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Original Research Article

Seroprevalence of rubella in female healthcare workers in a tertiary care hospital

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ABSTRACT

Background: The rubella virus is a member of the genus Rubivirus and causes Rubella infection which is a mild disease characterized by a rash. When rubella virus infects susceptible women early in pregnancy, it may be transmitted to the foetus and may cause birth defects known as the congenital rubella syndrome (CRS). In the healthcare setup the female healthcare workers are exposed to various infections and have more chances of acquiring Rubella infections. Hence, the healthcare workers of premarital age need to be assessed for their immune status with respect to rubella IgG antibodies. Therefore, this study was carried out to evaluate seroprevalence of Rubella IgG.
Methods: This was a cross-sectional and comparative study conducted in the Department of Microbiology, MGM Medical College and Hospital, Kamothe, Navi Mumbai. Female healthcare workers in the age group 18-30 years were included in the study. The specific IgG antibody titre was evaluated by commercially available ELISA.
Results: Among the total participants (172), 20 were seronegative and 152 were seropositive. Of the total seronegative participants, 2 were vaccinated and none of them had history of past Rubella infection. The maximum seronegative participants were from the age group 18-22 and none from 26-30 age group. The prevalence of Rubella IgG antibodies was found to be 88.38%.
Conclusions: The seronegative healthcare workers need to take precautions and due to the gaps in vaccination coverage, Rubella vaccination should be provided to young healthcare workers to prevent potential outbreak.

Keywords: Rubella, ELISA, Healthcare workers, Seroprevalence

INTRODUCTION

The rubella virus is a member of the genus Rubivirus in the family Togaviridae. It causes Rubella or German measles which is a mild disease characterized by a rash. It affects children and adolescents worldwide and can also affect young adults. When the rubella virus infects susceptible women early in pregnancy, it may be transmitted to the foetus and may cause birth defects. Therefore, accurate diagnosis is critical in pregnancy. It can also cause severe birth defects known as congenital rubella syndrome (CRS) when infection occurs early in pregnancy.[1,2] Up to 70% of infected adult women develop arthritis. If, however, infection occurs in the first weeks of pregnancy, up to 85% of neonates are born with a pattern of growth restriction and major birth defects known as congenital rubella syndrome (CRS). Later-onset sequelae of rubella in early pregnancy include autism and diabetes.[2]

Congenital rubella syndrome (CRS) is a rare disease with severe ocular and systemic consequences. Despite ongoing efforts to eradicate the disease, some parts of the world remain infected. The disease's burden is heavy on individuals and society; hence vaccination and other preventative methods should be vigorously encouraged.[3] Congenital rubella syndrome (CRS) can cause deafness, heart problems, cataracts, and several other irreversible symptoms.[4] Worldwide, 78 countries (more than one-

third) reported a national policy of using rubella vaccine.[5] This was closely related to the country's economic status. Based on the United Nations country classification, the rubella vaccine is used in 92% of industrialized countries, 36% of those with economies in transition, and 28% of developing countries.[6]

Cases of congenital rubella syndrome (CRS) may be prevented as, by providing direct protection to women and schoolgirls (a selective vaccination strategy); by vaccinating boys and girls to provide indirect protection by reducing the transmission of rubella virus (a childhood vaccination strategy); or by a combination of these approaches (a combined strategy). A combined strategy was most commonly reported (60% of countries); seven countries (9%) reported a selective strategy; and 24 countries (31%) reported only childhood immunization.[5] In India, only childhood vaccination strategy is followed, and childhood vaccination alone may pose a risk of an increase in CRS cases. Hence it is essential to include vaccination of women of childbearing age in rubella control strategy.[5]

The Measles, Mumps, and Rubella (MMR) vaccine has been available in India since 2000, but only recently, i.e., in 2017, the Rubella-containing vaccine was introduced in the National Immunization Schedule.[7] In the National Immunization Program of the Government of India, the Rubella vaccine is included in MMR which is given in early childhood (at 1-2 years). The immune status of these children can be variable by the time they reach their twenties.

