Pathogenesis of Haemophilus parasuis Infection: Update of Current Research

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Abstract
Haemophilus parasuis has traditionally been considered a sporadic stress associated disease of young swine in conventional herds. In recent years there has been renewed interest in H. parasuis infection for several reasons. One of these reasons has been the expansion of high health status herds in which H. parasuis can produce severe disease with high morbidity and mortality in all age groups. Another important factor is the emergence of Porcine Reproductive and Respiratory Syndrome Virus in Europe and North America as H. parasuis can be an important second bacterial infection in herds infected with PRRSV. The following will provide a brief review of the role H. parasuis plays in swine disease and an update on current research efforts relating to the pathogenesis of H. parasuis infection.

Disciplines
Veterinary Infectious Diseases | Veterinary Microbiology and Immunobiology | Veterinary Pathology and Pathobiology

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Pathogenesis of *Haemophilus parasuis* Infection: Update of Current Research

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*Haemophilus parasuis* has traditionally been considered a sporadic stress associated disease of young swine in conventional herds. In recent years there has been renewed interest in *H. parasuis* infection for several reasons. One of these reasons has been the expansion of high health status herds in which *H. parasuis* can produce severe disease with high morbidity and mortality in all age groups. Another important factor is the emergence of Porcine Reproductive and Respiratory Syndrome Virus in Europe and North America as *H. parasuis* can be an important secondary bacterial infection in herds infected with PRRSV. The following will provide a brief review of the role *H. parasuis* plays in swine disease and an update on current research efforts relating to the pathogenesis of *H. parasuis* infection.

**Role of H. Parasuis in Swine Disease**

*H. parasuis* is best known as a cause of polyserositis and polyarthritis in conventional swine. In high health status herds with naive swine, *H. parasuis* can produce severe disease in all age groups. Sudden death, septicemia, and myositis may occur in addition to the more typical polyserositis and polyarthritis syndrome. The importance of *H. parasuis* in other disease conditions is not as well established. *H. parasuis* is commonly isolated from the nasal cavity of apparently healthy pigs and in these situations is regarded as normal nasal flora. *H. parasuis* is also frequently isolated from the lungs of pigs, however the role it plays in pneumonia is not clear. In field cases *H. parasuis* is most often found in mixed infections with other bacteria or viruses. In experimental models of *H. parasuis* infection, pneumonia has been reported only following high concentration, high volume inocula, often via an intratracheal route.

**Serotypes, Vaccination, And Cross Protection**

The most recent serotyping scheme utilizes an immunodiffusion technique and recognizes 15 serovars of *H. parasuis*. The most prevalent serovars in North America are (in descending order) 5, 4, 13, 14, 2, and 12. A substantial number (14%) of isolates are untypable by the current scheme.

The large number of serotypes and percentage of nontypable isolates suggests there is marked phenotypic heterogeneity among *H. parasuis* strains. This heterogeneity is present at the herd and individual pig level as more than one serovar of *H. parasuis* can be isolated from a herd or individual pig and using DNA fingerprinting up to 4 different strains have been identified in a single herd. Vaccination with both commercial and autogenous bacterins is often used in attempts to control disease due to *H. parasuis* infection. Natural exposure appears to provide cross protection from heterologous strains. The efficacy of bacterins in inducing cross protection is less clear. Initial reports suggested cross protection did occur and that virulence and immunoprotection were related. In recent abstracts pigs vaccinated with a bacterin containing serovars 4 and 5 were protected from challenge strains representing se-
rovars 4, 5, 13, and 14 but not from challenge strains of serovars 2 and 12. When strains representing serovars 2 or 12 were used in a bacterin there were significant differences in the protective immunity of strains within a serovar. The marked variability in immunogenicity of strains within the same serovar indicate that the protective immunogens are complex. Further efforts will be required to identify the immunogens important in protection.

Pathogenesis

Much of the experimental literature on *H. parasuis* has addressed suspected virulence attributes of the organism, serotypes, vaccination, and cross protection. Relatively little is known about the epidemiology, immunology, or pathogenesis of *H. parasuis* infection. Efforts in our laboratory to examine the pathogenesis of *H. parasuis* infection have utilized a CDCD pig model to identify the sequence of events which follow an intranasal challenge.

An important first step in the pathogenesis of bacterial infections is colonization of a mucosal surface. The tonsil has been identified as an important site of localization for *Streptococcus suis* in swine. Reports from a slaughter survey and our experimental infection of swine suggest that the nasal cavity is the site of colonization of *H. parasuis*. Efforts in our lab are continuing to determine the mechanisms of colonization of *H. parasuis* and identification of virulence factors important in this process.

Following mucosal colonization, entrance into the blood stream is necessary to produce lesions at distant sites. In a recent study we have shown that following colonization of the nasal mucosa, *H. parasuis* enters the blood stream as pigs were bacteremic at 36 hours post inoculation. *H. parasuis* then has a predilection for serosal surfaces such as the peritoneal and pleural surfaces, meninges, and joints. Typical lesions of fibrinosuppurative polyserositis and polyarthritis were present at these locations. In many cases multiple sites had severe lesions however *H. parasuis* was recovered only sporadically.

Interactions with PRRSV

A variety of bacterial pathogens have been clinically associated with PRRSV infection. An interaction of PRRSV and *Streptococcus suis* has been demonstrated in an experimental model. To date there are no epidemiologic investigations to confirm clinical impressions of an increased incidence and severity of *H. parasuis* infection in PRRSV infected herds. A recent abstract reported that pigs experimentally infected with PRRSV were not more susceptible to *H. parasuis* challenge. Additional field investigations and experimental models are warranted to determine the interactions of *H. parasuis* with PRRSV and other pathogens.

Diagnostics

The current method for definitive diagnosis of *H. parasuis* infection is bacterial isolation from tissues or swabs. Recovery of *H. parasuis* from field cases is often difficult and cultures may be negative even when significant lesions are present. As *Streptococcus suis* can produce similar clinical signs and lesions in this age group, more sensitive diagnostic methods would be useful. Development of an immunohistochemical technique to identify *H. parasuis* in tissue sections may prove useful in these situations.

Serologic testing may be useful in identifying naive animals prior to introduction into a herd in which *H. parasuis* is present. Serologic testing utilizing an ELISA is available from a few diagnostic services, but is not in widespread use at state diagnostic laboratories. A recent report indicates an immunofluorescent test may be useful to detect *H. parasuis* antibodies.

Summary

*H. parasuis* is an important cause of polyserositis and polyarthritis with added importance in high health status herds and herds infected with PRRSV. The organism is expected as a component of normal nasal flora of conventional swine. Pneumonia does not appear to be a major manifestation of *H. parasuis* infection. *H. parasuis* is often difficult to recover.
from field cases, however at the current time more sensitive diagnostic techniques are not available.

There is marked heterogeneity among *H. parasuis* strains and more than one strain can be present within a herd. Although autogenous bacterins can provide good homologous protection, recent reports indicate that some virulent strains isolated from cases of *H. parasuis* may not be immunogenic and therefore not useful in an autogenous bacterin. Cross protection against heterologous strains occurs for some strains, but is not complete. This may result in failure of some bacterins. Additional work to determine the protective immunogens, virulence factors, interactions with other respiratory disease agents, and improved diagnostic methods is necessary to further our understanding of *H. parasuis*.

**References**


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