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In Practice Review Article: Ear disease in pet rabbits

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Key Learning Outcomes:

- Know the basic anatomy of the rabbit ear.
- List the common causes of otitis externa and media in pet rabbits.
- Recognise and differentiate the clinical signs associated with otitis externa, media and interna in pet rabbits.
- Select and perform appropriate diagnostic tests for the diagnosis of otitis externa, media and interna in pet rabbits.
- Decide and implement an appropriate initial treatment plan (surgical or medical) and outline ongoing patient care.

Introduction:

Ear disease is a common presenting condition in pet rabbits in veterinary practice and can involve any or all parts of the ear - the external ear canal, the middle ear and the inner ear. Our knowledge of ear disease in this species has significantly advanced over the past ten years, with recent and relevant publications reported in the literature (Mancinelli and Lennox, 2017). A higher incidence occurs in lop-eared rabbits, thought to be due to their pinna anatomy (Johnson and Burn, 2019).

Aim:

This article will review rabbit ear disease, focusing on clinical signs, diagnostics and treatment in pet rabbits. Clinical signs associated with ear disease will be discussed. These may vary depending on the severity, chronicity and anatomical location and range from ear scratching and head shaking with otitis externa, to facial muscle contracture and neurological deficits with otitis media. The diagnosis of ear disease will be covered. Diagnosis is based on clinical signs and clinical examination findings, along with diagnostic imaging, ear cytology and culture. Treatment options for rabbits with ear disease will be outlined. Treatment varies depending on the clinical signs, disease location and severity. Prompt diagnosis and treatment of ear disease in pet rabbits is essential to avoid progression of disease and clinical signs. This article is a useful overview for all veterinary staff treating pet rabbits in veterinary practice.

Otitis:

‘Otitis’ is used to describe inflammation of the external ear canal (otitis externa) and of the middle ear structures (otitis media) and inner ear (otitis interna). The external ear consists of the pinna, external auditory canal and tympanic membrane. The middle ear is an air-filled cavity (tympanic bulla) which sits between the tympanic membrane and the inner ear. It

comprises the tympanic bulla, auditory ossicles, oval window, round window and Eustachian tube connecting to the nasopharynx. The inner ear is encased in the temporal bone of the skull and consists of the vestibule (inner ear cavity), cochlear (hearing) and semicircular canals (balance).

Otitis Externa:

The rabbit external ear canal extends to the tympanum and is supported by three auricular cartilages that interlock and support the ear (the cartilaginous acoustic meatus or annular cartilage, which connects to the vertical bony acoustic meatus arising from the bulla, the smaller scutiform cartilage, and then the auricular cartilage forming the distal ear canal and pinna). Adjacent and connecting to the annular cartilage is the tragus which is the proximal part of the auricular cartilage. There is a pocket or diverticulum in rabbits located rostrally from the edge of the pinna to the tragus, which can be confused with the ear canal initially when performing otoscopic exam (Figure 1). Cartilages lock together in straight-eared rabbits. In lop-eared rabbits, there is a 3-5mm gap between the tragus and annular cartilage. Laterally there is only soft ear canal wall and this folds over closing the ear canal. The fold effectively blocks the ear canal. Normally, desquamated cells and cerumen migrate up and out of the ear canals, dry out, and then are shed during grooming. This does not happen in lop-shaped ears and the material builds up in the ear base (Figure 2). Otitis externa may then occur with the development of purulent material associated with secondary yeast and/or bacterial infection. Purulent material can accumulate, resulting in rupture of the tympanic membrane and middle ear infection. Ascending bacterial infections via the Eustachian tube into the middle ear can also occur, often secondary to upper respiratory tract disease, such as rhinitis or sinusitis (Mancinelli and Lennox, 2017).

Otitis externa is commonly seen in pet rabbits. Potential causes of otitis include ear mite infestation (*Psoroptes cuniculi*) which causes crusting, erythema and pruritis, secondary bacterial or yeast infections, ascending bacterial infections via the Eustachian tube and more rarely foreign bodies or neoplasia (e.g. malignant melanoma, trichoblastoma), (Mancinelli and Lennox, 2017).

