Seroprevalence of Rubella Immunity (IgG Antibody) among Female Health Care Workers in a Hospital in Southern India

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ABSTRACT

Introduction: Rubella is a mild exanthematous illness caused by Rubella virus which belongs to the family Togaviridae. Rubella is considered of public health importance for the teratogenic potential of the virus, this lead to disastrous consequences in pregnant women if contracted during first trimester. An effective and safe vaccine against rubella is available, yet according to estimation, over 100,000 infants are born with Congenital Rubella Syndrome (CRS) annually worldwide. Rubella is endemic in India and CRS contributes in morbidity and mortality among the live birth. As rubella vaccine has been incorporated in their immunisation schedule, the incidence of rubella has been reduced drastically. But still seronegative population has been noted in various studies in India.

Aim: To evaluate the immune status (Rubella specific IgG antibody) of Rubella among Health Care Workers (HCW) of our hospital.

Materials and Methods: A prospective, cross-sectional study was conducted among female health care students and workers (n=145) in a tertiary care teaching hospital in South Chennai

from January to February 2017. Blood samples were collected after getting informed consent and serum was separated. A rubella specific IgG antibody was detected by ELISA using the commercially available kit as per the manufacturer's instruction. Samples showing IgG antibody titre >10 IU/mL were taken as positive and ≤10 IU/mL as negative. The results were analysed statistically using Epi Info version 7.2.

Results: A total n=145 samples were analysed and among which 124 (85.5%) workers had adequate titre and 21 (14.48%) were negative for rubella IgG antibody. The mean age of the participants was 19.65. The participants were MBBS students (n=75), BDS students (n=48), Laboratory technicians (n=12), Staff nurses (n=9) and Doctor (n=1). None of them was remembering their vaccination status.

Conclusion: The study concludes that immunisation of HCWs against rubella is an important target regardless of their vaccination status. There is a more chance of exposure to infection and also in transmission of infection in the hospital environment. Hence, maintenance of immunity is an essential part of prevention and infection control scheme.

INTRODUCTION

Rubella is a mild exanthematous illness caused by Rubella virus which belongs to the family Togaviridae. As a clinical disease it was first described by a German author in the mid of 18th century [1]. Rubella is a self-limiting disease, characterised by fever, rash, arthralgia, lymphadenopathy and conjunctivitis. Rubella is considered of public health importance for the teratogenic potential of the virus, which leads to disastrous consequences in pregnant women if contracted during first trimester [2]. An effective and safe vaccine against rubella is available, yet according to estimation, over 100,000 infants are born with CRS annually worldwide [3]. Sero-surveillance from 45 developing countries has shown a wide range of susceptibility to Rubella virus that is seronegative in 10-20% of the population. CRS accounts for a significant mortality and morbidity in India as well [3]. But the dearth of nationwide reporting system for CRS and lack of consistent testing have led to insufficient data on the population-based burden of the disease [4]. About 10 to 15% of intrauterine infections are thought to be due to rubella. A systematic review done by Dewan P et al., showed that CRS as the cause in 1-60% of ocular abnormalities, 1.5-29% of congenital deafness and about 30% of congenital heart disease [5]. Moreover, immune status of HCW against rubella warrants special concentration. Sero negative HCW are not only at risk of getting disease from the patient, also have the risk of transmitting the infection particularly to the antenatal cases [6,7]. Prevention of transmission of infection is also difficult since most of the infections are asymptomatic [7]. Majority of the women become immune when they reach child bearing age from

childhood exposure to rubella virus or by immunisation. Yet a quite proportion of women populations are seronegative and becoming susceptible to infections [2]. Serosurveillance for Rubella IgG antibody among the HCW from various countries declared that 2.4 to 36.3 of the female HCW were seronegative and vulnerable for infections [8]. Hence, the study was intended to evaluate the serostatus of Rubella among female HCW in tertiary care teaching hospital in South Chennai, Tamil Nadu, India.

