Effects of Intranasal Versus Intramuscular Modified Live Vaccines and Vaccine Timing on Health and Performance by Newly Received Beef Cattle

G. C. Duff, PhD, K. J. Malcolm-Callis, PhD, D. A. Walker, MS, M. W. Wiseman, BS
Clayton Livestock Research Center
New Mexico State University
Clayton, NM 88415
M. L. Galyean, PhD
Department of Animal Science and Food Technology
Texas Tech University
Lubbock, TX 79409-2141
L. J. Perino, DVM, PhD
Division of Agriculture
West Texas A&M University
Canyon, TX 79016

Abstract

Two studies were conducted to evaluate the effects of viral vaccines and vaccination programs on health and performance of newly received beef cattle. In Exp. 1, two loads (120 steer and bull calves and 108 heifer calves for Load 1 and 2, respectively) were used to evaluate the effects of an intranasal vs an intramuscular IBR-PI3 vaccine on performance and health of newly received beef cattle. Treatments were: 1) no vaccine (Control); 2) an intranasal modified-live IBR-PI3 vaccine (IN); and 3) an intramuscular modified-live IBR-PI3 vaccine (IM). No treatment x load interactions were observed for performance data. For the 28-d receiving period, cattle given IN IBR-PI3 vaccine had greater daily gain (P < .05) than cattle given IM IBR-PI3 vaccine. No differences (P > .10) were noted for daily dry matter (DM) intake, however, the feed:gain ratio was increased (P < .05) for the IM group as compared to the IN group. No differences (P > .10) were noted among treatments in the percentage of cattle treated for BRD. In Exp. 2, 102 steer and bull calves were used to evaluate vaccine timing on health and performance of newly received calves. Treatments included: 1) no vaccine (Control); 2) no vaccine at processing, with an IM multiple antigen (IBR-PI3-BVD-BRSV) viral vaccine given on d 7; 3) intranasal IBR-PI3 administered at processing with IM IBR-PI3-BVD-BRSV vaccine given on d 7; and 4) IM IBR-PI3-BVD-BRSV vaccine administered both at processing and on d 7. No differences were noted for daily gain or daily DM intake during the 28-d receiving period. Feed:gain was improved (P < .10) for vaccinated calves as compared to controls. Results suggest that an intranasal IBR-PI3 vaccine might have beneficial effects on gain and feed efficiency compared with an intramuscular IBR-PI3 vaccine. There was no advantage or disadvantage to delaying vaccination with viral vaccines until 7 d after arrival. In terms of overall 28-d gains and morbidity, vaccines did not enhance gains or effect morbidity, compared to negative controls. However, statistical power to detect differences was marginal in both experiments.

Introduction

Infectious bovine rhinotracheitis and parainfluenza3 (IBR-PI3) pathogens are associated with the bovine respiratory disease (BRD) complex. Feedlots typically vaccinate against IBR-PI3 as part of routine processing. These vaccines can be administered by either intranasal (IN) or intramuscular (IM) routes, but data are limited concerning the effects of route of administration on performance. It might be advantageous to delay vaccination with IBR-PI3-BVD-BRSV vaccine...
until animals have an opportunity to recover from stresses associated with shipping. In addition, because of the potential stress of multiple injections given to the animals at arrival, administration of an IN IBR-PI3 vaccine might prove beneficial. Two experiments were conducted at the Clayton Livestock Research Center to evaluate the effects of IBR-PI3 vaccines and IBR-PI3-BVD-BRSV vaccination on health and performance of newly received beef cattle.

