JOURNAL OF CLINICAL MICROBIOLOGY, Mar. 2002, p. 1083–1084 Vol. 40, No. 3
0095-1137/02/$04.00+0 DOI: 10.1128/JCM.40.3.1083–1084.2002

Neisseria meningitidis Serogroups W135 and A Were Equally Prevalent among Meningitis Cases Occurring at the End of the 2001 Epidemics in Burkina Faso and Niger

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Received 10 October 2001/Returned for modification 5 November 2001/Accepted 9 December 2001

Meningococcal infections occur as epidemics in the African meningitis belt. *Neisseria meningitidis* serogroup A is predominantly involved in these epidemics. We report here new data on the involvement of both serogroups A and W135 in meningitis cases in Burkina Faso and Niger at the end of the 2001 epidemic.

Burkina Faso and Niger were among the countries most severely affected by the meningitis epidemic between the end of January and the end of June 2001, with 13,039 cases, 1,813 deaths and 7,906 cases, 595 deaths, respectively (8).

Among clinical specimens that had been obtained for individual case management, we collected a convenience sample of 57 cerebrospinal fluids (CSF) and one serum sample from 58 patients in Burkina Faso and 37 CSF and three sera from 40 patients in Niger from the 10 April to 3 July 2001. However, most of the specimens (85%) were collected during a field investigation between 10 and 24 April (weeks 15 to 17 of the outbreak). All patients presented clinical signs of meningitis, and specimens were taken just before treatment with oily chloramphenicol. Investigation sites were various hospitals and health centers located in 14 districts in Burkina Faso along a west-to-east axis (Oradora; two districts each of Bobo Dioulasso, Dano, Houndé, Boromo, and Koudougou; and four districts each of Ouagadougou, Zorgho, Koupela, and Fada N′Gourma) and in two districts in Niger (Niamey and Boboye). In Burkina Faso, 11 of 14 visited districts experienced a meningitis epidemic in 2001 that was under control by the time of our visit, except in Koupela. In Niger, Boboye experienced a limited epidemic that began to decline in week 15. Age was known for 94 subjects, of whom 65 (69%) were under 15 years old. Vaccination status against meningococcal disease (A and C vaccine) was known for 46 subjects, of whom 21 (46%) were vaccinated, mainly (16 subjects) in 2001. In such a small sample, no influence of vaccination status on the distribution of serogroups could be significantly deduced.

CSF and serum samples were tested by PCR for the presence of *Streptococcus pneumoniae* DNA (2) and *N. meningitidis* DNA (6), as well as for the presence of *Haemophilus influenzae* type b DNA (1). Samples positive for *N. meningitidis* were further tested by PCR for capsule genes to predict the serogroups A, B, C, Y, and W135 (6). Of the 58 samples from Burkina Faso, 32 (55%) were positive for *N. meningitidis* (including the serum sample), 4 were positive for *S. pneumoniae*, and 22 failed to give a detectable gene amplification for the three tested bacterial species. Of the 40 samples from Niger, 31 (78%) were positive for *N. meningitidis* (including the three serum samples), 3 were positive for *S. pneumoniae*, 2 were positive for *H. influenzae* type b , and 4 failed to give a detectable gene amplification for the three tested bacterial species (presence of inhibitors in three of them). Among the 32 *N. meningitidis* PCR-positive samples from Burkina Faso, 8 corresponded to serogroup A, 12 corresponded to serogroup W135, and 2 corresponded to serogroup C. PCR failed to predict serogroup in 10 samples. PCR amplification of capsule genes of *N. meningitidis* led to the identification of 16 as serogroup A, 12 as serogroup W135, and 1 as serogroup C among the 31 *N. meningitidis* PCR-positive samples from Niger, while for 2 others determination of serogroup failed. We have no explanation for the failure in predicting serogroups from 12 *N. meningitidis*-positive samples in this study. In a previous study, the sensitivity and specificity of meningococcal DNA detection by PCR were 93 and 96%, respectively, and serogroup prediction was successful in all *N. meningitidis*-positive samples (6).

Thus, among the *N. meningitidis*-positive samples for which serogroup could be predicted, 38% corresponded to serogroup W135, 38% corresponded to serogroup A, and 5% corresponded to serogroup C. Serogroup could not be predicted in 19% of the samples. A systematic questionnaire revealed no link to the 2001 Hajj pilgrimage (neither travel nor contact with pilgrims) for the W135 cases. Sixteen (42%) of the meningitis cases that occurred in the 5-to-15-year-old group were W135.

In addition, 12 strains of *N. meningitidis* had been isolated from other CSF samples (4 from Burkina Faso and 8 from Niger). No vaccination history was available for these cases. Among the four strains isolated in Burkina Faso, on 21, 22, 23, and 24 April 2001, only one was A:4:P1-9, while the three others were W135:2a:P1-2,5. The eight *N. meningitidis* strains from Niger had been isolated on 4 December 2000 and 8 January, 6 and 29 March (2 strains), 24 April, and 12 May 2001. Seven isolates had the antigenic formula A:4:P1-9 and one,

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from April 2001, was W135:2a:P1-2,5. Multilocus DNA fingerprint typing showed identical markers of the ET-37 clonal complex for the four serogroup W135 strains. Pulsed-field gel electrophoresis analysis of these strains showed that their patterns differed only by two bands from that obtained with the W135, ET-37 clone of the Hajj 2000 pilgrimage (5, 7). Recent meningococcal epidemics in the African meningitis belt have usually been of the antigenic formula A:4:P1-9, clone III-1 (3). Vaccination against serogroups A and C is used to control these epidemics. Other serogroups have been occasionally detected, including serogroup W135 (3, 4), but without evidence for epidemic spread. During an epidemic in Mali in 1993-1994, 2 of 12 *N. meningitidis* strains were of serogroup W135, clone ET-37 (3). In a 6-year study in Gambia (1990 to 1995), 6 of 14 *N. meningitidis* isolates were of serogroup W135, clone ET-37 (4). Since the global spread of the clone related to the Hajj of 2000, the characterization of W135 strains from several countries revealed the presence of several related clones that all belong to the ET-37 complex (5, 7). As the samples we tested were not random and were collected at the end of the epidemic, we cannot be certain that the *N. meningitidis* W135 ET-37 clone was a major cause of disease during 2001 in Niger and Burkina Faso. In particular, one cannot assess whether meningococcal meningitis cases due to serogroup W135 represented epidemic rather than endemic cases, since at the time of our sample collection a great proportion of exposed people had been vaccinated against serogroups A and C. However, our results are a warning that strains of serogroup W135 could spread to a large extent in the African meningitis belt.

N. meningitidis is genetically variable and may undergo escape strategies by transformation and recombination (capsule switch, capsule replacement, and escape mutation) to circumvent host immunity. Such genetic variations may be responsible for the selection of antigenic variants able to escape mass immunization campaigns.

The observation of a high proportion of *N. meningitidis* of serogroup W135 among the *N. meningitidis* strains in our sample suggests that an active laboratory surveillance of meningitis cases during the interepidemic period as well as a longitudinal epidemic laboratory investigation should be implemented in these countries to identify circulating strains that could be responsible for future epidemics and to adapt the formulation of existing vaccines.

We are grateful to Alfred Da Silva from the Association pour l'Aide à la Médecine Préventive, Mathias Somé from the Ministry of Health, and Mohamed-Mahmoud Hacen, WHO representative, in Burkina Faso and to Mamoudou Harouna Djingaray from the Ministry of Health of Niger for their great help in the organization of our field investigations. We thank Bradford Gessner for fruitful discussions and critical reading of the manuscript.

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