

CASE REPORT

Self-expanding tracheal stent placement in a cat with primary tracheal collapse

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A 12-year-old mixed-breed spayed female cat presented with dyspnoea, open-mouthed breathing, and cyanosis that was difficult to control with medical pharmacotherapy; the cat was diagnosed with the primary tracheal collapse of the neck and chest regions. The diagnosis was confirmed by dynamic chest radiography, tracheal endoscopy, and computed tomography (CT). Tracheal endoscopy and CT showed dropsy of the dorsal membranous wall over most of the trachea. A self-expanding Nitinol cross-and-hook braided stent was placed along the entire tracheal lumen using surgical X-ray fluoroscopy. Bacterial cultures in the trachea were negative. Dyspnoea disappeared immediately after the endotracheal stent was implanted. Although the long-term prognosis remains under observation, the short- to medium-term prognosis was very good. These results suggest that stenting may be useful in the treatment of primary tracheal collapse in cats.

KEYWORDS

collapsed trachea, elder cat, endoluminal stent implantation, feline

1 | INTRODUCTION

Tracheal collapse is rare in cats, with most cases secondary to tumours or foreign bodies (Bell et al., 2006; Culp et al., 2007). Although it is more common in small dogs of middle to old age (Della Maggiore, 2020; Johnson & Pollard, 2010; R. A. S. White & Williams, 1994; R. N. White, 1995), the number of cases reporting the treatment of primary tracheal collapse in cats is extremely limited (Mims et al., 2008). Consequently, there is a lack of evidence for effective treatment. Herein, we report a favourable outcome of endotracheal stenting in a 12-year-old mongrel cat with grade 4 primary tracheal collapse. Chest radiography, dynamic chest radiography, tracheal endoscopy, and computed tomography (CT) confirmed the diagnosis.

2 | CASE REPORT

The patient was a 12-year-old, mixed-breed spayed female cat weighing 3.3 kg. The cat was a completely indoor cat. The cat had shown

intermittent vomiting since it was young, but the frequency of vomiting increased approximately 1 year ago, simultaneously with intermittent breathing abnormalities. Symptoms improved with anti-inflammatory drugs (prednisolone, 0.5 mg/kg) prescribed following a consultation with a local veterinarian who suspected reflux esophagitis. Six months ago, dyspnoea without vomiting reappeared. One month ago, the cat was taken to a referral physician who prescribed antibiotics, anti-inflammatory drugs, and bronchodilators, which temporarily relieved the symptoms. Furthermore, a few days ago, the cat showed effortful open-mouthed breathing, drooling, cyanosis, and severe breathing difficulties. The respiratory sounds increased, but there was no coughing or stridor. The patient was referred to our Veterinary Medical Center for a thorough examination and treatment.

At the first assessment (Day 1), blood tests showed mildly elevated BUN (31.1 mg/dl), but there were no notable findings in complete blood count (CBC) or biochemical tests, including serum amyloid A (4.33 μ g/ml; reference value < 5.49 μ g/ml). The chest radiography showed more than 80%–90% narrowing of the tracheal lumen in the narrowest

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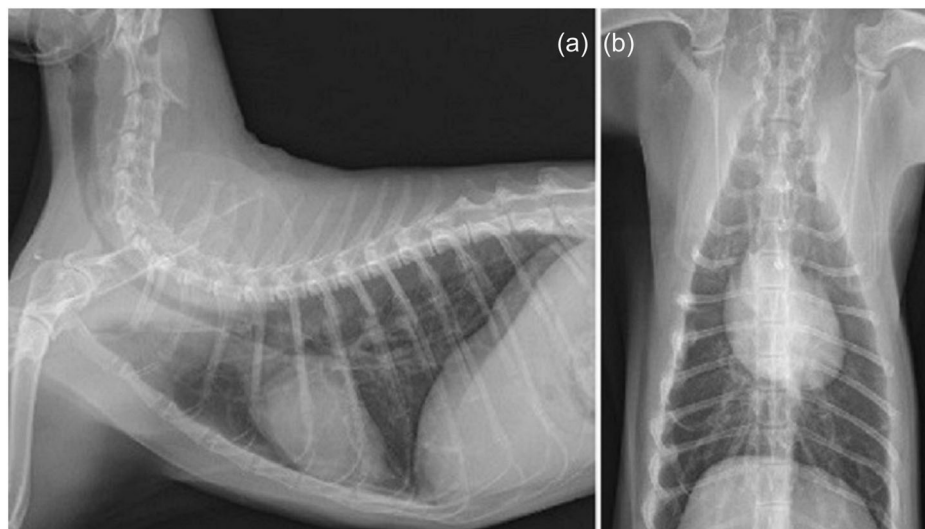


