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Control and Prevention of Serogroup C Meningococcal Disease: Evaluation and Management of Suspected Outbreaks: Recommendations of the Advisory Committee on Immunization Practices (ACIP)

Summary

Outbreaks of serogroup C meningococcal disease (SCMD) have been occurring more frequently in the United States since the early 1990s, and the use of vaccine to control these outbreaks has increased. These outbreaks are characterized by increased rates of disease among persons who may have a common organizational affiliation or who live in the same community. By using surveillance for SCMD and calculation of attack rates, public health officials can identify SCMD outbreaks and determine whether use of meningococcal vaccine is warranted. This report describes 10 steps for evaluation and management of suspected SCMD outbreaks. The principles described also apply to suspected outbreaks caused by meningococcal serogroups A, Y, and W-135. The effectiveness of mass chemoprophylaxis (administration of antibiotics to large populations) has not been demonstrated in most settings in which community and organizational outbreaks occur. However, in outbreaks involving small populations, administration of chemoprophylaxis to all persons within this group may be considered. The ability to validate some aspects of these recommendations is currently limited by incomplete reporting of serogroup information in most systems for meningococcal disease surveillance in the United States and by the relative rarity of SCMD and SCMD outbreaks.

INTRODUCTION

In the United States, outbreaks of serogroup C meningococcal disease (SCMD) have been occurring more frequently since the early 1990s, and the use of meningococcal vaccine to control these outbreaks has increased. During 1980-1993, 21 outbreaks of SCMD were identified, eight of which occurred during 1992-1993 (1). Each of these 21 outbreaks involved from three to 45 cases of SCMD, and most outbreaks had attack rates exceeding 10 cases per 100,000 population, which is approximately 20 times higher than rates of endemic SCMD. During 1981-1988, only 7,600 doses of meningococcal vaccine were used to control four outbreaks, whereas from January 1992 through June 1993, 180,000 doses of vaccine were used in response to eight outbreaks.

The decision to implement mass vaccination to prevent meningococcal disease depends on whether the occurrence of more than one case of the disease represents an outbreak or an unusual clustering of

endemic meningococcal disease. Because the number of cases in outbreaks is usually small, this determination is not easily made without evaluation and analysis of the pattern of disease occurrence. Mass vaccination campaigns are expensive, require a massive public health effort, and can create unwarranted concern among the public. However, mass vaccination can prevent unnecessary morbidity and mortality. This report provides public health professionals (i.e., epidemiologists in state and local health departments) with guidelines for determining whether mass vaccination should be implemented to prevent meningococcal disease.

BACKGROUND

Meningococcal disease is an infection caused by Neisseria meningitidis. Meningococcal disease manifests most commonly as meningitis and/or meningococcemia that can progress rapidly to purpura fulminans, shock, and death. N. meningitidis is transmitted from person to person via respiratory secretions; carriage is usually asymptomatic.

Endemic Disease

In the United States, rates of endemic SCMD have remained unchanged at approximately 0.5 cases per 100,000 population per year (2). Most of these cases are sporadic and are not epidemiologically associated with other SCMD cases. Secondary and co-primary SCMD cases sometimes occur among close contacts of persons with primary disease; however, such cases are rare, primarily because close contacts are administered chemoprophylaxis (3).

Control of Outbreaks

SCMD outbreaks represent a different epidemiologic phenomenon than does endemic SCMD. SCMD outbreaks are characterized by increased rates of disease among persons who may have a common organizational affiliation or who live in the same community yet do not have close contact. By using the guidelines contained in this report, public health officials can identify SCMD outbreaks and determine whether the use of meningococcal vaccine is warranted. Meningococcal vaccine is recommended for the control of SCMD outbreaks, which often affect older children and adults, for whom vaccination is effective.

The benefit of vaccination for control of SCMD outbreaks is difficult to assess because the pattern of disease occurrence is unpredictable and the numbers of cases are usually small. However, in three recent SCMD outbreaks in the United States during which vaccination campaigns were conducted, additional SCMD cases occurred only among nonvaccinated persons in the group targeted for vaccination (1), suggesting that additional SCMD cases probably were prevented by vaccination.

