

## ENTERIC INFECTIONS IN PIGLETS – AN UPDATE ON DIAGNOSTICS, TREATMENT AND VACCINATION STRATEGIES TO CONTROL BACTERIAL AGENTS

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### Introduction

Enteric infections in pigs belong among important diseases with a negative impact not only on economics of pig finishing operations but also on piglet production. Contrary to the porcine respiratory diseases complex (PRDC), however, enteric infections are not considered a dominant health problem in a majority of intensive pig production countries.

Enteric infections are an example of endemic diseases whose economic importance has been assessed repeatedly. At the individual farm level, performance data are often available. Most of common performance indicators, however, reflect the health status of the animals concerned only indirectly. The link between disease and its effect on performance needs to be established for each disease individually (Thomson et al., 2007). Because the majority of porcine enteric infections need not be reported to veterinary authorities, data on enteric disease must be collected, e.g., as part of research projects. The ban on the use of antimicrobials as growth promoter in pigs resulted not only in a small reduction in production as documented in Denmark but also in an increase in endemic diseases prevalence.

#### ***Clostridial enteric infections in neonatal pigs***

*Clostridium perfringens* type A and C and *Clostridium difficile* are the principal enteric clostridial pathogens of swine (Songer and Uzal, 2005).

#### ***Clostridium perfringens* type C enteritis**

**Aetiology and prevalence.** *Clostridium perfringens* type C is a much-feared causative agent of haemorrhagic diarrhoeas in piglets in the perinatal period characterized by high mortality in litters affected. In some countries in which the disease has spread to the majority breeding farms (Denmark), vaccination of sows with type C toxoids is absolutely necessary. That was, after all, demonstrated by an outbreak of new infections following the end of registration of clostridial vaccines and thus the end of their use there. The vaccines that were to replace the previously used proved less effective. It was the changes in the use of vaccines that underlined the delicate balance during the controls of haemorrhagic enteritis among piglets caused by *C. perfringens* type C, in view of permanent exposure of sows and piglets to type C strains in certain herds.

Contrary to Denmark, type C strains did not spread to many farms in the Czech Republic because important nucleus and multiplier herds had not been affected. A critical situation, however, developed in a commercial operation with 800 sows where the first outbreak of haemorrhagic enteritis of piglets occurred 1995 and affected most of litters. The disease and the causative agents were eradicated only after 5 years of careful monitoring, vaccination and partial depopulation with negative gilts.

**Diagnosis** should be based on bacteriologic culture followed by genotyping of isolates using polymerase chain reaction method to detect genes for the major toxins. Type C is found rarely, and in small numbers, in the intestine of healthy animals.

#### ***Clostridium perfringens* type A enteritis**

**Aetiology and prevalence.** Rather than haemorrhagic diarrhoeas in neonatal piglets associated with type C, enteritis associated with type A are much more widespread in Central European countries. The course of the disease is milder, and *C. perfringens* type A has been identified as the only suspect agent. Diarrhoeas affecting the small intestine appear about 2 or 3 days after birth and last several days, usually until the age of 8 or 10 days. Piglets usually do not die, but those that have suffered of diarrhoea for several days will lag behind in growth and will not compensate for the loss of weight before weaning. In the Czech Republic, these strains spread very quickly particularly to breeding sow herds.

**Diagnosics** is based on culture. Type A isolates from diarrhoeic piglets are especially noted for the fact that they carry the gene (*cpb2*) in the plasmid DNA that encodes the production of a novel toxin referred to as b 2-toxin, which is similar to the b 1-toxin of pathogenic strains of serotype C. A problem is that, compared with type C infections, cultivation findings of type A *cpb2*<sup>+</sup> are also very frequent in piglets with no clinical manifestation of diarrhoeas. Moreover, sows in most herds with a prevalence of clostridial enteritis in suckling piglets are vaccinated with commercial vaccines against type C containing also the a- toxoid, which induces the production of antibodies also against the a -toxin of type A. For that reason, molecular analysis and subsequent study of pathogenesis for newborn piglets are essential for the clarification of the role of type A *cpb2*<sup>+</sup> isolates. Currently, commercial tests are not available for detection of b 2-toxin in culture supernatants or faecal contents.

