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Epidemiology of meningitis in Al-Ain, United Arab Emirates, 2000—2005☆

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KEYWORDS
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Summary
Objective: To describe the epidemiologic features of meningitis in Al-Ain Medical District, United Arab Emirates from January 2000 through June 2005.
Methods: A retrospective review of clinical records and notification forms for cases of meningitis reported to the Department of Preventive Medicine, Al-Ain. Data collected and compiled included demographic features, causative microbiologic agents, and annual incidence rates of meningitis, by etiology.
Results: Ninety-two cases of meningitis were reported during the study period; 53% were bacterial and 37% were viral in origin. *Neisseria meningitidis* was the leading bacterial pathogen (35%) followed by *Streptococcus pneumoniae* (16%). Ten percent of clinically diagnosed cases of meningitis had no causative microorganism recovered, and in 33% of patients with presumed pyogenic meningitis no specific bacterial pathogen could be identified. The peak occurrence of meningitis was in young children less than one year old. Most cases of meningococcal meningitis were seen among prison inmates and laborers, while viral meningitis occurred mainly in children and young adults attending school. The incidence rate of meningitis in Al-Ain ranged between 2.2/100 000 population in 2000 and 1/100 000 in 2005, with an overall downward trend by year. The incidence of *Haemophilus influenzae* type b decreased significantly after implementation of the national immunization program in 1999.
Conclusions: Improved methods of bacterial detection including isolate serotyping must be made available in order to further reduce mortality and morbidity from meningitis.

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Introduction

Meningitis is a common disease worldwide and remains a major international health problem. In 2002, meningitis caused an estimated 173 000 deaths worldwide, mostly among children from the developing world.[1] The occurrence and microbial etiology of meningitis varies according to geographic region, with degrees of endemicity. During the pre-meningitis vaccination era, the incidence of meningitis in the United Arab Emirates (UAE) was similar to other countries and *Haemophilus influenzae* type b (Hib) was the most common cause.[2] Since the introduction of the conjugate Hib vaccine in UAE's national immunization program in 1999, the absolute number of cases of meningitis attributable to Hib has declined, but its impact on the epidemiology of meningitis due to other causes has received little attention. The present study describes recent epidemiologic features of meningitis in Al-Ain Medical District of UAE.

Patients and methods

The city of Al-Ain is located in the emirate of Abu Dhabi, and its population has grown from a few thousand in the pre-oil boom days to around 410 000 in 2005.[3] Al-Ain possesses high quality medical facilities including primary health centers, private clinics, and hospitals. In Al-Ain Medical District, meningitis is a reportable disease, and mandatory notification of each case to the Department of Preventive Medicine within the Ministry of Health is required within 24 hours. Physicians in the district are provided with official case definitions of meningitis and case reporting guidelines.

All clinical records (case notification forms and hospital medical records) for cases of meningitis reported to the Department of Preventive Medicine from January 2000 through June 2005 were examined for basic patient demographic information including age, gender, nationality, microbiologic etiology of meningitis, travel history, vaccination status against meningitis causes, underlying conditions, and clinical outcome. The following case definitions were used in this study: (1) a diagnosis of meningitis was based upon clinical assessment, with features including fever, headache, vomiting, neck stiffness, convulsions, and altered consciousness; (2) bacterial meningitis was confirmed by a positive Gram stain of cerebrospinal fluid (CSF), by cultural isolation of a relevant microorganism from CSF and/or blood, or by detection of bacterial antigens in CSF; (3) viral meningitis was diagnosed presumptively on clinical grounds and by exclusion of bacterial meningitis.

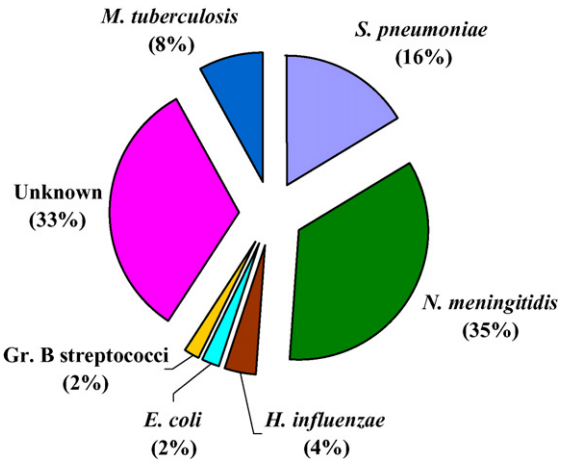

Figure 1 Causative agents of bacterial meningitis.

