IMPACT OF SWINE ENTERIC CORONAVIRUSES IN THE INTESTINAL BARRIER: A HISTOPATHOLOGICAL AND IMMUNOHISTOCHEMICAL APPROACH

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Introduction

Porcine enteric coronaviruses include some of the pathogenic viruses with the greatest impact on the global swine industry, including porcine epidemic diarrhea virus (PEDV), transmissible gastroenteritis virus (TGEV) or porcine enteric coronavirus (SeCoV).

OBJECTIVE: to compare the impact of three different strains of swine enteric coronaviruses in the small intestine of infected piglets, focusing on the pathology and main components of the intestinal barrier, including the number of goblet cells, and the expression of the viral antigen, FOXP3 and IgA.

Materials and methods

24 4-week-old piglets were divided into 4 groups:

- **Control group**
- **Group inoculated with PEDV (G1b PEDV-2330-Orense) (PEDV group)**
- **Group inoculated with SeCoV (European SeCoV-1480-Murcia-Lorca) (SeCoV group)**
- **Group inoculated with a recombination between PEDV-SeCoV (European recombinant PEDV-SeCoV-1931-1- Valladolid-Molpeceres) (rPEDV-SeCoV)**

At 3 y 6 dpi. 3 animal/group were euthanized

Duodenum, jejunum and ileum samples were taken for histopathology and IHC studies (viral antigen, TUNEL, FOXP3 and IgA)

Results

Microscopic lesions consisted of shortening and fusion of the villi (Fig. 1B, arrow) in the three infected groups mainly at 3 dpi, which was correlated with the viral load in feces (Fig. 1C) and the frequency of viral antigen-positive cells. No significant changes were observed in the number of globet cells.

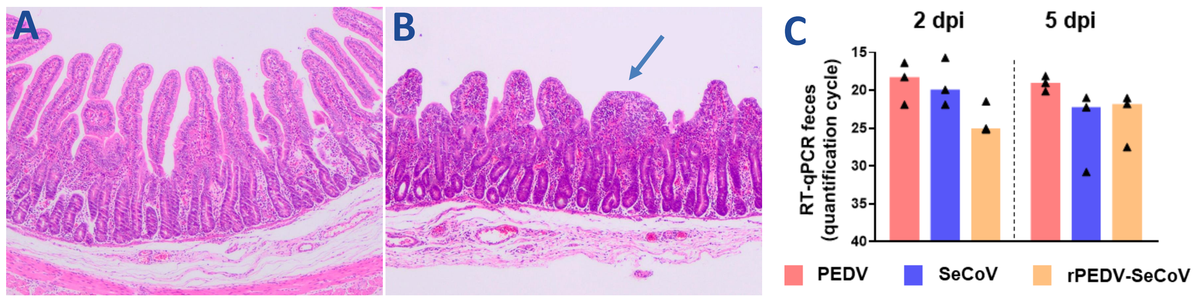


FIGURE 1. Histopathology (H&E) from a jejunum of pig from control group **(A)** and from a PEDV group **(B)** at 3 dpi. Arrow shows shortening and fusion of villi. **(C)** Quantitave RT-qPCR of feces at 2 and 5 dpi.

Viral antigen labeling was observed in the cytoplasm of enterocytes from the tip of the villus (Fig. 2A-C) and in a lesser extent in the cytoplasm of scattered goblet cells (Fig. 2A, inset). The frequency of viral antigen positive cells was higher during the first days of infection (3 dpi), mainly in the jejunum and ileum in PEDV and SeCoV groups (Fig. 2D). At 6 dpi, the number of viral antigen+ cells decreased in all infected groups (Fig. 2D).

