

**Lily's Lucky Lesions**

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## **Introduction:**

Bovine Papular Stomatitis (BPS) was first described in 1884 and first recognized in the United States in 1960.<sup>3</sup> It is caused by the Bovine Papular Stomatitis Virus which is a Parapoxvirus within the Poxviridae family.<sup>1,5</sup> BPS is present worldwide and infects young and immunocompromised cattle most commonly.<sup>5,6</sup> Clinical signs of acute BPS include hyperemic and/or raised lesions on the mucous membranes, muzzle, or nose.<sup>3,5</sup> Erosions or shallow ulcers can be observed in similar locations.<sup>6</sup> Another form is also observed in lactating cattle where lesions appear on the teats, as well as a chronic form that has been described as extremely fatal. The morbidity rates associated with BPS can be extremely high in severe outbreaks but mortalities are rare with the acute form.<sup>6</sup> This disease is easily overlooked by farm staff and veterinary professionals because it is most often benign and/or asymptomatic, however, it may be more common than we realize.<sup>3</sup> This discussion will focus on a case of BPS seen in a calf at Mississippi State University College of Veterinary Medicine.

## **History and Presentation:**

H607, also known as Lily, was 4 week old mixed breed beef heifer that presented to the MSU-CVM Food Animal Service on October 14, 2020 for bloody diarrhea and lethargy. She was brought in by the workers at MAFES Prairie Branch as soon as the bloody diarrhea was noted.

On examination, she was depressed and dull. She weighed 36.3 kilograms (80 pounds) and appeared thin, with a body condition score of 3 out of 9. She had a rectal temperature of 104.5 degrees Fahrenheit, a heart rate of 148 beats per minute, a respiratory rate of 24 breaths per minute, and her mucous membranes were pink with a capillary refill time of less than 2 seconds.

On auscultation of her heart and lungs, no murmurs, arrhythmias, crackles, or wheezes were appreciated. On auscultation of her gastrointestinal tract, she had noticeably decreased borborygmi. She had injected vessels in her sclera bilaterally and dried bloody feces surrounding her rectum and tail. During her exam, she defecated and her feces consisted of frank blood and mucosal shreds. The remainder of her physical exam was within normal limits.

### **Diagnostic Approach:**

Following Lily's initial physical exam, bloodwork revealed a mild increase in PCV at 48% indicating dehydration, a mild monocytosis, hyponatremia, hyperkalemia, hypochloremia, hypoproteinemia, hyperphosphatemia, hypomagnesemia, an elevated creatinine kinase, and decreased CO<sub>2</sub> which indicated metabolic acidosis. A fecal float was performed in which no ova were seen and a Salmonella screening protocol was started which consisted of 5 fecal samples on days one through five of hospitalization. All five of the samples were negative for *Salmonella spp.* An abdominal ultrasound did not reveal any abnormalities other than decreased amount of ingesta in the small intestines. After the initial workup, Lily and her dam were placed in an outdoor isolation pen due to her bloody diarrhea.

On day 5 of hospitalization, Lily developed proliferative and ulcerative lesions throughout her oral mucosa and chin while continuing to have profuse liquid bloody diarrhea. She also developed thrombophlebitis in her right jugular vein from the intravenous catheter and it was subsequently pulled. Due to her continued and worsening clinical signs, another chemistry was performed which revealed mostly improved electrolytes and a normal CO<sub>2</sub>, indicating her metabolic acidosis had resolved.

The development of oral mucosal lesions while hospitalized prompted us to perform an ear notch to test Lily for Bovine Viral Diarrhea Virus (BVDV) using SNAP ELISA, which was negative. A few days later (day 8), two biopsies of the lesions on her chin and dental pad were submitted for histopathology. Due to the appearance of the lesions and similarity to multiple foreign animal diseases, the State Veterinarian was contacted to alert them of Lily's case before biopsy results were finalized. Lily and her dam were placed under quarantine the following day and no direct contact was allowed with humans or other animals until the State Veterinarians could perform their own testing. On day 8, before quarantine was initiated, a recheck abdominal ultrasound was performed which showed an increased amount of hyperechoic lines in her liver (potentially an increased amount of fibrous tissue) and thickened intestinal walls with normal gastrointestinal motility. The afternoon of day 10 of hospitalization, the State Veterinarians arrived at MSU-CVM to examine Lily and collect multiple tubes of blood, nasal swabs, swabs of her oral lesions, and esophageal fluid samples. These samples were sent to Plum Island Animal Disease Center in New York to test for various Foreign Animal Diseases (FAD).

