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Review Article

Perspectives in COVID-19 Vaccines for Children

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Abstract

Background: A large proportion of the adult population has already received vaccine against the COVID-19. On account of issues related to availability of the vaccines and safety restraints, the child population, comprising around one-third of the world population, stands more or less left out.

Objective: Developing a state-of-the-art update on different aspects of COVID-19 vaccination of children and the vaccines that are now available for actual use.

Design: Review of the English medical literature concerning COVID-19 vaccination of children with special reference to the vaccines that have become available for administration to paediatric population.

Salient Features: COVID-19 pandemic has so far been defying availability of a specific medication against the causative virus. Mercifully, scientists have done a spectacular job in developing a number of vaccines in less than a year after the identification of the aetiological virus. The vaccines are being extensively used worldwide to vaccinate the adult population. The approval of vaccines, successfully tested for children, has come only recently. Hence, the use has just got off the ground in restricted age groups and is picking up.

Conclusion: Like adults, virtually all children must be vaccinated against COVID-19. However, vaccination of children against COVID-19 is a recent development. Presently, Pfizer-BioNTech and Chinese Sinovac vaccines are available for use. Indian Covaxin has now been included in the national campaign for children aged 12-17 years. Moderna vaccine for children > 12 years is also approved. It is felt that child vaccination against COVID-19 must pick up. Else, the gains from adult vaccination may well be diluted since unvaccinated children are likely to spread the virus widely and a proportion may suffer from severe complications, including the multisystem inflammatory system (MIS-C).

Keywords: *Children; COVID-19 Vaccines; MIS-C; Pfizer-BioNTech Vaccine; Sinovac's Vaccine*

Introduction

In the absence of antiviral drugs of proven effect against the causative virus, prevention through COVID-19 appropriate behaviour (especially through the trio of hand-washing, social distancing and mask) and vaccine are the only armamentarium available at our disposal

to defeat the COVID-19 pandemic [1]. Though adult vaccination is in progress world over with some recurring "dips" primarily due to shortage of the vaccine. However, vaccination of children has just made a small beginning. There is a pressing need to boost the vaccine coverage of child population to keep the transmission down.

This communication proposes to provide a state-of-art review of the different facets of COVID-19 vaccines for children and make a strong case for suitable availability of these vaccines for use on all children in the world.

COVID-19: Current scenario

This was in November-December 2019 when novel coronavirus disease, COVID-19, was first detected in mainland China's Wuhan. The spread of the causative virus, SARS-CoV-2, was fast enough to compel the World Health Organization (WHO) to declare it a global "pandemic" [2]. The pandemic has since caused a colossal damage in terms of morbidity and mortality, global health projects, world economy and social milieu [2]. The resultant disaster has surpassed all earlier pandemic-related disasters [2,3]. The impact on antibiotic resistance is believed to be quite perceptible, opening up the avenue of compounded crisis [3,4].

Currently, the ongoing COVID-19 pandemic may well be lying low in some countries. However, by no means it is over. According to the expert estimates, it is likely to linger on for long with waxing and waning [4]. The unique ability of the COVID-19 virus to undergo mutation after mutation is the big roadblock in its control. At present, we already have quite a few variants, including Delta variant, Omicron, Omicron BA.2 and Delta-Omicron recombitant (DeltaCron). Presently, Omicron BA.2 has become dominant strain across the world, especially in the USA and Europe. This subvariant of Omicron spreads fast but causes mild to moderate illness.

COVID-19 vaccines: Overview

Unfortunately, as yet the medical profession does not have at its disposal any specific medication for the COVID-19 patients. Preventive measures, including vaccination against it, therefore, have assumed a predominant role [6]. All individuals, irrespective of age and gender. must be adequately vaccinated. Mercifully, a number of COVID vaccines, thanks to the herculean endeavours of scientist with international cooperation and collaboration, have become available in a record short time of less than one year after the onslaught of the pandemic with identification of the causative virus. Despite bottlenecks such as shortage of supply, the vaccination programme is moving fairly well for adults worldwide. According to the official claims, India alone has already given over 1.82 billion (182 crore) doses of COVID-19 vaccines to its population under nationwide vaccination drive - the largest in the world - as per data on 26 March 2022 [7]. This includes over 221 million (2.21 crore) precautionary doses (4th, i.e. booster doses). As far as children, only 10.7 million (1,07 crore) doses have been given to age group 12-14 years. This needs to be clarified that, in India, COVID-19 vaccination for the age group 12-14 years was started on 16 March, 2022 only.

However, overall, the shortage of vaccines in low and middle income countries continues to be a roadblock. According to the WHO, the world is desperately in need of multiple COVID-19 vaccines to address the huge "access inequity" world over [8]. The WHO has called upon manufacturers to participate in the COVAX Facility, share their knowhow and data and contribute more aggressively towards bringing the pandemic under control.

