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Case Report



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Abstract

Case summary This paper presents two cases of acute postoperative upper airway obstruction following ventral bulla osteotomy (VBO) in cats. The first cat underwent a unilateral left-sided VBO for a suspected inflammatory polyp. The second cat underwent a single-session bilateral VBO procedure for bilateral otitis media. In the first case, immediate re-intubation and a gradual lightening of the anaesthetic plane resolved the clinical signs; in the second case, the patient deteriorated and went into acute cardiorespiratory arrest and received cardiopulmonary resuscitation. Both patients recovered well and were discharged home 3 days after surgery. Both cases were reported to show no further clinical signs on postoperative follow-up 3 weeks and 4 months after surgery, respectively.

Relevance and novel information Upper airway obstruction should be regarded as a potential complication of VBO in cats.

Keywords: Middle ear; surgery; respiratory compromise; ear polyp

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Introduction

Ventral bulla osteotomy (VBO) is a successful and widely recognised procedure for the management of feline middle ear disease resulting from inflammatory polyps, otitis media or benign and malignant neoplasia that may not otherwise be amenable to conservative treatment. In contrast to lateral bulla osteotomy (LBO), VBO is a less invasive procedure, which may or may not impair a patient's hearing (unless impaired before surgery).[1]

Horner's syndrome, facial palsy and the development of vestibular signs have been described as major complications of VBO surgery.[2] Significant pharyngeal swelling and consecutive upper airway obstruction have been described after bilateral total ear canal ablation (TECA) and LBO in dogs;[3] however, until recently,[4,5] upper airway obstruction as a life-threatening complication of VBO in cats had not been published.

This paper describes two consecutive cases of an acute upper airway obstruction following VBO in cats. In the first case, a unilateral left-sided VBO procedure was performed as treatment for an inflammatory polyp. In the second case, a single-stage bilateral VBO procedure was performed as treatment for bilateral otitis media.

Case description

Case 1

A 1-year-old neutered male Maine Coon, weighing 6 kg, was presented for investigation of recurrent bilateral otitis externa of 6 months' duration. Previous otoscopic investigation by the referring veterinary surgeon diagnosed a suspected left middle ear polyp and a right-sided otitis externa.

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At the time of referral, the clinical examination was unremarkable. Otoscopic examination revealed bilateral external ear disease, with a visible polyp within the left ear canal. The right ear canal was mildly inflamed with a visible mucoid discharge, and the tympanic membrane was noted to be intact. A CT scan of the head for further investigation of the suspected polyp was recommended to the client but declined owing to financial constraints.

The following day an elective left-sided VBO was performed, with examination and lavage of the right external ear under video-otoscopic guidance. Anaesthesia was maintained with a combination of oxygen and isoflurane (IsoFlo; Abbott) after premedication with acepromazine (0.02 mg/kg of body weight IV; ACP Injection 2 mg/ml [Elanco UK AH]) and methadone (0.2 mg/kg of body weight IV; Comfortan 5ml [Dechra Veterinary Products]) and induction by alfaxalone (maximum dose 5 mg/kg of body weight given IV to effect [Alfaxan Multidose; Vétoquinol]). Endotracheal intubation was performed with a 5.0 mm internal diameter cuffed endotracheal (ET) tube, after applying lidocaine spray (Intubeaze 20 mg/ml Oromucosal Spray for Cats) directly on the larynx (with subjectively normal shape and function). During general anaesthesia, electrocardiography (ECG), oscillometric arterial blood pressure (O-NIBP), the end-expiratory partial pressure of carbon dioxide ($ETCO_2$) and pulse oximetry (SpO2) were monitored and recorded at 5 min intervals (T5 Beneview). Rectal temperature was measured at the beginning and the end of the procedure. Lactated Ringer's solution (Aqupharm Animalcare) was infused at 5 ml/kg of body weight per hour, intravenously. During general anaesthesia, heart rate was recorded within the range of 90–150 beats per min (bpm), blood pressure (mean arterial pressure; MAP) between 59 and 92 mmHg, $ETCO_2$ between 4.1 and 5.0 kPa and SpO2% was maintained between 96% and 100%.

During surgery, the patient was positioned in dorsal recumbency, with its head away from the anaesthetic machine on a forced-air warming system (Bair Hugger; 3M), with its neck fixed in an extended position. A swab pack was placed under the neck to facilitate its extension.

A VBO was performed as described previously,[2] using an osteotome and Lempert rongeur. The hypotympanium was noted to be filled with mucus, tissue debris and two polypoid structures. After gentle evacuation, the tympanic cavity was lavaged with a warm sterile saline solution followed by thorough suction. Total surgical time was 40 mins, and no surgical or anaesthetic complications were noted. On recovery, the patient was positioned in left lateral recumbency, and the right ear canal was irrigated with saline under otoscopic guidance. Isoflurane administration was then discontinued and the patient maintained on oxygen. The patient was extubated 5 mins later when the pinnal and swallowing reflex reappeared.

