Calves with Bovine Viral Diarrhea Virus (BVDV) Maternal Antibodies Vaccinated with a Modified Live BVDV Vaccine were Protected against a Virulent BVDV Type 2 Challenge

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Introduction

- Parenteral immunization of calves for BVDV is complicated by the presence of maternal antibody that may affect the efficacy of the vaccine.

- Intranasal innoculation of calves with maternal antibodies results in long term protection without detectable antibody levels.
Introduction

- This study was designed to evaluate the efficacy of an adjuvanted MLV BVDV vaccine given to calves in the presence or absence of maternal antibodies. The calves were challenged with a virulent type 2 BVDV strain (1373) 3-1/2 months following vaccination.
Materials and Methods

Animals

- 23 newborn dairy-cross calves
  - Group 1: negative control calves
  - Group 2: vaccinated—with no BVDV colostral antibodies
  - Group 3: vaccinated—with BVDV colostral antibodies
Materials and Methods

- Pre-challenge serology
  - All calves were tested for the presence of BVDV antibodies (type 1 & 2) by serum neutralization pre-colostrum, pre-vaccination, and post-vaccination.
Materials and Methods

- **Challenge**
  - All calves were challenged intranasally with $7.3 \times 10^7$ virus/mL (in 5 mL) of type 2 BVDV strain 1373 at 104 DPV.
Materials and Methods

- **Post-challenge clinical observations**
  - Calves were observed for clinical signs of BVDV infection for 14 days following challenge.
    - Rectal temperatures, nasal and ocular discharge, diarrhea, abnormal respiration, depression, and the presence of oral ulcers.
Materials and Methods

- Post-challenge sample collection
  - Whole blood was collected for:
    - Hematology (WBC) - two days prior to challenge to 14 days post-challenge (DPC).
    - Virus isolation (type 2) - every other day beginning one day prior to challenge and continuing to 13 DPC.
    - BVDV serology (type 1 & 2) - on the day of challenge (104 DPV), 7 DPC (111 DPV), and 14 DPC (118 DPV).
Materials and Methods

Statistical analysis was performed using a general linear model with repeated measures to evaluate body temperature, white blood counts, clinical score data, and type 1 and 2 BVDV antibody titers.
Results

Temperature data: Group 1 (controls) had statistically higher temperatures (p<0.05) than Groups 2 and 3 (vaccinates) on days 7-10 post challenge.
Results

- Group 1 had lower (p<0.05) WBC counts than Group 2 (a) and Group 3 (b) on various days post challenge.
Clinical scores: Group 1 (controls) had higher scores ($p<0.05$) than Group 2 and 3 from day 7 to 14 post challenge. 4/7 control animals died or were euthanized following challenge.
## Results

<table>
<thead>
<tr>
<th>Day Post-Challenge</th>
<th>-1</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
<th>11</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Positive</td>
<td>0/7</td>
<td>0/7</td>
<td>1/7</td>
<td>1/7</td>
<td>6/7</td>
<td>5/7</td>
<td>3/7</td>
<td>3/6</td>
</tr>
<tr>
<td>Percentage</td>
<td>0%</td>
<td>0%</td>
<td>14%</td>
<td>14%</td>
<td>86%</td>
<td>71%</td>
<td>43%</td>
<td>50%</td>
</tr>
</tbody>
</table>

- **VI results:** Only Group 1 (controls) had positive virus isolation results. Virus was isolated beginning on day 3 post-challenge and continuing to day 13.
## Results

### Serology results (log 2)

<table>
<thead>
<tr>
<th>Day/BVDV type</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precolostrum/type 1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2 (0-1)</td>
</tr>
<tr>
<td>Precolostrum/type 2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Prevaccination/type 1</td>
<td>0.0</td>
<td>0.0</td>
<td>8.5 (6-11)</td>
</tr>
<tr>
<td>Prevaccination/type 2</td>
<td>0.0</td>
<td>0.0</td>
<td>8.7 (7-11)</td>
</tr>
<tr>
<td>Day 28/type 1</td>
<td>0.0</td>
<td>7.9 (5-10)</td>
<td>7.7 (3-11)</td>
</tr>
<tr>
<td>Day 28/type 2</td>
<td>0.0</td>
<td>5.5 (4-8)</td>
<td>7.0 (6-8)</td>
</tr>
<tr>
<td>Day 104 Challenge Day 0/type 1</td>
<td>0.0</td>
<td>9.4 (8-11)</td>
<td>5.8 (4-7)</td>
</tr>
<tr>
<td>Day 104 Challenge Day 0/type 2</td>
<td>0.0</td>
<td>5.6 (4-7)</td>
<td>4.2 (1-6)</td>
</tr>
<tr>
<td>Day 111 Challenge Day 7/type 1</td>
<td>0.0</td>
<td>9.5 (7-11)</td>
<td>5.6 (3-7)</td>
</tr>
<tr>
<td>Day 111 Challenge Day 7/type 2</td>
<td>1.3 (0-6)</td>
<td>8.6 (6-11)</td>
<td>4.4 (1-6)</td>
</tr>
<tr>
<td>Day 118 Challenge Day 14/type 1</td>
<td>5.6 (4-6)</td>
<td>12.6 (12-13)</td>
<td>9.8 (7-13)</td>
</tr>
<tr>
<td>Day 118 Challenge Day 14/type 2</td>
<td>6.6 (6-7)</td>
<td>12.4 (10-13)</td>
<td>7.0 (2-12)</td>
</tr>
</tbody>
</table>

Two-weeks post-challenge all 3 groups had significant (p<0.05) increases in both type 1 and 2 BVDV SN titers over the 7 DPC titers.
Summary

- Using the virulent 1373 challenge model, there was no difference in clinical signs, WBC, or viral shedding between vaccinates in the presence or absence of maternal antibody.

- An adjuvanted vaccine provided protection against a virulent challenge in the face of maternal antibody.
Future studies are being planned to compare the non-adjuvanted vaccine to the adjuvanted vaccine.
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