

Case Report Rapport de cas

Management of dogs and cats with endotracheal tube tracheal foreign bodies

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Abstract – Two cats and 3 dogs were treated for an endotracheal tube tracheal foreign body (ETFB) during recovery from general anesthesia. Bronchoscopy was used to remove the ETFB. Animals were clinically normal at discharge. While rare, ETFB can occur upon recovery from anesthesia. Bronchoscopy is an effective way to remove ETFB.

Résumé – Gestion des chiens et des chats avec un corps étranger trachéal à cause du tube endotrachéal. Deux chats et 3 chiens ont été traités pour un corps étranger trachéal à cause du tube endotrachéal (CETTT) durant le réveil de l'anesthésie générale. Une bronchoscopie a été utilisée pour enlever le CETTT. Les animaux étaient cliniquement normaux au congé. Quoique rare, le CETTT, peut se produire au réveil de l'anesthésie. La bronchoscopie est une manière efficace d'enlever le CETTT.

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Intubation with endotracheal tubes (ET) is commonly performed to provide oxygen supplementation and inhalant anesthesia, and to help prevent aspiration pneumonia during general anesthesia. In order to prevent complications upon extubation, a smooth, closely monitored recovery plan is necessary. While extubation in dogs occurs when the dog swallows or shows head or limb movement, cats can recover more quickly and extubation is often performed when a strong medial palpebral reflex, ear flick, increase in respiratory rate or slight tongue movement is noted. Even with close monitoring, it is possible for a dog or cat to recover from general anesthesia more quickly than anticipated and subsequently sever the ET. This can result in aspiration of the amputated portion of the ET, resulting in a tracheal foreign body. This could also happen with adaptor disconnections from the ET during general anesthesia, if not quickly noticed (1).

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There is little information regarding prevalence, treatment options, and outcome of this potential side effect of intubation. There are several reports on techniques for removal with materials found in most veterinary hospitals, such as passing a smaller cuffed ET or a Foley urinary catheter through the severed ET, inflating the cuff/balloon and then removing both tubes (2–8). Several effective methods are published for the removal of all types of tracheal foreign bodies, including rigid or flexible bronchoscopy with grasping forceps, use of a Foley catheter passed alongside the bronchoscope and inflated past the foreign body, vacuum extraction, and the use of forceps with fluoroscopy (1,9–11). These methods could also be considered for the removal of severed ET tracheal foreign bodies (ETFB). Surgical removal, including pre-sternal tracheotomy, endoscopy through a tracheostomy site, and thoracotomy, has been described in the event that less invasive methods of removal fail (12–14). This phenomenon has been reported in human hospitals as well, and, as in veterinary medicine, both rigid and flexible bronchoscopy are quick and effective methods of removal, although it is suggested that more practitioners in human medicine are turning to flexible bronchoscopy which has fewer reported complications (15). The purpose of this report is to review the methods available to remove ETFB in dogs and cats, the potential side effects, and the outcome in 2 cats and 3 dogs.

Case descriptions

Case records were obtained for all patients which were diagnosed with ETFB at the Ontario Veterinary College Veterinary Teaching Hospital (OVC-VTH) and the Mississauga-Oakville Veterinary Emergency Hospital (MOVEH) between 1990 and 2011. Information obtained included signalment, history, abnormalities on physical examination, location of the ET, anesthetic records, removal method, post-anesthetic treatment,

Table 1. Summary of data for cases presenting with ETFB.

Signalment	Procedure performed prior to ETFB	Duration of ETFB	Clinical signs	Induction and maintenance for removal of ETFB	Removal method	Medications administered after removal of ETFB	Complications
Case 1 1 yo MN German shepherd dog	Orchiectomy (cryptorchid)	< 12 h	Mild cough	Oxymorphone	Bronchoscope type not recorded, alligator forceps	Antibiotic and anti-inflammatory (type not recorded)	None noted
Case 2 1 yo FS DSH	Ovario-hysterectomy	48 h	Moderate increase in respiratory effort	Propofol	4.5 mm flexible bronchoscope, alligator forceps	Dexamethasone, Clavamox	Mild cough that resolved within 24 h
Case 3 3 yo FS DSH	Onychectomy	< 12 h	None	Propofol	Rigid endoscope, forceps not recorded	Butorphanol	None noted
Case 4 7 yo MN golden retriever	Gastric dilation and volvulus	< 1 h	Re-anesthetized immediately	Propofol	Equipment not recorded	Dexamethasone and cephalexin	None related to ETFB
Case 5 3 yo FS Bernese mountain dog	Esophageal foreign body	< 5 min	Re-anesthetized immediately	Propofol	Flexible veterinary endoscope, alligator forceps	None	None noted

ETFB — endotracheal tube foreign body, yo — years old, MN — male, neutered, FS — female, spayed, DSH — domestic short hair.

length of time spent in hospital, and any treatment past discharge (Table 1).

