AG-FO-3932
1990

MINNESOTA EXTENSION SERVICE

Milk Fever in Dairy Cattle

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Introduction

Milk fever (parturient paresis) is a disease that occurs at calving. It is caused by the inability of the cow's hormonal system to maintain proper levels of calcium in the cow's blood, muscle and nervous tissue. Low blood calcium concentrations result in a paralysis of skeletal muscles and muscles of the digestive and nervous systems. This is why prompt treatment is necessary when the cow is down—she may die of bloat or heart failure.

Calving is also nearly impossible in a cow with milk fever at calving. When a cow goes down, many complications may occur, such as muscle and nerve damage, teat lacerations, broken or dislocated bones, and increased chances for all types of infections. Furthermore, she may become a "downer."

Treatment consists of administering calcium borogluconate to raise the concentration of calcium ions in body tissues. Treatment should be considered as soon as the cow is observed to be off feed, staggering or unable to keep her balance, and not defecating.

Occurrence

Most cases of milk fever occur between 24 hours prior to and 72 hours after calving. Occasionally milk fever occurs later into lactation, but generally this is rare. Causes of mid-lactation milk fevers are unknown, but may be associated with some cause of stress and/or high blood estrogen levels.

First-lactation heifers almost never develop milk fever. As cows age, incidence of milk fever increases. Cows in their fifth and sixth lactations are most prone to milk fever, with incidence rates averaging 20 percent. Jerseys appear to have a higher incidence than other breeds.

The average incidence rate of milk fever in dairy herds is about 8 percent. Problem herds can have as high as a 60 to 70 percent incidence rate. Cost of this disease ranges from milk loss (.5 percent over the lactation) to death of the cow.

Why does milk fever occur?

Milk fever develops due to an inability of hormone and other control mechanisms to maintain blood calcium in the normal range. Certain diets may reduce the likelihood of milk fever occurring, while other diets may result in a 70 percent or higher incidence rate. The animal always has enough calcium in the bone to provide the calcium needed for early milk production. Under normal conditions, there is enough calcium in the digestive tract to support maintenance and milk production requirements.

At calving, feed intake drops and there is an inadequate quantity of calcium in the gut for absorption. Milk fever occurs as a result of calcium and phosphorus not being released rapidly enough from bones to make up the deficiency in calcium uptake from the digestive tract.

Calcium metabolism

Calcium is extracted from blood by the mammary gland for the formation of colostrum and milk. Approximately .04 ounces of calcium are removed from the blood for each pound of colostrum produced. This is roughly one-half of the total calcium found in the blood at any one time. Thus, a cow producing 50 pounds of colostrum will totally deplete her blood calcium supply about every hour. The inability to replenish this blood calcium loss through diet and bone loss results in milk fever.

Normal blood calcium levels are 8.5 to 10 milligrams (mg) per 100 ml. Around the time of calving, most cows will drop to as low as 8 mg/100 ml. Milk fever cows drop to less than 7.5 mg/100 ml. The drop in blood calcium also is accompanied by a

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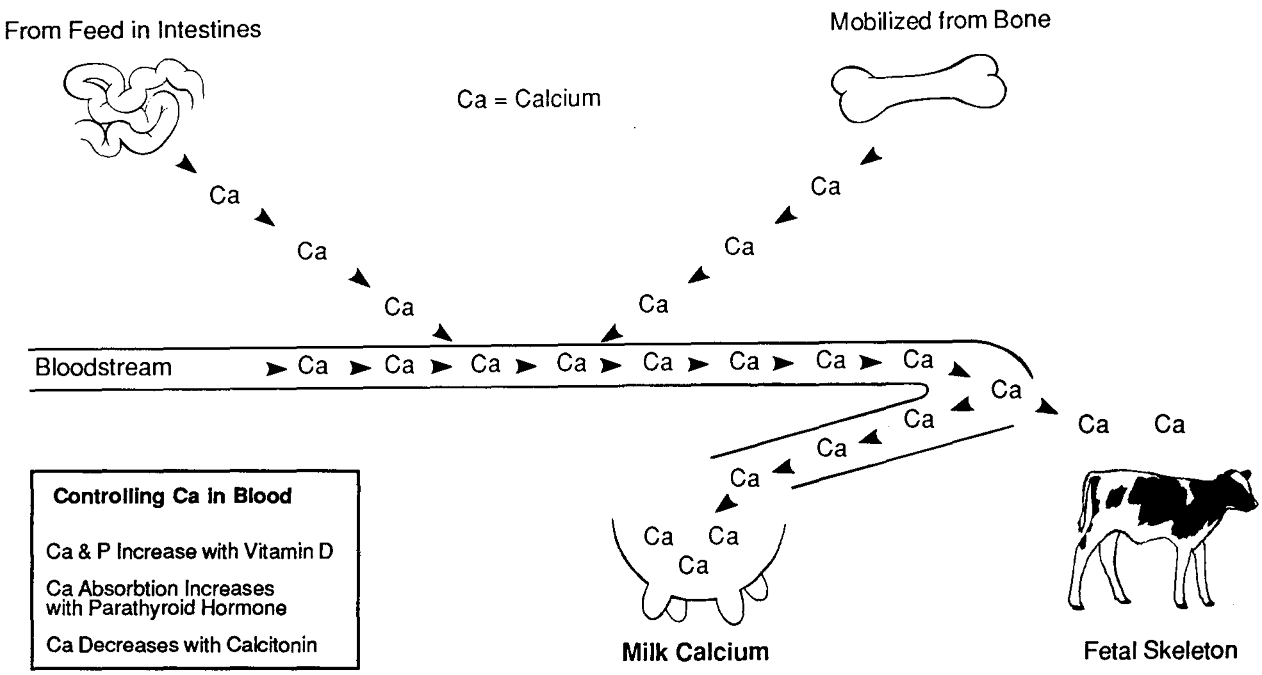
SOURCES AND LOSSES OF CALCIUM AT CALVING



