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# Pharyngeal trauma in dairy cattle: 27 cases

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## Abstract

**Background:** Characterization of the clinical signs, response to treatment and prognosis can be useful information for decision-making when evaluating cattle with pharyngeal trauma.

**Objective:** To describe the signalment, history, clinicopathologic, endoscopic, ultrasonographic, radiographic, and postmortem findings as well as treatments and outcomes of cattle diagnosed with pharyngeal perforation/trauma.

**Animals:** Review of medical records of cattle >1 month of age admitted to a Veterinary Teaching Hospital from 1995 to 2017.

**Methods:** Retrospective study. Review of medical records of cattle with pharyngeal perforation/trauma identified by oral or endoscopic examination in hospital setting.

**Results:** Twenty-seven out of 7550 (0.36%) cases met the inclusion criteria. Pharyngeal perforation/trauma was associated with the administration of a bolus in 24 (89%) cows and a magnet in 3 (11%) cases. The boluses contained monensin (n = 12), calcium salts (n = 5), iodine (n = 1), aspirin (n = 1), vitamins (n = 1), and an unknown product (n = 4). The primary clinical signs were dysphagia, swelling of the throatlatch, subcutaneous emphysema, swelling, and pain on palpation of the throatlatch. Seventeen (63%) cows were discharged whereas 10 (37%) were euthanized. Median time between the suspected traumatic event and hospital admission was 1 day (range: 0.5-3 days) and 2 days (range: 0.5-15) for surviving and nonsurviving cattle, respectively. All 5 cows that suffered pharyngeal trauma associated with administration of calcium salt bolus were euthanized.

**Conclusions and Clinical Importance:** Pharyngeal trauma is a rare condition in cattle. Case fatality rate increases if not diagnosed and treated promptly. The nature of the penetrating foreign body influences the outcome.

KEYWORDS

calcium bolus, emphysema, mediastinitis, pharyngitis

## 1 | INTRODUCTION

During the last 3 decades, the major advance in dairy production has been the paradigm change from treatment of clinical condition to

**Abbreviations:** BG, blood gas; CHUV, Centre Hospitalier Universitaire Vétérinaire de l'Université de Montréal; NSAIDs, non-steroidal anti-inflammatory drugs; SBP, serum biochemistry profile; TMS, trimethoprim sulfadoxine.

disease prevention.[1] These advances have led to a widespread use of oral medications such as boluses, and devices, such as magnets, in the cattle industry.[1] Most medications for dairy cattle are prescribed or recommended by veterinary practitioners; however, the majority of these medications are administered by farmers. Anecdotal evidence suggests that traumatic damage and physical harm—especially pharyngeal trauma—can occur when an untrained farmer or a farmer unfamiliar with the application device incorrectly administers boluses and magnets.[2]

There are reports of pharyngeal trauma after administration of boluses or magnet,[2-10] however these involved a limited number of cases. Further characterization of the clinical signs, response to treatment, and prognosis can be useful information for decision-making when evaluating cattle with suspected pharyngeal trauma. The objective of this retrospective study was to describe the signalment, history, clinicopathologic, endoscopic, ultrasonographic, radiographic and postmortem findings as well as treatments, outcomes of adult cattle diagnosed with pharyngeal laceration/trauma at the Centre hospitalier universitaire vétérinaire (CHUV) de l'Université de Montréal, Canada.

## 2 | MATERIALS AND METHODS

Data from medical records of all cattle >1 month of age admitted to the CHUV between January 1995 and January 2017 with a diagnosis of pharyngeal perforation/trauma obtained through direct peroral or endoscopic examination of the pharynx were reviewed. Records from cows with pharyngitis without evidence of trauma or laceration, pharyngeal abscessation not associated with recent trauma, or pharyngeal masses were excluded.

