

Dilemma of the Virulence of *Streptococcus suis* Strains

In a paper recently published (11), Rasmussen et al. have reported an interesting association between ribotype profiles of *Streptococcus suis* serotype 2 strains and clinical pathological observations of pigs from which the strains had been isolated. Their study provides further useful information on the use of molecular tools for epidemiological investigations. However, in their study, the authors included among “five well-characterized avirulent *S. suis* serotype 2 strains,” the strain 89-1591. The paper specifies that the information about the lack of virulence of this strain was obtained from Dr. H. Smith, of the ID-LDO, Lelystad, The Netherlands in a personal communication. The experimental infection model used by ID-LDO researchers is based on an intranasal inoculation of 1-week-old colostrum-deprived piglets which had previously received an intranasal infection with *Bordetella bronchiseptica* 2 days before the *S. suis* infection (14, 15).

The strain 89-1591 was originally isolated in our laboratory. As stated in the paper published by Beaudoin et al. (1) which was cited by Rasmussen et al. (11), this strain was recovered from a case of septicemia and was isolated from lungs, liver, heart, and spleen of the infected pig. This strain was originally used as a virulent wild-type parent strain for the characterization of spontaneous “low virulent” acapsulated mutants (6) and was also considered to be a virulent strain after experimental infection of conventional specific-pathogen-free piglets (10). In addition, this strain was used to measure the in vivo growth of *S. suis* using intraperitoneal chambers in piglets (3). Moreover, we recall that in one of these piglets, one of the intraperitoneal chambers was partially broken, and the animal died from septicemia within 12 h. To our knowledge and experience, this strain should be considered as virulent. In addition, this strain is still being used in our laboratory for the study of virulence factors in North American strains. Surprisingly, Staats et al. (12) considered this strain as highly virulent for mice but of low virulence for pigs.

Experimental infection models for *S. suis* can be misleading. Different studies have designated field strains as being virulent or avirulent based on the clinical condition of the animal from which the strain was isolated (clinically diseased or healthy animals), the presence of virulence-related proteins, the virulence in a mouse model, and the virulence to pigs from high-health-status herds, specific-pathogen-free pigs, and colostrum-deprived pigs (2, 7, 10, 12, 14, 15). In fact, several discrepancies exist in the literature. For example, Okwumabua et al. (9) mentioned that a field strain from Minnesota (DH5) was avirulent for pigs, whereas Staats et al. (12) considered the same strain as highly virulent for the same animal species. This strain was originally isolated from the brain of a pig during an outbreak of *S. suis* meningitis in a closed farrow-to-finish herd and was considered as representative of the epidemic strain causing the problem in that herd (8). Controversially, this strain was considered avirulent by Galina et al. 3 years later (5). Similarly, the serotype 2 reference strain S735 was considered highly virulent (2) or weakly virulent (14) after experimental infections of pigs by two independent research groups. Finally, the mouse model

of the infection correlated well (7) or not at all (13) with the pig model.

Since results from experimental infections of *S. suis* in swine may rely, among other considerations, on the immunological status of the animals, the route of infection, the size of the inoculum, and the presence of *S. suis* as normal inhabitants of the upper respiratory tract, caution should be taken when the terms virulent and avirulent are used to reach definitive conclusions. In the case of strain 89-1591 included in the study of Rasmussen et al., the authors clearly stated that the atypical ribotype profile obtained with this strain is probably more related to its geographical origin (it was the only North American strain) rather than its lack of virulence. We found similar results in the past, as reported by Beaudoin et al. (2) and, more recently, by Chatellier et al. (4).

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Ed. Note: *The authors of the original manuscript did not reply.*