Practical Bovine Immunology

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Historically, vaccination programs have been designed as a preventative procedure. The bovine practitioner with his accumulated knowledge of pathogenesis and epidemiology of disease conditions is placed into a position of developing vaccination routines. These vaccination routines evolve into a portion of his total herd health program. It has become apparent that decisions regarding a vaccination routine must be made with a knowledge that the routine must be supported by good management and nutritional practices, and that the vaccination routine alone will not prevent all disease conditions from occurring.

The control of bovine respiratory disease presents an ongoing disease preventive problem. A survey of 407,000 yearling cattle entering feedlots indicated a morbidity of 5.1% with 75% of clinical diagnoses attributed to respiratory disease.[5] In comparison, a recent survey (Table 1) of accumulated data from Kansas and Nebraska feedlots shows 495,000 head of cattle with a total morbidity rate of 8-9% annually with 66-78% of all illness attributed to respiratory disease. This level of respiratory disease places a considerable burden on the practitioner or consultant to design and implement effective disease control programs that will minimize the economic losses resulting from treatment costs, decreased weight gain and feed efficiency, and mortalities.

Susceptibility of incoming cattle varies considerably between groups. Work in Texas feedlots indicates that 66-92% of all incoming cattle are susceptible to IBRV, 11-46% to BVDV, and 10-55% to PI_3V.[4] A Kansas survey of 758 head of yearling cattle entering six feedlots (Table 2) indicates that 73% (range 94-57%) were susceptible to IBRV, and 36% (range 41-7%) were susceptible to BVDV. These results additionally indicate that the remaining seropositive population has had a previous seroconversion due to natural infection, vaccination, or passive maternal antibody to these viruses and may be considered partially immune.[8] However, these findings indicate the need for an effective vaccination routine on all incoming cattle.

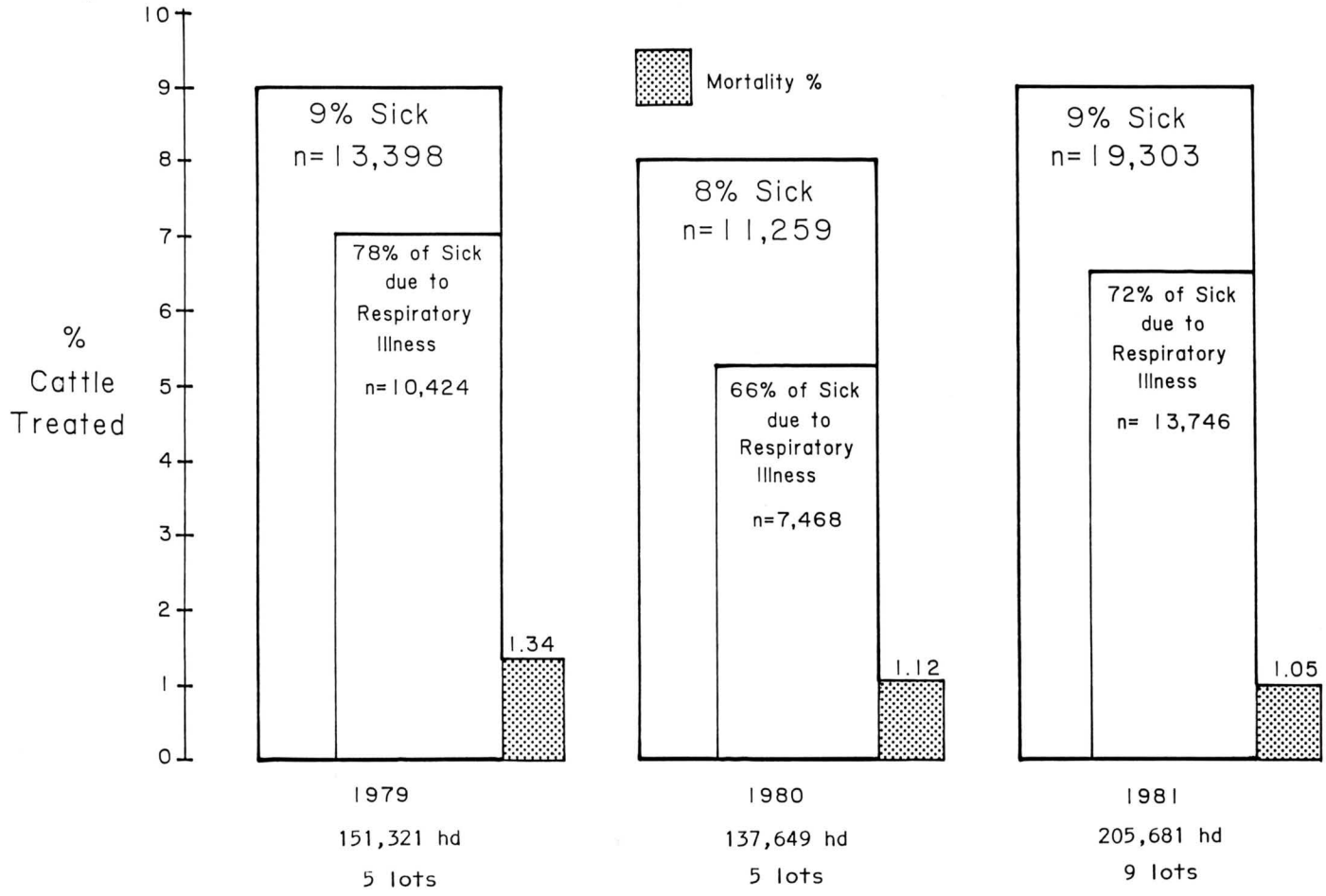
A vaccination procedure should not be expected to initiate seroconversion in all animals in a population of recently stressed cattle, nor should it be expected to provide absolute protection from infection in this type of cattle due to the complexity of the immune response mechanism. Incomplete immune responses in young cattle populations may result from antibody present from previous antigenic exposure[7], passive antibody[7], immunosuppression[6], environmental and nutritional stressors[18], and/or poor delivery of the immunizing agent. The result from the Kansas survey (Table 2) indicate that a seroconversion of four-fold or greater was found 60 days postvaccination in 77% of IBRV and 59% in BVDV vaccinated cattle. This suggests a large population of incoming cattle have an incomplete immune response to "at processing" vaccination procedures.

