



EFFICACY OF A MODIFIED LIVE PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS VACCINE (INGELVAC® PRRS MLV) AGAINST HETEROLOGOUS VIRULENT LELYSTAD CHALLENGE

M.B. Roof, D. Gorcyca, D. Wensvoort
Boehringer Ingelheim Vetmedica, Inc., 2501 North Loop Drive, Suite 1000, Ames, IA 50010

Introduction

Porcine Reproductive and Respiratory Syndrome (PRRS) is a viral disease of swine responsible for major economic losses (1). The virus was first isolated by Wensvoort et al in 1991 and later confirmed to be present in North America and Asia. The disease can be manifested in both a respiratory form in pigs and severe reproductive failure in pregnant sows. Although PRRS is classified as an Arterivirus, there are distinct differences between European and North American isolates in terms of genetic homology. There are numerous documented studies demonstrating efficacy against North American challenge strains using a commercially available vaccine (Ingelvac® PRRS MLV) (2). The objective of these studies was to evaluate a modified live PRRS vaccine (Ingelvac® PRRS MLV) against a heterologous virulent challenge using the Lelystad strain.

Materials and Methods

The vaccine strain used was Ingelvac® PRRS MLV, a commercially available PRRS modified live vaccine. The vaccine was administered as recommended by the manufacturer's label. The challenge strain used in all 3 studies was European PRRS virus, Lelystad isolate (CDI-NL-2.91) at 5.3 logs/dose. Serology was done using Immunoperoxidase Monolayer Assay (IPMA). Virus isolation after challenge was determined using porcine alveolar macrophages.

Study 1 was designed to test whether the Ingelvac® PRRS MLV vaccine could reduce the infection and spread of the European LV challenge virus in a group of 9 week old SPF, Dutch Landrace pigs, compared to non-vaccinated pigs. At 9 weeks of age, 1 pig from each group was challenged intranasally with the heterologous, wild type European strain of Lelystad virus. After 1 day, the challenged pigs were returned to their original pens and monitored for clinical signs and viremia.

Study 2 was designed to test whether the Ingelvac® PRRS MLV vaccine could reduce the infection and spread of the European LV challenge virus in a group of 11 week old SPF, Dutch Landrace pigs, compared to non-vaccinated pigs. At 11 weeks of age, 5 pigs from each group were challenged intranasally with the heterologous, wild type European strain of Lelystad virus. After 1 day, the challenged pigs were returned to their original pens. The pigs were then monitored for clinical signs, viremia, and contact shedding.

Study 3 was designed to test whether gilts vaccinated at pre-breeding with Ingelvac® PRRS MLV are protected against challenge at day 86-88 of gestation with the heterologous PRRS, Lelystad isolate. Thirteen gilts (Dutch Landrace/Yorkshire cross) were randomly assigned to 3 treatment groups and five of the gilts were vaccinated pre-breeding with a single dose of Ingelvac PRRS. Two weeks after vaccination, all gilts were bred by artificial insemination. At 86-88 days of gestation, two of the groups were exposed to virulent PRRS, Lelystad isolate. At farrowing, the pigs were collected pre-suckling and bled. Each litter was assessed for pigs born live-healthy, live-weak, dead or mummified.

Table 1. Study Design

Study 1		
Group	5 week Vaccine	9 week Challenge
1	Ingelvac PRRS (n=10)	LV challenge (n=1)
2	Non-vaccinated (n=10)	LV challenge (n=1)
Study 2		
Group	5 week Vaccine	11 week Challenge
1	Ingelvac PRRS (n=10)	LV challenge (n=5)
2	Non-vaccinated (n=10)	LV challenge (n=5)
Study 3		
Group	Pre-Breed	LV Challenge
1 (n=3)	Non-vaccinated	None
2 (n=5)	Non-vaccinated	Yes
3 (n=5)	Ingelvac PRRS	Yes

Results

Study 1 compared the level of virulent virus isolation and transmission between vaccinated (n=10) and non-vaccinated (n=10) 5 week old pigs. Virulent challenge exposure occurred at 9 weeks of age using a single pig challenge contact per group. In the vaccinated group 3/9 contact pigs seroconverted and 6/9 contact pigs had virus in their serum. This compares with 9/9 for both parameters in the non-vaccinated group. No lung lesions were noted at necropsy.

Study 2 compared the level of virulent virus isolation and transmission between vaccinated (n=10) and non-vaccinated (n=10) 5 week old pigs. Virulent challenge exposure occurred at 11 weeks of age using 5 challenged pigs per group. Following virulent challenge, vaccinates (2.1) had a significant (P<0.01) reduction in the total number of fever days (≥ 40 C) when compared to non-vaccinates (5.6). Vaccinates had a significant (P<0.05) reduction in the total number of virus positive samples between vaccinates (14/90 or 16%) and controls (35/90 or 39%). All pigs in both groups seroconverted to the EU challenge virus.

Study 3 was conducted using gilts and comparing animals vaccinated prior to breeding with strict controls (no vaccine/no challenge) and challenge controls (non-vaccine/virulent challenge). Following virulent challenge exposure at 86-88 days of gestation, the challenge controls (4.6/gilt) had a significantly higher level of pig death between days 0-28 post-farrowing, compared to the vaccinated group (1.2). The challenge controls (46%) also had a significantly (P<0.05) higher level of transplacental infection in pigs that died post-farrowing when compared to the vaccinates (15%).

Discussion

Because of the known genetic differences between North American and European PRRS strain, the ability of a North American derived vaccine and its ability to provide heterologous protection against isolates needs to be determined. These 3 studies evaluate the ability of the vaccine (Ingelvac® PRRS MLV) to reduce the shed, spread, level of viremia, and clinical disease associated with heterologous challenge in a pig model. In studies 1 and 2, vaccinated animals had reduced viral shedding to sentinels and fewer viremic days in the trial. There was little clinical disease noted in any of the groups following challenge, although fever reduction in vaccinates was noted in both trials. Attempts to evaluate the vaccine as an eradication tool (R value) were not successful due to the size of the trial and the duration of virus recovery.

The use of the reproductive model in study 3 suggests this is a more sensitive model and further confirms that the PRRS vaccine can provide some level of heterologous protection against a European challenge virus. In this study, there were significant improvements in the vaccinated gilts for the parameters of post-weaning mortality, group mortality, and transplacental virus transmission.

In general, the use of a modified live viral vaccine should be expected to give superior efficacy compared to a killed preparation. Despite this, variation between strains and the viral change commonly associated with a RNA virus will require that experimental trials continue over time to confirm the efficacy of the vaccine. Despite this, no vaccine is perfect and other parameters including proper vaccine use, management, other infectious agents, and the relative virulence of the strain may impact the results seen in the field.

In conclusion, this summary confirms the ability of a modified live PRRS vaccine (Ingelvac® PRRS MLV) to provide heterologous protection following virulent challenge with the European LV strain of PRRS.

References

- Wensvoort, G., Terpstra, C., Pol, JMA, et al. (1991) *Vet Quart.* 13:121-130.
- Gorcyca, D.E., et al. (1996) 14th IPVS congress, 1996 #390.