Outbreak Settings

In the United States, SCMD outbreaks have occurred in organizations and communities. In a community-based outbreak, identifying groups most likely to benefit from vaccination is more difficult because communities include a broad range of ages among whom risk for disease and vaccine efficacy vary. Thus, the recommendations for evaluation and management of organization-based and community-based outbreaks are considered separately.

DEFINITIONS

In this report, the following definitions for SCMD and other definitions are used (4):

Case Definitions

A confirmed case of SCMD is defined by isolation of N. meningitidis serogroup C obtained from a normally sterile site (e.g., blood or cerebrospinal fluid) from a person with clinically compatible illness. A

probable case of SCMD is defined by the detection of serogroup C meningococcal polysaccharide antigen in cerebrospinal fluid (by latex agglutination or counterimmunoelectrophoresis) in the absence of a diagnostic culture from a person with clinically compatible illness.

Close Contacts

Close contacts of a patient who has meningococcal disease include a) household members, b) day care center contacts, and c) persons directly exposed to the patient's oral secretions (e.g., through mouth-to-mouth resuscitation or kissing) (3). Primary, Secondary, and Co-Primary Cases

A primary case is a case that occurs in the absence of previous known close contact with another case-patient. A secondary case is defined as one that occurs among close contacts of a primary case-patient greater than or equal to 24 hours after onset of illness in the primary case-patient. If two or more cases occur among a group of close contacts with onset of illnesses separated by less than 24 hours, these cases are considered to be co-primary.

Organization- and Community-Based Outbreaks

An organization-based outbreak of SCMD is defined as the occurrence of three or more confirmed or probable cases of SCMD during a period of less than or equal to 3 months in persons who have a common affiliation but no close contact with each other, resulting in a primary disease attack rate of at least 10 cases per 100,000 persons. In instances where close contact has occurred, chemoprophylaxis should be administered to close contacts. Organization-based outbreaks have recently occurred in schools, universities, and correctional facilities (1). Investigation of organization-based outbreaks may reveal even closer links between patients than suggested by initial reports. For example, data from an investigation of one outbreak at a school indicated that all persons who had meningococcal disease had ridden the same school bus (5).

A community-based outbreak of SCMD is defined as the occurrence of three or more confirmed or probable cases during a period of less than or equal to 3 months among persons residing in the same area who are not close contacts of each other and who do not share a common affiliation, with a primary attack rate of at least 10 cases per 100,000 population. Community-based outbreaks have occurred in towns, cities, and counties (1). Distinguishing whether an outbreak is organization-based or community-based is complicated by the fact that, in some instances, these types of outbreaks may occur simultaneously.

Population at Risk

The population at risk is defined as a group of persons who, in addition to close contacts, are considered to be at increased risk for SCMD when compared with historical patterns of disease in the same population or with the risk for disease in the general U.S. population. This group is usually defined on the basis of organizational affiliation or community of residence. The population at risk is used as the denominator in calculations of the disease attack rate.

Vaccination Group and Seasonality of Outbreaks

During a vaccination campaign, the group designated to be administered vaccine is called the vaccination group. In some instances, the vaccination group will be the same as the population at risk; however, in other instances, these groups may differ. For example, in an organization-based outbreak at a university in which all cases have occurred among undergraduates rather than graduate students, faculty, or other staff, undergraduates may be the vaccination group. In community-based outbreaks, cases often occur in persons within a narrow age range (e.g., only in persons less than 30 years of age) (1). Because the available vaccine is probably not effective in children less than 2 years of age, these children are not usually included in the vaccination group, and the vaccination group may be that portion of the population at risk who are 2-29 years of age.

In the United States, the incidence of meningococcal disease varies by season, with the highest rates of disease occurring in February and March and the lowest in September (2). For control of SCMD outbreaks, vaccination administered before or during the seasonal peak (i.e., fall and winter months) is more likely to prevent cases than vaccination administered during lower incidence periods (i.e., spring and summer).