Materials and Methods

Experiment 1. Two loads of cattle were used in the experiment. Load 1 consisted of 120 steer and bull calves. Cattle were purchased from an order buyer in Meridian, MS. Average time in transit was 17.5 h with an average shrink of 6.1% from a pay weight of 366 lb (166 kg). There were 82 (68.33%) bulls and 37 animals (31.83%) that required horn tipping. Processing occurred immediately after arrival and included weighing each calf individually, individual identification, branding, castration of bulls, horn tipping as necessary, injection with vitamin A/D3, treatment for internal (oxfendazole) and external parasites (fenthion), vaccination with a multivalent clostridial bacterin-toxoid and sorting into treatment pens. In addition, cattle received one of three treatments: 1) no IBR-PI3 vaccine (Control); 2) an IN modified-live virus (MLV) IBR-PI3 vaccine; or 3) an IM MLV IBR-PI3 vaccine. The IN vaccine was administered using 2 mL syringes to give 1 mL per nostril. The IM vaccine was administered as a 2 mL injection in the neck. Treatments were assigned randomly to individual animals based on processing order using a predetermined random number table. Pens were randomly assigned to treatments using a random number table (four pens per treatment with 10 calves per pen). Although not blocked by sex (steer versus bull) and horns, the number of bulls (29, 27, and 26 bulls for Table 1. Ingredient composition of 70% concentrate diets fed to steers and heifers receiving modified live vaccines

<table>
<thead>
<tr>
<th>Ingredient/Item</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Load 1</td>
<td>Load 2</td>
</tr>
<tr>
<td>Sorghum sudangrass hay</td>
<td>10.30</td>
<td>30.72</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>19.48</td>
<td>-</td>
</tr>
<tr>
<td>Whole corn</td>
<td>10.12</td>
<td>9.91</td>
</tr>
<tr>
<td>Steam-flaked corn</td>
<td>46.01</td>
<td>46.05</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>3.51</td>
<td>3.26</td>
</tr>
<tr>
<td>Molasses</td>
<td>4.89</td>
<td>4.73</td>
</tr>
<tr>
<td>Fat (yellow grease)</td>
<td>2.06</td>
<td>1.91</td>
</tr>
<tr>
<td>Limestone</td>
<td>0.75</td>
<td>0.71</td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
<td>0.50</td>
<td>0.48</td>
</tr>
<tr>
<td>Salt</td>
<td>0.35</td>
<td>0.33</td>
</tr>
<tr>
<td>Urea</td>
<td>0.50</td>
<td>0.48</td>
</tr>
<tr>
<td>Ammonium sulfate</td>
<td>0.50</td>
<td>0.48</td>
</tr>
<tr>
<td>Premix*</td>
<td>1.03</td>
<td>0.94</td>
</tr>
</tbody>
</table>

Chemical composition

<table>
<thead>
<tr>
<th>Ingredient/Item</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>85.6</td>
<td>83.8</td>
</tr>
<tr>
<td>Ash</td>
<td>8.1</td>
<td>7.9</td>
</tr>
<tr>
<td>Crude protein</td>
<td>14.7</td>
<td>12.0</td>
</tr>
<tr>
<td>Acid detergent fiber</td>
<td>12.3</td>
<td>20.5</td>
</tr>
</tbody>
</table>

*Premix contained (DM basis): wheat midds (83.11%), vitamin A - 30,000 IU/g (0.66%), vitamin E - 500 IU/g (1.98%), Rumensin-80 (1.125%), Tylan-40 (1.125%), and trace mineral package (12%). Trace mineral package contained (DM basis): calcium iodate (0.269%), cobalt carbonate (0.362%), copper sulfate (3.268%), ferrous sulfate (19.445%), magnesium oxide (29.762%), manganese oxide (6.944%), zinc sulfate (28.169%), wheat midds (7.831%), and mineral oil (3.95%).