Medical records were systematically reviewed and the following information was recorded: age, sex, breed, month and year of hospitalization, presenting complaint, time between suspected trauma and hospital admission, treatment before presentation, clinical signs before hospital admittance, and lactation and reproductive stage. Data from clinical signs, oral examination, CBC, serum biochemistry profile (SBP), blood gas (BG) and endoscopic, radiographic, and ultrasonographic findings were registered. Information regarding treatment (including surgical interventions), duration of hospitalization, and outcome for surviving cattle was also recorded. For cows that died or were euthanized, postmortem findings were reviewed. Animals were euthanized with an intravenous injection of pentobarbital. The range and median were used to describe findings.

## 3 | RESULTS

### 3.1 | Cases included

Twenty-seven of 7550 (0.36%) cases admitted to the CHUV met the inclusion criteria. The diagnosis of pharyngeal perforation/trauma was confirmed by oral examination in 6 cows, endoscopic examination in 8 cows, and by both in 13 cases.

### 3.2 | Signalment

Cases included 24 Holstein cows, 2 Ayrshire, and 1 Brown Swiss. All cases were older than 1 year of age except 1 2 month-old heifer. The median age (n = 24) was 3.5 years (range: 2 months to 8 years). Information regarding the reproductive and lactation status was available for 25 cows. There were 4 (19%) pregnant heifers. Seventeen (62%) cows were in the peripartum period with 6 (22%) animals being in the last month of gestation and 11 (40%) in the first 4 weeks postpartum. The remaining 4 (19%) cows were in the middle of the lactation period.

### 3.3 | History

In all cases but 1, the primary complaint was a description of dysphagia and swelling of the pharyngeal area. Pharyngeal trauma was associated with the administration of a bolus in 24 (89%) cows and a magnet in 3 (11%) cases. The boluses contained monensin (n = 12), calcium salts (n = 5), iodine (n = 1), aspirin (n = 1), vitamins (n = 1), and an unknown product (n = 4). In 8 (30%) cases, the referring veterinarian (n = 1) or the owner (n = 7) reported difficulties administering the bolus. In 2 cases, the owner reported that they felt "something" ruptured during bolus administration. Median time between the suspected traumatic event and presentation to hospital was 2 days (range: 0.5 to 7 days) in cases reported (n = 23). Two cows had history of fever, 10 of swelling of the neck or throat or both, and 4 of respiratory distress. Sixteen cows were treated with antimicrobials, 9 with non-steroidal anti-inflammatory drugs (NSAIDs), and 6 with steroids before admission. In all of these cases, the primary complaint was a description of dysphagia and apparent oral pain.

### 3.4 | Physical examination

At the time of hospital admission, 23 (85%) cows were anorectic, 1 (4%) was eating normally, and for 3 cows this information was not available. The median rectal temperature was 39.5°C (103°F) (range: 37.4°C-41.5°C; 99.3°F-106.7°F) and 15 (56%) cows were febrile (temperature > 39.2°C; 102.5°F). Median heart rate was 96 beats per minute (bpm) (range: 56-150 bpm) and 19 (70%) cows were tachycardic (HR > 80 bpm). Median respiratory rate was 32 respirations per minute (rpm) (range: 16-66 rpm) and 13 (48%) cows were tachypneic (reference range > 32 rpm). Four (16%) cows had diarrhea, 2 (8%) were bloated, 12 (44%) had hypomotile rumen, and 7 (26%) had ruminal atony. Sixteen (60%) cows were obtunded, 5 (20%) were alert, and 1 (4%) cow was anxious. Percentage of dehydration was available for 16 cows (median: 6%; range: 5%-10%).

Dyspnea was detected in 15 (56%) cows, an upper respiratory noise in 12 (44%), subcutaneous emphysema on the neck in 23 (85%), swelling of the throatlatch in 17 (63%), and pain upon palpation in 17 (63%). Five (20%) cows had extended neck and 11 (41%) had cough. Fourteen (52%) cows had clear nasal discharge, 8 (30%) had mucopurulent discharge, 3 (12%) epixtasis, 1 (4%) mucopurulent with epixtasis, 2 (8%) mucopurulent with the presence of feed material, 1 (4%) was described

as a mucoid discharge, and 1 (4%) had foamy discharge. Twelve (44%) cows had halitosis and 12 (44%) had ptyalism.

