External and Middle Ear Disease in the Dog and Cat

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Diseases of the external and middle ear are common problems in dogs and cats. Chronic otitis externa alone accounts for approximately 10% of admissions to small animal hospitals. Ear disease often goes unnoticed by the owner until the disease has progressed, become well established, and led to irreversible structural changes. Initial medical management may fail for a variety of reasons. Diseases of the external ear canal and middle ear are often related to more than one underlying problem. For these reasons and others, surgery may become the most effective recourse for treatment (Table 1).

CAUSES OF OTITIS EXTERNA AND MEDIA

- Hypersensitivity and allergic disorders: the two most common primary causes of otitis externa in dogs
- Infection: usually secondary to other problems, but once established can be difficult to treat and lead to significant structural damage to the external canal and middle ear
- Tumors: benign and malignant
- Parasites
- Foreign bodies
- Conformation of the ear canal and pinna

Infectious, parasitic, and immune or allergic causes of ear disease, if recognized early and treated appropriately, can be managed without surgery. If appropriate medical management fails to cure or control the primary disease process or if a tumor is present, surgery can be an effective adjunct or primary therapy (Figure 1).
PRESURGICAL DIAGNOSTIC TESTING

- **Otoscopic exam:** Evaluating the vertical and horizontal ear canals otoscopically or with video otoscopy is important in deciding whether surgery is indicated and which surgical procedure would be most beneficial to the patient. Evaluation of the eardrum in an ear that has had chronic otitis but appears to have a normal canal diameter may be difficult regardless of the presence of middle ear disease, especially if discharge is present in the canal. Dogs and cats that have had chronic ear disease are in pain and must be sedated or anesthetized. If it is obvious that the ear canal is stenotic, then performing this exam may not be necessary or even possible.

- **Neurologic exam:** Neurologic deficits are not usually present in patients being evaluated for ear disease. If present, they must be documented because they may determine whether other diagnostic testing is performed and can limit the potential benefits of surgery. The most common neurologic deficits that may accompany ear disease are facial nerve paralysis, vestibular disease (peripheral or central), Horner’s syndrome, and deafness. If neurologic deficits are present, a more in-depth evaluation of the middle ear should be considered. This may include skull radiography; however, computed tomography (CT) and magnetic resonance imaging (MRI) are more sensitive in evaluating both bone and soft tissue changes of the bulla and middle ear.

- **Complete blood count/chemistry screen and thyroxine:** Patients may have concurrent medical problems that contribute to ear disease. Screening for Cushing’s disease and hypothyroidism is advisable before surgery on the ears.

- **Skull radiography, CT, MRI:** Skull radiography can be used to evaluate the tympanic bulla and external ear canals. The bulla can be evaluated for soft tissue or fluid opacities occupying the bulla, periosteal change, and bony lysis. The ear canals can be evaluated for patency and mineralization. Skull radiographs can be difficult to interpret because of superimposition of other bony structures. CT and MRI have become more available and are superior in evaluating the bulla and ear canals for changes related to both bone and soft tissue.

**SURGICAL OPTIONS FOR THE EXTERNAL AND MIDDLE EAR**

Lateral Ear Canal Resection

C. P. Zepp first described lateral ear canal resection (LECR) in 1949, and this surgical procedure is still often called a “Zepp.” LECR is used to treat chronic otitis before the vertical and horizontal canals become stenotic. It can also be used in resecting benign tumors involving the lateral wall of the vertical canal. The procedure involves removing the lateral half of the vertical ear canal and creating a drainage board for the horizontal ear canal. This creates an ear canal in a dog or cat that more closely resembles that of a person. When performed correctly, it allows better access to the horizontal canal for application of medication and allows discharge in the horizontal canal to drain without traversing up the vertical canal. If significant

<table>
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<th>SURGERY TYPE</th>
<th>INDICATIONS</th>
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<tr>
<td>Lateral ear canal resection</td>
<td>Chronic otitis externa and or media without stenosis of ear canal</td>
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<td></td>
<td>Benign tumors involving the lateral wall of the vertical canal</td>
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<tr>
<td>Total ear canal ablation</td>
<td>Chronic otitis externa with stenosis of ear canal</td>
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<td></td>
<td>Benign or malignant tumors involving the external ear canal</td>
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<tr>
<td>Lateral bulla osteotomy</td>
<td>Performed concurrently with total ear canal ablation to treat disease in the middle ear</td>
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<tr>
<td>Ventral bulla osteotomy</td>
<td>Used to treat disease confined to the middle ear or concurrently with total ear canal ablation</td>
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middle ear disease is also present, this procedure can be combined with ventral bulla osteotomy (VBO) to treat both the external and middle ear. With a narrowed external ear canal, LECR will not provide adequate drainage and the patient will continue to exhibit clinical signs. It is important to consider LECR early in the treatment of otitis. When treating a malignant tumor involving the ear canal, LECR has been shown to have an inferior outcome compared with total ear canal ablation.  

**Total Ear Canal Ablation**

Total ear canal ablation (TECA) is considered a salvage procedure and is used to treat end-stage otitis externa and malignant tumors of the ear canal. End-stage ear disease occurs when stenosis of the ear canal is present with inflammation and fibrosis that prevents drainage of otic discharge from the horizontal canal to and out of the vertical canal. Chronic tissue change makes it impossible to get topical medication to the entire diseased canal and for discharge to exit the canal. In these cases, the surfaces of the vertical and horizontal canals often have ulcerations, and the auricular cartilage can be mineralized. Dogs with end-stage ear disease can no longer be treated medically and cannot be adequately treated by LECR. TECA is also recommended for treating malignant tumors of the ear canal because of the better outcome when compared with LECR.

