Using rectal temperature measurements in fresh cow monitoring programs and treatment protocols.

Senior Seminar by
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Today's dairy industry is marked by decreasing or stagnant profit margins[1] and tight labor markets. Input costs continue to rise faster than the milk price. At the same time cost of living increases and government regulations have forced farm managers to increase the wages and benefits paid to employees and themselves. Payroll is second only to feed cost, in operating expenses on dairies.[1] This puts farm managers under increasing pressure to use their employees more efficiently and effectively. While our ability to manage the nutrition and genetics of cattle has dramatically increased the productivity of dairy cattle, it also causes additional stresses that need to be managed.

Along with watching labor costs, farms must also make efficient use of their high priced consultants. The one consultant that appears at the top of the list is the herd veterinarian. Gone are the days of the veterinarian being the primary health care giver of all of the cows. Farm managers cannot afford to pay veterinarians $80-$90 per hour to diagnose and treat all of the cows that might get ill. This job then falls to the employees of the farm. The veterinarian must then develop systems and protocols whereby sick cows are appropriately diagnosed and treated in his or her absence. These protocols must be kept simple, as many of the farm employees are either undereducated or language challenged. Developing protocols that can be easily translated, understood, an implemented is becoming increasingly important.

The majority of cattle disease in modern management systems occurs in the immediate postpartum period. It becomes imperative that this period receives proper weight in the design of health systems. Protocols must, however, be kept in balance with the overall efficiency goals of the farm. They also must be simple to ensure they will be done by the farm staff. This seminar will examine the recent advent of daily monitoring of rectal temperatures in fresh cows. Is it a practical tool for identifying and treating sick cattle? What are the advantages and disadvantages of using a single monitoring parameter? What is the best way to implement the system on farms?

The first step in this process is to review those diseases that are important in the fresh cow. The diseases that occur at freshening (dystocia, prolapsed uterus, parturient paresis and retained fetal membranes) are easily recognized through general observation by farm employees. The diseases occurring in the immediate postpartum period (1-14 DIM) are not as easy to diagnose without some training or tools. These include ketosis, indigestion, displaced abomasum, mastitis and metritis. First we will examine these

diseases more closely with our focus on the postpartum period. Then we will try to simplify the diagnosis through a few easily administered tests.

One of calcium's main roles in the body is in muscle contraction. It's action can be divided again into effects on skeletal muscle and smooth muscle. Clinical hypocalcemia in cows is easy to recognize due to its effect on skeletal muscle. At subclinical levels its effect is mainly on smooth muscle in the gastrointestinal tract. Hypocalcemia decreases smooth muscles ability to contract and thereby decreases gut motility. The decreased motility can be seen mainly as decreased feed intake. It may also play a role in displacement of the abomasum. In group housed cattle efficient measurement of rumen motility or feed intake is difficult. Subjectively measuring rumen contraction by auscultation would take several hours in a large group of fresh cows. It does however, translate into decreased milk production. On farms with daily recording of milk weights this information becomes available and can be used to detect problems. This does include some time lagsince the decreased feed intake occurs before the drop in production.

Milk weights can also be used to identify another common postpartum problem. Displaced abomasums cause decreased feed intake which then translates into decreased milk production. The diagnosis is by auscultation and percussion with follow up surgical treatment.

The majority of cows with clinical mastitis are identified by examination of the milk for abnormalities. This is usually included as part of the milking routine. Another inexpensive and simple tool that can be used is the California Mastitis Test. This does require some experience to get repeatable results. Other means of identifying abnormal milk include conductivity meters which can be included in an automatic parlor monitoring system. Treatment protocols vary from farm to farm depending on the predominant organisms present on the dairy, and their sensitivity.

Diagnosis of ketosis is usually limited to the measurement of ketones in the urine or milk. This is an easy test to perform, although it can be very time consuming and lacks some specificity. Again, daily milk weights may ba a useful primary diagnostic tool. Ketosis is generally treated with intravenous dextrose, oral propylene glycol, and the possible addition of gluconeogenic drugs.

