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Editorial

Confronting the Epidemiology, Burden, Treatment, and Prevention of Meningococcal Disease



Meningococcal disease has always been one of the most feared infectious diseases among clinicians. It is difficult to diagnose in the early stages, and it can take a life within hours. Throughout the world, meningococcal disease rates peak specifically among infants and adolescents/young adults, making this topic particularly pertinent to those treating adolescents and young adults. The four articles in this supplement to the *Journal of Adolescent Health* address the devastating medical, emotional, and societal impacts of meningococcal disease, track the changing epidemiology of the disease across the world, and review the preventive measures aimed at mitigating the effects of this dreaded disease [1–4].

The article by Dr. Nadel [1] makes it clear that meningococcal disease is often difficult to recognize in its early stages. It moves quickly from relatively vague symptoms to sepsis and can have devastating consequences to the infected individual. Although the disease is rare, meningococcal disease is associated with a 10% mortality rate with antibiotic treatment—improved from a far higher rate between 70% and 85% before the use of antibiotics. Approximately 11%–19% of survivors experience significant sequelae. The classic rash that many might mistakenly rely on for diagnosis is a relatively late symptom; the level of suspicion of meningococcal disease must always be high, and immediate treatment with antibiotics should be initiated if the disease is suspected. The primary targets of treatment include shock and increased intracranial pressure, the complications of which lead to ischemia of the skin, limbs, and kidneys, as well as neurologic sequelae such as cognitive deficits, hearing and visual impairments, and stroke. Thus far, studies of agents that might specifically slow or arrest the effects of the endotoxins that are responsible for the biological derangements associated with the disease are producing disappointing results. Dr. Nadel has included multiple algorithms for the treatment of meningococcal disease that help guide providers with the most recent evidence-based recommendations. Dr. Nadel paints a frightening picture of meningococcal disease that exposes the bacteria's ruthless drive to destruction. Early detection and intervention are keys to clinical success when treating disease caused by *Neisseria meningitidis*.

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The epidemiology of meningococcal disease is described in this up-to-date chronicle of the evolving shifts in serogroup prevalence throughout the world by Dr. Pelton [2]. The primary serogroups that cause disease among humans include serogroups A, B, C, W-135, Y, and X. Each region of the world has experienced outbreaks of meningococcal disease; the prevalent serogroups of *N. meningitidis* responsible for the outbreaks differ by region. As each country responds to disease outbreaks by introducing serogroup-specific vaccines, the prevalent serogroups in the region have shifted uniquely based on the vaccine policy for that region. In the United States, rates of invasive disease have decreased steadily since the Year 2000, well before the introduction of meningococcal vaccines. Dr. Pelton postulates that the seasonal peak of invasive meningococcal disease 2 weeks after the peak in hospitalization for influenza implies that more routine use of influenza vaccination in the United States has impacted the decline in meningococcal disease rates. Tracking the epidemiologic trends of meningococcal disease in the United States is somewhat challenging due to low disease rates overall. Since the recommendation for routine use of the quadrivalent conjugate vaccine addressing serogroups A, C, W, and Y in 2005, serogroup B has become the serogroup most commonly identified in outbreaks among university students, and serogroup C is the serogroup most commonly associated with outbreaks among men having sex with men. In Europe, the shift from predominantly serogroup C disease to mostly serogroup B and now an increasing proportion of serogroup Y disease is likely due to the widespread use of conjugate vaccines targeting serogroup C. In Latin American countries, where the use of meningococcal vaccines is not widespread, serogroups C and W are gaining ground. In sub-Saharan Africa, where rates of disease exceed rates seen elsewhere in the world, disease from serogroup A is decreasing where vaccines against serogroup A are being used, and the proportion of disease due to serogroup W is starting to increase. Cases due to the relatively rare serogroup X are being seen in Africa, indicating the need for continued surveillance. As the world becomes more interconnected with more efficient forms of travel, the regional politics of disease and disease prevention through vaccination may ultimately determine the epidemiology of disease throughout the world.

The article by Martín-Torres [3] provides a comprehensive overview of the costs and burden of meningococcal disease. The author points to the global burden of disease and the high fatality rates and serious morbidity that result from infection. In addition to the physical sequelae with which we are most familiar

(e.g., hearing loss, amputation, skin scarring), Martínón-Torres points out that meningococcal disease can result in cognitive impairment, including deficits in memory and executive functioning. He also discusses the increased risk for post-traumatic stress disorder and other mental health sequelae both in children and adolescents who survive meningococcal disease and in their families. The direct and indirect medical costs of meningococcal disease have been well studied and are summarized in this article, highlighting the unique issues associated with developed versus undeveloped countries. Perhaps the most novel aspects of the article by Martínón-Torres are his emphasis on the societal and neglected costs of the disease, which are not typically considered in cost-effectiveness analyses and public health policy and planning. Some of these neglected burdens include long-term mental health treatment needs, costs associated with heightened opiate dependence, long-term effects of family stress, legal burdens (e.g., the risk of malpractice suits after misdiagnosis), and the effects of “fear of meningococcal disease” on medical practice with the potential for increased use of costly and unnecessary medical tests. These “neglected” burdens are difficult to quantify, and yet they need to be considered in weighing the benefits of meningococcal vaccination.

The final article by Baker [4] provides a useful, detailed overview of six *N. meningitidis* serogroups (A, B, C, W, X, and Y) and focuses on the available vaccines in the United States that can prevent disease caused by five of these serogroups. The quadrivalent conjugate vaccine (MenACWY), which has been licensed in the United States since 2005, protects against serogroups A, C, W, and Y. As previously noted, serogroup B, not covered by the routinely recommended quadrivalent meningococcal vaccine, is now responsible for many of the recent meningococcus outbreaks in the United States. Two different serogroup B vaccines have recently been licensed for use in the United States. Baker does an excellent job of reviewing the history of meningococcal vaccine development, summarizing current recommendations, and providing a detailed analysis of the differences between the two MenB vaccines. In 2005, the Advisory Committee on Immunization Practices (ACIP) issued a routine recommendation for MenACWY, which has helped to establish MenACWY vaccination as part of the routine adolescent immunization platform [5]. Many states now require MenACWY vaccination for middle school and/or high school entry [6]. Although ACIP has recommended routine vaccination against serogroup B vaccines for those at increased risk of disease (e.g., those who work with serogroup B bacteria in a laboratory, those in an area with an outbreak), ACIP has issued a Category B recommendation (a “permissive” recommendation) for all other adolescents, which is often interpreted as a weak recommendation [7]. Baker warns that this approach almost certainly leads to lower vaccination rates. Given the confusion around serogroup B vaccine recommendations, Baker emphasizes the importance

of increasing knowledge and awareness about serogroup B disease and the vaccine among health care providers and the public in general, including adolescents/young adults and their families and institutions serving large numbers of adolescents and young adults. It is essential that families understand that the routinely recommended vaccine against serogroups A, C, W, and Y will not protect them against all meningococcal serogroups and that an additional vaccine to protect against serogroup B disease is available and covered by medical insurance.

As a group, the four articles in this supplement provide excellent, detailed information about meningococcal disease and its epidemiology, treatment, and prevention. The supplement is a valuable resource for health professionals. Readers of these articles will be extraordinarily well informed about bacterial meningitis and well equipped to discuss the seriousness of infection and the importance of prevention through vaccination.

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