RECOMMENDATIONS

The following recommendations regarding the evaluation and management of suspected SCMD outbreaks are based on experience with SCMD outbreaks in the United States. However, the principles described apply to outbreaks caused by the other vaccine-preventabl e meningococcal serogroups A, Y, and W-135.

- Establish a diagnosis of SCMD. Only confirmed and probable SCMD cases should be considered in the characterization of a suspected SCMD outbreak. Cases not fulfilling these criteria should be excluded from consideration.

- Administer chemoprophylaxis to appropriate contacts. Chemoprophylaxis should be administered to close contacts of patients. Administering chemoprophylaxis to persons who are not close contacts of patients has not been effective in preventing community outbreak-associated cases and usually is not recommended. Neither oropharyngeal nor nasopharyngeal cultures for N. meningitidis are useful in deciding who should receive chemoprophylaxis or when investigating suspected outbreaks (3).

- Enhance surveillance, save isolates, and review historical data. Most state and local health departments rely on passive surveillance for meningococcal disease, which may result in delayed or incomplete reporting of cases. When an SCMD outbreak is suspected, potential reporting sites should be alerted and encouraged to report new cases promptly. Reporting sites also should send all N. meningitidis isolates to a designated local or state laboratory until investigation of the suspected SCMD outbreak is completed. This action will ensure availability of isolates for confirmation of serogroup and application of other methods for subtyping.

  Information on the serogroup of N. meningitidis isolates is needed to fulfill criteria for confirmed and probable case definitions. This information should be obtained promptly with all meningococcal disease case reports in the United States. To ensure availability of serogroup information, health department laboratories should support laboratory facilities that do not routinely perform serogrouping on meningococcal isolates.

  Public health officials should review overall and serogroup-specific meningococcal disease rates for previous years in the same or comparable population(s) and in different regions within the state. These data should be compared with data currently reported for the population being evaluated to characterize both the geographic extent and magnitude of the outbreak.

- Investigate links between cases. In addition to demographic information, public health professionals should collect age-appropriate information concerning each SCMD patient (e.g., close contact with other case-patients, day care attendance, participation in social activities, participation in sports activities, and affiliation with organizations). This information will help identify secondary and co-primary cases and also may reveal links between cases that will help define the population at risk.

- Consider subtyping. Subtyping of N. meningitidis isolates, using methods such as multilocus enzyme electrophoresis or pulsed-field gel electrophoresis of enzyme-restricted DNA fragments, may provide information that will be useful in determining whether a group of cases represents an outbreak. SCMD outbreaks usually are caused by closely related strains. Subtyping data can allow identification of an "outbreak strain" and aid in better defining the extent of an outbreak. If strains from a group of patients are unrelated by subtyping, the group of cases most likely does not represent an outbreak. Although subtyping is potentially useful, it is time consuming and can be

done only in specialized reference laboratories. In addition, results can sometimes be difficult to interpret. Initiation of outbreak-control efforts should not be delayed until subtyping results are available.

- Exclude secondary and co-primary cases. To calculate a primary disease attack rate, all confirmed and probable cases should be summed; secondary cases should be excluded and each set of co-primary cases counted as one case. Because the purpose of calculating attack rates is both to characterize the risk for disease among the general population and to determine whether overall rates have increased, related cases (i.e., secondary and co-primary cases) should not be included. Epidemiologically, secondary and co-primary cases can be considered as representing single episodes of disease with direct spread to one or more close contact(s), which is consistent with endemic disease. Because the risk for acquiring meningococcal disease is 500-800 times greater among close contacts of case-patients than among the total population, chemoprophylaxis is recommended for these persons (3). Because secondary and co-primary cases occur infrequently, they should represent a small portion of outbreak-associated SCMD cases in the United States.

- Determine if the suspected outbreak is organization- or community-based. Epidemiologic and laboratory investigations can reveal common affiliations among case-patients. Potential affiliations can be organizational, with all or most of the patients attending a particular day care center, school, or university; belonging to a sports team or club; or sharing an activity (e.g., riding a school bus). Alternatively, common affiliations can be geographic (e.g., residing in the same town, city, or county). Of 21 U.S. outbreaks identified between 1980 and mid-1993, 11 (52%) were organization-based and 10 (48%) were community-based. Eight (73%) of the 11 organization-based outbreaks occurred in schools (1). If a common organizational affiliation other than community can be identified, the outbreak is termed organization-based; otherwise, it is considered to be community-based.

