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K19 capsular polysaccharide of acinetobacter baumannii is produced via a Wzy polymerase encoded in a small genomic island rather than the KL19 capsule gene cluster

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Abstract

© 2016 The Authors.Polymerization of the oligosaccharides (K units) of complex capsular polysaccharides (CPSs) requires a Wzy polymerase, which is usually encoded in the gene cluster that directs K unit synthesis. Here, a gene cluster at the Acinetobacter K locus (KL) that lacks a wzy gene, KL19, was found in Acinetobacter baumannii ST111 isolates 28 and RBH2 recovered from hospitals in the Russian Federation and Australia, respectively. However, these isolates produced long-chain capsule, and a wzy gene was found in a 6.1 kb genomic island (GI) located adjacent to the cpn60 gene. The GI also includes an acetyltransferase gene, atr25, which is interrupted by an insertion sequence (IS) in RBH2. The capsule structure from both strains was→3)-α-D-GalpNAc-(1→4)-α-D-GalpNAcA-(1→3)-β-D-QuipNAc4NAc-(1→, determined using NMR spectroscopy. Biosynthesis of the K unit was inferred to be initiated with QuiNAc4NAc, and hence the Wzy forms the β-(1→3) linkage between QuipNAc4NAc and GalpNAc. The GalpNAc residue is 6-O-acetylated in isolate 28 only, showing that atr25 is responsible for this acetylation. The same GI with or without an IS in atr25 was found in draft genomes of other KL19 isolates, as well as ones carrying a closely related CPS gene cluster, KL39, which differs from KL19 only in a gene for an acyltransferase in the QuiNAc4NR synthesis pathway. Isolates carrying a KL1 variant with the wzy and atr genes each interrupted by an ISAba125 also have this GI. To our knowledge, this study is the first report of genes involved in capsule biosynthesis normally found at the KL located elsewhere in A. baumannii genomes.

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