FIGURE 1 Chest radiograph at the initial examination (Day 1). Both inhalation and exhalation showed more than 80%–90% narrowing of the tracheal lumen at the narrowest point, but no foreign body or tumour was visible. (a) Lateral and (b) ventral dorsal

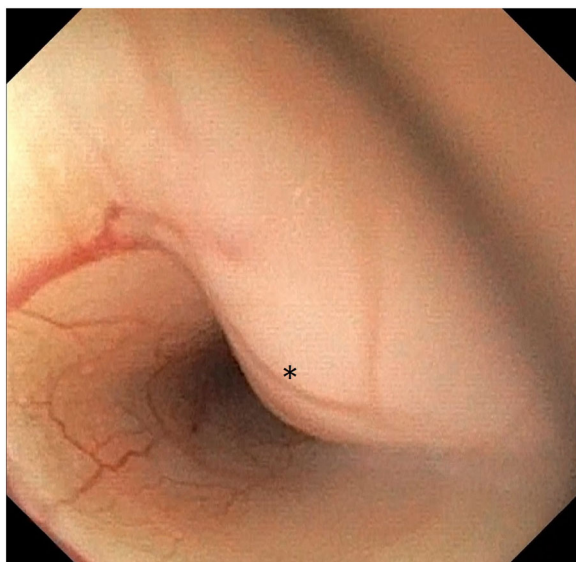


FIGURE 2 Tracheal endoscopy was performed under general anaesthesia on Day 1. There was no foreign body or mass lesion in the tracheal cavity, and the dorsal membranous wall of the trachea was relaxed (*)

part during inspiration and expiration, but no foreign body or tumour was found (Figure 1). Echocardiography did not reveal any notable findings. Tracheal endoscopy under general anaesthesia revealed that there were no foreign bodies in the tracheal cavity and relaxation of the dorsal membranous wall over most of the trachea (Figure 2). The collapse was static, and the tracheal rings flattened and collapsed in the dorsoventral direction at the site of maximum stenosis. Dynamic chest radiography confirmed the presence of a tracheal collapse. A CT scan did not show evidence of a mass lesion in the peri-tracheal or cervicothoracic areas (Figure 3). Therefore, the patient was diagnosed with a primary tracheal collapse.

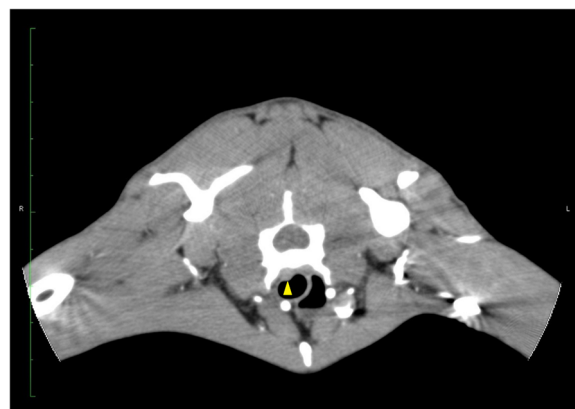


FIGURE 3 Computed tomography (CT) scan showed no evidence of a mass lesion in the peri-tracheal or cervicothoracic areas (Day 1). Relaxation of the tracheobronchial wall observed in endoscopy was also observed in the CT scan (arrowhead)

The cat had severe respiratory distress with effortful open-mouth breathing, drooling, and cyanosis. There was no mass or compressive lesion around the trachea, and there was a collapsed trachea in the neck and chest. Therefore, an endotracheal stenting procedure was performed on Day 28 under surgical X-ray fluoroscopy (Carm). The referring physician managed the patient in an oxygen room from the initial diagnosis until surgery. A self-expanding nitinol stent (Fauna Stent; M.I. Tech Co., Ltd., Pyeongtaek, Korea) with cross-and-hook braiding was implanted. The diameter of the stent was selected to be approximately 10% larger than the maximum diameter of the tracheal region (8.2 mm), where no collapse was observed on preoperative chest radiographs. Anaesthesia was maintained using continuous rate infusions (CRI) of propofol. The stent was placed 15 mm from the epiglottis and extended to the tracheal bifurcation (stent diameter: 9 mm; stent length: 90 mm). Atropine (0.01 mg/kg, intravenous injection [iv]), ampicillin (30 mg/kg, iv; ampicillin sodium; ampicillin sodium injection 1 g, Kyoritsuseiyaku

