Porcine Epidemic Diarrhea

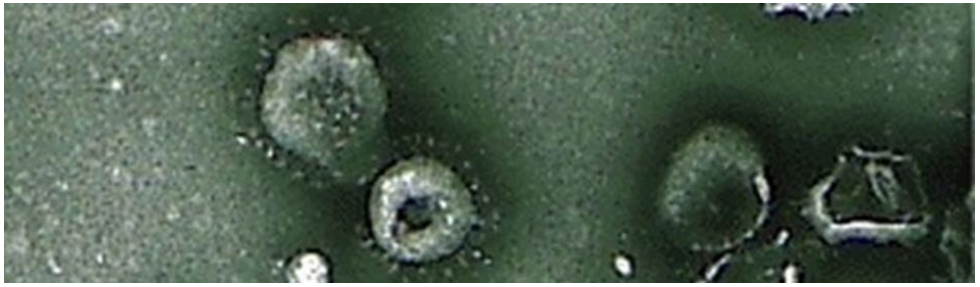
SEALAB
SOUTH-EAST ASIA LAB NETWORK

Background

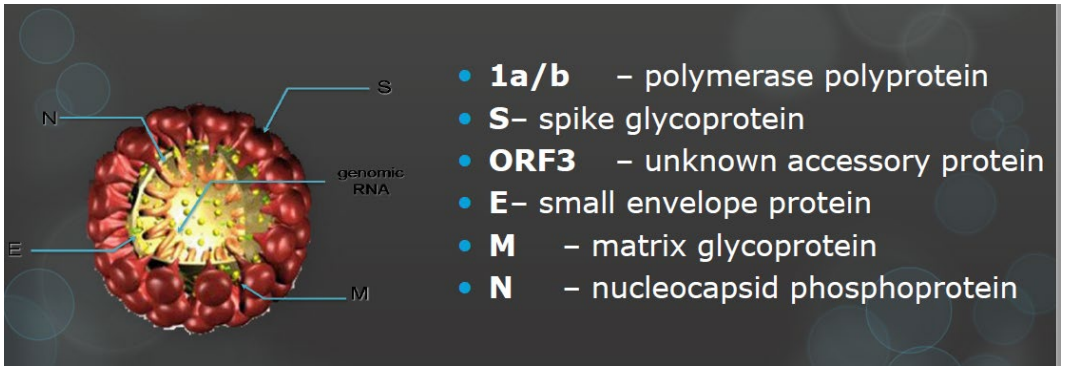
- Sudden outbreaks of scour involving large numbers of litters with acute diarrhea and high mortality are common in pig raising and suggest various pathogens.
- First reported in Europe in the 1970's, PED has emerged in several Asian countries including Japan, Korea and China in the 1990's, Thailand, Vietnam and the Philippines from 2006, causing outbreaks with neonatal mortalities approaching 100%.
- In the winter of 2020, a new wave of PEDV epidemic swept across China.

ETIOLOGY

The PED virus



- Porcine Epidemic Diarrhea Virus (PEDV) is a member of the **coronavirus** group. The sequencing shows that there are 3 types of PEDV, the new one come from China.
- It is a single-stranded RNA virus: this is why it is very labile and has a facility **to mutate and recombine** its genome forming new strains.
- Data show that 1 g of feces dissolved in 100 L of water is highly infectious to pigs / the infective dose of PED is as few as 100 virus particles / the head of a pin=20 million virus particles



Survival of PEDV

- Survival in fresh feces: 7 days
- Survival in manure slurry: 14 to 28 days
- Survival in drinking and recycled water: 7 to 13 days
- Survival in feed: wet feed for 28 days

Disinfection

- Multiple commonly used disinfectants have demonstrated efficacy against TGEV **when no organic matter** was present and contact time is enough.
- The infectious dose of PEDV is extremely low, therefore, methods of disinfection that only reduce the amount of virus may not be sufficient
- Coronaviruses can be inactivated by the following common disinfectants available in Cambodia: peroxygen-based compounds (Virkon 0.5%) and quaternary ammonium and quaternary ammonium / glutaraldehyde combination disinfectants (TH4+ 0.5%)
- PEDV are sensitive to drastic changes in pH, but the application of pH changes in the field as a method for sanitation and decontamination is limited