Results

During the study period, 92 cases of meningitis were reported in the medical district of Al-Ain, of which 53% were bacterial and 37% were viral in origin. Nine cases (10%) were clinically diagnosed as meningitis but in each of these instances no specific microbial etiology could be determined. Among bacterial causes of meningitis, *Neisseria meningitidis* was the most frequent causative agent, occurring in 17 (35%) cases (mostly adults), followed by *Streptococcus pneumoniae* in eight (16%) cases. All four cases (8%) of meningitis due to *Mycobacterium tuberculosis* were seen in adults, with a mean age of 30 years. The BCG vaccination status was not available for these cases, and none of these subjects was an immunocompromised host. One case (2%) each of *Escherichia coli* and group B streptococcal meningitis, respectively, occurred in neonates. Both cases (4%) of meningitis due to *H. influenzae* occurred in children who had not been previously vaccinated. Sixteen (33%) cases of meningitis were presumptively attributed to bacterial pathogens without final determination of causative organisms (Figures 1 and 2).

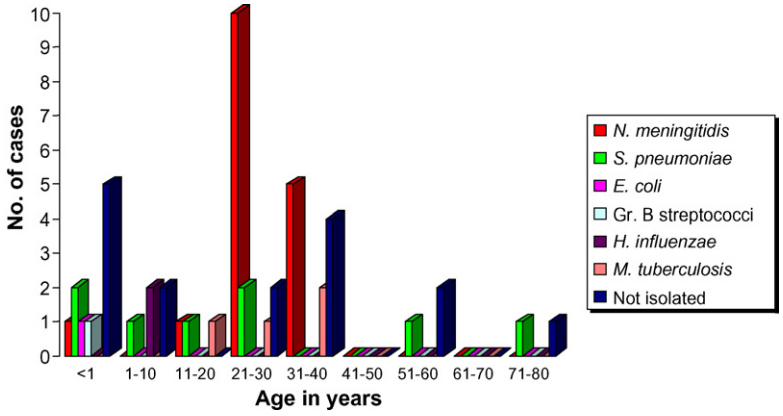

Figure 2 Causative agents of bacterial meningitis in different age groups.

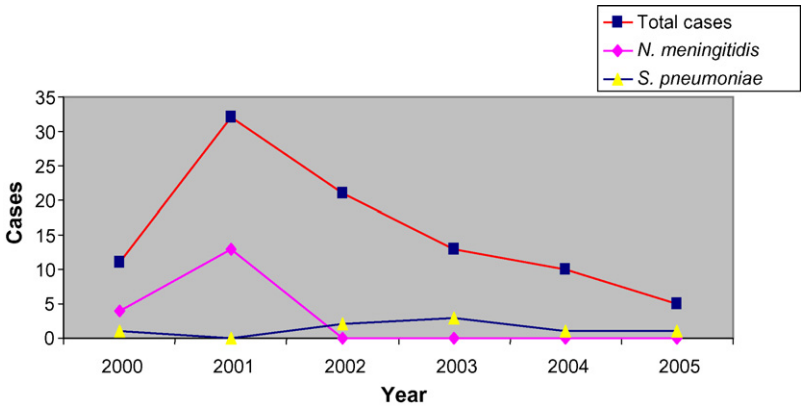

Figure 3 Distribution of meningitis cases by year.

Most cases of meningococcal meningitis occurred in prison inmates and laborers. Twelve bacteriologically-confirmed cases of meningitis due to *N. meningitidis* were reported among inmates of Al-Ain prison between December 2000 and April 2001. All affected subjects were adult males (mean age 30 years) who received appropriate treatment and fully recovered. Cases of viral meningitis were mainly seen in children, teenagers, and young adults attending school. The incidence of meningitis due to Hib began to decrease significantly after implementation of the national immunization program in 1999, and this trend continued during the study period. The incidence of meningeal infection of all types in Al-Ain Medical District ranged from 2.2/100 000 population in 2000 to 1/100 000 population in 2005, with an overall downward trend by year (Figure 3).

The age group between 0 and 5 years had the highest rate of meningitis, with the largest number of cases occurring in children less than one year old. Overall, the mean patient age was 19 years (SD = 1.660). An increase in the incidence of meningitis in the 21—30 year age group was attributed to the outbreak of meningococcal infection that occurred among inmates of Al-Ain Prison in 2001. There was no variance in incidence by gender, with both sexes being equally affected. Meningitis cases were observed throughout the year without any seasonal variation.