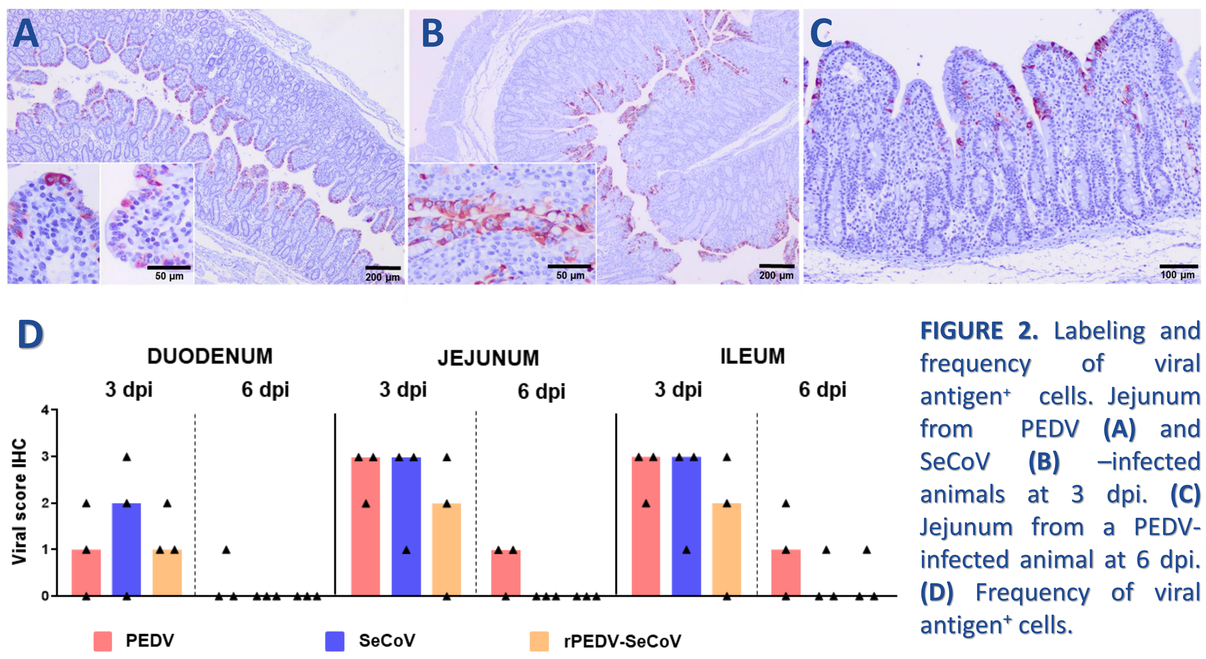


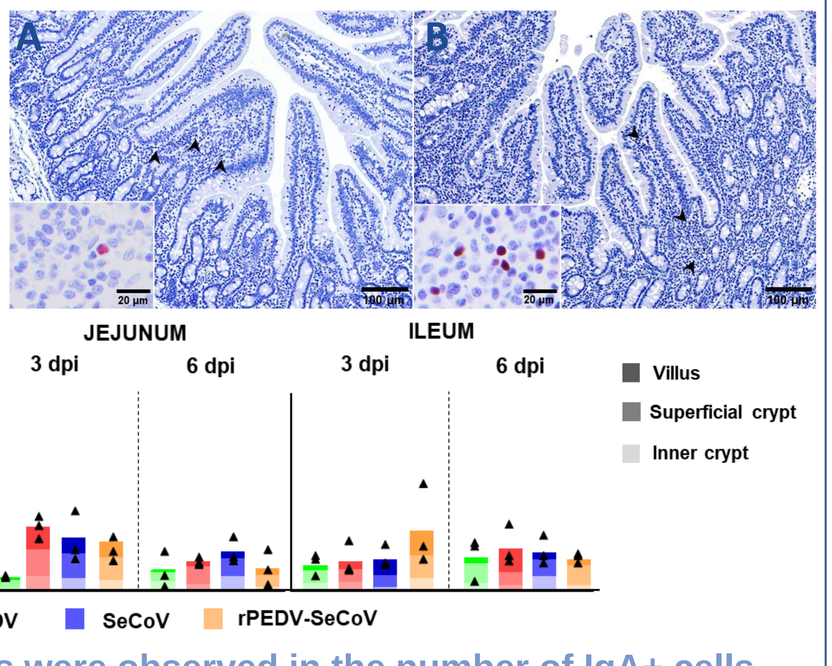
FIGURE 2. Labeling and frequency of viral antigen+ cells. Jejunum from PEDV **(A)** and SeCoV **(B)** –infected animals at 3 dpi. **(C)** Jejunum from a PEDV-infected animal at 6 dpi. **(D)** Frequency of viral antigen+ cells.

Higher cellular death was detected in samples from infected animals compared with control (Fig. 3), mainly in the lamina propria (Fig. 3C,inset) and enterocytes from the tip of the villi (Fig. 3B, inset).

FIGURE 3. Labeling and frequency of TUNEL+ cells. Duodenum from control **(A)**, SeCoV **(B)** and rPEDV-SeCoV **(C)** -infected animals at 3 dpi. **(D)** Frequency of TUNEL positive cells.

A higher frequency of FoxP3 positive cells was detected in infected animals compared with the control ones, especially in the duodenum and jejunum, at 3 dpi (Fig. 4).

FIGURE 4. Labeling and frequency of FOXP3 positive cells. Duodenum from a control **(A)** and SeCoV-infected animal **(B)** at 3 dpi. Arrowheads and insets show positive cells. **(C)** Frequency of positive FOXP3 cells.



No significant changes were observed in the number of IgA+ cells.

Conclusion

The results suggest an induction of FoxP3 cells in the small intestine to control inflammation and damage, mainly of epithelial cells, caused by viral replication. Further studies should determine the role of these cells during swine enteric coronavirus infections.