Neonatal Calf Management: A Guide to Disease Investigation

Sheila M. McGuirk, *DVM, PhD*
University of Wisconsin
School of Veterinary Medicine
2015 Linden Drive West
Madison, WI 53706

Introduction

An investigation of a calf disease problem on a dairy should follow certain consistent, repeatable steps. Whether you are the attending or consulting veterinarian, it behooves you to compile baseline information so you know the purpose of the calf raising operation (replacement heifers, veal, dairy beef). Baseline information can be obtained by interview but it should be corroborated by a review of the calf records, billing slips, or laboratory data. This information becomes your initial database which is used to **accurately state the problem**. It is imperative that there is agreement between veterinarian and owner about what the problem is. Subsequently, the investigation of a calf disease outbreak will be problem-oriented, thus avoiding the natural tendency to target everything in an operation which is problematic or could be improved.

1 Determine the type of operation

2 State the problem

- Note age of onset
- Characterize clinical signs
- Determine cause of death

If there is a general perception by the calf raiser that they are losing too many calves, establish the mortality rate. As a general rule, calf mortality rates greater than 5% leave a significant opportunity for improvement. It is not uncommon that mortality rates are acceptable (< 5%) but treatment rates are high. Treatment rates and level of intervention differ from farm to farm but it is realistic to set a goal that no more than 1 out of 5 calves require significant medical care. Treatment interventions may be as simple as an antibiotic in the milk replacer or a single medication administered at or around the time of birth. When several days of multiple feedings and/or medications are required in more than 20% of calves, there is a problem.

3 Determine the morality rate attributable to this problem

4 Establish the level and rate of treatment interventions

5 Set some realistic goals for mortality and morbidity or treatment rates and establish a time frame for achievement of these goals.

Investigation of the Problem

Dry cow management is an important aspect of calf health. Calving ease, newborn calf health and colostrum quality and quantity, for example, will be influenced by nutrition, body condition and general health of the dry cow.

6 Dry cow nutrition

In the last weeks of pregnancy, digestible energy, crude protein, and trace mineral requirements go up at the same time that dry matter intake will decline. Therefore, ration adjustments are needed to insure adequate intake as outlined in Table 1:*

	Far-Off Dry Cows	Transition Cows
DMI, lb/d	28.0	25.0
NEL (min), Mcal/lb	0.58	0.70
Crude Prot (min), %	13	15.5
Magnesium (min), %	0.20	0.25
Phosphorus (min), %	0.25	0.30
Sulfur (min), %	0.16	0.20
Copper (min), ppm	12	15
Iodine (min), ppm	0.60	0.70
Iron (min), ppm	50	60
Manganese (min), ppm	40	50
Zinc (min), ppm	50	60

In addition, vitamins A, D, and E requirements are increased in the close up dry cows as indicated in Table 2:*

	Far-Off Dry Cows	Transition Cows
Vit A (min), KIU/lb	1.8	2.2
Vit D (min), KIU/lb	0.75	1.0
Vit E (min), IU/lb	10	12

**Oetzel GR. Recommended nutrient content of diets for mature dairy cattle*

In addition to immunoglobulins, leukocytes and other immuno-modulating factors, colostrum is a rich source of energy, fat soluble vitamins (especially vitamin A), and trace minerals, including those listed above and selenium. Parenteral supplementation of the latter in dry cows obviates the need to supplement newborn calves receiving adequate colostrum.

7 Dry cow vaccination

Activation of the cow's immunity during the dry period optimizes production of colostrum with immunoglobulins and leukocytes which can enhance organism specific immunity of the newborn calf provided an appropriate volume of good quality colostrum is ingested and absorbed by the newborn calf. There are limitations to the duration of maternal immunity, particularly as it relates to protection from enteric disease of the calf. To extend the period of immunity, calves must continue to ingest antibodies at regular intervals for the first 2 to 3 weeks of life. A vaccination program to prevent scours may take 2 to 3 years before measurable results are seen on a farm. This apparent delayed efficacy may be that the improvement is related to reduced shedding of enteric pathogens in the carrier cow. With some pathogenic agents (*Cryptosporidium parvum* and Bovine Respiratory Syncytial Virus (BRSV), for example), colostrum from vaccinated cows may not protect but rather reduce the severity of acquired disease in calves.