Fever, neck stiffness, seizure, vomiting, and bulging fontanelle were the most frequent presenting features. The meningitis case-fatality rate was 11% (10 of 92). Mortality according to microorganism was as follows: bacterial (documented or presumptive) 16% (8 of 49); viral 3% (1 of 34); unknown etiology 11% (1 of 9).

Discussion

Except for a prison-related meningitis outbreak in 2001, there has been a decline in the incidence of meningitis cases in Al-Ain over the past five years. This decrease can potentially be attributed to multiple factors including improvements in living conditions, regional introduction of vaccines against *H. influenzae* type b and *N. meningitidis*, better availability of healthcare facilities, earlier detection of meningitis, and improved prevention and control strategies by the Ministry of Health against all types of meningitis. The decline in incidence rates is unlikely to have been affected by changes in surveillance because no modifications were made in the national diagnostic criteria used for meningitis, and only passive surveillance was conducted throughout the entire study period.

H. influenzae type b, once the leading cause of meningitis in children under 5 years of age, has become rare since the introduction of conjugate Hib vaccination in UAE in 1999.[2] Similar epidemiology has been reported from the USA and Europe, and from the neighboring countries of Qatar and Saudi Arabia where the incidence of all forms of invasive Hib disease has been dramatically reduced as a result of systematic and mandatory immunization of all children.[4—8] Only two isolates of *H. influenzae* were recovered from CSF during our study period, both during 2000 when the Hib vaccination had only recently been introduced into the community. Since 2000, there have been no cases of Hib meningitis reported, thus demonstrating the remarkable success of the national immunization program in UAE.

None of the isolated bacterial agents were further typed or serogrouped in order to precisely identify the circulating strain. Sub-classification (serotyping) is especially important for *N. meningitidis*, in which immunity is group-specific, and information about the predominant strain is very important in developing and implementing an effective community-based vaccine strategy.[4] Similarly, in spite of a very well-constructed reporting form available from the Ministry of Health, routine antibiotic sensitivity test results were lacking in most cases. This observation is extremely relevant, since resistance of pneumococci to penicillin and cephalosporins has been increasing globally in the past decade.[9] In many parts of the world, penicillin can no longer be used by itself to empirically treat suspected bacterial meningitis.[10,11] Furthermore, *H. influenzae* isolates can produce β-lactamases, and have widely developed resistance to antibiotics such as ampicillin and chloramphenicol.[12] Antibiotic sensitivity testing plays a crucial role in formulating effective treatment, reducing unnecessary use of broad-spectrum agents, and limiting spread of drug-resistant strains. We suggest that all bacterial isolates recovered from CSF must be tested for antimicrobial susceptibility using Kirby—Bauer disk diffusion, E-test, and/or β-lactamase detection methods.[13]

In this study, the occurrence of nine (10%) cases of meningitis of undetermined etiology, as well as the failure to isolate a causative microorganism from 19 (33%) cases of presumed bacterial meningitis, reflects the need for

improvement of laboratory procedures and practices in UAE. Etiologic diagnosis of meningitis can be enhanced by using antigen detection (e.g., latex agglutination) and nucleic acid amplification (e.g., polymerase chain reaction) techniques.[14,15] Antigen testing can be very useful when a patient is partially treated with antibiotics (often self-administered) before examination of CSF, leading to a false-negative Gram stain and/or culture. In fact, failure to isolate a causative agent is most often related to antibiotic treatment received prior to lumbar puncture. The above-mentioned diagnostic methods should be routinely incorporated into standard laboratory practice and made available at all the reference laboratories.

Acute bacterial meningitis in childhood has considerable mortality, complications, and long-term neurologic sequelae.[16,17] A limitation of our retrospective study was an inability to fully determine the morbidity of meningitis such as hydrocephalus, cerebral edema, sensorineural hearing loss, vision impairment, and failure to thrive that are likely to occur in UAE because patient-specific clinical outcomes were generally unavailable. Long-term clinical follow-up and information about outcome of meningitis, especially for cases involving young children, are needed and should be recorded regularly and accurately.

In conclusion, correct and early identification of the precise etiologic agent and timely institution of appropriate antimicrobial therapy is of paramount importance in the successful management of meningitis. There is an urgent need to upgrade the diagnostic and reporting system for meningitis in UAE. Improved methods of bacterial detection and isolate serotyping must be made available in UAE in order to further reduce mortality and morbidity from meningitis.

Conflict of interest: No conflict of interest to declare.

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