

Correspondence

Low rate of seropositivity (IgG) to mumps component in MMR vaccinees in Chennai, south India

Sir,

Mumps is an acute, highly contagious, systemic, communicable viral infection found throughout the world, characterized by parotitis of one or both salivary glands. Although it is generally believed that mumps virus is serologically monotypic, distinct genetic lineages of wild-type mumps viruses have been described and reported to be co-circulating globally¹. The introduction of MMR vaccine had led to a decline in the levels of measles, mumps and rubella infections. Recent reports suggest the re-emergence of mumps infections in the vaccinated populations². It is proposed that this re-emergence is due to the poor efficacy of the mumps vaccine strain and circulation of a heterologous strain different from the vaccine strain³. We have recently reported mumps infection in MMR vaccine recipients in India and identified genotype C rather than the vaccine strain (genotype N)⁴. There is a paucity of data regarding mumps infection in India, except for a few studies which have assessed the efficiency of MMR vaccine⁵⁻⁷. The present study was aimed to screen the rate of vaccine induced IgG seropositivity among healthy MMR vaccinees and to determine the peak antibody level.

This study was conducted between February 2011 and December 2012 in the Department of Microbiology, Dr. ALM institute of Basic Medical Sciences, Chennai, Tamil Nadu, India. MMR vaccinated healthy children, adolescents and adults aged 2 to 25 years were selected randomly from Sri Ramachandra Medical College & Research Institute and V. K. Nursing Home, Chennai, India. An informed written consent and details including name, sex, date of birth, status and date of MMR immunization, past history suggestive of measles, mumps or rubella infection were obtained. Only those subjects who received one dose (15th month) and two doses (15th month and 5th yr

of MMR vaccine were included in the study. Human ethical clearance was obtained from Sri Ramchandra Medical College & Research Institute and Dr. ALM PG Institute of Basic Medical Sciences as per the study protocol. Blood sample (3 ml) was collected from each study participant and serum was separated and stored at -86°C until use. Participants having a history of receiving prolonged steroid therapy, convulsions or epilepsy, having received another live vaccine within the last four weeks, those who received blood, plasma or immunoglobulin within the last three months, those diagnosed with malignancy or immunodeficiency diseases or those with a history of severe reactions to a previous dose of MMR vaccine were excluded from the study. Measles, mumps and rubella specific quantitative IgG EIA (Techno Genetics, Italy) was done to quantify MMR induced specific IgG antibody to confirm that they had been vaccinated. IgG antibody titres of > 115 mIU/ml for mumps, > 115 mIU/ml for measles and >15 IU/ml for rubella were defined as seropositivity⁴. Data were analyzed by means of One-way and Two-way ANOVA, non-parametric Brown-Forsythe test, $P < 0.05$ was considered significant, and GraphPad Prism 6, version 6.01 (GraphPad Software, Inc, USA) was used.

A total of 12 individuals who had received a single dose and 95 individuals who had received two doses of MMR vaccine participated in this study; four of the 95 were excluded because of a doubtful history of previous infection. The participants were subdivided into four age groups: 2-5, 6-12, 13-18 and 19-25 yr. Of the 103 samples, highest seropositivity (100%) was noticed for rubella. The lowest rate of seropositivity was found for mumps (49 & 83%, for two doses and one dose, respectively). Seropositivity to measles was intermediate (76 & 92%, for two doses and one dose, respectively) suggesting that there was variation

Table I. Seropositivity of MMR vaccine recipients

Age groups (yr)	Number (%) seropositive for mumps, measles and rubella in MMR vaccinees					
	Two dose MMR recipients					
	Mumps		Measles		Rubella	
6-12	M 18	4 (22)	M 18	11 (61)	M 18	18 (100)
	F 25	20 (80)	F 25	16 (64)	F 25	25 (100)
13-18	M 14	11 (79)	M 14	10 (71)	M 14	14 (100)
	F 9	7 (78)	F 9	7 (78)	F 9	9 (100)
19-25	M 19	2 (10)	M 19	19 (100)	M 19	19 (100)
	F 6	1 (17)	F 6	6 (100)	F 6	6 (100)
Total	17/51 (33)	28/40 (70)	40/51 (78)	29/40 (72)	51/51 (100)	40/40 (100)
Total = 91	45 (49)		69 (76)		91 (100)	
Single dose MMR recipients						
2-5	M 7	5 (71)	M 7	7 (100)	M 7	7 (100)
	F 5	5 (100)	F 5	4 (80)	F 5	5 (100)
Total = 12	10 (83)		11 (92)		12 (100)	
M, male; F, female						

in antibody responses to the three different viruses. The seropositivity as detected by the presence of IgG antibody to mumps virus was significantly lower ($P < 0.05$) among all the age groups, compared with measles and rubella (Table I). The percentage of MMR recipients who developed a protective range of mumps IgG after one dose and two doses of the vaccine was more among females (100 & 70%, respectively) than males (71 & 33%, respectively) but IgG against measles was more among males (100 & 78%, respectively) than females (80 & 72%, respectively) and equal (100%) for rubella IgG. The median concentration of IgG antibodies was evaluated in different age groups and the persistence of antibody to MMR vaccine was at its peak in the 6-12 yr age group and declined in the later age for mumps and measles (Table II).

