



Feline Inflammatory Polyps and Ventral Bulla Osteotomy

Kristyn E. Donnelly, DVM
D. Michael Tillson, DVM, MS, DACVS
Auburn University

ABSTRACT:

Feline inflammatory polyps are benign growths that most likely originate in the middle ear and eustachian tubes. Depending on which path polyps take when exiting the middle ear and eustachian tube, patients may present with otitis, nasopharyngeal signs, or both. A patient's condition may be acute or chronic. Recurrence rates are minimized when tympanic bulla osteotomy is used to successfully remove the polyp and its inflammatory contents. Ventral bulla osteotomy is the preferred surgical approach. Horner's syndrome and otitis interna are common complications with this procedure; however, they should be minimized with careful surgical technique.

Feline inflammatory polyps are known by many names, such as middle ear, otopharyngeal, and nasopharyngeal polyps. These benign, fibrous, pedunculated masses have a variety of clinical manifestations, including acute dyspnea and otitis externa. After lymphoma, feline inflammatory polyps are the second most common cause of nasopharyngeal disease and should be considered a top rule out when a mass emanates from within the ear canal.¹ Inflammatory polyps tend to occur in younger cats (i.e., usually younger than 2 years of age); however, these polyps have been reported in cats that were a few weeks to 15 years of age.² No breed or sex predilection has been identified, and polyps tend to be unilateral. Although the cause is still unknown, both infectious and congenital causes have been theorized. The origin of inflammatory polyps is unknown; however, a middle ear or eustachian tube origin has been speculated.

disease, a diagnosis of feline inflammatory polyps often begins with observing relevant clinical signs. Clinical signs are usually related to the extension of the mass(es) into the nasopharynx and/or external ear canal. Cats with nasopharyngeal polyps may present with dysphagia or upper respiratory signs such as stertorous respiration, nasal discharge, sneezing, voice change, or dyspnea.² Signs of secondary infection such as nasal discharge, rhinitis, and sinusitis may also be present. A retrospective study of 31 cats with nasopharyngeal polyps found upper airway obstruction in 30 cats.³ Cats with polyps that impinge on the auditory system present with very different clinical signs. Polyp extension into the external ear canal appears clinically as dark ceruminous discharge, head tilt, head shaking, or a visible mass in the ear canal.² Signs of otitis media or interna such as head tilt, nystagmus, and disequilibrium may also be present.

HISTORY AND CLINICAL SIGNS

Because less than half of cats with polyps have grossly visible

GROSS APPEARANCE AND HISTOPATHOLOGY

Nasopharyngeal masses tend to be pink and pedunculated and have variable ulcerations.

Email comments/questions to
compendium@medimedia.com,
fax 800-556-3288, or log on to
www.VetLearn.com

External ear polyps are oval to elliptical, are often red, pink, or white, and glisten because of a mucosal covering.⁴ Polyps that have not extended through the tympanic membrane may distort or discolor the tympanic membrane before perforation. Feline inflammatory polyps are typically composed of stratified squamous to pseudostratified ciliated columnar epithelium that covers a core of fibrovascular connective tissue containing scattered lymphocytes, plasma cells, and macrophages.^{4,5}

CAUSE

The cause of feline inflammatory polyps is still unknown. Both the temporal relationship between polyp formation and inflammation and the site of origin remain unproven. Two common theories link polyps to congenital or infectious causes. The young age of most affected cats suggests that feline inflammatory polyps are aberrant growths, remnants of the branchial arches. Based on histopathology and clinical signs, however, polyps appear to be produced in response to inflammation (see Histopathology section). *Pasteurella multocida* and β -hemolytic *Streptococcus* were the two most common bacterial isolates in a clinical study of 12 cats with inflammatory polyps.¹ *Klebsiella*, *Achromobacter*, and *Bordetella* spp have been isolated as well.^{3,6} However, one

panic cavity via either the eustachian tube (to the nasopharynx) or the tympanic membrane (to the external ear canal).^{1,2,4,5}

