

Mannheimia haemolytica acute fatal polyserositis, aerogenic or hematogenic infection?

Case-control study of 108 veal calf necropsies

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Introduction

- Mannheimia haemolytica* (*Mh*) serotype A2 is one of the leading causes of acute fatal fibrinous polyserositis (PS) in veal calves (het Lam et al., 2023) (Fig. 4). *Mh* A1/A6 are the known dominating serotypes in the Bovine Respiratory Disease (BRD) Complex.
- Significantly increased incidence of fatal *Mh* infections in cattle in the Netherlands between 2004 and 2018 (Biesheuvel et al., 2021)
- Calves with fatal *Mh* PS often do not show (histo)pathologic signs of pneumonia, which suggests a hematogenous spread towards the serosae.
- If so, to what extent is *Mh* present in other organs in these cases, and are the *Mh* strains in the other organs genetically closely related to those residing in the respiratory tract of these calves?
- Is the prevalence and/or genetic diversity of *Mh* in various organs of calves with PS different from calves without PS?

Materials and methods

- A total of 108 veal calves, regularly submitted for necropsy by veterinarians or farmers as part of the National Cattle Health Surveillance program were included (54 cases, 54 controls).
- Cases with peritonitis, pleuritis and pericarditis or at least two of these conditions, were included after confirmation by isolating the *Mh* as dominant bacteria. For each case, a veal calf of similar age, without PS was included as control as soon as possible.
- Cases and controls were sampled at the nasal cavity, tonsils, bronchial mucosa, spleen, cerebellum and retropharyngeal, pulmonary and mesenteric lymph nodes
- A selection of *Mh* isolates was analyzed by Whole Genome Sequencing (WGS).

Results

- In case calves *Mh* was widely spread and also present in the spleen, indicating a sepsis (Fig.1).
- In control calves *Mh* was present in only a few organs, primarily in the upper respiratory tract (Fig.1).
- Of *Mh* in cases 98% were serotype A2. The remaining two isolates, obtained from the upper respiratory tract (nasal cavity and retropharyngeal lymph nodes) were of serotype A1 (Fig. 2+3).
- Of *Mh* in control calves 79% were serotype A1. The remaining 4 out of 19 sequenced isolates, obtained from tissues in contact with environmental air (nasal mucosa, tonsils, bronchial mucosa), were serotype A2.
- Within each calf, *Mh* isolates from different organs were clonal. Overall, the genetic diversity of A2 isolates between animals was limited (10-130 SNP), while A1 isolates varied more (1-355 SNP). The mean genetic difference between A1 and A2 was >10.000 SNP.

Conclusions

- Mh* PS in veal calves was strongly associated with sepsis, suggesting hematogenically spread.
- All *Mh* isolates from inflamed serosae were serotype A2 and clonal bacteria were found in the majority of sampled organs of the cases.
- In contrast, in controls *Mh* was not widely spread and involved mostly A1, mostly residing in the tonsils.