Clinical History:

A thorough clinical history should be taken with information obtained on access to toxins, recent in-contact animals and recent new additions, which could increase the likelihood of infectious diseases or recent stressors. Any signs of ear discomfort – head shaking, scratching, ear discharge or malodour should be documented, as well as any history of upper respiratory tract infection. For head tilt cases a detailed description should be obtained, including how and when it was first noticed and whether the condition has altered since onset. This will help to ascertain the chronicity and severity of the condition.

Clinical signs of Otitis Externa:

External ear disease may initially be asymptomatic, but usually progresses to ear shaking, excessive grooming or scratching of the affected ear and a reaction to touching the ear or ear base. Subtle clinical signs may be overlooked or dismissed as unimportant. A discharge may be evident from the ear canal in severe cases, which can be malodorous. The build-up of material in lop-shaped ears can bulge laterally, forming a lateral ear base pouch (Figure 2). Ear base swellings are easily palpated, even when still relatively small, but are often missed by owners. These can develop into encapsulated para-auricular abscesses if the ear canal ruptures. Eventually, the material pushes through the tympanic membrane into the middle ear resulting in otitis media.

On otoscopic or endoscopic examination of the ear canal (Figure 3), inflammation and build-up of material within the ear canal may be evident, although it is difficult to see past the fold in conscious lop rabbits (Figures 4 and 5). White material squeezing out of the fold suggests material is accumulating further down (Figure 6). The rabbit is often reactive to placement of the otoscopic cone. Cytological examination may reveal inflammatory cells, bacteria and yeast associated with active inflammation and infection, or alternatively may confirm the material to be ceruminous exudate only. In the former, appropriate culture and sensitivity based antibiotic/antifungal/anti-inflammatory medication may be instigated topically. In the latter, endoscopic saline flushing may still be indicated to remove the build-up of ceruminous material within the ear canal, to prevent progression of ear disease.

It is interesting to note that rabbits with unilateral painful ear disease may favour the non-painful side to chew food and this can result in overgrowth of the cheek teeth arcades on the affected side, observed on otoscopic oral examination.

Otitis Media:

Otitis media is common following chronic otitis externa, associated with rupture of the tympanic membrane and infection spreading to the middle ear. Otitis media may also occur secondary to ascending infection via the Eustachian tube from respiratory tract infections or potentially secondary to dental infections. In one study approximately 80% of commercially reared adult rabbits with pasteurella-associated rhinitis also had changes associated with the paranasal sinuses and tympanic bullae (Deeb and others, 1990).

Middle ear infections with *Pasteurella multocida* appear to be common, however other bacteria may be involved such as *Staphylococcus spp.*, *Pseudomonas spp.*, *Bordetella spp.*, *Escherichia.coli*, *Proteus mirabilis*, *Moraxella spp.* and *Mycoplasma spp.* (Mancinelli and Lennox, 2017). The author is seeing multi-resistant infections in referred rabbits that have

had prolonged courses of antibiotics without culture and sensitivities performed. It is therefore imperative that bacterial and fungal cultures and antibiotic sensitivities are performed in these cases. Other causes of middle ear disease such as neoplasia or polyps are rare in rabbits. Vestibular syndrome has been associated with a cerebellar infarct in one rabbit case report (Garcia and others 2021). Head tilts may also present secondary to *E.cuniculi* associated with vestibular disease (Eatwell, 2013) and can be associated with both bacterial otitis and *E.cuniculi* infection concurrently, requiring appropriate diagnostic evaluation and targeted therapeutics. Reported by Gruber and others, 2009, head tilt was the most common presenting neurological sign in rabbits, however only 2/37 (5.4%) cases were due to otitis media, with the vast majority of 35/37 (94.6%) attributable to *E.cuniculi* in this study.

Clinical Signs:

Bilaterally affected animals may be deaf. Rabbits affected with otitis media are often asymptomatic, making diagnosis based solely on clinical signs difficult, unless there is also a concurrent otitis externa. Even advanced cases may not exhibit clinical signs, being detected as ‘incidental’ findings on Computer Tomography (CT) (Figure 7). De Matos and others (2015) reported 27% of middle ear infections were asymptomatic. Bone changes associated with osteomyelitis of the tympanic bulla may not be easily palpable, except in advanced cases, due to the overlying mandible. Facial muscle contracture is common on the affected side in these cases (Figure 8). Other neurological deficits which can occur are loss of / reduced blink reflex (often with secondary corneal ulceration) and facial nerve issues (loss of function), (Chow, 2011). Inflammation, swelling and abscessation may also be evident around the ear base associated with bulla disease, however normally the bullae are not palpable in rabbits as they do not extend ventrally beyond the occipital bone and the wide mandible also prevents this. Anatomically the bulla lies dorsal to the angular process of the

caudal mandible (Eatwell, 2013). Severe cases can progress to otitis interna with associated head tilt, rolling, balance issues and nystagmus (Figure 9). Clinical signs of an underlying disease process such as respiratory disease, dental disease or neurological disease (for example paresis associated with concurrent *E.cuniculi* infection) may also be evident.

