ACCESS Medicine

Kaplan Medical Center

Access Provided by:

SILVERCHAIR INFORMATION SYSTEMS

Chapter 205: Measles (Rubeola)

Kaitlin Rainwater-Lovett; William J. Moss

DEFINITION

Measles is a highly contagious viral disease that is characterized by a prodromal illness of fever, cough, coryza, and conjunctivitis followed by the appearance of a generalized maculopapular rash. Before the widespread use of measles vaccines, it was estimated that measles caused >2 million deaths worldwide each year.

GLOBAL CONSIDERATIONS

Remarkable progress has been made in reducing global measles incidence and mortality rates through measles vaccination. In the Americas, intensive vaccination and surveillance efforts—based in part on the successful Pan American Health Organization strategy of periodic nationwide measles vaccination campaigns (supplementary immunization activities, or SIAs)—and high levels of routine measles vaccine coverage interrupted endemic transmission of measles virus. The World Health Organization's (WHO's) Region of the Americas was declared to have eliminated measles in September 2016—the first region in the world to do so. In the United States, high-level coverage with two doses of measles vaccine eliminated endemic measles virus transmission in 2000. Progress also has been made in reducing measles incidence and mortality rates in sub-Saharan Africa and Asia as a consequence of increasing routine measles vaccine coverage and provision of a second dose of measles vaccine through mass measles vaccination campaigns and childhood immunization programs. From 2000 to 2019, estimated global measles deaths decreased 62%, from 539,000 (95% confidence interval [CI], 357,200–911,900) to 207,500 (95% CI, 123,100–472,900). Measles vaccination prevented an estimated 25.5 million deaths over this period. However, a global measles resurgence in 2019 led to the loss of measles elimination status in the Region of the Americas and threatened elimination in the United States, highlighting the continual risk. In 2019, the 1282 measles cases reported in the United States were the highest since 1992.

The Measles and Rubella Initiative, a partnership led by the American Red Cross, the United Nations Foundation, UNICEF, the U.S. Centers for Disease Control and Prevention (CDC), and the WHO, is playing an important role in reducing global measles incidence and mortality rates. Since its inception in 2001, the Initiative has provided governments and communities in 88 countries with technical and financial support for routine immunization activities, mass vaccination campaigns, and disease surveillance systems.

ETIOLOGY

Measles virus is a spherical, nonsegmented, single-stranded, negative-sense RNA virus and a member of the *Morbillivirus* genus in the family Paramyxoviridae. Measles was originally a zoonotic infection, arising from animal-to-human transmission of an ancestral morbillivirus thousands of years ago, when human populations had attained sufficient size to sustain virus transmission. Although RNA viruses typically have high mutation rates, measles virus is considered to be an antigenically monotypic virus; i.e., the surface proteins responsible for inducing protective immunity have retained their antigenic structure across time and distance. The public health significance of this stability is that measles vaccines developed decades ago from a single strain of measles virus remain protective worldwide. Measles virus is killed by ultraviolet light and heat, and attenuated measles vaccine viruses retain these characteristics, necessitating a cold chain for vaccine transport and storage.

EPIDEMIOLOGY

Measles virus is one of the most highly contagious directly transmitted pathogens. Outbreaks can occur in populations in which <10% of persons are susceptible. Chains of transmission are common among household contacts, school-age children, and health care workers. There are no latent or persistent measles virus infections that result in prolonged contagiousness, nor are there animal reservoirs for the virus. Thus, measles virus can be

Downloaded 2024-2-22 7:33 A Your IP is 154.59.125.153
Chapter 205: Measles (Rubeola), Kaitlin Rainwater-Lovett; William J. Moss

©2024 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

maintained in human populations only by an unbroken chain of acute infections, which requires a continuous supply of susceptible individuals. Newborns become susceptible to measles virus infection when passively acquired maternal antibody is lost; when not vaccinated, these infants account for the bulk of new susceptible individuals.