MATERIALS AND METHODS

A cross-sectional study was conducted on apparently healthy, unmarried, female HCW of our hospital viz., Students of MBBS, BDS, Laboratory technicians, Staff Nurses and doctor. The age of the participants ranges from 18-28 years. The study was conducted in tertiary care teaching hospital in South Chennai during a period of January to February 2017. Total number of the participants of the study were n=145. The sample size was calculated by using the formula $n=4P(1-P)/d^2$ [9] where, n=sample size, P=Expected prevalence (Prevalence of previous study in India), [8] and d=allowable error=5%. After getting Institutional ethical committee approval (Ref:NoSP No9/IEC NO:2/May2014) the study was initiated. Written Informed consent was obtained from each participant. Participants who did not consent were excluded from the study. The unstructured questionnaire was self-developed, based on a review of related literatures [2,6]. The questionnaire was administered on demographic details of the participants like age, sex, area of residence and clinical details like history of vaccination to rubella and previous history

of fever with rash or lymphadenopathy were collected [Annexure 1]. Three mL of blood sample was collected and the serum was separated and stored at -20°C. Rubella specific IgG antibody was tested using a commercial IgG ELISA-Enzyme Linked Immunosorbent assay using DS-EIA Anti Rubella–G-Fast, Italy. The test was done and results were calculated and interpreted as per manufacturer's instruction. The samples showing an IgG antibody titre >10 IU/mL were taken as positive and ≤10 IU/mL as negative as per International guidelines [10]. All the negative samples were retested in duplicates and results were confirmed. All seronegative participants in our study were directed and followed up for vaccination.

STATISTICAL ANALYSIS

The data was analysed statistically using Epi Info version 7.2.

RESULTS

Out of 160 participants enrolled, 15 participants did not give their consent and were excluded. Therefore, the total number of the participants were 145 (n=145). The age of the participants was 18 to 20 years n=122 (84.13%), 21 to 28 years were n=23 (15.8%) and mean age of the participants was 19.6 years [Table/Fig-1]. Among the participants, majority were MBBS students 75/145 (51.72%), followed by BDS students 48/145 (33.10%), Laboratory technicians 12/145 (8.27%), Staff nurses 09/145 (6.2%) and Doctor 01/145 (0.69%) [Table/Fig-2]. Out of 145, 124 (85.52%) were immune to rubella virus and 21 (14.48%) were seronegative for rubella infection [Table/Fig-3]. The maximum participants were of 18-20-year-old n=122 (84.13%), followed by 21-28 years, n=23 (15.8%). The seropositive and seronegative in relation to the age of the participants were displayed in [Table/Fig-4]. From the questionnaires the following results were observed: All the participants were living in urban area at the time of study; none of them had past history of fever with rash or lymphadenopathy and could not recollect their vaccination status.

Age	N (%)
18-20 years	122 (84.13%)
21-28 years	23 (15.8%)
Mean	19.65

[Table/Fig-1]: Distribution of the age of the participants.

Education	No (%)
MBBS students	75 (51.72%)
BDS students	48 (33.10%)
Laboratory technicians	12 (8.27%)
Staff nurses	09 (6.2%)
Doctor	01 (0.69%)

[Table/Fig-2]: Distribution of participants according to their Educational status.

Immune status	Frequency	Percentage
Seronegative	21	14.48%
Seropositive	124	85.52%
Total	145	100%

[Table/Fig-3]: Serostatus (IgG antibody) of the participants.

Age (years)	Number of participants	IgG positive	IgG negative
18-20	122 (84.13)	104 (85.2%)	18 (12.4%)
21-28	23 (15.8%)	20 (86.9%)	03 (13%)
Total	145	124 (85.52%)	21 (14.48%)

[Table/Fig-4]: Immune status of rubella in relation to the age of the participants.

