For Veterinarians only

PET POD

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Canine Otitis – Diagnosis and Preventing Complications

Otitis, the inflammation of ear, is one of the most common and multifactorial disorders accounting for up to 10-20 percent of consultations in companion animal practice. The condition is characterized by aural pruritis, erythema, swelling of aural canal lining, ceruminous or purulent otic discharges, foul odour, shaking or tilting of head and various degrees of pain on palpation of ear. Several etiologies involve including, hypersensitivities (atopy, food reactions), contact reactions, parasites, foreign body, inflammatory polyps, endocrine disorders, neoplasia, keratinization disorders, juvenile cellulitis, conformational abnormalities, bacterial infection, yeast infections and chronic pathological changes to ear (e.g. aural hematoma, calcification of ear canal, ceruminous gland hyperplasia, inflammatory mass in ear canal). *Staphylococcus* spp. and Malassezia yeast are among the most common pathogens causing otitis. Otitis can significantly affect a dog's quality of life, leading to discomfort, pain and potential hearing loss if not managed properly.

Acute and uncomplicated otitis can often be treated successfully, but chronic or recurrent otitis is more challenging. Typically, underlying primary factors as well as predisposing and perpetuating factors are at play, including secondary otic infection. Repeated bouts of inflammation and infection can cause secondary changes in ear canal that can ultimately lead to further lack of success in treating, and possible end-stage ear disease. Severe glandular changes, fibrosis, stenosis and calcification along the ear canal lead to patient discomfort as well as progression of otitis from acute to chronic, and simple to complicated. These changes are indicative of end-stage ear disease, that can usually be avoided with appropriate therapy for secondary and primary disease early in its progression. Though not a life threatening ailment, it can be a frustrating disease for patients and owners. Successful treatment often requires addressing underlying causes, predisposing factors and secondary infections. Understanding complex canine ear, the multifactorial etiology, clinical manifestations, diagnostic approaches and management strategies are crucial for effective treatment and prevention.

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Dear Vets,

Canine otitis is a common but multifactorial complex condition requiring a multifaceted approach for diagnosis, treatment and prevention. Early intervention, proper hygiene, and addressing underlying causes are key to successful outcomes. Management revolves around, identifying and correcting the primary cause, involvement of middle and internal ear, removing any debris from ear canal, treating concurrent infections, and controlling inflammation within ear or reversing pathological changes in ear. When dogs are presented with early ear disease, detailed diagnostic work-up, including frequent follow-up examinations can help prevent development of complications that may lead to chronic otitis, hearing loss, otitis media and end-stage ear disease. Pet parent's education for regular follow-up is key to manage chronic or recurrent cases and prevent complications of end-stage ear disease.

We invite Veterinarian's feedback/ insights to this issue of PetPod and also would appreciate if you can share your clinical management of canine otitis in routine practice by scanning below QR code or else alternatively reach us *via* e-mail to petpod@intaspharma.com

Anatomy of Canine Ear

External ear: Includes the pinna and external auditory canal. Ear canal of dogs is much deeper than that of other mammals and creates a better funnel to carry sound to ear drum. Ear canal forms an L-shape, with approximate 90-degree bend where vertical part transitions to horizontal. This creates a

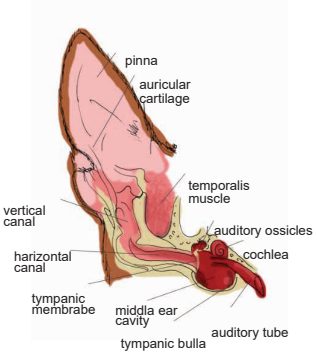

Fig. 1: Anatomy of canine ear

warm, moist environment conducive to microbial growth, predisposing them to infections.

Middle ear: Comprises the tympanic membrane (eardrum), auditory ossicles (hammer, anvil and stirrup) and tympanic cavity. It also includes two muscles (tensor tympani and stapedius, that protect inner ear from loud sounds), oval window (that connects with inner ear), and eustachian tube (narrow channel connecting middle ear to nasopharynx, playing a crucial role in equalizing pressure and draining fluid from the middle ear). Tympanic membrane, is not positioned directly across horizontal canal. Instead, it makes an angle of around 45 degrees to long axis of horizontal canal, which makes it more difficult to visualize the entire tympanic membrane during examination.