Endemic measles has a typical temporal pattern characterized by yearly seasonal epidemics superimposed on longer epidemic cycles of 2–5 years or more. In temperate climates, annual measles outbreaks typically occur in the late winter and early spring. These annual outbreaks are probably attributable to social networks facilitating transmission (e.g., congregation of children at school) and environmental factors favoring the viability and transmission of measles virus. Measles cases continue to occur during interepidemic periods in large populations, but at low incidence. The longer epidemic cycles occurring every several years result from the accumulation of susceptible persons over successive birth cohorts and the subsequent decline in the number of susceptibles following an outbreak.

Secondary attack rates among susceptible household and institutional contacts generally exceed 90%. The average age at which measles occurs depends on rates of contact with infected persons, protective maternal antibody decline, and vaccine coverage. In densely populated urban settings with low-level vaccination coverage, measles is a disease of infants and young children. The cumulative incidence can reach 50% by 1 year of age, with a significant proportion of children acquiring measles before 9 months—the age of routine vaccination in many countries, in line with the schedule recommended by the WHO's Expanded Programme on Immunization. As measles vaccine coverage increases or population density decreases, the age distribution shifts toward older children. In such situations, measles cases predominate in school-age children. Infants and young children, although susceptible if not protected by vaccination, are not exposed to measles virus at a rate sufficient to cause a heavy disease burden in this age group. As vaccination coverage increases further, the age distribution of cases may be shifted into adolescence and adulthood; this distribution is seen in measles outbreaks in the United States and necessitates targeted measles vaccination programs for these older age groups. Some countries have a bimodal distribution, with measles cases predominantly in young infants and adults.

Persons with measles are infectious for several days before and after the onset of rash, when levels of measles virus in blood and body fluids are highest and when cough, coryza, and sneezing, which facilitate virus spread, are most severe. The contagiousness of measles before the onset of recognizable disease hinders the effectiveness of isolation measures. Viral shedding by children with impaired cell-mediated immunity can be prolonged.

Medical settings are well-recognized sites of measles virus transmission. Children may present to health care facilities during the prodrome, when the diagnosis is not obvious although the child is infectious and is likely to infect susceptible contacts. Health care workers can acquire measles from infected children and transmit measles virus to others. Nosocomial transmission can be reduced by maintenance of a high index of clinical suspicion, use of appropriate isolation precautions when measles is suspected, administration of measles vaccine to susceptible children and health care workers, and documentation of health care workers' immunity to measles (i.e., proof of receipt of two doses of measles vaccine or detection of antibodies to measles virus).

As efforts at measles control are increasingly successful, public perceptions of the risk of measles as a disease diminish and are replaced by concerns about possible adverse events associated with measles vaccine. As a consequence, numerous measles outbreaks have occurred because of opposition to vaccination on religious or philosophical grounds or unfounded fears of serious adverse events (see "Active Immunization," below, and **Chap. 3**).

PATHOGENESIS

Measles virus is transmitted primarily by respiratory droplets over short distances and, less commonly, by small-particle aerosols that remain suspended in the air for long periods. Airborne transmission appears to be important in certain settings, including schools, physicians' offices, hospitals, and enclosed public places. The virus can be transmitted by direct contact with infected secretions but does not survive for long on fomites.

