PCV2 and PRRS in relation to PMWS, secondary infections and management factors

F. Dirven (Lintjeshof NL)
Porcine
regarding the pig
Circular (type of genome)

Circo-
Virus
Typ 2
Porcine Circovirus Typ 2 (PCV2)

- Clinical symptoms first described in Canada (1991) and France (1996)
- Wasting of pigs especially 1-2 weeks post weaning (often without any other symptoms like coughing or diarrhoes …)
- Sometimes already symptoms in suckling pigs (sneezing, wasting)
- Sometimes abortions in sows in all stages of pregnancy (West et al., 1999; Allan et al., AASP 2000)
Theories, why PCV2 Symptoms did occur so „late“ (since about 1998) although the virus is already circulating in pig populations since decades

- Also pcv2 virus in healthy herds (SPF), virus has become endemic (Antibodies in all herds)
- Mutation of the virus from symptomless to pathogene.
- Suspension of mammalian proteins from pig diets (due to BSE)
- Increase of mycotoxins in pig diets (multifactorial)
- Higher production (30 piglets/sow/year) and concentration of pig production
- „Mistake for PRRS symptoms“
- Genetic change (pietrain strains??)
Pathogenesis (PCV2) experimental

• Oronasaal infection seronegative SPF gilt (DURING GESTATION)

  \[ \text{viraemia} \]

  \[ \text{virusreplication in embryo} \]
PATHOGENESIS

INFECTION PCV2

55-75 DAYS GESTATION
- MUMMYFICATION
  - STILL BIRTHS
  - GESTATION GOES ON

UP 75 DAYS GESTATION
- VIRUS POS.
  - PIGLETS
  - NOT GROSSLY AFFECTED

POSTNATAL PIGLETS
- *
  - LYMPHOIUED DEPLETION
  - MONOCYOTE INFILTRATION
Lymphoïd depletion in lymphnodes due to PCV2

- Lnn. are producing cells for the immunesystem
- Decreased production lymphocytes (defense cells)
- Macrophages (pac man) are destroyed (monocyte infiltration), a decrease up to 30%
- Immune system (defense system) is weakened and sometimes unable to challenge new sec. infections
- At this stage pcv2 is not yet developing disease, the piglet is infected with pcv2 virus without symptoms (only enlarged lnn. and dark tear traces)
Pathogenesis (pcv2) in field conditions

Important role by cofactors

• Cofactors stimulate immunesystem of a piglet infected with pcv2
• Pcv2 replication and pcv2 infiltration in lnn
• Pcv2 responsible or lymphodepletion in lnn which indicates immunosupression

• Secundairy infections PMWS
immunity

immuno stimulation

immunosystem piglet with pcv2

pcv2 replication

lymphodepletion

pathologic pmws in Inn

immunosupression

secondary bact. infections clinical symptoms of PMWS

virus (prrs, ppv and auy) other stress factors toxines

cofactors

INTRUTERINE I
PMWS

Postweaning

Multisystemic

Wasting

Syndrom
Co-factors

• Viruses as pRRS and pPV (often together)
• Vaccination; every irrelevant immunogen (adjuvant) can give immunostimulation
• Stress factors: mixing, overcrowding and feed changes
• Mycotoxins
• Other bacteria.
PCV2 – Potentiation of clinical symptoms due to coinfektion with PRRSV

(Infection of 3 weeks old CD/CD pigs)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Infection</th>
<th>Mortal. (%)</th>
<th>clinic (scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>9</td>
<td>---</td>
<td>0</td>
<td>&lt;1</td>
</tr>
<tr>
<td>G2</td>
<td>19</td>
<td>PCV2</td>
<td>32</td>
<td>&lt;1</td>
</tr>
<tr>
<td>G3</td>
<td>13</td>
<td>PRRSV</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>G4</td>
<td>17</td>
<td>PRRSV+PCV2</td>
<td>59</td>
<td>12</td>
</tr>
</tbody>
</table>

Harms et al., AASP 2000
Immunostimulation may induce PMWS

Submitted field study with 3 groups (28 piglets each) in a farm with PMWS symptoms

