Nilla Wafer's Fetid Breath

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History and Presentation

Nilla Wafer is a 5 week old mixed breed calf that presented to Mississippi State University Food Animal Service on September 23rd, 2019, for signs of respiratory distress and heat stress. The morning of presentation, he was seen acting dull and lethargic. The owner administered florfenicol subcutaneously (40 mg/kg). Throughout the day, his condition continued to decline, and he presented to the clinic for evaluation.

On presentation, Nilla was laterally recumbent, open mouth breathing with a dramatically increased respiratory effort. He was immediately placed on flow by oxygen, and his vital signs were taken revealing a heart rate of 108 beats per minute, a respiratory rate of 54 breaths per minute, and a temperature of 109.4°F. Rapid cooling was initiated while his physical examination was performed. Harsh bronchovesicular sounds were heard on thoracic auscultation bilaterally, as well as, over the trachea, and an increased respiratory effort was observed on both inspiration and expiration. His sclera were moderately injected, and he was estimated to be 7-10% dehydrated. Horizontal nystagmus was seen bilaterally, and a menace response was not present at this time. His mucus membranes were tacky and pale with a capillary refill time of 3 seconds. An oral examination was performed, and a laryngoscope was used to assist in visualizing the larynx and arytenoids. A strong fetid odor was appreciable coming from the oral cavity, and visualization revealed a grey membrane and plaques on the surface of his larynx. When assisted to stand, knuckling was noted on both hindlimbs. Small interdigital ulcers were noted on both hindlimbs consistent with foot rot. His umbilicus palpated normally. The remainder of his physical exam was within normal limits. A thoracic ultrasound was performed revealing bilateral diffuse comet tails and small hyperechoic areas consistent with consolidation cranioventral to the cardiac silhouette. At this time, based on the clinical signs of dyspnea, open mouth breathing, and fetid breath, a clinical diagnosis of necrotic laryngitis was made.

Diagnostic Considerations

The diagnosis of necrotic laryngitis is typically made based on clinical signs and oral examination. [1,3,7,9] Clinical signs may include anorexia, pyrexia, depression, severe inspiratory or mixed dyspnea, stridor, head and neck extension, mucopurulent nasal discharge, fetid breath, and open mouth breathing. [1,7,9] In the case of Nilla Wafer, a definitive diagnosis of necrotic laryngitis was made following visualization of his larynx. Endoscopy can be utilized to determine the degree of necrosis and structural alteration of the arytenoids, larynx, and trachea. [3] Thoracic radiographs and ultrasound should also be considered to rule out additional causes of dyspnea. [6]

Pathophysiology

Necrotic laryngitis is an infection of the laryngeal region due to *Fusobacterium necrophorum.* It is believed that an injury to the mucosa of the arytenoids is required to facilitate invasion of the bacteria.[3,4,5,7,8,9] *Fusobacterium necrophorum* is a gram negative, non-spore-forming, anaerobic bacteria that is normal flora of the animal oral cavity, respiratory tract, and gastrointestinal tract making it an opportunistic pathogen. [4,5,9] *Fusobacterium necrophorum* also plays role in other bovine disease processes including hepatic necrobacillosis and interdigital phlegmon. [4] Necrotic laryngitis is a noncontagious disease process that is seen in 1-2% of feed lot cattle in the United States every year. [1,3,8] A predisposition has been recognized in breeds such as the Belgian blue due to their narrow larynx and smaller lung volume. It is believed that this combination results in an increased air velocity which is enough to induce mucosal lesions and subsequent necrotic laryngitis. [8] Typically, the disease is seen in cattle less than two years of age and is often only recognized once clinical evidence of dyspnea and an audible stridor are present. [4,5,8]

Treatment and Management

Success of medical therapy is dependent on the progression of the disease process at the time of recognition. [1] Medical therapy requires long term antibiotic use with medications such as penicillin, oxytetracycline, florfenicol, or sulfonamides. [9] Supportive care with NSAIDs and soft quality food is

also needed during the initial stages of treatment. [9] In severe cases of respiratory distress, a temporary tracheostomy can be performed as a lifesaving procedure. [2,9] Failure to respond to medical therapy can indicate the need for additional surgical management including permanent tracheostomy, tracheolaryngostomy, or arytenoidectomy. [1,2,6,7] While long term survival is hard to determine in a production driven industry, it has been reported that the survival rate to these types of procedures ranges from 58-65.2%. [8]