Diagnosis of Ear Disease in Pet Rabbits:

Otitis externa

Otitis externa is often diagnosed on clinical examination with palpation of the ear bases and examination of both ears. This should always be followed by otoscope examination of the ear canals for evidence of inflammation and infection (often associated with a malodourous discharge), as well as collection of samples from both ears for cytology as routine practice. Samples for bacterial and fungal culture and sensitivity should also be collected if indicated on clinical exam and / or cytology.

A CT scan can help determine the extent of the external ear canal disease, as well as ruling out middle ear disease, which is a likely secondary complication in these cases (de Matos and others, 2015), (Figure 10). Underlying respiratory and dental disease can also be evaluated using this imaging technique.

Otitis media:

Otitis media is often subclinical and diagnosis can therefore be challenging (De Matos and others, 2015). Computed tomography is the diagnostic imaging technique of choice for evaluation of the tympanic bullae and is useful in the diagnosis of middle ear disease for assessing the need for surgical intervention and ascertaining prognosis (Figures 11a, b, c and d). CT imaging can be performed conscious with intravenous contrast and high-resolution imaging of the head (Richardson and others, 2019), (Figure 12). A grading scale, as proposed by Richardson and others (2015), may be used for evaluation of severity and extent of otitis externa and media in

pet rabbits, based on CT imaging findings. Radiography and ultrasonography are less likely to pick up early or intermediate cases, with only advanced cases evident associated with bone changes to the bulla (King and others, 2012). It is also not possible to assess the integrity of the tympanic membrane with these latter diagnostic modalities. Aural endoscopy under general anaesthesia, with myringotomy if indicated can also be used to assess disease severity and simultaneously samples can be collected for cytology and culture, as well as treatment instigated. Bacterial culture and sensitivity of samples from the middle ear is essential in otitis media cases for appropriate antibiotic use and middle ear samples can be collected either during bulla osteotomy procedure or via myringotomy.

Otitis Interna:

Diagnosis of otitis interna is usually based on progression of otitis media with associated vestibular signs such as ataxia, spontaneous nystagmus (typically horizontal or rotatory, with no change in direction when the head moves, if the lesion is peripheral; typically permanent, positional and vertical if the lesion is central) and head tilt, usually to the affected side (Schunk, 1988), (Figure 13). Other differential diagnoses should be ruled out, such as *E. cuniculi* and toxoplasmosis. Serology, haematobiochemistry, radiography and CT imaging may all be useful diagnostic aids.

Treatment of Ear Disease in Pet Rabbits:

Otitis externa:

All rabbits should have an otoscopic ear examination and palpation of ear bases as part of the routine clinical examination. In cases of suspect otitis externa (head shaking/ irritation when ears touched, erythema of ear canal, purulent material visualised in ear canal, malodorous discharge from ear, palpable ear base swellings) cytology should be performed on each ear and further diagnostics and subsequent treatment based on the results. If cytology shows no evidence of inflammation / infection, no ear base swellings are present and culture is negative, then routine ear cleaning with a

ceruminolytic/ceruminosolvent ear cleaner may be recommended, initially 1-2 times weekly, reducing frequency to once a fortnight after a month (Table 1). Re-examination is recommended at this time. The correct technique for application of drops and ear massage should be carefully demonstrated to the owners. In lop-eared rabbits, ear base swellings can occur due to build-up of ceruminous material, without cytological evidence of inflammation or infection. In these cases, material should be removed, using ear cleaners in mild cases, or with a conscious ear flush under local or general anaesthesia.