Experimentally ligating the auditory tube causes mucociliary dysfunction, mucous hypersecretion, and otitis media with effusion, which is frequently complicated by bacterial colonization.⁸ Furthermore, granulation tissue in the middle ear may cause the respiratory epithelium to undergo metaplasia, resulting in stratified squamous epithelium, which may form a polyp.⁸ In a study by Trevor and Martin,⁵ all cats with inflammatory polyps had a tympanic cavity filled with polyp material. In further support of polyps originating in the middle ear, the lowest recurrence rate occurs when bulla osteotomy is performed.^{1,5} The origin of the polyp stalk is presumably removed with this procedure. Simple traction-avulsion techniques have much higher rates of regrowth.^{2,8}

DIAGNOSIS

Upper respiratory tract infections (e.g., due to feline calicivirus and rhinotracheitis), nasal foreign bodies, neoplasia, otitis externa/media/interna, and mycotic disease should be included in the differential diagnosis of feline inflammatory polyps. Diagnosing inflammatory polyps

Young cats that present with acute dyspnea should be examined for nasopharyngeal polyps.

study found bacteria in only 3 of 29 cats with polyps.³ Whether inflammation and infection are primary or secondary to this disease is still unclear.³ It has been postulated that microorganisms migrate from the nasopharynx into the middle ear. In support of this idea, feline calicivirus has been isolated from some polyps and the nasopharyngeal region, although the direct relationship has not been determined.^{4,7} Experimental ligation of the auditory canals leads to polyp formation as well.^{7,8}

A related matter that is still in question is the exact origin of feline inflammatory polyps. This distinction is important to determine the best surgical approach. Some sources cite the origin of polyps as the mucosa of the nasopharynx, eustachian tube, or middle ear.^{8,9} Others suggest that feline inflammatory polyps originate solely within the middle ear or auditory tube close to its junction with the tympanic cavity. Polyps then exit the tym-

panic cavity via either the eustachian tube (to the nasopharynx) or the tympanic membrane (to the external ear canal).^{1,2,4,5}

Polyps may also be seen exiting the external auditory meatus. They can be visualized with an otoscope or a videotoscope. The tympanic membrane should be examined for bulging, perforation, or inflammation. A myringotomy may be performed to obtain a culture.¹⁰

Radiographic analysis is warranted to diagnose polyps. Diagnostic quality views of the tympanic bulla and surrounding structures require anesthesia. Ventrodorsal, oblique lateral, and frontal open-mouth projections are useful in evaluating the tympanic bulla. Findings such as a proliferative periosteal response, thickening or irregularity of the bulla wall, or soft tissue

opacity within the bullae are consistent with potential long-standing middle ear disease (Figure 1). Changes on routine views correlate with 75% of known positives, leaving 25% of cases of otitis media undiagnosed based on radiographs alone.⁴ This must be considered given that polyps may not cause otitis media until late in the disease process.^{3,9,11} Kapatkin and Matthiesen³ found that 84% of cats with polyps had a radiographic middle ear change. Lateral views are best for nasopharyngeal polyps, which are visualized as a soft tissue opacity in the nasopharynx.

Both computed tomography (CT) and magnetic resonance imaging (MRI) allow better evaluation of the bulla than do radiographic skull films.^{4,8} They provide a much clearer view of the tympanic bulla and surrounding tissues (Figure 2). Thickening of the osseous bullae as well as soft tissue opacities is much more easily seen than with radiography. MRI is capable of showing soft tissue changes of the tympanic bulla, fluid accumulation, and cystic growths.

Many surgeons advocate ventral bulla osteotomy regardless of obvious radiographic involvement of the middle ear because polyps potentially originate from the bulla. This is supported by the low recurrence rate after ventral bulla osteotomy.⁵ We believe, given the likelihood that polyps originate from the middle ear, that even if bulla abnormalities are not seen using radiography, MRI, or CT, surgical intervention in an affected middle ear can be recommended with confidence.

The definitive diagnosis of feline inflammatory polyp is made histologically from surgical biopsy samples.