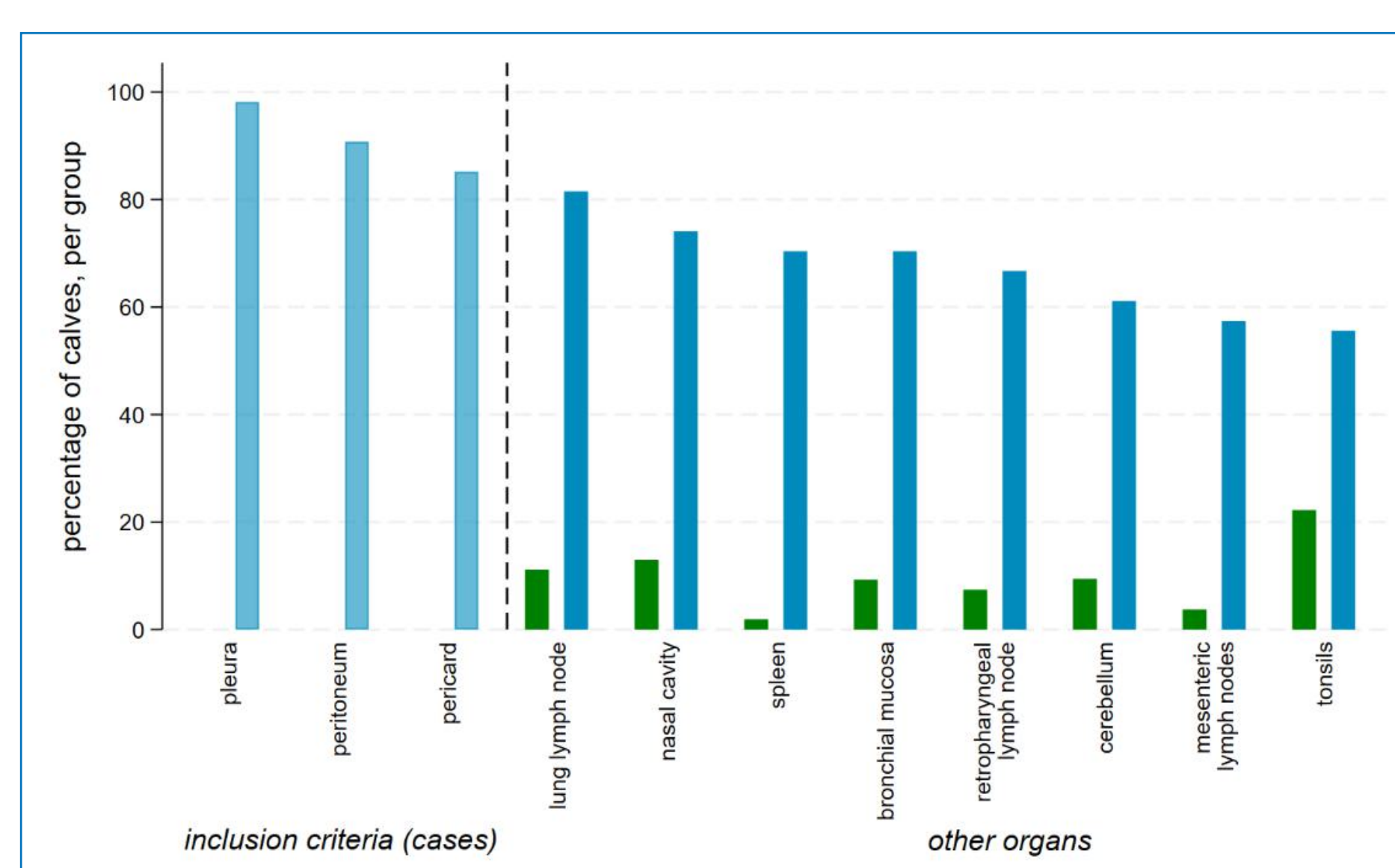


Figure 1. *Mh* culture results of samples obtained from organs in case (blue bars) and control (green bars) calves. For each sampling site, a percentage of samples in which *Mh* was detected relative to the total of cases or controls is presented.