If cytology shows evidence of inflammation / infection and ear base swellings are evident, then bacterial and fungal culture and sensitivity should be performed as a minimum, ideally with CT examination as well. If CT imaging shows otitis externa only, with intact tympanic membranes, then an ear flush is indicated to remove any accumulated material in the external ear canal (Figure 14). This may require general anaesthesia and endoscopic flushing, or in some cases can be performed conscious using topical local anaesthetics.

Following this procedure medicated ear drops may be prescribed (containing antibiotics or antifungals), based on culture and sensitivity results. A short course of topical glucocorticoids can be helpful to reduce inflammation, although these should be used with care to avoid acute side effects. In rabbits that resent handling, long acting or single dose ear preparations may be considered, however cytology should be performed at the re-examination and treatment continued if bacterial infection is still present (Table 1).

Table 1. Dose rates for topical agents used to treat ear disease in rabbits (anecdotal references, off-license use)

Topical medication	Dose rate and frequency	Comments
Ear Cleaners		
'CleanAural Cat' - Dechra	Initially 1-2 times weekly, 2-3 drops each ear, reducing frequency to once a fortnight after a month	Ceruminosolvent ear cleaner. Use only if tympanic membrane intact. Contains glycerine and propylene glycol. pH balanced.

'EpiOtic Ear Cleaner' - Virbac	Initially 1-2 times weekly, 2-3 drops each ear, reducing frequency to once a fortnight after a month	Anti-bacterial, pH neutral, keratin modifying, cerumenolytic, anti-pruritic and moisturising. Contains salicylic acid, EDTA and PCMX. Use only if tympanic membrane intact
'TrizAural' Ear Flush - Dechra	Daily initially, reducing frequency to 2-3x weekly, then fortnightly	Tris-EDTA alkalising pre-treatment antibacterial flush for cleaning and treating ears before application of specific ear canal preparations. Antibiotic and / or anti-inflammatory medication can be added to this. Useful in Gram negative infections
Medicated Ear Drops		
'Osumia gel' - Dechra	½ tube per affected ear, repeat after 7 days	Do not use if eardrum ruptured. Do not allow rabbit or companions to ingest following grooming. Contains terbinafine, florfenicol and betamethasone acetate. Anecdotal use, not licensed in rabbits, safety and efficacy unknown.
'Neptra' - Bayer	Single use, 0.5ml per affected ear	Do not use if eardrum ruptured. Do not allow rabbit or companions to ingest following grooming. Contains terbinafine, florfenicol and mometasone furoate. Anecdotal dose, not licensed in rabbits, safety and efficacy unknown.
'Surolan' - Elanco	1-2 drops twice daily for 7-14 days.	Do not use if eardrum ruptured. Do not allow rabbit or companions to ingest following grooming. Contains miconazole nitrate, prednisolone acetate and polymyxin B sulfate. Gram negative activity – use based on culture and sensitivity results. Anecdotal use, not licensed in rabbits, safety and efficacy unknown.
'Aurizon' - Vetoquinol	3-5 drops once daily for 7 days	Do not use if eardrum ruptured. Do not allow rabbit or companions

		to ingest following grooming. Contains clotrimazole, dexamethasone and marbofloxacin. Anecdotal use, not licensed in rabbits, safety and efficacy unknown.
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Key: ml = millilitres

In persistent cases with ear base swellings present, a surgical approach may be required.

Fenestration of the lateral wall of the ear canal base can be considered in rabbits with severe and persistent lateral pouching of the ear canals (lateral ear canal stoma surgery), (Figure 15).

In these cases, endoscopic ear flushing may be futile. The fenestration sites should be monitored and kept clean as they can matt over or slowly close with time and infections may occur (Figure 16). Lateral ear canal resection (LCR) can be considered in rabbits with otitis externa, but without otitis media. The tragus can be removed alone, or along with the cartilage of the acoustic meatus (annular cartilage), (Figure 17).

An alternative in amenable rabbits is a conscious ear flush every 1-2 months (or as soon as the pouch fills). The rabbit is restrained in a towel, local anaesthetic instilled into the ear canal, and the lower ear below the fold is flushed out using saline through a catheter passed through the fold using an otoscope.