It has been proposed that there is a need for determination of serological status among the women in the reproductive group especially in the premarital clinic, subfertility clinic, prepregnacy clinic, and also in the antenatal clinic so that appropriate vaccination can be offered.[8] Also, the virus when circulating in the population; may pose a threat to the population whose immunity is less in their early twenties.Since Rubella is not notifiable in many countries and its clinical diagnosis is frequently inaccurate, serosurveys are used to assess the epidemiologic pattern of Rubella in a community. India is a vast country but only a few such surveys have been conducted so far. It was therefore considered worthwhile to study the Rubella seroprevalence rates and to analyse them according to age, socioeconomic status, and previous immunization history in a tertiary care hospital.[7]

In the healthcare setup, female healthcare workers are exposed to various infections and have more chances of acquiring Rubella infections. Hence, healthcare workers of premarital age need to be assessed for their immune status concerning rubella IgG antibodies.

The objective of this study was to check the seroprevalence of Rubella in young Health care workers so that the immune status of the women having a lower titer of IgG can be vaccinated.

METHODS

Study design

This was a cross-sectional and comparative study.

Study place

The study was conducted in the Department of Microbiology, MGM Medical College and Hospital, Kamothe, Navi Mumbai

Period of study

The study was conducted for one year from February 2023 to February 2024.

Inclusion criteria

Female healthcare workers in the age group 18-30 years were included in the study.

Exclusion criteria

Participants were excluded if they had a recent history of Rubella infection or did not provide consent for participation.

A total of 172 blood samples were collected for the study. Each sample consisted of 5 ml of venous blood, which was processed using the ELISA method.

Sample processing

Serum samples were handled following good laboratory practice. Fresh serum could be stored for four days at 2-8°C or frozen at -20°C for longer periods. Samples were thawed a maximum of three times and mixed carefully before assay. Auto-defrosting freezers were avoided to prevent erroneous results. Microbial contamination was avoided to maintain sample quality.

The required number of strips for ELISA was prepared, and the wash buffer was diluted (100 ml wash buffer + 900 ml H_2O). Samples were diluted by mixing 10µl of serum with 1ml of diluent (1:101). Each diluted sample, along with controls and calibrators, was dispensed into wells (100µl per well). The wells were covered with protective film and incubated at 37°C for 45 minutes. The strips were then washed four times with 300µl of wash buffer. Conjugate (100µl) was added to each well, incubated at 37°C for 45 minutes, and washed again. Substrate (100µL) was added and incubated at room temperature for 15 minutes. Finally, 100µL of stop solution was added, and absorbance was read at 450nm. Quantitative IgG results were expressed in international units (IU), with calibration performed against reference standards of 5, 10, 50, 100, and 200 IU/ml according to the manufacturer's instruction. Samples with IgG antibody concentration ≥13 IU/ml were regarded as seropositive while samples <7 IU/ml were

considered as seronegative (DIESSE Enzywell Rubella IgG).

Ethical approval

Institutional Ethical Committee approval was taken before initiating the study (Approval number: DHR-EC/2022/SC/12/135).

Statistical analysis

Microsoft Excel 2010 was used to analyse all the data. Independent t-test was used to test for significant differences between means. P>0.05 was considered to be not significant in all statistical comparisons and the results are presented in tables.

RESULTS

Among all the participants, the number of non-vaccinated participants (79%) were more than the vaccinated participants (21%) indicating statistical significance (p<0.05). Between the age group of 18-22 only 18 participants were vaccinated, between the age group of 22-26 only 17 participants were vaccinated and between the age group of 26-30 only 1 participant was vaccinated. Out of 172 samples tested for Rubella IgG among female healthcare workers in the age group of 18 to 30, 12% of participants were found to be non-immune having antibody titre <7 IU/ml and 88% of participants were found to be immune i.e. having antibody titre >13 IU/ml indicating statistical significance (p<0.05). Only one participant had the history of past Rubella infection and was in the age group of 26-30 and was vaccinated.

