

Delayed virus clearance after recovery from African swine fever – a challenge for disease control and monitoring

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ABSTRACT

African Swine Fever (ASF) is a devastating viral disease affecting domestic pigs and wild boars worldwide. Since its re-emergence in Europe in 2007, the disease has spread across large parts of the world, causing massive economic losses. In both, domestic pigs and wild boars, ASF is typically lethal, but clinical signs can vary depending on the viral strain and host factors. The causative agent, African swine fever virus (ASFV), is a large double-stranded DNA virus with numerous strains of varying pathogenicity. Here, we report the gross pathological findings and virus quantification from experimental infections with two highly virulent (Armenia 2008, Georgia 2007) and one moderately virulent (Estonia 2014) isolate, in regular farm pigs and in SPF pigs. Regardless of the infection route, the two highly virulent strains caused death of all animals within 6-8 days after infection, with classical pathologic lesions including splenomegaly, hemorrhagic lymph nodes and pleural and pericardiac effusions. The infection with Estonia 2014 resulted in 10-50% lethality, with the classical pathological lesions in animals that succumbed to the disease. Interestingly, the organs of the animals that recovered from ASF showed no visible lesions at day 28 post-infection but contained still remarkably high viral loads. While the lesions of ASF are well described, our results underscore the need for continued monitoring and targeted surveillance strategies to effectively mitigate the risk of ASFV transmission, especially in regions where outbreaks of the disease have occurred.

○ Farm Pigs ○ SPF Pigs

BACKGROUND

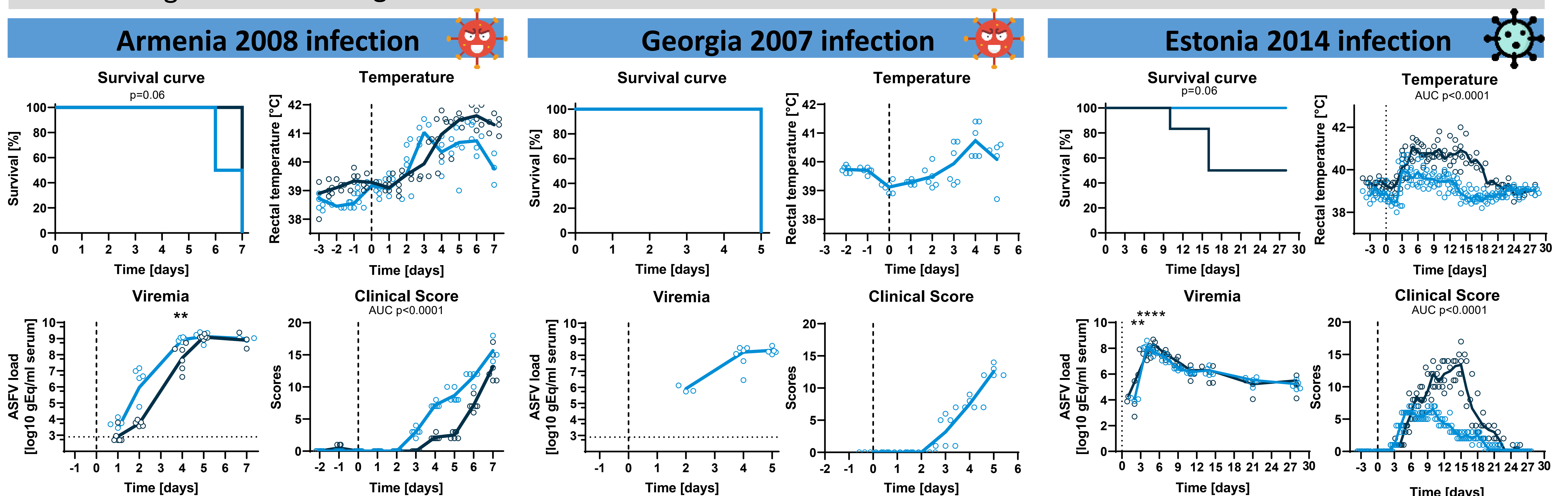


Fig. 1. Survival curves, clinical signs and viral loads in farm and SPF-pigs after infection with highly virulent (Armenia 2008 and Georgia 2007) and moderately virulent (Estonia 2014) ASFV strains. With the highly virulent strains, all animals irrespective of hygienic status succumbed to the disease within 7 days, while for infections with Estonia 2014, 50% of the farm pigs and all SPF pigs survived the infection. Rectal temperature, clinical score, and survival were recorded daily, viremia was determined by qPCR in serum. For infections with Georgia 2007, only SPF pigs were used. Further details in Radulovic E, Mehinagic K, et al. (2022), The baseline immunological and hygienic status of pigs impact disease severity of African swine fever. *PLoS Pathogens* 18(8): e1010522. <https://doi.org/10.1371/journal.ppat.1010522>

RESULTS



Fig. 2. Representative and macroscopical findings in organs of ASFV-infected animals at early timepoints (5-15 days post-infection). External lesions including (A) cyanosis of pinnae and (B) subcutaneous hemorrhages could occasionally be seen. While most lymph nodes are enlarged and hemorrhagic, (C) gastro-hepatic and (D) renal lymph nodes were disproportionately affected. The inset shows a cross section of the gastro-hepatic lymph node with hemorrhages and hyperplasia. Renal petechiae are a common finding but can vary greatly from (E) massive to minimal (F) as highlighted by the arrows, irrespective of viral strain used. (G) Splenomegaly is common and (H) infarctions can often be seen. The upper spleen in (G) is from a mock-infected animal.