It is clear that vaccination of the dry cow is not a standard management practice on most dairies.[1] Given the importance of colostral immunity to disease prevention in the newborn calf as well as the apparent delay in the calf's ability to mount a protective active immune response, vaccination of dry cows is one way to improve disease resistance in calves receiving colostrum. If enteric disease is the primary problem, vaccination of the dry cow using an *E. Coli*, rotavirus, coronavirus, and enterotoxemia combination may be useful. On some farms, dry cow vaccination using a gram negative bacterial core antigen may reduce the severity of enteritis and pneumonia due to gram negative bacterial pathogens in calves receiving colostrum. At this time, there is not sufficient evidence for a positive cost-benefit ratio in calves receiving colostrum from dry cows vaccinated with *Pasteurella* or *Hemophilus* bacterins.

It is believed that the colostral immunity derived from dry cow vaccination using Infectious Bovine Rhinotracheitis, Bovine Viral diarrhoea virus, and Parainfluenza Type 3 virus combination may be beneficial in reducing respiratory disease in the first few months of a calf's life.

8 Maternity pen management and hygiene

Calf diarrhoea problems which occur in the first week of life are usually the result of infection shortly after birth. Adult cow shedding of enteric pathogens poses a significant risk factor for calf infection on most dairies where the calves are left in the maternity area for several hours after birth. Maternity pens should be dry, well drained and of sufficient capacity to accommodate 15% more animals than expected at any one time.[2] Frequent use of a maternity area without appropriate sanitation and disinfection results in a build-up of pathogenic organisms and a high prevalence of disease in calves. At a minimum, frequent bedding changes can provide some separation between the newborn calf and pathogenic organisms. A more successful practice is to remove newborn dairy calves from the maternity pen as soon after birth as possible. This can be a practical solution when there is a sufficient labor force to monitor the calving area and/or when calving occurs during the day. Dry cow feeding once daily in the late afternoon or evening may result in more daytime calving.

9 Colostrum Management

Most calf raisers are aware of the importance of colostrum feeding in preventing disease in calves. Research has shown that calves which absorb an adequate level of colostrum immunoglobulins have a longer time to their first illness and fewer sick days. Calves with adequate passive transfer that do become infected with viral or bacterial pathogens have shorter periods of viremia or bacteremia and less shedding than calves with failure of passive transfer (FPT). In addition to the important role in disease prevention, colostrum enhances growth and productivity.

When calf disease is prevalent on a dairy, there is frequently FPT or partial FPT. As you investigate, consider the 3 phases of passive transfer: 1) formation of colostrum with a high concentration of immunoglobulin; 2) ingestion of an adequate volume of colostrum within 6 hours of birth; 3) absorption of colostral immunoglobulins. The first step is addressed in dry cow management.

- Colostrum Volume
- Timing of Feeding
- Source of colostrum
- Colostrum Quality

From the NDHEP[1], it is known that 95% of calves receive colostrum from their own dam. More then 30% of dairy calves are left with their dam for at least 12 hours and nurse colostrum on their own. Unfortunately, dairy calves left to nurse the cow rarely ingest adequate colostral volume to achieve passive transfer. This is due to 2 reasons - failure to nurse more than 2 quarts and lack of immunoglobulin mass in 2 quarts of colostrum from dairy cows.

Holstein calves should be hand fed **4 quarts** of colostrum **within 6 hours of birth**. To maximize the immunoglobulin mass in those 4 quarts, **the dam should be milked as soon as possible after calving**. Routine udder sanitation practices should be

implemented and colostrum should be filtered to eliminate particulate matter. It should be fed as soon as possible by allowing the calf to nurse, by force feeding or a combination of both. Though force feeding reduces the efficiency of absorption of immunoglobulins, there should be sufficient immunoglobulin reserve in 4 quarts of colostrum to provide adequate passive transfer.

