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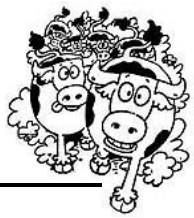

HERD-BASED DIAGNOSIS OF SUBACUTE RUMINAL ACIDOSIS

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Introduction

Subacute ruminal acidosis is a common health and production problem in the cattle industries of the United States. It is a risk wherever cattle are fed diets rich in starch in order to achieve high rates of growth or milk production. For a variety of reasons, subacute ruminal acidosis has been a difficult diagnosis to make in the field. Foremost, the absence of specific diagnostic tests has made the diagnostician dependent on recognizing the syndrome of characteristic secondary clinical signs within the herd. A tentative diagnosis of subacute rumen acidosis is usually confirmed by the herd response to corrective nutrition. If the diagnosis proves to be correct, fault will be assigned to either the nutritionist who formulates the ration, the feed supplier who may mix and deliver feeds to the dairy, or to the herd owner or manager who is responsible for the feed delivery system. Into this arena of vested interests, a veterinarian with modest or poor training in nutrition has to justify the tentative diagnosis based upon secondary signs of the problem. The situation is a potential point of stalemate or conflict in the resolution of herd problems, and begs for a more objective diagnostic approach. Used in conjunction with clinical observations and ration analysis, rumen fluid analysis can aid in making the diagnosis of subacute ruminal acidosis (1).

Clinical Syndrome Of Chronic And Subacute Ruminal Acidosis In A Dairy Herd

Unlike the severe illness of acute or peracute ruminal acidosis, the clinical signs at the time of the subacute ruminal acidosis insult may include a mild diarrhea, a moderately distended and doughy rumen, a reduction in feed intake, and subsolar hemorrhages into the hoof (2). Individual cows with these problems may not be noticed, particularly in the group housing and feeding systems typical of larger herd management systems of our time.

Dairy herds with chronic and subacute ruminal acidosis usually show secondary signs which include laminitis, poor body condition in spite of adequate energy intake, abscesses without obvious causes, hemoptysis or epistaxis, abomasal disease, and high herd cull rates for poorly defined health problems. Epistaxis and hemoptysis are manifestations of the "posterior vena caval thrombosis" syndrome (2) and usually a sequelae to rumen acidosis. Many veterinarians who work with these herds observe a poor therapeutic response of conditions like metritis and mastitis to routine therapy and become suspicious of "immunosuppression" in the herd. These secondary signs of acidosis do not appear until weeks or months after the causative events. A herd profile of the characteristic secondary clinical signs can be strongly suggestive of subacute acidosis, but each sign by itself could have other causes.

Ration Analysis

A careful analysis of the herd rations is certainly a useful diagnostic procedure. In the nutrient system used in the US, particular attention is given to the amounts of acid detergent fiber, neutral detergent fiber, non-fiber carbohydrates, added fat, and crude protein.

However, a tentative diagnosis of ruminal acidosis should not be ruled out based upon the ration analysis alone. There are two problems with an emphasis on the ration analysis. First, the ration printout does not always reflect the ration that the cows consume. It is sometimes difficult or impossible to accurately measure the actual consumption of ration components which makes the nutrient analysis into guesswork. Second, even if the ration is accurately described, the nutrient analysis does not fully predict what will happen in the rumen. In addition to the nutrient content of the ration, rumen pH will depend upon total intake, particle size, moisture, consumption patterns, and many other confounding factors. Several of these factors will be discussed in part two of this paper.

Herd Milk Fat %

"Normal" herd average milk fat % has been commonly and inappropriately used to rule out ruminal acidosis in herds. Abnormal low milk fat % is frequently a result of acidosis, but can occur due to excess ration fat, ionophores, and other potential causes. However, many herds with normal average milk fat % have significant acidosis problems. This is particularly true if the herd acidosis problem affects primarily the periparturient cows. Early lactation cows are quite sensitive to ruminal acidosis, but milk fat % of these cows is not well related to ruminal pH. In herds with multiple rations, subgroups of

the herd may experience ruminal acidosis and produce low fat milk, but their milk is pooled with the rest of the herd which may mask the effect.

Rumen Fluid Analysis

Oral collection of rumen fluid has been used for many years in research trials and for transfaunation of other cattle. Several devices such as the Dirksen probe and the Geishauser probe have made collection of moderate quantities of fluid feasible. However, samples collected orally become contaminated with variable quantities of saliva which limits their value for evaluating subacute ruminal acidosis. In addition, their use as a veterinary diagnostic instrument is awkward in that they do not fit readily into typical veterinary practice units used in the US and they are difficult to clean which makes them potential fomites of infectious agents from farm to farm.