EPIDEMIOLOGY

Susceptible Species

- Pigs are the only known host of PED virus

- The occurrence of PED in wild pigs is unknown
- PED is not zoonotic

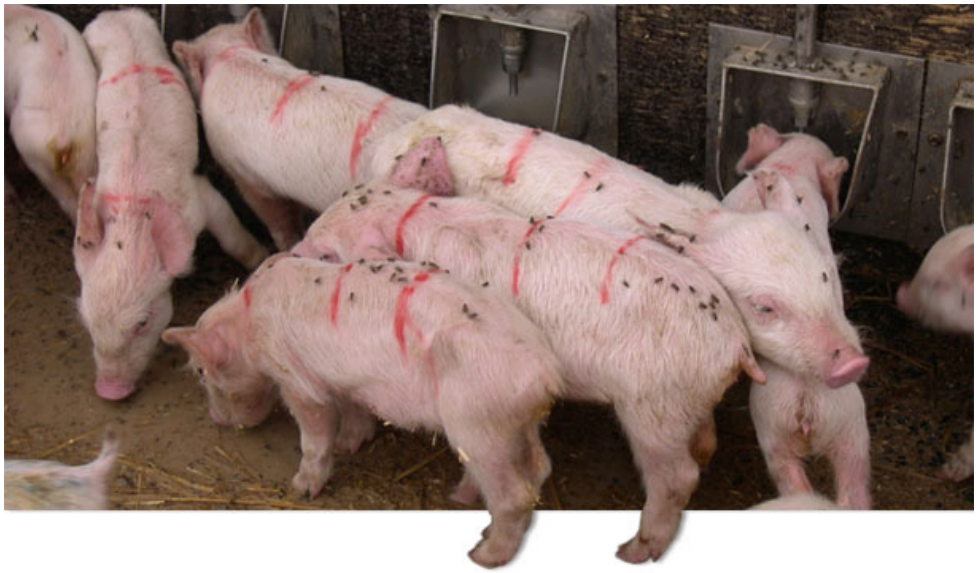
Transmission of PED

- The fecal–oral route is the main means of direct transmission of PEDV via the feces and/or vomitus of infected pigs
- Indirect contact transmission of PEDV is also frequent within and between farms, particularly, with a low biosecurity, via transport trailers, farmers' hands, boots and clothes…
- farm-to-farm (up to 10 km away) airborne transmission of PEDV via aerosolized PEDV particles

Morbidity and Mortality

- Morbidity: up to 100%! The incubation period is typically two to four days and the first clinical signs in a herd are seen approximately four days after PEDv enters the herd. When the virus is first introduced on to the farm there is a rapid spread of diarrhea with almost 100% morbidity (pigs affected) within 5 to 10 days.

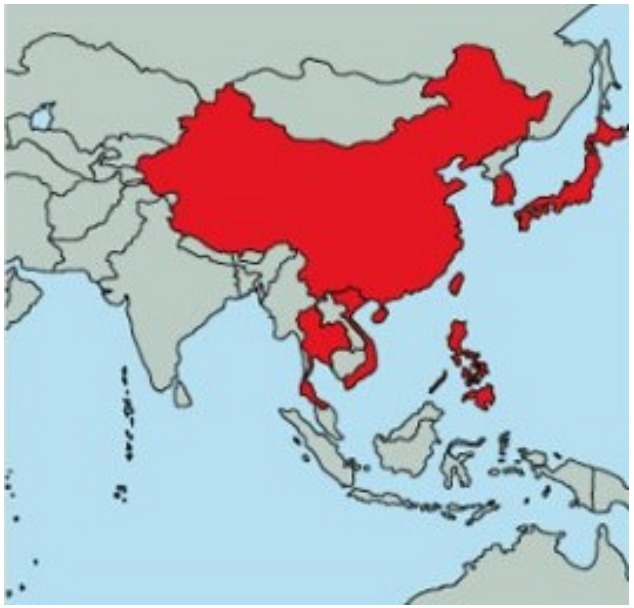
- Mortality vary depend on age:
  - Suckling piglets: up to 100%
  - Piglets older than 10 days:10%; however the condition is severely impacted and often must be culled
  - Sows and fattening pigs: 5%



Geographical distribution of PED

- The major outbreaks of PED occurred in Korea in the 1990s.
- From 2005 to the present, PED outbreaks due to these "Korean" strains have become a problem, particularly in the Philippines, which has made several imports of Korean pigs over this period.
- Since 2008 there has been new waves of outbreaks due to new strains of PED virus that have emerged in China.

