Strategies For Rearing Co-mingled, Colostrum-Deficient Calves

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Colostral immunoglobulin levels and exposure to pathogens are the two most important factors that affect health and mortality of baby calves. Farm management that affects either of these two factors has been shown to have a significant impact on calf morbidity and mortality.[1]

Dairy farms are capable of controlling colostrum feeding to insure immunoglobulin transfer and managing the environment to minimize pathogen exposure. Calf ranches, however, characterized by the co-mingling of day old calves purchased from a variety of sources, place calves at high risk of enteric and respiratory pathogen exposure. Failure of colostral immunoglobulin transfer is also high in these calves since the dairies from which calves are sourced have little incentive to feed colostrum.

This report describes approaches to manage health programs for calves under different management systems. Calf management programs for dairy herds will be contrasted with those of calf ranches. Results will be compared so that practitioners can appreciate problems that may be encountered if calves with different histories are treated the same.

Calves Raised On Dairy Herds

The benefits of colostral immunoglobulin transfer to newborns are well documented[2-4] and most dairy producers working with veterinarians have developed practical programs for colostrum feeding.[5] Programs can be outlined for employees of large dairies as described in Figure 1, so that colostral immunoglobulin transfer occurs in almost all calves.[6] Veterinary practitioners generally recommend herd vaccination programs that assure high immunoglobulin content of colostrum.

Calving areas on dairy farms are maintained to reduce pathogen exposure to the newborn. Individual calving pens, grass pastures or properly cleaned close-up corrals are common on most dairies. The calf-raising facilities are of two types: calf barns in which the environment of the calf can be controlled, or individual pens or hutches arranged outside in a designated area of the dairy. Both systems reduce disease transmission by separating calves, and permitting close observation and

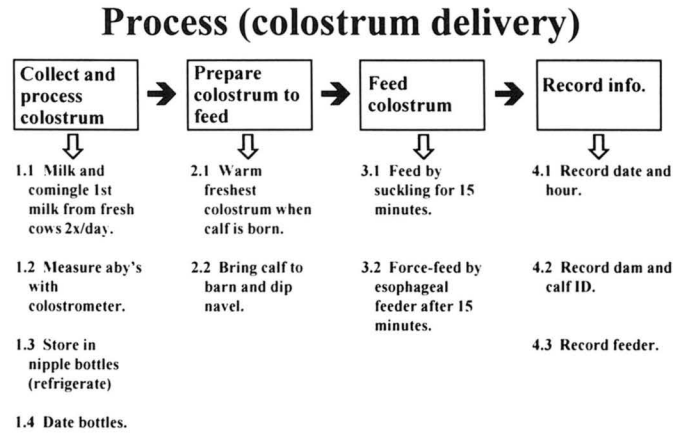

Figure 1. Process (colostrum delivery)

treatment when necessary.Dairies with artificial insemination (AI) programs have the goal of raising all heifer calves for herd replacements. Significant management effort is put into raising heifer calves in these AI herds as compared to those herds which utilize natural service bulls and consequently do not raise their calves. Even in well managed AI herds, bull calves may be discriminated against and receive less attention regarding colostrum feeding and may be housed under different, less optimal conditions than heifer calves.

Calf health results were monitored on a 4500 dairy cow over 7 years. The herd vaccination program included:

1. MLV IBR/BVD/PI3 and 5 strain leptospira bacterin to cows annually at 15 days post-calving.
2. Five strain leptospira bacterin at pregnancy confirmation (30-60 days after insemination and again at time of dry off).
3. Gram negative core antigen vaccine at dry off, at approximately 20 days prior to calving and again within 5 days after calving.
4. Calves received MLV BRSV vaccine at 30 and 45 days of age and weaned at approximately 45 days. Intranasal IBR/PI3 administered prior to moving to group pens (at 30-35 days of age).

5. Along with Brucella vaccine, calves received MLV IBR/BVD/PI3 between 6-7 months.
6. Prior to breeding at 14 months, MLV IBR/BVD/PI3 and 5 strain leptospira bacterin administered to heifers.
7. Five strain leptospira bacterin to heifers at pregnancy revivification (90-120 days in gestation) and at 20 days prior to calving. Gram negative core antigen vaccine administered at the same time as the second leptospiral bacterin.

Twenty-four hour observation of calving on this dairy permitted feeding colostrum within 2 hours of birth. First milking colostrum was collected twice daily and stored in nipple bottles in refrigerators. Calves were fed colostrum for 3 feedings within 24 hours, then fed pasteurized mastitis milk twice daily for 14 days. Most of the calves received adequate colostrum as determined by spot checking serum for antibody levels according to the zinc sulfate turbidity test. Milk replacer or pasteurized mastitis milk supplemented with milk replacer to provide 1.2 lb. of dry matter per calf per day in 3 quarts was fed once daily till weaning at 45 days. Water and grain were available at all times.

