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Indian Journal of Obstetrics and Gynecology Research

Journal homepage: www.ijogr.org

Original Research Article

A stockpile of neonatal antibodies pertaining to SARS Covid (COVID 19) ascertained in cord blood after complete vaccination of covishield in mother- An observational study

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ARTICLE INFO

Article history:
Received 26-08-2023
Accepted 23-10-2023
Available online 22-11-2023

Keywords:
COVID- 19
Vaccination
Covishield
Cord blood
ECLIA

ABSTRACT

Background: Maternal antibodies are a vital component of neonatal immunity. These antibodies give the baby a head start in building their immune system and fighting off diseases. The study was carried out to check the presence of IgG antibodies in cord blood of a completely vaccinated mother with Covishield and to find out if any side effects occurred during their vaccination. It was clear from the study that all the cord blood samples showed presence of antibodies and only limited side effects were observed in the vaccinated mothers.

Materials and Methods: An observational study was done in the gynecology department of a tertiary care hospital in Trivandrum from November 2022 to April 2023 (6 months duration) with 40 cord blood samples taken from completely vaccinated mothers.

Results: A total of 40 women were included who had completed two doses of Covishield vaccine. Presence of umbilical cord blood IgG was found in all the 40 samples, i.e. Covid IgG > 17.8 BAU/mL. Among the 40 samples, 75% of them had not experienced any side effects after their vaccination while the remaining 25% had experienced minor side effects.

Conclusion: The findings made from this study can be used to prove that vaccines are capable of producing antibodies in mother which will be transferred to her baby through the cord blood. It is also evident that the vaccine has produced only minor side effects.

1. Introduction

Covid-19 is an infectious disease caused by the SARS-CoV-2 virus, which has resulted in the death of over 3 million around the world. Human corona viruses that were evident in the 1960s are responsible for upper respiratory tract infections. The virus was scavenged from the tracheal organ cultures from the respiratory tract of an adult with common cold.[1] These viruses are single stranded RNA viruses with 5'cap and 3'poly (A) tail encompassing it. Virion diameters varying from 60 to 140nm and distinct spikes of 9 to 12 nm were clearly visible from the electron microscopy of the virus. The four structural proteins present in the coronaviruses are Spike (S), Membrane (M), Envelope (E) and Nucleocapsid (N).[2]

Due to the commencement of Covid-19 epidemic, attempts have been made to establish acquired immunity against Covid-19. Before the manufacture and authorization of covid-19 vaccines, there was a clear comprehension about the composition and function of corona viruses

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https://doi.org/10.18231/j.ijogr.2023.089

which pushed to the development of vaccines.[3] Covishield, Covaxin and Sputnik V are the three vaccines available in India.[4] Serum institute of India authorized the exigency use of Covaxin and Covishield in 16th of January 2021. Covishield is comprised of a recombinant and non-replicating chimpanzee adenovirus vector concealing the SARS-CoV-2 S protein.[5] Covishield vaccination has two doses of 0.5ml each. The second dose is to be taken in between 4 to 12 weeks. The storage condition of Covishield vaccine is 2-8 degree Celsius for 6 months. This vaccine was produced by AztraZeneca. The efficacy of covishield was determined to be 80% after complete vaccination based on a case control study conducted in India. The covishield vaccine produced an increase in spike specific antibodies by day 28.[6,7]

The SARS-CoV-2 antibodies which is produced from the inactivated COVID-19 vaccine in a mother before pregnancy can be passed on to the new born through the placenta.[8] Umbilical cord blood is the medium which helps in the transfer of antibodies from a mother to her fetus.[9] IgG is the only antibody class that significantly cross the human placenta. It is evident that the immune protection from a mother to unborn child will occur when the specific antibodies that are produced by either vaccination or infection are transferred through the umbilical cord blood.[10] The visualisation of antibodies produced in cord blood sample can be done by using various methods. CLIA is an immunoassay technique which is used for the same. An antigen-antibody or an immune complex is formed through the binding of paratope and epitope of antibody and antigen respectively in the presence of complimentary particles. Immune complex is estimated by using labelled antibodies are the basis of CLIA.[11]

We studied cord blood for the presence of IgG obtained from vaccination of Covishield and about the side effects. The information brought forward from this study can be utilized to make sure that vaccines are effective for producing antibodies in mother which will be transferred to her baby through the cord blood.

2. Materials and Methods

The investigation was performed in the department of gynecology in a tertiary care hospital in Kerala, India between November 2022 and April 2023. The sample size was 40 (purposive sampling). During the time of delivery, umbilical cord blood was routinely collected as per the inclusion criteria, i.e. the pregnant women those who had completed two doses of Covishield vaccine. Pregnant women who were at risk in pregnancy (Latent pregnancy, Preterm delivery, Thyroid dysfunction, Gestational diabetes, Preeclampsia) and those who were not interested to participate in the study were excluded. The sample was collected from the study subjects after obtaining the informed consent and the collected cord blood was tested in the laboratory for identification of IgG antibodies using CLIA method. The result was obtained within 2 hours.