***Feline inflammatory polyps
have the lowest recurrence rate
when they have been removed using
ventral bulla osteotomy.***

TREATMENT

Medical management has been routinely ineffective at eliminating polyps and has been best used in conjunction with surgical removal (i.e., medical management of residual otitis media). Surgically managing inflammatory polyps remains the preferred choice of treatment with minimal recurrence. Surgical options for removing inflammatory polyps include traction-avulsion, ventral bulla osteotomy, myringotomy, lateral ear resection, ear canal ablation combined with lateral bulla osteotomy, and, in a limited role, laser debulking and sterilization of the middle ear.⁴ Ventral bulla osteotomy provides the best access to the middle ear, from which polyps are thought to originate.^{1,2,10} Lateral bulla osteotomy with total ear canal ablation is another option, but it is probably unwarranted because cats are left without an external ear canal.⁴ Ventral bulla osteotomy, which is the most common and successful (i.e., recurrence rate: 2%) surgery for polyp removal, is discussed in detail in this article.²

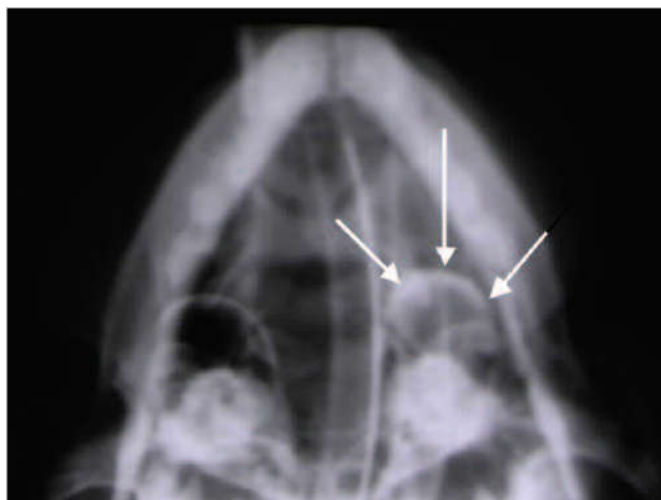


Figure 1. Open-mouth rostrocaudal radiograph of a tympanic bulla. Arrows indicate the affected bulla.

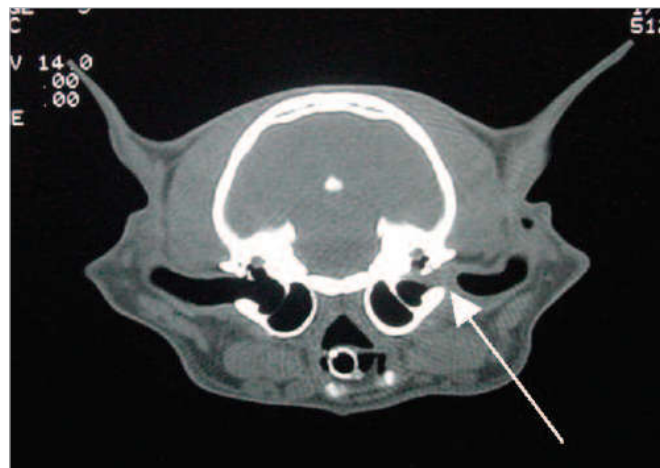


Figure 2. CT of a cat with an auditory inflammatory polyp that is affecting the right ear canal and bulla (arrow). The diagnosis was confirmed histologically.