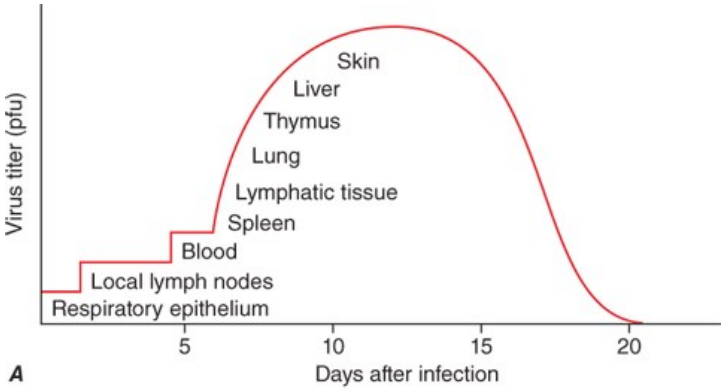
The incubation period for measles is ~10 days to fever onset and 14 days to rash onset. This period may be shorter in infants and longer (up to 3 weeks) in adults. Infection is initiated when measles virus is deposited in the respiratory tract, oropharynx, or conjunctivae **(Fig. 205-1A)**. During the first 2–4 days after infection, measles virus proliferates locally in the respiratory mucosa, primarily in dendritic cells and lymphocytes, and spreads to draining lymph nodes. Virus then enters the bloodstream in infected lymphocytes, producing the primary viremia that disseminates infection throughout the reticuloendothelial system. Further replication results in secondary viremia that begins 5–7 days after infection and disseminates measles virus throughout the body. Replication of measles virus in the target organs, together with the host's immune response, is responsible for the signs and symptoms of measles that occur 8–12 days after infection and mark the end of the incubation period **(Fig. 205-1B)**.

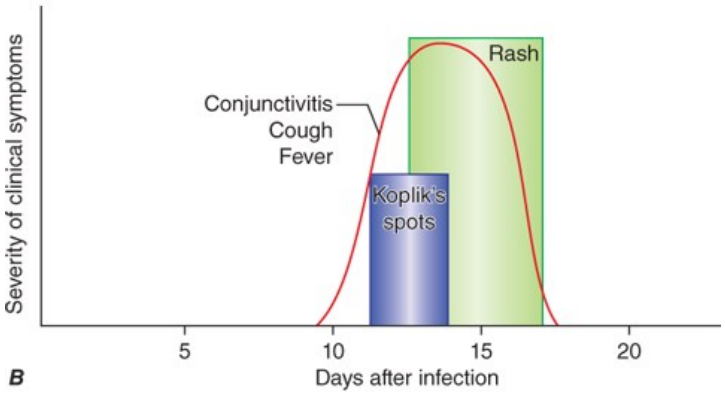
Downloaded 2024-2-22 7:33 A Your IP is 154.59.125.153
Chapter 205: Measles (Rubeola), Kaitlin Rainwater-Lovett; William J. Moss
©2024 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

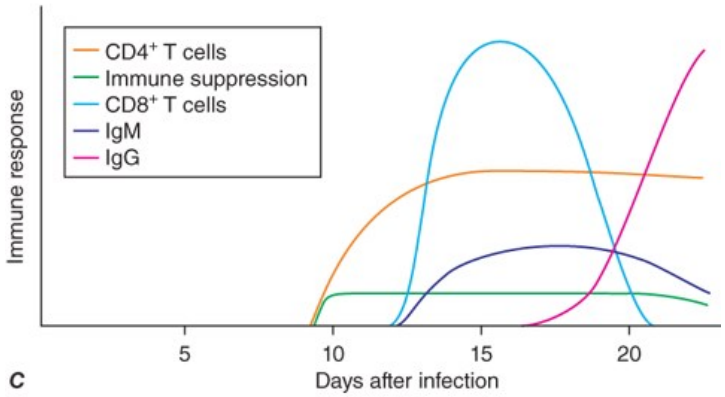
ACCESS Medicine
Kaplan Medical Center
Access Provided by:
SILVERCHAIR INFORMATION / SYSTEMS

FIGURE 205-1

Measles virus infection: pathogenesis, clinical features, and immune responses. ***A.*** Spread of measles virus, from initial infection of the respiratory tract through dissemination to the skin. ***B.*** Appearance of clinical signs and symptoms, including Koplik's spots and rash. ***C.*** Antibody and T cell responses to measles virus. The signs and symptoms of measles arise coincident with the host immune response. *(Reproduced with permission from WJ Moss: Global measles elimination. Nat Rev Microbiology 4:900, 2006.)*







Source: Joseph Loscalzo, Anthony Fauci, Dennis Kasper, Stephen Hauser, Dan Longo, J. Larry Jameson: Harrison's Principles of Internal Medicine, 21e
Copyright © McGraw Hill. All rights reserved.