Inner ear: A complex structure that includes cochlea (organ of hearing) and vestibular system (organ of balance). The unique structure of canine ear (Fig. 1) predisposes it to infections, especially in breeds with specific anatomical features.

Classification of Canine Otitis

Otitis is of three types according to part of ear involved. Otitis externa, is an inflammatory disease of external ear canal, including ear pinna. Otitis media and interna are other conditions, which affects middle and internal ear respectively. Otitis externa is the most frequently observed condition.

Etiology

Canine otitis is multifactorial, involving primary, predisposing and perpetuating factors.

Primary factors

These are conditions that can directly cause clinical disease in the absence of other factors.

- **Hypersensitivity disease:** Conditions like atopic dermatitis, food allergies and contact allergies (response to medications) are significant contributors to otitis. Most common primary disease resulting in otitis externa is atopic dermatitis. An estimated 10 percent of dogs have clinically significant atopy. Of these up to 80 percent exhibit otitis externa as part of their disease. Food allergies tend to be expressed year-round and are reported to be less responsive to corticosteroid therapy.
- **Otic parasites:** Ear mites *(Otodectes cynotis)* are common, especially in puppies; often infest external ear, causing inflammation of ear canal (unilateral or bilateral). However, this highly contagious, non-species specific parasite is frequently and inappropriately overlooked as cause of otitis in dogs. Ear mites are usually found deep in external ear. Other parasites involved include *Otobius megnini* (spinous ear tick) and *Demodex* spp.
- **Foreign bodies:** Objects like grass awns and plant material can become lodged in ear canal, causing irritation.
- **Endocrine disorders:** Hypothyroidism may be a primary cause of otitis externa or may contribute to severity of disease when coupled with other primary diseases, such as atopy or food allergy.
- **Uncommon causes:** Less common causes of otitis externa include immune-mediated dermatitis, such as pemphigus, lupus, or juvenile cellulitis (puppy strangles), adverse drug reactions, erythema multiforme, seborrheic dermatoses, and traumatic injury to cartilage. Typically uncommon primary causes have other clinical signs or involve other areas of the body, leading the Veterinarian to suspect these diseases.

These primary diseases should be the focus of diagnostic and therapeutic intervention in long term management of otitis. Failure to identify and treat the primary cause of otitis externa will consistently result in poor response to therapy, recurrence and progression of disease.

Predisposing factors

Are conditions that increase the risk of developing otitis, but do not directly cause disease. These include conditions that decrease ventilation, increase moisture, prevent normal clearance of debris, damage normal barrier function, or suppress immunity.

- **Anatomical features:** Breeds with pendulous ears (e.g. Cocker Spaniels) or excessive hair in ear canal (e.g. Poodles) are at higher risk.
- **Environmental factors:** Frequent swimming or bathing can introduce moisture, promoting microbial growth. Changes in external environmental temperature and humidity can also act as predisposing factor

(high-humidity months of summer).

- **Previous ear disease:** Dogs with a history of ear infections are more susceptible to recurrence. Moreover, dogs with obstructive ear canal diseases such as tumors, polyps are more prone to otitis. Any obstructive mass, benign or malignant, can result in overgrowth of bacteria or yeast and subsequent clinical otitis. The most common malignancy in dogs is ceruminous gland adenocarcinoma.

Perpetuating factors

Perpetuating factors are changes in the microenvironment or anatomy resulting from acute or chronic otitis that then go on to maintain disease and prevent resolution, even if the primary cause is identified and managed. These include bacteria, yeast, secondary changes and otitis media.

- **Pathological changes in external ear canal:** Changes that occur in external ear canal in response to chronic inflammation may include hyperkeratosis, epithelial hyperplasia, edema, glandular hyperplasia, loss of epithelial migration, ceruminoliths, stenosis, fibrosis, mineralization and cholesteatoma formation.
- **Infection:** Opportunistic bacteria such as *Staphylococcus* spp., *Pseudomonas* spp. are common perpetuating factors that replicate under favourable conditions created by another primary cause. Other bacteria associated with otitis include *Proteus* spp., Enterococcus, *Streptococcus* spp. and Corynebacterium spp. Bacteria like Staphylococcus and Pseudomonas may produce biofilm, which can lead to persistence of infection despite adequate therapy, as the biofilm needs to be disrupted for any antimicrobial therapy to be effective in clearing the infection. **Malassezia yeast** has been isolated from otitis as the most common organism and complicating factor and often appears during high-humidity months of summer. It is an opportunistic organism and grows when environment in dog's ear canal changes due to another disease condition such as allergies (atopic dermatitis or food hypersensitivity), hormonal imbalance (hypothyroidism), bacterial infection or increased moisture. Prolonged use of certain medications, such as glucocorticoids and antibiotics, increased levels of cerumen (ear wax) can predispose to an infection with this yeast.

