Maternally-derived antibodies impair piglet humoral and cellular immune responses to vaccination against porcine reproductive and respiratory syndrome

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Background (1)

- PRRS vaccination with modified live vaccine (MLV)
  - Decrease of clinical signs in growing pigs (Martelli, 2009)
  - Decrease virus transmission under experimental conditions (Pileri, 2015, Rose, 2015)
  - In the field, difficulties to control PRRSV circulation with MLV vaccines only (Geldhof, 2013)
  - Hypothesis to explain discrepancies between experimental and field conditions
    - Breeding conditions
    - Internal biosecurity
    - Infectious / immune status regarding PRRS at the time of vaccination

➤ Maternally Derived Antibodies (MDA)
- Maternally derived antibodies (MDA)
  - Of 1\textsuperscript{st} importance for piglets during their early life
    - No specific immunity at birth
  - Could interfere with vaccine when administered in piglets. MDA interference with vaccine proven for:
    - Swine: Influenza KV or Aujeszky’s disease MLV or KV (Kitikoon, 2006; Tielen, 1981; Vannier, 1984)
    - Equine viral arteritis (Arterivirus): foal born from immune mares failed to respond to vaccine and died after virulent challenge (Mc Collum, 1976)
• After PRRSV infection
  – Early anti-PRRSV response detected by ELISA 7 - 9 dpi: do not neutralize the virus
  – Neutralizing antibodies (NA) appear from 3 - 4 weeks pi. NA can:
    • Prevent PRRSV infection in passive transfer experiments (Lopez, 2007)
    • Be induced by PRRS MLV in gilts / sows (Scortti, 2006)
    • Be transferred from dam to piglets by colostrum
    • Delay PRRSV infection in piglets (Geldhof, 2013)
Study objectives

• **In this context:**
  • Seem likely that MDA interference with PRRS MLV could exist in piglets.
  • MDA interference could explain in part difference in PRRS vaccine efficacy between experimental and field conditions

• **1/ Primary objective**
  • Investigate the interference of MDA with a PRRS MLV in piglets in terms of humoral and cellular immune responses

• **2/ Secondary objectives**
  • **A/** Assess the natural decrease over time of MDA in piglets
  • **B/** Assess transmission of the vaccine strain between piglets
Study design

- Study set-up under field conditions
  - Farrow to finish pig herd
  - No PRRSV circulation
  - Vaccination of dams (Porcilis PRRS IM, Blitz) / No vaccination of piglets

- To achieve the objectives of the study:
  - Identification and follow-up of 4 groups of piglets
    - A+V+ (n=30): MDNA+ & vaccinated
    - A-V+ (n=30): MDNA- & vaccinated
    - A+V- (n=20): MDNA+ & unvaccinated (isolated): obj 2A
    - Sentinel (A-V- n=12): MDNA- & unvaccinated: obj 2B
Material & methods

- 7 visits before / after vaccination of piglets (3w of age, Porcilis PRRS ID)

Blood samples to assess:
- PRRSV vaccine viremia (RT-PCR + sequencing)
- Cell mediated immune response (IFNγ ELISPOT)
- Antibody level (Idexx ELISA + Virus neutralization test)
Results: Vaccine viremia

PRRS RT-PCR positive animals (serum)

% of the group

Weeks post-vaccination

A+V+
A-V+
Sent
Results: cell-mediated immune response

PRRS ELISPOT for A-V+ group

PRRS ELISPOT for A+V+ group
Results: ELISA antibodies
Results: Neutralising antibodies

- **PRRS Neutralizing Abs A-V+ group**
  - Graph showing NA titer over weeks PV.

- **PRRS Neutralizing Abs A+V+ group**
  - Graph showing NA titer over weeks PV.

- **PRRS Neutralizing Abs A+V- group**
  - Graph showing NA titer over weeks PV.

- **PRRS Neutralizing Abs Sentinel group**
  - Graph showing NA titer over weeks PV, with a note: "NOT TESTED"
Results summary

- In A-V+ piglets
  - Expected results after a PRRS MLV vaccination
    » Vaccine viremia
    » IFNγ cell immune response
    » Fast seroconversion detected with ELISA
    » Delayed detection of NA

- In A+V+ piglets
  - No immune response to vaccination at 2 and 4 weeks PV
    » Hypothesis: neutralization of the vaccine virus by NA → no vaccine viremia, no cell immune response, decay of MDA
  - At 8 weeks PV: detection of the vaccine strain and of the related immune response (same as in sentinel piglets)

- In A+V- piglets
  - Natural decay of MDA
    » At 11 weeks of age, all piglets negative for ELISA and neutralizing Abs

- In sentinel (A-V-) piglets
  - At 8 weeks PV: more than 60% of animals PCR+: strong circulation of the vaccine strain
Conclusion and perspectives

• Conclusion
  – First study to demonstrate that MDA (in particular NA) can inhibit cell-mediated and humoral immune response in piglets vaccinated with a PRRS MLV

• Limits
  – No data (yet) on the impact of MDA on vaccine efficacy

• Perspectives
  – Evaluate the impact of MDA on the efficacy of a PRRS MLV in piglets (after a viral challenge): in progress
    » Clinical and virological parameters
    » Virus transmission
  – NA but not anti-N Abs (detected by screening ELISA) seems involved in MDA interference with PRRS vaccine
    » VN test only available in research lab, need for an easy tool to monitor NA (ELISA)
Study supported by:
Thank you for your attention

Any questions?