Case 1

A 1-year-old, castrated male German shepherd dog was referred to the OVC-VTH after biting through and aspirating the severed ET upon recovery from general anesthesia (thiopental induction and methoxyfluorane maintenance) from a cryptorchid neuter surgery. Radiographs done by the referring veterinarian confirmed the presence of the ETFB in the trachea. Upon presentation to the OVC-VTH, the patient was sedated and coughed with tracheal palpation, with no other abnormalities noted on physical examination. He was further sedated with oxymorphone (Numorphan; Endo Pharmaceuticals, Chadds Ford, Pennsylvania, USA), 0.086 mg/kg body weight (BW), IV, and was supported with oxygen tracheal insufflation and intravenous fluids. Inhalant anesthesia was not utilized. Bronchoscopy was performed and the ETFB was visualized 5 cm caudal to the larynx. It was grasped with alligator forceps and removed. The trachea was examined endoscopically after removal and showed erythema and mucoid material. The time from sedation to reversal was approximately 30 min; naloxone (Naloxone; Hospira, St. Laurent, Quebec), 0.02 mg/kg BW, IV, was administered to reverse the sedation. The patient recovered in hospital and was discharged that day to the care of the referring veterinarian with the recommendation for antibiotic and anti-inflammatory therapy (duration and type not specified), and a few days of exercise restriction.

Case 2

A 1-year-old, spayed female domestic medium haired cat was referred to the OVC-VTH for retrieval of the distal end of an ET that was chewed off and aspirated 2 d earlier upon recovery from general anesthesia for an ovariohysterectomy. The

anesthetic protocol used for the ovariohysterectomy was not available for review. Radiographs showed a marked aerophagia, and a 45-mm severed ET in the distal thoracic trachea. The ETFB entered the right mainstem bronchus, extending 7 to 8 mm past the carina. Attempts to remove the ETFB at the referring clinic were unsuccessful; the methods used to attempt to remove the ETFB were not recorded. The cat was sedated (sedation protocol not available) and transported by a 45-minute airplane trip for removal of the ETFB. Upon admission, the patient was bright, alert, and responsive and the only abnormality found on physical examination was a moderate increase in respiratory effort. Flow-by oxygen supplementation was provided, and general anesthesia was induced and maintained with intravenous propofol (Diprivan 1%; AstraZeneca, Mississauga, Ontario). A 4.5-mm flexible bronchoscope was used to visualize the ETFB. Alligator forceps were passed alongside the bronchoscope and the ETFB was grasped and removed. Inspection of the airway endoscopically after the ETFB was removed showed moderate erythema of the distal trachea and proximal right mainstem bronchus. The length of time for the procedure was not recorded. A single dose of dexamethasone (Dexasone; Pd-Rx, Oklahoma City, Oklahoma, USA), 1 mg IV (animal's weight not available in medical record) was given after the procedure to decrease inflammation. Recovery from anesthesia was uneventful.

Amoxicillin-clavulanate (Clavamox; Pfizer Animal Health, Kirkland, Quebec), 62.5 mg PO, q12h, for 5 d was commenced pending bacterial culture of the ETFB, which was shown to have a light growth of *Pasteurella dagmatis*, susceptible to all antibiotics tested. The patient developed a mild cough after recovery that resolved within 24 h, and had a slight wheeze upon thoracic auscultation, along with a mild increase in tracheal sounds when purring. The patient was clinically normal when discharged 3 d later.

