An insight into the Danish experience of oedema disease

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Oedema disease is an Escherichia coli enterotoxaemia in pigs usually occurring during the first two weeks after weaning, but older pigs can also be affected. In Denmark the disease has been caused by haemolytic F18-positive E. coli which produces Shigatoxin Stx2e (verotoxin 2e). Each year 30-50 new cases are diagnosed in Denmark by laboratory examinations.

Clinical signs

The clinical signs are oedema of the eyelids and forehead, neurological disorders and sudden death. The disease can be prevented by the same measures as post weaning diarrhoea (low protein, restricted feeding, zinc oxide, antibiotics etc).

However, these measures might reduce the performance of the pigs and cause consumer concern about antibiotic use.

With a new potent vaccine against oedema disease these problems should belong to the past.

Before 1990 oedema disease was absent or at least very rarely observed by veterinary practitioners in Danish pig herds.

So, the recent history of oedema disease in Denmark started in 1994 when purchase of gilts from a nucleus herd with an outbreak of oedema disease was associated with a significant spread of the disease.

Detection of the causal E. coli isolates is performed at the National Veterinary Institute in Copenhagen through examination for relevant virulence factors by PCR. Oedema disease is confirmed by detection of E. coli F18+, Shigatoxin Stx2e+ (and usually enterotoxin negative).

Since 1994 the average number of herds diagnosed has been 41 per year, with a range from 12 to 64 per year.

In Fig. 1 the numbers of herds with oedema disease per year in the period from 2005 to 2012 are shown. In the 1990s most infected herds were located in the southern part of Jutland which is the part of Denmark that is close to Germany.

Many herds had direct or indirect contact to the nucleus herd in the region with an outbreak of oedema disease. Other herds were located close to farms known to be infected.

Today the disease has been diagnosed in most parts of Denmark. In Fig. 2 the location of herds infected between 2005-2012 are shown.

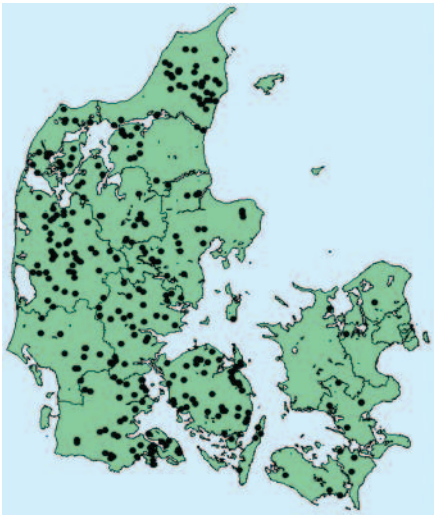
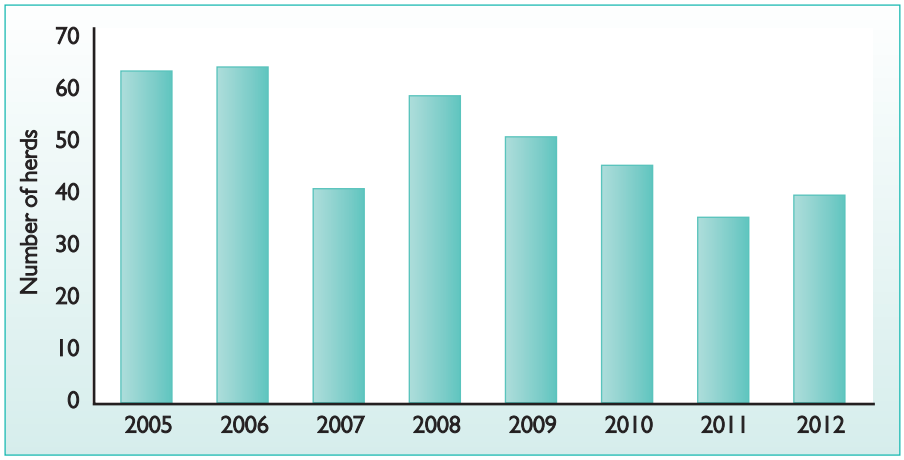


Fig. 2. Location of herds in Denmark with oedema disease in the period 2005-2012.

Fig. 1. Number of herds per year with oedema disease in the period 2005-2012.



Eradication

Due to the sudden spread of oedema disease in Denmark from 1994 attempts to eradicate oedema disease by depopulation and repopulation was tried in a number of infected farms. The eradication costs were sponsored by what today is the Pig Research Centre (PRC).