Treatment of Otitis Media:

Symptomatic treatment and supportive care is often instigated pending results of diagnostic tests. For bacterial otitis externa /media a prolonged course of systemic antibiotics may be required for four to six weeks, based on culture and sensitivity testing. Antibiotics which are effective against

Pasteurella include trimethoprim-sulpha drugs, fluoroquinolones (enrofloxacin), chloramphenicol, cephalexin, penicillin and tetracyclines. Azithromycin has a broad spectrum of activity and is effective against Staph., Strep. and *Pasteurella* (Mancinelli and Lennox, 2017), (see Table 2).

Table 2. Dose rates for antibiotic agents used to treat ear disease in rabbits. (Carpenter and Marion, 2018), (Lennox and Mancinelli, 2017)

Antibiotic drug	Dose rate and frequency	Comments
Azithromycin	15-30mg/kg PO q24h	Broad spectrum
Cephalexin	15mg/kg SC q12h	Do not give orally in rabbits
Enrofloxacin	5-20mg/kg PO, SC, IM, IV q12h	Tissue necrosis associated with injectable form. Oral suspension requires dilution
Penicillin G Procaine form	42,000 – 84,000 U/kg SC, IM q24h	Do not give orally in rabbits, stop if diarrhoea occurs
Trimethoprim-sulpha	15-30 mg/kg PO, SC, IM q12-24h	Can cause tissue necrosis if injection used.

Key: q=every, PO = Per Os, SC = subcutaneous, IM = intramuscular, IV = intravenous, mg= milligram, kg= kilogram, h = hours

Accumulation of material in the ear can cause pain due to pressure within the ear canal, tympanum and middle ear and therefore appropriate analgesia is recommended in these cases (see Table 3).

Table 3. Dose rates for analgesic agents used to treat ear disease in rabbits (Carpenter and Marion, 2018)

Analgesic drug	Dose rate and frequency	Comments
Bupivacaine	1-2mg/kg	Local infiltrate or nerve block, lasts 4-6h
Buprenorphine	0.01-0.05 mg/kg SC, IM, IV q6-12h	Use lower dose in debilitated animals, may cause respiratory depression
Lidocaine	1-2mg/kg	Local infiltrate or nerve block, lasts 1-2h
Maropitant citrate	2mg/kg SC q24h	Can be given long term q48h or 3x weekly if needed
Meloxicam	0.5-1mg/kg PO q24h	Care in cases with dehydration, renal or gastrointestinal disease

		Anecdotal this may be given twice daily at the 0.5mg/kg dose rate.
Morphine	0.5-2mg/kg SC, IM q2-4h	Mu receptor antagonist
Tramadol	5-15mg/kg PO q8-12h	Data on efficacy lacking, anecdotal reports
CRI - ketamine	2-5mg/kg loading dose IV	CRI rate IV/h 0.3-1.2mg/kg

Key: q=every, PO = Per Os, SC = subcutaneous, IM = intramuscular, IV = intravenous, mg= milligram, kg= kilogram, h = hours, CRI = continuous rate infusion

General anaesthesia with myringotomy to obtain samples for cytology and culture and alleviate pressure by aspiration of fluid or material accumulating in the middle ear is a good option when bony changes have not yet occurred in the bulla (Jekl and Knotek, 2015). Systemic antibiotics may be necessary, although antibiotics can also be instilled directly into the middle ear after cleaning. Care should be taken with this procedure as iatrogenic head tilt is a possible unwanted side effect.

Surgical treatment with bulla osteotomy is indicated in cases with advanced middle ear disease and associated bony destruction of the tympanic bulla. This can however be associated with a high risk of post-operative complications (see Box 1), but these are also risks if no surgery is performed. Surgical risks and intensive nursing care post-operatively should be discussed with the owner prior to any procedure.

Box 1. Possible post-operative complications associated with ear surgery in rabbits (Lennox and Mancinelli 2017), (Sanchez-Migallon Guzman and others, 2021).

- Facial nerve paralysis / spasticity – lack of palpebral reflex, ipsilateral drooling, facial drooping or contracture, corneal ulceration due to reduced blink reflex.
- Food accumulation in the mouth and increased possibility of dental disease developing due to pain or difficulty chewing.
- Hypoglossal nerve damage – difficulty chewing and tongue trauma.
- Temporary or permanent vestibular disease – head tilt, rolling, circling, nystagmus.
- Horner's syndrome - miosis, ptosis, enophthalmos due to damage to the sympathetic nervous system supplying the eye.
- Wound complications - dehiscence, infection, necrosis of cartilage or pinna, abscess formation, cellulitis, wound break down.