Case 3

A 3-year-old, spayed female domestic short-haired cat was referred to the OVC-VTH for the removal of an ETFB in the trachea following recovery from general anesthesia for a declaw surgery. The cat was sedated with 0.9 mL of BAG (butorphanol, acepromazine and glycopyrrolate premixture, ratio of drugs not noted in record), induced with thiopental and maintained with inhaled halothane. A lateral thoracic radiograph showed the ETFB lodged between the thoracic inlet and the carina within the trachea. The patient was sedated with 0.5 mL of BAG premixture and transported to OVC-VTH. On presentation, the patient was sedated with no signs of respiratory distress; however, there were increased bronchovesicular tone on thoracic auscultation. Blood gas analysis was unremarkable. The patient was anesthetized with propofol (Diprivan 1%; AstraZeneca), 5 mg/kg BW, IV, over 20 min, and a rigid endoscope was used to visualize the ETFB. The ETFB was removed with forceps; the type of forceps used was not recorded. Mild tracheal erythema was noted endoscopically after removal, and butorphanol (Torbugesic; Wyeth Animal Health, Guelph, Ontario), 0.175 mg/kg BW, IV, was administered for analgesia. The duration of the procedure was not recorded. After an uneventful recovery, the patient was discharged the same day with no medication dispensed.

Case 4

A 7-year-old, castrated male golden retriever dog was referred to the OVC-VTH for gastric dilation and volvulus (GDV). The dog was premedicated with hydromorphone (Hydromorphone; Sandoz Canada, Boucherville, Quebec), 0.1 mg/kg BW, IV, induced with diazepam (Diazepam; Sandoz), 0.2 mg/kg BW, IV, and maintained with inhaled isoflurane (Aerrane; Baxter, Mississauga, Ontario). Upon recovery from general anesthesia for an incisional gastropexy and gastrotomy for removal of a concurrent foreign body, the patient awoke rapidly and bit through the ET. A lateral cervical radiograph confirmed the location of the ET within the trachea. The patient was re-anesthetized and maintained with propofol (Diprivan 1%; AstraZeneca), 1.25 mg/kg BW, IV, to induce, and 10 mg/kg BW, IV, total for maintenance of anesthesia. Dexamethasone (Dexasone; Pd-Rx), 0.1 mg/kg BW, IV, was administered to minimize swelling. An endoscope was used to visualize the severed ET, and forceps (type not specified) were used to remove the ETFB. Mild laryngeal erythema and swelling were present after the removal of the ETFB. An intact ET was placed to maintain a patent airway during recovery, which was unremarkable. The length of the procedure was less than 5 min. Mild pyrexia developed the following evening. Thoracic radiographs ruled out aspiration pneumonia, and a localized peritonitis was suspected. The patient was started on cephalexin (Novolexin; Novopharm), 25 mg/kg BW, PO, q8h for 10 d. The patient was discharged after 2 d in hospital. On subsequent rechecks, the patient showed no apparent side effects from the ETFB.

Case 5

A 3-year-old, spayed female Bernese mountain dog was presented to the MOVEH for endoscopic removal of an esophageal foreign body. The dog was premedicated with butorphanol

(Torbugesic; Wyeth), 0.3 mg/kg BW, IV, induced with propofol (Diprivan 1%; AstraZeneca), 6 mg/kg BW, IV, and maintained with inhaled isoflurane (Aerrane; Baxter). An apple core was endoscopically removed from the esophagus. Upon recovery from general anesthesia, the patient awoke rapidly and bit through the ET. The patient was re-anesthetized and maintained with propofol (Diprivan 1%; AstraZeneca), 1.25 mg/kg BW, IV, for induction, and with the total for maintenance of anesthesia not recorded. A flexible veterinary endoscope was used to visualize the ETFB, and alligator forceps were used to remove the ETFB. The trachea appeared normal on endoscopic inspection after removal. The duration of the procedure was less than 5 min. After an uneventful recovery, the patient was discharged the following day with no medication dispensed.

