Infection, Disease & Health (2016) 21, 192–196

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.journals.elsevier.com/infection-disease-and-health/

Research paper

Risk factors and clinical profile of measles infection in children in Singapore

Vikram Naga Vemula [a,*], Ling Li [b], Koh Cheng Thoon [c,e,f], Chia Yin Chong [c,e,f], Nancy Wen Sim Tee [d,f], Matthias Maiwald [d,f,g], Natalie Woon Hui Tan [c,e,f,h]

[a] Department of Paediatrics, KK Women's and Children's Hospital, Singapore
[b] Infection Control Unit, KK Women's and Children's Hospital, Singapore
[c] Infectious Diseases Service, Department of Paediatrics, KK Women's and Children's Hospital, Singapore
[d] Department of Pathology and Laboratory Medicine, KK Women's and Children's Hospital, Singapore
[e] Yong Loo Lin School of Medicine, National University of Singapore, Singapore
[f] Duke-National University of Singapore Medical School, Singapore
[g] Department of Microbiology, Yong Loo Lin School of Medicine, National University of Singapore, Singapore
[h] Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore

Received 2 October 2016; received in revised form 28 November 2016; accepted 28 November 2016

KEYWORDS
Measles;
Risk factors;
Children

Abstract *Background:* Measles is a highly contagious disease with potentially severe complications. A marked increase in the number of cases hospitalized for measles was observed in children in Singapore between December 2013 and February 2014. This study examined the clinical epidemiology and risk factors of children admitted for measles.
Methods: A retrospective study was conducted between January 2013 and May 2014 that included all children admitted for measles to KK Women's and Children's Hospital (KKH). Patients were identified from the KKH laboratory database, based on positive detection of measles virus RNA.
Results: A total of 68 children were identified in this study, of which 63.2% were male, 80.9% were <24 months and 54.4% <12 months of age (range: 3–130 months). The majority (89.7%) had not received measles, mumps and rubella (MMR) vaccination and 10.3% had only 1 dose. In the peak period from December 2013 to February 2014, there were 33 children with measles identified; out of which, 17 (51.5%) had a travel history to countries with documented measles outbreaks (Philippines, 52.9%; Indonesia, 35.3%). This was significantly higher compared to children admitted for measles during other months (OR 5.13, 95% Confidence Interval, CI, 1.686–15.625). Common symptoms of measles included fever (100%), rash (92.6%) and cough (92.6%). The most common complication was pneumonia (17.6%). All children recovered well. Infants had a lower risk than children >12 months of developing lymphopenia (OR, 0.029, 95% CI, 0.003–0.244) and conjunctivitis (OR 0.294, 95% CI 0.103–0.843) but a higher risk of developing diarrhea (OR 3.248, 95% CI 1.125–9.379).

* Corresponding author. 100, Bukit Timah Road, Singapore 229899, Singapore.
E-mail address: nagavikram.vemula@mohh.com.sg (V.N. Vemula).

http://dx.doi.org/10.1016/j.idh.2016.11.004

Conclusion: Apart from absent or incomplete MMR vaccination, risk factors for measles infection in children included age <24 months (80.9%) and travel history to countries with documented measles outbreaks. Continued cross border surveillance of measles and, timely administration of MMR vaccinations are therefore essential.

Highlights

- A retrospective study to understand the risk factors and clinical profile of measles infection in children in Singapore.
- Risk factors included age <24 months, absent or incomplete MMR vaccination and travel to countries with measles outbreaks.
- Continued cross border surveillance of measles and, timely administration of MMR vaccinations are therefore essential.

Introduction

Measles is an acute highly infectious disease that is spread by airborne transmission and has potentially severe complications [1]. The measles virus belongs to the genus *Morbillivirus* [2] within the family *Paramyxoviridae*. Clinical features indicative of measles include rash lasting at least 3 days, fever for at least 1 day, with temperatures often above >40 °C and at least one of the three Cs: cough, coryza or conjunctivitis [3].

Before the introduction of the measles vaccine, the measles virus caused millions of deaths worldwide [4]. However, routine vaccination in many countries have caused measles to become relatively uncommon. In Singapore, with the successful implementation of the National Childhood Immunization Programme using the monovalent measles vaccine, measles incidence declined from 88.5 cases per 100,000 in 1984 to 6.9 per 100,000 in 1991 [5]. Resurgences of measles were observed in 1992, 1993 and 1997. A 'catch-up' vaccination program using the trivalent measles, mumps and rubella (MMR) vaccine was conducted in 1997, followed by introduction of the two-dose vaccination schedule in January 1998, resulting in the incidence of measles declining sharply to 2.9 per 100,000 in 1998. Vaccination coverage was maintained at 95% for the first dose and 92—94% for the second dose. To further eliminate sporadic cases of measles, the national immunization schedule was amended in December 2011 to bring forward the first MMR vaccine dose from 15 to 18 months to 12 months of age, and the second dose from 6 years to 15—18 months. Presently, the majority of the cases in Singapore occur as single cases or in the form of small clusters of endemic or import-related cases [5].

A marked increase in number of measles cases was observed in children admitted to KK Women's and Children's Hospital (KKH), Singapore between December 2013 and February 2014. Our study examined the clinical epidemiology, risk factors and clinical profile of children admitted for measles.

Methods

This is a single-institution, retrospective study of patients with measles infection who were admitted to KKH between January 2013 and May 2014. Patients were identified from the KKH laboratory database, based on positive detection of measles virus RNA.

After identifying the patients, information was gathered on the demographics (age, gender, positive travel history to areas with documented measles outbreaks, and whether they had previously received MMR vaccination), clinical presentation (including history, physical examination), investigations, treatment and outcome of the patients. A positive travel history for measles was defined as measles resulting from exposure to measles virus during travel outside Singapore 7—21 days before rash onset, and rash onset occurring within 21 days of re-entering Singapore, with no known exposure to measles in Singapore during that time. A nosocomial case of measles was defined as any patient with measles who had contact with a confirmed measles case in the hospital 7—21 days before rash onset and had no other source identified. Pneumonia was diagnosed by chest X-ray, based on the detection of pulmonary infiltrate or consolidation. Analysis was done using the SPSS software version 17.0 software (IBM, Armonk, New York, USA). Differences between categorical variables were analysed for statistical significance using the chi-square test and Fisher's exact test. Differences between continuous variables were analysed for statistical significance using Mann—Whitney U test. P values are considered statistically significant at <0.05. This study was approved by the Singhealth institutional review board.

Results

Demographics

A total of 68 children with measles were identified during the study period. Table 1 shows the demographic