The prevention and controls of swine enteric coronavirus disease in China

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Talking from

- Accurate diagnosis
- Immunization
- Biosecurity
- Treatment
There are many kinds of situation of pig diarrhea in China

Positive rates in samples and pig farms
Accurate diagnosis is essential

- Guide immunization
- Manage farm biosecurity practices
- Manage prevention and control protocols
How to diagnose the pig diarrhea cases

- Primary diagnosis depends on clinical sign in pig farm

- Laboratory assay makes confirmative diagnosis
It is difficult to make difference diagnosis on clinical sign and gross anatomy.
Colloidal gold test of TGE, PED and PoRV

A: PED negative  C: TGE negative
B: PED positive  D: TGE positive
E: PoRV negative  F: PoRV positive
Diagnosis methods in laboratory

1. RT-PCR (Nest-PCR)
2. Real-time PCR
3. FA (IFA)
4. RT-LAMP
5. ELSIA
6. VN (Virus Neutralization test)
7. Virus isolated
Analysis of complete genome sequences of CV777 P125, CH/S, CH/FJND-3/2011

<table>
<thead>
<tr>
<th>Strains</th>
<th>Full-length (bp)</th>
<th>5'UTR (bp)</th>
<th>ORF1 (bp)</th>
<th>ORF1a</th>
<th>ORF1b</th>
<th>S (bp)</th>
<th>ORF3 (bp)</th>
<th>E (bp)</th>
<th>M (bp)</th>
<th>N (bp)</th>
<th>3'UTR (bp)</th>
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</table>

Nuclotides deletion in CV 777 P125 (Vaccine strain)

![Diagram showing the deletion in ORF1 and ORF3 between CV777 and CV777-P125]
RT-LAMP make difference diagnosis between WT & AT of PEDV
RT-PCR make difference diagnosis between 
WT & AT of PEDV

Figure 1 Nested RT-PCR on the PEDV strains (including CV777 vaccine strain)

a. The first PCR products for the 11 field PEDV strains and CV777 vaccine strain.
b. The second PCR products for the 11 field PEDV strains and CV777 vaccine strain. From left to right: A, CH/HJLJH/06; B, CH/HNJCH/06; C, CH/IMT/06; D, CH/SHH/06; E, CH/HLJM/07; F, CH/GSJI/07; G, CH/GSJI/07; H, CH/HNHJ/08; I, CH/JL/08; J, CH/JL/09; K, CH/GSJI/07; L, CV777 vaccine strain; M, Negative control; N, DNA marker (DL2,000).
# Preventions & Controls of PEDV in China

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<table>
<thead>
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<tr>
<td>China</td>
<td>CV777 p125</td>
</tr>
<tr>
<td>Japan</td>
<td>P-5V</td>
</tr>
<tr>
<td>South Korea</td>
<td>KPED-9, DR13</td>
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</table>

**PED Vaccines are developed in China**

- Bi-Combined killed vaccine against TGEV and PEDV (1996)
- Bi-Combined live vaccine against TGEV and PEDV (2003)
- Tri-Combined live vaccine against TGEV, PEDV and PoRV (G5) (under way)
The protective efficiency of live vaccine against TGEV by different immunization pathway

- The results of attenuated strains oral and/or intranasal vaccination have generally been disappointing (Henning and Thomas, 1981; Moxley and Olson, 1989; Saif and Bohl, 1979, 1981; et al.)

- The mortality among challenged pigs from vaccinated dams by orally or/ and IM ranged from 25% to 100% (Moxley and Olson, 1989a; Saif and Bohl, 1979; Saif and Jackwood, 1990)

- Inoculating lyophilized attenuated virus in enteric-coated gelatin capsules induced high levels of TGEV IgA antibodies in milk and reported only 10% piglet mortality (Hess et al., 1978; Votes et al., 1980)
# Comparision of inoculating TGEV attenuated vaccine by HouHai point and oral

