

**“Cheryl’s Struggle with SARA”**

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**Introduction:**

Subacute Ruminant Acidosis (SARA) is defined as a ruminal pH less than 5.6 for greater than three hours per day.<sup>5</sup> As opposed to acute ruminal acidosis, SARA has a transient but chronic duration. Risk factors that predispose cattle to SARA include early lactation, primiparous cows, heat stress and most importantly, diets high in carbohydrates.<sup>1</sup> The prevalence among dairy cattle is difficult to measure due to intermittent periods of ruminal acidosis and lack of clinical signs, but is estimated to occur in 11-26% of lactating dairy cows.<sup>1</sup> Definitive diagnosis of SARA is difficult and therefore based on clinical signs combined with evidence at necropsy. Secondary sequela of SARA includes laminitis, liver abscesses and culling of affected cattle.

**History and Presentation:**

A 7-year-old Jersey cow, presented to Mississippi State University College of Veterinary Medicine's Food Animal Service on May 27, 2020 for a two-week history of ADR and inappetence. Two weeks prior to presentation, the patient was treated for diarrhea with Kaolin pectin and Probios. Her owner noted improvement in her stool but a decrease in appetite and temperature. The patient was treated with propylene glycol and oral CMPK. Her owner noted that her appetite would wax and wane, with a normal appetite for one day followed by periods of inappetence lasting two days. Her diet consisted of 18% dairy pellet (20 pounds per day), one scoop beet pulp, and one scoop alfalfa balage. It was noted that the patient had a normal calving in September 2019 and was approximately 5 months pregnant. Previous medical history included treatment by her referring veterinarian in January 2020 for loss of appetite, fever, and respiratory issues that were non-responsive to Florfenicol. At the time she was treated with Tulathromycin with improvement noted by her owner.

On presentation, the patient was bright, alert and responsive. Her vitals were within normal limits with a temperature of 101.2 degrees Fahrenheit, a pulse of 52 beats per minute and a respiratory rate of 24 breaths per minute. She weighed 394 kilograms with a body condition score of 2.75/5. Cardiopulmonary auscultation was within normal limits. Normal rumen motility and decreased rumen fill was noted. Bilateral jugular pulses were present. The pre-femoral and supra-mammary lymph nodes were bilaterally enlarged. The medial claw on the left forelimb was overgrown with notable weight bearing on the heel. During the exam, the patient began to grind her teeth. She ventroflexed normally on the withers pinch test. Rectal exam was within normal limits with a palpable fetus aged to be approximately 5-6 months.

### **Diagnostic Approach:**

Differentials included neoplasia, liver disease, traumatic reticuloperitonitis and parasitism. Following the initial physical exam, a fecal sample was collected for a fecal eggs per gram with an insignificant finding of 7 Strongyle eggs per gram. Blood was drawn for a complete blood count and large animal chemistry panel. Bloodwork results included anemia  $3.99 \times 10^6/\text{ul}$  (5.0-11.0), hyperfibrinogenemia 700mg/dl (100-600), neutrophilia 5,453/ul (600-4,000), hypoglycemia 58mg/dl (61-102), elevated AST 179U/L (64-76), elevated GGT 256U/L (10-35), hypoproteinemia characterized by hypoalbuminemia 2.3g/dl (2.4-3.7), hypocalcemia 8.9mg/dl (9.7-12.4) and hypomagnesaemia 1.9mg/dl (2.0-2.8). The results were consistent with a liver insult and decreased feed intake. Abdominal ultrasound examination was performed and revealed a 10x13 cm mass between the 7<sup>th</sup>-9<sup>th</sup> intercostal spaces on the right side. The combined results of the diagnostics led to a tentative diagnosis of liver abscess with consideration given to neoplasia.

Ultrasound is a sensitive but not specific modality of diagnosing liver abscesses. It is important to remember that the entire liver cannot be evaluated by ultrasound alone because the cranial portion of the liver is hidden by the lung field.<sup>3</sup> Definitive diagnosis of a hepatic mass requires biopsy to identify cell types within the lesion. However, studies describe the most common appearance of liver abscess via ultrasound to be a well circumscribed mass with a hypoechoic center between the 7-12<sup>th</sup> intercostal spaces. There may be pinpoint hyperechoic foci representing smaller abscesses. The presence of a capsule and hypoechoic center has been associated with chronicity.<sup>2</sup> Systemic evaluation of the liver should be performed on the right side beginning caudal to the last rib and extend cranially to the 5<sup>th</sup> intercostal space.<sup>3</sup> When a hepatic mass is identified, differentials should include abscess, neoplasia and cyst.<sup>3</sup>

Due to the appearance of the hepatic mass, a liver abscess was moved to the top of the differential list. The patient was prescribed Procaine Penicillin G (44,000 IU/kg) to be given once a day for 14 days and Probios. A recheck appointment was scheduled two weeks later to evaluate response to the antibiotic course. The patient represented on June 2, 2020 as her condition did not improve and her owner noted an elevated temperature the previous day. A fine needle aspirate of the left and right pre-femoral lymph nodes was performed. Cytologic examination revealed lymphoid hyperplasia consistent with antigenic stimulation. There was no evidence of infectious agents or neoplasia within the sample. Bloodwork was repeated and revealed an increase elevation in liver enzymes. A second abdominal ultrasound was performed, noting an increase in size of the hepatic mass. The patient was hospitalized and a laparotomy for abdominal explore was scheduled for later in the week.

