Measles re-emerges and recommendation of vaccination

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Abstract: Measles is a highly infectious viral illness and is one of the world's most contagious diseases that can affect all people if they have not been vaccinated or have not had it before. Before measles vaccine became available in 1963, major epidemic occurred approximately every 2 to 3 years and thus 99% of the people were thought to have been infected naturally with measles virus and got immune for life. In 2000, measles was declared eliminated from the United States, and yet 1215 cases have been reported from 30 states as of August 22, 2019. Currently, there are several large measles outbreaks universally, and some people who were not immune and they need to get their measles, mumps, rubella (MMR) vaccine to prevent measles outbreaks. As vaccination coverage increases, the average age of measles infection can change to adolescents and young adults. In addition, the protective antibodies derived from vaccination might decrease gradually, and the risk of measles infection in young adults is increasing regardless of international travelling.

Keywords: Measles; Measles vaccines; Outbreak

1. INTRODUCTION

Measles, also called rubeola, is a supremely contagious viral infection and it may spread by airborne droplets and direct contamination with nasal or throat secretions of infected persons. If one person has it, up to 90% of people around him or her will become infected if they are not protected.[1,2] According to World Health Organization (WHO), there has been a 300% rise in measles cases universally this year compared with the same period in 2018.[3] Measles can cause potentially serious complications particularly in immunocompromised hosts, pregnant women, poor nutritional status such as vitamin A deficiency, and very young age.[4,5] The risk of complications is raised in developing countries, where there is 4% to 10% of case fatality rate.[6] It still remains a significant cause of death worldwide among young children and can be prevented entirely by two doses of a safe and effective measles, mumps, and rubella (MMR) vaccine. According to the WHO data sources, improvement in routine measles vaccine ranges from 71% in 1999 to 76% in 2004 and thus overall global measles mortality decreased to 48%, approximately 871 000 deaths in 1999 to 454 000 deaths in 2004.[7] In 2015, there were an estimated 134 200 measles deaths worldwide representing a 79% decline since 2000.[8] To reduce morbidity and spread of measles and mortality rate, measles vaccination systems need to be improved to provide that ≥90% of infants are vaccinated against measles at the age of 12 to 15 months or shortly after through their routine immunization program of their countries.[7] The measles vaccine is a live attenuated virus vaccine and two doses are recommended by WHO to provide protection from disease. One dose of MMR vaccine is 90% to 94% effective as well as two doses of vaccine are 97% to 98% effective. Currently, two measles-containing vaccines used in the United States (U.S.) are the MMR vaccine and the combined measles-mumps-rubella-varicella (MMR-V) vaccine.[9]

2. CLINICAL CHARACTERISTICS

Measles is caused by infection with measles virus from the paramyxovirus family and humans are the only natural hosts of measles virus. It is an acute viral respiratory illness and characterized by a prodrome of fever (≥38.3°C or higher) and malaise, cough, coryza, conjunctivitis,[10] and Koplik's spots (small greyish-white spots) on the inside of the cheeks.[11,12] Incubation periods for measles usually is 10 to 14 days (range: 7-23 days) from exposure to the onset of symptoms.[8] Three to five days after the onset of symptoms, red blotchy skin rashes appear on the face at the hairline and spread downward to the rest of the body. Rashes last usually 4 to 7 days and can persist for up to 3 weeks leaving with brownish staining and sometimes fine skin peeling.[2] Infected people can spread the disease to other people from 4 days before the rash starts until 4 days after that. Measles complications such as ear infections, pneumonia, severe diarrhea and dehydration, encephalitis, and/or permanent disability[12] and can occur in up to 30% of people, usually occur within 2 to 3 weeks after rash onset and it depends on age and predisposition conditions, such as young age, malnutrition, and immunocompromised persons. Young children under 5 years of age are still most of the burden of the disease globally.[13,14]

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3. DIAGNOSIS AND LABORATORY TESTS

