HB-007's Final Ride

by

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Introduction:

Clostridial myositis, also known as blackleg, is caused by *Clostridium chauvoei* and considered an economically devasting disease accounting for many deaths within livestock operations across the globe. The disease commonly affects bovine species but can be seen in a range of animals including other ruminants such as caprine and ovine[1]. The disease process results in a hemorrhagic and emphysematous necrotic myositis and myocarditis reaching a mortality rate of almost 100% in unvaccinated calves in some studies[3,4]. Vaccination protocols are the gold standard for prevention of the disease. Still, due to financial constraints and/or the inability to handle cattle multiple times each year, cattle are not vaccinated or are improperly vaccinated in some livestock operations. As a result, veterinarians still see and treat many outbreaks across the world every year.

Diagnosis of blackleg is difficult because an antemortem diagnostic test is unavailable; instead, the disease is diagnosed based on clinical signs or postmortem testing. This disease presents with varying clinical signs that include but are not limited to lameness, inappetence, ruminal stasis, and acute death[5]. In many cases, death can follow clinical signs within 12- 36 hours, but in some cases the cattle display no clinical signs before death making the diagnosis of the disease harder for veterinarians[5]. Although diagnosis of blackleg in an individual animal is often accompanied with a grave prognosis, discovering this disease within a herd presents an opportunity for veterinarians to implement preventative measures to control outbreaks. Due to the poor prognosis for the disease, veterinarians have long worked to create a prevention plan for cattlemen that helps to decrease the incidence of the disease.

Blackleg is a hardy bacterium that results in resistant spores that reside in the soil for long periods of time. Outbreaks have been associated with warm weather and high rainfalls, because

of the exposure of latent spores in the soil during these times[9]. As a result, preventing the spores in soil has been unrewarding for many years for veterinarians and clients. Keeping this in mind, preventative measures for the disease are based around a vaccination protocol that must be followed strictly by the clients. The suggested vaccination protocol recommends an initial vaccination series given to calves at 4-6 months of age with a killed vaccination containing the bacterium, then giving a booster dose within 30 days of the first vaccine. Annual vaccination with a Clostridium bacterin is recommended.[3]. This vaccination series presents a logistical challenge for small cattle operations who only handle their cattle once yearly and sometimes once only every few years.

History and Presentation:

HB-007, a 2-year-old Brangus steer, presented on October 29, 2020, to the MSU-CVM Food Animal Service for lameness and bloat. The owner reported that on the morning of October 29, 2020, he was checking his cattle when he noticed that the steer appeared to be lame on his right hindlimb and bloated. The owner called his referring veterinarian to come out and assess the steer. The referring veterinarian diagnosed the steer with an unknown right hindlimb lameness and bloat and treated with flunixin meglumine intravenously and Therabloat® (poloxalene) via orogastric tube. The owner did not recheck the steer until later that afternoon and upon inspection the steer was down. When he did rise, the right hindlimb lameness appeared to be more severe and the bloat was more evident. The owner immediately loaded the steer on a trailer and brought him to MSU-CVM for further evaluation.

Upon arrival, a history was taken from the owner, and he reported that he runs an approximately 67 head commercial cattle operation in Northwest Alabama and that his stock is kept on pasture throughout the year and supplemented with grain and hay. The owner vaccinates

his cattle once a year with a respiratory vaccine given subcutaneously but he could not remember the name or what was in the product. Vaccinations are administered in the hindquarter due to facility constraints. Approximately two years ago he had an outbreak of acute deaths in his calves that claimed the lives of multiple calves in a span of a few days. The owner didn't seek any veterinary care, so a definitive diagnosis was not made at the time. Recently, the owner lost 3 cattle to perilla mint toxicosis and the plant which was removed from the pasture after the episode. In addition, the owner reported that there were instances over the years of cattle bloating and dying within a couple of days after onset of clinical symptoms. The owner reported no other problems within the herd.