This leads to the final general category of disease in postpartum dairy cows, uterine infections. In the past, several protocols have been used in fresh cows. Included in these was the treatment of all cows with retained fetal membranes. This was an attempt to prevent metritis. However, it has been shown that

many cows with RFM can pass them with limited self-curing infections. The other option is to postpone treatment of RFM until metritis can be diagnosed. This diagnosis often requires rectal palpation and lochia observation. This is obviously avery subjective diagnosis when made by these methods. Failure to treat cows with metritis can have both negative economic[2] and animal welfare consequences.

The need to simplify the diagnosis and treatment of fresh cow diseases now becomes apparent. Although the number of common fresh cow diseases is small, their diagnosis can be somewhat complex. Generally their diagnosis can be simplified by focusing on the treatment options that farm employees have. There are four basic categories of drugs at employees' disposal for use in dairy cattle. They are calcium products, intramammary antibiotics, glucose or gluconeogenic products, and systemic antibiotics. In addition, transfaunation or "stomach pumping" is becoming a popular adjunctive treatment to those above. Categorizing diseases by this method greatly simplifies treatment algorithms and ensures proper treatment.

To this end, I propose that a "fresh cow database" of appetite, ketone status, milk character and rectal temperature can give farm employees the information they need to make reasonable theraputic decisions. By connecting each data point to a treatment we end up with simple algorithms. Cows with abnormal appetites should be checked for a displaced abomasum and treated with calcium and transfaunation or stomach pumping. Abnormal milk should trigger the mastitis protocol. Ketonuria is treated with dextrose ± steroids. Finally, high temperatures are treated with systemic antibiotics.
There are two basic questions we need to answer about fever. What constitutes a fever in a dairy cow? And, what does a fever tell us? True fever is a change in the thermoregulatory set point in the hypothalamus. It must be differentiated from hyperthermia which is caused by an inability of the body to rid itself of heat faster than it is generating it. This occurs when the ambient temperature and humidity interfere with heat loss. True fevers are most often caused by the release of pyrogenic substances that act directly on the hypothalamus. Other causes may include direct hypothalamic involvement with a tumor or a toxic insult to the hypothalamus. Two of the most studied pyrogens in the body are IL-2 and TNFα. They are produced when body tissues become damaged. Infections cause the overwhelming number of fevers although general tissue trauma can also be a causative agent. A distinction between bacterial and viral infections must be made. One simple way to judge the cause is to see whether the fever responds to

antimicrobial therapy. This means that good record keeping of treated cows and their response to treatment is necessary.

Let's go back to the first question. What constitutes a fever in dairy cows? The Merck Veterinary Manual lists the normal rectal temperature of dairy cattle as 101.5 ±1˚F. With this information any rectal temperature over 102.5˚F would constitute a fever. However we must correct for any baseline hyperthermia that might be present. Research has shown that the rectal temperature of cattle will increase by 1-2˚F when they are exposed to high ambient temperatures.[3] This infers that a seasonal adjustment should be made to the "normal" rectal temperature. A one degree adjustment seems reasonable for the summer ambient temperatures that are experienced in the northeast part of the United States. This adjustment does not need to be made in cooler seasons, but later discussion will show that 103˚F should be used rather than 102.5˚F.

Another factor that needs to be taken into account is the diurnal temperature pattern that occurs in dairy cattle. There is approximately a 1˚F variation in rectal temperature that occurs over the course of 24 hours. The lowest temperature occurs around 4:00 AM and the highest around 7:00 PM.[4] This suggests that any temperature monitoring should occur at the same time every day to control for diurnal variations. Taking early morning temperatures will reflect the most accurate physiological temperature by eliminating any daytime temperature variations.