Clinical diagnosis of measles, however, is challenging for many healthcare providers who have not seen measles and in patients who has less apparent clinical signs and symptoms initially.[15] Making timely diagnosis of measles is enough to grant quarantine, contact tracing, vaccination of susceptible contacts as well as other public health interventions. Even though measles is easily recognizable by its clinical features, typical measles rash may be absent in patients with impaired cell-mediated immunity.[16] Furthermore, other acute viral infections such as dengue virus infection, rubella virus infection, parvovirus B19 infection, and human herpes virus 6 infection might be confused with measles.[11] Hence, this requires a good history and physical examination. What's more, history can support in identifying a patient's vaccination status as well as possible exposure to measles, such as travel to areas of ongoing transmission. The clinical case definition of measles recommended by the Centers of Disease Control (CDC) are any persons with fever, generalized maculopapular rash (nonvesicular rash), cough, coryza or conjunctivitis, and a case that meets the clinical case definition has a high sensitivity (75%-90%) but a low positive predictive value in low-incidence settings, indicating the need for laboratory confirmation.[15,17] Laboratory tests with measles-specific IgM antibody in serum (sensitivity 83%-89% and specificity 95%-99%)[11,18] and measles RNA by real-time polymerase chain reaction (RT-PCR) in a respiratory specimen are the most common methods for confirming measles infection.[19] Measles IgM antibodies begin to appear 1 to 2 days after the onset of rash; nevertheless, the IgM response can be delayed. Furthermore, obtaining urine sample and throat swab or nasopharyngeal swab for measles virus can increase the likelihood of detecting measles virus.[11] Molecular analysis can be conducted to determine the genotype of measles virus. It can distinguish wild-type measles virus infection and vaccine-type measles virus and can help to link or unlink cases.

4. MANAGEMENT

There is no specific antiviral therapy for measles and the treatment is only supportive to prevent dehydration, nutritional supplementation, and prevent secondary bacterial infection.[11] The American Academy of Pediatrics (AAP) recommends for severe measles cases among children, such as those who are hospitalized, should be treated with vitamin A. Recommended daily age-specific doses are 200 000 IU for children 12 months of age and older, 100 000 IU for infants 6 to 11 months of age, and 50 000 IU for infants younger than 6 months of age. Due to the fact that people with measles are highly contagious from the onset of the prodrome until 4 days after the rash appears, infected people should be isolated for 4 days after they develop a rash and hospitalized patient should be isolated with airborne precautions in healthcare settings.[15,20]

5. IMPACT OF MEASLES

Measles remains a common disease in many parts of the world, especially in parts of Africa, Asia, Europe, and the Pacific. The universal annual incidence of measles cases between 2000 and 2017 decreased from 145 to 25 cases per million population.[14,15] Nevertheless, recent increases in the incidence of measles in the U. S. as well as in developed countries commenced in 2018 and is continuing to 2019.[15] Measles leads a more overwhelming course in children in developing countries and mortality as high as 1% to 15%.[15,21] It is extremely contagious and affects both children and adult, and yet most common in young children as well as remains as one of the leading causes of death among young children worldwide. Sometimes infected persons need to be hospitalized due to serious complications. Diarrhea is the most common complication, approximately 8% of cases and pneumonia is the most common cause of measles-associated death in children, approximately 6% of cases.[2] About one in five unvaccinated people in the U.S. who get measles hospitalized, and as many as one out of every 20 children with measles gets pneumonia. In every 1000 children who get measles, one or two will develop encephalitis, and nearly one to three will die from respiratory and neurological complications. Children infected with measles at a young age <2 years have high risk for developing subacute sclerosing panencephalitis (SSPE). Sign and symptoms of SSPE develop at an average of 7 years after measles infection but might develop decades later.[9] Pregnant woman who gets measles also have a miscarriage or a low birth-weight baby.[2,22]

6. MEASLES CASES AND OUTBREAKS

Measles can be prevented with vaccination; however, there are more unvaccinated children, adolescents, and adults in our communities due to some parents who have refused or delayed immunization to their children in recent years. Before the introduction of measles vaccine and widespread vaccination, major epidemics occurred every 2 to 3 years and measles caused an estimated 2.6 million deaths each year.[22] In 2019, CDC reported 13 outbreaks of measles, most of which were imported cases in unvaccinated persons.[23] Approximately three times as many cases were reported from January 1 to July 31 this year, 182 countries reported 364 808 measles cases, and this exceed the 129 239 cases reported by 181 countries during the same period in 2018. The highest outbreaks are raging in the Democratic Republic of Congo, Madagascar, and Ukraine. Major outbreaks also take place in Angola, Cameroon, Chad, Kazakhstan, Nigeria, Philippines, South Sudan, Sudan, and Thailand.[24] Since the measles vaccine was introduced in 1963, ongoing measles transmission was declared eliminated from U.S. in 2000.[25] Nevertheless, measles is still brought to U.S. by the travelers who came back from other countries to U.S. From January 1 to August 22 this year, 1215 measles cases were confirmed in 30 states and this is the greatest number of cases reported in the U.S. since 1992.[26] In Taiwan, as of May 8 this year, 30 imported and 60 indigenous measles cases were confirmed and 77% of cases(69 cases) were in 20 to 39 age group.[27] Even though there is global widespread vaccination, there were 110 000 measles deaths globally in 2017 and mostly were children under the age of five. Safe and cost-effective measles vaccination prevented an estimated 21.1 million deaths during 2000-2017.[14,15] There is no specific antiviral treatment for measles infection and routine measles vaccination for children and combined with mass immunization campaigns in countries with high case and death rates are important strategies to reduce global measles deaths.

