Presence of Porcine Endogenous Retrovirus C in Domestic Pigs in Kansas

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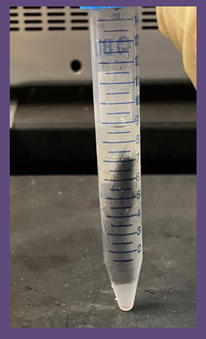
Abstract

There is currently a shortage of organs avaliable to perform allotransplantations in humans, prompting the exploration of xenotransplantation as an alternative. Xenotransplantation is the transplantation of living tissues between different species. Porcine, or pig, tissues are a promising option for this. However, there are concerns regarding immunological barriers and cross species transmission. More specifically, the transmission of Porcine Endogenous Retroviruses (PERV's). There are three subtypes of PERV's, only two of which are found in all pigs: PERV-A and PERV-B. Both are also capable of infecting humans. The third subtype, PERV-C, is only found in some pigs and cannot infect humans on its own. However, it can recombine with PERV-A. This recombinant virus has been shown to be more infectious than PERV-A or –B on their own. Since PERV's can be passed from parent to offspring and then become incorporated in all tissues, this presents a major problem when transplanting porcine tissues in humans. Therefore, it is important to track the presence of PERV-C in different pig populations to help prevent the transmission of the virus to humans.

Methodology

Samples from 11 litters of pigs from the FHSU farm were obtained in between 2017 and 2019. The samples were stored at -20° C in 95% ethanol. DNA extraction was done using Qiagen Dneasy Blood and Tissue extraction kit, following the manufactures instructions for this type of tissue samples. PCR was run and gel electrophoresis was used to detect and visualize the ENV gene of PERV-C.



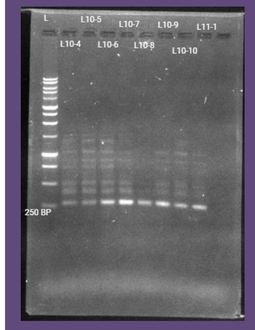
PCR Primers	
PERV-C ENV	Fwd: 5' CTGACCTGGATTAGAACTGG Rev: 5' ATGTTAGAGGATGGTCCTGG

The samples used were ear and tail clippings from piglets at the FHSU farm, these were stored in the test tubes shown in the middle in the conditions listed above. On the left, the PCR primers used to detect the ENV gene of PERV-C.

Results and Discussion

A total of 68 Samples were tested. Of these samples, 23 were positive. This is a positive rate of approximately 34%. These results are similar to what was expected. That is, this is similar to what has been seen in other domestic populations and lower than feral populations.

There were some anomalous results. In some cases, it appears that some samples had lower copy number, so it was not always clear if they were positive. Additionally, it was hypothesized that all litters would have the same results. However, for some litters this was not the case. While it is not believed that these had a major impact on the results of this study, it is important to consider.

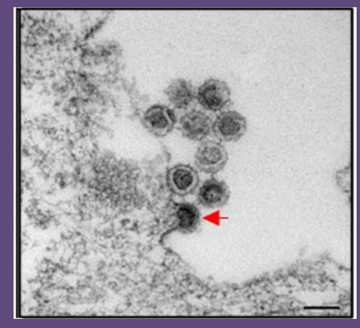


Left: Example of a gel of one litter showing that all samples are positive. In the left lane of the gel is a ladder with an indication where 250 bp is. In the reaming lanes are the samples from litter 10. Additionally, it is shown that there is variation in the strength of the band. This is hypothesized to be the result of different copy numbers of the provirus in the individuals.

Right: A gel showing litter 6, in which some individuals were positive, and some were negative.

Conclusions

The results of this study offer a promising outlook for overcoming the immunological challenges associated with PERV infections when considering xenotransplantation. While continued surveillance and studies are necessary, this study suggests that domestic pig populations could serve as a viable solution to address the critical organ shortage and pave the way for the implementation of xenotransplantation into clinical practice.



PERV-A/C particles budding from a human cell in vitro (Denner, 2021).

References

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