases of COVID-19, 0.9% cases were in the age group of 0-10 years and 2% cases were in the age group of 0-19 years as reported by Chinese Centre for Disease Control and Prevention (5). Livingston et al reported that, in Italy, out of 22,512 confirmed COVID-19 cases only 1.2% was present children younger than 18 years of age (6). In United States, 5% cases were noted in individuals below the age of 19 years, among the total 4,226 COVID-19 cases as reported by Morbidity and Mortality Weekly Report (MMWR) (7). Previous coronavirus outbreaks caused by MERS-CoV and SARS-CoV have also shown similar trends of low incidence among children. Stockman *et.al* in their study of SARS outbreak of 2003 reported only 6.9% cases were present in children less than 18 years of age. No death in children or adolescent age group was also reported (8). A descriptive analytical study by Azhar *et al* of MERS cases from 2012 to 2016 reported that only 1.6% of cases occurred in children. It was also observed that the severity of symptoms shown by children is lesser than adults (9). COVID-19 affects children of both sexes and all age groups from newborns, infants to young children with a wide range of clinical manifestations. It was observed that infants can be infected by SARS-CoV-2 (10). The severity of symptoms and signs of disease were lesser and prognosis was better in children when compared to adult population (11). From the data of the previous coronavirus outbreaks and the current COVID-19 pandemic till now, it is evident that the incidence of said diseases is low as compared to adult population. Multiple theories are in vogue but the exact reason for the low incidence and milder clinical presentation of disease among children remains obscure. This literature discusses the possibility of cross reactivity between SARS-CoV-2 and routine childhood vaccination which in turn is responsible for the low incidence of COVID-19 in children.

Role of childhood vaccines causing low incidence of covid-19

The first standardised vaccination schedule for children was declared by Expanded Program on Immunisation (EPI), an initiative by World Health Organisation, in the year 1984, which included four vaccines namely BCG, DPT, measles, and OPV. Since then, in the past two decades several new vaccines have been recommended and were also included by most of the countries in their national immunisation program like hepatitis B, *Haemophilus influenzae* **type b**, rubella, mumps, rotavirus, **Japanese encephalitis**, typhoid, yellow fever, **pneumococcal conjugate vaccine** etc (12). Different countries have their own national immunization program recommended as per endemicity and prevalence of diseases and many of them uses different strains of vaccine against the same disease. Apart from the targeted effects towards the specific pathogen, vaccines have been observed to have some non-specific effects on morbidity and mortality from other non-targeted infections also. Meeting of the Strategic Advisory Group of Experts (SAGE) on immunisation in, April 2014, in Geneva, Switzerland, reported the non-specific immunological effects and non-specific beneficial effects of vaccination on all cause mortality were commonly observed and plausible, though its exact mechanism was not fully established. Systematic reviews on BCG and measles presented to SAGE, suggested that non-specific beneficial effects by these vaccines on all cause mortality were possible. These non specific effects were recognized post vaccination or even after exposure to its component antigens (13). A follow up study by Kristensen *et al* reported that measles vaccine has shown non-specific beneficial effects which results in an overall improvement in the infant mortality and increased child survival (14). It has been observed that many of the vaccines conferred protection against various other diseases and especially lower respiratory tract infections. In a population based Cohort study of Dansih children, it was concluded that MMR vaccine was associated with overall lower rate of hospital admissions for any infection (15). Studies done at various health care centers on MMR and OPV vaccines have demonstrated to provide non-specific protection against various other diseases and especially lower respiratory tract infections (15,-18). Many of the immunological studies have reported that the non-specific beneficial effects after vaccination could also be related of T cell cross reactivity. Antigen antibody complexes formed following previous exposure to antigens may stimulate T cell cross reactivity which may lower viral replication of subsequent heterologous viral infections as observed by Selin *et al* (19). It may be a likely possibility that cross reactivity against a virus can also be due to bacterial vaccine or its component antigen. Round JL reported that HIV envelope glycoprotein Env gp41 antibodies were observed to cross react with human intestinal commensal bacteria. There is a possibility that similar cross reactivity may exist between SARS-CoV-2 and antigens from some bacterial childhood vaccines also (20). In some other immunological studies it has been shown that the non-specific immunological effects post vaccination can be because of trained innate immune system also. Innate immune evasion of many respiratory viruses like Influenza virus with other RNA viruses like coronaviruses may also be a possible explanation for the cross reactivity (21).

DISCUSSION

From these illustrated hypotheses, we confer that routine childhood vaccines displays non-specific immunological effects against various heterologous viral infections and especially lower respiratory tract infections. Finally, we conclude that the possibility of cross reactivity between the SARS-CoV-2 and childhood vaccinations do exist which needs to be confirmed by further studies. This may also lead to a road towards development of vaccine or therapies against SARS-CoV-2. We also recommend the assessment of the antigenic determinants of various routine childhood vaccines vis-a-vis genomic protein sequences of SARS-CoV-2 to combat the emerging COVID-19 pandemic.

Abbreviations

COVID-19 Coronavirus disease 2019

MERS-CoV Middle East respiratory syndrome coronavirus
SARS-CoV Severe Acute Respiratory Syndrome Coronavirus
SARS-CoV-2 Severe Acute Respiratory Syndrome Coronavirus 2

Conflict of interest
The authors declare that they have no conflict of interest.

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