Treating cats with inflammatory polyps without radiographic evidence of otitis media remains controversial. In these cases, careful traction can be used to remove inflammatory polyps from the external ear canal or nasopharynx. The soft palate should be retracted with a stay suture or spay hook to allow visualization of the polyp. On occasion, the soft palate must be incised down its midline to increase visualization. The polyp should be grasped with right angle or alligator forceps and gentle traction applied until it is avulsed from its origin. Hemorrhage is generally minimal.⁴ A similar method can be used to extract polyps that emanate from the external ear canal. This method remains controversial because the polyp base is often left behind, promoting recurrence. Nasopharyngeal polyp removal by traction, in conjunction with prednisolone (1 to 2 mg/kg/day for 14 days, followed by a tapered withdrawal for 2 weeks) resulted in a recurrence rate of only 11% in cats.⁴ External ear polyps had a recurrence rate of 50% after removal by traction.⁴ These statistics are not surprising considering that most polyps appear to originate within the middle ear. Surgical procedures should extract the entire polyp, including its base and all associated debris to minimize the chance of recurrence; because of the local anatomy, however, this cannot be done without risks.²

If radiographic evidence of middle ear disease is present, ventral bulla osteotomy should be performed.^{1,2-6,10} Because polyps likely originate from the middle ear, ventral bulla osteotomy is probably justified in all cases of inflammatory polyps.^{2,5} Lateralization via an otoscopic examination (for an otic polyp) or imaging technique (i.e., radiography, CT, MRI; for an inflammatory polyp)

is appropriate before ventral bulla osteotomy. Bradley and Noone⁹ performed ventral bulla osteotomies in three of five cats that presented with nasopharyngeal polyps. In these three cats, polyps did not recur, whereas polyps recurred in both cases in which simple traction was applied via an oral approach.⁹ In one study of 12 cats, polyps did not recur when ventral bulla osteotomy was performed based on radiographic evidence of otitis and histologic confirmation of inflammatory polyps.¹ Kapatkin and Matthiesen³ performed bulla osteotomies on 23 of 31 cats. Four of five cats in which regrowth occurred did not have an initial bulla osteotomy. Kapatkin and Matthiesen³ as well as Boothe⁶ concluded that, even without radiologic evidence of otitis media, bulla osteotomy may be justified in all cats during polyp removal to eliminate otitis and prevent recurrence.

SURGERY

To perform ventral bulla osteotomy, the patient should be intubated and placed in dorsal recumbency with cervical support to extend the neck and maximize the surgical area. The cervical, intermandibular, and facial areas should be clipped and aseptically prepared. The rounded ventral aspect of the tympanic bulla (bound by the wing of the atlas [C2], caudal border of the mandible, and larynx) can be palpated in most cats. A 3- to 5-cm incision should be centered between the wing of the atlas and angular process of the mandible (i.e., paramedian) and made directly over the bulla.¹⁴ Dissection should be continued through the platysma and sphincter colli muscles. The mandibular salivary gland and bifurcation of the

facial and lingual veins (if visible) should be retracted from the field. Blunt dissection should be continued between the digastric muscle laterally and styloglossus and hyoglossus muscles medially. The hypoglossal nerve, located medial to the hyoglossal muscle, should be identified and the lingual artery retracted medially. The external carotid is dorsolateral to the bulla and should not be in the field. Senn and/or Gelpi retractors should be used to carefully retract soft tissue and improve visualization. A periosteal elevator should be used to remove overlying soft tissue from the ventral surface of the bulla.

The bulla should be entered through the larger ventromedial compartment. Osteotomy can be performed using a 1/8-inch Steinmann pin and a hand chuck or an air drill. If a Steinmann pin is used, the osteotomy should begin with a small pin and progress to larger pins until the opening is large enough to accommodate rongeurs (e.g., Kerrison, Lempert). Thick mucus or other debris is often encountered at this point.

Once the osteotomy of the ventral aspect of the tympanic bulla is complete, the dorsolateral compartment should be entered because that is where most polyps originate.² The ventral portion of the septum should be

removed at its lateral-most aspect to avoid the sympathetic fibers coursing over the oval promontory and reduce the risk of causing Horner's syndrome. The septum can be removed in a fashion similar to the original entry into the tympanic cavity (i.e., with a drill and pin). Once both compartments have been entered, appropriate cultures should be taken, including those for mycoplasma.¹²