On presentation, HB-007 was down in the trailer in left lateral position. Due to the severity of the steer's condition a physical was performed on the trailer. The respiratory rate was less than 20 with increased effort. The steer was severely dehydrated with an estimated 12% dehydration and scleral injection. Upon cardiopulmonary auscultation bradycardia was noted with normal lung sounds. Abdominal auscultation revealed no pings or abnormal sounds upon percussion, but there were severely decreased ruminal contractions noted. The right hindlimb was edematous in the quarter region with crepitus upon palpation and there were no defects of either claw on the right hindlimb. No external wounds were noted upon examination of the right hindlimb, and all joints palpated normally. The rest of the physical exam was unremarkable.

Differential Diagnoses:

Following the physical exam and history, a differential list was quickly constructed to make sense of the previous clinical signs observed along with the general history. The first clinical sign observed by the owner was bloat, which has several etiologies. Bloat can be attributed to cattle that graze pastures heavy in legume pastures, can be related to physical

obstruction of eructation, and/or ruminal atony due to grain overload, but in HB-007's case the highest differential was secondary tympany due to lateral recumbency[2].

Next, the lameness and its top differentials were addressed based on clinical signs. The differential list for this steer's lameness included the possibility of trauma considering the acute nature of the lameness. Trauma can result in a wide range of conditions causing lameness including a fracture, penetrating wound, or joint luxation. Trauma as a differential was dropped lower on the differential list because of the lack of findings on palpation and manipulation of the right hindlimb. Also included on the differential list were common causes of lameness not related to trauma, which include white line disease, interdigital dermatitis (hoof rot), digital dermatitis (hairy heelwart), sole abscess, or several other conditions affecting locomotion. Finally, because of the crepitus felt upon palpation of the right hindquarter, blackleg *(*infection with *Clostridium chauvoei*) was pushed to the top of the differentials list. Blackleg commonly causes edema, crepitus, and lameness in the affected limb or limbs.

Diagnostic Approach/Considerations:

Due to the critical nature of the patient in this case, diagnostics were not performed immediately. Instead, life saving measures were attempted. An orogastric tube was partially passed to relieve the severe bloat present, but once partially inserted into the esophagus the tube was unable to be passed. The tube was unable to be passed because the steer died on the trailer after a physical exam and treatment was attempted. The owner elected for necropsy due to the high suspicion of blackleg and its potential effect on the remaining herd. The steer was presumptively diagnosed with blackleg and preventative measures were discussed with the owner.

The necropsy results confirmed the diagnosis of blackleg by submitting the samples of the right hindlimb for fluorescent antibody testing, which came back positive for *Clostridium chauvoei*. In addition, the right hindlimb had multifocal areas of necrohemorrhagic myositis that upon cut surface contained dark red to black muscle with multiple, small, circular air bubbles. The heart contained multifocal areas of dark red to purple lesion in the left and right ventricular epicardial surface that extended into the myocardium on cut surface. On histological examination, the heart contained multifocal necrotizing myositis. The previous findings are consistent with a diagnosis of clostridial myositis (blackleg) caused by (*Clostriduium chauvoei*)

Pathophysiology:

Clostridial myositis, also known as blackleg, is caused by the spore forming, Gram-positive anaerobic bacillus *Clostridium chauvoei* [1,3,9]. *Clostridium chauvoei* resides in the environment as a spore in the soil and manure and can persist in the environment for long periods of time. The spore enters the animal through the oral cavity and remains in the animal's gastrointestinal system, gaining access to the bloodstream after absorption by the intestines[3]. Once the spores have been absorbed and enter the bloodstream, deposition into the skeletal muscles is the final destination[1]. After the spores enter the skeletal muscle, the bacteria can lay dormant until a hypoxic and/or anoxic event occurs creating an anaerobic environment for the bacteria to replicate. Hypoxic or anoxic events result from localized trauma to the skeletal muscle, which can be caused by a wide array of events. Local trauma includes but is not limited to damage to the skeletal muscle during handling of cattle in chutes, physical trauma from being kicked, or injections in the affected muscle. Once an anaerobic environment is established the spore produces hyuronidases (gamma-toxin), deoxyribonucleases (beta-toxin), and oxygen labile hemolysins[6]. Release of the toxins into the muscle causes the muscle fibers of the animal to

become hyalinized resulting in neutrophil infiltration and necrosis. The toxins can also result in alteration to the vascular endothelium causing necrosis and thrombosis within the vessels, and increased neutrophil infiltration into the musculature[6].