- These outbreaks of PED have spread throughout China, also reaching Vietnam and Thailand.
- In the winter of 2020, a new wave of PEDV epidemic swept across China.



DIAGNOSIS

Clinical diagnosis

- The incubation period is typically 2 to 4 days and the first clinical signs in a herd are seen approximately 4 to 6 days after PEDv enters the herd
- The clinical signs of disease are very age-specific and much more severe in younger animals; it depends as well of the immunological status of the pigs against corona viruses.

- The clinical signs of PED infection can be variable in its severity and are not distinguishable from other causes of diarrhea.
- Confirming a diagnosis of PED cannot be made on a clinical basis only.

Clinical signs

Neonatal piglets

- Diarrhea, anorexia and vomiting
- Dehydration
- Weight loss
- Lethargy
- Death

Weaned, growing

- Diarrhea of short duration can reach 100%, but pigs generally remain in good condition and mortality is usually low to none

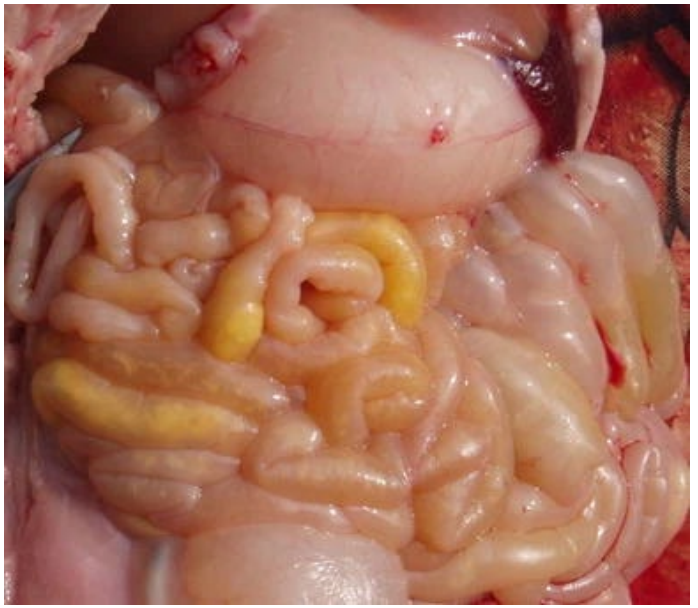
Sows

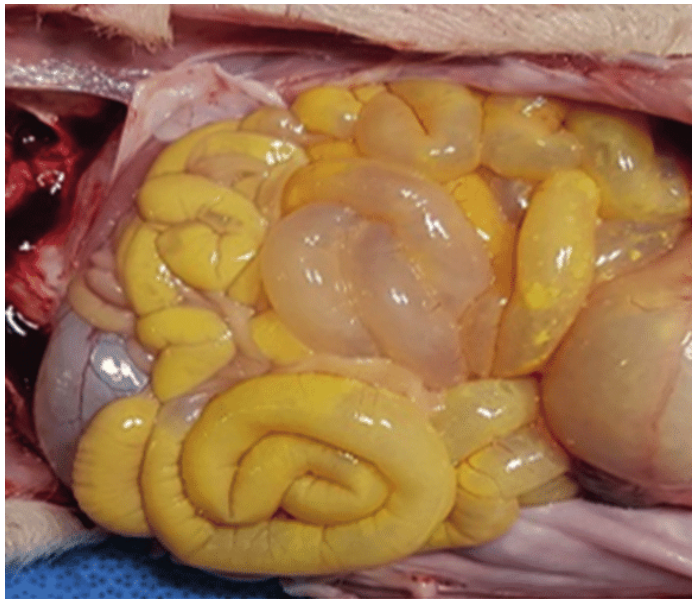
- Diarrhea may or may not be observed.
- Inappetence and agalactia.