Thumb forceps and a small curette should be used to remove the polyp, epithelial lining, and accumulated material while avoiding iatrogenic trauma to the nerves. Small curettes and Freer periosteal elevators should be used to remove all polypoid material and associated attachments. The excised tissues should be submitted for histopathologic analysis. The site should be thoroughly lavaged with warm saline before closure. Although drain placement is controversial, we place a 1/4-inch Penrose drain in the bulla with an egress site adjacent to, but not incorporated within, the original incision. The external ear and/or oropharynx should be examined to ensure full removal of the polyp. Otoscopic and pharyngeal examination can help ensure complete removal. Traction may be necessary to remove the

Surgical Anatomy

Before surgery, the anatomy of the feline middle ear should be reviewed because of its intricate compartments and vulnerable sympathetic nerve supply.¹ Knowing the anatomy of the middle ear minimizes the possibility of iatrogenic trauma.^{1,11}

The feline bulla is divided by a bony septum into dorsolateral and ventromedial compartments (A and B). The smaller dorsolateral compartment is arbitrarily divided into epitympanum and mesotympanum. The tympanic membrane forms most of the lateral wall. The compartments of the middle ear communicate through a narrow fissure on the caudomedial aspect of the smaller compartment, where the septum is incomplete dorsally. Toward the caudal extremity of the fissure, it enlarges into a triangular foramen. The oval promontory extends medial to this foramen.^{11,13,14}

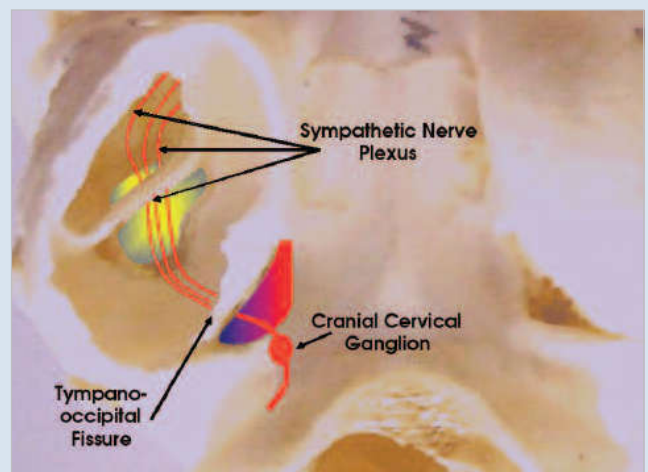
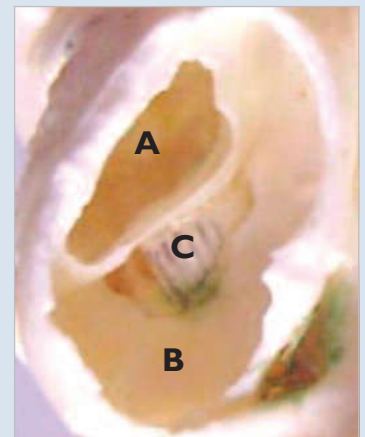
The sympathetic nerves in the middle ear are postganglionic, originating from the cranial cervical ganglion. They course with the internal carotid artery, enter the tympanooccipital fissure caudal to the tympanic bulla, and pass between the bulla and the petrosal bone, where they meet the glossopharyngeal nerve (C). The nerves enter the tympanic cavity at the caudal aspect of the promontory (ventromedial aspect), where they branch out to form the tympanic plexus, which is exposed on the surface of the promontory, making the nerves highly vulnerable to surgical trauma. Injury to the sympathetic fibers causes Horner's syndrome. The tympanic plexus crosses the oval promontory and continues into the dorsolateral compartment through the communicating fissure, where the nerves are shielded by the septum. The nerves of the sympathetic plexus continue rostral to the eye, joining the ophthalmic branch of the trigeminal nerve.^{11,13,14} Parasympathetic fibers also course through the middle ear, innervating the parotid and mandibular salivary glands. These fibers appear clinically to be less affected by iatrogenic trauma.

C. Depiction of the sympathetic nerve plexus coursing through the tympanooccipital fissure into the ventromedial compartment over the promontory and continuing through the dorsolateral compartment of the tympanic bulla.



