

# **A Troubled Trachea**

A Salvage Procedure for Necrotic Laryngitis

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Clinicopathologic Conference

7/13/2018

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## **Introduction**

Respiratory disease in calves is commonly seen and generally associated with viral and bacterial infections. These typically occur in calves when there is lack of passive transfer, poor air quality housing, new introductions into the herd without isolation, fence line contact with infected cattle, and stress, such as traveling, weaning and processing. <sup>(2)</sup>

A respiratory infection can lead to a more serious sequela from immunosuppression and a secondary infection may occur. Necrotic laryngitis as well as bacterial bronchopneumonia or pleuropneumonia are common secondary diseases that occur. These secondary infections can be life threatening to calves if not caught early. <sup>(7,9)</sup>

## **History and presentation**

E022, is a two month old Aberdeen Angus heifer who presented for acute respiratory distress on June 15th 2017. That morning, the producer noticed E022 making a honking noise during respiration. On presentation, she had a normal heart rate of 88 beats/min, she was tachypneic and dyspneic with a respiration rate of 66 breaths/min, and pyrexia at 104.1°F. An emergency temporary tracheostomy tube was placed at tracheal rings five to six. After tracheostomy tube placement, the heifer's dyspnea and stertorous breathing immediately improved. On endoscopic examination, necrotic laryngitis was diagnosed by visualization of swollen and necrotic arytenoids as well as a swollen epiglottis and decreased movement of the arytenoids on inspiration. Florfenicol was administered subcutaneously every four days at 46 mg/kg and Procaine Penicillin G was administered subcutaneously daily for eight days at 50,000 units/kg. Dexamethasone SP was administered once intravenously at 0.2 mg/kg. Once her breathing returned to normal, a follow up endoscopic examination revealed improvement of the swelling in

her arytenoids and epiglottis. The tracheostomy tube was removed and E022 was discharged on June 26th 2017 with instructions to administer Procaine Penicillin G daily and Florfenicol every four days until the tracheostomy site was completely healed. She was brought in on July 6<sup>th</sup> 2017 for a recheck and was doing well at that time.

E022 represented to MSU-CVM on July 9th 2017 for respiratory distress. The producer noticed she had labored breathing in the field and collapsed while being transported to the clinic. At presentation, she was depressed with pyrexia, open mouth breathing, and foamy oral discharge. Harsh upper airway sounds were auscultated over the trachea. An elliptical incision was made around the site of the previous tracheostomy and a metal tracheostomy tube was placed. Dexamethasone SP at 0.2 mg/kg was given intravenously on presentation. An ultrasound examination of the lungs was performed and pneumonia was diagnosed based on the consolidation seen diffusely in the left lung fields. Florfenicol was administered at 40mg/kg subcutaneously and flunixin meglumine at 1.1 mg/kg intravenously. Several endoscopic evaluations were performed to assess the arytenoids and larynx. The arytenoid cartilage was enlarged with a purple and black discoloration and arytenoid chondritis was diagnosed. Large amounts of fibronectic debris was seen in the trachea at the site of the tracheostomy. The debris was cleaned out manually through the temporary tracheostomy site. On July 13<sup>th</sup>, a recheck endoscopy was performed. The size of the arytenoids were decreased and function had improved. A kissing lesion was on the arytenoids and there was a mild amount of necrotic debris seen in the trachea at this time. Harsh lung sounds were still heard bilaterally. Florfenicol at 40 mg/kg subcutaneously was administered every 4 days for pneumonia. The second tracheostomy tube was removed and the site was cleaned daily for optimum healing. A heat challenge was attempted on July 17th 2017. E022 was brought back into the clinic on July 20th 2017 for signs

of respiratory distress, tachypnea and pyrexia. Dexamethasone SP at 0.2 mg/kg was given intramuscularly. Repeat endoscopy showed improvement in the arytenoids but a narrowed tracheal lumen and purulent debris in the distal trachea was seen. Tracheitis was then diagnosed. She was heat challenged again on July 25th 2017 and checked on hourly for respiratory distress. She was noticed to have an increase in upper airway noise on July 27th 2017 at 3 AM with an increased respiratory rate. Radiographs of the trachea and lungs were performed later that day. Abnormal soft tissue opacity was seen in the trachea at the site of the previous emergency tracheostomy tube placement at the level of cervical vertebra four. An endoscopic exam was performed on July 28th 2017, severe tracheal stenosis was diagnosed and purulent mucous was seen in the distal trachea.