Following Nilla's diagnosis, an 18-gauge catheter was placed in the right jugular vein to facilitate intravenous fluid therapy. Two liters of LRS 2.5% dextrose solution with 5 milliliters of B complex added to each liter were administered as a bolus. Following the fluid bolus, he was maintained on LRS + B complex solution at a rate of 60 ml/kg/day for the next 48 hours. He was given a 1.1 mg/kg dose of Flunixin Meglumine to aid with pain, inflammation, and endotoxemia. For antibiotic therapy, he was given 2 additional milliliters of florfenicol subcutaneously to reach his full 40 mg/kg dose which was to be repeated every four days and a 44,000 IU/kg dose of penicillin intramuscularly which was to be repeated daily. A 10 mg/kg dose of thiamine was also administered due to his dull mentation and neurological deficits. At this time, a local block was performed using 5 milliliters of Lidocaine 2% subcutaneously over the ventral midline of the neck. A 2-3 inch vertical incision was made on the ventral midline of the neck, and the muscles covering the trachea were separated by blunt dissection. An incision was made into the trachea, and a tracheostomy tube was placed to assist in respiration. An ear notch was taken and submitted for Bovine Viral Diarrhea Virus PCR, and the results confirmed that Nilla'a Persistently Infected status was negative.

Nilla Wafer's owners elected to donate him to the calf rearing project for further medical treatment. On September 25th, an endoscope was passed into the nasal cavity to visualize the extent of the necrosis of the larynx. Necrotic debris could be seen in the laryngeal region, and white plaques were noted along the larynx and arytenoids. There was minimal movement the arytenoids during respiration. The following day a repeat thoracic ultrasound was performed revealing diffuse comet tails and small

hyperechoic areas consistent with consolidation still present. On September 30th, a wrap was placed around Nilla's neck occluding the tracheostomy site to challenge him to breathe normally, and within 15 minutes he was open mouth breathing and dyspneic. The wrap was removed and within minutes his respiration rate and effort had returned to normal. An endoscopy was performed 3 days later revealing a wall of caseous material nearly occluding the edematous arytenoids. At this time, 0.2 mg/kg of Dexamethasone SP was administered intravenously with plans to repeat the dose in 48 hours. On October 8th, a repeat endoscopy was performed revealing that while the arytenoids were still edematous, there was a significant decrease in the amount of caseous material present. On October 10th, a local block was performed using 5 milliliters of Lidocaine 2% subcutaneously around the site of his existing tracheostomy. A scalpel blade was used to remove the excess scar tissue around the site, and a larger tracheostomy tube was placed to facilitate more air flow.

On October 25th, an endoscopy was performed, and no caseous material was seen at or around the larynx. With the scope still in place, Nilla's tracheostomy site and one nostril were occluded to encourage deep breaths while visualizing the arytenoids. Throughout this process, there was no movement of the arytenoids, and a presumptive diagnosis of laryngeal paralysis was made. It was determined that medical management of Nilla's condition would not be sufficient, and a unilateral arytenoidectomy was scheduled for November 6th. On November 2nd, all antibiotic therapy was discontinued until the day of surgery.

Prior to surgery, food was withheld for 12 hours. He was administered 44,000 IU/kg of Procaine Penicillin G subcutaneously and 40 mg/kg of Nuflor subcutaneously. A 16-gague indwelling catheter was placed in the right jugular vein, and he was premedicated and induced with intravenous injections. Once at an appropriate anesthetic depth, he was intubated and maintained on 2% Isoflurane. He was placed in dorsal recumbency, and an endoscope was passed through the nasal cavity to allow visualization of the arytenoids. An approximately 7 cm medial incision was made over the larynx and thyroid cartilage. The paired sternothyrohyoideus muscles were separated with blunt dissection to expose the cricothyroid membrane and the thyroid and cricoid cartilages. The base of the epiglottis and arytenoid cartilages were

