

“Betsy’s Bout with Bad Breath”

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## **Introduction:**

Necrotic laryngitis, also known as calf diphtheria or laryngeal necrobacillosis is an acute to chronic infection of the laryngeal mucosa and cartilage of cattle.<sup>5</sup> It is amongst the more common causes of inspiratory dyspnea and stridor in cattle less than 24 months.<sup>4</sup> The incidence of necrotic laryngitis is estimated to be 1% to 2% in U.S. feedlot cattle and 0.1 and 0.8% in dairy and Belgian blue beef veal calves. It is generally accepted that the disease begins with mechanical mucosal lesions in the larynx, which are colonized by *Fusobacterium necrophorum*.<sup>4</sup> Necrotic laryngitis is very common especially in feedlots or where cattle are housed in dirty or crowded conditions.<sup>6</sup> Damaged laryngeal mucosa and cartilage allows entry of the causative agent, *F. necrophorum*.<sup>8</sup>

Necrotic laryngitis is characterized by prominent inspiratory stridor (which is worse if the calf is exercised or excited), open-mouth breathing with extended head and neck, mucopurulent bilateral nasal discharge, foul breath, guarded cough, salivation, fever, anorexia and depression. If untreated, many calves will die in a matter of days as a result of systemic effects of bacterial toxins and upper airway obstruction.

Recovered cases may have a chronic roaring respiration and a harsh, dry cough because of the dysfunction of the larynx.<sup>6</sup> In calves and young cattle with diphtheria the lesion may be large enough to act like a valve to cause severe inspiratory dyspnea, cyanosis, anxiety and rapid death.<sup>5</sup> Aspiration pneumonia and chronic ill thrift may be seen if not treated in a timely fashion. Differential diagnoses include pharyngeal abscess/granuloma/neoplasia, pharyngeal foreign body, and infectious bovine rhinotracheitis (IBR) due to bovine herpesvirus 1 infection (BHV-1).<sup>8</sup>

Diagnosis is made by direct examination of the larynx with an oral speculum with a light source to show an inflamed larynx with a fibrinonecrotic, gray/yellow brown membrane.<sup>6</sup> The laryngeal opening (rima glottides) may appear mostly occluded by edematous arytenoids/vocal folds and necrotic debris.<sup>6</sup> Diagnosis can also be made via endoscopy.<sup>8</sup>

### **History and Presentation:**

Betsy, an approximately two month old mixed breed heifer, presented to MSU CVM Food Animal Services on December 20, 2018 for respiratory distress. She had been having trouble breathing for the past month and was administered a two week course of corticosteroids (Dexamethasone) and antibiotics (tulathromycin and ceftiofur crystalline free acid). She was housed indoors, bottle fed with four pints of milk replacer twice daily and offered free choice grain at these feedings.

Upon presentation to MSU CVM Food Animal Services, Betsy was tachypneic with a respiratory rate of 160 breaths/minute. She was open mouth breathing with a goose honking sound (inspiratory dyspnea). She was bright and alert with pink mucous membranes and a CRT of less than two seconds. Her eyes were clear and free of discharge with mildly injected sclera. Betsy was adequately hydrated. She weighed 74 kilograms on presentation and had a good body condition score of 5/9. The rest of her physical exam was within normal limits. The most likely cause for inspiratory dyspnea in a young calf is necrotic laryngitis, caused by *Fusobacterium necrophorum*.