### **Pathophysiology**

Necrotic Laryngitis, also known as calf diphtheria, is an infection of the laryngeal cartilage or mucosa with bacterial agent *Fusobacterium necrophorum*. This is most common in young cattle from 5 weeks to 18 months of age. *Fusobacterium necrophorum* is a gram-negative, non-spore forming anaerobe that is a normal inhabitant of the alimentary, respiratory, and genital tract of animals. Necrotic laryngitis infections usually occur from upper respiratory tract inflammation following a viral or bacterial respiratory infection that cause contact ulcers on the arytenoid mucosa. *Fusobacterium necrophorum* then infects the ulcerated mucosa as an opportunistic organism.<sup>(2)</sup> Occasionally, other organisms may be present, usually *Truperella pyogenes*.<sup>(10)</sup> The infection produces fibrinonecrotic laryngitis and eventually chondrosis. Clinical signs include depression, anorexia, fever, stridor, dyspnea, salivation with foul breath, and mucopurulent nasal discharge. If it is caught early, prognosis is good with appropriate treatment. It is a poor prognosis if caught later in the disease process.<sup>(3)</sup>

With necrotic laryngitis, bronchopneumonia may also be present secondary to the *Fusobacterium necrophorum* infection. Pieces of caseous infectious material from the larynx may be aspirated to the lungs where abscessation or pneumonia can result.<sup>(7)</sup> The bronchopneumonia may also include *Histophilus Somni* as an opportunistic pathogen as it commonly invades mucus membranes in the respiratory tract and would easily cause infection from the damaged endothelium.<sup>(3)</sup>

### **Diagnostic approach/ Considerations**

A diagnosis of Necrotic Laryngitis is usually determined on clinical signs and physical exam alone. Though visualization of the larynx is needed to definitively diagnose. Visual inspection can be done with a speculum, laryngoscopy, endoscopy, or radiography.<sup>(2)</sup> It is also possible to submit a swab for anaerobic culture, this is most frequently done at necropsy.<sup>(11)</sup>

### **Treatment and management**

Treatment may include a temporary tracheostomy tube to relieve respiratory distress. Appropriate antibiotics include penicillin, oxytetracycline, sulfonamides, and florfenicol. Prolonged therapy of seven to fourteen days is recommended. Supportive care may include NSAIDS or corticosteroids to reduce inflammation and offering softened feed. Without treatment, death usually occurs in two to seven days. To prevent this disease from occurring, other causes of upper respiratory tract infections should be eliminated. This would include vaccination against respiratory pathogens and minimizing risk factors such as comingling and stress that predisposes them to respiratory infections.<sup>(2,3,7)</sup>

Surgical techniques have been uncommonly described and reported as salvage procedures for laryngeal obstruction. These include laryngotomy, tracheolaryngostomy, unilateral

arytenoidectomy, and very few reports of permanent tracheostomy. The highest success was seen with a laryngotomy and resection of necrotic tissue at 58% survival. Complications were reported with all of these procedures and included tracheal stricture, mucosal hyperplasia, dysphagia, coughing, and death.<sup>(1,4,5,10)</sup>

### **Case outcome**

Several treatment options were discussed, though a permanent tracheostomy was chosen to be the best option as a salvage procedure for E022. This procedure is commonly performed in horses as a standing procedure. Few documented cases of the procedure being performed in cattle exist. There is one published case on a one year old heifer who was able to go through at least one calving season with success<sup>(5)</sup> Another case resulted in tracheal collapse four years after surgery.<sup>(8)</sup> The goal of this surgical procedure in E022 was to allow her to grow to maturity.