In order to join the eradication programme the farmers had to accept a very strict washing and disinfection protocol. Barn equipment was disassembled, manure channels emptied and disinfected.

All barns were inspected before an empty period of three weeks and the following repopulation was allowed. The 15 eradicated herds were without clinical signs of oedema disease during an observation period of two years.

Unfortunately, the oedema disease statuses of all these herds were not registered in the long run but some herds had new outbreaks of oedema disease.

Eradication of oedema disease by depop-repop is quite a challenge due to the strict cleaning protocol necessary and the fact that no replacement animals can be guaranteed free from infection with the oedema disease E. coli (F18+, Stx2e+).

In Denmark, multiplying and nucleus herds

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are declared free from clinical signs of the disease. However, there is no laboratory test available to test a herd free from the infection. So, eradication of oedema disease is not considered a relevant strategy.

Prevention

When clinical signs are observed, the release of Shigatoxin Stx2e and its absorption from the intestine has already taken place and treatment is not effective anymore. Since oedema disease can not be treated effectively, prevention is very important. Preventive use of antibiotics often induces development of antimicrobial resistance.

Stress at weaning, feed changes and transfers to the grower and finisher barn are important predisposing factors for the development of oedema disease. Restricted feeding and low levels of crude protein can ease the gastrointestinal stress at the time of transition. The prophylactic feeding regimes will only be effective, if all animals are able to eat simultaneously, which is difficult in most houses with large pens and ad libitum feeding. Inclusion of zinc oxide in the feed for weaned pigs can postpone the disease and/or reduce the number of cases, but extended use of zinc oxide is illegal and poses environmental strain.

PRC tested a number of different preventive measures in the 1990s – but the only measures that really worked were the addition of 3000ppm zinc oxide to the weaner diet and treatment with Shigatoxin Stx2e antiserum produced in horses. The other tested measures were feeding with barley/oats after weaning, inclusion of organic acids or probiotics in the weaner diets.

During the period from 1997 to 2010 'oedema disease serum' was used to prevent oedema disease in many Danish herds. This serum was produced at the National Veterinary Institute by immunising horses with a toxoid vaccine based on purified shigatoxin 2e (verotoxin 2e).

This strategy was chosen because only a limited quantity of the vaccine was available and large scale production could not be established at that time.

The serum was very effective, but had serious adverse effects in some herds where several piglets died due to anaphylactic reactions.

The serum production was stopped in 2010 due to requirements for GMP procedures that made the production unprofitable.

Since December 2012 the vaccine Ecoporc Shiga is available for Danish farmers with dispensation from the National Veterinary Institute based on a laboratory detection of E. coli F18+, Shigatoxin Stx2e+ in the specific herd.

How good is the vaccine?

The Pig Research Centre has tested the new oedema disease vaccine Ecoporc Shiga in collaboration with IDT Biologika, Germany. The trial was carried out in 2012 in a Danish herd with oedema disease.

The study was performed as a masked trial with one vaccinated group (257 piglets) and one control group (255 piglets).

The piglets were vaccinated with 1ml when most piglets were four days old. The inclusion criteria were: healthy pigs, age >2 days, body weight >800g.

Antibiotic treatments were allowed only by injection. To control post weaning diarrhoea 3000ppm zinc oxide were included in the diet for two weeks after weaning.

Vaccinated and non-vaccinated pigs were mingled and housed in the same pens after weaning. The main response variable was the proportion of pigs that died of post weaning oedema disease.

Laboratory examinations

All dead piglets were subject to laboratory examinations. The results showed that a single injection in the first week of life reduced the mortality due to oedema disease from 8% to 1%, which corresponds to approximately 90% reduction.

The vaccinated pigs grew 15g more per day in the nursery period compared to the unvaccinated, but this difference was not statistically significant. They were examined for adverse events immediately after vaccination and again the following day. None of the pigs had side effects resulting from vaccination.

The primary effect of the vaccine is the reduction of mortality due to oedema disease. For every per cent of reduction in mortality the profit per nursery pig increases by €0.50. On top of this the farmer can expect reduced costs to antibiotics and feed additives and improved performance due to normal feeding during the nursery period.

Conclusion

Over the last 20 years the oedema disease of pigs has widely spread throughout Denmark. Although many attempts have been made to control the disease no great success could be achieved by conventional measures.

The newly available vaccine Ecoporc Shiga is a safe and effective tool to significantly reduce the mortality caused by oedema disease and can easily be integrated into modern pig husbandry. ■