- Define population at risk and determine its size. In organization-based outbreaks, cases are linked by a common affiliation other than a shared geographically delineated community. The population at risk is the group of persons who best represent that affiliation. For example, if the only association between patients was attending the same school or university, the population at risk would be all persons attending the school or university. Information concerning the size of the organization should be obtained from officials in the organization. In community-based outbreaks, there are no common affiliations among patients other than a shared, geographically defined community. The population at risk can be defined by the smallest geographically contiguous population that includes all (or almost all) case-patients. This population is usually a neighborhood, town, city, or county. The size of the population can be obtained from census information.

- Calculate the attack rate. If three or more SCMD cases have occurred in either an organization- or community-based outbreak in less than or equal to 3 months (starting at the time of the first confirmed or probable case), a primary disease attack rate should be calculated. Because of the small number of cases typically involved and the seasonal patterns of meningococcal disease, rate calculations should not be annualized for use in this algorithm. The following formula can be used to calculate this attack rate:

  Attack rate per 100,000 = [(Number of definite and probable SCMD cases during a 3-month period] */(Number of population at risk)] x 100,000

  If an attack rate exceeds 10 SCMD cases per 100,000 persons, vaccination of population at risk should be considered. +

  The actual attack rate at which the decision to vaccinate is made may vary. Public health personnel should consider the following factors: a) completeness of surveillance and number of possible SCMD cases for which bacteriologic confirmation or serogroup data are not available; b) occurrence of additional SCMD cases after recognition of a suspected SCMD outbreak (e.g., if the SCMD

outbreak occurred 2 months previously and if no additional cases have occurred, vaccination may be unlikely to prevent additional SCMD cases); and c) logistic and financial considerations.

- Select the target group for vaccination. In most organization-based outbreaks, the vaccination group may include the whole population at risk provided all persons are greater than 2 years of age. If a substantial proportion of patients are less than 2 years of age and, thus, not eligible to receive the current vaccine, patients less than 2 years of age may be excluded and, if at least three case-patients remain, an attack rate should be recalculated. If after recalculation the attack rate is still more than 10 cases per 100,000 persons, vaccination should be considered for some or all of the population at risk greater than or equal to 2 years of age. In some organization-based outbreaks, a vaccination group larger than the population at risk may be designated. For example, in a high school in which all outbreak-associated cases occurred among students, authorities may decide to offer vaccine to staff. In community-based outbreaks, the vaccination group usually can be defined as a subset of the entire population at risk, based on a group greater than or equal to 2 years of age (e.g., 2-19 or 2-29 years of age). This age range should contain all (or almost all) SCMD patients greater than or equal to 2 years of age. If a large proportion of patients are less than 2 years of age and probably will not be protected with the current vaccine, patients less than 2 years of age may be excluded from calculation of an attack rate. ***

  In some situations, the entire population greater than or equal

to 2 years of age, without other age restriction, might be the most appropriate vaccination group. For example, in a small town in which several cases have occurred among children greater than or equal to 2 years and adults greater than 29 years of age, it may be most appropriate to select all persons greater than or equal to 2 years of age as the vaccination group. For larger populations, this decision would be costly in terms of finances and human resources and restricting the vaccination group to the persons in age groups with the highest attack rates may be more appropriate. Age-specific attack rates can be calculated by using the formula previously provided and restricting the numerator and denominator to persons within specific age groups (e.g., persons 2-19 years of age). Many recent immunization programs have been directed at persons who are 2-19 years of age or who are 2-29 years of age (1). The 10 steps are summarized as follows:

Summary of 10 steps in the evaluation and management of suspected outbreaks of serogroup C meningococcal disease (SCMD)

1. Establish a diagnosis of SCMD.
2. Administer chemoprophylaxis to appropriate contacts.
3. Enhance surveillance, save isolates, and review historical data.
4. Investigate links between cases.
5. Consider subtyping.
6. Exclude secondary and co-primary cases.
7. Determine if the suspected outbreak is organization- or community-based.
8. Define the population at risk and determine its size.
9. Calculate the attack rate.
10. Select the target group for vaccination.