### 3.5 | Oral examination

Oral examination findings were available in 22 (81%) cases. A foreign body (monensin bolus) lodged in the pharynx and laceration was observed in 5 (20%) cows. In 12 (44%) cows, laceration of the pharynx was identified but a foreign body was not observed. Swelling of the pharynx (n = 15) with the accumulation of feed material and fibrin in the pharynx and larynx (n = 13) was the main finding documented. Other reported findings included laceration in the soft palate (1), ulceration of the tongue (1), and ulceration of the soft palate (1).

### 3.6 | Comorbidities

In addition to pharyngeal trauma, other diseases reported included aspiration pneumonia (n = 14), hepatic lipidosis (n = 1), placental retention (n = 1), gastrointestinal parasitism (n = 1), and hypokalemia syndrome associated with isoflupredone acetate administration (n = 1).

### 3.7 | Clinicopathologic findings

Results from the CBC and SBP were available for all cases. Hematologic findings were leucocytosis (>12 $\times$ $10^3$ cells/μL) in 9 (33%) cases (median: 10 $\times$ $10^3$ cells/μL, range: 2.4-20 $\times$ $10^3$ cells/μL), neutrophilia (>4 $\times$ $10^3$ cells/μL) in 13 (48%) cases (median: 5 $\times$ $10^3$ cells/μL, range: 0.7-16 $\times$ $10^3$ cells/μL), bands were detected in 13 (48%) cases (median: 0.11 $\times$ $10^3$ cells/μL, range: 0-1.1 $\times$ $10^3$ cells/μL), toxic changes identified in the neutrophil morphology in 9 (33%) cases, and hyperfibrinogenemia (>500 mg/dL) in 21 (78%) cases (median: 800 mg/dL, range: 300-1200 mg/dL). Alteration in the SBP and BG analyses included hyperglobulinemia (>4.5 g/dL) in 5 (20%) cases (median: 3.3 g/dL, range: 2.5-4.7 g/dL) and metabolic acidosis ($HCO_3^-$, <24 mEq/L) in 8 (30%) cases (median: 27 mEq/L, range: 18-33 mEq/L).

### 3.8 | Endoscopic findings

Endoscopic examination was performed in 21 (78%) cows. A foreign body lodged in the pharynx was observed in 2 cows. The site of the trauma was reported in 12 cows. In all 12 cows, the perforation was identified in the dorsal aspect of the pharynx with necrotic tissue and feed material accumulation was identified. Collapse of the upper airway was reported in 2 cows. Severe edema and swelling of the pharynx preventing observation of the larynx was reported in those 2 cows.

### 3.9 | Ultrasonographic findings

Ultrasound examination of the neck and throatlatch was performed in 13 (48%) cows. The presence of subcutaneous emphysema (n = 10) and edema (n = 5) was reported in 10 cows. Bilateral emphysema was observed in 8 cows, while unilateral in 2 cows. Findings compatible with the presence of abscessation of the throatlatch region were reported in 2 cows.