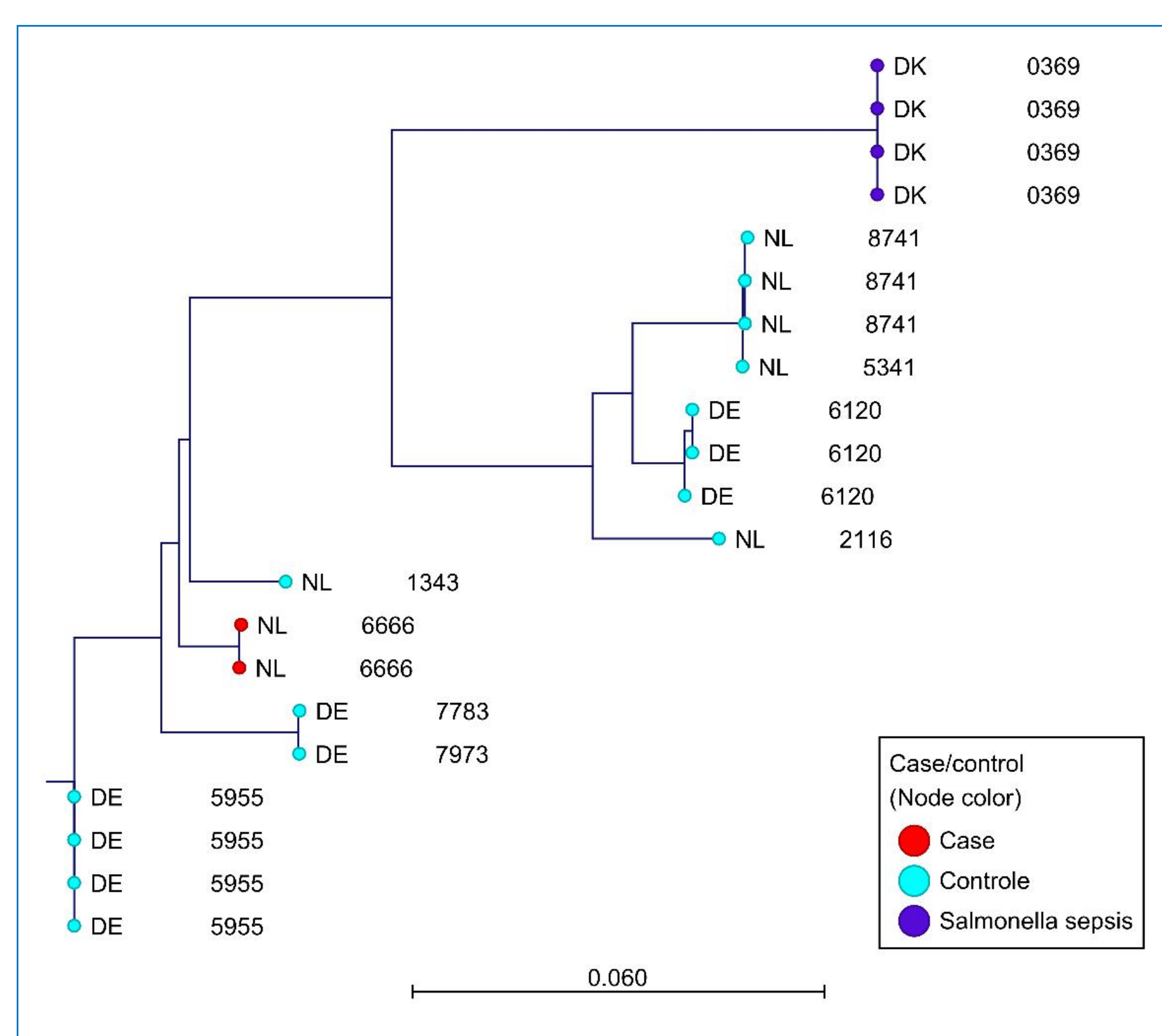


Figure 2. Dendrogram based on SNPs reflecting the relationship between serotype A1 isolates from case and control animals. Isolates from case animals are marked with a red dot and those from control animals with a light blue dot. There is a strong grouping per individual animal.



Figure 4. Laboratory for Pathology & Histology, Royal GD. Veal Calf with acute fibrinous pleuro-peritonitis (polyserositis) caused by *Mannheimia haemolytica*

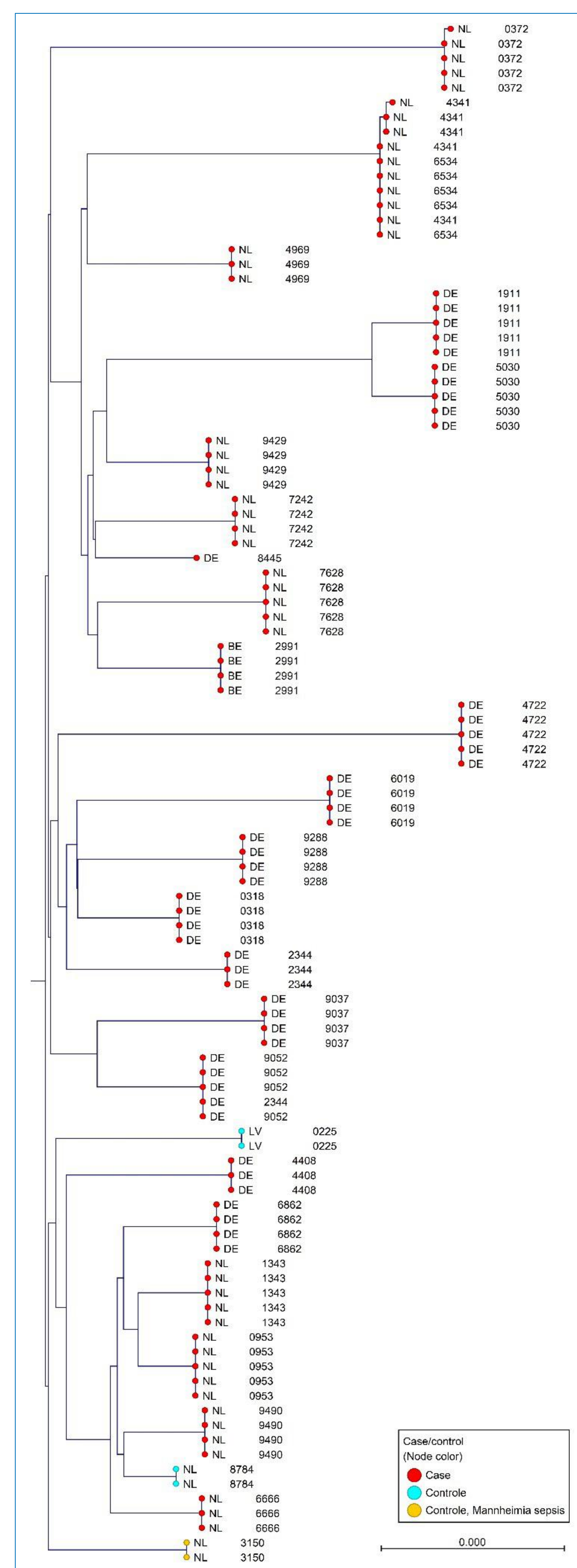


Figure 3. Dendrogram based on SNPs reflecting the relationship between serotype A2 isolates from case and control animals. Isolates from case animals are marked with a red dot and those from control animals with a light blue dot. There is a strong grouping per individual animal.



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