Vaccine

Quadrivalent meningococcal vaccine is available in single, 10- or 50-dose vials. Fifty-dose vials are designed for use with jet-injector devices. Questions about vaccination or use of jet-injector devices should be addressed to the National Immunization Program, CDC (telephone: [404] 639-8257) (6).

From 7 to 10 days are required following vaccination for development of protective levels of antimeningococcal antibodies. Cases of SCMD occurring in vaccinated persons within 10 days after vaccination should not be considered vaccine failures.

Other Control Measures

Mass chemoprophylaxis (i.e., administration of antibiotics to large populations) is not effective in most settings in which community-based or organization-based outbreaks have occurred. Disadvantages of widespread administration of antimicrobial drugs for chemoprophylaxis include cost of the drug and administration, difficulty of ensuring simultaneous administration of chemoprophylactic antimicrobial drugs to large populations, side effects of the drugs, and emergence of resistant organisms. In most outbreak settings, these disadvantages outweigh the possible (and unproven) benefit in disease prevention. However, in outbreaks involving small populations (e.g., an outbreak in a small organization, such as a single school), administration of chemoprophylaxis to all persons within this population may be considered. If mass chemoprophylaxis is undertaken, it should be administered to all members at the same time. In the United States, measures that have not been recommended for control of SCMD outbreaks include restricting travel to areas with a SCMD outbreak, closing schools or universities, or cancelling sporting or social events.

Educating communities, physicians, and other health-care workers about meningococcal disease is an important part of managing suspected SCMD outbreaks. Educational efforts should be initiated as soon as an SCMD outbreak is suspected.

CONCLUSIONS

The ability to validate some aspects of these recommendations is currently limited by both incomplete reporting of serogroup information in most systems for meningococcal disease surveillance in the United States and the infrequency of SCMD cases and SCMD outbreaks. As additional information becomes available from ongoing surveillance projects, these recommendations may be revised.

Consultation on the use of these recommendations or other issues regarding meningococcal disease is available from the Childhood and Respiratory Diseases Branch, Division of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, CDC (telephone: [404] 639-2215 or [404] 639-3311 outside normal working hours).

References

1. Jackson LA, Schuchat A, Reeves MW, Wenger JD. Serogroup C meningococcal outbreaks in the United States: an emerging threat. JAMA 1995;273:383-9.

2. CDC. Surveillance for diabetes mellitus -- United States, 1980-1989 and laboratory-based surveillance for meningococcal disease in selected areas -- United States, 1989-1991. MMWR 1993;42(No. SS-2):21-30.

3. CDC. Control and prevention of meningococcal disease and Control and prevention of serogroup C meningococcal disease: evaluation and management of suspected outbreaks: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1997;46(No. RR-5).

4. CDC. Case definitions for public health surveillance. MWMR 1990;39(No. RR-13).

5. Harrison LH, Armstrong CW, Jenkins SR, et al. A cluster of meningococcal disease on a school bus following epidemic influenza. Arch Intern Med 1991;151:1005-9.

6. CDC. General recommendations on immunizations: recommendations of the Immunization Practices Advisory Committee (ACIP). MMWR 1989;38:205-14,219-27.

- Secondary cases should be excluded, and co-primary sets should be counted as one case. ** Calculation of attack rates for organization-based SCMD outbreaks is most useful for large organizations (e.g., some universities). However, in most organization-based SCMD outbreaks with three cases of disease, the rate will exceed 10 cases per 100,000 population. Thus, occurrence of three cases in these settings should prompt consideration of vaccination. In some situations, public health officials also may wish to consider vaccination after only two SCMD cases are identified. *** Because community-based outbreaks often affect a broader age distribution than organization-based outbreaks, it may be appropriate to include patients less than 2 years of age in the calculation of an attack rate even though persons in this age group are unlikely to benefit from vaccination.

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