DISCUSSION

Rubella is an infectious disease which involves all age groups. HWCs are at high risk of acquiring rubella, unless they have protective level of immunity to rubella. As Rubella infections are commonly a subclinical, there is a risk that infected HCWs may unknowingly transmit the infection to the patients or workers in the hospital. Moreover, infection in antenatal mothers especially in the first trimester leads to devastating consequences in the form of CRS in infants. Even Institutional outbreaks have been reported in Chandigarh and Vellore [11,12].

Our study showed that 21/145 (14.48%) were seronegative for Rubella virus [Table/Fig-2]. This is similar to the study conducted by Velvizhi G et al., in south Tamilnadu, the seronegative for Rubella was (15.6%), Vijayalakshmi P et al., (15%), RajaSundari TA et al., (11.4%), Arunkumar G et al., in Manipal University (16.6%), Asari S et al., in Japan (12.5%) [6-8,13,14], whereas study by Valsan C et al., the seronegativity was 33.8% which was higher than our study [2]. There were studies showing less seronegativity (<10%) viz., Alp E et al., (3%), Aypak C et al., (2.5%), and Celikbas A et al., (1.7%) [15-17]. [Table/Fig-5] shows seronegative % of Rubella Immunity (IgG antibody) among HCW in different places [6-8,13-18].

Study region	Author and year of study	Seronegative (%)
Japan	Asari S et al., 2003 [14]	12.5
Madurai, South Tamil Nadu, India	Vijayalakhsmi P et al., 2004 [7]	15.0
University of York, UK	Celikbas A et al., 2006 [17]	1.7
Madurai, South Tamil Nadu, India	RajaSundari TA et al., 2006 [8]	11.4
Turkey	Alp E et al., 2012 [15]	3.0
Turkey	Aypak C et al., 2012 [16]	2.5
Manipal University, India	Arunkumar G et al., 2013 [13]	16.6
South Tamil Nadu, India	Velvizhi G et al., 2014 [6]	15.6
Mumbai, India	Gohil DJ et al., 2016 [18]	12.0
North Tamil Nadu, India	Present study	14.48

[Table/Fig-5]: Seronegative of Rubella Immunity (IgG antibody) among HCW in different places [6-8,13-18].

The surveillance of HCWs against rubella and to vaccinate the susceptible personnel has an important implication in the hospital environment. These results of surveillance in the hospital environment can be extrapolated in the general population also. There are few studies among general population in India were showing similar results among HCWs. A study in Mumbai, among 18-24-year-old college students, in which susceptibility rate of 12% was observed, in Jammu among 11-18-year-old school girls (33%) and Thayyil J et al., in the age group of 13-15 years of young teen girls showed 30% of susceptibility rate [18-20]. These high percentages of susceptibility may be due to the improved socioeconomic status and high standard of living in these states. Hence most of the studies in India showed that the susceptibility to rubella still exist the same in different states (11-33%) almost for a period of 15 years. WHO reports that even if the susceptible level in women is below 10%, there is a chance of CRS in the future [21]. Therefore, with this high level of susceptibility in various regions indicates the high chances of developing CRS in India.

Considering, the age of susceptibility to rubella varies from region to region, in our study the participants were in the age group of 18-28 years [Table/Fig-1]. The seronegativity among 18-20-year-old was n=18 (12.4%) and in 21-28 years n=03 (13%) [Table/Fig-4]. A study by Aypak C et al., revealed that rubella antibodies were lower in HCWs aged less than 30 years than those of in the age of 30-44 years, which was supported by many studies in India [6,8,16]. The prevalence of rubella antibodies may reflect not only the vaccination status but previous infection or booster effect by the wild virus. The lower prevalence of antibodies in HCWs <30 years suggests that vaccination should be reinforced in this age group.

In our study, serosurveillance was carried out only in female HCWs and not in the male population. But study showed that seronegativity was also observed in male group which point out the risk of transmission to non-immune pregnant women from infected male [8]. Also in our study, none of them remember their vaccination status against rubella. On the other hand, a study conducted in Manipal University students showed that 10.5% of those previously vaccinated were having inadequate antibody levels [13]. This shows waning of antibodies after a period of 15-20 years. It has also been documented, in those vaccinated at younger age groups; outbreaks of rubella had noticed which emphasis the need for renewal opportunities for vaccination in older children and adolescence [22].