We will examine the last algorithm in detail using one New York dairy farm's protocol as an example. Venice View Farm is currently milking about 2200 cows in their facility in Venice, New York. Throughout the year they average about 7 freshenings per day. If we assume that all fresh cows need to be monitored daily for at least a week postpartum, then they need to monitor on average 50 cows per day. If the average physical takes 5-7 minutes then monitoring with physical exams would take between 4 and 6 hours per day. In an attempt to decrease this time and to more effectively use their resources Venice View Farm has started taking rectal temperature measurements on all fresh cows. It is done in the palpation rail as the fresh cows exit the parlor. They then use this information combined with daily milk weights to determine what cows need further diagnostic workup or treatment.

There have been two recent studies looking at the use of rectal temperature monitoring in fresh cows as a trigger for antibiotic use. Chun (2001) looked at 330 cows whose rectal temperature exceeded

103.1 F in the first 10 days of lactation. These cows were randomly assigned to a treatment group who received three daily treatments of ceftiofur (1 gram) or a control group who received no treatment. Cows who received treatment showed a significantly higher cure rate as judged by decreased rectal temperature, no further antimicrobial use, and no clinical signs. However, there was an interaction between treatment and vaginal discharge. In cows that did not have a vaginal discharge, there were no significant differences in the cure rates between the treated and control groups. Cows with vaginal discharge showed an odds ratio for cure of 3.14 when treated with ceftiofur.[5]

Kristula et al. did a larger study involving 1042 cows on a farm in Pennsylvania. On this farm they recorded daily rectal temperatures for 10 days postpartum. Primiparous cows with rectal temperatures above 103 F and multiparous cows above 103.5 F for two days were treated with 5 days of ceftiofur (1 gram). Health events of dystocia, mastitis, metritis, and retained fetal membranes were recorded. Any cows with these events were labeled abnormal, all others were labeled as normal. In this study cows treated with systemic antibiotics responded with a significant drop of 1˚F in rectal temperature by the following day.

This study also gave some insight into what temperatures should be used for monitoring programs. They found that 48% of normal cows had rectal temperatures greater than 102.5˚F for an average of 1.9 days. This means that rectal temperatures must exceed 103 F for two days to be an accurate predictor of disease. Cows receiving antibiotics had average rectal temperature of 103.5˚F on the day they received initial treatment.

In this study 41% of the cows labeled as normal were treated with antibiotics and responded with a decrease in temperature. This means that if the cows not showing overt disease on a farm are ignored, then any cows that would benefit from the use of antibiotics would be missed. On the other hand, 45% of cows defined as abnormal did not receive antibiotics. The lack of temperature increase suggests that these cows were able to overcome their disease processes and acheive a self cure. In this study the cows diagnosed with metritis and retained fetal membranes received the highest antibiotic use, 98% and 72% respectively[6]. Some questions still remain. What are the economic benefits from the decreased temperature in the cows that are treated? Would there be benefits to treating all cows with retained fetal membranes? These questions will undoubtedly be answered in future studies.

The use of systemic antibiotics in food animals has come under intense scrutiny. Increasing resistance of some bacterial species and strains, and contamination of the food supply are some of the concerns. The challenge to the food animal veterinarian then becomes how to best use the antibiotics we have. A balance must be struck between overuse in the treatment of animals not requiring them, and the welfare of the animals that do. Failure to treat cows can have severe economic consequences. Metritis can increase days to conception by 19 days and reduce first service conception rate by 20%[7]. The social consequences of continued development of multi drug resistant bacteria must also be considered.

The decision to treat animals with systemic antibiotics is made daily on farms in the absence of direct veterinary input. There is a need for a simple diagnostic tool that is both sensitive and specific in identification of cows needing systemic antibiotics. Rectal temperature monitoring reasonably fulfills these criteria in the absence of veterinary diagnosis. It remains important that the veterinarian monitor the data that is collected and make adjustments as needed to any protocols. Furthermore, performing further diagnostics on animals that do not respond to treatment is important in disease surveillance.

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