Eight percent of calves were born dead on arrival. Death loss from day 1 to weaning averaged less than 2%. Diarrhea incidence approximated 15%, but most were treated without antibiotics. Scouring calves returned to normal by feeding oral electrolytes and a gel-pectin additive. Treatment for respiratory disease was less than 2%.Post mortem samples as well as samples from calves with enteric or respiratory disease were analyzed to monitor disease control programs. *E. Coli* was frequently isolated from calves with diarrhea, but strain k-99 was never identified. *Salmonella typhimurium* grew only occasionally from fecal samples during the first two years. *Pasteurella multocida* was frequently isolated from nasal swabs of calves by 30 days of age but rarely identified from lungs of calves at post mortem. BRSV infection did cause transient respiratory disease, but lessened after the MLV BRSV vaccination program was initiated. Diagnosis of BVD infection (based on culture, fluorescent antibody identification and histopathological tissue analysis) occurred in only a small number of "poor doers" that either died or were euthanized within 1-2 months after weaning.

Calves Raised on Commercial Calf Ranches

Calf ranches have sprung up in the southwestern U.S. as a result of the numbers of bull calves produced by large dairy herds each year. Bull calves are viewed as a nuisance by large dairy owners who specialize in milk production and raise only heifer replacements. Bull calves represent low profit potential, a cash flow drain due to overhead and additional operation cost, require extra management, and are a higher risk for death or treatment losses compared to other cattle on the dairy. Dairymen prefer to sell bull calves promptly after birth.

Calf ranches operate by purchasing calves at one day of age. Calves from many dairies are co-mingled and usually housed in hutches on a single ranch. They are managed for optimum growth and usually are contracted or sold to feedlots at approximately 4 months of age. Some ranches also purchase heifer calves to raise and sell as dairy herd replacements; other ranches contract with dairymen to raise their herd replacements for them.

Typically, calves are purchased on a daily basis from dairies located anywhere from several miles to hours from the ranch. Under some systems, calves may be temporarily assembled in depots for 2 to 5 days, then transported in large semi trucks over long distances (greater than 24 hours) to a main ranch. Management programs for these co-mingled calves have been described by others.[7] Typically, milk replacer, mixed in large batches, is fed twice daily through nipple bottles so that calves suckle unassisted. Grain and water are fed free-choice and weaning usually occurs between 35-60 days. Calf ranches are highly specialized enterprises: maximum growth is attained at minimum cost, unskilled laborers are trained to perform very specific tasks, and health programs generally include prophylactic and therapeutic treatments to large groups of animals.

The calf ranch industry is particularly susceptible to financial pressure from other markets. When beef prices are high and feed costs low, the potential for profit is good. Under these circumstances, higher health and management input can be justified compared to when market pressures force tighter margins. Records from a large calf ranch were summarized over three years to evaluate losses compared to health costs. The ranch maintained over 25,000 head of calves per month; the number of calves in hutches and "on milk" daily varied from 5,000-15,000. Initially drug use and prophylactic medications were minimal. The objective was to apply the same principles and programs implemented on dairy herds to the calf ranch operation. Modifications to these programs and increased drug use were necessary in response to higher health problems and changes in market pressures which changed the value of calves and potential profit margins for the enterprise.

Calves arrived on the ranch 1-5 days old; some were in transit for greater than 24 hours. Approximately 30% were clinically dehydrated and required intravenous rehydration therapy. Greater than 50% were colostral immunoglobulin deprived based on surveys which analyzed serum samples for total protein, a system common in the industry.[8] Virtually 100% of all calves scour by

10 days of age. *Escherichia coli* and *Salmonella typhimurium* were consistently recovered from rectal samples.

The vaccination program underwent several modifications and included:

1. Intranasal IBR/PI3 upon arrival.
2. MLV IBR/BVD/PI3/BRSV at day 7 and again on day 35.
3. MLV *Pasturella multocida* and *P. hemolytica* vaccine at day 15.
4. Gram negative core antigen vaccine administered at 3 weeks of age.
5. Intranasal IBR/PI3 and pink eye vaccine prior to movement to corrals at 55 days.

Oral and injectable prophylactic medications were used routinely:

1. Vitamin E, selenium and a broad spectrum antibiotic to incoming calves and again at the time of movement to corrals.
2. Prophylactic oral antibiotics fed in milk replacer; choice of antibiotics based on clinical observations and routine culture and sensitivity test results.
3. Therapeutic drugs administered to individual calves based on twice-a-day clinical observations by trained technicians. Drugs selected and dosage decisions were under veterinary supervision and based on culture and sensitivity information generated routinely.

