An improved method of *Streptococus suis* serotyping and vaccine efficacy

Paulraj K Lawrence, Brittanny L Wiener, Eric A Bumgardner

Introduction

Streptococcus suis is a gram positive bacterium that causes arthritis and fatal meningitis in young pigs. Currently, 35 different serotypes have been identified and serotype 2 is most commonly associated with the disease in the U.S. Serotyping results from isolates sent to diagnostic laboratories for testing are often non-typeable or ambiguous using current methods. In the present study, we used next generation sequencing to identify the serotype of several isolates. This method appears to be robust and could correctly assign a serotype to nearly all isolates tested. We recently completed a vaccination-challenge study demonstrating that the *S. suis* capsule is the primary target of protective immune responses.

Materials and Methods

The genomic DNA from *S. suis* isolates was extracted, libraries constructed, and sequenced on a MiSeq instrument. Reads were mapped to reference genomes to identify the serotype of each isolate. The results were compared against those obtained from traditional testing. To demonstrate the importance of the capsule in vaccine formulation, ten naïve pigs were vaccinated with one of three different preparations: A) A capsular conjugate vaccine; B) An inactivated whole cell vaccine; C) Mock vaccine. Animals were challenged two weeks after their last vaccination with the same isolate used for vaccine preparation. Clinical symptoms and mortality were evaluated post-challenge.

Results

The serotyping method described here can be used to rapidly establish a serotype for *S. suis* isolates and more is reliable than standard serotyping methods such as PCR and serum agglutination. In addition, this method allows a more holistic examination of differences present in the capsular locus of strains from different serotypes. Our data indicate that field isolates of *S. suis* have a complex and plastic genome. The capsular locus is amenable to extensive recombination. Thus, capsular loci possess a complex mosaic structure. Our vaccination-challenge study demonstrates the importance of the capsule in inducing a protective immune response based on mortality scoring. When pigs were given a lethal challenge, a vaccine manufactured using capsular components was able to protect a majority of the pigs. When a whole cell vaccine was used, nearly complete protection was achieved, demonstrating the utility of whole cell vaccines for protection of animals when serotypes are well matched.

Conclusion

In this study, when used in conjunction with a robust serotyping method, inactivated vaccines provided protection against a lethal *S. suis* challenge.