Understandably, only vaccinating adults and ignoring children is not the right approach. Children are an excellent reservoir for transmitting/spreading the virus to others. Thus, left unvaccinated, they may end up as a roadblock in controlling the pandemic.

COVID-19 vaccines for children

The essential need

Though everybody needs to be vaccinated as an essential part of our fight against COVID-19 pandemic, until recently, children were more or less left out. There was no available vaccine for this around 25 - 35% segment of the population. In keeping with the ethical prin-

ciple of distributive justice, it is imperative that the benefits and burdens should be distributed among society›s members in a just and equitable manner. Thus, there is a strong case that all children must be vaccinated against COVID-19. Delayed Entry: Why?

Then, why the delay? Many ascribed it to the observation that children usually have mild or asymptomatic COVID-19. However, this could not be a valid reason for skipping their vaccination. After all, COVID-19 is known for causing serious complications like respiratory failure, carditis, kidney failure, blood clots, etc. in children. Infrequently, even multisystem inflammatory syndrome (MIS-C), also termed paediatric multisystem inflammatory syndrome (PMIS), may develop [9]. This syndrome can lead to organ failure and shock - a life-threatening condition in which the body's tissues are starved of oxygen. There is also the risk of developing "long COVID", which appears to be commoner with 1.8% of school-aged children having vague symptoms.

The real underlying reason was to first obtain success in vaccinating the adults and then addressing the issue of vaccinating the children. The main objective was ensuring the safety of the child. Undoubtedly, children require much more stringent testing of the vaccine. Only recently dengue vaccine has per se been blamed for causing illness. In other words the pathway for identifying COVID-19 vaccine for children is quite vigorous. Understandably, therefore, research and development of vaccine for the paediatric population started after the success with the vaccines for the adults [10-13].

Available vaccines

Today, we have reached a stage when approved vaccines for children are beginning to be available for actual clinical use.

The Pfizer-BioNTech vaccine is already approved for children 5 through 17 years of age [11]. Children 12- through 17 years get the same dose as adults. For younger group, the dose is less one-third of adult dose. Smaller needles, designed specifically for children, are also used for children ages 5 through 11 years. Second dose is after 3 weeks. According to the company, the vaccine showed 90.7% efficacy in a clinical trial of 2,268 children aged 5 to 11 years old. The vaccine is administered in two shots of a 10-microgram dose, a third of the dose administered to those aged 12 years and beyond. This vaccine is most popular at present and is being used by most countries that have rolled out vaccine for children and adolescents.

China has approved emergency use of Sinovac's vaccine for children aged 3 to 17 years [13]. It has a two-dose schedule with a spacing of 2 - 4 weeks. This is an inactivated vaccine. Its easy storage requirements make it very manageable and particularly suitable for low-resource settings. This vaccine is also being used in other countries such as UAE and Indonesia.

In India, Zydus Healthcare's ZyCoV-D, meant for children above 12 years of age stands approved for emergency use in children [13]. It is a DNA plasmid-based COVID-19 vaccine developed by the Indian pharmaceutical company Cadila Healthcare, with support from the Biotechnology Industry Research Assistance Council. The principle ingredient of the vaccine is DNA plasmid vector which carries the gene encoding the spike protein of SARS-CoV-2.

In 2021, India's Bharat Biotech's vaccine was recommended for final approval for use in children 2-18 years of age [13] from Drugs Controller General of India (DCGI) and regulatory approval from Central Drugs Standard Control Organisation (CDSCO) prior to product launch and market availability. This is the only vaccine in the world that is supposed to be appropriate between 2 - 5 years of age. However, the Government of India permitted its use in children between 15 - 18 years in the last quarter of 2021. Effective March 2022, the age span has been modified to include children aged 12-18 years.

Summary and Conclusion

The scientists have done a wonderful job in developing vaccines against the causative virus of COVID-19 in a record time frame of less than one year after identification of the virus.

Bearing in mind the safety of children, extra vigilance was needed. Hence the work on vaccines for children started after the vaccines for adults were successfully developed and tested. Today, Pfizer-NBioTech vaccine for children has emerged as the pioneer in the category and its use has kickstarted. The SinoVac vaccine from China is being used in China and other countries such as UAE and Indonesia. Moderna vaccine covers children above 12 years only. India's Covaxin, though claiming to be appropriate for children in 2-18 years age group, stands incorporated in the national programme for inoculation for children aged 12-18 years only.

In conclusion, it is imperative that endeavours aimed at vaccination of all children are intensified for winning the war against the blasted ongoing COVID-19 pandemic.

Conflict of Interest

Nil.

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