Discussion

Endotracheal tube tracheal foreign bodies (ETFB) are extremely rare, but are encountered in dogs and cats. These foreign bodies should be dealt with quickly and efficiently because of the location and possible complications which can range from mild respiratory distress and discomfort, to the more severe upper airway laceration, injury or obstruction of air flow (5,16). Endotracheal tube tracheal foreign bodies could be immediately life-threatening if lacerations of the trachea or mainstem bronchi were to occur, as pneumomediastinum and pneumothorax could result. However, the cat in Case 2 survived for 2 d with a substantial piece of ET in the trachea and recovered well after removal with no clinical signs at discharge from hospital. In animals that aspirate larger portions of ET and are allowed to recover, acute respiratory distress would typically be expected. All animals presented here had aspirated large pieces of the distal end of the ET, and those that recovered from anesthesia prior to removal of the ETFB displayed mild to moderate clinical signs associated with the respiratory tract, including coughing and an increase in respiratory effort. One animal was presented with no clinical signs; therefore, based on these cases, severe respiratory distress is not expected. The cause of the clinical signs upon recovery should be apparent, as the veterinarian or personnel recovering the patient would likely recognize that a section of ET had been severed. However, a small piece of ET aspirated into the respiratory tract can cause significant irritation without an obvious cause, and can result in a chronic cough. A single case that was reported in a case series of intrabronchial foreign bodies described an aspirated piece of rubber from an ET that resulted in a chronic cough of 2-months' duration (9). In this case, general anesthesia had been performed to repair an abdominal hernia. The dog died 2 months after surgical correction of several episodes of post-surgical wound dehiscence and ultimately shock, whereby the authors theorized that this could be directly attributed to coughing secondary to the foreign body. However, it is not possible to definitively correlate these 2 occurrences; a postmortem examination was not performed to investigate this possibility. This published case does underline the importance of inspecting the ET after use for general anesthesia, to ensure that it is intact.

Although we describe ETFB that occurred at the time of recovery, a human case study describes the connector of the

ET coming loose and the tube being aspirated deeper into the respiratory tract (17). This is an important reminder that while an ETFB will most commonly occur due to the patient severing it during a rapid recovery, it is important to ensure that the connector is tightly attached to the tube and to ensure that all parts of the ET are present after extubation.

Removal of the ETFB using rigid and flexible bronchoscopy with grasping forceps was performed in the cases presented in this report and, in this small sample of patients, there was no indication that one method was superior to the other. In human patients, flexible bronchoscopic removal of an ETFB is reported to have fewer complications than rigid bronchoscopic removal. Patient size will likely limit the use of rigid bronchoscopy to cats and small dogs. All patients had visual evidence of irritation in the trachea, but all lesions were relatively mild and clinically resolved within a short period of time. While bronchoscopic removal was the method of choice in this report, other techniques may be equally effective. At veterinary clinics without endoscopy, it may be prudent to attempt to remove the foreign body with tools on hand, including passing a smaller cuffed ET or a Foley urinary catheter into or through the lodged ET, inflating and then removing both tubes (2–8). Caution must be taken when using these techniques, as over-inflation of the cuff, if placed beyond the ETFB, could result in damage to the trachea. If bronchoscopy is not employed, then the larynx should be visually inspected throughout the entire ETFB removal procedure in an attempt to minimize damage. Other possibilities that could be considered are bronchoscopy with a Foley catheter (passed alongside the bronchoscope and inflated within or just past the ET), a vacuum extraction technique modified from methods used in human medicine, and the use of forceps or a Foley catheter with fluoroscopy (1,9–11).

Using forceps with fluoroscopy to remove tracheal foreign bodies was shown in one study to be substantially faster than endoscopy, decreasing the duration of intravenous anesthesia (9). However, grasping the end of an ETFB may be a challenge using endoscopic forceps and fluoroscopic guidance. This could result in increased trauma to the adjacent tracheal wall; therefore, the increased accuracy offered with bronchoscopy over fluoroscopy may supersede the increased time required.

An important consideration in selecting a method to remove the ETFB is that there is a risk of obstructing the airway with the instruments used, especially in smaller animals. It is important to select an endoscope and removal tools that allow air passage into and out of the airways. If this is not possible, then fluoroscopy appears to be a safe and effective alternative to bronchoscopy, as fewer tools are introduced into the airway.

A surgical approach, although avoiding obstruction of the airway, is unnecessary in virtually all cases. A thoracotomy, if required, presents its own risks with ventilation complications, a prolonged recovery period, and other common surgical complications.

Endotracheal tube tracheal foreign bodies are rare in dogs and cats, but can occur with an animal's quick recovery from general anesthesia thus requiring immediate intervention. Patients recovering from general anesthesia should be closely monitored by personnel having equipment readily available to perform immediate extubation if indicated, to avoid ETFB. Personnel performing recovery of animals from general anesthesia and extubation must be properly trained in assessing the signs indicating the need for immediate extubation. The use of rigid or flexible bronchoscopy and grasping forceps is a safe and effective way to remove ETFB.

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