  Canine otitis externa is very often complicated by combined bacterial and yeast infections. In a study, out of 92 dogs diagnosed positive for otitis externa, Malassezia alone was identified in 42.39 percent dogs, followed by combination of bacteria and Malassezia in 33.70 percent and bacteria alone was identified in 23.91 percent dogs.

  If infection travels to the tympanic bulla, presence of this infection in the middle ear can also act as a perpetuating factor, leading to recurrent external ear infections. Perpetuating factors are often the main reason for treatment failure in dogs affected by recurrent otitis. Hence, these are very important in the management of otitis.

Pathogenesis

- A variety of abnormal immunologic events occur due to hypersensitivity (atopy/food allergy), resulting in inflammation, vasodilation, edema, erythema and pruritus. In the ear canal, early pathologic changes include alteration of epidermal barrier, changes in cerumen composition, dermal edema and glandular hyperplasia. Narrowing of the canal coupled with accumulation of ceruminous debris provides a better environment for microbial overgrowth, which exacerbate local inflammation as exotoxins and antigens penetrate the altered epidermal barrier. The combination of allergic reaction and secondary infection amplifies inflammation resulting in progressive deterioration of clinical signs. Even if the initial allergen trigger diminish due to seasonal change, secondary infections perpetuate signs year-round. In severe cases, chronic allergen, bacteria and yeast stimulation causes severe proliferative changes, fibrosis and ossification, ultimately leading to permanent stenosis of the canal lumen.
- Ear mite can induce Type-I hypersensitivity reactions resulting in local mast cell degranulation, release of vasoactive peptides, edema and inflammation of the external ear canal. Additionally, Type-III, or Arthus-type, reactions occur when mite antigen and host antibody form immune complexes along the epidermal-dermal junction or in dermal vessels of the ear canal. Immune complex deposition triggers activation of the complement cascade followed by cell-mediated immune response. This type of reaction causes intense local inflammation, pruritus and pain. As few as 2 or 3 mites can trigger these reactions; therefore, adult dogs with

very low mite burdens can have severe otitis externa. Because of the severity of inflammation and the low number of mites, the diagnosis can easily be missed.

- Dog with hypothyroidism exhibit impaired immune response, increased cerumen production and alteration of epidermal barrier function. These changes can contribute to overgrowth of Malassezia and bacteria resulting in clinical disease.

Otitis Externa

One of the most common type of condition seen in dogs, particularly those with large, floppy or hairy ears (e.g., Cocker Spaniels, Poodles etc.), however it can occur in any breed. Otitis externa may be acute or chronic (persistent or recurrent lasting for 3 months or longer) and unilateral or bilateral.

Clinical Signs

- Inflammatory process promotes erythema of pinnae, external meatus and lining of the external canal of varying magnitude. Subsequently, a wide range of clinical signs, namely head shaking, ear scratching, alopecia, ceruminous or purulent otic discharge [brownish in case of yeast infection (Fig. 2) and dry black in ear mite infestation]. Other symptoms include self-trauma to pinnae and pre-auricular region, aural hematoma, acute moist dermatitis near base of ear, foul odour, swelling, ulceration of external ear canal, and pain on palpation. In dogs with normally upright ears, external ear may droop. A torn eardrum is also possible.

Fig. 2: Otitis due to *Malassezia* spp.

- If the infection extends into middle or inner ear, causing an otitis media or otitis interna, neurological signs such as head tilt, vestibular disease, hearing loss and pain when opening mouth or swallowing might also be present.

Otitis Media

Inflammation of middle ear, usually caused by an extension of infection from the external ear canal or by penetration of tympanic membrane by foreign body. Mostly it occurs secondary to chronic otitis externa in up to 50 percent of cases. It can result in more severe clinical signs. Otitis media may extend to inner ear structures causing otitis interna leading to loss of balance and deafness.