IMMUNE RESPONSES

Host immune responses to measles virus are essential for viral clearance, clinical recovery, and the establishment of long-term immunity **(Fig. 205-**

Downloaded 2024-2-22 7:33 A Your IP is 154.59.125.153
Chapter 205: Measles (Rubeola), Kaitlin Rainwater-Lovett; William J. Moss
©2024 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

1C). Early nonspecific (innate) immune responses during the prodromal phase include activation of natural killer cells and increased production of antiviral proteins. The adaptive immune responses consist of measles virus–specific antibody and cellular responses. The protective efficacy of antibodies to measles virus is illustrated by the immunity conferred to infants from passively acquired maternal antibodies and the protection of exposed, susceptible individuals after administration of anti–measles virus immunoglobulin. The first measles virus–specific antibodies produced after infection are of the IgM subtype, with a subsequent switch to predominantly IgG1 and IgG3 isotypes. The IgM antibody response is typically absent following reexposure or revaccination and serves as a marker of primary infection.

The importance of cellular immunity to measles virus is demonstrated by the ability of children with agammaglobulinemia (congenital inability to produce antibodies) to recover fully from measles and the contrasting picture for children with severe defects in T lymphocyte function, who often develop severe or fatal disease **(Chap. 351)**. The initial predominant T_H1 response (characterized by interferon γ) is essential for viral clearance, and the later T_H2 response (characterized by interleukin 4) promotes the development of measles virus–specific antibodies that are critical for protection against reinfection.

The duration of protective immunity following wild-type measles virus infection is generally thought to be lifelong. Immunologic memory to measles virus includes both continued production of measles virus–specific antibodies and circulation of measles virus–specific CD4+ and CD8+ T lymphocytes.

However, the intense immune responses induced by measles virus infection are paradoxically associated with depressed responses to unrelated (non–measles virus) antigens, which persist for several weeks to months beyond resolution of the acute illness. This state of immune suppression enhances susceptibility to secondary infections with bacteria and viruses that cause pneumonia and diarrhea and is responsible for a substantial proportion of measles-related morbidity and deaths. Delayed-type hypersensitivity responses to recall antigens, such as tuberculin, are suppressed, and cellular and humoral responses to new antigens are impaired. Reactivation of tuberculosis and remission of autoimmune diseases after measles have been described and are attributed to this period of immune suppression. Importantly, measles results in depletion of circulating antibodies against previously encountered viruses and bacteria, impairing immunologic memory. This mechanism may explain why child morbidity and mortality can be increased for >2 years after measles.

Approach to the Patient with Measles

Clinicians should consider measles in persons presenting with fever and generalized erythematous rash, particularly when measles virus is known to be circulating or the patient has a history of travel to endemic areas. Appropriate precautions must be taken to prevent nosocomial transmission. The diagnosis requires laboratory confirmation except during large outbreaks in which an epidemiologic link to a confirmed case can be established. Care is largely supportive and consists of the administration of vitamin A and antibiotics (see "Treatment," below). Complications of measles, including secondary bacterial infections and encephalitis, may occur after acute illness and require careful monitoring, particularly in immunocompromised persons.

CLINICAL MANIFESTATIONS

In most persons, the signs and symptoms of measles are highly characteristic (Fig. 205-1B). Fever and malaise beginning ~10 days after exposure are followed by cough, coryza, and conjunctivitis. These signs and symptoms increase in severity over 4 days. Koplik's spots **(see Fig. A1-2)** develop on the buccal mucosa ~2 days before the rash appears. The characteristic rash of measles **(see Fig. A1-3)** begins 2 weeks after infection, when the clinical manifestations are most severe, and signal the host's immune response to the replicating virus. Headache, abdominal pain, vomiting, diarrhea, and myalgia may be present.

Koplik's spots are pathognomonic of measles and consist of bluish white dots ~1 mm in diameter surrounded by erythema. The lesions appear first on the buccal mucosa opposite the lower molars but rapidly increase in number and may involve the entire buccal mucosa. They fade with the onset of rash.