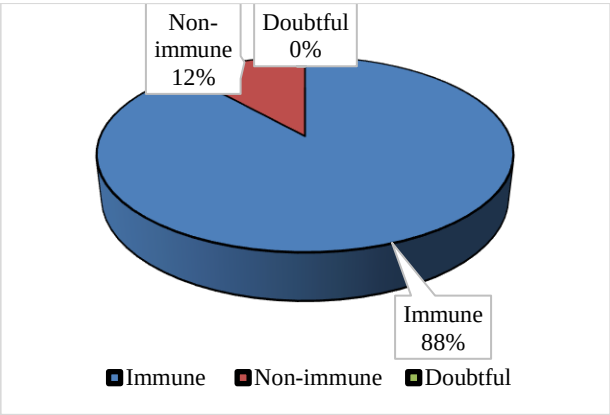

Figure 1: Degree of immunity of participants (n=172).

Association between the socioeconomic group and serostatus of participants was also studied and is given in table 1. Most seronegative participants were seen from the upper middle socioeconomic class (15) and lower middle socioeconomic class (5). And most seropositive participants were from upper middle socioeconomic class (120). With respect to seronegative among participants (20) only 2 were vaccinated and none of them had history of past Rubella infection. The maximum seronegative participants were from the age group 18-22 and none from 26-30 age group given in table 2. Among all the seropositive participants (152) 34 were vaccinated and 118 were not vaccinated. Only one participant had history of past Rubella infection. The maximum seropositive participants were from the age group 18-22 followed by 22-26 and 26-30 given in table 3. Seroprevalence of Rubella IgG among the female healthcare workers in this study was found out to be 88.38%.

Table 1: Association between socioeconomic group of participants and serostatus of participants (n=172).

Socioeconomic group (Score according to Kuppuswamy scale)	No. of participants	Seropositive participants	Seronegative participants
Upper (26-29)	3	3	0
Upper middle (16-25)	135	120	15
Lower middle (11-15)	32	27	5
Upper lower (5-10)	2	2	0
Lower (<5)	0	0	0
Total	172	152	20

Table 2: Consolidated data of seronegative participants (n=20).

Total seronegative	MMR Vaccination		History of Rubella		Age group		
	Yes	No	Yes	No	18-22	22-26	26-30
20	2	18	0	20	13	7	0

Table 3: Consolidated data of seropositive participants (n=152).

Total seropositive	MMR vaccination		History of Rubella		Age group		
	Yes	No	Yes	No	18-22	22-26	26-30
152	34	118	1	151	77	69	6

DISCUSSION

The rubella infection is marked by a characteristic rash and slight fever and can be avoided with vaccination. Even while rubella is usually safe for healthy people, there are still serious concerns associated with it, especially for vulnerable groups like expectant mothers and their unborn children as it can lead to CRS. Health care workers may be more prone to contracting and spreading rubella because of their frequent contact with patients and infectious agents. They are susceptible to contracting rubella due to a number of factors, such as their immune system, level of immunization, type of job, patient population, and compliance with infection control protocols.

It was observed that maximum participants were from the age group of 18-22 years (52.32%). In a similar study conducted by Tamirat et al.[9] The maximum participants were from the age group 25-29 years (37.9%) followed by the age group 20-24 years (36.7%) suggesting the potential differences of variation in the demographic profiles of the populations studied.

Only 21% of the healthcare workers were vaccinated whereas 79% of them were not vaccinated. This finding is statistically significant ($p<0.05$). Also, in a study done by Shashank Shekhar et al in the Departments of Obstetrics and Gynaecology and Microbiology, School of Public Health, AIIMS, Jodhpur, Rajasthan, India; none of the participants gave the history of prior immunization with either MMR vaccine in childhood or Rubella vaccine in adolescence indicating that Rubella vaccination was not in routine practice when these studies were carried out.[10]

