# 42 - SECTION 6 Diseases Caused by Gram-Negative Bacteria

# SECTION 6 Diseases Caused by Gram-Negative Bacteria

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Gram-Negative Bacteria Manish Sadarangani, Andrew J. Pollard

Meningococcal

Infections ■ ■DEFINITION Infection with Neisseria meningitidis most commonly manifests as asymptomatic colonization in the nasopharynx of healthy adolescents and adults. Invasive disease occurs rarely, usually presenting as either bacterial meningitis or meningococcal septicemia. Patients may also present with occult bacteremia, pneumonia, septic arthritis, conjuncti vitis, and chronic meningococcemia. ■ ■ETIOLOGY AND MICROBIOLOGY N. meningitidis is a gram-negative aerobic diplococcus that colonizes humans only and causes disease after transmission to a susceptible individual. Several related neisserial organisms have been recognized, including the pathogen N. gonorrhoeae and the commensals N. lactam ica, N. flavescens, N. mucosa, N. sicca, and N. subflava. N. meningitidis is a catalase- and oxidase-positive organism that utilizes glucose and maltose to produce acid. Meningococci associated with invasive disease are usually encap sulated with polysaccharide, and the antigenic nature of the capsule determines an organism's capsular group (serogroup) (Table 160-1).

TABLE 160-1 Structure of the Polysaccharide Capsule of Common Disease-Causing Meningococci MENINGOCOCCAL CAPSULAR GROUP CHEMICAL STRUCTURE OF OLIGOSACCHARIDE CURRENT DISEASE EPIDEMIOLOGY A 2-Acetamido-2-deoxyD-mannopyranosyl phosphate Epidemic disease mainly in sub-Saharan Africa; sporadic cases worldwide B α-2,8-Nacetylneuraminic acid Sporadic cases worldwide; propensity to cause hyperendemic disease C α-2,9-O-acetylneuraminic acid Small outbreaks and sporadic disease Y 4-O-α-D-glucopyranosylN-acetylneuraminic acid Sporadic disease and occasional small institutional outbreaks W 4-O-α-Dgalactopyranosyl-Nacetylneuraminic acid Sporadic disease; outbreaks of disease associated with mass gatherings; epidemics in subSaharan Africa X (α1→4) N-acetylD-glucosamine-1phosphate Sporadic disease and large outbreaks in the meningitis belt of Africa In total, 12 capsular groups have been identified (A–C, X–Z, E, W, H–J, and L), but just six of these—A, B, C, X, Y, and W (formerly W135)—account for the majority of cases of invasive disease. Group D is often listed as the thirteenth capsular group but has been identified as an unencapsulated variant of group C. Meningococci are commonly isolated from the nasopharynx in studies of carriage; the lack of capsule often is a result of phase variation of capsule expression, but as many as 16% of isolates lack the genes for capsule synthesis and assembly. These "capsule-null" meningococci and those that express capsules other than A, B, C, X, Y, and W are only rarely associated with invasive disease and are most commonly identified in the nasopharynx of asymptomatic carriers. Beneath the capsule, meningococci are surrounded by an outer phospholipid membrane containing lipopolysaccharide (LPS, endo toxin) and multiple outer-membrane proteins (Figs. 160-1 and 160-2). Antigenic variability in porins expressed in the outer membrane defines the serotype (PorB) and serosubtype (PorA) of the organ ism, and structural differences in LPS determine the immunotype. Serologic methods for typing meningococci are restricted by the limited availability of serologic reagents that can distinguish among the organisms' highly variable surface proteins. Where available, high-throughput antigen gene sequencing has superseded serology for FIGURE 160-1 Electron micrograph of Neisseria meningitidis. Black dots are gold-labeled polyclonal antibodies binding surface opacity proteins. Blebs of outer membrane can be seen being released from the bacterial surface (arrow). (Photo courtesy of D. Ferguson, Oxford University.)

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