On day 15, biopsy results were finalized and revealed thickened and hyperplastic epithelium with intracellular edema and intraepithelial pustules. Numerous keratinocytes also contained eosinophilic and intracytoplasmic viral inclusion bodies. These histopathologic findings were consistent with Bovine Papular Stomatitis. By day 20, all of Lily's clinical signs and lesions were improving rapidly. Based on the histopathology results and preliminary FAD testing results, she was cleared by the State Veterinarian to be discharged from the hospital. Three days after she was discharged, the FAD results were finalized which showed that she tested negative for Foot and Mouth Disease (FMD) and Vesicular Stomatitis (VS) in all samples that were submitted.

Definitive diagnosis of Bovine Papular Stomatitis consists of clinical signs, classic histopathological lesions, and viral isolation.<sup>6</sup> In Lily's case, we used her clinical signs, histopathology results, and ruling out specific FAD to make her diagnosis.

### **Differential Diagnoses:**

Important differential diagnoses that were considered for Lily's bloody diarrhea included *Salmonella spp.*, *Clostridium perfringens* Type A, *Coronavirus*, BVDV, *Eimeria spp.*, and *Cryptosporidium parvum*.<sup>4</sup> The cause of Lily's bloody diarrhea was never officially diagnosed despite many different tests performed to rule in or out common calf diarrhea pathogens.

Important differential diagnoses that were considered for Lily's oral mucosal and chin lesions included BVDV, BPS, FMD, and VS. Due to the results of all her diagnostics and confirmation via histopathology, Lily's official diagnosis was Bovine Papular Stomatitis.

### **Pathophysiology:**

BPS typically infects cattle aged 1 month to 2 years old or immunocompromised individuals.<sup>6</sup> This disease is closely related to Contagious Ecthyma and Pseudocowpox and has similar clinical lesions caused by BVDV, FMD, and VS.

Clinical signs of acute BPS typically start with small, hyperemic foci on the muzzle, nose, oral mucosa, or esophagus that later increase in size and become raised or convex. These lesions later develop a rough texture and expand peripherally but eventually begin to heal in the center.<sup>3,5</sup> Erosions or shallow ulcers can also be observed in the same locations, as well as the rumen.<sup>6</sup> Lesions can take up to 3 weeks to regress but the healed spots (appearing yellow, brown, or red) can persist for several more weeks.<sup>5</sup> According to one study in Canada, multiple affected

calves that were observed had a decreased appetite, increased temperature, loose feces (some blood tinged), decreased rumen contractions, and a dull appearance. Most cases described throughout the research do not have other clinical signs besides oral lesions, however, sometimes there is a concurrent disease or mild systemic disturbance.<sup>3</sup> Animals infected with BPSV can also be completely asymptomatic and serve as a reservoir for the virus.<sup>6</sup>

Occasionally BPS will affect the teats of lactating cows as well, both dairy and beef cattle. These teat lesions are associated with severe local pain in which they are unable to be milked and occasionally develop secondary mastitis. This is economically significant due to decreased milk production and interruption of lactation in affected herds. These lesions are frequently transmitted to humans due to the high amount of contact between the cows and milking personnel. In a study describing teat lesions, the clinical course for affected cows was 7 to 12 days.<sup>2</sup>

A previously unreported chronic form of BPS was first described in Israel in the 1990s. The chronic form is severe, generalized, and fatal after several weeks. Clinical signs of the chronic form described in this study consist of proliferative and necrotic stomatitis, profuse salivation, decreased appetite, increased body temperature, generalized focal exudative necrotic dermatitis, and hyperkeratosis around the mouth, anus, and ventral tail. All animals that were studied with the chronic form died within 4 to 6 weeks.<sup>7</sup>

Histologic lesions of BPS appear as hydropic degeneration of epithelial cells of the affected tissue. If the lesions reach the ulcerative stage, secondary necrosis, bacterial invasion, and epithelial sloughing can also be observed.<sup>5</sup> Most commonly, eosinophilic cytoplasmic inclusion bodies are seen in the epithelial cells.<sup>3, 5</sup>

