International Pig Topics

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ESPHM 12th EUROPEAN SYMPOSIUM OF PORCINE HEALTH MANAGEMENT

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Vaccinology XVI

Actinobacillus pleuropneumoniae

Actinobacillus pleuropneumoniae (APP) is one of the most difficult pathogens to control by vaccination. There are currently 15 APP serotypes described. Clinical symptoms range from per acute deaths (2-3 hours after being infected) to hardly noticeable sub-clinical infections.

The lung can be completely filled up on one side with blood and damaged tissue. Or both lungs can have some isolated, well encapsulated, bumps. APP bacteria produce serotype specific toxins (APX toxins), that are playing a role in these lesions. APP first infects the tonsils and later cells of the lower respiratory tracts of the lungs. Interaction between APX toxins, bacterial LPS and the pig's immune system, determine the pathological outcome. APX toxins damage the wall of the blood vessels. This results in leakage of blood components in the lung tissue, severe oedema and closing of vessels. Tissue damage is further caused by the pig's immune response. Immune competent cells migrate to the affected parts of the lungs and chemical compounds, normally occurring inside these cells, are freed when the cells are killed by the APX toxins, adding to the tissue damage. Death is mainly caused by the shock induced by APP LPS.

In short, an APP vaccine must control a situation where both the APP bacteria and the immune system of the pig in reaction to the infection, are the cause of the pathological changes that can lead to death. APX toxins are the basis of the problem. To solve this problem by vaccination, the vaccine should generate antibodies to neutralise these APX toxins.

Why is that such an issue?

The problem can be split into three different categories:

1. The vaccine must have the right APX toxin, as toxoids, for inducing the right antibodies.

2. The vaccine (toxoid and adjuvant) must induce these right antibodies in sufficient quantities.

3. These right antibodies must reach the right location in the lungs, in time.

For the first issue, the important APX toxins that are produced by APP bacteria present in a certain region must be included, in the form of toxoids, as the vaccine antigens.

The second issue is more important. Killed APP bacterial vaccines normally have a quantity of APX toxoids that is too low to induce meaningful titers of antibodies to neutralise the APX toxins. Therefore sub-unit vaccines, with a much higher quantity of toxoids, have been developed, coupled with a potent adjuvant to induce the desired level of antibodies. But these APX sub-unit vaccines are very sensitive to interference with maternally derived antibodies (MDA) reducing their efficacy. This is a complicating factor that is often neglected under practical conditions.

The last issue, (number three) is of critical importance. Antibodies that are circulating in the body with the help of the bloodstream are, in the case of an APP infection, only needed on very specific spots in the lungs. It is essential that enough blood is going through these locations to get the desired quantity of antibodies in the affected region of the lung. With APX toxins damaging the blood vessels and blocking the blood flow, this becomes an issue.

Some APP serotypes are highly pathogenic. The balance between the quantity of APX toxin and the quantity of APX toxin neutralising antibodies in the lungs is the difference between survival or death!