The rash of measles begins as erythematous macules behind the ears and on the neck and hairline. The rash progresses to involve the face, trunk, and arms, with involvement of the legs and feet by the end of the second day. Areas of confluent rash appear on the trunk and extremities, and petechiae may be present. The rash fades slowly in the same order of progression as it appeared, usually beginning on the third or fourth day after onset. Resolution of the rash may be followed by desquamation, particularly in undernourished children.

Downloaded 2024-2-22 7:33 A Your IP is 154.59.125.153
Chapter 205: Measles (Rubeola), Kaitlin Rainwater-Lovett; William J. Moss
©2024 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

Because the characteristic rash of measles is a consequence of the cellular immune response, it may not develop in persons with impaired cellular immunity (e.g., those with AIDS; **Chap. 202**). These persons have a high case–fatality rate and frequently develop giant cell pneumonitis caused by measles virus. T lymphocyte defects due to causes other than HIV-1 infection (e.g., cancer chemotherapy) also are associated with increased severity of measles.

A severe atypical measles syndrome was observed in recipients of a formalin-inactivated measles vaccine (used in the United States from 1963 to 1967 and in Canada until 1970) who were subsequently exposed to wild-type measles virus. The atypical rash began on the palms and soles and spread centripetally to the proximal extremities and trunk, sparing the face. The rash was initially erythematous and maculopapular but frequently progressed to vesicular, petechial, or purpuric lesions.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of measles includes other causes of fever, rash, and conjunctivitis, including rubella, Kawasaki disease, infectious mononucleosis, roseola, scarlet fever, Rocky Mountain spotted fever, enterovirus or adenovirus infection, and drug sensitivity. Rubella is a milder illness without cough and with distinctive lymphadenopathy. The rash of roseola (exanthem subitum) **(see Fig. A1-5)** appears after fever has subsided. The atypical lymphocytosis in infectious mononucleosis contrasts with the leukopenia commonly observed in children with measles.

DIAGNOSIS

Measles is readily diagnosed on clinical grounds by clinicians familiar with the disease, particularly during outbreaks. Koplik's spots are especially helpful because they appear early and are pathognomonic. Clinical diagnosis is more difficult (1) during the prodromal illness; (2) when the rash is attenuated by passively acquired antibodies or prior immunization; (3) when the rash is absent or delayed in immunocompromised children or severely undernourished children with impaired cellular immunity; and (4) in regions where the incidence of measles is low and other pathogens are responsible for the majority of illnesses with fever and rash. The CDC case definition for measles requires (1) a generalized maculopapular rash of at least 3 days' duration; (2) fever of at least 38.3°C (101°F); and (3) cough, coryza, or conjunctivitis.

Serology is the most common method of laboratory diagnosis. The detection of measles virus–specific IgM in a single specimen of serum or oral fluid is considered diagnostic of acute infection, as is a fourfold or greater increase in measles virus–specific IgG antibody levels between acute- and convalescent-phase serum specimens. Primary infection in the immunocompetent host results in antibodies that are detectable within 1–3 days of rash onset and reach peak levels in 2–4 weeks. Measles virus–specific IgM antibodies may not be detectable until 4–5 days or more after rash onset and usually fall to undetectable levels within 4–8 weeks of rash onset.

Several methods for measurement of antibodies to measles virus are available. Neutralization tests are sensitive and specific, and the results are highly correlated with protective immunity; however, these tests require propagation of measles virus in cell culture and thus are expensive and laborious. Commercially available enzyme immunoassays are most frequently used. Measles can also be diagnosed by isolation of the virus in cell culture from respiratory secretions, nasopharyngeal or conjunctival swabs, blood, or urine. Direct detection of giant cells in respiratory secretions, urine, or tissue obtained by biopsy provides another method of diagnosis.

For detection of measles virus RNA by reverse-transcription polymerase chain reaction amplification of RNA extracted from clinical specimens, primers targeted to highly conserved regions of measles virus genes are used. Extremely sensitive and specific, this assay may also permit identification and characterization of measles virus genotypes for molecular epidemiologic studies and can distinguish wild-type from vaccine virus strains.