The surgical approach depends on the severity and anatomical location of the ear disease (see Table 4), (Figure 18 a,b,c).

Table 4. Surgical approach and technique depending on the severity and anatomical location of the ear disease (Chow, 2011), (Lennox and Mancinelli, 2017).

Surgical Approach	Indication	Comments
Lateral ear canal resection (LCR)	Rabbits with otitis externa, but without otitis media	May not resolve the otitis externa. Tragus removed alone, or with cartilage of acoustic meatus.
Partial Ear Canal Ablation (PECA)	Rabbits with otitis externa, but can be combined with LBO	Removal of part of the lateral ear canal, with stoma created
Total ear canal ablation (TECA)	Severe ear canal disease	Stenosis or neoplasia
Ventral bulla osteotomy (VBO)	Rabbits with otitis media, without otitis externa	Removal of material from bulla, samples for culture and sensitivity. Technically more difficult than LBO.
Lateral Bulla Osteotomy (LBO)	Rabbits with otitis media / empyema of the bulla, without otitis externa.	Rarely performed alone as external ear canal disease usually concurrent
Total ear canal ablation (TECA) and lateral bulla osteotomy (LBO)	Rabbits with otitis externa and otitis media	Osteomyelitis of the wall of the bulla can be present in severe cases. Diseased bone may need to be removed
Partial Ear Canal Ablation (PECA) and lateral bulla osteotomy (LBO)	Rabbits with otitis externa and otitis media	Part of lateral wall of ear canal resected and bulla opened for removal of debris.

Care must be taken to avoid the facial nerve, which is located along the medial aspect of the bulla, exiting the skull caudally to the bulla, and running along the ventral surface of the bulla and ventral aspect of the ear canal. In rabbits the bullae are thinner ventrally and medially, with thicker bone on the lateral and rostral areas. (Sanchez-Migallon Guzman and others, 2021).

For further details on surgical techniques see Csomos and others, 2016, and Mancinelli and Lennox, 2017.

Post-operative care and nursing treatment can be intensive and consists of analgesia (local, systemic, continuous rate infusion), prokinetic drugs, systemic antibiotics, ocular lubricants, intravenous fluid therapy and assisted syringe feeding (Tables 2, 3 and 5). Some authors will leave the bulla open and continue to flush this area post-operatively. Ideally a review of any surgical case should take place with a repeat CT examination at six months post-surgery to assess the success of any surgery.

Treatment of Otitis Interna:

Otitis interna may be associated with the following clinical signs; Nystagmus, heat tilt, torticollis and circling and can arise as an extension of otitis media. Treatment if signs of vestibular disturbance are present can include; Phenothiazine derivatives and antihistamines which act on vestibular pathways, such as prochlorperazine, meclizine, cyclizine and cinnarizine, diazepam or midazolam to suppress acute neurological signs such as rolling, and metoclopramide or maropitant as anti-emetic drugs. Systemic antibiotics, analgesia, intravenous fluid therapy, as well as general supportive and nursing care, may also be considered in these cases (see Table 5), (Figure 19).

Table 5. Dose rates for therapeutic agents, fluid therapy and assisted feeding used in the treatment of otitis interna in rabbits. (Carpenter and Marion, 2018), (Lennox and Mancinelli, 2017)

Medication	Dose rate and frequency	Comments
Cinnarizine	0.3mg/kg PO q8h (human dose)	Use anecdotal, extrapolated from human labyrinthitis medication
Cyclizine	8mg/rabbit PO q12h	Use anecdotal, extrapolated from human labyrinthitis medication