drop in blood phosphorus from 5 to 8 mg/100 ml to below 4 mg/100 ml, and blood magnesium increases slightly from a normal level of 2 mg/100 ml. Regulation of these processes is under the influence of two hormones—parathyroid hormone (PTH) and 1,25-dihydroxyvitamin D (1,25-$(OH)_2D$). When hypocalcemia occurs, the secretion rate of PTH from the parathyroid gland increases, which, in turn, stimulates the synthesis of 1,25-$(OH)_2D$ in the kidney. Release of 1,25-$(OH)_2D$ into the blood increases calcium absorption from the small intestine and mobilizes calcium from bone stores.

Because cows at or near calving are consuming very little or no feed, the mobilization of calcium from bones is a more important source of calcium for maintaining blood levels than intestinal absorption. Once feed intake resumes, dietary calcium becomes the main source of calcium for maintenance of blood levels.

Signs of milk fever

Skeletal and smooth muscle weakness or paralysis account for all of the visible signs. Before the cow goes down and cannot get up again, several problems may be noticeable: incoordination, stumbling, weakness, sunken eyes, inability to expel the calf, failure to pass eliminations, limp tail, and slowed eye movement (smooth muscles are found in the eye and in the digestive and reproductive systems). As the hypocalcemia progresses, the most notable problem of the affected cow is staggering, falling and an inability to get up, even though she tries to get up. Finally, while down, she rolls over on her side and begins to bloat. Death can occur in a matter of hours if there is no treatnent at this time.

Complications

Muscle, nerve, bone or joint damage may occur when the cow goes down, especially so in stanchions or over the gutter. Mastitis, metritis, ketosis, displaced abomasum, fatty liver syndrome, retained placenta and downer cow syndrome are all possible problems that may occur alone or in many combinations. How the cow is housed and managed during this critical time will largely determine the complications and how severely they will affect the health and productivity of that cow.

Treating Milk Fever

Early detection and treatment and proper management of cows with milk fever are all essential to a favorable recovery and continued good health. As the cow becomes more seriously affected (down on her side), the risk of requiring retreatment increases and the risk of complications becomes greater.

While treatment by a veterinarian is highly recommended for the best possible outcome and to avoid a delay in treating for other complications, some dairy producers have become skilled in treating uncomplicated cases of milk fever. Persons considering treating their own animals should check with their veterinarian on the accuracy of their diagnosis, correct treatment, dosage and proper administration technique. Persons attempting their own treatment are taking some risk and should know when to seek assistance from their veterinarian.

When the cow is down, it is very important to consider rolling her to the opposite side. This will improve circulation in those muscles before treatment and allow for the best possible opportunity for getting up without injury to the cow's leg. When rolling the cow, look for any evidence of trauma or lacerations to the teats or legs.

When to retreat? If the cow is not responding or up in four hours, she must be re-evaluated for any complications and retreatment. You can expect about 25 percent of the cows to require more than one treatment, with 10 percent requiring three or more treatments. Early treatment and best management can reduce retreatments and unfavorable outcomes considerably.

Nursing and managing calving facilities

Cows should calve in a clean, well-bedded maternity pen. The maternity pen should be 144 square feet, with a non-slip surface. When cows must calve in stanchions, cover the gutter with plates or fill the gutter with straw bales. If these recommendations are followed, the calf will not be immediately contaminated with feces (reducing the chance of diarrhea). Also, injury to the cow or contamination of her teats and reproductive tract will be greatly reduced, lowering the likelihood of mastitis, metritis, retained placenta, prolapsed uterus and teat injuries. It is thought that preventing these problems greatly reduces the likelihood of a cow developing fatty liver syndrome.

Good footing is important in preventing joint and muscle injuries in uncoordinated milk fever cows. Plenty of of bedding, along with limed or sanded floors, helps prevent injuries. One has to compromise between roughened concrete and problems in maintaining good sanitation. Some dairy producers are using washed sand in maternity pens with good success. This method requires good planning and extra labor.