A permanent tracheostomy procedure was performed on August 4<sup>th</sup>, 2017. Flunixin meglumine at 1.1 mg/kg was given intravenously, and Florfenicol at 45 mg/kg was given subcutaneously preoperatively. E022 was placed in dorsal recumbency and maintained on a constant rate infusion of 5% Guaifenesin with 1000mg of Ketamine. A surgical scrub was performed with chlorhexidine and alcohol. A line block was performed with Lidocaine 2% in an ellipse surrounding midline, distal to the previous temporary tracheostomy site. An elliptical incision, 8 cm in length, was made in the skin on the ventral surface of the neck from the mid to distal trachea with a number 22 scalpel blade. The skin was removed and discarded. Sharp and blunt dissection with the scalpel blade and general operating scissors was performed to expose the sternothyroideus muscles and the ventral portion of the trachea. The sternothyroideus muscles were dissected away from the trachea at the connections cranially and caudally, and reflected away from the trachea. Once the tracheal rings were visualized, the ventral 1/3 of the

tracheal rings were excised with a number 15 scalpel blade. The tracheal cartilage was then carefully dissected from the tracheal mucosa underneath without damaging the mucosa. This procedure was repeated for three additional distal tracheal rings. The ventral 1/3 of tracheal rings 11 through 14 were resected off of the tracheal mucosa. The subcutaneous tissue was then closed with simple continuous sutures (2-0 PDS) to relieve tension from the skin and to close dead space. A double “Y” incision was made in the tracheal mucosa. The tracheal mucosa was sutured with simple interrupted or cruciate sutures to the skin cranially, caudally, and on the left and right lateral aspects of the trachea (2-0 PDS). The remainder of the tissues were closed in a routine fashion and aluminum spray was applied to the skin incision to help with hemostasis and to provide a protective barrier after surgery.

The tracheostomy site was carefully cleaned daily with gauze, a gloved finger, and sterile saline to prevent discharge from blocking the tracheostomy site. Vaseline was placed around the incision to decrease the buildup of discharge. Flunixin meglumine was given intravenously at 1.1 mg/kg the day following surgery. Procaine Penicillin G was administered subcutaneously every 24 hours at 44,000 units/kg for four days. One additional dose of Florfenicol was administered at 40 mg/kg subcutaneously on August 8th. Meloxicam was given at 1 mg/kg every 24 hours orally for 3 days, and then decreased to every other day at 0.5 mg/kg for 6 days. She was heat challenged on August 10th and remained outside with little complications. Fly spray was kept on the surrounding skin of the tracheostomy site and sutures were removed on August 16th. She was sent home on August 23rd 2017.

E022 was attempted to be reintegrated into a calf herd, though this was unsuccessful as she could not keep up in activity or growth with the other calves. Because of this, she was moved to an individual pen on the property. Unfortunately, on October 16<sup>th</sup> 2017, E022 presented again for

respiratory distress. A temporary tracheostomy tube was placed in her permanent tracheostomy site and flow by oxygen was supplemented. Dexamethasone SP was administered and tracheal radiographs were taken and an endoscope exam was performed. The trachea was collapsed and fibrosed at the level of the stoma causing tracheal stenosis and difficulty breathing. At this time, a permanent tracheostomy tube was considered. A Boston Moore human intended silicone tracheostomy tube was inserted into her tracheal stoma. The tube was cleaned frequently at home and she did well for 4 additional months on pasture. Unfortunately, she was found deceased in the pasture in early February of 2018. On necropsy, the cause of death was determined to be acute occlusion of the tracheostomy site leading to hypoxia and hemorrhage in the lungs.

In conclusion, a permanent tracheostomy procedure in cattle could be considered as a salvage procedure when necessary. Though complications should be expected and a long term prognosis is poor without further interventions. It is likely that the surgical procedure would have been more successful if it was performed at a more proximal aspect of the trachea. This was unable to be done due to the scar tissue present at the previous temporary tracheostomy site. Further research is needed to determine its true potential for success.



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