Prochlorperazine	0.2 – 0.5 mg/kg PO q8h	Use anecdotal, extrapolated from human labyrinthitis medication
Meclizine	12.5-25 mg/kg PO q8h – q12h	Use anecdotal, human labyrinthitis medication
Diazepam	0.5mg/kg SC, IM or IV	Sedation for animals with severe neurological signs such as head tilt and rolling
Maropitant citrate	2mg/kg SC q24h x 3-5 days	Neurokinin (NK1) receptor antagonist. Anti-nausea medication. Long term dosing q48h or 3x weekly may be given.
Midazolam	0.5-2mg/kg SC, IM or IV	Sedation for animals with severe neurological signs such as head tilt and rolling
Metoclopramide	0.5mg/kg PO or SC q8h	Anti-emetic drugs may be useful. Also promotes gastro-duodenal transit.
Fluid therapy	50 – 100mls/kg/day maintenance (2-4ml/kg/h)	Intravenous or subcutaneous routes
Assisted Feeding	Follow manufacturer's guidelines, aim for 10ml/kg per feed 4-6x daily	Commercial critical care diets available, e.g. 'Oxbow Critical Care'- Oxbow Animal Health, 'Emeraid Intensive Care Herbivore' – Lafeber Vet
Prokinetics - Cisapride	0.5mg/kg PO q8-12h	Promotes gastrointestinal motility
Analgesics - Meloxicam	0.5 - 1mg/kg PO q24h	Care in cases with dehydration, renal or gastrointestinal disease Anecdotaly this may be given twice daily at the 0.5mg/kg dose rate.
<i>E.Cuniculi</i> treatment	Fenbendazole 20mg/kg PO q24h	Start pending serology results if CNS signs are present and clinical history is suspicious. Caution - in rare cases may be associated with anaemia and arteritis.

Key: q=every, PO = Per Os, SC = subcutaneous, IM = intramuscular, IV = intravenous, mg= milligram, kg= kilogram, ml = millilitres, h = hours

Severely affected animals often still continue to eat and pass droppings. Spasm of the neck muscles is common associated with head tilt and owners should be encouraged to massage these muscles regularly. Clinical signs may gradually resolve with affected rabbits adapting to the head tilt over a few weeks. The rabbit should be housed in safe environment during this time to avoid self-injury. The individual animal's welfare should always be considered and in severe cases euthanasia may be indicated.

Summary:

Ear disease is common in pet rabbits, particularly in lop-eared rabbits. All rabbits undergoing veterinary examination should have their ears examined using an otoscope and ear bases palpated for ear base swellings. A sound knowledge of the clinical signs associated with ear disease and how these differentiate according to anatomical location affected (external ear, middle ear or inner ear) is important for the diagnosis of ear disease. Subtle clinical signs should not be overlooked. Ear cytology, bacterial and fungal culture and sensitivity, as well as CT imaging are all important diagnostic tools for ear disease in pet rabbits. Treatment options, including analgesia and topical therapies, as well as decision making as to whether medical or surgical management is appropriate, is important. Ongoing case care is essential and may be long term. Regular repeat examinations and appropriate diagnostics should be scheduled to monitor case progression and ensure a positive resolution.

Additional Information:

Owner consent in writing should be obtained for all non-licensed medications that are prescribed in pet rabbits and the veterinary cascade should be applied to all prescribed medications.

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In Practice Review Article: Ear disease in pet rabbits

Figure legends

Figure 1: Endoscopic view of blind ending pouch, which can initially be confused as the external ear canal. The pouch may normally contain a small amount of wax. (Photo courtesy of Dr Tim Nuttall, Head of Veterinary Dermatology, University of Edinburgh).

Figure 2: Ear base swelling in a rabbit surgically aseptically prepared to undergo lateral ear canal stoma surgery.

Figure 3: Endoscopic examination of the external ear canal in a rabbit. This is well tolerated in conscious animals, however if the ear canal is inflamed (otitis externa) head shaking may occur.

Figure 4: Endoscopic image of the external ear canal in a lop-eared rabbit. Note the stenosed ear canal opening due to lop-ear anatomy. (Photo courtesy of Dr Tim Nuttall, Head of Veterinary Dermatology, University of Edinburgh).

Figure 5: Endoscopic image of external ear canal in a straight-eared rabbit (Dutch breed) for comparison. The ear canal is more open, allowing visualisation of the tympanic membrane. (Photo courtesy of Dr Tim Nuttall, Head of Veterinary Dermatology, University of Edinburgh).

Figure 6: Endoscopic image of the external ear canal in a lop-eared rabbit. Note the inflammation and accumulation of purulent material within the ear canal indicating otitis externa. (Photo courtesy of Dr Tim Nuttall, Head of Veterinary Dermatology, University of Edinburgh).

Figure 7: Transverse-plane CT image of lop-eared rabbit skull at level of the bullae. The left bulla (B) is normal and air-filled. The left ear base is swollen (arrow). The right bulla is material filled (otitis media), with bony destruction of the lateral wall of the bulla (osteomyelitis). This rabbit was asymptomatic.