*AgriLabs, St Joseph, MO.
*Synanthic, Fort Dodge Animal Health, Overland Park, KS.
*Tiguvon, Bayer Corp., Shawnee Mission, KS.
*Ultrabac7 or TSV-2, SmithKline Beecham, West Chester, PA.
*IBR-PI3, Sanofi, Overland Park, KS.
control, IN, and IM, respectively) and animals requiring horn tipping (12, 13, and 12 for control, IN, and IM, respectively) were similar across treatments. After processing, steers were placed in their respective pens, offered sorghum-sudangrass hay (first week only) and a 70% concentrate diet (Table 1) in quantities sufficient for *ad libitum* consumption throughout the 28-d receiving period. Cattle were monitored daily for signs of BRD, including nasal and (or) ocular discharge, labored breathing, lethargy, and (or) depressed appetite. Cattle displaying signs were removed from their pens, taken to a processing facility, and their rectal temperature was measured. Cattle with a rectal temperature greater than 103°F (39.4°C) were treated with tilmicosin phosphate\(^a\) at 4.55 mg/lb (10 mg/kg) of body weight (1.5 mL/100 lb) and long-acting oxytetracycline\(^b\) at 9 mg/lb (19.8 mg/kg) of body weight (4.5 mL/100 lb).\(^c\) After treatment, cattle were returned to their assigned feedlot pens. All cattle were weighed on d 28, at which time feed bunks were swept, and any feed remaining was weighed and sampled for DM determination. Bunk samples were obtained at weekly intervals during the study and dried at 212°F (100°C) for approximately 22 h to determine DM matter content. Dietary ingredient samples were obtained every 2 weeks for DM determination.

For Load 2, 108 heifer calves averaging 423 lb (192 kg) were purchased from an order buyer in Southwestern Arkansas. Cattle from this order buyer are typically purchased from auction barns in Southwestern Arkansas and Eastern Texas with an assembly time of 4 days. The transit time was 13.75 h. Except for using a different brand clostridial bacterin-toxoid,\(^d\) heifers were processed similarly to steers in Load 1. The number of heifers that required horn tipping was not recorded. Rectal temperatures were recorded at processing, and any heifer with a temperature greater than 103.5°F (39.7°C) was treated with tilmicosin phosphate at 4.55 mg/lb (10 mg/kg) of body weight (1.5 mL/100 lb) and 10 mL of penicillin.\(^e\) Thirty-one heifers required treatment at processing with 10, 13, and 8 heifers in the control, IN, and IM groups, respectively. Heifers treated at processing were represented in all pens. Experimental treatments were assigned randomly to individual heifers using a random number table (4 pens per treatment and 9 heifers per pen) and were identical to Load 1. All other procedures were similar to Load 1.

Performance data were analyzed using General Linear Models (GLM) procedures of SAS.\(^f\) Pen was the experimental unit. For daily gain, the model included effects for IBR-PI, treatment, block (load), treatment x block, and pen within treatment x block. Orthogonal contrasts were used to evaluate treatment responses. Contrasts were: 1) control vs vaccines and 2) IN vs IM. Feed intake data and calculated feed:gain ratio were analyzed with a model that included treatment, block, and treatment x block. Percentage of morbid calves were calculated for each pen and analyzed using GLM procedures of SAS.\(^g\) Statistical power was evaluated by calculating the detectable differences in outcomes using published formulas\(^h\) for growth and morbidity data. Calculations were carried out with alpha = 0.05 and beta = 0.20.

**Experiment 2.** One hundred-two beef steer and bull calves weighing 455 lb (207 kg) were purchased from the same order buyer as for Load 2 of Exp. 1. The transit time was 12 h. Processing procedures were similar to Exp. 1. Using a random number table, individual cattle were randomly allotted to one of three treatments: 1) no vaccine (Control); 2) no vaccine at processing, with IM MLV IBR-PI-BVD-BRSV vaccine administered on d 7 (CON/IM); 3) an IN MLV IBR-PI\(^3\) vaccine administered at processing, with IM MLV IBR-PI-BVD-BRSV vaccine given on d 7 (IN/IM); and 4) IM MLV IBR-PI-BVD-BRSV vaccine given at processing and on d 7 (IM/IM). After processing, calves were placed in their respective treatment pens (4 pens per treatment with 8 to 9 calves per pen). Calves were observed daily for sickness, and animals with a rectal temperature greater than 103.5°F (39.7°C) were treated with 1.0 mg ceftiofur equivalents/lb (2.2 mg/kg) of ceftiofur hydrochloride\(^i\) (2 mL/100 lb of BW) at 48-h intervals, plus 10 mL of penicillin.\(^e\) Animals not responding to the initial treatment were given tilmicosin phosphate\(^f\) at 4.55 mg/lb (10 mg/kg) of body weight (1.5 mL/100 lb of BW). Animals were returned to their respective pens after medical treatments. The feeding regimen was the same as for Exp. 1, with animals receiving a 70% concentrate diet (Table 1), with *ad libitum* access to hay during the first week only. All other procedures were similar to Exp. 1.