### **Pathophysiology:**

*Fusobacterium necrophorum* is an anaerobic, non-spore forming pleomorphic Gram-negative rod, which is considered a normal inhabitant of the alimentary, respiratory, and genital tract of animals.<sup>2</sup> The organism is an opportunistic pathogen that causes several necrotic

conditions in animals (ie, necrobacillosis), including necrotic laryngitis.<sup>4</sup> *Fusobacterium necrophorum* is considered a secondary invader instead of a primary cause of disease.<sup>3</sup> It occurs primarily in feedlot cattle 3–18 months of age; however, cases have been documented in calves as young as 5 weeks and in cattle as old as 24 months. Cases are seen worldwide and year round but appear to be more prevalent in fall and winter.<sup>4</sup>

Predisposing factors are not fully understood but it seems that cattle breeds with a narrow larynx and relatively smaller lung volume like the Belgian blue, develop higher air velocity at the level of the larynx, predisposing them to mucosal lesions and subsequently necrotic laryngitis.<sup>4</sup> *Fusobacterium necrophorum*, commonly isolated from laryngeal lesions of affected cattle, is unable to penetrate intact mucous membranes.<sup>6</sup> Laryngeal contact ulcers, a common finding in slaughtered cattle, are thought to provide a portal of entry for *Fusobacterium necrophorum*.<sup>8</sup>

*Fusobacterium necrophorum* does not usually penetrate intact mucous membranes so laryngeal contact ulcers on the arytenoids are thought to be the site of entry.<sup>6</sup> Mixed upper respiratory tract infections (caused by infectious bovine rhinotracheitis virus and parainfluenza-3 virus; *Mycoplasma* spp; and bacteria including *Pasteurella* and *Haemophilus*), and the coughing and swallowing associated with these infections, may predispose feedlot cattle to develop laryngeal contact ulcers.<sup>8</sup>

*Fusobacterium necrophorum* causes inflammation, necrosis, and edema in the laryngeal mucosa, resulting in variable narrowing of the rima glottidis and inspiratory dyspnea and stridor.<sup>6</sup> If infection extends into the laryngeal cartilage, laryngeal chondritis develops, which may lead to a chronically deformed larynx. Pharyngeal invasion by the organism causes discomfort characterized by painful swallowing motions.<sup>6</sup> When treating these calves, soft

palatable food can be offered until the swelling in the pharyngeal region is reduced so they do not experience pain or difficulty when swallowing food.<sup>3</sup>

Lesions are typically located over the vocal processes and medial angles of arytenoid cartilages.<sup>6</sup> Acute lesions are characterized by edema and hyperemia surrounding a necrotic ulcer in the laryngeal mucosa; lesions may spread along the vocal folds and processes to involve the cricoarytenoideus dorsalis muscle. In chronic cases, lesions consist of necrotic cartilage associated with a draining tract surrounded by granulation tissue. Systemic signs of illness have been attributed to the exotoxin produced by *Fusobacterium necrophorum*. It has also been proposed that necrotic laryngitis results from a perilaryngeal vasculitis initiated by *H. somi* with secondary invasion by *Fusobacterium necrophorum*.<sup>6</sup>

#### **Diagnostic Approach/Considerations:**

Due to Betsy's stertorous breathing, an upper respiratory tract infection was suspected. Typical signs associated with an upper respiratory infection include nasal discharge, diminished air flow, stertor or stridor, sneezing, snorting, blowing or shaking head as well as exercise intolerance and open mouth breathing. Given her age and clinical signs associated with her presentation, necrotic laryngitis (calf diphtheria) was suspected. Since Betsy was in respiratory distress her airway needed to be accessed so she would not succumb to respiratory failure and die. A temporary tracheostomy tube was placed as soon as she presented.

In order to place the tube, the area was clipped and scrubbed with Chlorhexidine before 3mls of 2% lidocaine was used to numb the area. An incision in the cranial 1/3 to 1/2 of the neck was made with a #10 scalpel blade and the sternohyoideus muscles were exposed in order to gain access to the trachea. 1/3 of the circumference of the tracheal rings was incised and the

tracheotomy tube was placed and then secured. The remaining skin was closed with two cruciate sutures using 1 Braunamid.