WHO declared that if seronegativity to Rubella among women even less than 10% will provide a chance of CRS in the future [21]. In our study, like many other serosurveillance studies in developing countries, the seronegative to Rubella in female population is between 10-20%. Henceforth in order to eliminate Rubella, in 2017 MR (Measles-Rubella) campaign was introduced in India, which target a wide group of children (9 months to 15 years), to receive an additional dose of the vaccine regardless of previous vaccination status or history of illness. Also, follow-up campaigns will be executed every 3-5 years which target children born after the last campaign and to sustain a high level of population immunity. This campaign leads to rubella elimination, which is defined as the absence of endemic rubella virus transmission in a defined geographical area for >12 months, as well as the absence of CRS cases associated with endemic transmission in the presence of a well performed surveillance system [23].

LIMITATION

The limitations of our study were that we could not reach 100% of the sample size since few students did not give consent.

FUTURE RECOMMENDATION

It is essential to magnify the study in both the sexes and in large number of samples in the age group of 15 years and above.

CONCLUSION

In our study, the seropositivity to Rubella was 85.52% and seronegativity was 14.48% among young female. This susceptibility rate will significantly lead to CRS in the future if not prevented appropriately. Also, the study concludes that immunisation of HCWs against rubella is an important step regardless of their vaccination status. There is a more chance of exposure to infection and also in transmission of infection in the hospital environment. Hence maintenance of immunity is an essential part of prevention and infection control scheme. The existing female population older than 15 years of age has to be focused. This can be done either by serosurveillance followed by vaccination or vaccination irrespective of their immune status of rubella. This could be a sensitive tool to reduce the risk for CRS in a population.

REFERENCES

[1] Forbes JA. Rubella: Historical aspects. American Journal of Diseases of Children. 1969;118(1):5-11.

[2] Valsan C, Rao T, Innati S, Raji P. Prevalence of rubella immunity in health carstudents. The Internet J of Infect Dis. 2008;7(2):1-3.

[3] Robertson SE, Featherstone DA, Gaeic-Dobo M, Hersh BS. Rubella and congenital rubella syndrome; Global update. Rev Panam Salud Publica. 2003;14(5):306-15.

[4] Valsan PV. Introducing rubella vaccine into the National Immunization schedule. IJMM. 2017;35(1):143-45.

[5] Dewan P, Gupta P. Burden of Congenital Rubella Syndrome (CRS) in India: A systematic review. Indian Pediatr. 2012;49(5):377-99.

[6] Velvizhi G, Sucilathangam G, Anna T. Seropositivity of anti-rubella antibodies among health care professionals. Indian J Appl Research. 2014;4:446-47.

[7] Vijayalakhsmi P, Anuradha R, Karthik P, Kalpana N, Meenakshi R, Lalitha P, et al. Rubella serosurvey at three Aravind eye hospitals in Tamilnadu, India. Bulletin of the WHO. 2004; 82 (4):259-262.

[8] Rajasundari TA, Keerthy C, Vijayalakhsmi P, Muthukkarupan V. Immune status of health care personnel & post vaccination analysis of immunity against rubella in an eye hospital. Indian J Med Res. 2006;124:553-58.

[9] Ravindra A, Belavendra A, Sushil K. Sample size estimation in prevalence studies. Indian J Pediatr. 2012;79(11):1482-88.

[10] Centers for Disease Control. Control and prevention of rubella: Evaluation and management of suspected outbreaks, rubella in pregnant women, and surveillance for congenital rubella syndrome. MMWR Morb Mortal Wkly Rep. 2001;50:1-23.

[11] Singh MP, Diddi K, Dogra S, Suri V, Subash V, Ratho Rk. Institutional outbreak of rubella in a health care centre in Chandigarh, North India. J Med Virol. 2010;82(2):341-44. https://doi.org/10.1002/jmv.21672.

