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Porcine circovirus 3: a new virus infecting swine

Porcine circoviruses (PCVs) are small viral agents which infect members of the family Suidade. Until 2015, two species of PCVs were known: PCV-1 and PCV-2, being the last the pathogenic one, hence the most economically relevant. Recently, PCV-3 has been discovered and it is also considered as a new infectious viral agent. In this article, characteristics of the virus, its epidemiology, tissues in which has been found, diagnostic methods and its potential association with disease in the domestic pig are reviewed. In general, it defends the importance of knowing PCV3's state of the art since it could be useful for both the industry and the scientific community.

Porcine circoviruses (PCVs) are small viral agents that belongs to the family Circoviridae and infect members of the family Suidae. Until 2015, two species of PCVs were known: PCV-1, considered non-pathogenic, and PCV-2, one of the most economically relevant viruses for the swine worldwide industry. The third member of the genus Circovirus able to infect swine, PCV-3, was first discovered in the United States by metagenomic studies, specifically in tissues of animals that suffering from reproductive failure, porcine dermatitis and nephropathy syndrome, and cardiac and multisystem inflammation. In these cases, no other common pathogen was found and it was proposed that the new virus might etiologically be involved in disease

occurrence. Subsequently, studies allowed the detection of the PCV-3 genome both in samples of affected pigs with different diseases or pathologies as well in apparently healthy animals. The virus genome can be found in different tissues, serum, oral fluid and nasal swabs, as well as in feces, semen and colostrum.

Although the virus has recently been discovered, retrospective studies have shown that PCV-3 was already present in the swine herd by early 1990s. In fact, the presence of the virus in multiple countries has been described, therefore, it is suggesting that PCV-3 is a rather widespread virus worldwide. The PCV-3 genome has also been detected in pigs of all analyzed ages, including foetuses, mummified and stillborns. In a study carried out on longitudinally sampled pigs in Spain, PCV-3 DNA was detected at all tested age-groups in four analyzed farms, and the frequency of infection was not clearly dominant at any age, which has not allowed to establish a clear dynamic of infection for this virus.

Most recently, viral DNA has also found in wild boar samples expanding the scope of infection susceptibility among the Suidae family. In fact, the potential reservoir role of this specie for the domestic pig has been proposed. In these samples, the presence of the viral genome was detected during a period of at least 5 to 7 months in same animal, indicating a long-lasting infection.

Phylogenetic studies with PCV-3 partial and complete sequences available from around the world have revealed a high nucleotide identity (> 96%). However, two main groups and subgroups have also been proposed. In addition, it has been proposed the existence of a common ancestor dated around 50 years ago.

The detection of the virus is currently based on molecular techniques such as conventional PCR and quantitative PCR, as well as its characterization by Sanger sequencing or next generation sequencing (NGS). In addition to molecular techniques, the development of diagnostic tools that are not yet fully standardized, such as in situ hybridization (a technique used to detect viral genome in histological tissue sections) and serological tests. Viral isolation has been attempted with PCV-3 positive tissue homogenates in pig kidney cell lines and also in swine testicle cells without success. The lack of virus isolation has impeded the establishment of an infection model, so there is no data available on the pathogenesis of PCV-3 infection.

Taking into account the economic importance and the known effects of PCV-2 on the swine industry, it is considered that the understanding of aspects about a new member of the same family, as PCV-3, is of interest for both the industry and the scientific community.

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