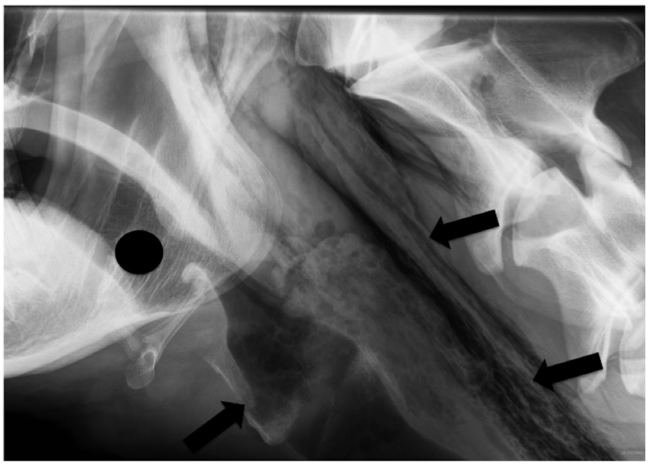

**FIGURE 1** Radiographic examination of the cranial neck of an adult cow with pharyngeal trauma and perforation associated with administration of calcium bolus. There is an increase in soft tissue opacity ventral to the common part of the mandibles (black dot). Large amount of free gas dissecting between the facial planes, within the retropharyngeal region, surrounding the trachea, esophagus, and larynx is present (black arrows)

### 3.10 | Radiographic findings

Radiographs of the neck and throatlatch were performed in 21 (78%) cows. The most frequent abnormality was the presence of gas, either subcutaneously (SC) or between fascial planes (Figures 1 and 2). A foreign body was visualized in 8 cows (monensin bolus, n = 6; magnet, n = 2; Figure 2). Emphysema of the pharyngeal region was observed in 20 (81%) cows. Soft tissue swelling (n = 17) and pneumomediastinum (n = 16) were also reported. Thoracic radiographic findings were available in 4 cows. In 3 cows, consolidation of the cranio- and caudo-ventral portion of the lungs was observed. In 1 case no relevant abnormality was detected.

### 3.11 | Bacteriological culture findings

Bacteriological culture of fluid collected from 2 cows by fine-needle aspiration, in which abscessation of the throatlatch and neck region was suspected based on ultrasonography findings, was attempted. In 1 cow, mixed aerobic and anaerobic bacteria (*Bacillus subtilis*, *Trueperella pyogenes*, and *Klebsiella pneumoniae subsp. pneumonia* were identified. In the other cow, no bacteria were isolated.

### 3.12 | Treatment

Treatment was attempted in 24 (89%) of 27 cows.

#### 3.12.1 | Foreign body removal

In all 5 (monensin bolus, n = 5) cows in which the foreign body was lodged in the pharynx, manual retrieval was performed during physical

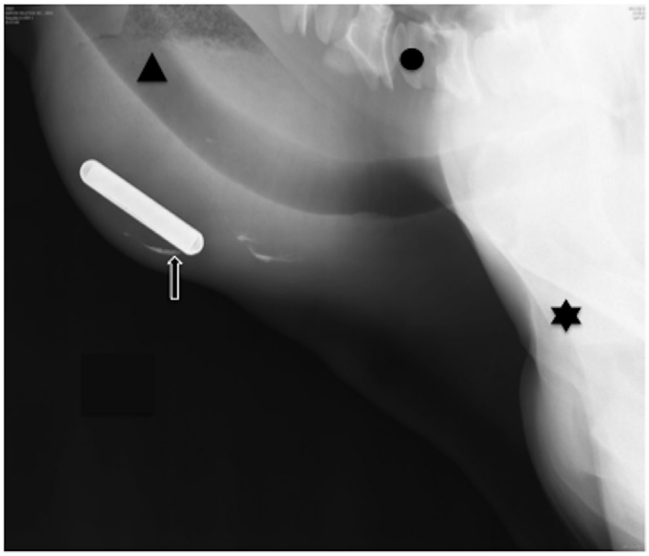

**FIGURE 2** Radiographic examination of the neck of an adult cow with pharyngeal trauma associated with administration of a magnet. Notice the presence of severe soft tissue opacity (soft tissue swelling) at the level of caudo-ventral neck, cranial to the thoracic inlet (black dot and black star). This soft tissue opacity is greater around a metallic foreign body (magnet, white arrow). There is also a small amount of mineral opacity adjacent to the foreign body (suspected to be sand). Ventral deviation of trachea is evident but otherwise it has a normal diameter. Large amount of mixed granular soft tissue and gas dorsal to the trachea suspected to be mixed feed material and gas outside of the esophagus is present (black arrowhead)