Figure 8: Left sided facial muscle contracture in a lop-eared rabbit. This animal presented for vaccination and the owner had not noticed the facial asymmetry.

Figure 9 (video): Rabbit with right sided head tilt and vertical nystagmus indicating peripheral vestibular disease (otitis interna). This rabbit was also positive for *E.cuniculi* on serological testing (Video courtesy of Monika Nawrocka RVN).

Figure 10: Transverse-plane CT image of a lop-eared rabbit skull at level of the bullae. The bullae are air-filled and normal and the tympanic membranes are intact, ruling out middle ear disease in this case. Material fills the external ear canal to the level of the tympanic membrane on both sides and bilateral ear based swellings are present.

Figure 11: Transverse-plane CT image of a lop-eared rabbit skull at level of the bullae. a) The bullae are air-filled and normal. b) Material fills the ear canals, causing the tympanic membrane to bulge inwards (otitis externa). c) Bilateral otitis media. The left bulla is completely filled with material; whereas the right bulla is only partially filled. Both bullae are intact and the lop-ear conformity is clearly seen. d) An advanced case of bilateral otitis media with bone destruction of the tympanic bullae (osteomyelitis).

Figure 12: Rabbit undergoing conscious CT imaging using the VetMouseTrap™. Oxygen is piped into the unit and the rabbit has an intravenous cannula attached for intravenous fluids and contrast as required. The whole process takes just a few seconds.

Figure 13: Rabbit with a right sided severe head tilt associated with otitis interna. This rabbit was still eating despite its peripheral vestibular disease. Ocular lubricants are indicated to protect the exposed left eye.

Figure 14 (video): Video endoscopy of the external ear canal of a lop-eared rabbit, following saline flushing and endoscopic removal of debris. The ear canal is free from debris, but inflammation is still evident. A small amount of saline is evident at the intact tympanic membrane. (Video courtesy of Dr Tim Nuttall, Head of Veterinary Dermatology, University of Edinburgh).

Figure 15: Post-surgical appearance of fenestration of the lateral wall of the ear canal base with creation of a stoma.

Figure 16: Resistant ear infections can occur with prolonged antibiotic use in rabbits. This rabbit underwent lateral ear canal resection and stoma surgery, however two months later a multi-resistant *Staphylococcus aureus* infection was identified on repeat culture.

Figure 17: Lateral ear canal resection. A skin incision has been made over the tragus and annular cartilage, to expose the cartilage prior to resection.

Figure 18: a) Pre-operative photo of rabbit with left sided head tilt. b) Lateral bulla osteotomy (LBO) with removal of purulent material from tympanic bulla. Bacterial culture revealed a pure growth of *Pseudomonas aeruginosa* c) Appearance of the rabbit post-operatively. The head tilt has significantly resolved. (Photos courtesy of Dr Athin Athinodorou MRCVS and Craig Tessyman RVN).

Figure 19 (video): Rabbit with a left sided head tilt taking oral medications. Medicating even severely affected cases can be straightforward. (Video courtesy of Monika Nawrocka RVN).

MCQ CPD quiz Rabbit Ear Disease

Qu.1: What clinical signs are associated with otitis externa in rabbits?

- A) Facial muscle contracture
- B) Head shaking
- C) A drooped ear
- D) Head tilt

Answer – B) Head shaking

Qu.2: What is the diagnostic tool of choice for otitis media?

- A) Radiography
- B) Cytology of the ear canal
- C) CT Imaging
- D) Ultrasonography

Answer C) CT Imaging

Qu 3: What treatment is recommended for persistent cases of otitis externa with ear base swellings?

- A) Lateral ear canal stoma surgery
- B) Ventral bulla osteotomy
- C) Endoscopic ear flush
- D) Topical medicated ear drops

Answer A) Lateral ear canal stoma surgery

Qu 4: What post-operative complication may be associated with bulla osteotomy?

- A) Hyperthermia
- B) Contralateral facial drooping
- C) Ataxia
- D) Facial nerve paralysis

Answer D) Facial nerve paralysis

Qu 5: Which of the following is used to treat otitis interna?

- A) Phenobarbitone
- B) Propanolol
- C) Prochlorperazine
- D) *Propentofylline*

Answer C) Prochlorperazine