Clinical Signs

- Similar to those of otitis externa including, head shaking, ear scratching, rubbing the affected ear on floor, rotating head towards affected side, usually painful on touch and may have discharge and inflammatory changes. Besides affected dogs may also show pain upon opening the mouth and reluctance to chew.
- As facial and sympathetic nerves travel through middle ear; facial nerve paralysis, constriction of pupil, drooping of eyelid, nystagmus, ataxia, cranial nerve deficits, sinking of eyeball into orbital cavity and protrusion of third eyelid may occur on the same side as the affected ear.
- If otitis interna occurs at same time, head tilt toward affected side is more prominent. If inflammation spreads to brain, neurological signs are evident. Chronic otitis media is associated with higher grades of hearing loss compared to hearing loss by otitis externa.

Otitis Interna

Most severe form, affecting the inner ear structures, leading to neurological signs such as head tilt, circling, nystagmus and balance issues (ataxia). This form can result from the progression of otitis media or hematogenous spread of infection.

Complications of Otitis

- Tympanic membrane rupture
- Hearing loss
- Vestibular signs (balance issues)
- Permanent damage to the ear canal, leading to stenosis and narrowing
- Facial nerve paralysis

- Chronic pain and discomfort

Otitis and Hearing Loss

Hearing loss may be conductive, sensorineural or mixed (combination of conductive and sensorineural). Conductive hearing loss can occur due to swelling, scarring, narrowing of the ear canal or glandular hyperplasia, making it difficult for sound to reach the inner ear. Sensorineural hearing loss may occur when the neurological (cochlea nerve) pathways of the brain are damaged by otitis interna, ototoxic medications, physical trauma, general anesthesia, or infection. When hearing is affected in dogs with otitis externa, cleaning of exudates and debris from the external ear canals results in measurable improvements in hearing. As otitis externa resolves, an improvement in hearing can be noticed in dogs if it was due to changes related to the otitis.

Diagnosis

Evaluation for otitis and its diagnosis is based on history, palpation, visual inspection of ears, including otoscopic examination, cytological analysis of otic contents, histopathology and imaging techniques. For each patient, practitioners should generate an appropriate list of differential diagnoses of primary causes.

A. Comprehensive history

A thorough history is vital, especially regarding allergies, moisture exposure and recurrence. Also needs to get information about the onset, duration and any previous treatments.

B. Physical examination

Need to assess ear canal and surrounding structures for signs of inflammation, foreign bodies, discharge and pain. Usually more than one abnormal finding is noted within an affected ear. Physical examination and history help identifying the likely causes, but very few differentials can be ruled in or out based on these findings alone.

C. Otoscopy

It visualize ear canal and tympanic membrane. Each patient should have careful otoscopic examination for foreign objects or obstructive masses. Sedation may be necessary for thorough examination, especially in painful cases. Evaluation of the tympanic membrane forms a key part of the otoscopic evaluation, though it may be difficult to assess the tympanum when otitis externa is present. It is reasonable to leave assessment of the tympanic membrane to a later date, after changes attributed to active otitis have been corrected.

D. Cytology

Cytological evaluation of otic contents is the single most informative diagnostic test that helps with treatment of otitis by identifying bacteria, yeast and inflammatory cells. Samples are collected by inserting sterile swabs to the junction of vertical and horizontal external ear canal and then heat fixed and stained with methylene blue or Diff-Quik stain. Another sample also to be collected using sterile swab and processed for culture and antibiogram, which helps in selecting systemic antibiotic therapy, if indicated. Otic cytological evaluations also help monitor response to therapy.

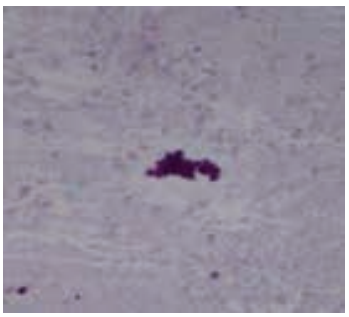

Fig. 3: Clumps of peanut-shaped *Malassezia* spp. in otitis sample (10X)

E. Allergy testing

Indicated in recurrent cases, especially when atopy is suspected. Always parasite hypersensitivity must be kept on the list of differential diagnoses for primary cause of otitis, unless the patient is currently receiving specific, effective therapy for *Otodectes cynotis.*

F. Advanced diagnostic approaches

Accurate diagnosis of canine otitis is crucial for effective treatment. While traditional methods like otoscopy and cytology remain foundational, advanced imaging techniques have become increasingly valuable, especially in complicated or chronic cases.