examination. Surgical exploration was carried out in 5 cows. In 2 cows, a monensin bolus was retrieved through a surgical incision of the right side of the neck. Blunt dissection was performed and tissue planes were filled with fluid and feed material. In 2 cows, a magnet was radiographically identified in the pharyngeal area. A blunt dissection of the involved tissue was performed until the magnet was identified and removed. In 1 of these cows with abscessation of the throatlatch region, a surgical drainage was performed and purulent material and feed particles were obtained. In all cases, the procedure was performed under local anesthesia with the animal standing. The jugular and the linguofacial veins, and the esophagus were identified before the incision. The size of the incision varied according to the size of the foreign body and all surgical wounds were left open for second intention healing. Lavage of the wound was performed daily with a diluted iodine solution until substantial closure was achieved. One cow in which a monensin bolus was retrieved through a surgical incision developed cellulitis of the tissue surrounding the surgical wound. After 10 days of treatment, the fistula failed to close, for example, there was complete communication between the oral cavity and the fistula (saliva was draining through the wound).

### 3.12.2 | Antimicrobial treatment

Antimicrobial treatment was instituted in 24 cases. Initial antimicrobial treatment consisted of combination of 2 antimicrobial agents in 17 cases and a single antimicrobial agent was used in 7 cases. Initial antimicrobial treatment regimens were trimethoprim sulfadoxine (TMS) (intravenously, IV) and sodium ampicillin (IV) (n = 6), TMS (IV) and procaine penicillin (intramuscularly, IM) (n = 7), sodium ampicillin (IV) and oxytetracycline (IV) (n = 1), sodium ampicillin (IV) and procaine penicillin (IM) (n = 1), sodium ampicillin (IV) and enrofloxacin (SC) (n = 1), and TMS (IV) and enrofloxacin (SC) (n = 1). Sodium ampicillin (IV) was used in 4 cases, and procaine penicillin (IM) TMS (IV) and oxytetracycline (IV) in 1 case, respectively. In 1 case in which sodium ampicillin (IV) was used alone, TMS (IV) was added to the treatment on day 3 and in 1 case where TMS (IV) was used alone, procaine penicillin was added on day 10. Duration of antimicrobial treatment ranged from 2 to 20 days (median: 9 days).

### 3.12.3 | Analgesic and anti-inflammatory treatment

Treatment with NSAIDs was administered to 24 cows. In 11 cows, ketoprofen was administered, flunixin meglumine in 5 cows, phenylbutazone in 2 cows, and meloxicam in 1 case. In 3 cases, a combination of ketoprofen and phenylbutazone was used, flunixin meglumine and phenylbutazone in 1 case, and meloxicam and flunixin meglumine in 1 case. The number of doses of NSAIDs ranged from 1 to 4 (median 2 days). In general, NSAIDs were administered every 48 hours. Corticosteroids were administered in 3 cases. These cases reported severe swelling of the larynx (n = 2) or respiratory distress (n = 1) during initial physical examination. In all cases, a single dose of dexamethasone was administered.

### 3.12.4 | Intravenous fluid therapy

A combination of sodium chloride 0.9% and dextrose 5% was implemented in 23 (85%) cases. The addition of dextrose in most of the cases was because of the associated anorexia in productive cows. Median duration of fluid therapy was 4 days (range: 1-13 days).

### 3.12.5 | Diet

The diet regimen during hospitalization was recorded in 12 (45%) cases. All the cows were kept off-feed during the first 24 hours. In 5 cows, beet pulp was introduced 48 hours (n = 2), 72 hours (n = 2), and 5 days (n = 1) after admission. Grain (milking cow concentrate) was offered to 4 cows at 48 hours (n = 1) and 72 hours (n = 3) after admission. Grass hay was offered to 1 cow on day 3 and fresh grass was offered to another cow also on day 3. A rumenostomy with permanent ruminal fistula was performed in 2 cases 1 week after admission.