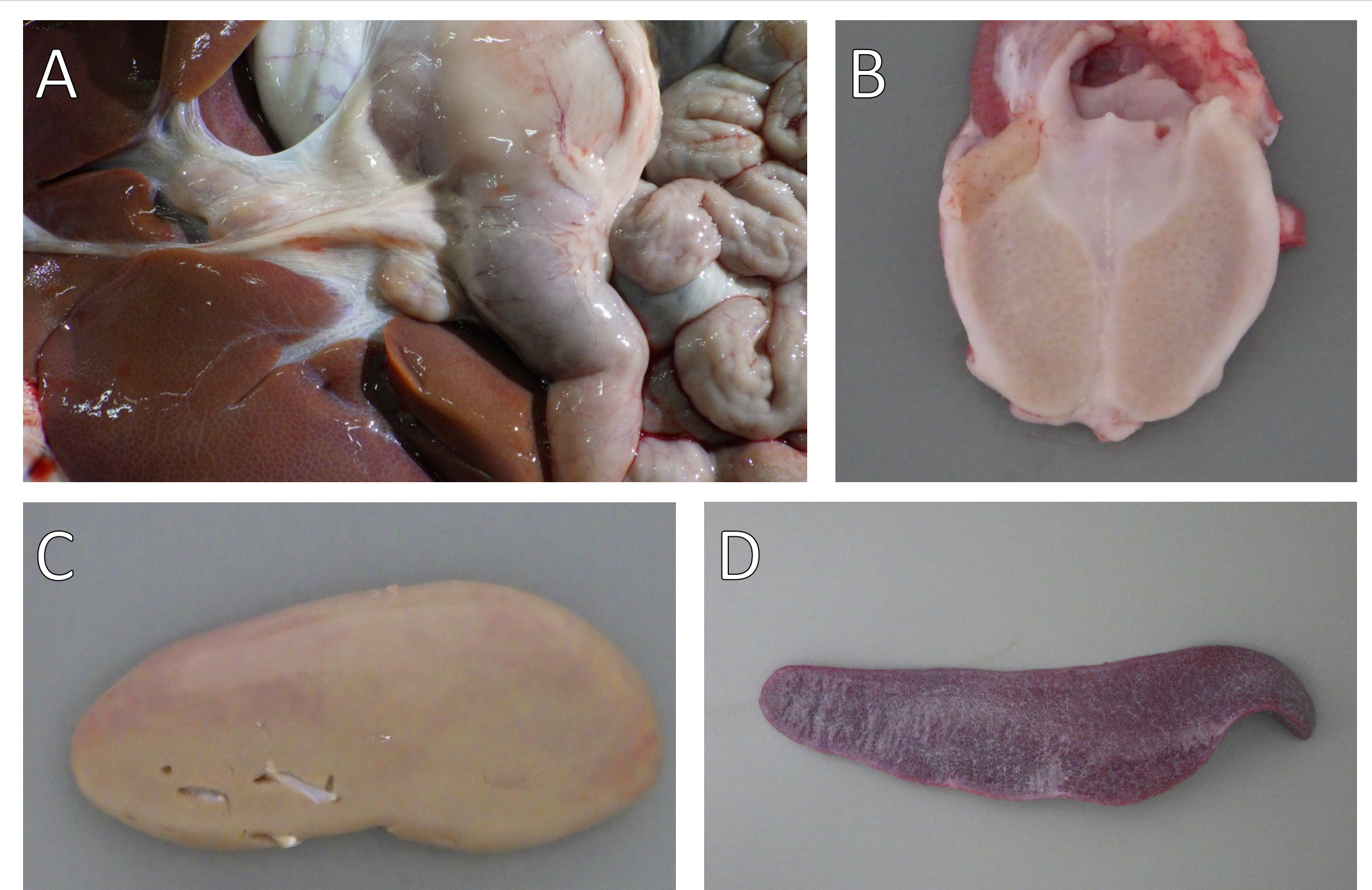


Fig. 3. Lack of macroscopical findings in organs of animals that recovered from ASFV-infection, euthanized at 28 days post-infection. No macroscopical lesions can be observed in the (A) gastro-hepatic lymph nodes, (B) tonsil, (C) kidneys and (D) spleen at 28 days post-infection. As can be seen in the right panel of Fig. 1, at 28dpi surviving animals have completely recovered and show no clinical signs.