Treatment of Measles

There is no specific antiviral therapy for measles. Treatment consists of general supportive measures, such as hydration and administration of antipyretic agents. Because secondary bacterial infections are a major cause of morbidity and death attributable to measles, effective case management involves prompt antibiotic treatment for patients who have clinical evidence of bacterial infection, including pneumonia and otitis media. *Streptococcus pneumoniae* and *Haemophilus influenzae* type b are common causes of bacterial pneumonia following measles; vaccines against these pathogens probably lower the incidence of secondary bacterial infections following measles.

Vitamin A is effective for the treatment of measles and can markedly reduce rates of morbidity and mortality. The WHO recommends administration of

Downloaded 2024-2-22 7:33 A Your IP is 154.59.125.153
Chapter 205: Measles (Rubeola), Kaitlin Rainwater-Lovett; William J. Moss
©2024 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

once-daily doses of 200,000 IU of vitamin A for 2 consecutive days to all children with measles who are ≥12 months of age. Lower doses are recommended for younger children: 100,000 IU per day for children 6–12 months of age and 50,000 IU per day for children <6 months old. A third dose is recommended 2–4 weeks later for children with evidence of vitamin A deficiency. While such deficiency is not a widely recognized problem in the United States, many American children with measles do, in fact, have low serum levels of vitamin A, and these children experience increased measles-associated morbidity. The Committee on Infectious Diseases of the American Academy of Pediatrics recommends that the administration of two consecutive daily doses of vitamin A be considered for children who are hospitalized with measles and its complications as well as for children with measles who are immunodeficient; who have ophthalmologic evidence of vitamin A deficiency, impaired intestinal absorption, or moderate to severe malnutrition; or who have recently immigrated from areas with high measles mortality rates. Parenteral and oral formulations of vitamin A are available.

Anecdotal reports have described the recovery of previously healthy pregnant and immunocompromised patients with measles pneumonia and of immunocompromised patients with measles encephalitis after treatment with aerosolized and IV ribavirin. However, the clinical benefits of ribavirin in measles have not been conclusively demonstrated in clinical trials.

COMPLICATIONS

Most complications of measles involve the respiratory tract and include the effects of measles virus replication itself and secondary bacterial infections. Acute laryngotracheobronchitis (croup) can occur during measles and may result in airway obstruction, particularly in young children. Giant cell pneumonitis due to replication of measles virus in the lungs can develop in immunocompromised children, including those with HIV-1 infection. Many children with measles develop diarrhea, which contributes to undernutrition.

Most complications of measles result from secondary bacterial infections of the respiratory tract that are attributable to a state of immune suppression lasting for several weeks to months, and perhaps even years, after acute measles. Otitis media and bronchopneumonia are most common and may be caused by *S. pneumoniae*, *H. influenzae* type b, or staphylococci. Recurrence of fever or failure of fever to subside with the rash suggests secondary bacterial infection.

Rare but serious complications of measles involve the central nervous system (CNS). Post-measles encephalomyelitis complicates ~1 in 1000 cases, affecting mainly older children and adults. Encephalomyelitis occurs within 2 weeks of rash onset and is characterized by fever, seizures, and a variety of neurologic abnormalities. The finding of periventricular demyelination, the induction of immune responses to myelin basic protein, and the absence of measles virus in the brain suggest that post-measles encephalomyelitis is an autoimmune disorder triggered by measles virus infection. Other CNS complications that occur months to years after acute infection are measles inclusion body encephalitis (MIBE) and subacute sclerosing panencephalitis (SSPE). In contrast to post-measles encephalomyelitis, MIBE and SSPE are caused by persistent measles virus infection. MIBE is a rare but fatal complication that affects individuals with defective cellular immunity and typically occurs months after infection. SSPE is a slowly progressive disease characterized by seizures and progressive deterioration of cognitive and motor functions, with death occurring 5–15 years after measles virus infection. SSPE most often develops in persons infected with measles virus at <2 years of age.

