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SEROLOGICAL RESPONSES IN DAIRY CALVES TO VARIOUS VACCINES ADMINISTERED VIA NEEDLE-FREE OR CONVENTIONAL NEEDLE-BASED INJECTIONS

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Summary

One hundred and four, 5- to 10-month-old Holstein heifers and steers were blocked by age within gender and randomly assigned to treatments. Calves were vaccinated with 5-way modified-live respiratory viral vaccine, *Mannheimia hemolytic* bacterin/toxoid, and 5-way Leptospira bacterin, administered via either needle-free or conventional needle-and-syringe injection techniques. Blood samples were collected from all calves at the time of vaccination and 21 days later. Blood sera were analyzed for antibody titers to infectious bovine rhinotracheitis (IBR) virus as the indicator of serological response to the 5-way viral vaccine, to *Leptospira pomona* (LP) as the indicator of serological response to the 5-way Leptospira bacterin, and to *Mannheimia hemolytica* (MH) leukotoxoid. Responses of heifers on day 21 to the IBR fraction of the 5-way viral vaccine, MH bacterin, and LP fraction of the 5-way Lepto bacterin did not differ between methods of administration. Responses of steers on day 21 to the IBR fraction of the 5-way viral vaccine and MH bacterin were greater for the needle-free method of administration, whereas serological response to the LP fraction did not differ between methods of administration. We conclude that needle-free injections can eliminate broken needles in the carcass, reduce needle-borne transmission of disease, and possibly produce greater serological responses to various antigens, compared with those obtained with conventional needle-and-syringe injection systems.

(Key Words: Needle-free Injection, Vaccines, Serology.)

Introduction

Beef and dairy cattle quality assurance guidelines recognize that inadequate animal restraint or use of small-diameter needles may result in needle breakage, with the broken fragment sometimes left in the tissue to pose a hazard to those who handle or eat the meat. They also recognize that blood-borne infectious diseases such as bovine leukosis or anaplasmosis may be transmitted animal-to-animal when a single needle is used to inject multiple animals. One technology that offers the potential to avoid these problems is the use of a pneumatically powered, needle-free injection device that uses air pressure to drive the vaccine through the skin and into the underlying subcutaneous tissue or muscle (Felton 250 Pulse™ Needle-Free Injector, Figure 1). The purpose of this study was to compare seroconversion when injecting a modified-live respiratory viral vaccine containing IBR vaccine, injecting a MH bacterin-leukotoxoid, and injecting a LP bacterin into Holstein heifer and steer calves by using either needle-free or conventional needle-and-syringe injection methods.

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Procedures

Fifty-four, 5- to 10-month-old Holstein heifers, and 50 steers from the Kansas State University Dairy herd were used. Animals of similar age and the same gender were housed in groups of 4 to 5 per pen. Animals were blocked into pairs by age within each gender group, and the method of administration of products was randomly allocated to each calf of each pair in each age block. Treatment 1 (T1) consisted of a 2-mL dose of Bovi-Shield® Gold 5 modified-live viral vaccine administered by Felton Pulse™ 250 needle-free intramuscular (i.m.) injection in the right side of the neck, a 2-mL dose of One Shot® *Mannheimia hemolytica* bacterin-toxoid administered subcutaneously (s.c.) in the left side of the neck via a disposable 3-mL syringe and 18 gauge × 1 inch needle, and a 2-mL dose of Leptoferm-5® Leptospira bacterin administered i.m. in the left side of the neck via a syringe and needle as previously described. Treatment 2 (T2) consisted of a 2-mL dose of Bovi-Shield® Gold 5 administered i.m. in the right side of the neck via a syringe and needle, a 2-mL dose of One Shot® administered s.c. in the left side of the neck by needle-free injection, and a 2-mL dose of Leptoferm-5® administered i.m. in the left side of the neck by needle-free injection. Blood samples were collected from calves on day 0 (vaccination day) and 21 days later. All blood samples were forwarded to the Kansas State University Veterinary Diagnostic Laboratory for serological evaluation.

Results and Discussion

Serological responses to IBR virus, *Mannheimia hemolytica,* and *Leptospira pomona* are shown in Tables 1 and 2. In heifers (Table 1), method of administration had no effect on IBR, MH, or LP responses on day 21. In steers (Table 2), on day 21, IBR and MH titer responses were greater with needle-free administration. In contrast, no significant difference was detected between methods for LP responses.

Conclusions

These findings indicate that use of the needle-free injection system to vaccinate dairy heifers and steers results in similar or sometimes greater serological responses, when compared with those obtained with conventional needle-and-syringe injection systems. Needle-free injection can eliminate the possibility for broken needles being left in the carcass and reduce the possibility of needle-borne transmission of disease among animals.

Table 1. IBR, *Mannheimia hemolytica,* and *Leptospira pomona* Serological Responses Associated with Route of Administration in Heifers

		Titer	
Administration Method	Antigen	Day 0	Day 21
T1 needle-free	IBR	2.00 ± 0.7	12.30 ± 4.7
T2 needle	IBR	0.52 ± 0.2	6.52 ± 1.6
T1 needle	*M. hemolytica*	0.27 ± 0.02	0.35 ± 0.02
T2 needle-free	*M. hemolytica*	0.26 ± 0.02	0.33 ± 0.02
T1 needle	*L. pomona*	0.0	177.8
T2 needle-free	*L. pomona*	0.0	70.4 ± 81

Table 2. IBR, *Mannheimia hemolytica,* and *Leptospira pomona* Serological Responses Associated with Route of Administration in Steers

		Titer	
Administration Method	Antigen	Day 0	Day 21
T1 needle-free	IBR	1.44 ± 0.27	9.84^{a} ± 3.4
T2 needle	IBR	1.12 ± 0.35	3.20^{b} ± 0.9
T1 needle	*M. hemolytica*	0.18 ± 0.01	0.25^{a} ± 0.01
T2 needle-free	*M. hemolytica*	0.21 ± 0.01	0.29^{b} ± 0.01
T1 needle	*L. pomona*	0.0	24.0
T2 needle-free	*L. pomona*	0.0	16.0 ± 10.4

[a,b]Values having different superscript letters differ ($P<0.05$).

Figure 1. Felton Pneumatic System and needle-free injector.