A. Caudoventral view of a feline skull. Osteotomy of the right bulla was performed to visualize the internal compartments.

B. Magnified view of a right bulla osteotomy, including the dorsolateral compartment (A), ventromedial compartment (B), and promontory (C).



remaining polypoid material. The wound should be bandaged until the drain is removed in approximately 3 days. An Elizabethan collar may be needed. Appropriate antibiotic therapy, based on culture and susceptibility, should be administered for approximately 3 to 5 weeks.

Surgical Complications

Potential complications following bulla osteotomy include Horner's syndrome, vestibular disturbances, polyp regrowth, otitis media, hemorrhage, wound drainage, hypoglossal nerve damage, damage to auditory ossicles and vascular structures, and facial nerve paralysis. Manipulating pharyngeal tissue that has nasopharyngeal polyps warrants postoperatively monitoring respiratory quality. Careful surgical technique and recognizing anatomic landmarks should minimize the risk of these complications.

Horner's syndrome has been observed in most cats after polyp excision.¹² Horner's syndrome, which is characterized by ptosis, miosis, enophthalmos, and elevation of the third eyelid, is most likely caused by damage to the oculosympathetic trunk during polyp removal and curettage. In most cases, it resolves within weeks to months. In a study by Faulkner and Budsberg,¹ 83% of cats were affected with Horner's syndrome, 25% of which were affected in the long term. In another study, three of five cats had Horner's syndrome that resolved in 7 to 14 months.⁹ Kapatkin and Matthiesen³ diagnosed Horner's syndrome in 22 of 23 cats that had a ventral bulla osteotomy. All cases eventually resolved.

Overzealous curettage of the bulla that damages the round and oval windows or vestibulocochlear apparatus results in vestibular disturbances. This manifests clinically as head tilt, ataxia, and nystagmus and appears to be less common than Horner's syndrome, with a reported incidence of 4% to 42%.^{1,3} Vestibular signs can be minimized with meclizine (12.5 mg PO q24h) until signs resolve.¹⁵ Facial and hypoglossal nerve paralyses are uncommon complications of ventral bulla osteotomy.

SUMMARY

Feline inflammatory polyps are benign masses that most likely originate in the middle ear and/or auditory tubes that extend into the nasopharynx and external ear canals. Diagnosis should be based on history, diagnostic imaging, and direct visualization. The most reliable method of permanently removing inflammatory polyps is ventral bulla osteotomy. Knowing the surgical anatomy of the feline middle ear is essential to perform

a successful ventral bulla osteotomy with minimal iatrogenic complications.

REFERENCES

1. Faulkner JE, Budsberg SC: Results of ventral bulla osteotomy for treatment of middle ear polyps in cats. *JAVMA* 26:496–499, 1990.
2. Pope ER, Constantinescu GM: Feline respiratory tract polyps, in Bonagura J (ed): *Kirk's Current Veterinary Therapy XIII*. Philadelphia, WB Saunders, 2000, pp 794–796.
3. Kapatkin AS, Matthiesen DT: Results of surgery and long-term follow-up in 31 cats with nasopharyngeal polyps. *JAAHA* 26:387–392, 1990.
4. Muilenburg RK, Fry TR: Feline nasopharyngeal polyps. *Vet Clin North Am Small Anim Pract* 32(4):839–849, 2002.
5. Trevor PB, Martin RA: Tympanic bulla osteotomy for treatment of middle ear disease in cats: 19 cases (1984–1991). *JAVMA* 202(1):123–128, 1993.
6. Boothe HW: Ventral bulla osteotomy: Dog and cat, in Bojrab MJ (ed): *Current Techniques in Small Animal Surgery*, ed 4. Baltimore, Lippincott, Williams & Wilkins, 1998, pp 109–111.
7. Parker NR, Binnington AG: Nasopharyngeal polyps in cats: Three case reports and a review of the literature. *JAAHA* 21:473–478, 1985.
8. Little JL: Nasopharyngeal polyps, in August JR (ed): *Consultations in Feline Internal Medicine*, ed 3. Philadelphia, WB Saunders, 1997, pp 310–315.
9. Bradley RL, Noone KE: Nasopharyngeal and middle ear polypoid masses in five cats. *Vet Surg* 14(2):141–144, 1985.
10. White RA: Middle ear, in Slatter DH (ed): *Textbook of Small Animal Surgery*, ed 3. Philadelphia, WB Saunders, 2003, pp 1760–1767.
11. Little CJ, Lane JG: The surgical anatomy of the feline bulla tympanic. *J Small Anim Pract* 27:371–378, 1986.
12. Smeak D: Ventral bulla osteotomy in cats. *Proc 12th Annu Vet Symp ACVS*:122–124, 2002.
13. Hudson LC, Hamilton WP: *Atlas of Feline Anatomy for Veterinarians*. Philadelphia, WB Saunders, 229–234, 1993.
14. Smith MM, Waldron DR: *Atlas of Approaches for General Surgery of the Dog and Cat*. Philadelphia, WB Saunders, 1993, pp 115–117.
15. Plumb DC: Meclizine. *Veterinary Drug Book*, ed 4. Ames, Iowa State University Press, 2002.