[12] World Health Organisation. Report of a meeting on preventing congenital rubella syndrome: Immunization strategies, surveillance needs, Geneva, 12-14 January 2000. Geneva: World Health Organization; 2000. Chapter 4.4 Vellore, India experience with CRS surveillance, PP 28. WHO document WHO/V&B/00.10. http://www.who.int/iris/handle/10665/70566

[13] Arunkumar G, Vandane KE, Sathishkumar N. Prevalence of measles, mumps, rubella, varicella susceptibility among health science students in a University in India. Am J Ind Med. 2013;569(1):58-64. https://doi.org/10.1002/ajim.22046.

[14] Asari S, Deguchi M, Tahara K, Taniike M, Toyokawa M, Nishi IMT, et al. Seroprevalence survey of measles, rubella, varicella and mumps antibodies in health care workers and evaluation of a vaccination program in a tertiary care hospital in Japan. Am J Infect Control. 2003;31(3):157-62. https://doi.org/10.1067/mic.2003.16.

[15] Alp E, Cevahir F, Gokahmetoglu S, Demiraslan H, Doganay M. Prevaccination screening of health-care workers for immunity in measles, rubella, mumps and varicella in a developing country. What do we save? J Infect Public Health. 2012;5:127-32. https://doi.org/10.1016/j.jiph.2011.

[16] Aypak C, Bayram Y, Eren H, Altunsoy N, Berktas M. Susceptibility to measles, rubella, mumps and varicella-Zoster viruses among health care workers. J Nippon Med Sch. 2012;79(6):453-58. https://doi.orp/10.1272/jnms.79.453.

[17] Celikbas A, Ergonul O, Aksaray S, Tuygun N, Esener H, Tanir G, et al. Measles, rubella, mumps and varicella seroprevalence among health care workers in Turkey in prevaccination screening cost-effective? Am J Infect Control. 2006;34(9):583-87. https://doi.org/10.1016/j.ajic.2006.04.213.

[18] Gohil DJ, Kothari ST, Chaudhari AB, Gunale BK, Kulkarni PS, Deshmukh RA, et al. Seroprevalence of measles, mumps and rubella antibodies in college students in Mumbai, India. Viral Immunol. 2016;29(3):159-63. https://doi.org/10.1089/vim.2015.0070.

[19] Sharma H, Chowdhari S, Raina TR, Bhardwaj S, Namjoshi G, Parekh S. Sero-surveillance to assess immunity to rubella and assessment of immunogenicity and safety of a single dose of rubella vaccine in school girls. Indian J Community Med. 2010;35(1):134-37. doi: [10.4103/0970-0218.62575]

[20] Thayyil J, Kuniyil V, Moorkoth AP, Rao B, Selvam P. Prevalence of rubella – specific IgG antibodies in unimmunised young female population. J Family Med Prim Care. 2016;5(3):658-62. http://www.jfmpc.com/text.asp?2016/5/3/658/197311.

[21] Guidelines for surveillance of Congenital Rubella Syndrome and Rubella: Field Test Version May 1999, Geneva: Department of vaccines and Biologicals, World health Organization; 1999.

[22] Boulianne N, De Serres G, Ratnam S, Ward BJ, Joly JR, Duval B. Measles, Mumps and rubella antibodies in children 5-6 years after immunization effect of vaccine type and age at vaccination. Vaccine. 1995;13(16):1611-16.

[23] Introduction of Measles-Rubella vaccine (Campaign and Routine Immunization). National operational Guidelines 2017. Ministry of Health & Family welfare, Govt of India. Chapter 1, pp.01.

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ANNEXURE-1

Questionnaire

Title: Seroprevalence of Rubella Immunity (IgG antibody) among Female Health Care Workers of Our Hospital in Southern India

Name:

Age/Sex:

Area of living: urban/rural

Occupation:

Vaccination H/O of MMR: Yes/No

Past H/O fever with rash/ Lymphadenopahty: Yes/No