**Therapy.** Therapeutic effect in the treatment of diarrhoeas with the isolation of *C. perfringens* type A *cpb2+* in the field practice was observed mainly after per oral application of not only aminopenicillins but also certain macrolides. Antibiotics proved effective particularly when administered early before clinical symptoms were fully developed. The current therapeutic failures need to be related to decreased sensitivity but also of resistance to antibiotics used in the treatment of other porcine bacterial infections than enteric (Masaříková, 2006). According to our hypothesis, one of possible reasons for the spreading of these isolates between 2000 and 2006 is the increase in MIC and the development of resistance, which gave these isolates a selective advantage in sow intestines as well as in newborn piglet intestine.

**Immunoprophylaxis.** Contrasting with the efficacy of commercial vaccines against infections caused by type C is the absence of such efficacy against infections caused by *C. perfringens* type A *cpb2+* (Masaříková and Smola, 2004). One of the main objectives is therefore the design of a vaccine that would protect piglets also against infection caused by isolates of type A *cpb2+*. The development of a new toxoid b 2-based vaccine is in the focus of interest of pharmaceutical companies. The new vaccine can be expected to provide protection for piglets not only against infections caused by type A *cpb2+* isolates but also to confirm the hypothesis that b-2 toxin is the major factor of virulence of these strains.

**What is needed?** It will be necessary to explain the etiological role of isolates of type A *cpb2+* in the outbreak of newborn piglet enteritis, and, at the same time, to develop a new vaccine capable of protecting newborn piglets against infection. In order to design an effective therapy, the development of isolate resistance in individual herds will have to be monitored. Irrespective of its aetiologic role, *C. perfringens* type A will have to be classified as an indicator species for resistance development monitoring on pig farms.

#### ***Clostridium difficile* – associated disease (CDAD)**

**Aetiology and prevalence.** *C. difficile* is commonly found in colon of clinically normal animals. In the USA the CDAD has emerged as a cause of enteritis in neonatal pigs (Songer and Uzal 2005). The CDAD develops in piglets 1 to 7 days of age born to gilts or multiparous sows.

Clinical signs of diseases include early-onset scours, rarely with respiratory distress, and sudden death. Pathogenesis of CDAD is likely mediated by toxins A and B. In contrast with the situation in the USA, in Europe and also in the Central Europe region the role and importance of toxinogenic strains of *C. difficile* in the diarrhoeic syndrome of suckling piglets in the first week of their life has never been defined.

**Diagnostic procedures.** The ongoing objective therefore must be a comprehensive differential diagnostics of neonatal piglet diarrhoeas, complete with a demonstration of the presence of toxins A and B in faeces or colonic contents.

**Results.** *C. difficile* toxins were detected repeatedly in colonic contents of neonatal piglets from Czech production farms since 2005. It follows from our studies that diarrhoeas of this aetiology might make up to 10% of newborn piglet diarrhoeas observed in the first week of their life.

#### **Conclusion**

Enteritis caused by the *C. perfringens* type A (*cpb2+*) range among the diseases of the newborn piglets with a major economic impact recently. The results based on the antibiotic treatment and or on the usage of the commercial vaccines against type C provided contradictory data. The causes underlying the spread of the infection are unclear. Our hypothesis suppose a relation with the absence of previously used antibiotic growth promoters, and possible decreased sensitivity of isolates to antibiotics frequently used in therapy of various bacterial infections in herds. In the retrospective study, decreased sensitivity of isolates to tylosin was expected compare to tiamulin. An increase of tiamulin MICs values in *C. perfringens* type A (*cpb2+*) during the past 3 years was detected. The new vaccine based on b 2-toxoid can be expected to provide protection for piglets not only against infections caused by type A *cpb2+* isolates but also to confirm the hypothesis that b-2 toxin is the major factor of virulence of these strains. The CDAD has emerged as a new cause of enteritis in neonatal piglets in Czech republic. It is necessary to test specimens from suspect cases and based on detection of *C. difficile* toxins established the importance of CDAD in the complex of enteric diseases in our herds.

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