Measles

(Rubeola, Hard measles, Red measles, Morbilli)

Manitoba Health
Public Health

Communicable Disease Control Unit

Case Definition

Confirmed Case: Laboratory confirmation in the absence of recent immunization (one to 14 days) with measles containing vaccine:

1. detection of measles virus from urine or throat/nasopharyngeal swabs;

   OR

2. significant rise in measles-specific antibody titre between acute and convalescent sera;

   OR

3. positive serologic test for measles IgM antibody using a recommended assay.

If the clinical and epidemiological presentations are inconsistent with a diagnosis of measles, IgM results must be confirmed by additional testing (e.g., 1 or 2 above).

Clinical Case: Clinically compatible illness[1] in a person who is epidemiologically linked to a laboratory-confirmed case.

[1] clinical illness includes all of the following symptoms:

- temperature of 38.3°C or greater;
- cough, coryza or conjunctivitis;
- generalized maculopapular rash for at least three days (following temperature and cough, coryza or conjunctivitis).

Suspected clinical case: Meets criteria for clinical illness except rash not present for three days.

Reporting Requirements

- Positive measles IgM, four-fold rise in antibody titres or viral culture are reportable by laboratory.
- Confirmed and suspect clinical cases are reportable by attending health care professional.

Clinical Presentation/Natural History

An acute, highly communicable viral disease with prodromal fever, conjunctivitis, coryza, cough and Koplik spots on the buccal mucosa. A characteristic red, blotchy rash appears on the third to seventh day, beginning on the face, becoming generalized. It lasts four to seven days, and sometimes ends in brawny desquamation. Leukopenia is common. The disease is more severe in infants and adults than in children. Infection during pregnancy leads to an increased frequency of miscarriage and prematurity. Complications may result from viral replication or bacterial superinfection, and include otitis media, pneumonia, laryngotracheobronchitis (croup), diarrhea and encephalitis.

In the United States, death from measles has occurred at a rate of about 2 to 3/1,000 cases in recent years; deaths occur mainly in children under five years of age, primarily from pneumonia and occasionally from encephalitis. Measles is a more severe disease in the very young and in malnourished children, in whom it may be associated with hemorrhagic rash, protein-losing enteropathy, otitis media, oral sores, dehydration, diarrhea, blindness and severe skin infections. Children with clinical or subclinical vitamin A deficiency are at particularly high risk. The case-fatality rates in developing countries are estimated to be 3-5% globally, but are commonly 10-30% in some localities. Both acute and delayed mortality in infants and children has been documented. In children who are borderline nourished, measles often precipitates acute kwashiorkor and exacerbates vitamin A deficiency, leading to blindness. Subacute sclerosing panencephalitis (SSPE) develops very rarely (about 1/100,000) several years after infection, as a late sequela; over 50% of SSPE cases were diagnosed with measles in the first two years of life.

Etiology

Measles virus, a member of the genus Morbillivirus of the family Paramyxoviridae.

Epidemiology

Reservoir and Source: Humans

Transmission: Airborne by droplet spread, direct contact with nasal or throat secretions of infected persons, and, less commonly, by articles freshly soiled with nose and throat secretions. Measles is one of the most highly communicable infectious diseases, and a herd immunity of 94% may be needed to interrupt community transmission.

Occurrence:

General: Prior to widespread immunization, measles was common in childhood. Ninety per cent of people had been infected by age 20 and few went through life without an attack. Measles was endemic in large metropolitan communities, attaining epidemic proportion about every second or third year. In smaller communities, outbreaks tended to be more widely spaced and somewhat more severe. With longer intervals between outbreaks, as in the Arctic and some islands, measles outbreaks often involved a large proportion of the population with a high case-fatality rate. With effective childhood immunization programs, measles cases in the United States, Canada and other countries (e.g., Finland, the former Czechoslovakia) have dropped by 99% and occur in persons too young to be immunized or are generally deferred to older age groups.

In the United States, there was a marked increase in measles incidence during 1989-1991. The majority of cases occurred in non-immunized children, including almost 25% of cases in babies under 15 months of age (the previously recommended age for immunization). Non-immunized inner-city preschool children were a major contributing factor in this epidemic. Also, cases occurred among non-immunized children in schools and among those with vaccine failures in the highly immunized school-aged (including high school and college-level) populations. Sustained outbreaks have occurred in immunized school populations among the 2-5% who failed to seroconvert after one dose of vaccine and, in one instance, when waning vaccine-induced immunity was documented. In temperate climates, measles occurs primarily in the late winter and early spring.

Canada: In 1999, 38 cases were reported. Large outbreaks occurred in British Columbia and Alberta in 1997. In B.C., over 300 cases occurred primarily in post-secondary students or young adults not targeted in the 1996 grade one to 12 mass measles immunization campaign. In Alberta, at least 206 cases occurred primarily in school aged children (median age 13 years).

Manitoba: The last large outbreak occurred in 1986 with greater than 3,000 cases. One case of measles was reported in each of 1993 and 1994, with no additional cases reported until 1999 (one case).

Incubation Period: About 10 days, varying from seven to 18 days from exposure to onset of fever, usually 14 days until rash appears; rarely longer or shorter. Immune Serum Globulin (ISG), given for passive protection later than the third day of the incubation period, may extend the incubation instead of preventing disease.

