

## Original Article

# Clinical Analysis of 220 Infants Less Than 12 Months Old with Measles

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### Abstract

**Aims:** To observe the clinical characteristics of infant measles and strengthen its prophylactic methods. **Materials and Methods:** 220 cases diagnosed as infant measles were enrolled in the Central Hospital of Jinhua City in China from January 2008 to August 2015. Enzyme-linked immunosorbent assay (ELISA) kit was used to test specific immunoglobulin (Ig)M against measles. Routine blood tests, blood biochemistry and myocardial enzymes using venous blood were done for the 220 measles patients. **Results:** All cases had fever fluctuating between 37.5°C to 41°C and mucosal plaques (Koplik's spots) on the oral mucosa. In all cases, measles IgM antibodies were found to be positive after eruption. 80.46% of patients were <8 months of age. Of the 138 cases (62.73%, 138/220) with pneumonia complications, there were 32 cases of severe pneumonia, 30 cases accompanied with diarrhoea, 25 cases with acute laryngitis, 16 cases with mouth ulcers, 5 cases with febrile seizures, and 4 cases with toxic encephalopathy. In this patient group, complications were more prevalent than in the older children group. A total of 210 subjects were cured, the clinical condition of 7 cases improved and 2 individuals gave up treatment and were discharged from hospital due to expensive treatment charge. One patient died. The clinical manifestations were typical, with a short prodromal period and several complications. **Conclusions:** The present study showed that in our population, measles tended to affect the younger age, and that pneumonia was the most common complication. Revaccination of women of childbearing age against measles might reduce the incidence of measles in infants.

**Key words** Complication; Infant; Measles; Pneumonia

### Introduction

Measles is an acute exanthematous infectious respiratory disease caused by the measles virus and is a major threat to

the health of children.<sup>1</sup> Since introduction of the live attenuated measles vaccine in 1965 in China, the incidence of measles has reduced appreciably. Nevertheless small-scale epidemics have continued to occur. According to the Chinese National Vaccination Schedule, the first measles vaccine was administered at 8 months of age, the second between 1.5 to 2 years, and the third booster vaccine at 7 years. To understand the clinical characteristics of infant measles and strengthen its prevention and control, 220 cases of infant measles treated in the Central Hospital of Jinhua City from January 2005 to August 2012 are reported here.

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### Clinical Data

#### General Information

From January 2008 to August 2015, 220 cases of infant measles were treated at Jinhua Central Hospital. The

diagnosis was based on the criteria set in the seventh edition of *Practical Pediatrics* by Futang Zhu.<sup>2</sup> The breakdown of cases was 90 cases in 2008, 22 in 2009, 16 in 2010, 48 in 2011, 19 in 2012, 7 in 2013, 5 in 2014 and 13 in 2015. Of these 220 cases, there were 157 boys and 63 girls (ratio, 2.49:1). Eighteen cases (8.18%) were 0-3 months old (minimum was 21 days old), 65 cases were between 3-6 months old (29.55%), 94 cases were between 6-8 months old (42.73%), and 43 cases were between 8-12 months old (19.54%). The distribution of measles outbreaks was: 61 cases (27.73%) from January to March, 98 cases (44.55%) from April to June, 33 cases (15.0%) from July to September, and 28 cases (12.72%) from October to December. A total of 83 cases were from city/urban areas, 72 cases were from rural areas and 65 were from the areas that were none of the above. Seven subjects aged 8-12 months had been vaccinated within 1 day to 3 days, but the others had not been vaccinated. A total of 192 mothers had accepted measles vaccination in their childhood, and 28 mothers had not. Nine mothers of these 220 children with measles had measles during the same period. The general data were showed in Table 1.

**Table 1** General data of 220 infants with measles

Variables	Number of cases	Rate(%)
Sex		
Male	157	71.36
Female	63	28.64
Age		
<3 months	18	8.18
3~6 months	65	29.55
6~8 months	94	42.73
8~12 months	43	19.54
Distribution of outbreaks		
January to March	61	27.73
April to June	98	44.55
July to September	33	15.00
October to December	28	12.72
Area		
City/urban	83	37.73
Rural areas	72	32.73
Transient population	65	29.54
Maternal vaccination		
Vaccination	192	87.27
N/A	28	12.73

### Clinical Manifestations

All cases had fever at the beginning of the disease, with body temperature fluctuating between 37.5°C to 41°C and mucosal plaques (Koplik's spots) on the oral mucosa. They had typical rashes of measles appearing 2-5 days after fever. Pigments subsided in all cases after the disappearance of the measles rash. In these cases, 13 were haemorrhagic measles with worsened disease during measles and a body temperature between 39°C and 41°C. Five had seizures (2.27%) and 30 had gastrointestinal symptoms (13.64%) (Table 2). In 9 cases, both mother and child had measles (4.09%); 3 cases aged 0-3 months and 6 cases aged 3-6 months, and all their mothers had been vaccinated with measles vaccine during their childhood.