In a calf disease investigation, the final review of colostrum feeding practices is the evaluation of immunoglobulin absorption. Calves less than 1 week of age are suitable for testing. For most practitioners, measurement of calf serum protein concentration is the most practical method of evaluation. Ninety percent of the calves should have serum protein concentrations greater than 5.0 gm/dl; ideally, most (at least 80%) will have concentrations greater then 5.5 mg/dl. When calves are routinely getting 4 qt of colostrum and serum protein concentrations are not at recommended levels, colostrum quality can be surveyed using a colostrometer, which correlates specific gravity with immunoglobulin concentration. The accuracy of measurement is temperature dependent and is most accurate at 68°F. This tool can be useful in designating poor quality colostrum but it will err in yielding many false positive tests.

10 Calf Housing

- Spatial Density
- Temporal Density
- Sanitation and disinfection

Factors which affect the rate at which the environment is contaminated are how closely calves are housed together (**spatial density**), the time period between peak shedding intervals of successive occupants (**temporal density**), and the density of non-immune shedders. With attention to the colostrum feeding recommendations above, the latter can be reduced significantly.

Scours problems are accentuated in the winter and damp weather. Where heifers and cows are brought together for the first time at calving or when calves are housed in facilities shared with adult cattle, calf disease problems are magnified. The prevalence of diarrhoea is higher in enclosed, artificially ventilated, heated barns than in hutches. But hutches that are located in a poorly drained area of the farm, are downhill from adult cow housing, or which are not moved between successive occupants may contribute to a calf disease problem. A useful guideline on dairies is to have 15% more hutches than are needed at maximum occupancy.[2] This will reduce the temporal density and eliminate the need to put a newborn calf in the hutch that was just abandoned by the last fatality, the non-immune shedder. Hutches should be as far apart as they are wide and long in order to prevent calf to calf contact. Ideally, the hutches are raised off the ground by crushed limestone or other suitable material for percolation of liquid waste. When a calf is moved, the hutch should be pressure washed, disinfected and left to stand for at least 7 days. The space occupied by that hutch should be abandoned for 1 month.

Pressure washing and spraying contaminated pens and floors can aerosolize infectious diarrhoeal agents and increase humidity. The aerosol eventually coats the calf's haircoat, bedding or buckets, where previously airborne agents can be ingested and infect other calves. These procedures should be reserved for times when other calves are out of contact, thus necessitating at least regional all in-all out practices.

Appropriate disinfectants can limit the spread of salmonellosis, cryptosporidiosis and other infectious agents. Concrete and other solid building materials can be adequately disinfected provided that the organic debris is removed. Porous materials and soil cannot be effectively sanitized. Other factors which influence the survival time of infectious agents in the environment are ventilation (air turnover and humidity), frequency of bedding changes, sunlight and disinfectants. Determine what sanitation and disinfection practices are in place.

Feeding utensils can be a source of pathogenic organism transmission. Problems can be addressed by increasing the number of utensils so each calf has its own bucket. Sanitization between calves or meals can be accomplished with sodium hypochlorite (0.25%). Every part of the bucket must be in contact with the sanitizing solution. Nipples are more difficult to clean and the sanitizer must be "milked" through the opening. After cleaning, the rinse must be complete so that bleach is not ingested by the calf.

11 Calf Nutrition

Observe feeding practices on the farm, including timing, volume, mixing practices for milk replacer, presence of water, and freshness of the calf starter. The standard rule of feeding milk replacer at a rate of 1 pt per 10 lb body weight is not adequate to meet the caloric needs for maintenance and growth of a Holstein calf. By the second or third week of life, a Holstein calf should be gaining between 1.2 and 1.5 lb per day in order to meet expected height and weight at breeding and calving ages. If a good quality milk replacer is the sole source of calories, a 100 lb calf should consume approximately 7.5 quarts per day to achieve this rate of gain. Most dairy calves are fed 2 to 2.5 quarts of milk replacer twice daily. At this rate of feeding, the calorie deficit is managed by providing a good quality calf starter, beginning in the first week of life. A clean water source should be available for calves, particularly during warm weather and an episode of scours.

