Boehringer Ingelheim

TECHNICAL BULLETIN

PCV2d-BASED VACCINE DEMONSTRATES EFFICACY AND ROBUSTNESS UNDER SEVERE PCVAD CONDITIONS

Porcine Circovirus Type 2d (PCV2d) has emerged as the predominant PCV2 genotype, accounting for 90% of the porcine circovirus-associated disease (PCVAD) infections (confirmation and sequencing) in the United States.[1] In certain circumstances, some pigs within PCV2a-vaccinated herds may present clinical signs of PCVAD. In these cases, PCV2d infection can be thought of as lingering in the "corners of the room."

STUDY KEY FINDINGS

- Severe co-infection of PCV2d and porcine reproductive and respiratory syndrome virus (PRRSV) resulted in mortality of more than 60% of non-vaccinates, compared to only 8.2% of PCV2d vaccinates.[2]
- PCV2d vaccinates demonstrated a significant reduction in lymphoid lesion severity and viral replication under severe PCVAD field conditions compared to non-vaccinates and PCV2a vaccinates.[2]
- The number of pigs requiring treatment in the acute phase of PCVAD was significantly less among PCV2d vaccinates compared to non-vaccinates and PCV2a vaccinates.[2]

STUDY DESIGN

OVERVIEW

This randomized, blinded challenge study measured whether a PCV2d-based vaccine would provide more robust and targeted protection against PCVAD in cases of severe PCV2d co-infections (PRRS, IAV-S and endemic bacteria) compared to cross protection levels of a PCV2a-based vaccine.

STUDY DESIGN

The study consisted of 1,410 conventional production pigs, randomized and blocked based upon weight and gender into three groups on day 0: 470 non-vaccinated controls, 470 PCV2a vaccinates and 470 PCV2d vaccinates. On day 28, all groups were inoculated with 1 mL IM and 1 mL IN of PCV2d, as well as 2 mL IM of PRRSV 1-7-4. Mortality, percentage of treated pigs and body weights were recorded on days 0, 28, 56 and 140. On day 56, 20 pigs from each group were euthanized to evaluate gross lesions, lymphoid changes, amount of virus in tissue and viremia levels.

STUDY RESULTS

RESULTS SUMMARY

Experimental coinfection resulted in high mortality and severe PCVAD among non-vaccinates. Table 1 shows the effect of overall lymphoid lesion score and the detection of the virus. Viremia results are highlighted in Table 2.[2] *(See next page for tables and continued Results Summary.)*

REFERENCES

[1] Franzo G, Cortey M, Segales J, et al. Phylodynamic analysis of porcine circovirus Type 2 reveals global waves of emerging genotypes and the circulation of recombinant forms. *Mol Phylogenet Evol* 2016;100269-280.

[2] Fano E et al. Exploring the efficacy of a PCV2d-based vaccine under current severe PCVAD conditions, in *Proceedings*. AASV 2022.

TABLE 1: OVERALL LYMPHOID LESION SCORE AND VIRUS IDENTIFICATION – SUBSET OF 20 PIGS					
PARAMETER	NON-VACCINATES	PCV2a VACCINATES	PCV2d VACCINATES	SE	*P*-VALUE
Overall lymphoid lesion score (average)	1.63[a]	0.77[b]	0.09[c]	0.18	< 0.0001
PCR lymphoid tissue (Ct)	12.1[a]	17.8[b]	26.1[c]	1.35	< 0.0001

*Means with different superscripts indicate difference at $P \leq 0.05$

TABLE 2: VIREMIA MEASURED BY CT VALUE – SUBSET OF 20 PIGS					
PCV2 PCR CT**	NON-VACCINATES	PCV2a VACCINATES	PCV2d VACCINATES	SE	*P*-VALUE
7 days after challenge	27.2[a]	33.7[b]	36.7[c]	0.79	<0.0001
14 days after challenge	18.9[a]	29.3[b]	35.9[c]	0.93	<0.0001
21 days after challenge	22.5[a]	31.9[b]	36.6[c]	1.35	<0.0001
28 days after challenge	26.3[a]	32.0[b]	36.9[c]	1.37	<0.0001

*Means with different superscripts indicate difference at $P \leq 0.05$
**Ct cutoff negative, 37

Average daily gain (ADG) was significantly higher among both vaccinated groups compared to non-vaccinates (Table 3). ADG was 0.03 pounds/day higher among PCV2d vaccinates than PCV2a vaccinates.[2]

TABLE 3: AVERAGE DAILY GAIN (ADG) (LBS.)					
STUDY DAY	NON-VACCINATES	PCV2a VACCINATES	PCV2d VACCINATES	SE	*P*-VALUE
28–56	1.04[a]	1.21[b]	1.26[b]	0.03	<0.0001
28–140	1.66[a]	1.79[b]	1.82[b]	0.02	<0.0001
56–140	1.89[a]	2.01[b]	2.02[b]	0.03	0.0007
0–140	1.50[a]	1.59[b]	1.62[b]	0.02	<0.0001

*Means with different superscripts indicate difference at $P \leq 0.05$

There were no significant differences in mortality between the vaccinated groups (Table 4). The PCV2d vaccinates had 1.5% lower mortality and 7.6% fewer treated pigs than PCV2a vaccinates.

TABLE 4: MORTALITY (%)			
STUDY DAY	NON-VACCINATES	PCV2a VACCINATES	PCV2d VACCINATES
Day 28–56	61.7[a]	9.7[b]	8.2[b]
Day 56–140	1.3	2.9	3.1

*Means with different superscripts indicate difference at $P \leq 0.05$

TABLE 5: TREATED PIGS (%)			
STUDY DAY	NON-VACCINATES	PCV2a VACCINATES	PCV2d VACCINATES
Day 28–56	87.0[a]	44.2[b]	36.6[c]
Day 56–140	6.4	5.7	3.3

*Means with different superscripts indicate difference at $P \leq 0.05$

CONCLUSION

Under severe PCVAD conditions, PCV2d vaccinates demonstrated a reduction in lymphoid lesion severity and viral replication (serum and tissue) compared to PCV2A vaccinates. Both vaccinated groups had significantly better ADG and significantly lower mortality rate and number of treatments than non-vaccinates.

For swine herds experiencing severe PCVAD associated with PCV2d and co-infections, the homologous PCV2d-based vaccine can help producers protect their entire herd, including the “corners of the room” where heterologous protection can’t reach.