TECA involves removing the entire external ear canal and should in all cases be combined with a lateral bulla osteotomy (LBO) or VBO. Patients who undergo bilateral TECA combined with LBO are essentially deaf. The complication rate associated with TECA ranges from 21% to 82%, with the most common complication being facial nerve paralysis.

**Lateral Bulla Osteotomy**

LBO can be used in conjunction with TECA to treat disease within the middle ear. LBO allows access to the middle ear so that exudate and necrotic epithelium can be removed and the middle ear can be adequately flushed. During this procedure, it is important to remove enough of the lateral ventral wall of the bulla to access the middle ear with a small curette. The external carotid artery and maxillary
vein lie ventral to the bulla and must be protected when enlarging the osseous external acoustic meatus. A curette can first be used to remove the epithelium lining the meatus; then, a periosteal elevator can be used to remove soft tissue on the portion of the bulla that is to be removed. The elevator can then be used to gently retract the soft tissue and protect the artery and vein as the bone is removed with a rongeur or curette. In some cases, the bone can be exceptionally sclerotic, and it may be necessary to use a high-speed burr to remove this bone. If a burr is used, extreme caution is necessary to prevent the burr from contacting the soft tissues.

A bacterial culture sample of the bulla can be taken before curetting the cavity. This is likely to yield positive growth, possibly of more than one bacterium. Alternatively, the culture can be performed after

Management of Otitis

Acute

Chronic

Tumor

Failed medical management

Malignant

Benign

Canal open

Canal stenotic

TECA

LECR or TECA
Based on location of tumor

With otitis media

Without otitis media

TECA/LBO

TECA & LBO

FIGURE 1. Algorithm for management of otitis.
the bulla has been curetted and flushed to detect any residual bacteria. Although a culture obtained this way is less likely to yield positive results, this approach may be more representative should complications arise after surgery. If the procedure is performed bilaterally, a culture sample should be taken from each bulla. If all necrotic debris present in the tympanic cavity is not removed, there is an increased risk for postoperative complications related to residual infection and possibly abscessation (Table 2). A soft rubber drain can be placed through a separate ventral incision into the bulla to allow for postoperative drainage. I find it useful to use magnification loops and a headlight to improve visualization of the cavity during this entire procedure.

Ventral Bulla Osteotomy

VBO can be used in conjunction with TECA/LECR or as a singular procedure to treat disease confined to the bulla. When VBO is used in conjunction with TECA or LECR, the patient must be repositioned. One study comparing VBO and TECA versus LBO and TECA found no difference in outcome or complication rate; thus, combining LBO with TECA is usually recommended.10 Because LBO cannot be combined with LECR, VBO is necessary upon discovery that the bulla should be drained. The most common reason to perform VBO alone is removal of inflammatory polyps in cats. Of note, the tympanic bulla in cats is divided by a thin septum of bone that separates the bulla into dorsal lateral and ventral medial compartments. A small opening in the septum allows for communication between the compartments.

SUMMARY

Ear disease, whether acute or chronic, can be debilitating and painful, causing not only clinical signs related directly to the ears but often lethargy and anorexia. Treatment of diseases of the ear canal and middle ear can be complex and complicated because these diseases are often multifactorial. The anatomy of the ear can also make visualization difficult and an accurate diagnosis challenging. Because the ear canal and middle ear are more or less hidden from view, any disease process can often be advanced when first recognized. If an early accurate diagnosis is not made and appropriate medical treatment started, structural changes to the canal and/or bulla will occur, further complicating medical management. Lack of patient and owner compliance can also lead to failure of medical management.

Surgery can play an important role in treating otitis externa and media and should be considered at each step of the way depending on the patient’s response to medical treatment. Tumors of the canal and bulla are almost always treated surgically. When there are anatomic changes to the canal and/or bulla, surgery can play an important role in treatment. As with any surgery, careful preoperative assessment of the patient is essential. Evaluating the extent of the disease, and potentially staging if malignancy is suspected, is central to a good outcome. A thorough understanding of the anatomy of the ear canal, bulla, and surrounding structures is

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**TABLE 2 Potential Complications Associated with Surgery of the Ear Canal and Tympanic Bulla**

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<tr>
<th>COMPLICATION</th>
<th>LECR</th>
<th>TECA</th>
<th>LBO</th>
<th>VBO</th>
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<tr>
<td>Significant intraoperative hemorrhage</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Facial nerve paralysis (temporary or permanent)</td>
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<td>+</td>
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<td></td>
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<tr>
<td>Vestibular disease</td>
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<td>Hypoglossal nerve paresis</td>
<td></td>
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<td>Horner’s syndrome</td>
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<tr>
<td>Incisional dehiscence/drainage</td>
<td>++</td>
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<td></td>
<td>+</td>
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<tr>
<td>Deafness</td>
<td>++</td>
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imperative. Good surgical technique is important to diminish injury to vital blood vessels and nerves in the area; this will reduce the chance of both intraoperative and postoperative complications. **TVP**

**REFERENCES**


**Mark Cofone**

Mark Cofone, VMD, DACVS, is a staff surgeon and co-owner of the Veterinary Specialty Center of Delaware. He graduated with his VMD from the University of Pennsylvania, where he also completed his internship and surgical residency. He was a Senior Scientist at Ethicon, Inc., and for the past 20 years has been in private surgical practice.