<table>
<thead>
<tr>
<th>Group</th>
<th>Day 7</th>
<th>Injections at day of live</th>
<th>Day 28</th>
<th>Day 42</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M.hyo</td>
<td>M.hyo</td>
<td></td>
<td>NaCl-Sol.</td>
</tr>
<tr>
<td>2</td>
<td>NaCl-Sol.</td>
<td>Baypamune</td>
<td></td>
<td>Baypamune</td>
</tr>
</tbody>
</table>

PMWS-symptoms in:

- 42.9% of M.hyo vaccinated group,
- 50% of Baypamune injected group and
- only 10.7% of NaCl-injected group!

Kyriakis et al., J Comp Pathol. Januar 2002
**PMWS:** a complex with many faces!!

- **PRRS**
- **Circo**
- **Streptococcus**
- **APP**
- **Management**
- **Stress**
- **Unfavourable vaccine gramme**

**Postweaning-Multisystemic-Wasting-Syndrom**
PMWS after control of PRRSV

- Streptokokken
- Ungünstige Impfprogramme
- Management
- Stress
- APP
- Circo

Postweaning-Multisystemic-Wasting-Syndrom
PMWS after control of PRRSV and optimization of management

Circo

Streptokokken

APP

Postweaning-Multisystemic-Wasting-Syndrom
PCV2 after control of PRRSV, other infections and optimization of management

PCV2 allone usually does not induce clinical symptoms
PMWS

First in Canada (1991), now almost worldwide.

CLINICAL SIGNS

• From weaning until 40 kg bodyweight.
• Sneezing, coughing and pneumonia.
• Fever, lowered daily intake.
• Paleness (stomach ulceration)
• Wasting up to 10%.
• Lowered uniformity.
• Combination with PDNS.
PDNS

Porcine dermatitis and nephropathia
PDNS

- High conc. pcv2 antibodies
- persistant immunostimulation (viruses, stress, mycotoxines etc.)
- production (auto)immunecomplexes
- Obstruction smaller bloodvessels (skin, kidneys)
- No therapy (sometimes in early stage cortico’s)
- Losses up to 5 % (all ages)
Pathologic Findings (PMWS)

- Enlarged inguinal lymph nodes
- Gastric ulceration
- Enlarged kidneys (pdns)
- Interstitial pneumonia
- Bronchopneumonia
Technical data

- Mortality up to 25-30%
- Daily gain lowered - after weaning - in fattening period
- Higher feed conversion
Epidemiological

- All types of farms are dealing with pmws (also SPF herds)
- Only reproductive part is not affected
- 100% prevalence of pcv2 antibodies
- Influence of management factors
- Frequently in combination with PRRS
Secondary infections

- **M. Hyopneumoniae**: vaccination (double shot) relapses
  vaccination in pmws context
- **APP**: Type 2 and 9.
- **Haemophilus parasuis**: frequently involved
- **Pasteurella / bordetella**: sneezing/ coughing
- **Streptococcus**: different types
Prevention and control

Reduce the economical losses by

• Reducing infection pressure (sec. inf.)
• Increase the immune status (increase of passive and active immunity)
• Vaccination sows during gestation with pcv2 vaccin
Vaccination

- **Serotherapy** (difficult and risky)
- **New safe vaccin** (sow vaccination)
- **Maternal PCV antibodies** (by sow vaccination) are protecting for **PMWS** (challenge at 3 weeks age gives less clinical **pmws** signs)
- Maternal antibodies present until 4 weeks in a piglet
- High **pcv2** antibodies after several piglet vaccinations (min. 4 weeks old) gave also protection against **PMWS**, but immunity only after 25 days
- Conlusion: Vaccination of piglets after 4 weeks of age is too late (antibody production only 25 days later), herd vaccination is more economic and efficient
Passive immunity by piglets

- **Bodyweight at birth:** sow feeding schedule
  - feed composition (vitamins, minerals etc.)
  - co infections (prrs, ppv, infl.)
- **Colostral immunity:** piglet and sow
- **Lactation of the sow:** genetically
  - duration
- **Weight at weaning:** 5 – 7 kg bodyweight
Active immunity of piglet

