

Original Article

Evaluation of Antibodies against Rubella Virus in a Mass Campaign Vaccination in Tehran, Iran

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Abstract

Background and Aims: Vaccine is available, but fetal infection with rubella virus is still a main cause of congenital birth defects and mental retardation in many countries. Mass vaccination campaigns and Expanded Program of Immunization (EPI) have increased vaccine coverage in the world with a substantial impact on the reduction of rubella infections, such as Congenital Rubella Syndrome (CRS).

Methods: The present study was performed to evaluate the immune status against rubella before and after the mass campaign vaccination on 22 Dec. 2003. A total of 320 sera samples collected from the healthy subjects before (group a) and after the vaccination (group b) as well as 80 paired sera (group c) collected from other target group as a panel were tested for the presence of anti-rubella antibody using HI test.

Results: Following the mass campaign vaccination 98.1% of the population has anti -rubella antibody, whereas 92.2% were positive before the vaccination. In group c (the paired examined subjects) 98.75% have gained anti -rubella antibody.

Conclusion: Seronegative individuals were considered as high-risk members, which must be vaccinated again.

Keywords: Antibody titer; Rubella Virus; Mass vaccination; Haemagglutination Inhibition (HI)

Introduction

Rubella virus is the etiologic agent of German measles and is the sole member of the genus Rubivirus in the Togaviridae family. During the first trimester of pregnancy, the infection may induce congenital malformation and viral persistence in human fetus (1). Rubella is a contagious illness that passes through placenta to infect the unborn child. Before 1969, that rubella vaccine has been available, rubella epidemics have occurred every 6-9 years and more than

20,000 babies have been born with birth defects in the United States (2). Live attenuated rubella vaccines have been licensed in the USA since 1969 and introduced throughout the world (3).

Vaccination of children leads to prevent the spread of the illness to susceptible adult. Most women of childbearing age are immune to rubella because they either have been vaccinated or had the illness during their childhood. Because of wide spread use of the vaccine, birth defects caused by rubella have become rare (2). According to the WHO guidelines countries wishing to prevent rubella infections should immunize children, adolescent girls and women of childbearing age. The most rapid impact would be achieved by mass campaigns preferably for young women and men (3). The aim of the latest mass

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vaccination in Iran was to eliminate wide spread incidence of rubella virus.

In the present cross sectional study, Haemagglutination Inhibition (HI) test was applied to evaluate the status of antibody before and after the mass vaccination on 22 Dec 2003. HI test as a reliable index of the immunity level to rubella virus infections is most commonly used for serological diagnosis as well as for determination of immune status (4).

Methods

Study design

Three different sets of serum samples were studied. (a) A total number of 320 sera were collected from vaccinated and unvaccinated people before the mass vaccination. (b) The same size of samples was taken 4 weeks after mass vaccination. (c) The paired sera were collected from 80 healthy volunteers just before the mass vaccination program and 4 weeks after that.

Study population

Population with the age range of 5-25 years old was investigated in this study to evaluate anti-rubella antibody levels. All participants or their parents had been aware of the study details.

HI test

HI test was considered as a reference method to evaluate the immunity level against rubella virus. It was performed by using rubella haemagglutinin (RA) antigen (DADELBehring) (2, 4). The sera with known HI titers were included in each run. The highest dilution of each serum, which completely inhibited haemagglutination, was taken as the HI serum

titer. Statistical analysis

The statistical analysis was performed with SPSS version 10.00. Pearson Chi-Square and/or Spearman's nonparametric tests were used for data analysis, whenever required.

Results

Evaluation of anti-rubella antibody titer in the study population before and after the vaccination using HI test

Sera from the first group (a) was assessed by HI and 295 out of 320 participants (92.2%) were seropositive and 25 cases (7.8%) were seronegative before the vaccination, while 314 out of 320 sera (98.1%) in group b (after the vaccination) were positive (Table 1). Significant differences were observed in the pre and post vaccinated groups using Pearson Chi-square test ($p < 0.05$).

Frequency distribution of HI antibody titer before and after the vaccination has been illustrated in Fig. 1.

To obtain insight into the effect of mass vaccination, the antibody levels against rubella were studied in paired sera, collected just before the vaccination and 4 weeks later. All the attendants were in good condition of health and ranging from 5 to 25 years old. Members of group c were 80 people (46 males and 34 females) participated in the investigation before and after the vaccination. From this study population 33.75% had a history of rash exposure and only 36.25% had vaccination record before.

The data revealed that 98.75% of the subjects

Table 1. Distribution of HI antibody titer among the target groups before and after the vaccination (group a and b).

Antibody Titer	<1/8	1/8	1/16	1/32	1/64	1/128	1/256	1/512	1/1024	Total
No. of Pre-vaccination(a)	25	4	10	15	60	92	65	44	5	320
	7.7%	1.3%	3.1%	4.7%	18.8%	28.8%	20.3%	13.7%	1.6%	100%
No. of Post-vaccination(b)	6	5	20	22	25	70	75	50	47	320
	1.8%	1.6%	6.3%	6.9%	7.8%	21.9%	23.4%	15.6%	14.7%	100%

Characterization of the group (c) and prevalence of antibody levels in the paired subjects.