Performance data were analyzed using GLM procedures of SAS.\(^f\) Pen was the experimental unit. For daily gain, the model included effects for vaccine treatment and pen within treatment. Orthogonal contrasts were used to evaluate treatment responses. Contrasts were: 1) Control vs vaccines, 2) CON/IM vs the average of IN/IM and IM/IM, and 3) IN/IM vs IM/IM. Feed intake data and calculated feed:gain ratio were analyzed with a model that included treatment. Percent-

---

\(^a\) Micotil, Elanco Animal Health, Indianapolis, IN.
\(^b\) Liquamycin LA-200 or Bovishield-4, Pfizer Animal Health, Exton, PA.
\(^c\) 7-way, Aspen, Kansas City, MO.
\(^d\) Excenel, Pharmacia & Upjohn, Kalamazoo, MI.
\(^e\) Some doses and uses described constitute extralabel treatment and were done under veterinary supervision.
Table 2.  Effects of infectious bovine rhinotracheitis-parainfluenza3 (IBR-PI3) vaccines on performance and health of newly received beef cattle in Exp. 1.*

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment¹</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>IN</td>
<td>IM</td>
<td>SE²</td>
<td>Contrast³</td>
<td></td>
</tr>
<tr>
<td>No. of pens</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial body weight, lb</td>
<td>382.8</td>
<td>383.1</td>
<td>388.2</td>
<td>3.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day-28 body weight, lb</td>
<td>444.4</td>
<td>449.6</td>
<td>444.3</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average daily gain, lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days 0 to 28</td>
<td>2.20</td>
<td>2.37</td>
<td>2.00</td>
<td>0.12</td>
<td>2 (.05)</td>
<td></td>
</tr>
<tr>
<td>Daily DM intake, lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days 0 to 28</td>
<td>10.27</td>
<td>10.37</td>
<td>9.80</td>
<td>0.26</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Feed:gain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days 0 to 28</td>
<td>4.80</td>
<td>4.60</td>
<td>5.11</td>
<td>0.17</td>
<td>2 (.05)</td>
<td></td>
</tr>
<tr>
<td>Morbidity, %</td>
<td>40.8</td>
<td>38.2</td>
<td>41.8</td>
<td>4.85</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

*No treatment x load interactions were detected (P > .10); therefore, data were analyzed across loads.

¹Control - no IBR-PI3 vaccine at processing; IN - intranasal administration of IBR-PI3 at processing; IM - intramuscular IBR-PI3 vaccine at processing.

²Pooled standard error of treatment means, n = eight pens per treatment.

³Contrasts evaluated were: 1) control vs vaccines and 2) intranasal vs intramuscular. Observed significance (in parentheses). NS = not significant (P > .10).

Table 3.  Effects of timing of modified-live vaccine administration on performance and health of newly received beef cattle, Exp. 2.

