ROLE OF CAPSULE AND LIPOPOLYSACCHARIDES IN THE INTERACTIONS BETWEEN KLEBSIELLA PNEUMONIAE AND HUMAN MONOCYTE-DERIVED DENDRITIC CELLS

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Klebsiella pneumoniae causes a wide range of infections and is particularly devastating in immunocompromised patients. Two surface polysaccharides, lipopolysaccharides (LPS) and capsular polysaccharide (CPS) are critical for the bacteria in causing sepsis, but little is known about their role in triggering dendritic cells (DCs), an initial and crucial step in the host immune response.

We investigated the cellular responses of human monocyte-derived dendritic cells challenged with a capsulated wild-type K. pneumoniae strain and its LPS- and CPS-deficient mutants.

LPS- and CPS- isogenic deficient K. pneumoniae mutants were generated by allelic exchange in a Green Fluorescent Protein (GFP)-tagged wild-type strain. Immature DCs were obtained from human peripheral blood mononuclear cells and matured by addition of UV-killed bacteria. The interactions with bacteria were then monitored by flow cytometry analysis and laser scanning confocal microscopic observations.

Quantification of uronic acid and microscopic observations indicated that the two CPS mutants (Δwza and Δwzx) were severely impaired in capsule production, but showed a complete O antigen in Tricine-SDS-PAGE. A reduction in the cell-bound capsule was also observed with the three LPS deficient mutants (ΔwecA, ΔwbbM, and Δwzm), owing probably to the surface interactions between the two polysaccharides or their shared synthesis pathways. The internalization of the wild-type strain by DCs only occurred at high multiplicity of infection (100 and 1000), whereas the non-capsulated mutants showed much higher levels of binding, with 100% internalization after 3 hours of incubation for the Δwzx mutant. Mutants impaired in LPS synthesis also showed higher internalization rates compared to the wild-type strain, although not as elevated as the CPS mutants.

Capsular polysaccharides are essential for K. pneumoniae interactions with DCs, and probably prevent the phagocytosis through blockage of bacterial adhesion and uptake.