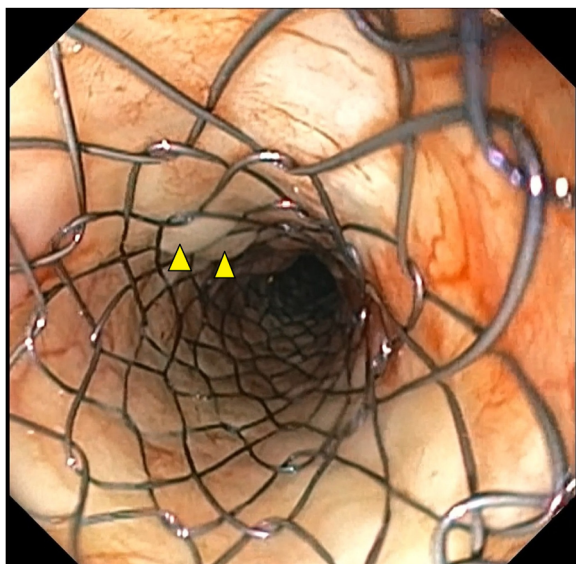


FIGURE 4 On Day 28, tracheal endoscopy was performed after implantation of the tracheal stent. It can be seen that the stent elevated the lax membranous wall on the dorsal side of the trachea, which was observed on Day 1 (arrowheads)

Co. Ltd., Tokyo, Japan), and butorphanol (0.2 mg/kg iv, preoperative and postoperative; Vetorphale®, Meiji Seika Pharma Co Ltd., Tokyo, Japan) were administered. Anaesthesia was induced with propofol (on effect, [iv]) (Mylan injection 1%, Mylan Inc., Tokyo, Japan). Intraoperatively, tracheal wipe fluid was collected for bacterial culture, and tracheal endoscopy was performed after stent placement. Endoscopy after stent placement showed that the entire tracheal mucosa was covered by the stent. There was no obvious bleeding, inflammatory reaction, or secretion in the tracheal lumen (Figure 4). The time from induction of anaesthesia to awakening was 20 min.

The respiratory status of the patient was very good immediately after awaking from anaesthesia. The general condition of the patient was good, and the patient was able to eat a complete meal of liquid food 5 h after the placement of the stent. The cat was cared for in a hospital room with 40% oxygen for the first 2 days after surgery. It was transferred to a general hospital room (Day 31) once respiratory status had stabilized following a gradual decrease in oxygen concentration. During hospitalization, the cat received antibiotics ABPC (ampicillin) (30 mg/kg, iv, BID) and enrofloxacin (5 mg/kg, subcutaneous injection (sc), SID) (Baytril 2.5%, Bayer Yakuin, Ltd.). Furthermore, the drug was administered through the nebulizer of the inhaler twice daily via the transbronchial route (Tyloxapol; 2.5 mg/head; Alevele ALEVAIRE Inhalation Solution 0.125%, Alfresa Pharma Co., Ltd., Osaka, Japan), salbutamol sulphate (2.5 mg/head; Venetlin for Inhalation 0.5%, GlaxoSmithKline K.K., Tokyo, Japan), acetylcysteine (200 mg/head; Mucofilin 20%, Eisai Co. Ltd., Tokyo, Japan), kanamycin (125 mg/head; Kanamycin Surfate Injection 250 mg/ml), budesonide (0.25 mg/head; Pulmicort Respules 0.25 mg, AstraZeneca K.K., Osaka, Japan). The patient was discharged on the third postoperative day (Day 31). Antibiotics (only ABPC) were continued for 4 weeks, and nebulization was performed

at home with BID for 1 week after surgery and SID for the following week. The culture results of the endotracheal wipe fluid at the time of stent placement were negative.

The postoperative course of the cat's general condition was good, including appetite and activity, and the owner was satisfied that the cat's condition was the same as before tracheal collapse. At postoperative 188 days, the clinical symptoms observed before surgery, such as dyspnoea, disappeared, and no stent migration or damage was observed (Figure 5). The owner was interviewed 239 days postoperatively, and it was revealed that the patient had very good vigour and appetite, with no signs of dyspnoea.

3 | DISCUSSION

Compared with cats, tracheal collapse is more common in small dog breeds such as Yorkshire Terriers, Toy Poodles, Pomeranians, Chihuahuas, and Pugs (Buback et al., 1996; Johnson & Pollard, 2010; Payne et al., 2006; R. A. S. White & Williams, 1994; R. N. White, 1995). The disease is most common in middle-aged dogs (Buback et al., 1996; R. A. S. White & Williams, 1994; R. N. White, 1995) although it is reportedly more severe in younger age groups (Buback et al., 1996). There are no sex differences in occurrence (Buback et al., 1996; R. A. S. White & Williams, 1994; R. N. White, 1995). In addition to congenital predisposition, acquired factors such as obesity, environmental allergens, tobacco, and Kennel cough worsen the clinical signs of tracheal collapse (Payne et al., 2006; R. A. S. White & Williams, 1994). In cats, tracheal collapse usually occurs secondary to tumours or foreign bodies, while primary tracheal collapse is rare (Bell et al., 2006; Culp et al., 2007). To the best of our knowledge, only one case of extracavitary ring prosthesis correction has been reported in cats (Mims et al., 2008; Jin et al., 2021).