## 3.13 | Outcome, time of hospitalization, and prognosis

Seventeen (63%) cows were discharged from the hospital and 10 (37%) were euthanized (including a 2-month-old heifer) because of poor prognosis, poor response to the instituted treatment, or economic

constraints. Overall hospitalization time (median) was 9 days (range: 0.5-22 days).

### 3.13.1 | Surviving cows

Eight (46%) out of 17 surviving cows had pharyngeal trauma associated with monensin, 1 (6%) with an iodine bolus, 3 (18%) with a magnet, 1 (6%) with a vitamin bolus, and 4 (24%) with an unidentified bolus. Median time between the suspected traumatic event and presentation to hospital was 1 day (n = 14) (range: 0.5-3 days). Sixteen (94%) cows displayed signs of improvement within the first 3-5 days. Twelve (71%) cows resumed appetite by day 3 after admission. In 4 (24%) cows, fever was controlled 3 days after presentation. Respiratory signs improved in 5 (29%) cows by day 3-5. Repeat oral endoscopic exam was performed in 4 cows between day 5 and 10. In all cows, closure of the perforation was identified with deposition of fibrin and feed material. One cow calved 5 days after admission, resumed appetite, and continued improving. One cow failed to show signs of improvement during the first 5 days, and then a rumenostomy was performed for feeding purposes. The clinical signs were improved by day 10 and the cow was discharged with a permanent rumen fistula. One other cow also failed to show any improvement by day 3, remained anorectic with excessive salivation and nasal discharge. Despite the guarded prognosis provided, the owner elected to take the animal home.

Two cows in which a magnet was surgically retrieved were discharged. The surgical wounds started to granulate rapidly after surgery. One cow was discharged 17 days after hospitalization with complete closure of the wound and the other cow was discharged on day 22 with minimal opening of the wound.

The time of hospitalization for surviving cows was 9 days (range: 4-22 days). Provided prognosis to the owners was available in all surviving cases. Good/favorable prognosis was given to 10 (60%) cows and guarded to 7 (40%) cows. Fifteen (88%) cows were discharged with instructions for continuing antimicrobial treatment (median 7 days, range: 3-13 days). In 1 case, continuing antimicrobial treatment was recommend until complete closure of the surgical wound.

### 3.13.2 | Nonsurviving cows

The time of hospitalization for nonsurviving cows was 3.5 days (range: 0.5-15 days). Median time between the suspected traumatic event and presentation to hospital was 2 days (n = 10) (range: 0.5-7 days). All 5 cows that had pharyngeal trauma associated with administration of bolus containing calcium salts were euthanized. Because of the severity of the clinical signs (eg, severe respiratory distress), the marked swelling and necrosis of the tissues associated to the pharynx and the poor prognosis given, euthanasia was elected at presentation in 4 out of the 5 cows. In the other cow, endoscopy examination on day 4 after admission revealed severe necrosis of the pharynx with an important amount of fibrin. Euthanasia was elected because of poor response to the treatment.

Two cows were euthanized because of the poor response to the treatment and complications associated with rumenostomy. In both cases, rumenostomy was performed to feed the cow until induction of parturition was possible. After calving, 1 cow was euthanized because of poor prognosis and complications with the rumen fistula. In the second case (2 days after rumenostomy), the surgical area appeared inflamed and necrotic tissue was observed. Abdominocentesis was performed and fluid analysis was compatible with peritonitis. The abdominal cavity was drained and 20 L of a turbid fluid was obtained. Because of the poor prognosis given, the cow was euthanized.

One cow that suffered pharyngeal trauma after administration of an aspirin bolus was euthanized 24 hours after admission because of the severity of the clinical signs with minimal response to the instituted treatment. In the cow that developed cellulitis and failure of wound closing after surgical retrieval of a monensin bolus, a rumenostomy for feeding purposes was recommended but declined by the owner. Because of the poor prognosis and likely economic constrains, the cow was euthanized.