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment¹</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Con/IM</td>
<td>IN/IM</td>
<td>IM/IM</td>
<td>SE²</td>
<td>Contrast³</td>
</tr>
<tr>
<td>No. of Pens</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial body weight, lb</td>
<td>451.2</td>
<td>460.2</td>
<td>454.4</td>
<td>454.8</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td>Day-28 body weight, lb</td>
<td>511.5</td>
<td>527.6</td>
<td>529.4</td>
<td>528.7</td>
<td>12.8</td>
<td>NS</td>
</tr>
<tr>
<td>Average daily gain, lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days 0 to 28</td>
<td>2.16</td>
<td>2.41</td>
<td>2.68</td>
<td>2.64</td>
<td>0.25</td>
<td>NS</td>
</tr>
<tr>
<td>Daily DM intake, lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days 0 to 28</td>
<td>10.77</td>
<td>11.13</td>
<td>11.66</td>
<td>10.88</td>
<td>0.71</td>
<td>NS</td>
</tr>
<tr>
<td>Feed:gain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days 0 to 28</td>
<td>5.23</td>
<td>4.63</td>
<td>4.38</td>
<td>4.15</td>
<td>0.39</td>
<td>1 (.10)</td>
</tr>
<tr>
<td>Morbidity, %</td>
<td>56.0</td>
<td>60.2</td>
<td>51.4</td>
<td>61.1</td>
<td>9.62</td>
<td>NS</td>
</tr>
</tbody>
</table>

¹Control - no vaccine; Con/IM – no vaccine at processing with IM vaccine on d 7; IN/IM - IN vaccine at processing with IM vaccine on d 7; and IM/IM - IM vaccine at processing and on d 7.

²Pooled standard error of treatment means, n = three pens per treatment.

³Contrasts evaluated were: 1) Control vs vaccines, 2) Con/IM vs the average of IN/IM and IM/IM, and 3) IN/IM vs IM/IM. Observed significance (in parentheses). NS = not significant (P > .10).
age of calves treated for each pen were analyzed using
GLM procedures of SAS. Statistical power was evalu-
ated by calculating the detectable differences in out-
comes using published formulas for growth and
morbidity data. Calculations were carried out with
alpha = 0.05 and beta = 0.20.

Results

Exp. 1. Performance data are presented in Table 2.
No treatment x load interactions were observed for
performance data. For the 28-d receiving period, cattle
given IBR-PI3 vaccine by the IN route had greater daily
gain (P < .05) than cattle given an IM injection of IBR-
Pl3 vaccine. Twenty-eight day ADG of vaccinates did
not differ from controls (P > .10). No differences (P >
.10) were noted for daily DM intake, however, the
feed:gain ratio was increased (P < .05) for the IM group
compared to the IN group. No differences (P > .10) were
noted among treatments for the percentage of cattle
treated for BRD. Statistical power was adequate to de-
tect a change of approximately 21 percentage points from
the baseline morbidity rate of 40%.

Exp. 2. No differences were noted among treat-
ments for initial or final body weight of steers given dif-
ferent vaccination programs (Table 3). Likewise, no
differences were noted for daily gain or daily DM in-
take for the overall 28-d receiving period. Feed:gain was
improved (P < .10) for vaccinated calves vs controls. No
morbidity differences (P > .10) were noted among treat-
ments (Table 3). Statistical power was adequate to de-
tect a change of approximately 46 percentage points from
the baseline morbidity rate of 57%.

Discussion

Results from Exp. 1 suggest there might be an ad-
vantange in performance when using an IN IBR-PI3 vac-
cine at processing as compared to an IM vaccine.
Responses to IN IBR-PI3 vaccine could be related to the
rapid onset of protection with this product. An IN tem-
perature-sensitive IBR vaccine has provided protection
within 24 h after vaccination, thereby providing protec-
tion almost immediately. However, an IM IBR vaccine
has provided protection within 48 h against a simulated
natural exposure to virulent IBR virus. Another pos-
able reason for the increased performance for IN vs IM
in Exp. 1 might be related to reaction to the vaccine.
Anecdotal information suggests that some IM vaccines
may cause an elevated body temperature, or “sweating”.
Data in these two experiments do not support or refute
these anecdotes. Body temperature was not measured in
the present experiment. Calves initially given IN vac-
cine and then given an IM booster vaccination on d 7 of
the receiving period showed no advantage in performance
over those receiving an IM injection of vaccine followed
by an IM booster vaccination on d 7 (Exp. 2).