exposed by incising the thyropharyngeus muscle. The cricothyroid membrane was also incised. Two-thirds of the ventral portion of the thyroid cartilage was incised using a scalpel blade. A Weitlaner retractor and an army-navy retractor were used to expose the laryngeal mucosa. On palpation of the arytenoid cartilages, it was noted that the arytenoids were thickened, mineralized, and fibrosed together at the base of the cartilage. The corniculate process was removed using a 15-scalpel blade and Allis tissue forceps. The mucosa ventral and caudal to the arytenoid cartilage was then incised, and the abaxial portion of the cartilage was removed with rongeur forceps. The body of the left arytenoid was cut from the muscular process and removed. The surgical site was thoroughly lavaged with sterile saline and suctioned to remove loose debris, blood clots, and lavage fluid. The incision through the laryngeal mucosa was sutured using 3-0 polydioxanone (PDS) in a ford interlocking pattern. The thyroid cartilage was sutured using 3-0 polydioxanone (PDS) in a ford interlocking pattern. The cricothyroid membrane was left to heal by second intention. The musculature and skin were apposed at the most cranial aspect with 2 Vicryl, leaving approximately 4 centimeters to heal by second intention. Nilla recovered from anesthesia without complications.

Following recovery from surgery, Nilla was administered 0.05 mg/kg of butorphanol subcutaneously. A red rubber catheter was used to administer 10 milliliters of wheat throat flush composed dexamethasone and glycerin to the ventral aspect of his incision, and plans were made to continue this flush twice daily for eight days. The day after surgery, Nilla was administered 1.1 mg/kg of Flunixin Meglumine intravenously, and the following day he was transitioned to 1 mg/kg of Meloxicam orally given daily for three doses and then every other day for an additional 2 doses. On November 14th, purulent material was seen at the incision site, and Nilla was administered a 40 mg/kg dose of florfenicol subcutaneously with plans to repeat the medication every 4 days for an additional 3 doses. During this time, Nilla was vaccinated with Vira Shield 6 + VLS and weaned.

On December 5th, an endoscopy was performed to evaluate postoperative healing and revealed dorsal displacement of his soft palate and medial displacement of his right arytenoid leaving only a small

opening to breathe through. A small amount of purulent material was seen around the surgical site and continued down the trachea, but no purulent material was seen coming from the bronchi. The tracheostomy site showed no signs of stricture. Following the endoscopy, an ace bandage was placed around Nilla's neck to encourage him to breathe through his nasal cavity. When the ace bandage was wrapped multiple times, Nilla would become dyspneic within 4-5 minutes; however, when the ace bandage was only wrapped once, Nilla's respiration would remain within normal limits. A plan was then devised to occlude the tracheostomy site with an ace bandage wrapped once for 20 minutes 2-3 times a day to facilitate exercise of the muscles and nerves surrounding his remaining arytenoid.

Case Outcome

During the month of December Nilla began to lose weight at a steady rate. Milk was reintroduced into his diet, and he was fed alfalfa and timothy hay in addition to calf grower and starter. Nilla was administered 1 mg/kg of Meloxicam daily for four days to help alleviate pain associated with eating. On January 7th, an endoscopy was performed revealing pharyngeal paralysis. When the tracheostomy site was occluded, the pharynx would completely collapse down on itself. At this time, due to the severity of disease, humane euthanasia was elected.

Necropsy revealed atrophy of the thyroid cartilage and narrowing of the first four tracheal rings leading to a markedly narrowed airway. There was an area of fibrosis on the ventral aspect of the epiglottis which would have inhibited movement and protection of the airway. There was evidence of a severe chronic suppurative bronchopneumonia in the cranioventral aspects of the lungs as well as a hemothorax of unknown origin.

Conclusion

In conclusion, necrotic laryngitis is a disease seen in young cattle. [1,3,8] Clinical signs may include anorexia, pyrexia, depression, severe inspiratory or mixed dyspnea, stridor, head and neck extension, mucopurulent nasal discharge, fetid breath, and open mouth breathing. [1,7,9] Definitive diagnosis is made

based on oral examination and visualization of the larynx. [1,3,7,9] Prognosis is good if caught early and treated aggressively, but due to the nature of the disease, it is commonly caught in the more chronic state. [1,9] As in the instance of Nilla Wafer, insufficient response to medical treatment will often result in a "poor doer" and possible death. [9] While multiple surgical options are available, economic feasibility must be considered while making the decision to pursue surgery. [8] Surgery survival rates are reported to range from 58-65.2% although this is likely more optimistic than what is being seen in clinical settings. [8]

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