Post mortem examinations were performed routinely to monitor disease incidence and determine exact cause of death. Rectal and nasal cultures were obtained at least monthly, but diagnostic testing surveillance was increased when sporadic episodes of health problems escalated.Evolution of the health program resulted from monitoring disease incidence and applying treatments in response to diagnostic testing.

1. Clinical signs of IBR infection developed in groups of calves within 7 days of arrival on the ranch; laboratory samples confirmed IBR infection by viral culture and fluorescent antibody examination. Intranasal vaccine controlled the problem.
2. BVD infection was suspected in calves that died at 20-30 days of age. Thrombocytopenic form of BVD was confirmed by virus culture from calves with dramatic, hemorrhagic lesions in the pleural and thoracic cavities.[9] Vaccination with MLV BVD at day 7 and again at day 35 as described by Cortese[10] virtually eliminated the problem.
3. BRSV infection was diagnosed on clinical signs after several groups of calves were affected with respiratory disease. Incorporation of MLV BRSV along with IBR/BVD/PI3 at day 7 and 35 dramatically reduced clinical signs of BRSV infection.
4. Respiratory bacterial disease was caused almost exclusively by *Pasturella multocida*; it was identified in greater than 99% of all positive lung and nasal cultures. **This agrees with findings of others[11,12] that *P. multocida* is the primary bacterial respiratory pathogen of young dairy calves.** It appears to be an opportunist, causing clinical disease only when another primary respiratory insult (e.g. fly spay, nutritional problem, severe weather changes, etc.) occurs. *P. multocida* can be cultured from nasal passages of normal and abnormal calves routinely. Vaccines that do not contain *P. multocida* antigens are probably of limited value for control of bacterial respiratory disease in the young dairy calf.
5. *Escherichia coli* was recovered most frequently from rectal cultures of calves with diarrhea. It was considered a primary pathogen when grown in pure culture from other internal organs during post mortem. *E. coli* caused high death loss epidemics when specific strains invaded calves. Culture and sensitivity results along with clinical observations during those epizootics identified very few antibiotics from which to select for therapy.
6. Salmonella was frequently cultured from clinically ill as well as normal calves. *S. typhimurium* is the species most commonly isolated from calves less than 15 days of age. Clinically ill calves with *S. typhimurium* were febrile and scoured; response to therapy was good, but some death losses occurred. By contrast, *S. dublin* infected calves were usually older and much sicker. They were depressed, had markedly elevated temperatures (104-105 F), displayed respiratory symptoms and sometimes had diarrhea. Treatment of calves with *S. dublin* was generally unrewarding, but vaccination with core antigen vaccine was protective. It has been demonstrated that the young calf (e.g. infected with *S. typhimurium)* is not able to respond immunogenically to gram negative antigens and vaccines in these very young calves were not useful. [13]

Over three years, monthly death loss to weaning age varied from 3 to 25 percent. Epizootics of enteric and respiratory disease occur spontaneously which explains the wide variation in results. Inability to identify exact causes for those epizootics so that preventive programs can be implemented seems to be common within the calf ranch industry.

Discussion

Veterinarians responsible for health programs on calf ranches, veal operations or who work with dairy clients that can not ensure adequate colostral immunoglobulin levels in calves may need to consider approaches which incorporate one or more of the following components:

1. Stimulating both cellular and humoral immunity with appropriate vaccines. Potential for benefit is especially high in colostral deprived calves, but evidence also suggests a health benefit for colostrum-fed calves.[14]
2. Monitoring health programs and troubleshooting epizootics with appropriate diagnostic tests can clarify specific causes of complex problems.
3. There is benefit to using prophylactic medication in calf populations during high risk exposure to pathogens when these risks can not be controlled.
4. Selection of therapeutic antimicrobials varies even when the same pathogen is identified during two similar epizootics. Diagnostic testing provides valuable supplemental information to clinical observations.

Summary

Calf health management programs differ between calf ranches and dairy farms because of differences in levels of colostral immunoglobulin and the risk of pathogen exposure. Veterinarians can modify their health programs to adjust for these differences although results are less predicable when there is less control of colostrum feeding and pathogen exposure. Frequent and routine clinical observations along with diagnostic laboratory testing is essential for the practitioner to monitor calf health programs and adjust for epizootics when these occur under either system.

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Abstract

Invasive malignant fibrous histiocytoma in a cow

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An invasive malignant fibrous histiocytoma associated with the left cornual process, and causing lysis of the frontal bone, was diagnosed in a cow. The mass compressed the left cerebral hemisphere focally and extended into the frontal sinus and ethmoid and nasal turbinates. It was composed of pleomorphic to spindle-shaped cells with ultra-structural evidence of fibroblastic, myofibroblastic, and fibrohistiocytic differentiation. Trauma and chronic inflammation may be predisposing facotrs for developement of neoplasia in cattle.