In our study only one participant showed the past history of rubella infection and was in the age group of 26-30. The participant underwent various complications during her pregnancy. During her first pregnancy she suffered a miscarriage during the second trimester and later during her second pregnancy the baby was born with Congenital Rubella Syndrome (CRS) including heart abnormalities and later died within a week. According to a similar study conducted by Singla N et al, past history of Rubella infection was given by only two participants indicating low prevalence of Rubella infection among the population or the infections may not be formally diagnosed or documented.[7]

Also, the data suggests that monitoring and control of rubella is very important in the risk vulnerable population such as pregnant women to mitigate the risk of adverse outcomes. In this study it was observed that among 172 participants only 20 (12%) of the participants were non-immune whereas 152 (88%) of them were immune to rubella virus. This finding is statistically significant ($p<0.05$). In a similar study conducted by Shashank et al Shekhar et al.[10] Out of the 188 samples, 161 (85.6%) were seropositive and 27 (14.36%) were seronegative. This indicates that while the majority of individuals in the studied population have immunity to Rubella, efforts should continue to ensure widespread immunity coverage and minimize the risk of Rubella transmission and associated complications. The immunity in absence of vaccination history can be due to exposure to rubella virus or subclinical infections.

In the present study, most seropositive participants were seen from the upper middle socioeconomic class (120) and lower middle socioeconomic class (27). On the other hand, in a related study conducted by Singla N et al, those with lower socioeconomic backgrounds showed statistically significant higher rates of Rubella seropositivity than people with higher socioeconomic backgrounds.[7] These differences point to a complicated relationship between socioeconomic class and Rubella seropositivity that is influenced by area epidemiology, healthcare access, and vaccination coverage, among other things. It is imperative to take these characteristics into account when developing focused public health initiatives meant to lower the incidence of Rubella and the accompanying morbidity in various demographics and environments.

Among all the seronegative participants, (20) only 2 were vaccinated and none of them had history of past Rubella infection. The maximum seronegative participants were from the age group 18-22 and none from 26-30 age group. Both the vaccinated participants were vaccinated during their childhood and the observed decline in IgG antibody titre among the vaccinated individuals could indicate a number of things, such as a gradual waning of protection, an insufficient response to vaccination, or possible problems with vaccine efficiency.

In a similar study conducted in the Municipality of Alasabaa- Libaya by Abdulfatah Ramadan Swesi in 2024 the seronegative participants (13.3%) were from the age group 18-23.[11] The comparison of the two research indicates that vaccination is crucial in preventing Rubella infection and raises the possibility that seronegativity for the disease may be more common in younger age groups.

Among all the seropositive participants (152) 34 were vaccinated and 118 were not vaccinated. Only one participant had history of past Rubella infection which indicates that past infection may confer immunity but it is relatively uncommon among individuals. The maximum seropositive participants were from the age group 18-22 followed by 22-26 and 26-30. The results demonstrate how well the rubella vaccination works to immunize those who receive it. Additionally, they stress how crucial immunization is in preventing Rubella infections, especially in younger populations.

Furthermore, the existence of seropositive people who did not receive a vaccination or who did not disclose a history of prior infection raises the possibility that additional variables, including natural exposure or herd immunity, may have contributed to the development of Rubella immunity in the research population. In a similar study carried out by Tamirat et al, the rate of antirubella IgG

peaked in the age range 20-24 years (89%) and decreased thereafter with increasing age of the population involved in the study.[9]

Limitations of the study was that it was restricted to sample size of 172 participants from a single location, limits the generalizability of the findings. The findings of the study would have been more reliable if the study included more locations and samples. Future studies addressing these limitations could yield a more comprehensive understanding of Rubella immunity and vaccination efficacy across populations.

CONCLUSION

Rubella is a public health concern due to low immunization rates and the possibility of serious consequences during pregnancy. Previous research has stressed the usefulness of Rubella vaccine in lowering the risk of Congenital Rubella Syndrome (CRS). Despite the inclusion of the MMR vaccine on the National Immunization Schedule in 2017, immunization gaps and decreasing immunity were observed. Individuals born before 2017 may require a booster dosage to maintain immunity, especially those in their reproductive years. However, further studies may be required on a larger scale to prevent potential outbreak of Rubella in future.

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