Microbiota-host interaction: the role of IgA-coated bacteria in bronchopulmonary dysplasia development

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Background

Secretory Immunoglobulin A (SIgA) is a vital immunoglobulin that is mainly found in the type I mucosa lining the gastrointestinal and respiratory tracts, etc. Through its interaction with bacterial polysaccharides and flagellin on the surface of bacteria, SIgA is capable of coating both commensal and pathogenic bacteria to generate IgA-coated bacteria. Moreover, its ability to maintain host-microbiota symbiosis by promoting the growth and colonization of beneficial bacteria at the mucosa and minimizing pro-inflammatory responses has been widely researched. The detection of certain bacteria coated with SIgA serves as an effective indicator of disease and aids in exploring the connection between the newborn microbiome and disease. While IgA-coated bacteria in the intestine have been found to indicate illness during the neonatal period, their role in the airway remains poorly studied.

Methods

The detection of IgA-coated bacteria in stool/tracheal aspirate samples was performed via IgA-antibody staining and flow cytometry analysis. In order to separate the IgA-positive bacteria from the IgA-negative fraction, a magnetic sorting technique was employed. The percentage of IgA-positive and IgA-negative bacteria present in each sample was determined via flow cytometry analysis subsequent to magnetic separation. 16S rRNA gene sequencing enables the identification of bacterial species and the quantification of their respective abundances in a given sample. Statistical analysis was carried out via a two-tailed unpaired student t-test for comparison of two groups and a one-way ANOVA for comparison of multiple groups, respectively.

Future Plans

We plan to conduct a pilot study on stool samples from NEC patients and non-NEC patients to evaluate the feasibility and reliability of the methodology. After validating the use of this technique on stool samples, we will move forward with full-scale analyses of the bacterial communities in tracheal aspirate samples of preterm neonates with bronchopulmonary dysplasia (BPD) and those without BPD. Our primary goals will be to identify any differences in the composition, relative abundance, and temporal dynamics of IgA-coated bacteria between these groups. These studies will provide new insights into the role of IgA-coated bacteria in the pathogenesis and progression of BPD, as well as establish a foundation for investigating the potential of these bacteria as therapeutic targets for treating preterm infants with respiratory disease.