Immediately after extubation the patient became dysphoric with an immediate increase of inspiratory effort, dyspnoea and paradoxical breathing. An immediate reintubation was performed after incremental alfaxalone induction. The upper airways were evaluated and no evidence of peri-laryngeal swelling was detected. However, a marked swelling of the ventral neck area could be seen externally. The patient was maintained on oxygen and extubated 15 mins later. Further recovery was uneventful. In the recovery period the patient developed signs of vestibular syndrome, facial palsy and Horner's syndrome. The patient was hospitalised for observation and discharged 3 days later. The neurological signs resolved entirely within 3 weeks. The clients were contacted by a telephone consultation after 4 months for postoperative follow-up. The owners were satisfied with the patient's postoperative outcome, with no further persistent clinical signs reported.

Case 2

A 4-year-old neutered male domestic shorthair cat, weighing 4.7 kg, was presented for investigation of a persistent non-progressive left-sided head tilt suggestive of middle ear disease. Previous examination by the referring veterinary surgeon noted a persistent left-sided head tilt with no evidence of otitis externa. A history of intermittent chronic upper respiratory signs that had completely resolved by the time of presentation was also noted. Further history was incomplete owing to the fact that the cat had been rescued from Egypt 3 years previously.

At the time of referral, clinical examination was unremarkable. Abnormal upper respiratory noises were not detected at the time of presentation. A moderate left-sided head tilt could be appreciated during general examination, but no other neurological signs were observed. CT of the head revealed increased soft tissue attenuation within the right tympanic cavity, with invasion of the right external ear canal, right tympanic bulla and early extension towards the right nasopharynx. Soft tissue and fluid attenuation were also noted within the left tympanic cavity. A diagnosis of a right-sided inflammatory polyp and bilateral otitis media was made. Preoperative blood test variables (Catalyst Dx Chemistry Analyzer and ProCyte Dx Haematology Analyser; IDEXX) were within the reference intervals.

The following day, an elective single-stage bilateral VBO was performed. A similar anaesthetic protocol as in case 1 was used. Anaesthesia was maintained with a combination of oxygen and isoflurane (IsoFlo; Abbott) after premedication with acepromazine (0.015 mg/kg of body weight IV [ACP Injection 2 mg/ml; Elanco UK AH]) and methadone (0.3 mg/kg of body weight IV [Comfortan 5 ml; Dechra Veterinary Products]) and induction by alfaxalone (maximum dose 5 mg/kg of body weight given IV to effect [Alfaxan Multidose; Vétoquinol]). Endotracheal intubation was performed with a 4.5 mm

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cuffed ET tube, after applying lidocaine spray (Intubeaze 20 mg/ml Oromucosal Spray for Cats) directly on the larynx (with subjectively normal shape and function). During general anaesthesia, ECG, O-NIBP, $ETCO_2$ and SpO2 were monitored and recorded at 5 min intervals (T5 Beneview; Mindray). Rectal temperature was measured at the beginning and at the end of the surgery. Lactated Ringer's solution (Aqupharm Animalcare) was infused at 5 ml/kg of body weight per hour rate, IV. During general anaesthesia, heart rate was maintained in the range from 92 to 122 bpm, blood pressure (MAP) between 63 and 86 mmHg, $ETCO_2$ between 5.1 and 7.0 kPa and SpO2% was maintained between 96% and 99%.

For the procedure, the patient was positioned in dorsal recumbency, with its head away from the anaesthetic machine on a forced-air warming system (Bair Hugger; 3M), with the neck in an extended position. A swab pack was placed under the neck to facilitate its extension.

Bilateral VBO was performed from two separate skin incisions, applying the same approach as in case 1,[2] with an osteotome and Lempert rongeur. Both tympanic cavities were filled with mucus, tissue debris and polyps (two polyps in the right side and one polyp in the left side). After a gentle evacuation, each tympanic cavity was flushed with a warm sterile saline solution followed by thorough suction. The total duration of the surgery was recorded as 70 mins. The patient was extubated 15 mins after surgery had finished.

Immediately after extubation, the patient showed signs of acute upper respiratory obstruction, with a drop in oxygen saturation levels below 90 mm Hg. At this point, immediate re-intubation (propofol 1 mg/kg of body weight titrated to effect) with an ET tube (4.5 mm) was performed. During re-intubation, laryngoscopy revealed moderate laryngospasm, with no notable pharyngeal swelling or fluid accumulation. The anaesthetic plane was lightened over a period of 10 mins and the patient was extubated again. The patient then became apnoeic and went into cardiac arrest. Immediate cardiopulmonary resuscitation was commenced. During this time, adrenaline (0.01 mg/kg of body weight; Epinephrine Hameln Pharmaceuticals) and atropine (0.04 mg/kg of body weight; Atropine Sulphate Injection Mercury Pharmaceuticals) was administered intravenously. Indirect heart massage and artificial ventilation with 100% oxygen were conducted over a 10 min period after which time the femoral pulses became palpable again, and spontaneous breathing returned. Another two attempts to extubate were then made, each time followed by laryngospasm and later a unilateral left-sided laryngeal paralysis. The patient was nebulised using 0.5 ml epinephrine (adrenaline) in 5 ml saline, and intravenous dexamethasone (0.4 mg/kg of body weight) was given. The patient was maintained under total intravenous anaesthesia of propofol for 20 mins to prevent any further episodes of laryngospasm.