Calves require additional calories when they are

in cold housing. A rule of thumb is to provide an extra milk feeding each day that the wind chill temperatures are consistently below 0°F. At temperatures consistently below -20° F, two extra feedings should be offered. Hair coats can be excellent insulators in cold weather provided that calves can get out of the wind and stay dry. Moisture decreases the insulating effect of the haircoat considerable. Cold stressed calves are weak, depressed, hypophagic, lethargic and appear to be more susceptible to disease.

12 Infectious Agents

- Diarrhoea

For the most part, agents which cause diarrhoea in calves have a qualitatively similar effect with regard to the metabolic disturbances they produce. Some outbreaks of diarrhoea appear to be triggered by a single infectious agent but most are due to mixed infections. For these reasons, therapeutic intervention is, for the most part, the same, regardless of the agent. The therapeutic interventions employed on the farm should be reviewed. Diarrhoeic calves should have adequate caloric intake. Both milk replacer and oral electrolyte solution should be fed to the calves. Milk replacer can be offered at each of 4 different feedings in order to reduce the volume fed at any one time as well as to insure normal daily intake. Oral electrolyte solution can be fed immediately after the milk replacer feeding. Antibiotic use should be reserved for salmonellosis outbreaks, FPT and septicemia.

- Pneumonia

When pneumonia is the primary problem in calves less than 6 weeks of age, *Pasteurella sp.* should be suspected. Viral agents, in particular BVD virus and BRSV, may be factors. All of these agents are more common when calves maintain contact with adult cows. Review treatment protocols for pneumonia, including selection of the antibiotic, route and method of administration, and duration of treatment. Early detection is a key to success in treating pneumonia so regular temperature taking is useful both for diagnosis and to serve as a barometer of treatment success. Outbreaks are often closely associated with weaning and movement to group pens. Coccidiosis control practices should be reviewed as part of your investigation. Ventilation (air turnover and humidity) should be evaluated when pneumonia is a repeating problem.

13 Personnel Management

As part of the disease investigation and prior to making recommendations for resolution, know how many calves are on the farm, the number of people feeding and treating calves, and how duties are distributed amongst the labor force over the course of the day and night. Determine the length of time for feeding and treating sick calves. Feeding and treating should be accomplished within 2 to 3 hours if there is an adequate number of trained workers. If these duties cannot be completed in that time, four times per day feeding protocols cannot be implemented. Practices should be regular and consistent. Feeding should be done at the same times every day.

Assessment of the Problem

Upon completion of data collection and your investigation of facilities, management, and animals, time should be spent weighing the facts, putting pieces together and planning for a solution. In constructing a plan, concepts which are useful are: 1) reducing the source of infection; 2) removal of the calf from the contaminated environment; 3) increasing the non-specific resistance of the calf; 4) increasing the specific resistance of the calf; and 5) reducing the stress in the environment.

In the case of most dairy calf diarrhoea and pneumonia problems, critical steps are reducing time in the maternity area, feeding 4 quarts of colostrum which is milked from the dam within 2 hours of calving and administered clean to the calf before it is 6 hours of age, followed by removal to a disinfected hutch. Preparation for weaning and housing changes associated with it can be modified to significantly reduce weaning pneumonia. One wants to avoid the trap of a standard set of recommendations in favor of a tailor made set of recommendations that are few in number and ranked in order of priority. Set some goals fro implementation and follow up on progress at weekly or biweekly intervals until there is some improvement noted. At all times, focus should be on the primary problem you and the owner have identified.

References

1. USDA, APHIS, VS, Nahms. Dairy herd management practices focusing on preweaned heifers. *NDHAP*, July 1993, p. 28. 2. Heath SE. Neonatal diarrhoea in calves; investigation of herd management practices. *Comp Cont Educ* 1992; 14: 385-395.

This Keynote Paper was presented at the XIX World Buiatrics Congress, Edinburgh, Scotland, July 8-12, 1996 by Dr. Leland C. Allenstein, Whitewater, Wisconsin on behalf of Dr. McGuirk who was unable to attend due to illness.