A series of feedlot observations were initiated to determine if revaccination with MLV IBRV/BVDV vaccine would be deleterious to the health of incoming feedlot cattle. Observations were additionally made to determine if revaccination would elicit an influence on morbidity and mortality. These observations were initiated with the understanding that the additional stress of reprocessing and the use of MLV vaccine might suppress the immune reaction in reprocessed cattle and potentially increase morbidity and mortality. Previous reports concerning primary immunizations have shown that the stresses of transportation[1,15], adjustment to a new environment and nutrition[10,14,16], and the vaccines used in immunization programs[8,12,13] may compromise the normal immune system. Additionally, revaccination may be taking place when natural infections are occurring and can potentially increase morbidity[9,11] or compromise further the animal's normal immune response[3,6]. Initial reprocessing procedures were performed from 5-28 days after initial processing. Immunologically, a more defined period from 5-7 days after initial processing would appear to be beneficial based on observations of nasal-induced interferon levels and serum neutralization antibody levels after this period[2,17].

In the first observation a total of 2,342 steers and heifers weighing under 250 kg were processed on arrival at the feedlot using multicomponent Clostridial bacterin/toxoid, MLV IBR/BVDV, implanted, ear tagged, and dipped. All cattle were revaccinated with a MLV IBR/BVDV product 5-28 days after the first processing. The results (Table 3) indicate that revaccination did not increase the number of clinically ill animals and did not appear to be a severe stressor.

A second observation was conducted to evaluate the effectiveness of revaccination on incoming steers weighing less than 250 kg. The cattle were processed in a similar manner to those in the first observation. The calves were randomly assigned to a control and a revaccination group at

Table 1. Incidence of feedlot disease in Kansas and Nebraska feedlots on routine health programs (1979-1981) consulted by the College of Veterinary Medicine, Kansas State University.



initial processing. Revaccination using a MLV IBR/BVDV vaccine occurred 10 days after the initial vaccination. The results (Table 4) indicate a trend in revaccinated cattle toward a reduction in both morbidity and mortality. This reduction in morbidity and mortality on 10-day revaccination was not statistically significant to the 95% confidence level.

