DISCONTOOLS

PCV2
Summary

Introduction

1. This note provides a brief summary of the Disease and Product analysis prepared by a DISCONTOOLS group of experts on Porcine circovirus 2 (PCV2). They reviewed the current knowledge on the disease, considered the existing disease control tools, identified current gaps in the availability and quality of the control tools and finally determined the research necessary to develop new or improved tools. Full details are available on the web site at http://www.discontools.eu/ and can be downloaded by selecting Disease Database, then the specific disease and highlighting the variables of interest. This is completed by selecting "create a report" which can then be downloaded as either a PDF or Excel spread sheet.

Disease profile

2. Porcine circovirus type 1 is a non-pathogenic virus found as a contaminant of porcine cell lines and in pigs. Porcine circovirus type 2 (PCV2) is associated with several disease manifestations in pigs. Most of the strains or isolates (genotypes a, b, c, d) of the type 2 virus appear to have >93% homogeneity at the nucleotide level. PCV2 is the necessary but not usually self-sufficient cause of a variety of manifestations of what have come known as Porcine circovirus diseases (PVCD). The history and circumstances for PCV2 emergence are largely unknown and it is not possible to predict the appearance of new, more pathogenic versions of the virus. There was some evidence that the severe diseases seen globally in the beginning of the centrury was linked to the emergence of specific genotypes, but the variability of disease may also be related to many other factors such as immune status to PCV2, time of infection, pig genetics, standards of management in the widest sense, and in particular to the health of the herd and the other concurrent diseases

3. All species of pigs appear to be affected including wild boar and feral pigs. Many pigs are infected without displaying clinical symptoms of disease and some of these animals act as carriers. There are a wide variety of clinical syndromes produced or associated with this virus known collectively as PCVD. The first to be identified was the Post Weaning Multi-Systemic Wasting Syndrome (PMWS) in which disease was found in young pigs. In the early cases in some countries there was also a severe skin /kidney syndrome called Porcine Dermatitis and Nephropathy Syndrome (PDNS) which was extremely difficult to differentiate from ASF/CSF but which was later shown to be associated with PCV2. Another reported syndrome is reproductive failure which is manifested as mid-late term abortions or farrowings with increased numbers of stillborn and mummies. In addition, PCV2 has been shown to contribute to a variety of disease complexes including enteric and respiratory diseases and gastric ulcers.

Risk

4. The virus transmits easily because of ubiquitous nature in the environment and as yet not understood effects on the host make it very difficult to control. In experiments PCV2 in-contacts are not always infected and infection does not always produce disease. There is no evidence of human infection, no evidence of vectors and probably most pigs are infected. The costs of the infections are difficult to quantify, but were considerable before the availability of vaccines. There was a complete loss of profitability due to variation in growth rate, increased morbidity and mortality and reproductive failure together with increased veterinary charges and antibiotic use.

Diagnostics

5. Clinical signs, gross post-mortem, particularly enlarged inguinal lymph nodes, histopathology with demonstration of PCV2 material by IHC or ISH which is available in most laboratories worldwide. Quantification of virus load in serum by real time qPCR has been used for diagnosis in many countries, but the results are doubtful as a diagnostic tool to predict clinical impact. Serological tests are not helpful for diagnosis as most pigs are seropositive and there is a lack of any predictive test that could identify pigs that will progress to severe disease. Diagnosis is still complex and is best made at the herd level with the necessary help of local laboratories. The existing tests are probably adequate although the development of pen-side test that assess need and/or impact of vaccination would be beneficial.

Vaccines

6. Vaccines for control of PCV2 infections in sows and piglets are available both recombinant and inactivated full-virus vaccines. Also combination vaccines where PCV2 are combined with vaccines against Mycoplama Hyopneumonia have been launched in Europe. These are freely available in Europe from a number of major companies and 60-100 % of sow herds in Europe vaccinate against PCV2, with some differences between different countries. All the vaccines appear to be successful in reducing losses due to PMWS and are capable of producing protective levels of colostral antibodies and to protect young piglets prior to acquisition of infection in the growing phase. Possible improvements would be to reduce the number of injections or replace them with other easier routes and consider including more antigen combinations in vaccines against common pig pathogens. No vaccines sold as marker vaccines are available but the subunit vaccines could be regarded as marker vaccines if diagnostic tests were developed targeting virus subunits not present in the vaccines. There is also a need to maintain surveillance of the viral populations under vaccination pressure since emergence of new virus variants in some reports has been linked to use of vaccine even though virus variants able to completely escape immunity against vaccine strains has not been documented.

Pharmaceuticals

7. None are available at present. The effect of existing antiviral drugs against PCV2 is not known and is not applicable until new antivirals become effective and usable in farm animals. It could be that a new generation of T-cell stimulants will be developed or intermediary metabolism modulators which could help to control the infection. Passive immunisation is not used to control PCV2 at present

Knowledge

8. There are still significant areas of uncertainty in the understanding and knowledge about PCV2 especially in relation to pathogenesis, immunology, and epidemiology. The mechanisms of pathogenicity are largely unknown, but as molecular understanding of viral pathogenicity increases so new developments may take place.

9. Continuing research on the fundamental immunology of the pig and its relation to PCV2 infection is needed. Pigs with PCV2 infections appear to mount a strong PCV2 specific antibody response. The role of cell-mediated immunity to PCV2 is not yet known and should be investigated whilst the potential immune modulatory role of PCV2, especially its effect on professional antigen presenting cells needs to be clarified. Neutralising antibodies and cellular immune response (measured as IFN-gamma producing cells) are considered the major immunological components in order to control infection. In PDNS there is a hypersensitivity type 3 reaction triggered and then pro-inflammatory stimulation predisposes to secondary bacterial infection. PCV2 is immunosuppressive but on the contrary immuno-stimulation has been shown to promote PMWS development.

Conclusions

10. The question remains on why this virus existed in the pig population for a long time and then in the mid to late 1980s suddenly started to cause disease. This can only have happened due to a number of factors:- i) a change in the virus which has not been documented, ii) a change in the environment of the pig with increased production, iii) loss of labour and therefore disappearance of care or iv) changes in the genetic makeup of the pig and/or a combination of those.

11. The availability of effective vaccines might prevent funding more research as the impact of the infection is limited in vaccinated herds. However there is a need for continued population monitoring of the viral population, and study of the pathogenicity and immunology especially to ensure diagnostic improvements. A repeatable, reproducible model of experimental disease is still missing. Reliable economic tools for costs/benefits assessments are also needed to assess the impact of such endemic diseases.