A
B
C
D

Post-mortem Lesions

- Thin and transparent intestinal walls (duodenum to colon)
- Accumulation of large amounts of yellowish fluid in the intestine
- The stomach can be filled with coagulated milk, possibly due to reduced intestinal peristalsis
- Other internal organs appeared normal



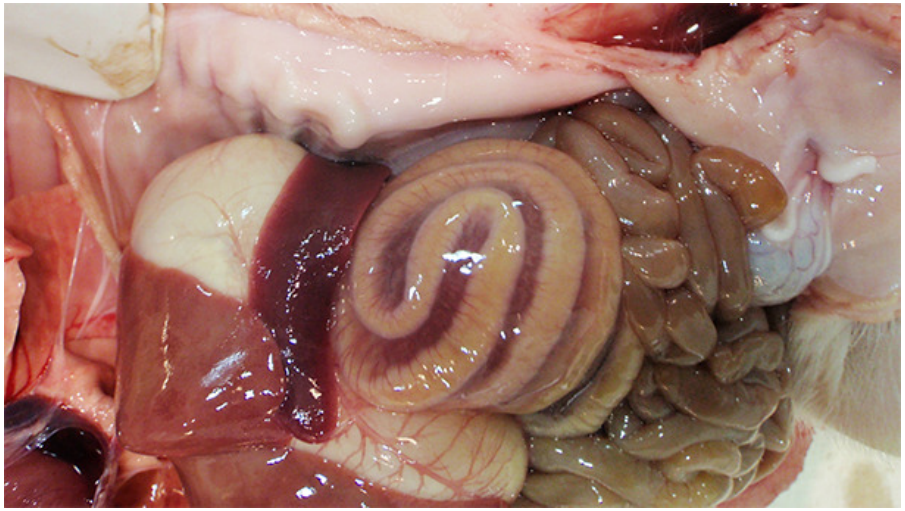


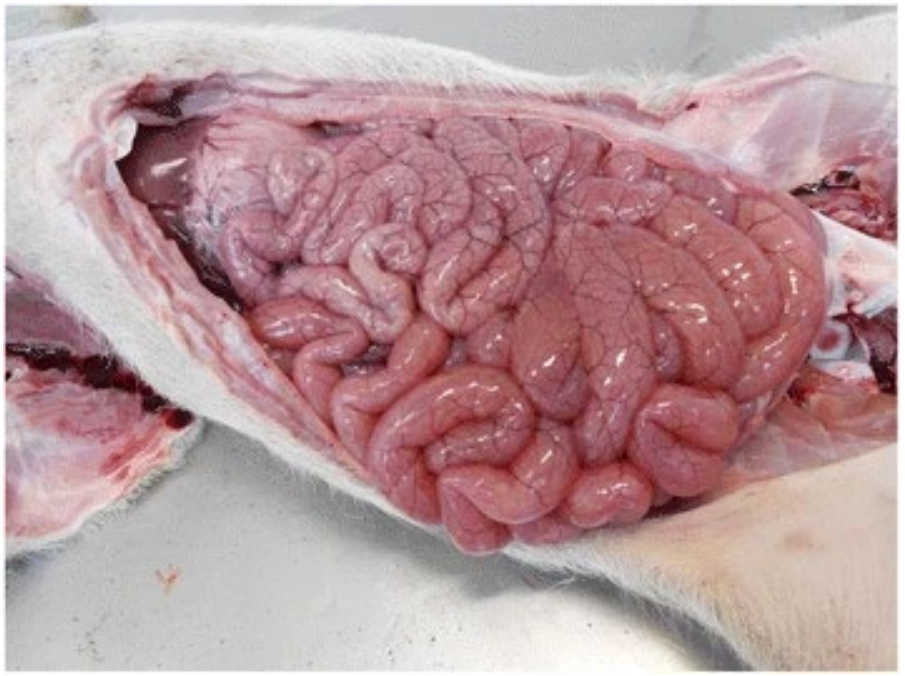
Differential diagnosis of acute diarrhea in piglets

There are other diseases that cause very similar clinical signs, such as:

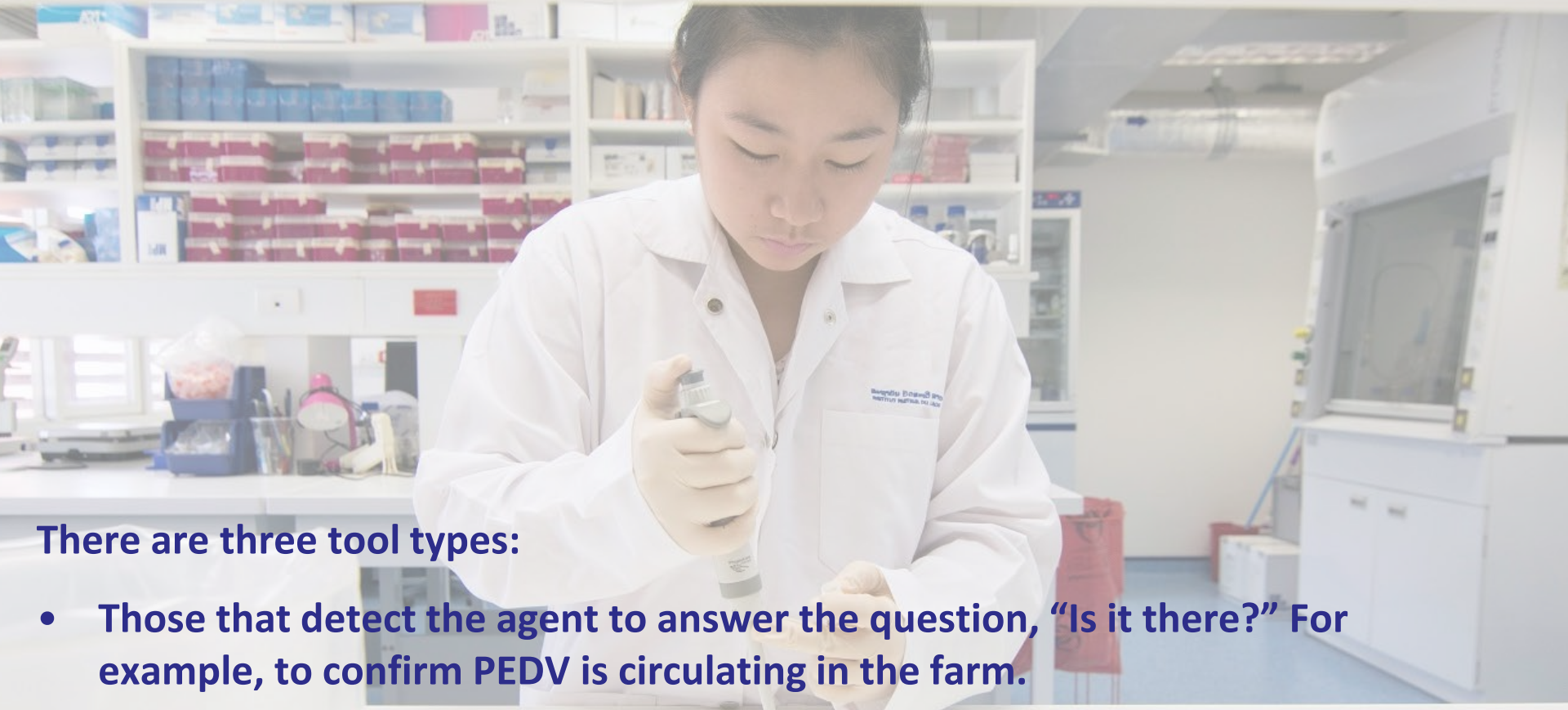
- Transmissible gastroenteritis (TGE), coronavirus similar to PED but cross-protection does not occur
- Coccidiosis, protozoa, easy to prevent (Toltrazuril), less mortality, treatment with sulfonamides
- Rotavirus diarrhea, similar signs of diarrhea but lower mortality
- *Clostridium* difficile, bacteria, diarrhea within just few hours of birth
- *E. coli*, less acute, treatment by antibiotics