G. Imaging techniques

Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) provide detailed visualization of the ear's anatomical structures, aiding in assessment of otitis media and interna. CT scans are particularly useful for evaluating bony changes and the extent of disease, while MRI offers superior soft-tissue contrast, beneficial for detecting inflammatory changes and neoplasms. Utilizing these techniques can enhance diagnostic

accuracy, particularly in cases where conventional methods are inconclusive or when surgical intervention is being considered.

It is vital that the Veterinarian evaluate involvement of various primary, predisposing, and perpetuating factors that may be contributing to ear disease while evaluating each individual patient affected by otitis. If all or most of these factors are identified, resolution of current otitis and prevention of future otitis episodes are likely.

Treatment

Effective treatment includes treatment of infection and inflammatory changes as well as determination and elimination of the underlying predisposing and primary factors (foreign bodies, ear mites, atopic dermatitis, food reactions) that led to development of otitis in the first place.

Cleaning and debridement

The area around the ear is clipped of fur to improve cleaning and treatment of the ears. Cleaning ears before topical therapy is critical in helping decrease cerumen, thus allowing topical therapy to be effective. Ear cleaning also helps break up the biofilm that may protect bacterial colonies from appropriate antimicrobial therapy. Mild cleaning/ antiseptic/ drying agents are most often used for flushing/ cleaning and long-term maintenance of chronic and recurrent otitis. Common ingredients include Chlorhexidine, Tris Ehylenediaminetetraacetic acid (Tris-EDTA), Propylene glycol **(Ambiflush)**. Other ingredients include Alcohol, Para-chloro-meta-xylenol (PCMX), Ketoconazole, Miconazole, Sulfur, Aluminum acetate, enzyme combinations and various types of acids at low concentrations.

Topical therapy

Topical therapy is the mainstay treatment for otitis externa although systemic use of anti-inflammatories and/or antimicrobials may be indicated for individual patients. Acute and chronic otitis media associated with otitis externa occured by bacterial and/or yeast infections need to be managed with long term treatment of topical drops containing antibacterial, antifungal and anti-inflammatory agents such as Ofloxacin, Clotrimazole and Betamethasone **(Pomisol Ear Drop)** or Marbofloxacin, Clotrimazole and Dexamethasone **(Oridot Ear Drop)**.

Systemic therapy

- Indications for use of systemic antibiotics include otitis media, underlying systemic disease, proliferative chronic otitis externa, purulent ulcerative otitis externa. If possible, systemic antibiotics should be selected based on culture sensitivity (CS) tests results. Depending on the pathogen and the severity and chronicity of infection, systemic antimicrobial treatment should be continued for 1-2 weeks after negative cytology followed by a topical maintenance program to prevent recurrence of infection.
- For Gram-positive infections associated with Staphylococcus, Cephalosporins **(Inj. Intacef Tazo Pet, Cefpet CLV tablet)**, Clindamycin and Amoxicillin trihydrate/ Clavulanate potassium are generally good initial choices. The only oral antibiotics that may be efficacious for gram-negatives (Pseudomonas) are the Fluoroquinolones, Marbofloxacin **(Marbomet tablet)** and Enrofloxacin. They should be used at the high end of the approved dosage range to avoid development of resistance.
- When Pseudomonas has become multi-drug resistant and topical therapy alone does not resolve the infection, parenteral antibiotic treatment is required. Options in dogs based on culture sensitivity (CS) generally include Ticarcillin disodium/ Clavulanate potassium, Amikacin and Gentamicin. Patients on the aminoglycosides must be monitored for nephrotoxicity with urinalysis for protein and tubular casts and serum for blood urea nitrogen (BUN) and creatinine every 1-2 weeks.
- When Malassezia infections have failed to respond to topical therapy alone or if yeast otitis media is present, oral antifungal medication with Ketoconazole, Fluconazole or Itraconazole **(Izopet)** is often required.
- For management of mites, antiparasitic such as Ivermectin **(Neomec tablet)** is highly effective.
- To combat allergy, anti-allergic medication, allergen-specific immunotherapy may be required.
- Most dogs with otitis, irrespective of its cause, will benefit from anti-inflammatory therapy, such as Meloxicam **(Melonex Suspension).**
- Administration of Glucocorticoids can help disrupt biofilm formation and reduce inflammation in otitis, making ear cleaning and medication administration easier and potentially preventing chronic changes.