Since December 2005, 110 (57%) of the 193 World Health Organization member States had included mumps vaccine in their national immunization programmes, by including the combined measles-

mumps-rubella (MMR) vaccine^{8,9}. MMR vaccine is not included in the Indian Immunization schedule and the Indian Academy of Pediatrics has suggested including two doses of an MMR vaccine in the immunization schedule¹⁰. In the last decade, mumps made a global resurgence irrespective of whether people were vaccinated with MMR or not. The failure of the available mumps vaccine in preventing disease transmission among populations with high two-dose vaccination coverage levels raises a question regarding the vaccine efficacy^{2,3,11}. In India, there are reports of non-adherence to the vaccination schedule which is alarming considering all the complications associated with mumps^{12,13}. In the present study, the presence of IgG antibody to mumps virus in a limited number of individuals was used as a measure of immunity against mumps in Chennai, India. The results showed that the MMR induced seropositivity to mumps was low which was similar to a report from Germany¹⁴. Our preliminary results also suggested absence of lifelong

Table II. Median concentration with range of IgG antibodies in MMR vaccinees

Age group (yr)	Mumps (mU/ml)	Measles (mIU/ml)	Rubella (IU/ml)
2 - 5	415 (925 - 0)	982 (2131 - 0)	110 (267 - 0)
6 - 12	475 (848 - 0)	1498 (1848 - 0)	302 (352 - 0)
13 - 18	422 (614 - 0)	1009 (1209 - 0)	298 (326 - 0)
19 - 25	410 (587 - 0)	803 (976 - 0)	293 (250 - 0)

protection and consequent susceptibility to infection. Further studies with a large number of MMR vaccinees are needed to confirm the decline of mumps and measles antibody levels over time after MMR vaccination, and the possibility of maintaining seroprotective antibody by additional doses during adulthood needs to be investigated.

Acknowledgment

Authors thank Dr. Padmasani Venkat Ramanan, Department of Pediatrics, Sri Ramachandra Medical College & Research Institute, Porur, Chennai and Dr Srinivasan V, Dr. Chitra S, V.K. Nursing Home, Valasaravakkam, Chennai, India for assistance in identifying the MMR recipients.

**Jeevan Malaiyan, Thatchayini Duraipandian,
Aparna Warriar & Thangam Menon***

Department of Microbiology, Dr. ALM PG
Institute of Basic Medical Sciences
University of Madras, Taramani
Chennai 600 113, India

*For correspondence:
thangam56@gmail.com

References

- World Health Organization. Mumps virus nomenclature update. *Wkly Epidemiol Rec* 2012; 87 : 217-24.
- Steven AR, Malen AL, Christian J, Cheryl Z, Laurie N, Bert KR, *et al*. Recent mumps outbreaks in vaccinated populations: No evidence of a immune escape. *J Virol* 2012; 86 : 615-20.
- Allwinn R, Zeidler B, Steinhagen K, Rohwäder E, Wicker S, Rabenau HF, *et al*. Assessment of mumps virus-specific antibodies by different serological assays: which test correlates best with mumps immunity? *Eur J Clin Microbiol Infect Dis* 2011; 30 : 1223-8.
- Jeevan M, Sambantham S, Thangam M. Characterization of mumps virus genotype C among the patients with mumps in India. *Indian J Med Microbiol* 2013; 31 : 290-312.
- Dubey AP, Banerjee S. Measles, mumps, rubella (MMR) vaccine. *Indian J Pediatr* 2003; 70 : 579-84.
- Sunil G, Shilpa KA, Shukla D, Ramachandran VG. Immune response to second dose of MMR vaccine in Indian children. *Indian J Med Res* 2011; 134 : 302-6.
- Raut SK, Kulkarni PS, Phadke MA, Jadhav SS, Kapre SV, Dhare RM, *et al*. Persistence of antibodies induced by measles-mumps-rubella vaccine in children in India. *Clin Vaccine Immunol* 2007; 14 : 1370-1.
- Chakravarti A, Yadav S, Berry N, Rastogi A, Mathur MD. Evaluation of serological status of rubella and mumps in children below five years. *Indian J Med Res* 1999; 110 : 1-3.
- Preeta KK, Deanna MKM, Gustavo HD, James PA, Nobia JW, Philip EG, *et al*. Seroprevalence of antibody to mumps virus in the US population, 1999-2004. *J Infect Dis* 2010; 202 : 667-74.
- Indian Academy of Pediatrics, Advisory Committee on Vaccines and Immunization Practices, Vashishtha VM, Kalra A, Bose A, Choudhury P, Yewale YN, *et al*. Indian Academy of Pediatrics (IAP) recommended immunization schedule for children aged 0 through 18 years, India 2013 and updates on immunization. *Indian Pediatr* 2013; 50 : 1095-108.
- Echevarria JE, Castellanos A, Sanz JC, Martinez de Aragon MV, Pena Rey I, Mosquera M, *et al*. Mumps virus genotyping: Basis and known circulating genotypes. *Open Vaccine J* 2010; 3 : 37-41.
- Immunization Schedule. Department of Public Health & Preventive medicine, Health and Family Welfare Department, Government of Tamil Nadu. Available from: <http://www.tnhealth.org/dphis.htm>, November 3, 2010.
- Geeta MG, Krishna Kumar P. Mumps - need for urgent action. *Indian Pediatr* 2004; 41 : 1181-2.
- Poethko-Müller C, Mankertz A. Seroprevalence of measles, mumps and rubella-specific IgG antibodies in German children and adolescents and predictors for seronegativity. *PLoS One* 2012; 7 : e42867.