JCM Journals.ASM.org

Invasive *Neisseria meningitidis* Strain Expressing Capsular Polysaccharides W and Y in Brazil

David E. Barroso,[a] Terezinha M. P. P. Castiñeiras,[b] Maria C. Rebelo,[c] Mary M. Tulenko,[d] Jane W. Marsh,[d] Mary G. Krauland,[d] Lee H. Harrison[d]

Laboratory of Biochemical Systematics, Oswaldo Cruz Institute, Rio de Janeiro, Brazil[a]; Department of Preventive Medicine, Federal University School of Medicine, Rio de Janeiro, Brazil[b]; Central Laboratory Noel Nutels, State Department of Health, Rio de Janeiro, Brazil[c]; Infectious Diseases Epidemiology Research Unit, University of Pittsburgh School of Medicine, and Graduate School of Public Health, Pittsburgh, Pennsylvania, USA[d]

Since late 1970, nine isolates expressing dual capsules (W and Y) have been described in North America and Europe (1–4). Although the origin of such isolates and the precise composition of the capsular polysaccharide expressed by them are open issues, meningococcal vaccines that include serogroup W and Y polysaccharides likely induce protective immunity against these mutants (3, 4). Critical points for laboratory-based surveillance are the PCR methods used to diagnose meningococcal disease, because they are not designed to recognize the unique capsular composition of these isolates (2–4). Accordingly, a nucleic acid amplification assay to discriminate among serogroups W, Y, and mixed W/Y has been proposed (4).

We present a description of a *Neisseria meningitidis* isolate (RJ122/08) expressing mixed W/Y polysaccharides isolated in September of 2008 from a patient in Rio de Janeiro State, Brazil. The serogroup was determined by slide agglutination with specific rabbit antisera (BD Difco) and serogroup-specific PCR (5). Serotype and serosubtype were determined by immunoblot analysis at the National Meningitis Reference Centre (Instituto Adolfo Lutz, São Paulo, Brazil). Multilocus sequence type (MLST) analysis and sequencing of outer membrane protein genes *porB*, *porA*, *fetA*, and *fHbp* and DNA sequencing of the *csw* (formerly *siaD*$_w$) gene were performed as previously described (3, 6).

The organism was isolated from the cerebrospinal fluid (CSF) of a 3-year-old girl with suppurative meningitis and a nonblanching rash. Although the isolate was identified as serogroup Y by PCR, it agglutinated with both anti-W and anti-Y antisera. Subcapsular antigens were characterized as 17,7:P1.5. The genotype was defined as 3-100:P1.5-1,10-80:F1-7:ST-7694 (clonal complex 175 [cc175]), with fHbp in variant 3/subfamily A (peptide identification no. [ID] 162). Sequencing of the *csw* gene revealed a point mutation resulting in replacement of glycine (*csy*) or proline (*csw*) with serine at amino acid position 310, which leads to this dual antigenic specificity (7). There were two other mutations at amino acid position 157 and 935, which result in the same amino acid sequence as that encountered in the serogroup W *csw* gene (3).

Since 2000, five additional serogroup Y meningococcal isolates have been recovered from patients in Rio de Janeiro State: three Y:17,10:P1.5, one Y:19,14:P1.5,2, and one Y:19,1:P1.5. The isolates were genotypically characterized as 3-48:P1.5-1,10-4:F4-12:ST-6526 (cc167), 3-48:P1.5-1,10-4:F4-12:ST-7711 (cc167), 3-298:P1.5-1,2-2:F5-8:ST-23 (cc23), and 3-36:P1.5-1,10-1:F4-1:ST-1655 (cc23); they all had fHbp in variant 2/subfamily A (peptide ID 23 or 25). By MLST analysis, 98% of 57 W isolates belonged to cc11, many times characterized as serotype 2a (95%); a single W:19,21 isolate belonged to cc174.

Previous reports of isolates expressing dual capsules noted that those isolates had all the antigenic and genetic features characteristic of serogroup Y *N. meningitidis*, i.e., cc23 and cc167 (2, 3). The mixed-serogroup W/Y *N. meningitidis* isolate described here has a genetic background that is distinct from those of other serogroup Y or W isolates from Rio de Janeiro State but belongs to a clonal complex that is typically associated with serogroup Y in other Brazilian states, Chile, and Argentina (8). ST-175 complex meningococcal isolates from neighboring countries frequently possess *porB*, *porA*, and *fetA* alleles identical to those present in our isolate (8–11), suggesting that a common strain circulating in South America underwent a mutational event that led to the expression of the mixed polysaccharides described here. The monitoring of such isolates has implications for routine meningococcal disease surveillance.