Susceptibility and Resistance: All persons who have not had the disease or who have not been successfully immunized are susceptible. Acquired immunity after illness is permanent. Infants born to mothers who have had the disease are immune for approximately the first six to nine months or more, depending on the amount of residual maternal antibody at the time of pregnancy and the rate of antibody degradation. Maternal antibody interferes with response to vaccine. Immunization with one dose results in seroconversion of about 95%; re-immunization may increase immunity levels as high as 99%. Children born to mothers with vaccine-induced immunity receive less passive antibody, and these infants may become susceptible

to measles and require measles immunization at an earlier age.

Period of Communicability: From slightly before the beginning of the prodromal period to four days after appearance of the rash; minimal after the second day of rash. The vaccine virus has not been shown to be communicable.

Diagnosis

See definition for confirmed case. When attempting to diagnose infection by the presence of IgM, a specimen should ideally be taken three to seven days after rash onset (at most 28 days after rash onset). It should be tested for rubella and parvovirus IgM as well. If a specimen taken earlier than three days after rash onset is negative for measles, parvovirus and rubella IgM, a second specimen taken after three days should be drawn. Both false positive and false negative measles IgMs can occur.

Infection can also be diagnosed through use of acute and convalescent sera, although this has the disadvantage of taking more time. Serum collected no later than seven days after the onset of rash is tested simultaneously with a follow-up specimen taken 10 to 20 days later, with a four-fold or greater rise in IgG being diagnostic. The follow-up specimen can also be tested for IgM.

When investigating a sporadic case, a urine specimen, and/or nasopharyngeal or throat swab should be obtained for viral isolation. The swab should be obtained within four days after the onset of rash. Since the virus is cell associated, an attempt should be made to collect epithelial cells. Swabs should be placed in a tube containing 2-3 ml of viral transport medium. If collecting urine, 50 sterile ml within seven days after onset of rash is required. **All culture specimens should be transported to Cadham Provincial Laboratory as soon as possible on ice at 4°C.**

All lab specimens should include date of fever and rash onset.

Key Investigations

- Immunization history including date and type of vaccine if known.
- Identification and appropriate follow-up of susceptible contacts.

Control

Management of Cases:

Treatment:

- No specific treatment is available

Public Health Measures:

- Persons with measles should be kept out of schools, universities and workplaces for four days after appearance of the rash.
- In hospitals, Airborne precautions from onset of catarrhal stage of the prodromal period through fourth day of rash reduces the exposure of other patients at high risk. Immunocompromised patients should be isolated for the duration of their illness.

Management of Contacts:

- Public health nurses will contact all reported cases to establish a list of exposed persons with special attention to susceptible persons who are pregnant, immunocompromised or between six and 12 months of age who may be considered for ISG.
- A contact is someone who shared the same airspace (no minimum length of time) during the infectious period. Examples of exposure situations where contacts should be identified, include home, school, day care, school bus, doctor's office and emergency department. Airline passengers should also be considered for tracing if this can be done soon enough (a Canadian protocol has not been developed; MOHs should have a copy of American guidelines).

- Susceptible contacts are persons born in 1970 or later who **do not meet one of the following criteria:**
  - received at least one dose of live measles vaccine after 12 months of age;†
  - have serological evidence of immunity;
  - have medical records from a previous illness documenting that they met the criteria for either a confirmed case or a clinical case as defined above.

    † Persons born in 1985 or later, who have not received two doses of measles-containing vaccine, will normally be considered susceptible, based on a catch-up program and changes to the childhood immunization schedule that occurred in 1996. Depending on the number of cases, their age and immunization histories, a decision may be made by the Public Health Branch, in consultation with an Outbreak Response Team, to consider older persons, without two doses of live vaccine, as susceptible.
- High-risk susceptible contacts, who meet one or more of the following criteria, should receive immune serum globulin (ISG):
  - immunocompromised;
  - pregnant;
  - have a valid contraindication to the receipt of measles vaccine;
  - between six and 12 months of age (unless vaccine can be given within 72 hours of exposure).*

    * Children given vaccine must receive two additional doses of measles vaccine after 12 months of age, at least one month apart. Children less than six months of age are assumed to be protected by maternal antibodies. If this is not the case, they too should be given ISG.
- ISG should be administered within six days of exposure. The dose is 0.25 ml/kg (0.11 ml/lb) up to a maximum of 15 ml. For immuno-compromised persons, 0.5 ml/kg is given, up to a maximum of 15 ml. Live measles vaccine should be given six to seven months later to those for whom vaccine is not contraindicated.
- Other susceptible contacts, who do not have contraindications to measles vaccine, should be immunized as soon as possible. Immunization within 72 hours of exposure may prevent disease.
- Susceptible persons attending day cares, schools, colleges, universities and workplaces where a case has occurred who have not received ISG or vaccine, should be excluded until two weeks after the onset of last known case.
- In hospitals, susceptible contacts should be discharged if possible before the fifth day after first exposure. Otherwise, place on Airborne precautions from day five after first exposure to day 21 after last exposure.

Management of Outbreaks

- Control of school-based outbreaks using immunization of students and staff has proven difficult because measles is spread rapidly.
- Management of outbreaks may require province-wide mass immunization campaigns for selected age ranges. This will be determined by the Public Health Branch, in consultation with an Outbreak Response Team.

Preventive Measures:

- Immunization of all children at one and five years of age with MMR vaccine.
- Children born 1985 or later should have received a second dose of measles vaccine. Those who missed this dose can be given vaccine as opportunities arise.