ARTICLE #3 CE TEST



This article qualifies for 1.5 contact hours of continuing education credit from the Auburn University College of Veterinary Medicine. Subscribers who wish to apply this credit to fulfill state relicensure requirements should consult their respective state authorities regarding the applicability of this program. To participate, fill out the test form inserted at the end of this issue. To take CE tests online and get real-time scores, log on to www.VetLearn.com.

I. At what age do cats most commonly present with feline inflammatory polyps?

- a. younger than 2 years
- b. older than 10 years
- c. 36 to 48 months
- d. younger than 6 weeks
- e. 5 to 6 years

- 2. Feline inflammatory polyps are histologically most consistent with**
- benign fibrous extensions of the gingival submucosa.
 - benign fibrous extensions of the gingival mucosa.
 - stratified squamous to pseudostratified ciliated columnar epithelium that covers a core of fibrovascular connective tissue.
 - malignant extensions of local epithelium.
 - benign fibrous stalks with well-defined bases.
- 3. Which clinical sign is not commonly associated with feline inflammatory polyps?**
- discharge from ear
 - airway obstruction
 - head tilt
 - sneezing
 - hyperthermia
- 4. _____ is/are ultimately the best method(s) of confirming that an otic or pharyngeal mass is an inflammatory polyp.**
- CT and MRI
 - Plain skull films
 - Fluoroscopy
 - Histopathologic analysis
 - Grossly visualizing a soft tissue stalk in the middle ear
- 5. Ventral bulla osteotomy has been associated with a recurrence rate of ____%.**
- 2
 - 10
 - 20 to 25
 - 65
 - more than 85
- 6. The feline bulla is divided into two distinct compartments:**
- ventromedial and dorsolateral.
 - dorsomedial and ventrolateral.
 - medial and lateral.
 - dorsal and ventral.
 - lateroventral and mediodorsal.
- 7. Which local structure is not encountered while performing ventral bulla osteotomy?**
- vestibulocochlear apparatus
 - oculosympathetic trunk
 - facial nerve
 - hypoglossal nerve
 - parotid gland
- 8. Ptosis, miosis, enophthalmos, and elevation of the third eyelid result from damage to the**
- hypoglossal nerve.
 - oculosympathetic trunk.
 - facial nerve.
 - vestibulocochlear apparatus.
 - optic nerve.
- 9. Transient signs consistent with Horner's syndrome have been seen in approximately ____% of cats after ventral bulla osteotomy.**
- 10
 - 30
 - 60
 - 80
 - 95
- 10. The most common bacterial isolates from cats with inflammatory polyps include**
- Staphylococcus aureus*.
 - P. multocida*.
 - Bordetella bronchiseptica*.
 - Klebsiella* spp.
 - Achromobacter* spp.