A third observation was conducted to evaluate the effectiveness of revaccination five days after initial processing on steers less than 200 kg. All steers were "in processed" as in observations 1 and 2. At five days post-processing, the calves were randomly assigned to a non-revaccination group and a revaccination group. The revaccinated calves received a MLV IBR/BVDV vaccine. The results of the observation are listed in Table 5. A significant decrease in morbidity occurred two days after revaccination and continued for the remainder of the observation period. A reduction in the number of calves that were repulled from the pens for treatment was additionally observed in revaccinated calves. A trend toward a reduction in pen morbidity occurred in this observation as it did in observation 2; however, the findings were not statistically significant.

Revaccination of incoming cattle 5-7 days after initial processing appears to offer an alternative to conventional one-processing procedures. This procedure has the potential to be used routinely on young calves less than 227 kg and on calves coming from ranch areas that have little opportunity for natural exposure. Further in-depth clinical investigations are being conducted to determine local and systemic cellular and antibody immune response in revaccinated cattle.

Table 2. A serological survey of 758 incoming yearling feedlot cattle taken on arrival and 60 days post-arrival.

	IBRV[a]	BVDV[a]
Incoming (% susceptible)[bc]	73	36
Range (%)	94-57	41-7
60 days post-arrival Seroconversion (%)[d]	77	59

a Measurement of humoral antibody by an antiviral serum neutralization test conducted at the Kansas State Diagnostic Laboratory, Manhattan, KS.

b Susceptible cattle referred to as those cattle with humoral antibody titers of less than 1:4.

c All cattle were processed on arrival with a modified live viral vaccine for IBRV and BVDV (Resbo IBR-BVD, Norden Laboratories, Inc., Lincoln, NE 68501), multicomponent Clostridial bacterin/toxoid (Siteguard MLG, Jensen-Salsbery Laboratories, Kansas City, MO 64141), implanted, and ear tagged.

d Results based on a four-fold or greater increase in humoral antibody titer.

Table 3. An observation of morbidity in 2,342 steers and heifers weighing under 250 kg revaccinated for infectious bovine rhinotracheitis virus (IBRV) and bovine viral diarrhea virus (BVDV)[a] 5-28 days after initial in-processing.

	Prior to Revaccination	After Revaccination
Hospital Pulls (%)	7.2	1.8

a All cattle were in-processed as soon after arrival as possible using a modified live IBRV-BVDV vaccine (Resbo IBR-BVD, Norden Laboratories, Inc., Lincoln, NE 68501), multicomponent Clostridial bacterin/toxoid (Siteguard MLG, Jensen-Salsbery Laboratories, Kansas City, MO 64141, implanted, ear tagged, and dipped. Cattle were revaccinated for IBRV-BVDV (Resbo IBR-BVD, Norden Laboratories, Inc., Lincoln, NE 68501) 5-28 days after initial processing.

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Table 4. An observation of the effects of revaccination with modified live virus infectious bovine rhinotracheitis (IBR) and bovine viral diarrhea (BVD) vaccine 10 days after initial processing in feedlot cattle weighing less than 250 kg.

	Normal Processing[a]	Revaccination 10 days After Initial Processing[b]
Total head	180	180
Morbidity (%)	11.7[c]	8.9[c]
Mortality (%)	1.7[d]	0.6[d]

a All cattle were in-processed as soon after arrival as possible using a modified live IBRV-BVDV vaccine (Resbo IBR-BVD, Norden Laboratories, Inc., Lincoln, NE 68501), multicomponent Clostridial bacterin/toxoid (Siteguard MLG, Jensen-Salsbery Laboratories, Kansas City, MO 64141), implanted, ear tagged, and dipped.

b Revaccinated using a modified live viral IBRV-BVDV vaccine (Resbo IBR-BVD, Norden Laboratories, Inc., Lincoln, NE 68501).

c $P > .05$

d $P > .05$

Table 5. An observation of the effects of revaccination with modified live virus infectious bovine rhinotracheitis (IBR) and bovine viral diarrhea (BVD) vaccine 5 days after initial processing in feedlot steers weighing less than 200 kg.