### Laboratory Tests

In all cases, measles immunoglobulin M antibodies were found to be positive after eruption; an enzyme-linked immunosorbent assay (ELISA) kit (Jiangsu Huaguan Biological Products Co., Ltd., Jiangsu, China) was used following manufacturer instructions. Routine blood tests, blood biochemistry and myocardial enzymes using venous blood were done for the 220 measles patients. In these cases, 52 cases had a white blood cell (WBC) count  $>12.0 \times 10^9/L$ , 35 cases  $<4.0 \times 10^9/L$ , and 133 cases within the normal range. A total of 189 cases had increased numbers of lymphocytes, 56 with increased levels of C-reactive protein ( $73 \pm 22$  mg/L), 82 with increased levels of serum alanine aminotransferase ( $241 \pm 51$  U/L), 130 with increased levels of aspartate aminotransferase ( $239 \pm 37$  U/L), 90 with increased levels of lactate dehydrogenase ( $651 \pm 72$  U/L), 194 with increased levels of creatine kinase up to  $379 \pm 68$  U/L, and 110 with increased levels of hydroxybutyrate catalase up to  $357 \pm 83$  U/L (Table 2).

### Complications

In the chest radiographs of 220 children, 138 cases had pneumonia, 45 cases had bronchitis and 27 cases had normal lungs. Of the 138 cases with pneumonia complications, there were 32 cases of severe pneumonia, 30 cases with diarrhoea, 25 cases with acute laryngitis, 16 cases with mouth ulcers, 5 cases with febrile seizures, and 4 cases with toxic encephalopathy (Table 2).

### Treatment and Prognosis

Integrated treatment was applied: intravenous antibiotic drips, such as cefradine, cefotaxime and ceftriaxone, to

cover for potential bacterial co-infection. Use of antipyretic treatment such as oral ibuprofen at dose of 5-10 mg/kg or acetaminophen at dose of 10-15 mg/kg during the high-temperature period. Also, dehydrating agents such as mannitol at dose of 0.5-1.0 g/kg, every 6-8 hours and methylprednisolone at dose of 1 mg/kg, every 12 hours were used for those with toxic encephalopathy. For those with severe pneumonia, oxygen, diuretics such as furosemide at the dose of 0.5-1 mg/kg, every 12 hours and intravenous gamma-globulin were given. The gamma-globulin was administered at the dose of 1 g/kg for 2 days. Tracheal intubation was performed for respiratory failure and supported by mechanical ventilation, the ventilation model was pressure control ventilation and protective lung ventilation strategy was carried out for the decreased pulmonary compliance. 1 mg budesonide and oxygen-driven atomising inhalation was added to treat any concurrent laryngitis 3 times every day. A total of 210 subjects were

cured, conditions of 7 cases were improved and 2 individuals were voluntarily discharged from hospital due to expensive treatment charge. One patient died despite active treatment because of severe pneumonia, respiratory failure and heart failure (Table 2).

## Discussion

Of the 220 cases of measles, infants under 8 months of age comprised 80.46% of the study cohort. The clinical manifestations were typical, with a short prodromal period and several complications. In this patient group, pneumonia was the most common complication reaching 62.73% (138/220), which was similar to the report by Ie Roux.<sup>3</sup> Complications were most likely related to the large number of subjects under 8 months of age, their immunocompromised status and strong virulence of the measles virus.<sup>4</sup> The pyrogenic period was long and high fever was common, in which 5 cases had hyperpyretic convulsions. Koplik's spots lasted for a long time, and were often misdiagnosed as infection due to *Candida albicans*. Rashes could be haemorrhagic and could also be commonly misdiagnosed as roseola infantum, scarlet fever or other measles-like diseases.<sup>5,6</sup> During treatment at the onset of pneumonia and acute laryngitis, because of the widely experienced dyspnoea and cyanosis, the attending physician could misdiagnose without careful checking for rashes. There were several cases with combined hepatic dysfunction<sup>7</sup> and increased levels of myocardial enzymes and the recovery time was long, beyond 3 weeks.<sup>8,9</sup>

