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Indirect transmission of *Actinobacillus pleuropneumoniae*

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Summary

This case report describes five herds in which porcine pleuropneumonia caused by *Actinobacillus pleuropneumoniae* appeared to have been transmitted through indirect means.

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Porcine pleuropneumonia is caused by *Actinobacillus pleuropneumoniae*. This organism is thought to be transmitted mainly through direct contact, usually after asymptomatic carrier pigs are introduced into a herd. The possibility of indirect transmission has only occasionally been raised.[1,2] Nicolet reported that the source of infection in Swiss specific-pathogen-free (SPF) herds was often unknown, and that in an experimental infection, some pigs were accidentally infected through contaminated boots, clothes, or equipment.[1] The source of infection in a Danish SPF herd also could not be identified.[2] However, since most recent reports have failed to specifically address the possibility that *A. pleuropneumoniae* can be transmitted indirectly, it remains an open question.

This report describes five cases, all occurring in the early 1990s, in which transmission appears to have taken place indirectly. We supervised the case herds as well as herds that supplied pigs to them. The supplying herds were considered free of *A. pleuropneumoniae* because:

- they had all been populated in the previous years with animals from minimal disease herds, which had not shown any evidence of infection with *A. pleuropneumoniae* in the past;
- they were visited once every 1–2 months, and clinical signs or lesions suggestive of pleuropneumonia had never been observed;
- slaughter checks for herds selling gilts or boars were conducted one to four times a year, and did not show any suspicious abnormalities (pleuropneumonia-like lesions, increased incidence of lung abscesses, or pleuritis);
- serological monitoring of the herds (about 10% of the sows, minimum of 25 samples) was performed approximately once a year using an ELISA test performed at the University of Montreal, which consistently yielded negative results;
- other farms from the same integration companies, and also receiving replacement animals or piglets from these herds, demonstrated no evidence of infection; and
- clinical signs, lesions, serological results, slaughter checks, and epidemiological data have continued to substantiate the negative status of the supplying herds since these cases ocurred.

Case #1

Minimal disease, *A. pleuropneumoniae*-free piglets were introduced into four of seven finishing units on one site. An outbreak of porcine pleuropneumonia occurred in pigs in one of the remaining three units, all of which had been filled with conventional-health pigs from different sources. *Actinobacillus pleuropneumoniae* serotype 1 was isolated from the unit with the outbreak, and sensitivity testing was performed. According to the owner, boots, overalls, and instruments remained in each individual unit and were not transferred between them. Several weeks later, the disease was also diagnosed in one other unit (130 meters [0.1 mile] away) that had been filled with *A. pleuropneumoniae*-free piglets. A serotype 1 strain was isolated and the sensitivity pattern to antimicrobials was identical to the one found in the isolate from conventional pigs.

Case #2

This case occurred in a finishing unit into which *A. pleuropneumoniae*-free, minimal disease piglets had been introduced from an integrated organization. After a few days without problems, an outbreak of porcine pleuropneumonia associated with *A. pleuropneumoniae* serotype 1 was diagnosed. Further investigation revealed that this disease was present in pigs in another herd about 400 meters (0.25 mile) away, and that the strain involved had the same serotype and sensitivity pattern to antimicrobials as the one isolated from the finishing unit.

These two farms were completely independent (different organizations), and the source of contamination could not be linked to common people or equipment. Meteorologic reports from a local weather station, however, indicated that during the period preceding the outbreak, the dominant winds had come from the contaminated farm toward the finishing unit.

Case #3

A farrow-to-feeder pig unit contaminated with *A. pleuropneumoniae* serotype 1 was undergoing an eradication program. Sows that

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serologically tested positive were removed from the farm. An isolation building (a former cattle barn) was rented so that seronegative gilts could be introduced. This barn was located more than 5 km (3 miles) away and had been left empty for years. The gilts came from a minimal-disease herd negative for *A. pleuropneumoniae*.

A few months after their introduction to the isolation building, many of the gilts were found to be seropositive to *A. pleuropneumoniae* serotype 1. The herd of origin was retested at that time, and regularly since then, and always found to be negative. Later, it was discovered that during the weekends, an employee had been entering and working in the isolation building wearing the same boots and clothes he had first worn in the contaminated sow herd and nursery.