7. VACCINE RECOMMENDATION

The measles vaccine is given as the combined MMR vaccine. One dose of MMR vaccine is approximately 94% effective at preventing measles and two doses are approximately 98% effective.[9] WHO recommended children should receive two doses of the MMR vaccine routinely and first dose is given at 12 to 15 months of age and the second dose is given at 4 to 6 years of age.[8,9] These are the recommended age; however, children can get the second dose at any age, as long as it is at least 28 days after the first dose. In Taiwan, a live-attenuated measles vaccine was introduced in 1968 and routine vaccination policy was formulated in 1978. Routine measles vaccination schedule for children in Taiwan is the first dose of MMR at 12 months of age and the second dose of MMR at 5 years of age.[28] Both serologic and epidemiologic

evidence reveal that nearly 95% of vaccinated persons examined 11 years after initial vaccination and 15 years after the second dose of MMR vaccine had detectable antibodies to measles.[9]

7.1. Vaccination for nonroutine vaccination population

MMR vaccination is not routinely recommended for infants younger than 12 months of age due to the presence of antibodies received from their mother during pregnancy. However, infants aged 6 to 11 months should get one dose of MMR vaccine if travelling overseas to areas with ongoing measles outbreaks. Such infants would still require two doses of MMR vaccine after 12 months of age.[15,28]

7.2. Vaccination for high-risk group

Since the seropositive rate decreased and waning immunity in young people, Taiwan CDC recommend the young people who were born after 1981 should get one dose of MMR vaccine before travelling to high-risk areas. Health care workers and the faculty of childcare institution who are 18 to 30 years of age and people who come into frequent contact with foreign travelers should receive two doses of MMR vaccine except that they have antibodies positive of measles or immunization certificate.[28]

7.3. Postexposure prophylaxis

MMR vaccine should be administered within 72 hours for people who were exposed to measles infection and who cannot readily show that they have evidence of immunity against measles. Immunoglobulin (IG) should be given within 6 days of exposure as postexposure prophylaxis for those who are at risk for severe illness and complications from measles. They are infants younger than 12 months of age, pregnant women without evidence of measles immunity, and people who are severely immunocompromised. MMR vaccine can be given in place of IG for infants aged 6 to 11 months, if administered within 72 hours of exposure.[9,15]

7.4. Contraindication for MMR vaccine

People with severe allergic reaction (anaphylaxis) after a previous dose, severe immunodeficiency (eg, from hematologic and solid tumors, receipt of chemotherapy, congenital immunodeficiency, or long-term immunosuppressive therapy or patients with human immunodeficiency virus [HIV] infection who are severely immunocompromised), pregnant women, and has a history of anaphylactic reaction to neomycin should not receive MMR vaccine.[8,9]

7.5. Adverse events of MMR vaccine

Serious adverse events are rare, and recipients may feel pain and tenderness at injection site, which is mild and transient and resolves within 2 to 3 days. Systemic reaction includes fever (about 5%-15% of recipients), transient rash occurring 7 to 10 days after vaccination (2%-5%), transient lymphadenopathy (5% of children and 20% of adults), parotitis (<1%), and aseptic meningitis (1-10 per million).[15,22]

In conclusion, measles is still common in many parts of the world and the majority of people who got measles were unvaccinated. During measles outbreaks, we should provide appropriate case management and immunization of children to reduce morbidity and mortality. In addition, to limit the transmission of infection, identify the high-risk groups and areas for implementing strategies to improve vaccination coverage and other control measures, and monitoring the changing epidemiology of measles.

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