No differences in morbidity were noted between the
IN and IM IBR-PI3 vaccinated groups in Exp. 1. Sta-
tistical power to detect differences was marginal. Early
research noted that an IN IBR vaccine did not protect
cattle against the respiratory form of IBR, however, sub-
sequent research suggested that IBR-PI3 vaccination of
calves decreased respiratory disease in a bull test sta-
tion in Canada. A recent review of field trials using
various respiratory vaccines reported mixed perform-
ance benefits. Likewise, IBR, IBR-PI3, or IBR-PI3-Pas-
teuella haemolytica vaccination within two weeks of
arrival increased mortality.

Anecdotal observations suggest that there might be
an advantage to delaying vaccination programs un-
til the animals have time to recover from the stressors
of shipping. In contrast to such observations, data from
Exp. 2 suggest that such a management program makes
little difference on growth performance or morbidity.
As in Exp. 1, statistical power to detect differences was mar-
ginal. Martin et al. reported that vaccination for respi-
atory disease within 2 weeks of arrival increased death
losses and health costs. Delaying vaccination for respira-
ory disease (including IBR, IBR-PI3 [IN and IM], and
IBR-PI3-PAST) in cattle fed corn-silage-based diets de-
creased the negative effects of vaccination; however,
no decrease was observed when dry hay-based diets were
fed. The disease dynamics in small pens likely differs from
that in large pens. Likewise, the calves in this study
were only observed for 28-d. Longer term studies under
commercial feeding conditions may further define dif-
fences in processing and vaccination strategies.

Conclusions

These data marginally support the need for vacci-
nation with infectious-bovine rhinotracheitis vaccines to
improve performance by newly received cattle. There
might be an advantage to an intranasal vaccine at pro-
cessing as compared to an intramuscular vaccine when
the animals are not revaccinated. Delaying vaccination
did not seem to be a beneficial management program.

Acknowledgments

This research was supported by funds from the
New Mexico Agric. Exp. Sta., Las Cruces 88003. We
thank Elanco Animal Health, Ft. Dodge Animal Health,
Pharmacia & Upjohn, and Roche Animal Health for
product support.

References

1. Curtis RA, Angulo A: A field trial to evaluate an intranasal in-
2. Durham PJK, Hassard LE, Donkersgoed JV: Serological studies
of infectious bovine rhinotracheitis, parainfluenza 3, bovine viral di-

70
THE BOVINE PRACTITIONER—VOL. 34, NO. 1


---

**EXCENEL**

**Sterile Suspension**

**For intramuscular and subcutaneous use in cattle. This product may be used in lactating dairy cattle.**

**CAUTION:** Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

**INDICATIONS**

EXCENEL Sterile Suspension is indicated for treatment of bovine respiratory disease (BRD, shipping fever, pneumonia) associated with Pasteurella haemolytica, Pasteurella multocida and Haemophilus somnus. EXCENEL Sterile Suspension is also indicated for treatment of acute bovine interdigital necrobacillosis (foot rot, pododermatitis) associated with Fusobacterium necrophorum and Bacteroides melaninogenicus.

**CONTRAINDICATIONS**

As with all drugs, the use of EXCENEL Sterile Suspension is contraindicated in animals previously found to be hypersensitive to the drug.

**DOSAGE AND ADMINISTRATION**

Administer by intramuscular or subcutaneous administration at the dosage of 0.5 to 1.0 mg ceftiofur equivalents/lb (1.1 to 2.2 mg/kg) BW (1 to 2 mL sterile suspension per 100 lb BW). Administer daily at 24 h intervals for a total of three consecutive days. Additional treatments may be administered on Days 4 and 5 for animals which do not show a satisfactory response (not recovered) after the initial three treatments. In addition, for BRD only, administer intramuscularly or subcutaneously 1.0 mg ceftiofur equivalents/lb (2.2 mg/kg) BW every other day on Days 1 and 3 (48 h interval). Do not inject more than 15 mL per intramuscular injection site.

Selection of dosage level (0.5 to 1.0 mg/lb) and regimen/duration (daily or every other day for BRD only) should be based on an assessment of the severity of disease, pathogen susceptibility and clinical response. Shake well before using.

