

Publication

A semisynthetic carbohydrate-lipid vaccine that protects against *S. pneumoniae* in mice

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Severe forms of pneumococcal meningitis, bacteraemia and pneumonia result in more than 1 million deaths each year despite the widespread introduction of carbohydrate-protein conjugate vaccines against *Streptococcus pneumoniae*. Here we describe a new and highly efficient antipneumococcal vaccine design based on synthetic conjugation of *S. pneumoniae* capsule polysaccharides to the potent lipid antigen alpha-galactosylceramide, which stimulates invariant natural killer T (iNKT) cells when presented by the nonpolymorphic antigen-presenting molecule CD1d. Mice injected with the new lipid-carbohydrate conjugate vaccine produced high-affinity IgG antibodies specific for pneumococcal polysaccharides. Vaccination stimulated germinal center formation; accumulation of iNKT cells with a T follicular helper cell phenotype; and increased frequency of carbohydrate-specific, long-lived memory B cells and plasmablasts. This new lipid-carbohydrate vaccination strategy induced potent antipolysaccharide immunity that protected against pneumococcal disease in mice and may also prove effective for the design of carbohydrate-based vaccines against other major bacterial pathogens.

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