An endoscopy was performed on Betsy's initial presentation to determine the severity of disease and to evaluate her laryngeal function. Betsy's larynx was extremely swollen and there was no air moving through her larynx at this time. Her arytenoids and epiglottis were also swollen and not abducting. After initial endoscopy, she was started on antibiotics PPG and florfenicol. PPG was given subcutaneously every 24 hours and florfenicol was given subcutaneously every 96 hours. A repeat endoscopy was performed on her sixth day of hospitalization, which revealed significant laryngeal edema and collapse, dorsally displaced soft palate, and swollen arytenoid cartilages were still present. The purulent lesions on the arytenoids were no longer present.

On her fourth day of hospitalization, Betsy developed a fever of 104.6F so she was administered flunixin meglumine (1.1 mg/kg) intravenously as needed. Additionally, she developed diarrhea. Antibiotics were suspected and we ruled out salmonella and parasites. These symptoms along with milk coming out of her tracheostomy site and rumen hypomotility were managed with supportive care and rumen transfusions for three consecutive days.

A final endoscopy was performed on day 26 of hospitalization that showed improvement. Betsy's previously mentioned laryngeal edema was still present but has decreased since the previous scope on her sixth day of hospitalization. The arytenoid cartilages were still swollen as well but the rima glottidis was larger than previous scopes. Her tracheotomy site appeared to be healing but slight narrowing was noted.

## **Treatment and Management:**

Oxytetracycline or procaine penicillin are the antimicrobials of choice.<sup>1</sup> NSAIDs are used to decrease the fever and laryngeal inflammation and edema. A single dose of dexamethasone may be used to decrease laryngeal edema in animals with severe respiratory distress. A tracheostomy is indicated in cattle with severe inspiratory dyspnea. Good nursing care should be provided. Intravenous fluids may be required in dehydrated animals. The prognosis is good for early cases treated aggressively; chronic cases require surgery under general anesthesia to remove necrotic or granulation tissue and to drain laryngeal abscesses.

A 60% success rate has been reported for surgical intervention in advanced cases.<sup>1</sup> The decision to operate depends on cost of the surgery and prognosis for the individual to recover. For laryngostomy to treat necrotic laryngitis, outcome is reported until discharge and up to a maximum of 1 year.<sup>4</sup>

If untreated, many calves will die in a matter of days as a result of systemic effects of bacterial toxins and upper airway obstruction. Recovered cases may have a chronic roaring respiration and a harsh, dry cough because of the dysfunction of the larynx.<sup>6</sup> Necrotic laryngitis can alter pulmonary function such that growth rate is impeded and also predisposes to secondary bacterial pneumonia.<sup>6</sup> In order to decrease occurrence, upper respiratory infections need to be controlled.<sup>8</sup>

Betsy's tracheostomy tube site was monitored intensely during the first 48 hours of hospitalization to ensure proper patency. Thereafter, respiratory patency was assessed every four hours. Her tracheostomy tube was left in place until day 20 of hospitalization. She was monitored intensely for any signs of respiratory distress. No evidence of dyspnea occurred after tracheostomy tube removal or until discharge on January 16<sup>th</sup>, 27 days after presentation.

Even though West, 1997 states that “chronic laryngeal obstruction either as a result of necrobacillosis or infectious bovine rhinotracheitis does not respond well to medical management, and a tracheolaryngostomy technique performed under general anesthesia has been reported to be successful after a six month follow-up”.<sup>7</sup> However, in Betsy’s case medical management was sufficient and this technique did not need to be performed in order for her to have a successful outcome. These medications included daily procaine penicillin G and every 96 hour administration of nuflo.

**Case Outcome:**

After spending four weeks at MSU CVM Food Animal Services, Betsy was discharged 27 days after initial presentation on January 16<sup>th</sup>. The owner was instructed to monitor Betsy for signs of respiratory distress including increased effort to breathe or open mouth breathing. Her tracheotomy site would also need to be monitored for any debris or drainage.

A recheck appointment was scheduled for Betsy a month from discharge and at that time, a follow-up scope would be done to recheck her laryngeal edema, arytenoid swelling, and the tracheotomy site. Unfortunately due to financial constraints, Betsy never returned for her appointment but her owner informed me she has been doing well since she was discharged and has no trouble breathing.



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