Next, the affected skeletal muscle hemorrhages and necroses, which results in necrotic muscle fibers and gas bubbles that elicit a crepitus upon palpation of the muscle and overlying skin[1]. Two type of muscle lesions are commonly observed on post-mortem examination: exudative or dry lesions. Exudative lesions are indicative of early stages of the disease, while dry lesions are more indicative of later stages of the disease[8]. Histologically, muscular lesions demonstrate coagulation necrosis, interstitial edema, and hemorrhage. On post-mortem examination, a "rancid butter smell" sometimes is noted due to the butyric acid being produced by the bacteria[8].

Treatment and Management Options:

Blackleg (*Clostridium chauvoei*) presents as a difficult disease to treat, because in some cases the animal displays no previous clinical signs before death. On the other hand, once clinical signs have been identified there are multiple therapy options aimed at stopping the progression of the disease. First, the animal can be started on crystalline penicillin intravenously at higher doses (44,000 IU/kg) initially and followed by intramuscular injections in the affected area with procaine penicillin (44,000 IU/kg). Surgical debridement can be used to aerate the affected areas and in some severe cases a fasciotomy may be performed of the tissue.

Due to the rapid progression of the disease, the best option to avoid blackleg losses is prevention. Vaccination protocols recommend administering the first multivalent killed vaccine at 4-6 months of age and then booster the first vaccine within 30 days. Vaccinations may be

administered at 3 weeks of age when the disease is endemic in the herd[3]. Vaccinations are recommended annually and during outbreaks it is recommended that all cattle between 6 months and 2 years of age be vaccinated, but studies show that the antibody levels aren't adequate for 2 weeks. As a result, in an outbreak it is suggested that the carcasses of affected animals be dissected and disposed of to prevent the exposure of other animals to spores[3,5].

Expected Outcome and Prognosis:

Once the spores have setup in the muscle tissue and have been exposed to an anaerobic environment, the bacteria begin to cause edema, hemorrhage, and necrosis. Death commonly occurs within 12-36 hours of onset of clinical signs[5]. Death results from several causes with the most common being a septicemia that develops from the release of bacteria into the bloodstream[1]. The small number of animals that survive are faced with debilitating lameness because of the muscle necrosis and hemorrhage from the disease. Due to the rapid progression of the disease process, blackleg carries a poor prognosis even with treatment.

Conclusion:

HB-007's case exemplifies the severity of blackleg disease in cattle, and how significant the disease can be for a producer and their finances. In this case, the producer lost a valuable steer, because of the producer's choice to not vaccinate his cattle against a common bacterium. Although, the exact cause of death couldn't be determined a presumptive cause of death was determined to be heart damage and bloat secondary to blackleg disease. Blackleg disease is a common disease seen around the world in many cattle operations, but the disease can easily be prevented with good vaccination protocols. Prevention of blackleg includes a good relationship

between the veterinarian and producer and the veterinarian's ability to help the cattle producer implement a good vaccination protocol.

In this case, the steer was severely debilitated upon presentation and so the diagnosis had to be made quickly and efficiently, so the owner could be consulted on the best course of action. In veterinary medicine, many times the veterinarian treats only one animal at a time and doesn't have to take into consideration the wellbeing of a population of animals. On the other hand, HB-007's case presents a situation where a veterinarian has to diagnose the disease and then use his/her knowledge to properly implement a prevention and treatment plan for a population of animals. HB-007 was evaluated, and a presumptive diagnosis was made and treatment and prevention for the other animals was implemented.

In conclusion, after the presumptive diagnosis was made, the client was educated on what blackleg disease is and how to properly prevent any future outbreaks. The client was sent home with instructions on how to implement an efficient vaccination protocol for blackleg. In many situations in veterinary medicine, the best way to avoid disease within a herd of animals is prevention of the disease. Unfortunately, blackleg and many other diseases present as challenging to treat due to the rapid decomposition of the animals. Animals are lost before treatment can be implemented. Even though, HB-007 couldn't be treated, this scenario presented an opportunity for educating the client and saving other animals in the future with good vaccination protocols and husbandry practices.

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