<table>
<thead>
<tr>
<th>Groups</th>
<th>No. of piglets</th>
<th>Age of days</th>
<th>Safety test</th>
<th>DPI</th>
<th>Immunization results</th>
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<td>Dose*</td>
<td>Morbidity</td>
<td>Challenge ID&lt;sub&gt;50&lt;/sub&gt;</td>
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<tr>
<td>HouHai point</td>
<td>38</td>
<td>3</td>
<td>0.1ml</td>
<td>0/38</td>
<td>7-12</td>
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<tr>
<td>HouHai point</td>
<td>30</td>
<td>3</td>
<td>0.2ml</td>
<td>0/30</td>
<td>9</td>
</tr>
<tr>
<td>Oral</td>
<td>15</td>
<td>3</td>
<td>0.1ml</td>
<td>0/15</td>
<td>7-10</td>
</tr>
<tr>
<td>Control</td>
<td>28</td>
<td>3</td>
<td>PBS 0.2ml</td>
<td>0/28</td>
<td>7-10</td>
</tr>
</tbody>
</table>

Dose* of vaccine: $10^{7.0}TCID_{50}$/ml

Meng et al., 1992 JTCVM No. 5 12~16
The location of HouHai point and shot method
Active immunization results of attenuated vaccine against TGEV and PEDV

5 batches vaccine, inoculated 1.0ml, 0.2ml (titers > 10^7.0 / 0.3ml) by HouHai point
Animals: 3~5 day-old negative piglets (VN antibodies ≤ 4) of TGEV and PEDV
Challenge virus: 1000 ID_{50} (TGEV H stain, PEDV CH/S strain) by oral

Protective rate: Vaccine group: TGEV (20/21); PED (24/24)
control group: TGE(0/5); PED(0/8)

Passive immunization results of attenuated vaccine against TGEV and PEDV

5 batches vaccine, inoculated 2.0ml (titers > 10^7.0 / 0.3ml) by HouHai point
Animals: pre-farrowing negatives own piglets (VN antibodies ≤ 4) of TGEV and PEDV
Challenge virus: 100 ID_{50} (TGEV H stain, PEDV CH/S strain) by oral

Protective rate: Vaccine group: TGEV (24/25); PED (25/25)
control group: TGE(0/5); PED(0/5)

Vaccination group

Control group

Normal villi

Vaccination

Control (challenge)
Preventions & Controls of PEDV in China

Vaccination: passive or active immunity

- Suckling piglets: passive immunity
- Other pigs: active immunity

For suckling piglets, the active immunity is ineffective.
For the other pigs, the active immunity is effective.
No whole-herd vaccination causes immunization failure

**Remember:** The whole herd of immunization! No susceptible herd of swine left!
Prime Whole-group-vaccination before 40 days before epidemic season
Booster vaccination 20 days at before pre-farrowing
Who is the shortest wood block?

- Gilts
- Backup boars
- Wean, nursing, and fatten

If your pig farm is positive of PEDV, and you want to keep the herd health, you must do good vaccination to the gilt. About 4 times vaccination to gilts before first farrowing.
Preventions & Controls of PEDV in China

- **Feedback**
  - The small intestine used to feed back should be collected within 24 hours post infection or the appearance of clinical signs.
  - Do the whole herd inoculation and you can’t do many times feedback.
  - Sow show clinical sign should be better

- **Autogenous killed vaccine**
  - If your farm get the PED, you can use killed autogenous vaccine, and you should do it ASAP, and it will get to stop diarrhea more than 1 week post inoculation

Both of them are effective for the PED control, and Autogenous vaccine is better, for the feedback could lead to the virulent virus spread.
Biosecurities for the PEDV control

- Disinfection, all-in all-out, keep units empty more than 2 weeks
- Multipoint feeding (sow and finishing pig)
- If your pig farm is negative, replacement breeding stock should originate from negative herds
- Stop workers to move from the sick units
- Don’t cross to use the tools and equipments
PEDV Treatment Measures

- Weaned, feeding the milk over 10-day old
- Another sow for nursing piglets under 10-day old
- Move the healthy sows to another litter house
- Controlling the co-infection of bacteria via antibiotic
- Rehydrated quickly and easily by drinking large quantities of a solution of oral rehydration salts.
- Antiserum therap

All measures could reduce the rate of mortality of suckling piglets, but it can’t stop to be sick, and its effect is limited in sick farm.
Summary

- Combine Passive immunity and active immunity in whole pig herds; Vaccination pathway affects the vaccine efficiency
- Do feedback and autogenous vaccine in right way
- Establish and strictly enforce biosecurity procedures.
- We should do both immunization and biosecurity better.
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