PROGNOSIS

Most persons with measles recover and develop long-term protective immunity to reinfection. Measles case–fatality proportions vary with the average age of infection, the nutritional and immunologic status of the population, measles vaccine coverage, and access to health care. Among previously vaccinated persons who do become infected, disease is less severe and mortality rates are significantly lower. In developed countries, <1 in 1000 children with measles dies. In endemic areas of sub-Saharan Africa, the measles case–fatality proportion may be 5–10% or even higher. Measles is a major cause of childhood deaths in refugee camps and in internally displaced populations, where case–fatality proportions have been as high as 20–30%.

PREVENTION

Passive Immunization

Human immunoglobulin given shortly after exposure can attenuate the clinical course of measles. In immunocompetent persons, administration of

Downloaded 2024-2-22 7:33 A Your IP is 154.59.125.153
Chapter 205: Measles (Rubeola), Kaitlin Rainwater-Lovett; William J. Moss
©2024 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

immunoglobulin within 72 h of exposure usually prevents measles virus infection and almost always prevents clinical measles. Administered up to 6 days after exposure, immunoglobulin will still prevent or modify the disease. Prophylaxis with immunoglobulin is recommended for susceptible household and nosocomial contacts who are at risk of developing severe measles, particularly children <1 year of age, immunocompromised persons (including HIV-infected persons previously immunized with live attenuated measles vaccine), and pregnant women. Except for premature infants, children <6 months of age usually will be partially or completely protected by passively acquired maternal antibody. Infants born to women with vaccine-induced measles immunity become susceptible to measles at a younger age than infants born to women with acquired immunity from natural infection. If measles is diagnosed in a household member, all unimmunized children in the household should receive immunoglobulin. The recommended dose is 0.25 mL/kg given intramuscularly. Immunocompromised persons should receive 0.5 mL/kg. The maximal total dose is 15 mL. IV immunoglobulin contains antibodies to measles virus; the usual dose of 100–400 mg/kg generally provides adequate prophylaxis for measles exposures occurring as long as 3 weeks or more after IV immunoglobulin administration.

Active Immunization

The first live attenuated measles vaccine was developed by passage of the Edmonston strain in chick embryo fibroblasts to produce the Edmonston B virus, which was licensed in 1963 in the United States. Further passage of Edmonston B virus produced the more attenuated Schwarz vaccine that currently serves as the standard in much of the world. The Moraten (“more attenuated Enders”) strain, which was licensed in 1968 and is used in the United States, is genetically identical to the Schwarz strain.

Lyophilized measles vaccines are relatively stable, but reconstituted vaccine rapidly loses potency. Live attenuated measles vaccines are inactivated by light and heat and lose about half their potency at 20°C and almost all their potency at 37°C within 1 h after reconstitution. Therefore, a cold chain must be maintained before and after reconstitution. Antibodies first appear 12–15 days after vaccination, and titers peak at 1–3 months. Measles vaccines are often combined with other live attenuated virus vaccines, such as those for mumps and rubella (MMR) and for mumps, rubella, and varicella (MMR-V).

The recommended age of first vaccination varies from 6 to 15 months and represents a balance between the optimal age for seroconversion and the probability of acquiring measles before that age. The proportions of children who develop protective levels of antibody after measles vaccination approximate 85% at 9 months of age and 95% at 12 months. Common childhood illnesses concomitant with vaccination may reduce the level of immune response, but such illness is not a valid reason to withhold vaccination. Measles vaccines have been well tolerated and immunogenic in HIV-1-infected children and adults, although antibody levels may wane. Because of the potential severity of wild-type measles virus infection in HIV-1-infected children, routine measles vaccination is recommended except for those who are severely immunocompromised. Measles vaccination is contraindicated in individuals with other severe deficiencies of cellular immunity because of the possibility of disease due to progressive pulmonary or CNS infection with the vaccine virus.