After weaning passive immunity turns to active immunity

- Feed intake
- Feed composition
- Housing
- Stress factors
- Genetics
- Vaccinations
Reducing infection pressure in general

- **Strict biosecurity**, no animals or semen from outside unless quarantine
- **Hygiene**, cleaning and disinfect every room, sterile instruments
- **Cross fostering** only strictly necessarily in first days
- **All in all out systems**
- **Separation or euthanasia** (sick animals to hospital room)
Reducing infection pressure specific

• Which infections are present? (prrs, m.hyo, influenza, app, h. parasuis, pasteurella etc.)

• Primairy and secundairy infections

• How to reduce these infections?
  (Starting up management measures, strategic antibiotic therapy, vaccination programs)
Control of PMWS

Strictly carrying out of
- Management programs
- Vaccination programs
- Antibiotic therapy

Monitoring
## Management factors

<table>
<thead>
<tr>
<th>Hygiene</th>
<th>Lower stock density</th>
<th>Removal to hospital room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biosecurity</td>
<td>No (re) mixing</td>
<td>Extra vitamins</td>
</tr>
<tr>
<td>Climate control</td>
<td>Small groups</td>
<td>Appropriate vaccination program</td>
</tr>
<tr>
<td>One site herds</td>
<td>Feeding systems/schedule</td>
<td>rodents</td>
</tr>
<tr>
<td>All in all out</td>
<td>Cross fostering</td>
<td></td>
</tr>
</tbody>
</table>

22/05/2006 lintjeshof

Lintjeshof
## Vaccination program example

<table>
<thead>
<tr>
<th>disease</th>
<th>gilt</th>
<th>sow</th>
<th>piglets</th>
</tr>
</thead>
<tbody>
<tr>
<td>auy</td>
<td>12, 16 and 26 weeks</td>
<td>Every 4 months</td>
<td>12 weeks</td>
</tr>
<tr>
<td>ery</td>
<td>12, 16 weeks</td>
<td>lactation</td>
<td></td>
</tr>
<tr>
<td>parvo</td>
<td>26, 30 weeks</td>
<td>lactation</td>
<td></td>
</tr>
<tr>
<td>prrs</td>
<td>18 weeks</td>
<td>Every 4 months</td>
<td>2 weeks</td>
</tr>
<tr>
<td>m. hyo</td>
<td>17 weeks</td>
<td>Every 3 months</td>
<td>1, 3 weeks</td>
</tr>
<tr>
<td>app</td>
<td>17 weeks</td>
<td>Every 3 months</td>
<td>6, 10 weeks</td>
</tr>
<tr>
<td>influenza</td>
<td>Comb auy</td>
<td>Combination auy</td>
<td>Combination auy</td>
</tr>
<tr>
<td>e. coli</td>
<td></td>
<td>3 weeks before farrowing</td>
<td></td>
</tr>
<tr>
<td>pcv</td>
<td></td>
<td>gestation</td>
<td></td>
</tr>
</tbody>
</table>
Monitoring

- Rapid reaction on new pathogens or reinfections
- Measurement tool for effect of vaccinations (seroconversions)
- Health status
- Eradication of certain diseases
Depop and repop

- Only when severe economical losses due to PMWS
- Not in swine dense areas
- No animals or semen from outside (spf)
- Partial depop-repop.
Conclusions

- **PCV2** and **PRRS** are responsible for lymphodepletion. It opens “the door” to sec. infections by immunosuppression.
- Also other cofactors give immunosuppression (stress, vaccinations)
- The complex pcv2 - prrs- cofactors - sec. infections is called **PMWS**
- Prevention by reducing secondary Infection pressure and increasing immunity
- Control by management - vaccination programs and strategic antibiotic therapies
- New **PCV2** vaccine is launched in a few country’s
- Total repop is very risky and expensive, partial depop is perhaps an option
- Monitoring is important
Thank you for your attention
Dr. F. Dirven