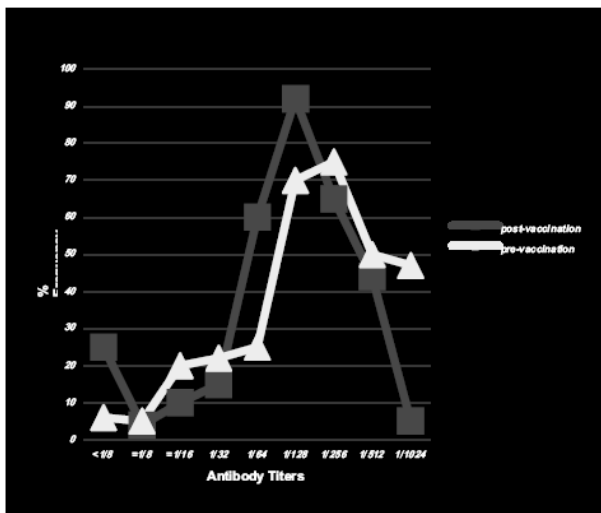


Fig. 1. Frequency distribution of HI antibody titers before and after the vaccination (group a and b).

Table 1. Distribution of HI antibody titer among the target groups before and after the vaccination (group a and b).

B.V ^a A.V ^b	≤ 1/8	1/8	1/16	1/32	1/64	1/128	1/256	1/512	1/1024
< 1/8	1 ^c	1	1	2	1		1		
1/8									
1/16					1				
1/32						1	1		
1/64					3	7	3	1	1
1/128						7	10	5	3
1/256							4	9	5
1/512								7	4
1/1024									1
Total No.	1	1	1	2	5	15	19	25	14

a. After vaccination (98.75% HI+ AND 1.25% HI)

b. Before vaccination.

c. The figures in the table demonstrate the number of positive sera in the specified titer.

had anti-rubella antibody, out of which 1.25%, Congenital rubella is a preventable disease, which has largely been controlled by immunization. Although the burden of CRS is not well characterized in all countries, it is estimated that more than 100000 CRS cases occur each year in the developing countries (5). The main purpose of rubella vaccination is to prevent the occurrence of CRS, which is one of the important causes of deafness, blindness and mental retardation. Live attenuated

1.25%, 1.25%, 2.5%, 6.25%, 18.75% 23.75% 27.5% and 17.5% showed HI antibody titer of equal to < 1/8, 1/16, 1/32, 1/64, 1/128, 1/256, 1/512 and 1/1024 respectively. The antibody titer variations in the two test groups were evaluated (Table 2) and the percentage of positive and negative cases was determined using Chi-Square test. Spearman's nonparametric test was also performed to study the correlation between the antibody titers before and after the vaccination. Titer difference was considered statistically significant ($p < 0.05$).

Discussion

RA27/3 strain of the virus was applied in bivalent combination with measles vaccine in the largest mass vaccination campaign in Iran (22 Dec 2003). According to the WHO guidelines all countries should assess their rubella situation and, if appropriate, make plans for introduction of rubella vaccination. Rubella immunization schedules vary in different countries of the Eastern Mediterranean Region. In some neighboring countries rubella

vaccine has been scheduled for the girls aged 12-13 years, whereas in some other countries, it is given to the target group of 12-15 months old (6). Rubella vaccination has recently been included in the national immunization programs in Iran. WHO has recommended that the large scale vaccination drastically reduces or probably eliminates rubella and CRS (3).

Accordingly immunization of both sexes reduces the number of infections and extends inter epidemic interval by reducing the circulation of the virus in the community. In order to eliminate CRS, it is required that every susceptible person to be effectively immunized.

The choice of policy in this regard requires some baseline information about the seroprevalence of susceptibility in the target groups. Specific seroprevalence study provides data to determine if it is necessary to change the immunization strategy. There is little document on the prevalence of rubella antibodies among the Iranian population especially in the rural areas. Previous study in 1994 in Tehran has shown that 91.5% of the sera collected from the cord blood had rubella antibody, whereas the prevalence of anti-rubella antibody among the children was 85% (7, 8).

Other studies have indicated that seropositivity among the women aged 14-70 years was 96.2% and among the children aged 2-7 years was 97.0% in Shiraz (9).

Based on the official health reports, despite of the scattered vaccination programs in Iran, there has been an increase in the number of rubella cases within three years before vaccination (10).

The prevalence of CRS was approximately 0.2/1 000 before rubella vaccination in Iran. Based on the results obtained by Sadighi, implementation of appropriate rubella vaccination program could potentially prevent about 12% of cases in sensorineural hearing loss in Iranian children (11).

This study was designed to assess the rubella situation in selected population in Tehran. Spearman's nonparametric test was used to study the correlation between HI antibody titers before and after the vaccination in the

paired sera. The achieved correlation coefficient was ($r = 0.735$) with $p < 0.001$, so that 7.8% of the cases were seronegative before the vaccination while only 1.9% of them remained seronegative after the vaccination.

In conclusion, the assessment of immunity status against rubella virus in various regions of the LR. Iran, particularly in the rural areas and among different age groups is essential. It seems that still susceptible people exist among population. Therefore, for rubella elimination, one should determine immune status in susceptible subjects. However, as long as the rubella virus remains in population, it is necessary to assess its situation for making plans to control and eradicate the virus.

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