The primary outcome was the presence of IgG antibodies in the cord blood and the secondary outcome was to identify the side effects occurred during their vaccination. Demographic details, vaccination details and maternity details were collected by interviewing the subjects and details of any side effects experienced were also collected.

The cord blood collected was analyzed by using Electrochemiluminescence immunoassay. The main upper hands of this immunoassay are high specificity reduced number of reagents and also its incubation time. In this, a small amount of the subject's sample is mixed with biotinylated and ruthenylated RBD antigen. This creates immune complexes when corresponding antibodies are present. Then, micro particles coated with streptavidin are added, which attach to the complex. The mixture is transferred to a measuring cell, where the particles are captured by an electrode and any unbound substance is removed. By applying voltage, electrochemiluminescence is induced and measured with a photomultiplier. The signal increases as the antibody titer value go up.

The data obtained from the study were statistically analyzed with the help of the software SPSS (version 22.0).

3. Results and Discussion

The samples were collected from 40 subjects. The mean age of the study group was 28 years (Table 1) and standard deviation was 4. The minimum age was reported as 19 years and maximum age was 39 years.(Figure 1) Majority of the subjects had completed their vaccination with in the interval of 3 months. All the 40 samples showed antibody production.(Figure 2) Here the antibody titer value was above 17.8 BAU/mL with a cut off value of 200 BAU/mL. It was evident that all the 40 samples had the presence of IgG antibodies.(Table 2) The association between the amount of antibody and interval between the doses were assessed by a statistical test called Chi-square test and it was found that there was no statistical association between these two variables. The Chi-square value was 0.81 and the P value was 0.368.

Table 1: Age wise distribution

Age (in years)	Number (n=40)	Percentage (%)
<25	9	22.5%
25-35	29	72.5%
>35	2	5%
Total	40	100%

The details of occurrence of side effects due to vaccination were obtained from the subjects (Table 3) and it showed that 75% of the subjects had no side effects while the remaining 25% experienced minor side effects like fever, headache, fatigue and chills.(Figure 3)

Table 2: Detection of antibody

Antibody detected	Number of participants	Percentage (%)
>17.8 BAU/mL	40	100
<17.8 BAU/mL	0	0

Table 3: Distribution of status of side effects

Side effects	Number	Percentage (%)
Absent	30	75.0
Present	10	25.0
Total	40	100.0

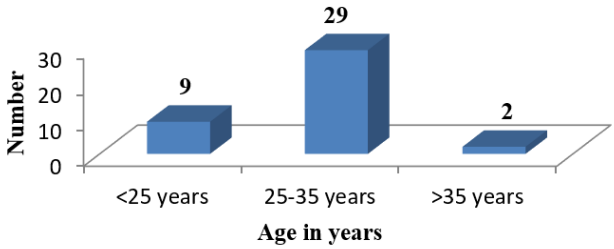

Figure 1: Age wise distribution

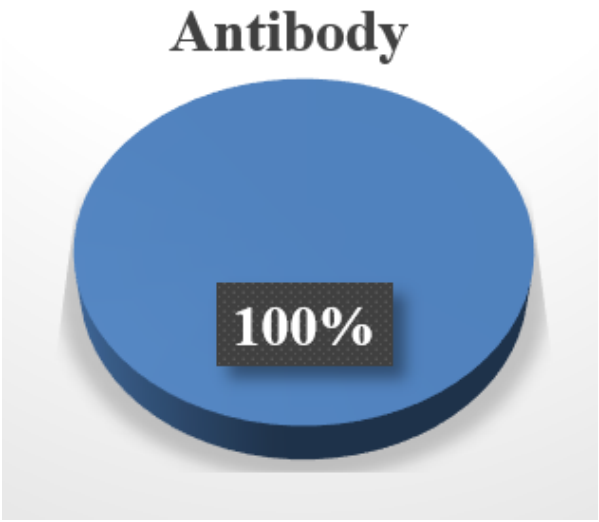

Figure 2: Detection of antibody

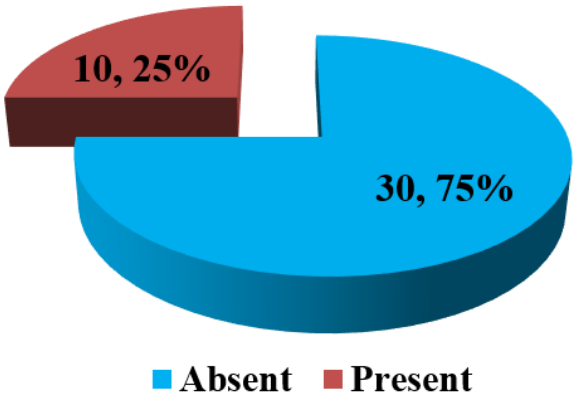

Figure 3: Distribution of status of side effects

The study aimed to find out if there are antibodies in the cord blood of individuals who received two doses of Covishield. With the emergency use authorization (EUA) of the three mRNA COVID-19 vaccines by the FDA, there has been a significant demand for research on their effectiveness and safety in pregnant and neonatal populations. The main findings of the study was, there were positive results for anti-spike antibodies in all the 40 samples; even though positive, 3 of the 40 samples showed antibody production less than 200 BAU/mL and those 3 subjects had completed their vaccination within one month duration; which is close to the studies done by Amikam U et al,[12] and Flannery D et al.[13]

According to the study by Amikam U et al., they discovered that there is a connection between the antibodies against SARS-CoV-2 in the blood of both mothers and newborns when the mothers are vaccinated against COVID-19 during pregnancy. The study by Flannery D et al revealed that the levels of IgG in cord blood were positively related to the levels in maternal blood.