Surgery

- In long term otitis media, surgery may be necessary to allow for drainage and adequate resolution of infection. However, early diagnosis and aggressive surgical management is the best course for any mass in the ear canal.
- Surgical options range from minor procedures like lateral ear canal resection to more extensive procedures like total ear canal ablation and lateral bulla osteotomy (TECA-LBO). The best approach depends on the severity and type of otitis, and whether the condition is responsive to medical treatment.

Prevention of Otitis and its Complications

Preventing otitis involves addressing underlying causes and implementing routine care practices.

- **Regular check-ups:** Thorough otic examination of all patients presented for a physical examination helps with early detection of mild and early cases of otitis. For breeds predisposed to otitis due to anatomical features, regular check-ups and tailored ear care routines are essential.
- **Regular ear cleaning:** Cleaning with ear cleaners can help maintain ear hygiene, especially after swimming or bathing, to prevent moisture build up that fosters microbial growth. Care should be taken to avoid over-cleaning, which can disrupt normal flora and cause irritation.
- **Managing underlying conditions:** Effective control of allergies (dust, food allergies), atopic dermatitis, endocrine disorders and other systemic conditions can reduce incidence of otitis.
- **Educating pet owners:** Thorough client education on recognizing early signs of otitis and the importance of adherence to treatment protocols can prevent chronic issues and improve outcomes.

When dogs are presented with early ear disease, detailed diagnostic work-up, including frequent follow-up examinations can help prevent development of complications that may lead to chronic otitis, hearing loss, otitis media and end-stage ear disease.

Prognosis

- **Acute otitis externa:** Good with appropriate treatment.
- **Chronic/recurrent cases:** Guarded; long-term therapy often required.
- **Otitis media/interna:** Variable; can lead to permanent hearing loss if not addressed promptly.

Conclusion

Canine otitis is a common but multifactorial complex condition requiring a multifaceted approach for diagnosis, treatment and prevention. Early intervention, proper hygiene, and addressing underlying causes are key to successful outcomes. Management of otitis revolves around, identifying and correcting the primary cause, involvement of middle and internal ear, removing any debris from ear canal, treating concurrent infections, and controlling inflammation within ear or reversing pathological changes in ear. Effective cleaning or flushing helps removing any debris, purulent material, or secondary infection in external ear canal. Acute and chronic otitis externa associated with otitis media and interna perpetuated by infections to be treated with long-term treatment of topical combination of antibacterial and antifungal agents. Anti-inflammatory will decrease pain and inflammatory changes associated with otitis. Systemic antimicrobials or surgical intervention may be required in severe cases. Further, proper management and regular cleaning of ear canal will prevent recurrence of otitis. Educating pet parents and regular follow-up evaluations are key to manage chronic or recurrent cases and prevent complications of end-stage ear disease.

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Canine *vs* Human Ear

Features	Canine Ear	Human Ear
Shape	Pointed, floppy or upright as per breed	Typically oval or rounded
Size	Larger, varying by breed	Relatively small and compact
Pinna	Large and mobile, acts like funnel to pass sound into inner ear more efficiently	Less mobile
Ear canal	Longer, wider and more flexible. Has a vertical section, which makes **more prone to foreign objects entering the ear**	Shorter and narrower
Ear muscles	Controlled by up to 18 muscles. These allow it to finely tune the position of ear canal so that it can localise a sound, hear it more accurately and from farther away	Equipped with only six muscles
Hearing range	Better high frequency hearing (65-45,000 Hz or higher). Can hear some sounds that are up to 4 times quieter than humans	20-20,000 Hz (cannot hear sounds that vibrate >20,000Hz)
Hearing development	Ears open at around 12-14th day of birth	Can hear from birth
Sensitivity	Best at 8,000 Hz (high frequencies)	Best at 2000 Hz
Sound Direction detection	Can detect where a sound is coming from by comparing difference in loudness and arrival time	Lesser sense of which direction a sound has come from

For suggestions and comments, please write to us

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