INTERNATIONAL SOCIETY FOR INFECTIOUS DISEASES

GUIDE TO INFECTION CONTROL IN THE HOSPITAL

CHAPTER 35

Measles

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Cover heading - Topic Outline

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KEY ISSUE

Despite progress in global immunization, measles remains a major infectious cause of mortality in developing countries and is responsible for more than 100,000 deaths in children each year. The importance of nosocomial transmission of measles varies substantially from one region to another according to local measles epidemiology and to vaccine coverage. Whatever the local incidence of measles, the hospital represents a critical site for cross-infection. Characteristics of hospital care settings present numerous risk factors for measles transmission

KNOWN FACTS

- Measles virus is a single-stranded, enveloped, negative sense RNA virus in the genus *Morbillivirus* of the family Paramyxoviridae. It is one of the most contagious pathogenic agents known. In tropical zones, most cases of measles occur during the dry season, whereas in temperate zones, incidence peaks during late winter and early spring.
- Measles virions remain viable for a few hours when suspended in air. Transmission is primarily person-to-person by airborne respiratory droplets that disperse within minutes, and transmission can also occur through direct contact with infected secretions. Therefore, cough of infected patients can be an important source of virus for susceptible individuals exposed in confined rooms. Infection has been described without face-to-face contact with an infected subject. Transmission may occur when the contagious individual has left the room up to 2 hours before the arrival of susceptible subjects.
- Patients with measles are contagious from 3 to 5 days before the onset of rash and 1 to 2 days before the onset of fever. This highly contagious prodromal phase significantly facilitates the spread of measles in the hospital and complicates control measures. Patients with measles remain contagious until 4 days after the onset of rash.

- Even in populations with good vaccine coverage, medical facilities can be the place for transmission of measles to patients and to healthcare workers. Indeed, the hospitals combine the factors of infected children, susceptible persons (e.g., those too young for immunization, debilitated patients), and crowding.
- In industrialized countries, most cases of hospital-acquired measles are transmitted patient-to-patient. However, non-immune healthcare workers are also often involved. Healthcare staff in developed countries who acquire measles most frequently are those in direct contact with patients (physicians, nurses). In contrast, most healthcare workers in developing countries have been definitively immunized by wild viruses during childhood and do not contribute significantly to nosocomial transmission.
- Healthcare-infected children with measles have higher case-fatality and complication rates and recover more slowly than community-infected patients. The increased complication rate in children with healthcare-associated measles is likely due to young age (infants) and the presence of underlying disease. In African countries, HIV infection is frequent in hospitalized children and is associated with prolonged measles disease infection, prolonged excretion of the virus in the respiratory tract and increased mortality.
- Immunization is generally performed in children 9 months of age or older in developing countries and in children 12 months of age or older in industrialized nations. Young non-immune infants are therefore highly susceptible to hospital-acquired measles. Young children are also at increased risk of hospital-acquired infection because of frequent contacts with healthcare facilities such as maternal and child healthcare clinics. In addition, young age is an important risk factor for severe illness.
- Several studies have suggested that hospital transmission is important in developed nations and that attendance at hospital facilities is a significant risk factor for acquiring measles. All types of healthcare settings have been implicated; direct or indirect exposure to measles

virus in waiting rooms and in emergency departments has been shown to be a significant risk factor during community outbreaks in the U.S. Low relative humidity and lack of fresh-air circulation in waiting rooms may facilitate measles transmission.

- During outbreaks in developing countries, hospital transmission appears to contribute to measles incidence in urban communities. In rural populations, however, no significant level of transmission appears to be linked to hospital contact, especially if vaccination coverage remains moderate.
- No antiviral treatment for measles is currently available. Vitamin A therapy has been associated with decreased morbidity and mortality in developing countries. The WHO recommends vitamin A for all children with measles, regardless of their country of origin.

Controversial Issues

- Safe and effective measles vaccines that can be administered before 6 to 9 months of age are needed to reduce the number of susceptible individuals and the burden of disease.
- Fears contribute to poor vaccination rates in some parts of the population, particularly in industrialized countries. Links between measles vaccination and autism or inflammatory bowel diseases have been proposed. There is now strong scientific evidence against the hypothesis that measles vaccination may be implicated as a causative agent in these two diseases.

SUGGESTED PRACTICE

- High rates of measles vaccination coverage must be maintained in the community for herd immunity. This intervention will minimize the number of susceptible individuals. In industrialized nations, 2 doses of measles vaccine are required to obtain prolonged protection.

