Immunological Similarities Between Poly-N-acetyl Glucosamine (PNAG) from Staphylococcus spp. and Escherichia coli

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Background: Staphylococcus epidermidis and S. aureus cause serious nosocomial infections, due, in part, to the ability to form a biofilm. The major biofilm constituent is PNAG, synthesized by enzymes encoded in the icaADBC locus. Recently, it has been demonstrated that the Escherichia coli locus ycdSRQP (renamed pgaABCD) has homology to the Staphylococcal icaADBC locus, and also encodes enzymes that direct the synthesis of a molecule nearly identical to PNAG that also promotes biofilm formation in E. coli.
The aim of this work was to evaluate the immunological similarities between PNAG and the E. coli polysaccharide.

Methods: Nineteen isolates of E. coli from urinary tract infections were used in this study. We also cloned the pgaABCD locus into an IPTG inducible plasmid, for over expression of the polysaccharide by E. coli, as well as made a pgaABCD mutant. Different growth conditions were tested in order to determine those that promoted polysaccharide production in E. coli. An immunoblot was performed using EDTA extracts from all the 19 E. coli strains that was probed with rabbit IgG raised against Staphylococcal PNAG. E. coli strains were also tested for susceptibility to phagocytosis using affinity- purified IgG's raised against a poorly acetylated form of Staphylococcal PNAG that induces good opsonic antibody to S. aureus and S. epidermidis.

Results: A polysaccharide reactive with antibody to staphylococcal PNAG was detected in about 50% of E. coli strains. Polysaccharide production was enhanced when glucose was included in the growth medium and elaborated primarily in stationary phase. The E. coli strain with the pgaABCD genes induced by IPTG elaborated high levels of the PNAG polysaccharide and the pga-deleted strain had no detectable PNAG. Rabbit IgG against the deacetylated Staphylococcal PNAG was able to kill some of the E. coli strains in an opsonophagocytosis assay.

Conclusions: In E. coli, PNAG production is dependent on environmental conditions and growth phase. The E. coli polysaccharide is produced in low amounts by clinical isolates, but this was still sufficient for PNAG-specific IgG to effectively kill some of these strains.