One cow with pharyngeal trauma associated with monensin bolus administration was euthanized because a severe pneumomediastinum and emphysema of the neck identified upon admission. After 1 week of treatment, the cow developed anorexia, generalized emphysema, increased respiratory effort, mucopurulent nasal discharge, and metabolic acidosis. Because of the deterioration of the health status, the cow was euthanized.

### 3.14 | Postmortem examination findings

Postmortem examination findings were available for 9 out of 10 cows. Five out of 5 cows with pharyngeal trauma because of administration of a bolus of calcium had extensive necrosis of the pharyngeal, laryngeal, and esophageal tissues and 3 had suppurative bronchopneumonia. In 1 of these cows, bacteriological culture of the lung yielded a positive result for *Escherichia coli*, *Mannheimia* spp, *Corynebacterium* sp., and *Trueperella pyogenes*. In the other 4 cows (3 monensin bolus and 1 aspirin bolus), a large laceration of the oropharynx was identified. Cellulitis and necrosis of tissues surrounding the pharynx, larynx, and esophagus, with severe mediastinitis (n = 3) and bronchopneumonia (n = 3) were also described.

## 4 | DISCUSSION

The number of cattle diagnosed with pharyngeal trauma in this study confirmed that the disease appears to be uncommon. It is possible that the low prevalence identified in our study was biased by the chosen study methodology. Medical records archives at teaching hospitals compile only the 2 or 3 most important diagnoses in each case. It is possible that some cases of mild pharyngeal trauma could have been treated symptomatically but pharyngeal trauma was not recorded as a final diagnosis, and therefore some potential cases were likely missed and severe cases could be overrepresented. Given that this was a retrospective study, the results must be interpreted cautiously as the data are subject to potential bias associated with the study design. In addition,

teaching hospitals are referral centers and are consulted more often for complicated cases occurring those attended by practitioners in the field.

The cause of pharyngeal trauma in all cattle included in this study was iatrogenic, mostly after difficult administration of medicine boluses by the owner or veterinarian. Therefore, obtaining a complete history including signalment and previous use of balling gun is necessary for the initial list of differential diagnosis in cattle presented with clinical signs described in our study.[10] The clinical signs consistent with pharyngeal trauma reported in this study included dyspnea, upper respiratory noise, subcutaneous emphysema, swelling of the throatlatch, and pain on palpation of the throat and neck. Although these signs are nonspecific, they are observed consistently with pharyngeal trauma in different studies[2,5,6,10] and other species[11] and should prompt an oral or endoscopic examination or both. This could aid with the identification of a foreign body lodged in the pharynx, observation of a soft tissue lacerations or swelling, or accumulation of feed material and fibrin in the pharynx and larynx.

In our study, changes in the CBC and SBP were nonspecific. Common findings included leukocytosis, with neutrophilia, hyperfibrinogenemia, and hyperglobulinemia that were consistent with an active inflammatory process. Endoscopic examination was useful in determining the presence of the foreign body lodged in the upper airways, to elucidate the anatomic location of the problem and to evaluate the extent and severity of the damage caused by the foreign body or the salts contained in the bolus (eg, calcium salts). The nature of our data prevents determining whether the findings in the endoscopic exam can be useful for treatment decision-making process and for providing an accurate prognosis. In the experience of some of the authors of this study, the lesion produced by calcium salts (eg, extensive necrosis of the tissues of the pharynx, larynx) is more severe than the trauma caused by monensin boluses or magnets.