Although median survival times are similar following extratracheal and endotracheal therapies in dogs (Tinga et al., 2015), this case had a thoracic tracheal collapse. Since endotracheal lumen therapy tends to be chosen over extratracheal therapy for dogs with thoracic or full tracheal collapse (Congiusta et al., 2021; Mittleman et al., 2004; Payne et al., 2006), we also chose endoluminal therapy to treat our patient because it was considered too invasive to treat the entire area of tracheal collapse with extraluminal therapy.

In the present case, the patient presented with severe clinical symptoms and had difficulty breathing normally except when in a 40% oxygen chamber. Therefore, interventional radiology treatment was mandatory to save cat's life. Tracheal stents can have complications such as inflammation, bacterial tracheitis, stent breakage, migration, and shortening after implantation (Durant et al., 2012; Jin et al., 2021; Mittleman et al., 2004; Moritz et al., 2004; Radlinsky et al., 1997; Sura & Krahwinkel, 2008; Tinga et al., 2015). Furthermore, many cats are highly active and perform greater vertical movements compared to dogs. Concerningly, three-dimensional movements, such as grooming, frequently subject the neck to physical forces that might be more likely to cause complications with the implanted stent. However, compared with canine tracheal collapse, the present case did not tend to have

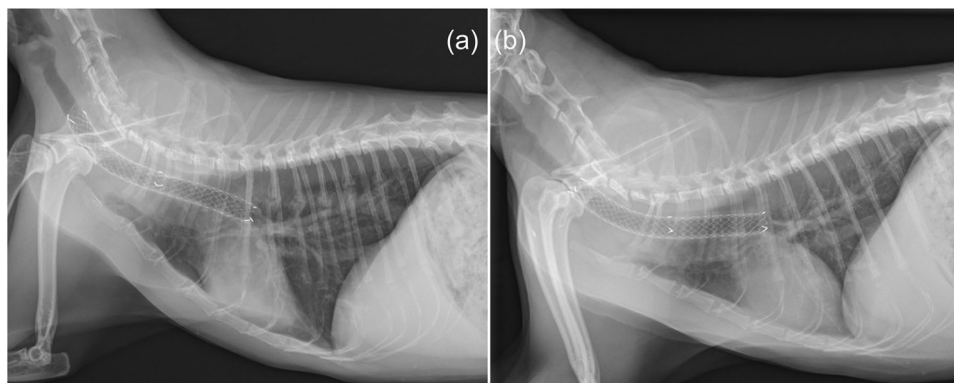


FIGURE 5 Chest radiographs immediately after surgery (a) and 188 days postoperatively (Day 215). No stent migration or breakage was observed

more sputum or coughing after stent placement. At 239 days postoperatively, the mid-term prognosis was extremely good.

Hospitalizations for dogs with tracheal collapse are multifactorial, with cardiomegaly, pulmonary oedema, respiratory infection, endotracheal intubation, the presence of smokers in the household, allergic respiratory disease, and obesity have been reported as factors linked to the onset of clinical signs (R. A. S. White & Williams, 1994). Meanwhile, the pathogenesis of primary tracheal collapse in cats remains unclear as it is extremely rare. In the present case, there was no cardiovascular disease, pulmonary oedema, infection, allergic disease, history of anaesthesia, or tracheal intubation for more than 10 years, and the cat was not obese. There were no smokers in the cat's family, but the cat resided in an area with poor air quality. Airway cultures are recommended for dogs undergoing stent placement for tracheal collapse (Lesnikowski et al., 2020). Similarly, an airway culture was performed for the present case, but the bacterial culture was negative. The special features of this case include a nervous and easily angered personality and a history of chronic reflux esophagitis. However, the relationship between these factors and primary tracheal collapse in cats requires further investigation.

In summary, the present case presented with severe dyspnoea and tracheal collapse that extended to the cervicothoracic region. As the patient was of old age, tracheal stenting was performed instead of extra cavitory therapy. The short- to medium-term prognoses were very good. Stenting for dogs with tracheal collapse is known to have long-term complications, such as stent failure and migration (Weisse et al., 2019). Although further follow-up is needed to establish the long-term prognosis, the present results suggest that self-expandable stenting for feline primary tracheal collapse may be a useful treatment option.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ETHICS STATEMENT

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to. Furthermore, we have informed consent from the animal's owner to use the animal's data to publish this case report.

AUTHOR CONTRIBUTIONS

Conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources software, supervision, validation, visualization, and writing—original draft : Akiko Uemura. *Writing—review and editing*: Masashi Tanaka and Akiko Uemura.

DATA AVAILABILITY STATEMENT

Data available on request from the authors: The data that support the findings of this study are available from the corresponding author upon reasonable request.

PEER REVIEW

The peer review history for this article is available at <https://publons.com/publon/10.1002/vms3.813>.

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