Predisposing causes of milk fever

Excessive dietary calcium. Cows consuming more than 100 grams of calcium per day are more likely to develop milk fever than those consuming less than 100 grams per day. Excess calcium in the diet in the dry period may reduce the responsiveness of bone to mobilize calcium rapidly after calving. Excess phosphorus intake, above 40 grams per day, may further potentiate the problem. **DO NOT** feed free choice minerals to dry cows.

Calcium-phosphorus ratio in the diet. No specific ratio has ever been identified as a causative milk fever factor. Calcium should always be at least 1.4 times greater than phosphorus in diets, but avoiding excessive calcium intakes during the dry period is more important in preventing milk fever than balancing for a specific ratio of calcium to phosphorus.

Low dietary magnesium levels. Cows deficient in magnesium are more prone to milk fever than cows receiving adequate amounts. Dry cow diets should contain .16 percent magnesium in the dry matter. Grass tetany should not be confused with milk fever; however, the treatment for grass tetany is similar to that for milk fever.

Fat cows. Dry cows that are overconditioned (score 4.5 or greater on 1 to 5 scale) or fed large

Daily nutrient requirement of dry cows

	Body weight (lb)				
	800	1000	1200	1400	1600
Crude protein, lb	1.5	1.6	1.9	2.2	2.5
Net energy, mcal	8.7	10.2	11.7	13.2	14.5
Calcium, grams	24	30	36	42	48
Phosphorus, grams	15	18	22	26	29

quantities of grain during the dry period may be more susceptible to milk fever than cows in good condition (score 3 to 4.5) and fed good quality grass forages and limited grain (less than .5 percent of body weight per day).

Prevention of milk fever

Dietary calcium and phosphorus. Avoiding large excesses or a deficiency of nutrients in the dry cow diet appears to be the best way of preventing or controlling milk fever. Calcium and phosphorus requirements are shown in the table at the bottom of the previous page. Avoid feeding over 100 grams of calcium and 40 grams of phosphorus per day. All dry cow diets should contain an adequate quantity of magnesium and a minimum of 540 IU of vitamin D per pound of dry matter. Feeding or injecting massive doses of vitamin D is not recommended.

Feeding calcium-deficient diets (10 to 20 grams per day) starting two weeks before calving has been an effective means of reducing milk fever problems. The dietary calcium deficiency stimulates mobilization of calcium from bone. Dietary restriction of calcium is difficult to implement under practical management conditions because of the calcium content of most forages. It requires feeding corn silage or other low calcium forages in limited amounts with some corn grain. All dietary and free-choice supplemental sources of calcium must be withdrawn during this period.

Ammonium chloride and ammonium sulfate supplementation. Cation-anion balancing of dry cow diets two to three weeks before calving may also reduce milk fever incidence. Diets high in cations, sodium, and potassium tend to induce milk fever, whereas diets high in anions, chloride, and sulfur tend to prevent milk fever. Calculations for estimating cation and anion balance in a diet containing 1 percent potassium, .25 percent sodium, .3 percent chloride, and .2 percent sulfur are shown below.

Potassium—.039 grams/milliequivalent (g/meq)
Sodium— .023 g/meq
Chloride—.036 g/meq
Sulfur—.016 g/meq

100 grams of dietary dry matter contains:
1 gram of potassium or 1/.039 = 25.6 meq
.25 grams of sodium or .25/.023 = 10.9 meq
.3 grams of chloride or .3/.036 = 8.3 meq
.2 grams of sulfur or .2/.016 = 12.5 meq

Cation-anion balance is:
(Potassium + Sodium) - (Chloride + Sulfur)
(25.6 + 10.9) – (8.3 + 12.5) = +15.7

This diet contains 15.7 meq more cations than anions per 100 grams of dry matter and would be implicated as a cause of milk fever. The balance of cations and anions in diets should be equal or slightly negative (more anions than cations) to prevent milk fever.

Colorado research indicates feeding 100 grams of ammonia chloride and 100 grams of ammonia sulfate per day to dry cows starting three weeks before calving was effective in preventing milk fever when diets contained 75 to 150 grams of calcium. These ingredients are relatively unpalatable and need to be mixed with grain or into a total mixed ration for best consumption.

Management. Incomplete milking is sometimes practiced as a preventive measure for milk fever. This practice is not recommended, as incomplete milking increases the chance of mastitis. However, many veterinarians feel complete milk-out of cows following a milk fever treatment contributes to a relapse of milk fever. Research on incomplete milking does not support this practice. Discuss this practice with your veterinarian, considering the effect on udder health.

Pre-treating milk fever-prone cows with a calcium solution before milk fever signs occur may be of little benefit. Look for the very early signs and then treat.

Feed four ounces of dicalcium phosphate the day of calving and for one or two more days. Administer as a drench if necessary. This recommendation has not been tested, so is only a suggestion for previous lactation problem cows.

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