Rumenocentesis procedure

Rumenocentesis, the collection of rumen fluid by percutaneous needle aspiration, has become a common diagnostic test in the United States. The technique has been described in detail (3), but essentially involves inserting a needle into the ventral rumen and aspirating a sample of rumen fluid. Landmarks for the puncture site are the left side, on a horizontal line level with the top of the patella about 15 to 20 cm posterior to the last rib. The site is clipped and prepared using a standard three scrub surgical preparation. We do not use sedation or local anesthetics. Rather, the cow is restrained in a stanchion or head-lock and one assistant elevates the tail of the cow while another assistant inserts a "nose leader" and pulls the cow's head to the right side. The clinician inserts the needle within a few seconds after the nose-leader is inserted. A disposable needle of 4" or 5" length (Air-Tite Products Co., Inc., 565 Central Drive, Virginia Beach, VA 23454) is thrust through the skin, then into the rumen and fluid is collected with very slight aspiration. The needle will usually become obstructed by ingesta which is cleared by forcing a small volume of air or fluid back through the needle. When the needle becomes obstructed, it is important to avoid creating a negative pressure within the syringe as CO_2 will leave the fluid and increase the pH. Typically, 3 to 5 ml of rumen fluid can be collected with minimal difficulty. When a sufficient volume has been obtained, air is evacuated from the syringe and pH is measured immediately.

Time of sample collection relative to feeding

Samples should be collected at a time when rumen pH is likely to be near the lowest point of the day. If the ration is fed as separate components, rumenocentesis should be performed between 2 to 4

hours after the cow is offered the primary concentrate meal of the day. If the ration is fed as a total mixed ration (TMR), the samples should be collected at 4 to 8 hours after the cows get access to the fresh ration.

pH determination

The use of a pH meter is recommended for the measurement. We have not made a complete survey of pH meters, but of the meters we have used, we recommend the Cardy Twin pH meter (Spectrum Technologies, Inc., Plainfield, Illinois 60544, USA, Telephone 815-436-4440). It is small, durable, and packed in a field case. It has a digital read-out, can function with just a few drops of fluid, and is equipped with a computerized calibration routine. In field use, we calibrate the meter using standard solutions of pH 4.0 and 7.0, read the samples, and then check accuracy of readings using the standard solutions again.

The alternative of pH indicator paper is problematic in that the gradations on the narrowest papers we can find are 0.3 pH units. Frequently, the color cannot be matched to a single reference value. The combination of greenish rumen fluid and poor lighting in many barns present additional practical problems for pH papers.

While there are advantages in communication of results if the readings are done cowside, the samples can be collected and held cold for pH analysis later. We measured pH of 18 samples on farm, kept the remainder on ice in capped plastic syringes from which air was expressed, and retested in 7 hours. The mean change in pH was less than 0.05 pH units and did not change the diagnostic classification of any animal or group. This limited analysis suggests that the samples, if kept cold, can be held for pH determination in a laboratory later that day.

Interpretation of results

Based upon literature reviews of rumen fiber digestion and our clinical impressions from using the rumenocentesis test in investigations of acidotic herds, we recommended a pH of 5.50 as the cut-point between normal and abnormal (3). Since that time, prospective studies have identified pH of 5.5 as the best cut-point to distinguish normal and fiber-deficient rations (4).

Our guideline is that if 30% of 10 or more sampled cows are below 5.50, the group is classified as experiencing ruminal acidosis. It is important to avoid making a herd diagnosis based upon a few samples. We recommend that 10 or more cows should be sampled from any group in which acidosis is suspected. In a feeding trial of with a normal and a fiber deficient ration, we found a prevalence of 8% of the rumen samples below pH 5.50 in the “normal” high production ration and a prevalence of 40% below 5.50 in the “acidosis” ration. With these distributions of pH values, the interpretive guidelines offered above will be correct more than 95% of the time (4).

Effect of method of rumen fluid collection

The method of collection has an effect on the pH of the sample. This should be kept in mind when reading rumen acidosis scientific reports. Samples collected by rumenocentesis have lower pH values than those collected by oral routes and through rumen cannula. Rumenocentesis samples were about 0.3 pH units lower than rumen fluid collected simultaneously through rumen canal (4). In a study not yet published comparing different collection methods, samples collected with the Geishauser tube were about 0.3 pH units higher and an indwelling rumen pH meter was about 0.1 pH units lower than the samples recovered through a rumen canal.

References

1. Radostits, O. M., D. C. Blood, and C. C. Gay. 1994. *Veterinary Medicine,* ed. 8. London, Bailliere Tindall, p. 256.

2. Nordlund K. V. and E. F. Garrett. 1994. Rumenocentesis: a technique for the diagnosis of subacute rumen acidosis in dairy herds. *Bovine Practitioner* 28:104.

3. Nordlund, K.V., Garrett, E.F., and G. R. Oetzel. 1995. Herd-based rumenocentesis: a clinical approach to the diagnosis of subacute rumen acidosis in dairy herds. *Compendium Contin Educ Pract Vet.* 17(8): S48-56.

4. Garrett, E.F., M.N. Pereira, K.V. Nordlund, L.E. Armentano, W.J. Goodger, and G.R. Oetzel. 1999. Diagnostic Methods for Detecting Subacute Ruminal Acidosis in Dairy Cattle. *J. Dairy Sci.* 82:1170-1178.