The duration of vaccine-induced immunity is at least several decades, if not longer. Rates of secondary vaccine failure 10–15 years after immunization have been estimated at ~5%, but are probably lower when vaccination takes place after 12 months of age. Decreasing antibody concentrations do not necessarily imply a complete loss of protective immunity: a secondary immune response usually develops after reexposure to measles virus, with a rapid rise in antibody titers in the absence of overt clinical disease.

Standard doses of currently licensed measles vaccines are safe for immunocompetent children and adults. Fever to 39.4°C (103°F) occurs in ~5% of seronegative vaccine recipients, and 2% of vaccine recipients develop a transient rash. Mild transient thrombocytopenia has been reported, with an incidence of ~1 case per 40,000 doses of MMR vaccine.

Since the publication of a report in 1998 falsely hypothesizing that MMR vaccine may cause a syndrome of autism and intestinal inflammation, much public attention has focused on this purported association. The events that followed publication of this report led to diminished vaccine coverage in the United Kingdom and provide important lessons in the misinterpretation of epidemiologic evidence and the communication of scientific results to the public. The publication that incited the concern was a case series describing 12 children with a regressive developmental disorder and chronic enterocolitis; 9 of these children had autism. In 8 of the 12 cases, the parents associated onset of the developmental delay with MMR vaccination. This simple temporal association was misinterpreted and misrepresented as a possible causal relationship, first by the lead author of the study and then by elements of the media and the public. Subsequently, many comprehensive reviews and additional epidemiologic studies refuted evidence of a causal relationship between MMR vaccination and autism.

Downloaded 2024-2-22 7:33 A Your IP is 154.59.125.153
Chapter 205: Measles (Rubeola), Kaitlin Rainwater-Lovett; William J. Moss
©2024 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility

PROSPECTS FOR MEASLES ERADICATION

Progress in global measles control has renewed discussion of measles eradication. In contrast to poliovirus eradication, the eradication of measles virus will not entail challenges posed by prolonged shedding of potentially virulent vaccine viruses and environmental viral reservoirs. However, in comparison with smallpox eradication, higher levels of population immunity will be necessary to interrupt measles virus transmission, more highly skilled health care workers will be required to administer measles vaccines, and containment through case detection and ring vaccination will be more difficult for measles virus because of infectivity before rash onset. New tools, such as microneedle patches to deliver measles vaccine, will facilitate mass vaccination campaigns and vaccination of hard-to-reach children such as those residing in remote rural areas. Despite enormous progress, measles remains a leading vaccine-preventable cause of childhood mortality worldwide and continues to cause outbreaks in communities with low vaccination coverage rates in industrialized nations.

FURTHER READING

De Swart RL, Moss WJ: The immunological basis for immunization series: Module 7: Measles. Update 2020. Geneva: World Health Organization, 2020.

Griffin DE: Measles immunity and immunosuppression. Curr Opin Virol 46:9, 2020. [PubMed: 32891958]

Mina MJ et al: Measles virus infection diminishes preexisting antibodies that offer protection from other pathogens. Science 366:599, 2019. [PubMed: 31672891]

Moss WJ: Measles. Lancet 380:2490, 2017.

Moss WJ et al: Feasibility assessment of measles and rubella eradication. Vaccine 39:3544, 2021. [PubMed: 34045102]

Phadke VK et al: Vaccine refusal and measles outbreaks in the US. JAMA 324:1344, 2020. [PubMed: 32797149]

Strebel PM, Orenstein WA: Measles. N Engl J Med 381:349, 2019. [PubMed: 31184814]

World Health Organization: Measles vaccines: WHO position paper—April 2017. Wkly Epidemiol Rec 92:205, 2017. [PubMed: 28459148]

World Health Organization: Progress towards regional measles elimination—worldwide, 2000-2019. MMWR Morb Mortal Wkly Rep 69:1700, 2020.

Downloaded 2024-2-22 7:33 A Your IP is 154.59.125.153
Chapter 205: Measles (Rubeola), Kaitlin Rainwater-Lovett; William J. Moss
©2024 McGraw Hill. All Rights Reserved. Terms of Use • Privacy Policy • Notice • Accessibility