- A high level of awareness of the dangers of measles must be maintained among medical staff. Healthcare personnel should be informed about the risk of hospital transmission of measles to non-immune subjects.
- Patients with fever and rash must be placed in respiratory precautions. These subjects should not enter the common waiting areas of healthcare facilities. Where possible, these patients should be taken to a room reserved for respiratory isolation. It is also important that waiting and treatment rooms be adequately ventilated.
- For developing countries, WHO recommends that children between 6 months and 9 years of age should be vaccinated against measles upon admission to hospital, even if there is evidence of previous measles immunization. The protection rate of measles vaccination is about 80 to 90% in developing countries. In industrialized countries, only unvaccinated patients need to be vaccinated upon admission.
- Various studies have shown that measles vaccination is effective in preventing measles in exposed subjects if vaccination is given within 72 hours of exposure. The vaccine efficacy varied between 68 and 100%.
- In unimmunized or insufficiently immunized individuals, measles vaccine may be administered within 72 hours of exposure to measles virus to protect against disease. Intramuscular or intravenous immune globulins injected within 6 days of measles exposure have been shown to prevent or modify measles in subjects without evidence of measles immunity and are often recommended in industrialized countries.
- Gamma globulins should only be used for patients with congenital immune function disorders or during immunosuppressive therapy.
- Staff members should be immune to measles. Most adults in developing countries have natural measles immunity.
- In industrialized countries, healthcare personnel without adequate measles antibody titers or documented vaccination should be vaccinated. Strong recommendations and high vaccination coverage

against measles in healthcare workers could contribute to eliminate measles in the general population.

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

See above.

SUMMARY

Measles is a serious and very contagious disease. Nosocomial transmission of measles remains a threat and may prove to be an important obstacle to the elimination of measles. Maintaining a high coverage or measles vaccination in the community is the most important preventive strategy against the disease. Other helpful interventions to limit nosocomial transmission include: post-exposure vaccination, immunization of hospitalized patients, increasing awareness of the clinical presentation of measles in healthcare facilities, and respiratory isolation of suspected or proven cases. Newer, safe vaccines that are more immunogenic in the first year of life and more stable in tropical countries are needed.

H1 REFERENCES

1. Measles Vaccines: WHO position paper — WHO Position Paper. WHO Wkly Epidemiol Rec. 2017. 92(17);205–28.
2. Arciuolo RJ, Jablonski RR, Zucker JR, Rosen JB. Effectiveness of Measles Vaccination and Immune Globulin Post-Exposure Prophylaxis in an Outbreak Setting — New York City, 2013. Clin Infect Dis 2017; 65(11):1843–7.
3. Biellik RJ, Clements CJ. Strategies for Minimizing Nosocomial Measles Transmission. WHO Bull 1997; 75(4):367–75.
4. Botelho-Nevers E, Gautret P, Biellik R, Brouqui P. Nosocomial Transmission of Measles: an Updated Review. Vaccine 2012; 30(27): 3996–4001. doi: 10.1016/j.vaccine.2012.04.023.

5. Botelho-Nevers E, Cassir N, Minodier P, et al. Measles among Healthcare Workers: a Potential for Nosocomial Outbreaks. Euro Surveill 2011; 16(2). pii: 19764.
6. McLean HQ, Fiebelkorn AP, Temte JL, Wallace GS; Centers for Disease Control and Prevention. CDC. Prevention of Measles, Rubella, Congenital Rubella Syndrome, and Mumps, 2013. Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recommendations and Reports 2013; 62:(RR04);1–34.
7. Choi WS, Sniadack DH, Jee Y, et al. Outbreak of Measles in the Republic of Korea, 2007: Importance of Nosocomial Transmission. J Infect Dis 2011; 204 Suppl 1:S483–490.
8. Davis RM, Orenstein WA, Frank JA Jr, et al. Transmission of Measles in Medical Settings: 1980 to 1984. JAMA 1986; 255(10):1295–8.
9. Gerber JS, Offit PA. Vaccines and Autism: a Tale of Shifting Hypotheses. Clin Infect Dis 2009; 48(4):456–61.
10. Groth C, Bottiger B, Plesner A, et al. Nosocomial Measles Cluster in Denmark Following an Imported Case, December 2008-January 2009. Euro Surveill 2009; 14(8). pii: 19126.
11. Hussey GD, Klein M. A Randomized, Controlled Trial of Vitamin a in Children with Severe Measles. N Engl J Med 1990; 323(3):160–4.
12. Liu L, Johnson HL, Cousens S, et al. Global, Regional, and National Causes of Child Mortality: an Updated Systematic Analysis for 2010 with Time Trends since 2000. Lancet 2012; 379(9832):2151–61. doi: 10.1016/S0140-6736(12)60560-1.
13. Madsen KM, Hviid A, Vestergaard M, et al. A Population-Based Study of Measles, Mumps, and Rubella Vaccination and Autism. N Engl J Med 2002; 347(19):1477–82.
14. Marshall TM, Hlatswayo D, Schoub B. Nosocomial Outbreaks — a Potential Threat to the Elimination of Measles? J Infect Dis 2003; 187(Suppl 1):S97–101.

15. Moss WJ. Measles. Lancet 2017; 390(10111):2490-2502. doi: 10.1016/S0140-6736(17)31463-0.
16. Ruuskanen O, Salmi TT, Halonen P. Measles Vaccination after Exposure to Natural Measles. J Pediatr 1978; 93(1):43–6.
17. Young MK, Nimmo GR, Cripps AW, Jones MA. Post-Exposure Passive Immunisation for Preventing Measles. Cochrane Database of Systematic Reviews 2014, Issue 4. Art. No.: CD010056. doi: 10.1002/14651858.CD010056.pub2.