We observed that only 25% of the subjects have experienced minor side effects like fever and fatigue, while the remaining 75% had no side effects during their vaccination. This correlates with the studies done by Kamal D et al,[14] and Pokharel K et al.[15]

The prospective observational study carried out by Kamal D et al observed the adverse events following Covishield vaccine amongst health care workers and they concluded that the vaccine is safe, well tolerated, and has a lower chance of causing reactions. Another descriptive cross-sectional study conducted by Pokharel K et al. proved that the Covishield vaccine has a good safety profile.

Through our study, we have evaluated the transfer of antibodies from mother to child in those who have completed two doses of Covishield vaccine. The above mentioned studies can be correlated with our studies for understanding the maternal antibody transfer through the cord blood to the infant. Also, it is evident from our study that the Covishield vaccine is one with good safety profile. Once vaccines are readily accessible, determining the best time for maternal vaccination during pregnancy will involve

considering both maternal and fetal factors, as well as ensuring sufficient time for neonatal protection.

4. Conclusion

The COVID-19 epidemic has been going on for over 3 years and has spread all around the world. Vaccines were made available to the public after clinical trials, but there is still limited knowledge about their effectiveness. Our study aims to examine the development of antibodies in cord blood after complete vaccination. Maternal immunization not only protects the mother and fetus from SARS-CoV-2 infection but also provides passive protection for the baby after birth through placental protection.

Our findings show that maternally derived antibodies have the potential to protect newborns from SARS-CoV-2 infection. We observed that all cord blood samples had high levels of anti-S antibodies following mRNA COVID-19 vaccination. Therefore, considering the ongoing pandemic since December 2019, it is recommended to consider vaccination for everyone worldwide, based on results from future large prospective studies.

5. Consent

As per international standard, informed consent was obtained from the participants and kept it on record by the author(s).

6. Ethical Approval

The study received approval and certification from the Institutional Research Committee (ECPS/RC-163/2023) of Ezhuthachan College of Pharmaceutical Sciences, Neyyattinkara, Trivandrum.

7. Source of Funding

None.

8. Conflict of Interest

The author has no conflict of interest to declare.

Acknowledgements

Firstly, we want to express our heartfelt gratitude to the Almighty for the grace and blessings that enabled us to successfully complete our project. We would like to extend our sincere thanks to our guide, Prof. (Dr). Shaiju S Dharan, for his unwavering support, patience, motivation, and immense knowledge. His guidance was invaluable throughout our research and in writing this thesis. We couldn't have asked for a better advisor and mentor. We also want to thank him for providing us with all the necessary facilities, insightful comments, and constant encouragement.

Our heartfelt appreciation goes to Dr. Amal A for graciously agreeing to be our co-guide and dedicating his valuable time, extensive knowledge, and unwavering patience to guide us through our project work. We are grateful for his guidance, which played a significant role in our successful project completion. We would also like to express our thanks to Dr. Merlin NJ (Director of PG studies) for her constructive criticism and valuable guidance, which greatly contributed to our project work.

We are deeply indebted to Dr. Drishya L, Assistant Professor for sharing her knowledge, ideas, and concepts, which had a profound impact on our entire work.

Lastly, we would like to express our humble gratitude and sincere regards to NIMS Medicity for allowing us to do this study and special regards to our respected associate professors, assistant professors, Head of Department (Department of Pharmacy Practice), Ezhuthachan College of Pharmaceutical Sciences. We want to express our heartfelt appreciation and respect to Mr. Jayakrishnan. K, the biostatistician, who played a crucial role in the statistics section.

Words alone cannot fully convey our gratitude to our parents for their unwavering support, constant encouragement, and spiritual guidance. We are grateful and fortunate to have received continuous support, guidance, and encouragement from all the teaching staff at Ezhuthachan College of Pharmaceutical Sciences, who played a vital role in the successful completion of our project. We would also like to extend our sincere regards to all the non-teaching staff for their timely assistance.

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Cite this article: Krishna AS, Adithya S L, Ahalya U, Anil A, Amal A, Dharan SS. A stockpile of neonatal antibodies pertaining to SARS Covid (COVID 19) ascertained in cord blood after complete vaccination of covishield in mother- An observational study. *Indian J Obstet Gynecol Res* 2023;10(4):469-473.