ACKNOWLEDGMENTS

This work was supported in part by a Fogarty International Center Global Infectious Diseases Research Training Program grant, National Institutes of Health, to the University of Pittsburgh (D43TW006592).

L.H.H. receives funding from the U.S. Centers for Disease Control and Prevention and the National Institute of Allergy and Infectious Diseases. He has received research support and lecture fees from Sanofi Pasteur and lecture fees from Novartis Vaccines and has served as a consultant to GlaxoSmithKline, Merck, Novartis Vaccines, Sanofi Pasteur, and Pfizer. His financial ties with industry were terminated before he became a voting member of the Advisory Committee on Immunization Practices in July 2012.

REFERENCES

1. **Brandt BL, Pier GB, Goroff DK, Altieri PL, Griffiss JM.** 1980. Elaboration of both the group W135 and group Y capsular polysaccharides by a single strain of Neisseria meningitidis. J. Gen. Microbiol. **118**:39–43.
2. **Rudolph KM, DeByle C, Reasonover A, Zulz T, Law DK, Zhou J, Tsang RSW.** 2011. Invasive meningococcal disease caused by Neisseria meningitidis strains expressing both serogroup Y and W-135 antigenic specificities. J. Clin. Microbiol. **49**:472–473.
3. **Tsang RSW, Tsai CM, Henderson AM, Tyler S, Law DKS, Zollinger W, Jamieson F.** 2008. Immunochemical studies and genetic background of two *Neisseria meningitidis* isolates expressing unusual capsule polysaccharide antigens with specificities of both serogroup Y and W135. Can. J. Microbiol. **54**:229–234.
4. **Claus H, Matsunaga W, Vogel U.** 2010. Molecular discrimination between *Neisseria meningitidis* serogroups W-135 and Y based on the nucleotide recognition domain sequence of the capsule polymerase. J. Clin. Microbiol. **48**:3459–3460.

Published ahead of print 26 December 2012

Address correspondence to David E. Barroso, barroso@ioc.fiocruz.br.

doi:10.1128/JCM.02787-12

5. **Rebelo MC, Boente RF, Matos JA, Hofer CB, Barroso DE.** 2006. Assessment of a two-step nucleic acid amplification assay for detection of *Neisseria meningitidis* followed by capsular genogrouping. Mem. Inst. Oswaldo Cruz **101**:809–813.
6. **Castiñeiras TM, Barroso DE, Marsh JW, Tulenko MM, Krauland MG, Rebelo MC, Harrison LH.** 2012. Capsular switching in invasive *Neisseria meningitidis*, Brazil. Emerg. Infect. Dis. **18**:1336–1338.
7. **Claus H, Stummeyer K, Batzilla J, Muhlenhoff M, Vogel U.** 2009. Amino acid 310 determines the donor substrate specificity of serogroup W-135 and Y capsule polymerase of *Neisseria meningitidis.* Mol. Microbiol. **71**:960–971.
8. **Abad R, Agudelo CI, Brandileone MC, Chanto G, Gabastou JM, Hormazabal JC, Gorla MCO, Maldonado A, Moreno J, Muros-Le Rouzic E, Lersch R, Regueira M, Salcedo C, Sorhouet C, Vázquez JA.** 2009. Molecular characterization of invasive serogroup Y *Neisseria meningitidis* strains isolated in the Latin America region. J. Infect. **59**: 104–114.
9. **Barroso DE, Rebelo MC.** 2007. Recognition of the epidemiological significance of *Neisseria meningitidis* capsular serogroup W135 in the Rio de Janeiro region, Brazil. Mem. Inst. Oswaldo Cruz **102**:773–775.
10. **Efron AM, Sorhouet C, Salcedo C, Abad R, Regueira M, Vázquez JA.** 2009. W135 invasive meningococcal strains spreading in South America: significant increase in incidence rate in Argentina. J. Clin. Microbiol. **47**: 1979–1980.
11. **Weidlich L, Baethgen LF, Mayer LW, Moraes C, Klein CC, Nunes LS, Rios SS, Kmetzsch CI, Rossetti MLR, Zaha A.** 2008. High prevalence of *Neisseria meningitidis* hypervirulent lineages and emergence of W135: P1.5, 2:ST-11 clone in Southern Brazil. J. Infect. **57**:324–331.