The third attempt at extubation was successful and well tolerated by the patient, and the patient maintained on flow-by oxygen therapy. The patient was transferred to an oxygen chamber and monitored overnight.

As in the first case, neurological signs of vestibular syndrome, fascial palsy and Horner's syndrome were noted over the recovery period; however, no more upper respiratory signs were observed. The patient recovered well and was eating on the second day after surgery, and was discharged after 3 days postoperatively. Both surgical wounds had healed well in 2 weeks, and the neurological signs had resolved within 6 weeks. The patient was reported to be doing well at follow-up 4 months later (owner telephone consultation).

Discussion

Upper airway obstruction following surgical procedures of the head and neck is not a commonly reported complication. In dogs, it can occur as a result of significant pharyngeal swelling if TECA and LBO are performed bilaterally as a single-stage procedure.[3] Complications are mainly related to oedema, inflammation and haemorrhage caused by tissue handling or over the early postoperative period owing to encircling head bandages that can further constrict the pharynx, enhancing the obstruction.[3] In cats, one of the most reported causes of upper airway obstruction in the perioperative period is laryngospasm, as a result of irritation of laryngeal tissue by fluid (blood and/or saline), or by direct mechanical trauma caused by endotracheal intubation or during extubation, especially in the presence of a light plane of anaesthesia.[6]

Anecdotally, high incidences of respiratory-related complications and death following single-stage bilateral VBO in cats have been noted by some veterinary surgeons. Still, the first well-described case was only published 3 years ago,[4] and the topic was studied more deeply by Wainberg et al.[5]

Wainberg et al,[5] based on a multicentric (25 veterinary referral and academic hospitals) retrospective study of 282 cats, stipulate the presence of preoperative upper respiratory signs, an inflammatory polyp and/or positive bacterial culture results contributed to the respiratory complications. However, a cause–effect relationship could not be established. It is anticipated that a preexisting state of inflammation might contribute to an early postoperative inflammatory reaction, resulting in upper airway compromise.

In both our cases, we believe that inflammatory polyps, rather than neoplasia, were the primary cause of the problem. Even though histopathology was omitted, both cats are still alive >4 months after surgery with no progression or local recurrence. Of the possible causes of peracute upper airway obstruction, pharyngeal oedema and/or fluid accumulation through the

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auditory (Eustachian) tube could be ruled out, as there was no fluid noted during repeated re-intubation and no significant oedema, with clear visibility of closed larynx. Reflexive laryngospasm after multiple nerve irritation was, in our opinion, more likely the cause, as after relaxation, unilateral (left) laryngeal paralysis persisted in case 2. It is not clear as to what part of the procedure may have caused the nerve irritation. In both cases an osteotome and Lempert rongeur was used to open the bulla, the method we have been using for more than 15 years now and have not encountered upper airway obstruction after VBO. Moreover, Wainberg et al[5] failed to prove that the method of opening of the bulla might contribute to the incidence of postoperative complications (with an osteotome and rongeur being specifically mentioned). A vigorous flush as a method of cleaning up the tympanic cavity was used in both reported cases. Warm saline solution instead of cold saline was used to minimise any possible irritation. A gentle inspection and curettage of the tympanic cavity (no different from previous cases) was also performed. The only potential significant difference was that in both cases, the polyps were firmly adhered and required more traction and gentle dissection to remove them from the tympanic cavity. This was apparently only a subjective feeling; however, with the polyp being attached to multiple areas of the tympanic cavity, the possibility of direct neural damage cannot be overlooked.

Conclusions

Based on conclusions drawn by Wainberg et al,[5] supported by our recent experience, we have decided to make some adjustments to the perioperative care of cats undergoing VBO. We no longer recommend single-stage bilateral VBO, as the risk of perioperative morbidity and death is, as proven by Wainberg et al,[5] unacceptably high. Also, in all cases of unilateral VBO, we mention upper airway obstruction in the list of possible complications and ask the owners for consent for tracheostomy (despite the previously described poor outcome in cats). We also recommend a single dose of dexamethasone at the end of surgery and extubation of the patient in theatre with the full attendance of the surgical team, with a re-intubation set and tracheostomy set ready. In agreement with the literature, in patients with pre-existing upper respiratory or neurological issues, we predict a worse prognosis and more possible complications.

Conflict of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical approval This work involved the use of non-experimental animals only (including owned or unowned animals and data from prospective or retrospective studies). Established internationally recognised high standards ('best practice') of individual veterinary clinical patient care were followed. Ethical approval from a committee was therefore not specifically required for publication in *JFMS Open Reports*.

Informed consent Informed consent (written) was obtained from the owner or legal custodian of all animal(s) described in this work for the procedure(s) undertaken (either prospective or retrospective studies). No animals or humans are identifiable within this publication, and therefore additional informed consent for publication was not required.

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