Case #4

A farrow-to-finish operation, located on two sites, was producing replacement gilts and boars. The herd was originally stocked with minimal-disease animals, and had always been negative to *A. pleuropneumoniae* based on the absence of clinical signs and lesions, negative serological results and slaughter checks, and no evidence that other herds had become infected from animals from this farm. After the initial stocking, this herd remained closed to the introduction of any animals and used within-herd replacements and artificial insemination. After more than 5 years of production without problems, serologic antibody reactions to *A. pleuropneumoniae* serotype 5 were detected. No clinical signs of porcine pleuropneumonia were ever observed, but a strain of *A. pleuropneumoniae* serotype 5 was eventually isolated from the lungs of a growing pig that had died of a condition not related to this organism.

The farm was a shower in-shower out facility that minimized visitor traffic and required visitors to have been free from contact with swine for 48 hours prior to being admitted. A small sow herd was located approximately 500 meters (0.3 miles) away, but no attempts were made to see whether it was positive for *A. pleuropneumoniae* serotype 5.

Case #5

A finishing unit was filled with minimal-disease, *A. pleuropneumoniae*-free piglets. The system had been operating without problems for several years when an outbreak of pleuropneumonia caused by serotype 1 was diagnosed. The same company was operating another finishing unit 300 meters (0.2 miles) away that was filled with conventional pigs, on which pleuropneumonia associated with serotype 1 had been confirmed. Fingerprinting of the isolates from the minimal-disease unit and from the conventional finishing unit indicated that the same strain was likely to be present in both units.

Discussion

The identical antimicrobial sensitivity patterns obtained from strains from different units in cases 1 and 2 do not necessarily mean that these strains are the same. Nevertheless, when performed properly and in a well-standardized manner, antimicrobial sensitivity testing can serve as a nonabsolute, but potentially useful, epidemiologic marker.[3]

The herds supplying *A. pleuropneumoniae*-free animals were under a regular veterinary supervision program that involved clinical evaluation of the farms, serological monitoring, and slaughter checks. These herds have remained negative to *A. pleuropneumoniae* after the incidents reported herein, which eliminates the possibility that contamination took place while the supplying herds themselves were becoming infected.

Although it is not possible to accurately determine the actual source of contamination in these cases, transmission likely occurred indirectly. The most probable source of contamination appears to be through aerosol for case #2, and by contaminated boots or clothes for case #3. The other three farms might have been infected by either of these transmission means, or by such other potential sources as rodents, birds, insects, or vehicles. A study conducted in the United Kingdom concluded that flies could spread *Streptococcus suis* infection within farms, and might also be a source of spread between farms.[4] Another British study found that contamination by flies may be common in farms infected with *Salmonella typhimurium*.[5] A recent study in Canada has also shown that *S. typhimurium* could be readily isolated from flies on an infected farm.[6] Thus the potential role of flies in the transmission of *A. pleuropneumoniae* and other organisms should not be disregarded.

Swine are considered to be the only natural hosts of *A. pleuropneumoniae*; however, it has also been isolated from cattle, deer, and lambs.[1] Furthermore, different species of rodents, like guinea pigs and mice, can be infected experimentally.[7] This suggests that other species might occasionally be involved in the transmission of the organism.

It has recently been shown that aerosol transmission of *A. pleuropneumoniae* can occur in experimental conditions over a distance of at least 1 m (3 feet).[8] This would tend to confirm field observations suggesting that this mode of transmission can take place over short distances, particularly during outbreaks of the disease.[9] Recently, Larsen published a report in which he indicated that airborne *A. pleuropneumoniae* may cause infections at a distance of 500 m (0.3 miles).[10]

Finally, there are no published reports of humans being infected with *A. pleuropneumoniae*. Nicolet was unable to isolate the organism from the pharynxes of 15 people working in newly infected herds, all of whom were also serologically negative.[1] This does not mean, however, that it is totally impossible for humans to carry the organism. *Actinobacillus pleuropneumoniae* serotype 5 was recovered from the poorly healing wound of a swine producer who was hospitalized after being bitten by a boar.[3]

Implications

In most situations, herds become infected with *A. pleuropneumoniae* when asymptomatic carrier animals are introduced. The cases related herein, however, suggest that this may not always be the case and that the possibility of indirect transmission should be considered.

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