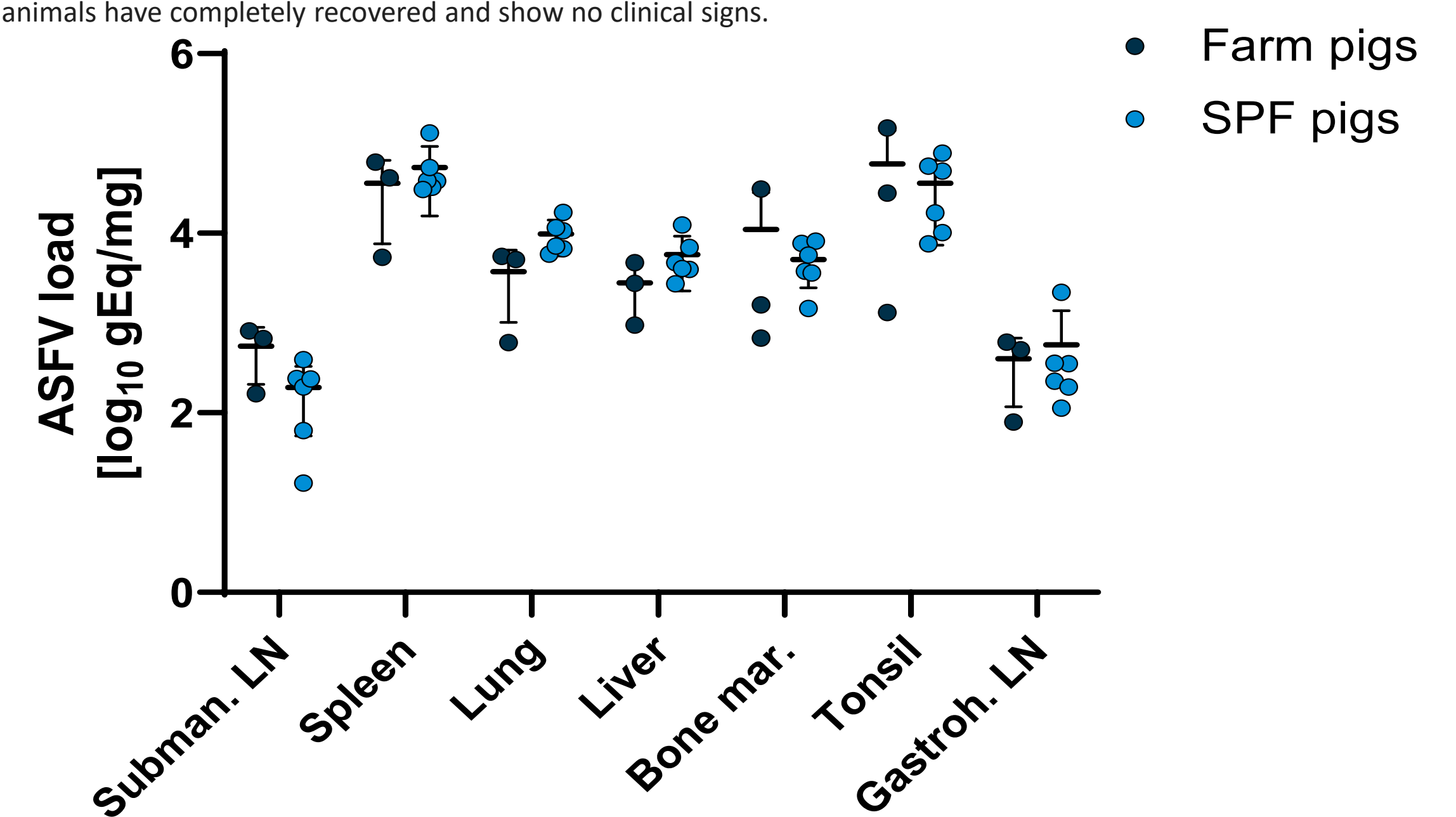


Fig. 4. Viral loads in organs of animals that survived and recovered from ASFV-infection, euthanized at 28 days post-infection. Despite the lack of clinical signs or macroscopic lesions, animals display high viral loads in all (n=8) tested organs. Viral loads were determined by qPCR on the day of euthanasia and expressed in genome copies (gEq) per milligram of tissue.

CONCLUSION

This study highlights the persistence of high viral loads in organs of pigs that recovered clinically from ASF, without evident gross pathological lesions. These findings underscore the potential for silent viral reservoirs to perpetuate infection, emphasizing on the necessity not only for comprehensive monitoring strategies, but also for vigilance from pathologists performing necropsies of pigs in high-risk areas.