Normal intestine
Clostridium difficile
E.Coli





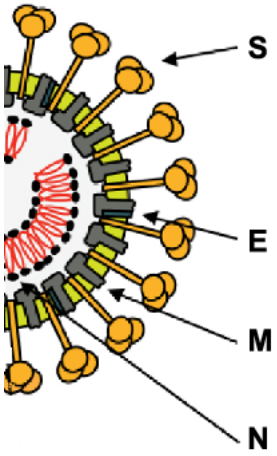
Laboratory diagnosis



There are three tool types:

- Those that detect the agent to answer the question, “Is it there?” For example, to confirm PEDV is circulating in the farm.
- Tests that find the agent in a lesion to answer the question, “Is it this virus causing the disease in this animal today?”
- To determine if animals were previously infected via detection of an antibody and answer the question, “Has this animal been previously infected?”

Is it there? PCR is a common test used to detect segments of nucleic acid (genes) to answer this question: “Is it there?”



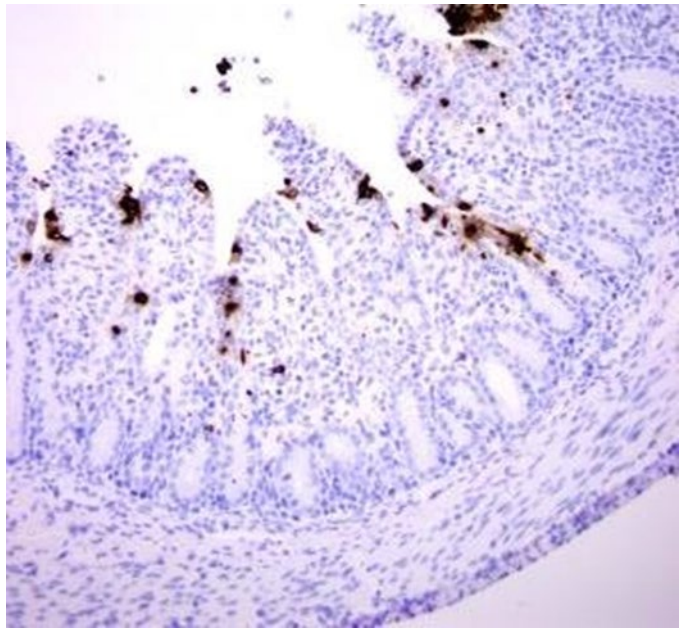
- PCR for PEDV may target one of several different genes coding proteins of the structure (S gene/ Spike, N gene/Nucleocapside, E gene/envelope or M gene/membrane)
- There are 2 objectives for PCR test application, **1/** to confirm PEDV is present when there is disease (“diagnostic mode”) and **2/** to prove PEDV is not present in pigs, environment, feed or substance (“surveillance mode”).

- PCR samples should be preserved by immediate refrigeration or freezing.
- Usually feces, rectal swabs,tissues or oral fluids, are required to be tested to confirm disease.

IHC, ImmunoHistoChemistry, to answer this question: is PEDV the real cause of the diarrhea?

PCR only detects a small portion of the PEDV genome, a positive test does not confirm that the sample contains live, viable or infective virus.

- IHC is a direct immunofluorescence method.
- It is useful diagnostic tool which shows antigen in infected tissues.
- The IHC test is much less sensitive in detecting PEDV than is PCR, but it detects the virus in tissue lesions and so confirm that the diarrhea is really due to PED



- Specimen: small intestine from acutely affected pigs be placed in 10% formalin immediately after euthanasia

Antibody Detection (Serology)

- Some tests can detect antibody specific for PEDV, formed as part of the immune response and becomes detectable after disease.
- A positive result suggests that an animal was previously infected (or in young animals, antibody passively acquired via colostrum) but should not be interpreted as predicting animals are “immune” to disease.
- Similarly, the absence of antibody in serum does not mean there is no immunity, particularly for mucosal pathogens such as PEDV
- In general, antibody detectable in serum for PEDV is relatively short-lived, meaning it does not survive three to five months.
- 2 tests, ELISA test detected antibody longer than the IFAT.
- Sample: colostrum, milk, serum and feces

TREATMENT, PREVENTION AND CONTROL