## **Treatment and Management Options:**

Treatment of liver abscesses is most successful when they are less than three centimeters in diameter.<sup>3</sup> A broad-spectrum antibiotic is prescribed for 14 days. For valuable animals, abscesses can be drained through laparotomy if they are not directly adjacent to the abdominal wall. However, this treatment is rarely indicated in commercial livestock operations due to financial considerations and variable outcome. The liver cannot be fully evaluated through ultrasound and may have more extensive pathology than is identified on imaging modalities.

While in the hospital the patient continued to receive Procaine Penicillin G (44,000 IU/kg) once a day. Her appetite remained decreased with a mild interest in alfalfa hay and dairy pellets. The fetal heartrate was monitored during hospitalization.

## **Pathophysiology:**

The pathophysiology of SARA is complex and involves both local ruminal effects and systemic inflammation.<sup>5</sup> The rumen relies on forages for appropriate function. Diets that are high in concentrates enhance gluconeogenic precursors through microbial growth. Increased microbial populations cause an increased concentration of volatile fatty acids (VFAs). VFA concentrations within the rumen increase beyond the ability for them to be absorbed which subsequently decreases the rumen pH.<sup>6</sup>

Grain feeding has been shown to increase the number of *E. coli* within the rumen. Gram negative bacteria are sensitive to low pH and death of these bacteria incite an inflammatory response within the rumen. Rumenitis occurs which compromises the epithelial barrier allowing bacterial translocation and release of endotoxin into the systemic circulation.<sup>5</sup> Rumen bacteria leak into portal circulation leading to liver abscesses.

Clinical signs of SARA are often absent until secondary complications from liver abscessation occur. Generalized signs indicating SARA may be present in a herd include decreased dry matter intake, loss of body condition, laminitis and loose feces. However, these clinical signs are an insensitive indicator of SARA.<sup>1</sup>

Reducing the incidence of liver abscesses in feedlot cattle is achieved by adding an antimicrobial compound to the feed. Antibiotics act to inhibit the main bacterial players, *Fusobacterium necrophorum* and *Trueperella pyogenes*, in liver abscess formation. Tylosin phosphate is the most effective antibiotic mixed into the feed.<sup>8</sup> However, this antimicrobial is not labeled for use in lactating dairy cattle. Under the veterinary feed directive, antimicrobial compounds cannot be used in an off-label manner. Efforts to reduce the incidence of liver abscesses in dairy cattle must be achieved through other avenues.

Nutrition management is the most important component of preventing SARA and its sequela. As milk production increases, the need for nutrition density increases and grains that are high in carbohydrates are added to the diet. However, physical fiber, such that is provided by forages, are necessary for appropriate rumen function. Physical fiber enhances cud chewing adding salivary buffer to the gastrointestinal contents. It also has roles in maintaining rumen motility, mixing and function of the rumen ecosystem.<sup>4</sup> Both forage amount and length should be maintained. A risk of forages that are too long in length within a total mixed ration may be sorted. This leads to cattle selectively eating greater amounts of carbohydrates and fewer of the offered forage material.

## **Case Outcome:**

On June 4<sup>th</sup>, the fetal heartrate was slow indicating impending abortion. The patient was placed on the hydraulic tilt table for a corrective foot trim prior to abdominal explore scheduled for the following day. On June 5<sup>th</sup>, there was a clear stream of mucus discharge from the patient's vulva and abdominal contractions were noted. The abdominal explore was delayed until the patient expelled the fetus due to the risk contractions would have on the surgical site. On June 6<sup>th</sup>, abdominal contractions had ceased without expulsion of the fetus. A rectal exam was performed, and the fetus was palpated but could not be extracted. The patient received Dexamethasone and Lutalyse to induce labor. Labor did not progress and the patient's condition continued to decline. Options were to perform a c-section and abdominal explore. However, due to poor prognosis despite therapy. humane euthanasia was elected and a necropsy performed.

Necropsy revealed numerous, disseminated nodules in the liver and one large mass that was 17x22x6cm in size in the cranial aspect of the right middle liver lobe. The nodules contained yellow, caseous material. Aerobic culture of the mass revealed faint growth of *Escherichia coli* and *Streptococcus* species. Although not found in this sample, the most common etiologies of liver abscesses are *Fusobacterium necrophorum* and *Treuperella pyogenes*.<sup>6</sup> There was multifocal small areas of fibrosis along the hepatic and diaphragmatic serosa. Incidental findings included rumen flukes. Interestingly, there was mineralization in multiple tissues (intima of the aorta/aortic valve, mucosa of the larynx and cranial trachea). The mineralization is thought to be metastatic mineralization; however, a cause was not identified.

**Conclusion:**

SARA is a complex disease that should be prevented as treatment methods can be unrewarding once secondary sequela develops. SARA contributes to long-term production consequences such as decreased dry matter intake, milk fat depression, reduced fiber digestion and loss of body condition.<sup>7</sup> Cattle are usually culled from the herd prior to diagnosis due to limited diagnostics and poor production. Appropriate nutritional management among dairy herds is the most effective preventive measure to prevent subacute ruminal acidosis.



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