Recently, the incidence of measles in China has changed appreciably with regard to the age at which it strikes individuals. The incidence of measles in infants <1 year of age has increased. In the present study, 80.46% of patients were <8 months of age and the youngest was 21 days of age, which suggested that the incidence of measles tends to affect those of younger age.<sup>10,11</sup> It has been reported that the prevalence of positive measles antibodies in the body is only 7.14% at 8 months before vaccination. This finding suggests that most infants lose their placenta-transferred antibodies by the time they are 8 months old and that passive immunisation is not possible in some babies due to intrusion of the measles virus after birth.<sup>12</sup> Babies under 8 months of age are entirely dependent upon their placenta-transferred antibodies to resist invasion by the measles virus because they have not been vaccinated against measles.<sup>13</sup> In the present study, both mother and child had measles in 9 cases, and these mothers had previously received the measles

**Table 2** Clinical data of 220 infants with measles

Variables	Number of cases	Rate (%)
Clinical manifestations		
Fever	220	100
Koplik's spots	220	100
Pigments	220	100
Haemorrhagic measles	13	5.91
Gastrointestinal symptoms	30	13.64
Seizure	5	2.27
Laboratory tests		
WBC >12.0x10 <sup>9</sup> /L	52	23.64
WBC <4.0x10 <sup>9</sup> /L	35	15.91
Normal WBC	133	60.45
C-reactive protein (73±22 mg/L)	56	25.45
Alanine aminotransferase (241±51 U/L)	82	37.27
Aspartate aminotransferase (239±37 U/L)	130	59.09
Lactate dehydrogenase (651±72 U/L)	90	40.91
Creatine kinase up to 379±68 U/L	194	88.18
Hydroxybutyrate catalase up to 357±83 U/L	110	50
Chest X-ray		
Pneumonia	138	62.73
Bronchitis	45	20.45
Normal lungs	27	12.27
Treatment and prognosis		
Cured	210	95.45
Improved	7	3.18
Voluntarily discharged	2	0.91
Death	1	0.45

vaccine during childhood and did not previously develop measles. It has been reported that, if a mother receives the measles vaccine again before pregnancy, the measles antibody levels of cord blood of her baby will be significantly higher than those of babies of mothers without revaccination against measles.<sup>14-16</sup> Mao et al reported that measles antibody seroprevalence was 95.9% in 2154 women of child-bearing age,<sup>17</sup> which was consistent with our result that there were 9 mothers and their children infected with measles (4.09%) although the mothers had been inoculated with 2 doses measles vaccine during childhood. It has been recommended that women at childbearing age should receive revaccination against measles before pregnancy. This action could not only improve the measles antibody levels of women of childbearing age, but could also improve placenta-transferred antibody levels to help reduce the incidence of measles in infants.

The local practice in mainland of China is a 2-dose measles containing vaccine programme of the 1st dose at 8 months and a 2nd dose between 18-23 months. While in other territories like Hong Kong, USA and UK, the 1st dose is given at 1 to 1.5 years while the 2nd dose is given at 3-6 years.<sup>18-20</sup> Vaccine strategies often require strong support from government and healthcare organisations, as well as tailored to culturally appropriate local approaches to optimise outcomes. In the Chinese mainland, the government schedules the measles vaccine for 8 months old, which maybe based on waning of the specific antibodies from the mother. Successful immunisation programmes not only result from high vaccine effectiveness, but also result from local government. It is a great and heavy burden for the inoculation of more than 1.4 billion people, which is all paid by the government. The present study analysed the measles babies under 12 months. The incidence of babies in the 0-3 month age group was the lowest with 8.18%, which might due to the protective antibody from the measles vaccinated mothers. After the inoculation of measles for 8-month old babies, the incidence dropped from 42.73% (6-8 months) to 19.54% (8-12 months), which indicated that the first dose at 8 month could be counted as a valid dose. Considering of the differences of the Chinese mainland measles vaccination from Hong Kong, USA and UK, further vaccine effectiveness study should be performed to explore the pros and cons of administering the 2nd dose at 18-23 months versus giving it later in life.

In summary, pneumonia was the most dangerous and the most common complication of measles infection. As the incidence of measles tends to affect the younger age group of less than 8 months old, we suggest that revaccination

against measles for women at childbearing age might reduce the incidence of measles in infants, especially for infants less than 8 months old.

## Declaration of Interest

None.

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