BPS is transmitted through direct contact with an infected bovine. Secondary lesions can also be spread through blood and intravenous inoculation which results in characteristic lesions occurring in the upper gastrointestinal tract.<sup>5</sup> In one study, the experimental incubation period was 3 to 9 days. One calf in this same study was resistant to re-infection within 2 months but the entire length of immunity was not studied.<sup>3</sup> BPSV has been isolated from adult animals which may serve as a reservoir for younger calves.<sup>7</sup> BPS is zoonotic and can be spread to humans through direct or close contact with infected bovines. In humans, clinical signs consist of painful localized skin lesions and papules, also termed a “Milker’s Node”.<sup>1</sup> According to a study performed in Brazil, these lesions in humans progressed to ulcerative and scabby lesions in 4 to 7 days.<sup>2</sup> Treatment of human lesions is not common since they typically resolve on their own.<sup>1</sup>

### **Treatment:**

After initial physical exam and workup, Lily was given Banamine 1.1mg/kg IV every 24 hours as needed to treat her fever and endotoxemia, Excenel 1-2 ml/100 lb SQ every 24 hours (for 5 days), and Penicillin 44,000 IU/kg both SQ and PO every 24 hours. An intravenous catheter was placed in her right jugular vein and she was started on Lactated Ringers Solution (LRS) IV at 120ml/kg/day. She was offered 4 pints of milk every 12 hours in a bottle but was also observed to be nursing her dam through the fence periodically. The following day (day 2), she was switched to a 1 liter bolus of LRS IV every 6 hours and the antibiotics and Banamine were continued.

On day 4, the LRS boluses were discontinued and a 4 day course of Albon was started. She also began to receive a Hydralyte packet PO every 24 hours. The following day (day 5), she finished a 5 day course of Excenel and the PO Penicillin was discontinued. A half of an

Endosorb bolus every 12 hours was also started. Although not many changes (good or bad) were noted up until this point, on the morning of day 8, Lily seemed more lethargic and would not eat her grain which was abnormal for her. At this time, she was still receiving Hydralyte, Penicillin SQ, Albon, Endosorb boluses, and Banamine as needed. Overall, Lily received only 3 doses of Banamine over an 8 day period.

On the morning of day 9, Lily was not improving and appeared more dehydrated. At this point, we were suspicious of an abomasal ulcer and began treating her with Sucralfate 1 tablet PO every 12 hours, Probios 1 tablet PO every 24 hours, and Kaopectate PO every 24 hours. Later that morning, the State Veterinarian put Lily and her dam under quarantine due to the development of oral lesions. No more treatments or medications were administered until they could do FAD testing the following day. Both Lily and her dam were monitored periodically and given feed and water through the fence at the outdoor isolation pens.

Less than 24 hours after being placed in quarantine and discontinuation of all medications, Lily's bloody diarrhea and relapse of lethargy began to resolve and by the time she was discharged she was having stools that were normal in color and consistency for a calf of her age. Past day 10 of her hospitalization, no other treatments or medications were administered.

According to the literature, there is no specific treatment for BPS lesions. However, in one study, cows showed mild clinical improvement with local treatment on their teat lesions with a 3% iodine solution.<sup>2</sup> Most commonly, clinical signs are treated symptomatically and the patients are supported as needed through resolution of signs. In young calves with diarrhea, addressing dehydration, metabolic acidosis, and electrolyte derangements is paramount to their successful recovery.



Vaccination against BPS appears to be uncommon due to the mostly benign nature of the disease and low mortality rates. No vaccine is currently marketed for protection from BPS but in cases where it is a consistent herd issue, local strains are recommended for vaccination and are most likely to be more protective than a generalized vaccine.<sup>5</sup>

### **Case Outcome and Conclusion:**

Lily was finally able to be discharged from the clinic after 20 days of hospitalization. At discharge, Lily's clinical signs, both the bloody diarrhea and BPS lesions, were completely resolved and she was acting more like a normal calf her age. After speaking with staff from MAFES Prairie Branch in April 2021, Lily's weaning weight was significantly lower than the rest of the weaned calves (~300 lbs) and she would probably not be retained in the herd.

There are known and likely unknown economic impacts of BPS which do not appear to have been studied thoroughly in the literature. One of the economic impacts that has been studied was in Brazil, where they found evidence that BPS negatively affects milk production in lactating cows.<sup>2</sup> It is unable to distinguish in Lily's case whether her stunted weaning weight was due to her undiagnosed prolonged course of bloody diarrhea or her infection with BPS. More research is needed on the economic impacts and immunity of BPS.

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