	Normal Processing[a]	Revaccination 5 days After Initial Processing[b]
Total Head	64	65
Morbidity (%)	48.4	35.3
Mortality (hd)	1	0
Repulls	6[c]	1[d]
Number pulls after revaccination (hd)	10	4
Number pulls greater than 2 days after revaccination (hd)	8[e]	1[f]

a All cattle were in-process 24 hours after arrival using a modified live IBRV-BVDV vaccine (Resbo IBR-BVD, Norden Laboratories, Inc., Lincoln, NE 68501), multicomponent-Clostridial bacterin/toxoid (Siteguard ML, Jensen-Salsbery Laboratories, Kansas City, MO 64141), ear tagged, and dewormed (Levasole, Pitman-Moore, Inc., Washington Crossing, NJ 08560).

b Revaccinated using a modified live viral IBRV-BVDV vaccine (Resbo IBR-BVD, Norden Laboratories, Inc., Lincoln, NE 68501).

c,d $P < .05$

e,f $P < .025$

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Panel Discussion

Question: The question is in using Synovex-S on heifers.

Answer: I don't know exactly if there has been any real good research done on that or whether we're picking up just shop talk. I don't know, maybe Dallas would be able to answer that a little better than I do in the feedlot situation. We didn't see any problems with it on any of the trials that we have done.

Answer: I would just add to what you have said. Comments, shop-talk, without documentation. I don't know of a well-controlled, replicated study with good statistics that says there is a difference.

Question: Do you see more vaginal prolapses with either of the implants?

Answer: Here again, speaking of spayed heifers, we've seen no difference. As far as implants and prolapses in general, I think this again has a lot to do with the particular set of heifers, the particular environment and I don't know whether I could really say that Ralgro or Synovex can be incriminated as far as producing vaginal prolapses. I don't think we can. I think it backs up to that particular individual set of animals. It probably has more influence on it than our implanting. If I understand you right, what you interpreted off of our slides is that the cost of gain on an intact heifer was less than a spayed heifer. . . . this is referring to strictly intact heifers and the cost of gain between implanted and not implanted. I don't think there was a significant difference on it.

Question: Where did you start your base line to figure the cost of gain in spayed females?

Answer: That was started at the time of the feeding. These were all spayed during the grass feeding period so it was at entry into that feedlot. I think that probably the data didn't come out very well in favor of implanting intact heifers, but I don't think that I would stop with that all the time. I think I would have to agree that over the years the trials show there is an advantage to implanting intact heifers.

Question: The comment here is on theoretically spayed heifers coming into the feedlots and that is more like a tubular ligation. The question is, if there are ovaries in there, would you still have to drop down the inability to become pregnant, would you still have to consider this as an intact heifer?

Answer: Yes, because unless that ovary is atrophied, if it can still function and they are coming into heat, they are still getting the estrogen stimulation, the growth promoting stimulation from that ovary.

Question: What about interferon?

Answer: If interferon is present, it ought to help protect against BVD. Now if you look at Todd's work in 1972 when they first published the article about intranasal vaccines, and read the discussion part, they mention in there heterologous protection. They were able to demonstrate protection with IBR vaccination, interferon protection against BVD. He never discussed any more than that. He never published any more and I called him one time just to ask him just what was that data. What they saw was a one-day delay in fever to BVD because of the presence of interferon. And so, depending on the challenge dose, you can demonstrate good protection against the challenge. If you can overwhelm interferon . . . interferon is not just something that holds everything back . . .and we did some challenge work not with BVD but with PI_3, used IBR virus up the nose of calves, induced interferon came back with PI_3 as a challenge. We challenged calves with 10^5 units, 100,000 virus particles, and showed excellent protection in those calves. We had some other calves which we challenged with 10^8, which is a thousand times more virus and so no protection with the interferon. It overwhelmed the interferon response. And so depending on the challenge dose you ought to see good or bad results. If you have a little bit of BVD virus around it is susceptible to interferon and you will see some benefit from the interferon. If you have an overwhelming challenge, you won't see any benefit from the interferon.