**WARNINGS**

**NOT FOR HUMAN USE. KEEP OUT OF REACH OF CHILDREN.**

Penicillins and cephalosporins can cause allergic reactions in sensitized individuals. Topical exposures to such antimicrobials, including ceftiofur, may elicit mild to severe allergic reactions in some individuals. Repeated or prolonged exposure may lead to sensitization. Avoid direct contact of the product with the skin, eyes, mouth, and clothing.

Persons with a known hypersensitivity to penicillin or cephalosporins should avoid exposure to this product.

In case of accidental eye exposure, flush with water for 15 minutes. In case of accidental skin exposure, wash with soap and water. Remove contaminated clothing. If allergic reaction occurs (e.g., skin rash, hives, difficult breathing), seek medical attention.

The material safety data sheet contains more detailed occupational safety information. To report adverse effects in users, to obtain more information or obtain a material safety data sheet, call 1-800-253-8600.

**RESIDUE WARNINGS:** Treated cattle must not be slaughtered for 48 hours (2 days) following last treatment because unsafe levels of drug remain at the injection sites. No milk discard time is required when this product is used according to label directions. Use of dosages in excess of those indicated or by unapproved routes of administration, such as intramammary, may result in illegal residues in edible tissues and/or in milk. A withdrawal period has not been established in pre-ruminating calves. Do not use in calves to be processed for veal.

**PRECAUTIONS**

Following intramuscular or subcutaneous administration in the neck, areas of discoloration at the site may persist well beyond 11 days resulting in trim loss of edible tissues at slaughter. Following intramuscular administration in the rear leg, areas of discoloration at the injection site may persist beyond 28 days resulting in trim loss of edible tissues at slaughter.

**STORAGE CONDITIONS**

Store at controlled room temperature 20° to 25° C (68° to 77° F) [see USP]. Shake well before using. Protect from freezing.

**HOW SUPPLIED**

EXCENEL Sterile Suspension is available in the following package size:

- 100 mL vial

NADA #140-890, Approved by FDA

Pharmacia & Upjohn Company • Kalamazoo, MI 49001, USA

July 1998 816 323 204A

692025
Penicillin Residues in Milk Following Subconjunctival Injection of Procaine Penicillin G*

K Liljebjelke, LD Warnick, and MF Witt
Department of Population Medicine and Diagnostic Sciences, Cornell University, Ithaca, New York 14853

Introduction

Subconjunctival injection of procaine penicillin G is used to treat infectious bovine keratoconjunctivitis. The purpose of this project was to find out how long penicillin can be detected in milk after a single 1 ml bulbar subconjunctival injection of procaine penicillin G.

Materials and Methods

Forty-six healthy, lactating Holstein cows were randomly assigned to receive either the penicillin injection or no treatment. A few drops of proparacaine were administered topically before injecting penicillin. Cow weights ranged from 1177 to 1716 lb (535 - 780 kg) (median = 1342 lb (610 kg) resulting in a penicillin dose of about 385 to 560 units per kg body weight. Milk samples were collected before treatment and at each of the next 4 milkings (4 hr, 16 hr, 28 hr, 40 hr) after treatment. Some cows were also sampled at 10 hr and 22 hr post-treatment to determine the number of positive tests midway between milkings.

Results

No milk samples from untreated cows were positive for B-lactam antibiotic residues using the SNAP® test (IDEXX Laboratories Inc., Westbrook, Maine 04092). The earliest positive tests for treated cows occurred at 4 hours and the latest at 22 hours after treatment. The percentages positive among treated cows were 0, 9, 92, 52, 33, 0, and 0% for pretreatment, 4, 10, 16, 22, 28, and 40 hours after treatment, respectively. These results suggest that a 36 hour milk withholding period should be adequate following this therapy. However, we did not evaluate the potential effect of clinical pinkeye infections on the duration of milk penicillin residues.

*This article was originally published in the 1999 Proceedings of the American Association of Bovine Practitioners (p. 259). An error was made during editing of the original version. The editor regrets this error.