Similar to previous case reports, during radiographic examination of the neck and throatlatch, a foreign body (eg, monensin bolus or magnet) was detected in all the cows suspected to have a foreign body lodged in the upper airways or proximal neck.[2,5,6,10,11] In those cases, radiographic evidence of the sequel of the trauma and perforation was evident (eg, gas, either SC or between fascia planes).[6] Similarly, ultrasound findings also demonstrated the sequelae of the perforation.[6]

Manual foreign body (monensin bolus) removal was performed during physical examination. Surgical exploration was necessary for foreign body removal in 5 cows (3 surviving and 2 nonsurviving). After removal, treatment in all cases was similar and consisted of antimicrobial, analgesic/anti-inflammatory treatment, and supportive care. In human medicine, broad-spectrum antimicrobials are strongly recommended to avoid mediastinitis, abscesses, and deep neck space infections.[3] In humans, the duration of antimicrobial treatment is based on the clinical response and the presence of complication (eg, abscessation).[12,13] Initial treatment options for cattle with pharyngeal trauma should involve gram-positive and gram-negative aerobic and anaerobic coverage (eg, combination of penicillins, aminopenicillins, potentiated sulfas, or oxytetracycline).[14] The ideal duration of antimicrobial treatment in cattle with pharyngeal trauma cannot be determined from the data presented herein and remains to be identified. However, based on these cases, 7 to 14 days is most likely an adequate duration.

Treatment should also include fluid and nutritional support. Initially, intravenous fluids are indicated to maintain normal hydration. Initial nutritional support can include offering soft feeds (eg, beet pulp) and grass. Our results showed that upon swelling and pain reduction, the appetite especially ingestion of hay and grain improved. Rumen fistulation allows nutritional support in valuable animals or pregnant animal close to parturition. This procedure was only performed in severe cases in this study. Although this procedure was successful in 1 case, it was associated with peritonitis in another case which carried a poorer prognosis. This type of complication has also been observed in cattle with pharyngeal trauma.[10] Despite the possible benefits of rumen fistulas, this procedure is not without complication and should be performed only when other alternatives have been exhausted.

The overall survival rate for cattle suffering from pharyngeal trauma was 63%. In humans, the case fatality rate for pharyngoesophageal injury varies from 15% to 19% and the case fatality and morbidity rate is directly associated with a delay in diagnosis or intervention.[15,16] For instance, the case fatality associated with esophageal perforations diagnosed during the first 24 hours versus after 24 hours was 4% and 44%, respectively.[17] In our study, the median time between the suspected traumatic event and presentation to hospital was shorter (1 day) for surviving than nonsurviving (2 days) cattle. These findings indicate that rapid recognition of disease and prompt initiation of treatment could have affected the outcome of cattle with pharyngeal trauma. Therefore, farmers and veterinary practitioners should be aware that prompt identification of pharyngeal trauma after bolus administration could positively affect their overall outcome.

The results of our study also demonstrated that cattle suffering from pharyngeal trauma associated with administration of a bolus containing fast dissolving, caustic compounds such as calcium salts have a poor prognosis. This finding is in agreement with previous published case reports and clinician experience.[8,10] This highlights the importance of the correct bolus administration and raises the question about veterinary responsibility for training farm personnel on bolus administration and balling gun handling as a part of the herd health program. Although it is clear that the complete prevention of complications is impossible, reduction of the incidence of pharyngeal trauma could be greatly reduced by using a correct technique and adequate cattle handling. This is of importance when dairy industry has promoted the widespread use of oral medications (eg, boluses) and devices (eg, magnets) for disease prevention.[1]

In conclusion, the results of this study revealed that pharyngeal trauma is a rare condition in adult cattle. Diagnostic procedures should include collection of a detailed clinical history, physical examination including oral examination, and diagnostic imaging including endoscopy, radiography, and ultrasonography. Prompt recognition of the trauma and rapid institution of treatment could positively impact the outcome of the cattle. Proper technique and adequate cattle handling during boluses administration could aid in the reduction of the incidence of pharyngeal trauma.

## ACKNOWLEDGMENT

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## CONFLICT OF INTEREST DECLARATION

Authors declare no conflict of interest.

## OFF-LABEL ANTIMICROBIAL DECLARATION

Authors declare no off-label use of antimicrobials.

## INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE (IACUC) OR OTHER APPROVAL DECLARATION

Authors declare no IACUC or other approval was needed.

## HUMAN ETHICS APPROVAL DECLARATION

Authors declare human ethics approval was not needed for this study.

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